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# Research Natural Area Needs in the Pacific Northwest

## Abstract

Research Natural Areas are examples of typical and distinctive natural ecosystems and habitats reserved for scientific and educational use. This outline of the minimal Research Natural Area system needed to provide adequate field laboratories for ecological, environmental, and land management research was developed by an interinstitutional, interdisciplinary working group. Natural area needs were first described on the basis of individual organisms, habitats, or ecosystems which should be represented. These "cells," the basic building blocks in defining the total scope of the system, considered terrestrial and aquatic environments as well as rare and endangered species. Identified cells were matched against existing Research Natural Areas to determine which were already filled. The remaining, unfilled cells were then tentatively grouped as units which were listed as Research Natural Area needs.

A minimal Research Natural Area system for Oregon and Washington requires approximately 360 tracts which, in turn, incorporate over 770 individual cells (ecosystems, habitats, or organisms). Since 60 Research Natural Areas are already established, about 300 additional areas are needed. These remaining needs were assigned a priority (low, medium, or high) based on importance and degree to which they are endangered, as well as identified as to the Federal, State, or private agency or institution most likely to be able to provide a tract of that type.

The purpose of Research Natural Areas, their place in land planning, history of Research Natural Area activities in the Pacific Northwest, and general observations and recommendations on unresolved problems are also outlined.

Keywords: Research Natural Area, scientific preserves, natural ecosystems, endangered species, Oregon, Washington.

RESEARCH NATURAL AREA NEEDS  
IN THE PACIFIC NORTHWEST  
A Contribution To Land-Use Planning

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Report on Natural Area Needs Workshop  
November 29—December 1, 1973, Wemme, Oregon

1975

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION  
U. S. DEPARTMENT OF AGRICULTURE  
FOREST SERVICE  
PORTLAND, OREGON



## FOREWORD

Research Natural Areas are important elements in land-use plans. They may be called Research Natural Areas, Nature Preserves, Range Reference Areas, or simply Natural Areas. They are tracts on which natural features are preserved in as nearly an undisturbed state as possible for scientific and educational purposes. Natural areas serve as a standard or baseline for comparison with areas influenced by man, as tracts for ecological and environmental study, and as reserves to protect typical as well as rare and endangered organisms. As baseline areas, field laboratories, and genetic reservoirs, they serve the scientist, the resource manager, and the public.

In the Pacific Northwest there has long been a steadily increasing interest in preserving typical and unique examples of the natural environment by the Federal Agencies, by the States of Oregon and Washington, and by various private groups and professional societies. However, a random accumulation of reserved tracts will not provide the representative system of Research Natural Areas needed. Coordination is required among the various groups to avoid unnecessary duplication and still preserve examples of all important terrestrial, freshwater, and marine ecosystems. Thus, one purpose of this guide.

Providing additional impetus to preparation of this guideline is the trend toward comprehensive land-use planning by Federal agencies and State and local government. I view the product as an important contribution to this planning process by alerting land planners to the value of Research Natural Areas and to the ecosystems lacking adequate representation in existing Research Natural Areas.

This guideline describes a minimal system of natural areas for Oregon and Washington. It is a working tool that will require revision as progress is made and as new information becomes available. This effort should not be viewed as a mandatory guide; it is a blueprint for coordination among the participants.

This guide was prepared under the overall direction of a steering committee whose members have long experience in administering programs involving renewable natural resources. More than 30 scientists made up the working group that prepared the basic plan, and several dozen reviewers offered valuable comment. However, the final responsibility for its adequacy rests with me and with the authors. We invite your comment and inquiry.



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## ACKNOWLEDGMENTS

A very large number of people contributed to this report at one time or another. For example, over 100 people reviewed the manuscript and most made suggestions. Obviously, it is impossible to mention each by name, but we sincerely appreciate the effort expended by each reviewer.

Those who participated in the Natural Area Needs Workshop are recognized elsewhere in the report. Members of the steering committee and workshop participants are shown in appendix VII. However, many additional people made substantial contributions following the workshop during preparation of the review draft and this revised version of the report. In the following lists we will attempt to acknowledge these contributions. Because so many have been involved, it is, of course, likely that some who should be listed are inadvertently omitted. For this, we apologize.

Robert L. Fernald (University of Washington) organized a followup marine and estuarine workshop in November 1974, in order to improve lists of Research Natural Area needs along the coasts of Oregon and Washington. Those attending and making substantial contributions to the revised lists include Austin Pritchard, Vicki Osis, and Chris Bayne (Oregon State University); Laimons Osis (Oregon Fish Commission); and R. L. Bacon (University of Oregon). Other valuable suggestions were offered by J. J. Gonor, R. Waaland, R. Norris, T. Mumford, Peter Taylor, Peter Frank, Paul Rudy, R. T. Paine, and Carter Broad.

Those making substantial contributions to the list of rare and endangered animal species include Carl Bond and Robert Storm (Oregon State University), and Murray Johnson and Gordon Alcorn (University of Puget Sound). In addition, Murray Johnson kindly allowed the use of his unpublished "Terms Related to Populations and Survival Status of Mammals."

Arthur Kruckeberg (University of Washington) and Jean Siddall (The Nature Conservancy), both workshop attendees, led the effort in compiling lists of plants of special interest in Oregon and Washington. Kenton Chambers (Oregon State University) shared data from his Oregon list of endangered plants, and C. Leo Hitchcock (University of Washington) was of major help in identifying special plants in Washington. Others who made contributions to the Oregon plant lists include Molly Grothaus, Frank McMullen, Lois Kemp, Ruth Hopson Keen, Bert Brehm, Calvin Burt, Russell Ofstadt, Ronald Burnett, Dorothy Marshall, Donald Kroeker, George Jeffcot, Lawrence Crocker, Frank Lang, Frank Secock, Roy Godfrey, Libby Pinkham, Diane Meyer, Ireta Kirkhofer, Jerry Strickler, Ruth Strong, and Ralph Anderson.

Glenn Juday wrote most of the section describing the Oregon State Natural Area Preserves Program. Information pertaining to the Washington State Natural Preserves Advisory Committee was supplied by A. R. O'Donnell and Gordon D. Alcorn.

Charles Wellner of Moscow, Idaho, provided extensive assistance in preparation of the material on the Okanogan Highlands.

We sincerely appreciate the help and encouragement of all these people.



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# *Part 1.*

## *Background*

### NATURE, PURPOSE, AND MANAGEMENT OF RESEARCH NATURAL AREAS

In this paper, we will generally follow the concepts of Research Natural Areas developed in the Federal program (Federal Committee on Research Natural Areas 1968). There are variations in what these natural ecological reserves are called and their specific rationale and management criteria. Nonetheless, the general objectives and criteria are common among, for example, the Federal, Oregon and Washington State, and The Nature Conservancy programs.

Research Natural Areas can be defined as “a naturally occurring physical or biological unit where natural conditions are maintained insofar as possible.” Further, the natural features are preserved for research and educational purposes. The features to be preserved may be important or unique ecosystems, habitats, or organisms and may be terrestrial, freshwater, or marine.

Most tracts selected as Research Natural Areas are those where the features of interest are in as nearly an undisturbed state or natural condition as can be found. They do not necessarily have to be pristine, however, as examples of many ecosystems which are essentially free of human disturbance no longer exist. Research Natural Areas are, ideally, sufficiently large to protect the feature of interest from significant unnatural influences.

The objectives of establishing Research Natural Areas are critical to understanding their importance in overall land-use planning. As stated by the Federal Committee on Research Natural Areas (1968) they are: (1) preservation of examples of all significant natural ecosystems for comparison with those influenced by man; (2) provision of educational and research areas for ecological and environmental studies; and (3) preservation of gene pools for typical and rare and endangered plants and animals.

In both Federal and State Research Natural Areas, the overriding guideline for management is that natural processes are allowed to dominate to the degree consistent with preservation of the natural features of interest. On many Research Natural Areas, protection from outside disturbances, such as logging, grazing, and fire, is the only management requirement. However, deliberate manipulation which simulates natural processes is allowed and may be necessary in order to maintain desired communities or organisms. Prescribed burning or grazing by domestic livestock of some grassland types is an example. Use of Research Natural Areas for research or education must also be consistent with maintenance of natural processes and features. For this reason, only research which is nondestructive in character is generally allowed. Often research of this type can be complemented with manipulative research on adjacent experimental tracts. The Nature Conservancy management guidelines vary more with the nature of the preserve and the objectives for which it was set aside.

Recreation is not a recognized use of Research Natural Areas, although certain types of recreational activities are allowed if they do not significantly alter the natural features for which a given tract was set aside. If recreational or other human activities threaten the existence or natural development of the features, such use can and should be prohibited.

It is at this point we can see how Research Natural Areas relate to other land use classifications such as National Parks, Wilderness Areas, and the U.S. Forest Service's Botanical, Geological, etc., Areas. Research Natural Areas are for situations where scientific values are primary and, in fact, relatively stringent constraints on other uses are necessary for the protection and realization of these values. Of course, there remain many landscapes which have substantial scientific interest. This is certainly true of National Parks and Wilderness Areas which have unique scientific potentialities of certain types—e.g., groves of unusually large trees, rookeries, nesting sites for eagles, habitats for wide-ranging ungulates and predators. However, these are typically large tracts in which recreational, educational, and other values are equally as important as the scientific. Further, many of these particular scientific values can be protected concurrently with other uses or, at most, necessitate a restrictive scientific designation for only a small part of the total landscape of the Park or Wilderness.

Natural reserves of these less restrictive types are important scientifically and should be fully utilized. Indeed, they are essential if any reasonably complete examples of large landscapes and wide-ranging organisms (many birds and large herbivores) are to be preserved. They reduce the number and extent of needed Research Natural Areas but, at the same time, cannot replace their unique role. Often Research Natural Areas can be placed within National Park or Wilderness units, thereby identifying a specific site where research potential is high and providing it with an extensive buffer of undisturbed landscape.

To summarize, Research Natural Areas recognize scientific and educational values as primary. These values are also associated with National Parks, Wilderness, and other specially designated areas but typically do not require the more exclusive designation for their protection.

# HISTORY OF RESEARCH NATURAL AREA PROGRAM IN OREGON AND WASHINGTON

There has been a high level of interest in establishment of Research Natural Areas in Oregon and Washington by many individuals and groups for many years. A short history of the various programs — Federal, State, and private — seems appropriate to provide some perspective for this report.

## Federal Activities

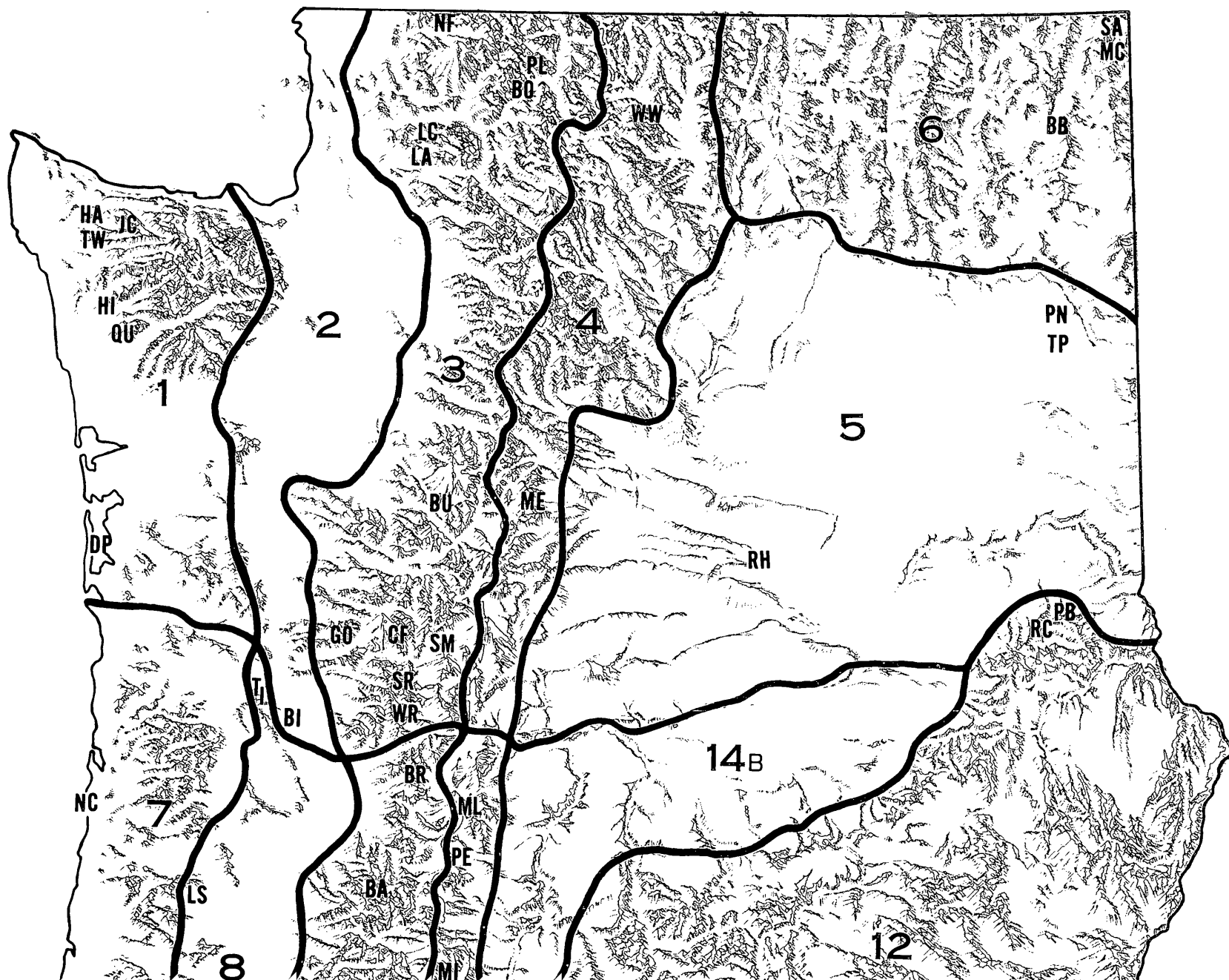
The Federal agencies have been active in the selection and dedication of Research Natural Areas for the longest period of time. Personnel in the U.S. Forest Service's Pacific Northwest Forest and Range Experiment Station were among the early activists — Thornton T. Munger, Leo A. Isaac, and Philip Briegleb, for example. The first of now 60 Federal Research Natural Areas in Oregon and Washington was formally established in 1931 by the U.S. Forest Service (Franklin 1970, Franklin et al. 1972). Over the next 30 years, location and establishment of areas proceeded at a slow but steady pace, with other Federal agencies becoming involved, including the Bureau of Land Management, National Park Service, and Fish and Wildlife Service.

In the 1960's, Federal agencies expanded and coordinated their activities. On the national level this was accomplished through the establishment of the Federal Committee on Research Natural Areas at the joint initiative of the Secretaries of Interior and Agriculture. Regionally, it took the form of increased interchange among the agencies. The Pacific Northwest Research Natural Area Committee, originally exclusively Forest Service, became interagency with representation of the Bureau of Land Management, Fish and Wildlife Service, and the National Park Service, as well as The Nature Conservancy. Their earliest cooperative efforts culminated in a guidebook to the then-existing 48 Federal Research Natural Areas (Franklin et al. 1972). Since 1972 the four Federal agencies have pooled financial resources to support a summer activities program (identifying, describing, and conducting research on natural areas) and have joined, of course, in sponsoring this report and the workshop upon which it is based.

There are, at present, 60 Federal Research Natural Areas in Oregon and Washington (fig. 1, table 1) and a number of additional areas being either considered or established (app. I).

Two aspects of the Federal program have evolved along with the improved coordination and the expansion of the system. The Forest Service involvement in the program was based initially upon the need for a system of areas which provided representative examples of the important forest and range types. All early Forest Service Research Natural Areas were of this type. In the middle 1960's, the concept was broadened to include all types of ecosystems, either typical or unique, aquatic as well as terrestrial. This broader concept has guided the entire Federal program since that time.

Secondly, the Federal agencies have continually endeavored to improve the systematic basis or general plan for the program. The plan developed here is, in fact, the latest in a series which have successively approximated the total scope of a system of reserves and remaining needs, each reflecting an improved understanding of the ecology of the region, future research needs, and the objectives of the system.



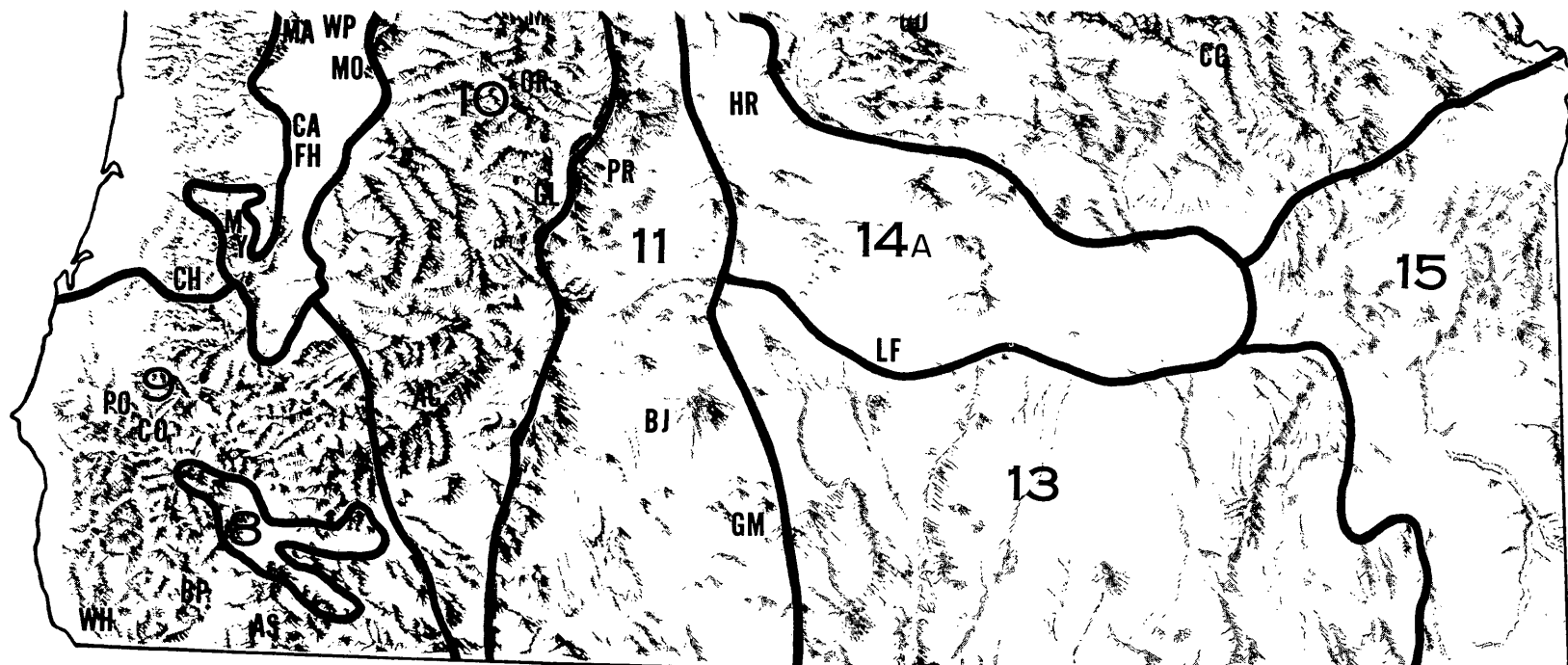


Figure 1.--Physiographic provinces and established Federal Research Natural Areas in Washington and Oregon. (See table 1, pages 6-8, for letter code for specific Research Natural Area.)

| <u>NO.</u> | <u>PROVINCE</u>                                  | <u>NO.</u> | <u>PROVINCE</u>                                             |
|------------|--------------------------------------------------|------------|-------------------------------------------------------------|
| 1          | Olympic Peninsula and<br>Southwestern Washington | 9          | Siskiyou Mountains                                          |
| 2          | Puget Trough                                     | 10         | Western Slopes and Crest,<br>Oregon Cascades                |
| 3          | Western Slopes and Crest,<br>Washington Cascades | 11         | Eastern Slopes, Oregon Cascades                             |
| 4          | Eastern Slopes, Washington Cascades              | 12         | Ochoco, Blue, and Wallowa Mountains                         |
| 5          | Columbia Basin                                   | 13         | Basin and Range                                             |
| 6          | Okanogan Highlands                               | 14         | High Lava Plains and Columbia Basin<br>A - High Lava Plains |
| 7          | Oregon Coast Ranges                              |            | B - Columbia Basin                                          |
| 8          | Western Oregon Interior Valleys                  | 15         | Owyhee Upland                                               |

Table 1.--Established Federal Research Natural Areas in Oregon and Washington

| Code | Name                 | Principal features                                                                                                                    | Administering agency <sup>1</sup> | Area  |       |
|------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------|-------|
|      |                      |                                                                                                                                       |                                   | Ha    | Acres |
| AC   | Abbott Creek         | Sierran-type mixed conifer forest                                                                                                     | FS                                | 1 077 | 2,660 |
| AS   | Ashland              | "Pacific" ponderosa pine, pure or mixed with Douglas-fir                                                                              | FS                                | 570   | 1,408 |
| BA   | Bagby                | Douglas-fir-western hemlock forests                                                                                                   | FS                                | 227   | 560   |
| BB   | Baird Basin          | Interior ponderosa pine, larch, and Douglas-fir                                                                                       | FWS                               | 65    | 160   |
| BI   | Blackwater Island    | Oregon white oak-Douglas-fir grassland on uplands, and willow, Oregon ash in lower portions, of channeled basalt along Columbia River | FWS                               | 52    | 129   |
| BJ   | Bluejay              | Ponderosa and lodgepole pine on coarse pumice                                                                                         | FS                                | 85    | 210   |
| BO   | Boston Glacier       | Major alpine glacier and cirque on northern Cascade Range including some recently deglaciated topography                              | NPS                               | 1 061 | 2,620 |
| BP   | Brewer Spruce        | Brewer spruce with many other conifers                                                                                                | BLM                               | 85    | 210   |
| BR   | Bull Run             | Noble and Pacific silver firs and western hemlock                                                                                     | FS                                | 146   | 361   |
| BU   | Butter Creek         | Subalpine mosaic of forest, meadow, and shrub communities with lakes and ponds                                                        | NPS                               | 810   | 2,000 |
| CA   | Camas Swale          | Dry Douglas-fir forest in foothills of Willamette Valley                                                                              | BLM                               | 130   | 320   |
| CC   | Canyon Creek         | Interior ponderosa pine forest                                                                                                        | FS                                | 283   | 700   |
| CF   | Cedar Flats          | Western redcedar and associated swamps and marshes and Douglas-fir forest                                                             | FS                                | 275   | 680   |
| CH   | Cherry Creek         | Coast Ranges Douglas-fir forest                                                                                                       | BLM                               | 239   | 590   |
| CO   | Coquille River Falls | Port-Orford-cedar stands                                                                                                              | FS                                | 202   | 500   |
| DP   | Diamond Point        | Sitka spruce-western hemlock forest                                                                                                   | FWS                               | 36    | 88    |
| FH   | Fox Hollow           | Dry Douglas-fir-ponderosa pine forest in foothills of Willamette Valley                                                               | BLM                               | 51    | 125   |
| GO   | Goat Marsh           | Extensive mountain marshes, record noble fir forest, beaver swamp, ponds, and lodgepole pine on recent mudflow                        | FS                                | 484   | 1,195 |
| GL   | Gold Lake Bog        | Subalpine bog communities and flora                                                                                                   | FS                                | 188   | 463   |
| GM   | Goodlow Mountain     | Interior ponderosa pine forest                                                                                                        | FS                                | 510   | 1,260 |
| HA   | Hades Creek          | Low-elevation Pacific silver fir-western hemlock forests                                                                              | NPS                               | 227   | 560   |
| HI   | Higley Creek         | Western hemlock forests                                                                                                               | NPS                               | 194   | 480   |
| HR   | Horse Ridge          | Western juniper savanna                                                                                                               | BLM                               | 243   | 600   |

See footnote at end of table.

Table 1.--Established Federal Research Natural Areas in Oregon and Washington (Continued)

| Code | Name                | Principal features                                                                                         | Administering agency <sup>1</sup> | Area           |       |
|------|---------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------|-------|
|      |                     |                                                                                                            |                                   | H <sup>a</sup> | Acres |
| JC   | Jackson Creek       | Douglas-fir forest                                                                                         | NPS                               | 65             | 160   |
| LA   | Lake Twentytwo      | Western redcedar-western hemlock forests and subalpine lake                                                | FS                                | 320            | 790   |
| LS   | Little Sink         | Slump ponds and conifer-bigleaf maple forest on margin of Willamette Valley                                | BLM                               | 32             | 80    |
| LC   | Long Creek          | Western hemlock forests                                                                                    | FS                                | 259            | 640   |
| LF   | Lost Forest         | Isolated ponderosa pine stands and sand dunes within a low-rainfall, shrub-steppe region in central Oregon | BLM                               | 3 628          | 8,960 |
| MC   | Maitlen Creek       | Douglas-fir/needlebark forest with stream drainage                                                         | FS                                | 259            | 640   |
| MA   | Maple Knoll         | Bigleaf maple stands                                                                                       | FWS                               | 40             | 100   |
| ME   | Meeks Table         | Interior ponderosa pine forests on isolated butte                                                          | FS                                | 28             | 68    |
| MI   | Metolius            | Interior ponderosa pine forests                                                                            | FS                                | 583            | 1,440 |
| ML   | Mill Creek          | Mosaic of interior mixed-conifer and Oregon white oak forest, and grass and shrub steppe                   | FS                                | 330            | 815   |
| MO   | Mohawk              | Douglas-fir, western hemlock, and western redcedar forest in foothills along Willamette Valley             | BLM                               | 61             | 150   |
| MY   | Myrtle Island       | California laurel stands                                                                                   | BLM                               | 11             | 28    |
| NC   | Neskowin Crest      | Sitka spruce-western hemlock forests                                                                       | FS                                | 278            | 686   |
| NF   | North Fork Nooksack | Douglas-fir and western hemlock forests                                                                    | FS                                | 605            | 1,495 |
| OD   | Ochoco Divide       | Ponderosa pine-Douglas-fir and grand fir-western larch-Douglas-fir forests                                 | FS                                | 777            | 1,920 |
| OR   | Olailla Ridge       | Subalpine mountain meadows with rich flora and mixed conifer forests                                       | FS                                | 291            | 720   |
| PB   | Pataha Bunchgrass   | Bluebunch wheatgrass stands                                                                                | FS                                | 21             | 51    |
| PE   | Persia M. Robinson  | Douglas-fir and ponderosa pine forests                                                                     | FS                                | 219            | 540   |
| PI   | Pigeon Butte        | Oregon white oak stands                                                                                    | FWS                               | 28             | 70    |
| PN   | Pine Creek          | Interior ponderosa pine and grasslands                                                                     | FWS                               | 65             | 160   |
| PO   | Port Orford Cedar   | Port-Orford-cedar and Douglas-fir forests                                                                  | FS                                | 454            | 1,122 |
| PR   | Pringle Falls       | Lodgepole and ponderosa pine forests on coarse pumice                                                      | FS                                | 470            | 1,160 |

See footnote at end of table.

Table 1.--Established Federal Research **Natural** Areas in Oregon and Washington (Continued)

| Code | Name                  | Principal features                                                                                       | Administering agency <sup>1</sup> | Area   |              |
|------|-----------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------|--------|--------------|
|      |                       |                                                                                                          |                                   | Ha     | Acres        |
| PL   | Pyramid Lake          | Subalpine lake with surrounding conifer forest                                                           | NPS                               | 48     | 119          |
| QU   | Quinalt               | Western hemlock-Sitka spruce forests                                                                     | FS                                | 594    | 1,468        |
| RC   | Rainbow Creek         | Interior mixed-conifer forest with abundant western white pine                                           | FS                                | 170    | 420          |
| RH   | Rattlesnake Hills     | Dry Columbia Basin shrub steppe                                                                          | ERDA                              | 30 364 | 75,000       |
| SA   | Salmo                 | Interior subalpine fir and western hemlock-western redcedar forest with stream drainage                  | FS                                | 563    | 1,390        |
| SR   | Sister Rocks          | Pacific silver fir forests                                                                               | FS                                | 87     | 215          |
| SM   | Steamboat Mountain    | Subalpine fir, Pacific silver fir and mountain hemlock forest, pond, and marshes                         | FS                                | 567    | 1,400        |
| TI   | Tenasillahe Island    | Black cottonwood-willow island stand in lower Columbia River                                             | FWS                               | 75     | 185          |
| TP   | Turnbull Pine         | Interior ponderosa pine stands, grasslands, and ponds                                                    | FWS                               | 81     | <b>200</b>   |
| TW   | Twin Creek            | Sitka spruce stands of "rain forest" type                                                                | NPS                               | 40     | 100          |
| WH   | Wheeler Creek         | Redwood-Douglas-fir forests near the northern limits of redwood                                          | FS                                | 135    | 334          |
| WM   | Wildcat Mountain      | Noble fir, Pacific silver fir, and mountain hemlock forests associated with meadow and shrub communities | FS                                | 405    | 1,000        |
| WP   | Willamette Floodplain | Willamette Valley bottomland grass and Oregon ash communities                                            | FWS                               | 97     | 239          |
| WR   | Wind River            | Douglas-fir-western hemlock forests                                                                      | FS                                | 478    | <b>1,180</b> |
| WW   | Wolf Creek            | Bitterbrush and bunchgrass communities                                                                   | FS                                | 61     | 150          |

<sup>1</sup> BLM = Bureau of Land Management  
ERDA = Energy Research and Development Administration  
FS = Forest Service  
FWS = Fish and Wildlife Service (National Wildlife Refuges)  
NPS = National Park Service.

## The State of Washington

In January **1966**, the Intercampus Committee for Educational and Scientific Preserves (ICESP) met at Central Washington State College to discuss the development of a statewide Natural Area Preserve system. From **1967** to **1970**, with modest funding available, inventories of actual and potential natural areas were prepared by a number of individuals from Western Washington State College, University of Washington, and Washington State University. The inventories of State and private lands received cooperation from the State of Washington Department of Natural Resources. During this period, Wallace Heath, Chairman of the ICESP, helped to keep the idea of a Natural Area Preserve system viable, and he secured some interim funding. The **1970** Session of the State Legislature passed Senate Bill **360**, a proposal within the multiple-purpose act for the Department of Natural Resources; it authorized the withdrawal of certain lands under State ownership for scientific and educational purposes. In the fall of **1971**, Representative Lois North was approached with the concept of a statewide Natural Area Preserve system; Representative North secured a hearing on the subject by the Interim Legislature Council in December **1971**, and reaction was favorable. A bill to create a Natural Area Preserve system was introduced into the State legislature in January **1972** (see appendix III for the complete text of this act); it was signed into law in February, at which time the Washington State Natural Preserves Advisory Committee was established with Gordon Alcorn of the University of Puget Sound as chairman. The Advisory Committee, consisting of seven voting members, is charged with reviewing prospective natural areas and with making recommendations to the Department of Natural Resources.

Natural areas are envisioned as permanent entities, and provisions have been made to ensure maximum protection. As such, their intended value embraces both educational and scientific interests. They allow continuing, nondestructive baseline studies, protection of endangered species, and, as "living museums," enhance the intrinsic cultural values, scenic beauty, and man's relationship to his environment.

Progress to date is as follows:

| <i>Natural<br/>preserve</i>                          | <i>County</i>                                                   | <i>Status</i>                                                             | <i>Keyfeature</i>             | <i>Size</i> |              |
|------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|-------------|--------------|
|                                                      |                                                                 |                                                                           |                               | <i>Ha</i>   | <i>Acres</i> |
| Sand Island and<br>Goose Island<br>Protection Island | Grays Harbor                                                    | Established                                                               | Caspian tern<br>rookery       | <b>10</b>   | <b>25</b>    |
|                                                      | Jefferson, off<br>Point Discovery,<br>Strait of Juan<br>de Fuca | Established                                                               | Rhinoceros auklet<br>rookery. | <b>15</b>   | <b>36</b>    |
| Mima Mounds                                          | Thurston                                                        | Being negotiated<br>for long-term<br>lease from The<br>Nature Conservancy | Mima mounds                   | <b>283</b>  | <b>700</b>   |

## The State of Oregon

The State of Oregon became formally involved in setting aside natural areas in **1973** with the passage of the Oregon Natural Area Preserves Act (see app. IV for the complete text of this act). Glenn Patrick Juday, an Oregon State University graduate student, drafted most of the legislation and played a significant role in the passage of the act. The State Natural Area

Preserves Advisory Committee, authorized by the legislation and consisting of seven voting members, was appointed November **21, 1973**, with Juday as chairman. This committee secures information, coordinates the State's efforts in natural area preservation, and makes recommendations to the State Land Board (comprised of the Governor, Secretary of State, and State Treasurer) concerning establishment of specific preserves. The authority to establish preserves is vested in the State Land Board. The Natural Area Preserves Act stipulates that State Preserves are established for scientific and educational benefits, as well as to encourage the appreciation of natural features.

The establishment procedure is a formalized rulemaking process that provides statutory protection from undue disturbance which would jeopardize a preserve's scientific and educational values. In addition to aiding in the establishment of preserves, the Advisory Committee is charged with surveying the State in order to create and maintain a registry of areas which may be suitable for inclusion within preserves. The Act provides that all areas included **as** preserves must be public lands. The committee is reviewing State Forest, State Park, Wildlife, and Board of Higher Education lands. According to the legislation, county and city parks, forests, and recreation lands may also qualify **as** Natural Area Preserves. Although no preserves have, as yet, been established, because of an excellent State Park acquisition history and generally progressive management by the State Forest system and the Wildlife Commission, a number of outstanding candidate areas are still available.

The Advisory Committee has, to date, concentrated on internal organization, establishing working relationships with the many individuals and agencies involved in natural area work, and establishing the procedure by which preserves are dedicated. It is expected that once these tasks are completed, the actual dedication of areas can proceed efficiently and rapidly.

## The Nature Conservancy

The Nature Conservancy has a long historical involvement in preservation of Research Natural Areas. It began with the establishment of the Natural Areas Committee of the Ecological Society of America in **1917**. This group, formed to take inventory of the remaining natural areas in North America became The Ecologists Union in **1946** and The Nature Conservancy in **1951**. Its concerns have typically included Research Natural Areas, as defined in this document, but have also been somewhat broader, including preservation of land for other than strictly scientific and educational purposes. The Nature Conservancy has an active program of land acquisition by donation and purchase, as well as either managing these areas or transferring lands to other agencies to insure their continued protection. Nationally, The Nature Conservancy has preserved over **600,000 acres (242 915 hectares)** of land in over **1,100** preserves.

A substantial portion of The Nature Conservancy's programs is handled through local chapters and with volunteer labor. In Washington and Oregon three chapters have been chartered—the Western Washington, Inland Empire, and Oregon Chapters. In addition, a northwest office has been established to provide assistance to the chapters as well as liaison with the western regional and national offices.

Since establishment of the first preserve in the Pacific Northwest in **1962**, 16 areas have been preserved (table 2). To establish priorities for natural area preservation, the Oregon Chapter has undertaken an Oregon inventory of natural areas on private lands (The Nature Conservancy **1974**), an effort coordinated with State and Federal programs of natural area preservation. The Nature Conservancy is also involved in an inventory of natural areas in San Juan County, Washington.

In order to utilize inventory data and select priorities for natural area preservation activities, The Nature Conservancy has felt the need for an overall plan in which the needs, as well as their role relative to other groups, are defined; hence, its involvement in the planning activity reported in this document.

Table 2.--*The Nature Conservancy Preserves established or in process of establishment in Oregon and Washington*

| Name                                  | Principal features                                                                                                                                                                                               | Size |       |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|                                       |                                                                                                                                                                                                                  | Ha   | Acres |
| Anderson Lake State Park Natural Area | Outdoor recreation area associated with State park in western Washington                                                                                                                                         | 6    | 15    |
| Burnt Bridge Creek Natural Area       | Freshwater marsh with marginal oak, maple, and Douglas-fir forests near Vancouver Lake in southwestern Washington; to be associated with natural recreational park                                               | 5    | 12    |
| Camassia Natural Area                 | Oak, madrone, camas, and aspen associated with openings and rock gardens floristically rich and with numerous ponds on basalt bluffs above the lower Willamette River, Oregon; leased to Lewis and Clark College | 9    | 23    |
| Cascade Head Preserve                 | Oregon coastal headland with extensive grassland and conifer and red alder forest                                                                                                                                | 121  | 300   |
| Cogswell-Foster Preserve              | Oregon white oak and Oregon ash woodlands and seminatural grasslands in central Willamette Valley, Oregon                                                                                                        | 34   | 83    |
| Dickey River                          | Virgin coniferous forest on the west slopes of the Olympic Peninsula in Washington                                                                                                                               | 2    | 6     |
| Dishman Hills Natural Area            | Part of 640-acre tract of ponderosa pine and Douglas-fir near Spokane, Washington, used for hiking and nature study                                                                                              | .32  | 80    |
| Englehorn Pond Preserve               | Pond and cattail marsh surrounded by low woods on edge of Columbia Basin in Ellensburg, Washington                                                                                                               | 1    | 2     |
| Foulweather Bluff Preserve            | Project to preserve waterfront and mixed conifer-hardwood forest along Hood Canal and a freshwater marsh on the eastern edge of the Olympic Peninsula in Washington                                              | 40   | 100   |
| Lake Louise Ecological Preserve       | Access tract to ecologically rich pond on an 80-acre Western Washington State College educational site                                                                                                           | 2    | 4     |

See footnote at end of table.

Table 2.--*The Nature Conservancy Preserves established or in process of establishment in Oregon and Washington*<sup>1</sup> (Continued)

| Name                                  | Principal features                                                                                                                                                                                    | Size |       |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|
|                                       |                                                                                                                                                                                                       | Ha   | Acres |
| Lawrence Memorial Grasslands Preserve | Bluegrass-bunchgrass community '(steppe) on biscuit scabland near Shaniko, Wasco County, eastern Oregon                                                                                               | 153  | 378   |
| Mima Mounds Research Natural Area     | Mima mound phenomenon and associated vegetation near Olympia, Washington; area leased from Washington State Department of Natural Resources through The Nature Conservancy to Evergreen State College | 222  | 548   |
| Moxee Bog Preserve                    | Floating sphagnum bog-with rare butterfly colony in steppe region of Yakima County, Washington; managed by Yakima Community College                                                                   | 6    | 14    |
| Neahkanie Beach Natural Area          | Rushes and grasses on strand and willows on stabilized dunes along northern Oregon coast                                                                                                              | 1    | 2     |
| Protection Island                     | Rhinoceros auklet breeding ground and seal haul out off Point Discovery, Strait of Juan de Fuca. Managed by Washington State Department of Game                                                       | 15   | 36    |
| Rose Creek Preserve                   | Seminatural grassland and shrub communities in Palouse region of southeastern Washington; being restored                                                                                              | 5    | 12    |
| Sandy River Gorge Preserve            | Project to acquire portions of river, gorge and associated river bar and canyon wall forests, lower Sandy River in western Oregon near Portland                                                       | 77   | 190   |
| Waldron Island                        | Project to acquire beach, large marsh, and Douglas-fir-hardwood forests in San Juan Island group, Puget Sound, Washington; cooperating with San Juan Island Conservation Committee                    | 104  | 256   |
| Wildflower Acres Natural Area         | Wooded area in urban Puget Sound environment, Snohomish County, Washington; conveyed to Western Washington State College                                                                              | 10   | 25    |

<sup>1</sup> Not all these areas qualify as Research Natural Areas in the sense of primary or exclusive dedication to scientific use.

## Professional Societies

A number of professional societies, most notably the Society of American Foresters and the Society for Range Management, have encouraged preservation of Research Natural Areas in the Pacific Northwest. For a perspective on these programs, which do not involve actual acquisition of lands, see Romancier (1974).

## DEVELOPMENT OF THE SYSTEM OUTLINE

The need for developing an overall Research Natural Area plan for Oregon and Washington is obvious. Suitable areas are rapidly being converted to other uses, reducing options for preserving examples of specific organisms and natural ecosystems—permanently in some cases. The profusion of individuals, agencies, and institutions actively involved suggests possible duplication of effort with consequent inefficiencies and confusion in the minds of the public as well as the land managers and politicians who must respond to the numerous proposals and initiatives. Comprehensive land planning by several major Federal land management agencies as well as by State and local governments makes the comprehensive outline of the ecosystems and organisms of critical scientific interest particularly important. Land managers and planners, as well as other interested public and private groups, need to know the scope and content of a minimal scientific preserve system, that it is finite, and that the diverse activities are coordinated.

In 1972 and early 1973, each major group involved in Research Natural Area programs concluded, almost simultaneously, that it needed a plan to guide its activities, including a listing of ecosystems and organisms of interest and a priority ranking for consideration. At the Federal level, this was reflected in a determination by the Pacific Northwest Research Natural Area Committee to prepare a new list of natural area needs to guide Federal land planners. In the States of Washington and Oregon, the Natural Area Advisory Committees established under recent legislation were charged with developing master plans outlining the scope and content of the system. The Nature Conservancy also wanted a long-range plan for its activities.

Aware of their similar and overlapping needs, these four groups agreed to join in a common effort to develop a comprehensive outline for an Oregon-Washington Research Natural Area system under the leadership of Robert E. Buckman, Chairman of the Pacific Northwest Research Natural Area Committee, the focal point for Federal agency activity in this region. As the initial step, a workshop was held in late November of 1973 to develop an outline of a minimal Research Natural Area system for the Pacific Northwest which would also identify the roles of each agency and institution involved in establishing such preserves.

## Workshop Format and Charge

The workshop was planned and charged with its tasks by the Steering Committee, organized and headed by Dr. Buckman. Steering Committee members were primarily State and Federal agency heads charged with significant administrative responsibilities:

Robert E. Buckman, Director, Pacific Northwest Forest and Range Experiment Station,  
U.S. Forest Service  
Kessler R. Cannon, Governor's Assistant for Natural Resources (Oregon)  
Archie D. Craft, State Director, U.S. Bureau of Land Management  
Don Lee Fraser, Supervisor, Natural Resources, Washington Department of Natural  
Resources

Arthur R. Kruckeberg, Chairman, Washington Intercampus Committee on Educational and Scientific Preserves  
Kenneth R. Margolis, Northwest Representative, The Nature Conservancy  
R. Kahler Martinson, Regional Director, U.S. Fish and Wildlife Service  
John A. Rutter, Regional Director, National Park Service  
Theodore A. Schlapfer, Regional Forester, U.S. Forest Service  
Phillip W. Schneider, Regional Executive, National Wildlife Federation

Attendance at the workshop was limited to keep the group of a workable size (see list of participants in app. VII); consequently, all interested and concerned scientists and other individuals could not be invited. Nevertheless, it was essential that participants representing the various relevant scientific disciplines (for example, geology, soils, limnology, and marine biology), as well as the major institutions and agencies involved in the Research Natural Area programs, be present. It was viewed as particularly important to have both scientists and land managers present because any plan needed to be jointly developed and mutually acceptable — those who could best identify the needs and would use the area should join in planning with those aware of the constraints and possibilities and who would set up and administer such tracts.

Workshop participants were charged with identifying the elements of a minimal Research Natural Area system for Oregon and Washington. In other words, what kinds of ecosystems and numbers of each should be protected by a Federal, State, or private institution within scientific reserves? The steering committee, in turn, reviewed the product of the workshop for its overall soundness and acceptability.

To meet this overall objective, six tasks were identified for the workshop participants:

1. Identify the terrestrial ecosystems which should be represented in the various physiographic provinces;
2. Identify the freshwater ecosystems which should be represented in the various physiographic provinces;
3. Identify the marine ecosystems, including estuarine, that should be represented;
4. Review rare and endangered plant and animal species and identify and list those best handled in a Research Natural Area context;
5. Match the four lists of needs against features already preserved in Research Natural Areas to identify remaining needs; and
6. Rank the remaining needs as to priority for attention and identify a lead agency or organization for each of the remaining needs (the group most likely to be able to fill the need).

To accomplish these tasks the participants were divided into five working groups based on their expertise: terrestrial ecosystems west of the Cascade Range, terrestrial ecosystems east of the Cascade Range, freshwater ecosystems, marine and estuarine ecosystems, and rare and endangered organisms.

Some additional guiding principles were provided:

1. The system should include examples of typical ecosystems as well as those which are unique or unusual.
2. Areas, features, and organisms having some scientific interest are practically infinite and only those cases requiring a special designation to protect the scientific values and enhance research potential should be identified as Research Natural Area needs. Scientific and educational values of an area can often be protected by other means. A species of plant or animal can be protected, sometimes more adequately, without requiring a Research Natural Area. Since land is a limited commodity with many competing uses, the Research Natural Area designation should be used only where it is essential.

3. Number of required areas for a given ecosystem should vary with its importance and variability. For example, where a particularly important system, such as Douglas-fir forest, is involved, sufficient examples should be proposed to encompass the major mixtures, environments, and ages. Furthermore, their importance should be considered in the context of whether the variations are sufficient to result in major differences in ecosystem function (e.g., growth) and to have different land management implications.

## Operation of the Workshop

The findings of the working groups and overall plan for the system are presented in later sections; however, it might be helpful to indicate how the effort evolved. At the outset the five working groups differed markedly in their starting point. The terrestrial groups and, to a lesser extent, the aquatic (freshwater) group had preliminary lists from which to work. Working groups on marine ecosystems and rare and endangered organisms had no listings or classifications relevant to planning scientific reserves.

Primary attention evolved toward the listing of cells—ecosystems or organisms which needed to be represented—as these are the basic subject units in developing a system. Various geographic or physiographic provinces were, in the case of terrestrial and aquatic systems, used as the basic stratification; and cellular listings were developed for each province. The cells differed in the degree to which they were defined, depending largely upon the level of knowledge about that ecosystem.

It became clear early in the deliberations of the working groups that a number of the cells could reasonably be expected to occur together and, hence, might possibly be combined into a single Research Natural Area. In the terrestrial and aquatic (freshwater) groups this process of aggregation advanced almost simultaneously with the listing of cells. In this way, the probable number of needed areas and their desired composition with regard to cells were developed together. Listings of cells in the marine and rare and endangered groups proceeded in a somewhat different fashion (see the reports of these working groups); ultimately rare and endangered cells for some animals were identified and incorporated into the list of needed Research Natural Areas.

## The Cellular Approach To Developing Research Natural Area Needs

Before proceeding with the report, it is important that the reader have some concepts firmly in mind. Cells are the basic units which must be represented in a natural area system. A cell can be an ecosystem, community, habitat, or organism. Organisms are generally recognized implicitly in cells identified for ecosystems, communities, or habitats. However, where an organism is of particular scientific significance or is rare or threatened, it may receive explicit recognition as a cell.

A “Research Natural Area need,” as identified in this report, is typically an aggregation of several cells which need representation. This, of course, assumes that these cells can be found together. The listed “needs” are simply guides intended mainly to encourage, insofar as possible, the establishment of multicellular Research Natural Areas. It may or may not prove possible to find a “Research Natural Area need” with the described aggregation of cells when a site is actually sought in the field. In all cases it must be remembered that it is the individual cell which is the basic unit requiring representation.

# *Part 11.*

## *Research Natural Area*

### *Needs by Province*

Outlined in this section are the major elements proposed for a comprehensive Research Natural Area system. It is based upon the best judgments of many individuals in universities and State and Federal agencies as well as the private sector. The plan should not be considered as either final or complete; it is a starting point and will be periodically revised. As the system develops and our knowledge of natural ecosystems increases, we should expect the type and number of areas needed to evolve through improved definition of needs, additions, and deletions. The potential role and needs for Research Natural Areas in marine ecosystems and for rare and endangered organisms are, perhaps, most poorly understood.

Nonetheless, it is clear what the overall scope of a minimal Research Natural Area system must be. The numbers of desired cells are summarized by physiographic province in table 3 for terrestrial and aquatic (freshwater) ecosystems and total approximately 360 and 180, respectively. Cells for rare and endangered vertebrate animals total 94. Substantial progress has already been achieved in representing examples of terrestrial cells (approximately 25 percent complete); however, existing Research Natural Areas have served aquatic needs much more inadequately (approximately 10 percent of cells are filled). Existing Research Natural Areas are known to fill only seven of the rare and endangered animal cells. Vascular plants of special interest were not identified as cells; a few are present on existing Research Natural Areas but our knowledge of the flora of many reserves is quite poor.

Table 3.--*Number of terrestrial, aquatic, and rare and endangered animal cells or ecosystems needing representation in Research Natural Areas in Oregon and Washington and number already filled or represented in existing reserves*

| Province                                      | Terrestrial cells |        | Aquatic (freshwater) cells |        | Rare and endangered animal cells |        |
|-----------------------------------------------|-------------------|--------|----------------------------|--------|----------------------------------|--------|
|                                               | Total             | Filled | Total                      | Filled | Total                            | Filled |
| Olympic Peninsula and Southwestern Washington | 27                | 8      | 17                         | 0      | 4                                | 0      |
| Puget Trough                                  | 16                | 2      | 8                          | 1      | 4                                | 0      |
| Western Slopes and Crest, Washington Cascades | 31                | 16     | 18                         | 7      | 8                                | 0      |
| Eastern Slopes, Washington Cascades           | 21                | 4      | 11                         | 0      | 7                                | 0      |
| Columbia Basin, Washington                    | 43                | 7      | 13                         | 2      | 12                               | 3      |
| Okanogan Highlands                            | 27                | 5      | 11                         | 2      | 3                                | 0      |
| Oregon Coast Ranges                           | 23                | 5      | 13                         | 0      | 4                                | 1      |
| Western Oregon Interior Valleys               | 26                | 8      | 9                          | 1      | 6                                | 0      |
| Siskiyou Mountains                            | 26                | 7      | 14                         | 2      | 8                                | 2      |
| Western Slopes and Crest, Oregon Cascades     | 27                | 7      | 17                         | 3      | 7                                | 1      |
| Eastern Slopes, Oregon Cascades               | 17                | 9      | 8                          | 0      | 2                                | 0      |
| Ochoco, Blue, and Wallowa Mountains           | 25                | 6      | 13                         | 0      | 5                                | 0      |
| Basin and Range                               | 19                | 0      | 14                         | 0      | 10                               | 0      |
| High Lava Plains and Columbia Basin, Oregon   | 19                | 8      | 6                          | 0      | 8                                | 0      |
| Owyhee Upland                                 | 15                | 0      | 8                          | 0      | 6                                | 0      |
| Total                                         | 362               | 92     | 180                        | 18     | 94                               | 7      |

Although the identification of marine and estuarine cells is not as complete, this working group recommended the establishment of 68 Research Natural Areas in coastal environments. If we assume that each natural area will fill, on the average, two cells, our estimate of total marine and estuarine cells amounts to approximately 172.

Putting all these cells or basic planning components together, we arrive at a Research Natural Area (RNA) system which should incorporate about 772 ecosystems, habitats, or rare and endangered organisms:

|                                  |            |
|----------------------------------|------------|
| Terrestrial cells                | 362        |
| Aquatic (freshwater) cells       | 180        |
| Rare and endangered animal cells | 94         |
| Marine and estuarine cells'      | <u>136</u> |
| Total                            | 772        |

Of course, this in no way implies a need for that many Research Natural Areas. In fact, it is estimated that the actual number of Research Natural Areas needed to provide examples of the various ecosystems is considerably less than half, or about 360. This is because areas can logically be selected which will fill several cells (terrestrial, aquatic, and rare and endangered) simultaneously. Experience to date with the 60 established Federal Research Natural Areas (see table 1) indicates an average of around two filled cells per area even though most were selected to represent a single cell. One (Rattlesnake Hills RNA) fills at least 10 cells needed in the Columbia Basin.

Research Natural Area needs were identified on a province-by-province basis (fig. 1), following a common format which incorporates most of the relevant information for each. The province presentation begins with a brief description of the physical and biologic features encountered. The cells which should be represented in a minimal natural area system are listed and described for terrestrial and aquatic (freshwater) ecosystems and rare or endangered vertebrate animals. Vascular plants of special interest are briefly discussed and listed. These necessary cells or components in the province are then compared with existing Research Natural Areas to determine cells which remain to be filled.

The last table in each province presentation identifies the type and number of additional Research Natural Areas which will probably be required to provide minimal coverage of the remaining unfilled cells. This has been done by aggregating the unfilled cells which could, with reasonable likelihood, be found within a single area and listing these as needed Research Natural Areas. In other words, the unfilled cells have been aggregated into *tentative* units listed as Research Natural Area needs.

The proposed Research Natural Area needs can be summarized as follows:

|                                         |     |
|-----------------------------------------|-----|
| Terrestrial-aquatic (freshwater) RNA's  | 46  |
| Terrestrial RNA's                       | 125 |
| Aquatic (freshwater) RNA's              | 64  |
| Special interest plant and animal RNA's | 13  |
| Marine and estuarine RNA's (tentative)  | 68  |
| Total additional RNA's                  | 316 |
| Existing RNA's                          | 60  |
| Total RNA's in proposed system          | 376 |

Research Natural Area needs are summarized by State and physiographic province in table 4.

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'We have not attempted to define marine and estuarine cells but rather **specific** areas needed as **RNA's**. Therefore, this is only a very rough estimate of number of needed cells.

Table 4.--*Estimated number of Research Natural Areas needed by State and physiographic province*  
(Does not include marine and estuarine needs)

| State and Province                            | Terrestrial and aquatic (freshwater) RNA's | Terrestrial RNA's | Aquatic (freshwater) RNA's | RNA's for rare and endangered species | Total     |
|-----------------------------------------------|--------------------------------------------|-------------------|----------------------------|---------------------------------------|-----------|
| <b>Washington:</b>                            |                                            |                   |                            |                                       |           |
| Olympic Peninsula and Southwestern Washington | 6                                          | 9                 | 6                          | 1                                     | 22        |
| Puget Trough                                  | 0                                          | 11                | 6                          | 0                                     | 17        |
| Western Slopes and Crest, Washington Cascades | 3                                          | 9                 | 6                          | 3                                     | 21        |
| Eastern Slopes, Washington Cascades           | 3                                          | 11                | 4                          | 3                                     | 21        |
| Columbia Basin, Washington                    | 0                                          | 9                 | 3                          | 0                                     | 12        |
| Okanogan Highlands                            | <u>3</u>                                   | <u>9</u>          | <u>1</u>                   | <u>0</u>                              | <u>13</u> |
| Total                                         | 15                                         | 58                | 26                         | 7                                     | 106       |
| <b>Oregon:</b>                                |                                            |                   |                            |                                       |           |
| Oregon Coast Ranges                           | 6                                          | 5                 | 4                          | 0                                     | 15        |
| Western Oregon Interior Valleys               | 1                                          | 14                | 6                          | 1                                     | 22        |
| Siskiyou Mountains                            | 5                                          | 10                | 6                          | 3                                     | 24        |
| Western Slopes and Crest, Oregon Cascades     | 5                                          | 13                | 4                          | 0                                     | 22        |
| Eastern Slopes, Oregon Cascades               | 3                                          | 6                 | 4                          | 1                                     | 14        |
| Ochoco, Blue, and Wallowa Mountains           | 5                                          | 9                 | 4                          | 0                                     | 18        |
| Basin and Range                               | 4                                          | 2                 | 4                          | 0                                     | 10        |
| High Lava Plains and Columbia Basin, Oregon   | 0                                          | 4                 | 5                          | 0                                     | 9         |
| Owyhee Upland                                 | <u>2</u>                                   | <u>4</u>          | <u>1</u>                   | <u>1</u>                              | <u>8</u>  |
| Total                                         | 31                                         | 67                | 38                         | 6                                     | 142       |
| Total, both States                            | 46                                         | 125               | 64                         | 13                                    | 248       |

A final reminder to users of these lists:

(1) Lists are not "final" but will undoubtedly be adjusted in future years. They do provide a basic outline for identifying candidate Research Natural Areas as a part of comprehensive land use planning.

(2) Cells are the basic units requiring representation and the focus is on filling these. The Research Natural Area needs listed are our best estimate as to how this can be done with the greatest economy in number and size of areas required.

(3) Scientists from several disciplines will be necessary in selecting areas to fill several cells.

(4) The listing of multicell Research Natural Areas should not lead to excessive pursuit of an ideal area. If an area with all attributes listed cannot be found after a reasonable search, the need as listed here should be broken down into two or more Research Natural Area needs which cover the same cells.

(5) Most of the needed Research Natural Areas are common or typical ecosystems rather than unique or unusual types. These should be as representative as possible of the normal environments (geology, climate, soils, etc.) occupied by those ecosystems. Representativeness is extremely important if Research Natural Areas are to be used as baseline or control areas for managed lands and as sites for research with management relevance.

(6) Size of desired areas will vary widely and is determined by the nature of the ecosystem or organism we wish to preserve.



## OLYMPIC PENINSULA AND SOUTHWESTERN WASHINGTON PROVINCE

The Olympic Peninsula is made up of a central core of the rugged Olympic Mountains surrounded by almost level lowlands (fig. 1). The effects of glaciation and rapid stream dissection due to the extremely heavy precipitation have combined to produce precipitous mountain slopes. All river valleys draining the Olympic Mountains are broad and U-shaped; and all major peaks are ringed with cirques, many containing active glaciers.

Geologically, the central portion of the Olympic Mountains is made up of late Mesozoic graywacke, with some interbedded slate, argillite, and volcanic rocks. This interior portion is encircled on the north, east, and south by two belts of volcanic rocks (largely basalt and flow breccia). The broad, level areas along the western and southern margins of the peninsula have been interpreted as marine terraces or glacial outwash fans.

Forested soils formed on the sedimentary rocks of the interior of the Olympic Mountains have been reported to be Brown Podzolics, with silt loam surface horizons and sandy clay loam B horizons. On the more gentle slopes, basalt parent materials give rise to deep, well-developed reddish-brown soils, generally of silty clay loam texture. Soils on glacial outwash deposits tend to be poorly developed and coarse textured (gravelly sandy loam is typical). Terraces adjoining principal river channels are generally mantled with deep silt loam soils which remain moist throughout the year.

Southwestern Washington, which includes the Willapa and Black Hills, is a region of low, rounded hills largely comprised of Eocene sandstone and siltstone.

For the most part, soils tend to be deep, reddish-brown in color, and fairly fine-textured. Along the coast, small areas of sand dunes are present, especially in the Long Beach area.

Dense coniferous forest with associated fauna and the streams and rivers are the dominant biologic features of this province (Franklin and Dyness **1973**). Western hemlock, Sitka spruce, Douglas-fir, and western redcedar dominate at lower and true firs at higher elevations. The "Olympic rain forests" on the west slopes of the peninsula are well known, with their elk and epiphyte-draped trees. Subalpine parklands and alpine regions cover substantial areas in the Olympic Mountains. Substantial variation exists in these ecosystems, however, reflecting both

climatic differences and historical effects. The northeastern and eastern portions of the Olympic Peninsula are much drier than the remainder of this generally superhumid province. Douglas-fir and subalpine fir are more conspicuous in this drier region, and the alpine region is more extensive. The southwestern Washington Coast Ranges have been heavily altered by logging and are dominated by much younger, secondary forests of conifers and red alder.

The coastal areas add substantially to the biotic diversity of this province; distinctive ecosystems are associated, for example, with the sand dunes, rocky headlands and islands, coastal plain prairies and cedar swamps, and ocean-front forests.

Dominant freshwater systems are streams and rivers, some of glacial origin, oligotrophic lakes and ponds at higher elevations, and a variety of bog and swamp ecosystems on the coastal plain. Anadromous fish are an important biotic element in many of the river and stream systems.

Identified terrestrial cells in the Olympic Peninsula and southwestern Washington Coast Ranges total 27 (table 5). These consist largely of the major variants of the coniferous forests and the complex subalpine and alpine community mosaics. Five of the cells specifically identify necessary coverage of the specialized coastal front and plain communities.

Aquatic cells total 17 (table 6) and recognize a need for designation of major stream drainages on both sides of the peninsula as Research Natural Areas. Two cells recognize anadromous fish runs as necessary components (Nos. 1 and 11). The remaining cells are mainly small lakes and ponds in a variety of environments, and swamps, marshes, and bogs on the coastal plain.

It is presumed that the terrestrial and freshwater areas will include the normal complement of animal and plant species. Four animal species are listed as cells for Research Natural Area consideration because of their rare and endangered status (table 7). The list of vascular plants of special interest is relatively long (table 8) and includes 12 species on the Smithsonian list of endangered and threatened plants. This is a consequence of the presence of several endemic species as well as numerous disjunct populations in the isolated Olympic Mountain block; most of these are subalpine and alpine plants and are concentrated in the northeastern part of the peninsula. The other major group of vascular plants of special interest is associated mainly with specialized habitats (bogs, marshes, cliffs) on the coastal plain.

There are six existing Research Natural Areas in this province (table 9), mostly small and all Federal, with four located in Olympic National Park. These fill 8 of 27 terrestrial cells and none of the freshwater or rare and endangered animal cells.

Consequently there is a large number of Research Natural Areas which need to be selected and established in the Olympic Mountains and Coast Ranges of Washington (table 10). Our tentative estimate is that 22 additional Research Natural Areas can provide minimal coverage of all listed cells and a majority of special interest vascular plants. Six of these (**Nos. 1-6**) involve relatively large areas to encompass a variety of terrestrial and aquatic cells typically taking in a complete drainage system of a stream, lake, or pond. Most of the remainder involve smaller areas to encompass one or two cells. Because of the large number of special interest vascular plants at high elevations in the Olympic Mountains, an alpine tract focused on several of these will probably prove necessary in addition to inclusion of typical alpine ecosystems in need No. 5.

Lead responsibility in this province is clearly split between the National Park Service and Forest Service on the peninsula, with Washington State, assisted by private organizations and the Fish and Wildlife Service, critical in the Coast Ranges. Olympic National Park clearly will shoulder the greatest load in both the coastal plain and mountains of the peninsula; but even there, cellular needs cannot be fully met solely within the Park (see, for example, No. 2). One of the most difficult needs to fill may be the cedar swamp with ponds and anadromous fish (No. 3), but it is considered critical.

The priority ratings reflect the already protected status of ecosystems within Olympic National Park; the ecosystems in the heavily impacted and rapidly developing southwestern Coast Ranges clearly need immediate attention. Nevertheless it is important that selection and establishment of tracts in Olympic National Park proceed quickly, as they represent such a large element in the province's Research Natural Area needs.

Table 5.--*Terrestrial cells in the Olympic Peninsula and Southeastern Washington Province*

| Cell                                                                                       | SAF<br>timber<br>type No. | Present<br>representation      | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------------------|---------------------------|--------------------------------|--------------------------------------------------|
| <u>Western Hemlock Zone:</u>                                                               |                           |                                |                                                  |
| 1. Old-growth Douglas-fir on a major river terrace, west side of peninsula                 | 229                       | Jackson Creek RNA              | 72-82                                            |
| 2. Douglas-fir-western hemlock on a marine terrace, west side of peninsula                 | 230                       | Quinault RNA                   | 72-82                                            |
| 3. Western hemlock/swordfern, west side of peninsula                                       | 224                       | Quinault and Higley Creek RNAs | 77-78                                            |
| 4. Western redcedar-western hemlock on the coastal plain, west side of peninsula           | 227                       | Quinault RNA                   | 79-82                                            |
| * 5. Western redcedar-western hemlock on uplands                                           | 227                       | Token, needs additional area   | 79-82                                            |
| * 6. Typical Douglas-fir-western hemlock forest on slopes, east side of peninsula          | 230                       | None                           | 72-82                                            |
| * 7. Douglas-fir-western hemlock/Oregon grape forest on slopes, east side of peninsula     | 230                       | None                           | 82                                               |
| * 8. Pure stand of red alder on upland site                                                | 221                       | None                           | 61-63                                            |
| <u>Pacific Silver Fir Zone:</u>                                                            |                           |                                |                                                  |
| * 9. Typical noble fir forest in Willapa Hills area                                        | 226                       | None                           | 94-98                                            |
| 10. Pacific silver fir-western hemlock at low-elevation, west side of peninsula            | 226                       | Hades Creek RNA                | 94-98                                            |
| *11. Pacific silver fir-western hemlock at mid- to high elevations, west side of peninsula | 226                       | None                           | 94-98                                            |
| *12. Pacific silver fir/salal community on slopes, east side of peninsula                  | 226                       | None                           | 94-98                                            |
| <u>Sitka Spruce Zone:</u>                                                                  |                           |                                |                                                  |
| 13. Sitka spruce-western hemlock/swordfern community                                       | 225                       | Twin Creek and Quinault RNAs   | 59-61                                            |
| 14. Second-growth Sitka spruce-western hemlock forest                                      | 225                       | Diamond Point RNA              | 59-61                                            |
| *15. Sitka spruce/salal community ocean front                                              | 223                       | None                           | 59-61                                            |

See footnote at end of table.

Table 5.--*Terrestrial cells in the Olympic Peninsula and Southeastern Washington Province*  
(Continued)

| Cell                                                                                                                    | SAF<br>timber<br>type No. | Present<br>representation           | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------|--------------------------------------------------|
| <u>Subalpine and Alpine Zones:</u>                                                                                      |                           |                                     |                                                  |
| *16. Mountain hemlock-Pacific silver fir forest in western Olympic Mountains                                            | 205                       | None                                | 101-106                                          |
| *17. Subalpine fir forest in northeastern portion of Olympic Peninsula                                                  | 206                       | None                                | 101-106                                          |
| *18. Subalpine parkland mosaic with mountain hemlock and heather-huckleberry dominance, western Olympic Mountains       | 205                       | None                                | 101-106<br>250-268                               |
| *19. Subalpine parkland mosaic with subalpine fir and grass-forb dominance, eastern Olympic Mountains                   | 206                       | None                                | 101-106<br>250-268                               |
| *20. Alpine community mosaic, including krummholz, northeastern Olympic Mountains                                       |                           | None                                | 284-290                                          |
| <u>Special types :</u>                                                                                                  |                           |                                     |                                                  |
| *21. Western redcedar swamp on coastal plain with evergreen huckleberry understory and possibly patches of skunkcabbage | 228                       | None                                | 68-69                                            |
| 22. Typical red alder swamp                                                                                             | 221                       | Higley Creek and Diamond Point RNAs | 68-69                                            |
| *23. Typical riparian hardwoods (red alder-cottonwood)                                                                  | 221                       | None                                | 66-67                                            |
| *24. Lodgepole pine forest, ocean front                                                                                 | 216                       | None                                | 291-294                                          |
| *25. Coastal sand dunes, including both active and stabilized dunes                                                     |                           | None                                | 291-294                                          |
| *26. Typical coastal prairie, west side of peninsula                                                                    |                           | None                                | 69-70                                            |
| *27. Sitka spruce/willow community, tideland area                                                                       | 223                       | None                                |                                                  |

\*Cells presently lacking adequate representation.

Table 6.--Aquatic cells in *the Olympic Peninsula and Southwestern Washington Province*

| Cell <sup>1</sup>                                                                      | Present representation | Remarks                                          |
|----------------------------------------------------------------------------------------|------------------------|--------------------------------------------------|
| * 1. Major stream drainage with coniferous forest and anadromous fish run              | None                   | Should be on west side of peninsula              |
| * 2. Major stream drainage with coniferous forest on east side                         | None                   | Stream draining east slopes of Olympic Mountains |
| * 3. Oligotrophic lake at low elevation                                                | None                   |                                                  |
| * 4. Lake and drainage basin of subalpine forest or forest and meadow                  | None                   |                                                  |
| * 5. Typical alpine lake and drainage basin                                            | None                   |                                                  |
| * 6. Low-elevation permanent pond                                                      | None                   |                                                  |
| * 7. Subalpine permanent pond                                                          | None                   |                                                  |
| * 8. Alpine permanent pond                                                             | None                   |                                                  |
| * 9. Low-elevation vernal pond                                                         | None                   |                                                  |
| *10. Subalpine permanent pond                                                          | None                   |                                                  |
| *11. Stream draining western redcedar swamp, with anadromous fish                      | None                   | West side of peninsula                           |
| *12. Headwaters of a subalpine stream, one fork glacially fed, another fork nonglacial | None                   |                                                  |
| *13. Large, upwelling cold spring                                                      | None                   |                                                  |
| *14. Typical hot spring                                                                | None                   |                                                  |
| *15. Western redcedar swamp                                                            | None                   |                                                  |
| *16. Typical marsh area                                                                | None                   |                                                  |
| *17. Coastal bog                                                                       | None                   | <b>Myrica</b> is typical shrub species           |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 7.--*Rare and endangered vertebrate animal cells in the Olympic Peninsula and Southwestern Washington Province*

| Cell                                                       | Verified<br>representation | Reference                                                                                                      |
|------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------|
| <u>Fish:</u>                                               |                            |                                                                                                                |
| *1. Olympic mudminnow                                      | None                       |                                                                                                                |
| <u>Amphibians :</u>                                        |                            |                                                                                                                |
| *2. Dunn salamander                                        | None                       | Stebbins 1954                                                                                                  |
| <u>Mammals :</u>                                           |                            |                                                                                                                |
| *3. Western pocket gopher<br>(subspecies <i>melanops</i> ) | None                       | Dalquest 1948<br>Johnson and Johnson 1952                                                                      |
| *4. Heather vole                                           | None                       | Dalquest 1948<br>Johnson and Johnson 1952<br>Maser and Storm 1970<br>Edwards 1955<br>Johnson 1973<br>Shaw 1924 |

\*Cells presently lacking adequate representation.

Table 8.--*Vascular plants of special interest in the Olympic Peninsula and Southwestern Washington Province*

| Species <sup>1</sup>                                           | Distribution                                                    |
|----------------------------------------------------------------|-----------------------------------------------------------------|
| <i>Anemone oregana</i> var. <i>felix</i> <sup>2</sup>          | Marshes or sphagnum bogs, Grays Harbor County                   |
| <i>Arenaria paludicola</i> <sup>2</sup>                        | Coastal southwestern Washington                                 |
| <i>Argostis aequivalvis</i>                                    | Bogs, Lake Ozette north                                         |
| <i>Aster paucicapitatus</i>                                    | Subalpine parkland, Olympic Mountains                           |
| <i>Astragalus cottonii</i>                                     | Alpine talus, Olympic Mountains                                 |
| <i>Botrychium lanceolatum</i>                                  | High-elevation, moist areas                                     |
| <i>Botrychium virginianum</i>                                  | Broad elevational range                                         |
| <i>Calamagrostis crassiglumis</i>                              | Around lakes; subalpine rock crevices, Olympic Mountains        |
| <i>Campanula piperi</i>                                        | Peat bogs and swampy woods, Grays Harbor County north           |
| <i>Carex pluriflora</i>                                        | Marshes and streambanks, south to Clallam County                |
| <i>Castilleja parviflora</i> var. <i>olympica</i> <sup>2</sup> | Subalpine meadows, Olympic Mountains                            |
| <i>Cheilanthes lanosa</i>                                      | Olympic Mountains                                               |
| <i>Cimicifuga elata</i>                                        | Lower elevations                                                |
| <i>Delphinium nuttallii</i>                                    | Outwash prairies and basaltic cliffs, Grays Harbor County south |
| <i>Douglasia laevigata</i>                                     | Northeastern Olympic Mountains                                  |
| <i>Draba incerta</i>                                           | Olympic Mountains                                               |
| <i>Eburophyton austiniae</i>                                   | Deep coniferous forest                                          |
| <i>Elmera racemosa</i>                                         | Olympic Mountains                                               |
| <i>Erigeron aliceae</i>                                        | Olympic Mountains                                               |
| <i>Erigeron flettii</i> <sup>2</sup>                           | Higher elevations, Olympic Mountains                            |
| <i>Erysimum arenicola</i> var. <i>arenicola</i>                | Higher elevations, Olympic Mountains                            |
| <i>Erythronium revolutum</i>                                   | Widely distributed                                              |
| <i>Gentiana douglasiana</i>                                    | Lake Ozette area                                                |
| <i>Geum triflorum</i> var. <i>campanulatum</i>                 | Olympic Mountains                                               |
| <i>Hedysarum occidentale</i>                                   | Olympic Mountains                                               |
| <i>Howellia aquatilis</i>                                      | Ponds and lakes                                                 |
| <i>Lewisia columbiana</i> var. <i>rupicola</i>                 | Olympic Mountains                                               |
| <i>Lomatium martindalei</i> var. <i>flavum</i> <sup>2</sup>    | Olympic Mountains                                               |
| <i>Myrica californica</i>                                      | Coastal dune habitats, Grays Harbor County south                |
| <i>Myrica gale</i>                                             | Coastal bogs, Grays Harbor County south                         |
| <i>Nephrophyllidium crista-galli</i>                           | Bogs and wet meadows, Olympic Peninsula                         |

See footnotes at end of table.

Table 8.--*Vascular plants of special interest in the Olympic Peninsula and Southwestern Washington Province (Continued)*

| Species <sup>1</sup>                                             | Distribution                                                          |
|------------------------------------------------------------------|-----------------------------------------------------------------------|
| <i>Oxytropis viscida</i>                                         | Olympic Mountains                                                     |
| <i>Pedicularis bracteosa</i> var. <i>atrosanguinea</i>           | Olympic Mountains                                                     |
| <i>Petrophytum hendersonii</i> <sup>2</sup>                      | Olympic Mountains                                                     |
| <i>Phacelia bolanderi</i>                                        | Wahkiakum County                                                      |
| <i>Pleuricospora fimbriolata</i>                                 | Olympic Mountains                                                     |
| <i>Poa pachypholis</i> <sup>2</sup>                              | Rare endemic on ocean cliffs, Pacific County                          |
| <i>Polemonium carneum</i>                                        |                                                                       |
| <i>Polypodium scolieri</i>                                       | Epiphyte in dunes and salt spray zone                                 |
| <i>Polystichum andersonii</i>                                    |                                                                       |
| <i>Polystichum kruckebergii</i> <sup>2</sup>                     | Hurricane Ridge, Olympic Mountains                                    |
| <i>Ranunculus cooleyae</i>                                       | Mount Colonel Bob, Olympic Mountains                                  |
| <i>Ribes lobbii</i>                                              | Disjunct reported on Olympic Peninsula                                |
| <i>Romanzoffia tracyi</i>                                        | Along coast of Olympic Peninsula                                      |
| <i>Sanquisorba menziesii</i>                                     | Southern limit in Olympic Mountains                                   |
| <i>Saxifraga oppositifolia</i>                                   | Olympic Mountains                                                     |
| <i>Senecio flettii</i>                                           | Moderate to high elevations, Olympic Mountains                        |
| <i>Senecio websteri</i> <sup>2</sup>                             | Endemic at high altitudes, Olympic Mountains                          |
| <i>Sisyrinchium californicum</i>                                 | Bogs near coast                                                       |
| <i>Stellaria humifusa</i>                                        | Widely disjunct in salt marshes                                       |
| <i>Synthyris pinnatifida</i> var. <i>lanuginosa</i> <sup>2</sup> | Alpine endemic, Olympic Mountains                                     |
| <i>Synthyris schizantha</i> <sup>2</sup>                         | Moist shaded cliffs at moderate to high elevations, Olympic Peninsula |
| <i>viola flettii</i> <sup>2</sup>                                | Subalpine to alpine, northeastern Olympic Mountains                   |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 9.--*Established Research Natural Areas in the Olympic Peninsula and Southwestern Washington Province*

| Name              | Principal features                                              | Agency <sup>1</sup> | Area |       |
|-------------------|-----------------------------------------------------------------|---------------------|------|-------|
|                   |                                                                 |                     | Ha   | Acres |
| Diamond Point RNA | Sitka spruce-western hemlock forest on an island in Willapa Bay | FWS                 | 36   | 88    |
| Hades Creek RNA   | Low-elevation Pacific silver fir-western hemlock forest         | NPS                 | 227  | 560   |
| Higley Creek RNA  | Western hemlock forests                                         | NPS                 | 194  | 480   |
| Jackson Creek RNA | Douglas-fir forest                                              | NPS                 | 65   | 160   |
| Quinault RNA      | Western hemlock-Sitka spruce forests                            | FS                  | 594  | 1,468 |
| Twin Creek RNA    | Sitka spruce stands of "rain forest" type                       | NPS                 | 40   | 100   |

<sup>1</sup>FS = Forest Service, FWS = Fish and Wildlife Service, NPS = National Park Service.

Table 10.--Additional Research Natural Areas needed in the Olympic Peninsula and Southwestern Washington Province

| Ecosystem or community                                                                                                                 | Cells represented <sup>1</sup>          | Remarks and possible locations                                                                                               | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                                                 |                                         |                                                                                                                              |                       |                          |                                           |                           |
| 1. Large stream drainage on western slopes of Olympics with Sitka spruce-western hemlock and Pacific silver fir-western hemlock forest | T-11,13,10<br>A-1<br>R&E-1,2            | Expansion of Twin Creek RNA may fill this need                                                                               | Medium                | NPS                      | 64-67<br>94-98                            | 0103                      |
| 2. Large stream drainage on eastern slopes of Olympics with Douglas-fir-western hemlock/Oregon grape forest                            | T-7,12<br>A-2                           | May have to be joint FS-NPS RNA                                                                                              | High                  | FS<br>NPS                | 82                                        | 0102                      |
| 3. Western redcedar swamp with ponds and stream with anadromous fish                                                                   | T-21,4,5<br>A-6,11,15                   | Ocean strip of Olympic National Park                                                                                         | High                  | NPS<br>FS                | 68-69                                     | 0104                      |
| 4. Mountain hemlock-Pacific silver fir forest, subalpine parkland mosaic, lakes, and ponds                                             | T-16,18<br>A-4,7,10<br>R&E-3,4          | Western port on of Olympic Mountains, Olympic National Park                                                                  | Medium                | NPS                      | 101-106<br>250-268                        | 0105                      |
| 5. Subalpine fir forest, subalpine parkland mosaic, alpine community mosaic, lakes, and ponds                                          | T-17,19,20<br>A-4,5,7,8,<br>10<br>R&E-4 | Northeastern portion of Olympic Mountains, Olympic National Park (Hurricane Ridge Area)                                      | Medium                | NPS                      | 101-106<br>250-268<br>284-290             | 0105                      |
| 6. Riparian hardwood forest (red alder-cottonwood) along a major river and vernal ponds                                                | T-23<br>A-9                             | Along Hoh River or tributaries to Quinault River                                                                             | Low                   | NPS                      | 66-67                                     | 0103<br>0104              |
| <u>Predominantly terrestrial natural areas:</u>                                                                                        |                                         |                                                                                                                              |                       |                          |                                           |                           |
| 7. Ocean-front Sitka spruce/salal community                                                                                            | T-15                                    | West coast of Olympic Peninsula                                                                                              | Medium                | NPS                      | 59-61<br>291-294                          | 0104                      |
| 8. Ocean-front lodgepole pine forest                                                                                                   | T-24                                    | Leadbetter Point                                                                                                             | Medium                | State                    | 291-294                                   | 0202                      |
| 9. Western redcedar-western hemlock forest                                                                                             | T-5                                     | Long Island                                                                                                                  | High                  | State                    | 79-82                                     | 0202                      |
| 10. Upland red alder forest                                                                                                            | T-8                                     | Northwestern portion of Olympic Peninsula                                                                                    | Low                   | State<br>Private         | 61-63                                     | 0103                      |
| 11. Coastal sand dunes                                                                                                                 | T-25                                    | Needs prograding dunes on north or south side of feeding river, both active and stabilized. Leadbetter Point or Fort Stevens | High                  | State<br>FWS             | 291-294                                   | 0202                      |
| 12. Pacific silver fir/salal community on east side of Peninsula                                                                       | T-12                                    |                                                                                                                              | High                  | FS<br>NPS                | 94-98                                     | 0102                      |
| 13. Typical coastal prairie                                                                                                            | T-26<br>R&E-3                           | Proposed Pats Prairie RNA may fill need                                                                                      | Medium                | FS<br>NPS                | 69-70                                     | 0104                      |
| See footnotes at end of table.                                                                                                         |                                         |                                                                                                                              |                       |                          |                                           |                           |

Table 10.--Additional Research **Natural** Areas needed in the Olympic Peninsula and Southwestern Washington **Province** (Continued)

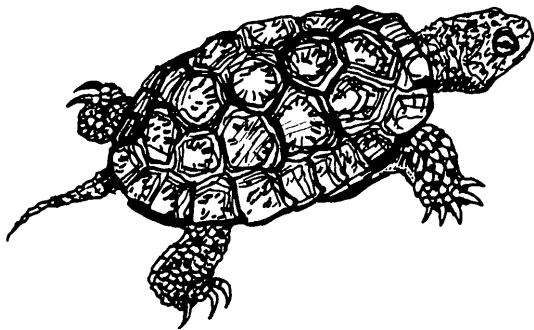
| Ecosystem or community                                                                   | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                                                                                 | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 14. Douglas-fir-western hemlock and noble fir forest in the Willapa Hills area           | <u>T-6,9</u>                   | Weyerhaeuser Company ownership                                                                                                                                                                 | High                  | Private State            | 79-80<br>94-98                             | 0202                      |
| 15. Sitka spruce/willow in tideland habitat                                              | <u>T-27</u>                    | North Hunting Island                                                                                                                                                                           | High                  | FWS                      |                                            |                           |
| <u>Predominantly aquatic natural areas:</u>                                              |                                |                                                                                                                                                                                                |                       |                          |                                            |                           |
| 16. Low elevation oligotrophic lake                                                      | <u>A-3</u>                     | Fern Lake is candidate area                                                                                                                                                                    | Medium                | State                    |                                            | 0104                      |
| 17. Subalpine stream with two major tributaries--one glacially fed, the other nonglacial | <u>A-12</u>                    | Olympic National Park                                                                                                                                                                          | Medium                | NPS                      |                                            | 0101                      |
| 18. Large, upwelling cold spring                                                         | <u>A-13</u>                    |                                                                                                                                                                                                | Low                   | NPS<br>State             |                                            |                           |
| 19. Typical hot springs area                                                             | <u>A-14</u>                    |                                                                                                                                                                                                | Medium                | NPS<br>State             |                                            |                           |
| 20. Low elevation marshland                                                              | <u>A-16</u>                    |                                                                                                                                                                                                | Medium                | NPS<br>Private State     | 68-69                                      | 0104                      |
| 21. Typical coastal bog ( <i>Myrica</i> )                                                | <u>A-17</u>                    |                                                                                                                                                                                                | Medium                | NPS<br>Private State     |                                            | 0104                      |
| <u>Natural area for special interest species:</u>                                        |                                |                                                                                                                                                                                                |                       |                          |                                            |                           |
| 22. Alpine tract                                                                         |                                | Northeastern Olympic Peninsula; area with populations of several vascular plants of special interest such as <i>Senecio websteri</i> , <i>Synthyris pinnatifida</i> , and <i>Viola flettii</i> | Medium                | NPS<br>FS                |                                            |                           |

<sup>1</sup>For a description of these cells see table 5 for terrestrial (T) ecosystems, table 6 for aquatic (A) ecosystems, and table 7 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate cells considered essential components of the proposed Research Natural Area; those not underlined represent cells which would be desirable but not essential.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of that type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. FS = Forest Service, FWS = Fish and Wildlife Service, NPS = National Park Service.

<sup>4</sup>See appendix V.



## PUGET TROUGH PROVINCE, WASHINGTON

The Puget Trough Province has two main sections—the northern half, which includes Puget Sound, and the southern half, largely made up of the Cowlitz River valley and upper basin of the Chehalis River (fig. 1). In both sections relief is moderate, with the elevation of the trough floor seldom exceeding **160 m**.

The northern portion of the province is a depressed, glaciated area which is now partially submerged (Puget Sound). Both geology and topography have been strongly influenced by a series of glaciers which pushed into the area from the north during the Pleistocene. The receding ice masses left a large, gently sloping area stretching approximately 20 km south of Olympia. This area contains many lakes and poorly drained depressions underlain by glacial drift. Soils formed on glacial till under coniferous forest vegetation are generally coarse-textured Brown Podzolics, with a thin **A2** horizon underlain by an iron- and humus-enriched **B** horizon.

The major portion of the southern half of the province is underlain by Eocene basalt flows and flow breccia. Pleistocene lacustrine deposits are also common in the area immediately north of the Columbia River. Soils derived from basalt commonly have well-aggregated silt loam to clay loam surface horizons underlain by **B** horizons generally showing evidence of clay accumulation. Other soils in this southern section include dark-colored, fine-textured soils formed under grass, and soils containing large amounts of volcanic pumice.

The ecosystems of this province have, for the most part, been strongly influenced by human activity. Secondary coniferous forests, developed following earlier logging, dominate. They are typically composed of Douglas-fir and western hemlock, with lodgepole and western white pine conspicuous associates of Douglas-fir on some sites in the glaciated northern half. Even aside from disturbance, many ecosystems are very distinctive from those in the mountains to the east and west. Many sites, especially in the northern section, have been glacially influenced with outwash soils, bogs, and lakes. In addition, this province has a markedly drier climate since it lies in the rain shadow of the coastal mountain systems. Consequently, substantial and important diversity is represented in the communities and constituent species.

The list of identified terrestrial cells totals **16** (table **11**). Seven of these are forest types, including typical coniferous forests on residual soils and glacial till. Four represent a mosaic of forest, savanna, and prairie which is found mainly at the southern end of Puget Sound and in the San Juan Islands. Three of the special ecosystem cells (Nos. **12**, **14**, and **15**) are also found in these two areas which are obvious concentrations of biotic diversity. The remaining terrestrial cells (Nos. **13** and **16**) involve flood plain communities along the Columbia River.

There are eight aquatic cells identified at present (table **12**). It is expected that the majority of these would be found in glaciated areas in the northern half of the province.

Terrestrial and aquatic areas presumably will include the normal complement of species. The list of rare and endangered vertebrate animals requiring specific consideration totals four (table **13**). The list of vascular plants of special interest is relatively short but includes four from the Smithsonian list of threatened and endangered species (table **14**). This list again identifies the prairie region at the south end of Puget Sound and the San Juan Islands as areas of particular significance (see terrestrial cells Nos. **8-12**, **14**, and **15**). Several of the plants are also associated with the dry Douglas-fir - Pacific madrone / rhododendron forests along the Hood Canal and eastern margin of the Olympic Mountains (terrestrial cell No. **3**).

At present there are only two identified Research Natural Areas within the Puget Trough Province (table **15**). These two areas fill 3 of the 28 cells listed (2 terrestrial and 1 aquatic).

Our estimate is that **17** additional Research Natural Areas will provide for a minimal system in the Puget Trough Province (table **16**). Most Research Natural Areas can be relatively small (under **500** acres, or **202** ha) since they are generally focused on one or two cells. Aquatic areas involving an entire drainage for lakes or small streams (items **12-14** in table **16**) would probably be the largest.

Identifying and establishing the necessary Research Natural Areas in this province may be difficult because of existing and potential human developments. Obviously, the major responsibility is upon State and private institutions. Department of Defense, particularly because of its Fort Lewis holdings, is in a unique position to provide representation of some of the major community mosaics (prairie, savanna, ponderosa pine) found on the glacial outwash at the south end of the sound. The Fish and Wildlife Service also has an important role in some specific needs.

The fast pace of development in this province necessitates that Research Natural Area establishment be given high priority. Consequently, most needs (table **16**) are given high or medium priority because of the danger suitable areas will be lost.

Table 11.--*Terrestrial cells in Puget Trough Province, Washington*

| Cell                                                                                                                                  | SAF<br>timber<br>type No. | Present<br>representation                            | Page reference<br>(Franklin and<br>Dyrness 1973) |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------|--------------------------------------------------|
| <u>Forest types (Western Hemlock Zone) :</u>                                                                                          |                           |                                                      |                                                  |
| * 1. Douglas-fir-western white pine/salal on glacial till                                                                             | 229                       | None                                                 | 88-89                                            |
| * 2. Douglas-fir (>100 years old)/salal on glacial till                                                                               | 229                       | None                                                 | 88-89                                            |
| * 3. Douglas-fir-madrone/rhododendron on glacial till, just west of Hood Canal                                                        | 229                       | None; consider vascular plants of special interest   | 88-89                                            |
| * 4. Mature Douglas-fir-western hemlock with mixed understory (Oregon grape, salal, and swordfern types)                              | 230                       | None                                                 | 88-89                                            |
| * 5. Western redcedar-western hemlock/swordfern on residual soil, Capitol Hills or eastern Willapa Hills                              | 227                       | None                                                 | 79-82                                            |
| * 6. Lodgepole pine/salal on glacial till                                                                                             | 216                       | None                                                 | 88-89                                            |
| * 7. Red alder/swordfern on glacial till                                                                                              | 221                       | None                                                 | 82-89                                            |
| <u>Prairie and savanna types:</u>                                                                                                     |                           |                                                      |                                                  |
| * 8. Ponderosa pine on glacial till in the Fort Lewis area                                                                            | 245                       | None                                                 | 88-89                                            |
| * 9. Prairie, oak woodland, conifer forest mosaic in Olympia-Tacoma area                                                              | 229<br>233                | Token, need additional area                          | 88-89                                            |
| *10. Oregon white oak woodland                                                                                                        | 233                       | Token, need additional area                          | 88-89                                            |
| *11. San Juan Islands forest-steppe mosaic with hardwood and coniferous woodland and fescue grassland                                 |                           | None                                                 | 313                                              |
| <u>Special types :</u>                                                                                                                |                           |                                                      |                                                  |
| 12. Mima mounds                                                                                                                       |                           | Minimal representation                               | 89-90                                            |
| *13. Riparian black cottonwood/willow along lower Columbia River                                                                      |                           | Token in Blackwater Island RNA, need additional area | 295-296                                          |
| *14. <i>Juniperus scopulorum</i> in San Juan Islands                                                                                  |                           | None                                                 | 313                                              |
| *15. Serpentine vegetation plus basalt contact on Puget Sound island                                                                  |                           | None                                                 | 309                                              |
| 16. Channeled basalt in flood plain of Columbia River with Douglas-fir and Oregon white oak stands, shrub communities, and grasslands |                           | Blackwater Island                                    |                                                  |

"Cells presently lacking adequate representation.

Table 12.--*Aquatic cells in the Puget Trough Province, Washington*

| Cell <sup>1</sup>                                                                    | Present representation | Remarks                      |
|--------------------------------------------------------------------------------------|------------------------|------------------------------|
| *1. Oligotrophic lake in glaciated topography and drainage basin of temperate forest | None                   |                              |
| *2. Eutrophic oxbow lake and drainage basin                                          | None                   |                              |
| *3. Permanent pond                                                                   | None                   |                              |
| *4. Typical stream drainage                                                          | None                   |                              |
| *5. Large, upwelling cold spring                                                     | None                   |                              |
| *6. Marshland area                                                                   | None                   |                              |
| *7. Typical bog                                                                      | None                   | <i>Ledum</i> is common shrub |
| 8. Vernal ponds and marshes in channeled basalt, Columbia River flood plain          | Blackwater Island RNA  |                              |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 13.--*Rare and endangered vertebrate animal cells in the Puget Trough Province, Washington*

| Cell                                             | Verified representation | Reference     |
|--------------------------------------------------|-------------------------|---------------|
| <u>Reptiles:</u>                                 |                         |               |
| *1. Western pond turtle                          | None                    | Stebbins 1954 |
| *2. Sharp-tailed snake                           | None                    | Stebbins 1954 |
| *3. Pacific ringnecked snake                     | None                    | Stebbins 1954 |
| <u>Mammals:</u>                                  |                         |               |
| *4. Masked shrew (subspecies <i>hollisteri</i> ) | None                    | Dalquest 1948 |

\*Cells presently lacking adequate representation.

Table 14.--*Vascular plants of special interest in the Puget Trough Province, Washington*

| Species <sup>1</sup>                             | Distribution                                   |
|--------------------------------------------------|------------------------------------------------|
| <i>Arctostaphylos medea</i> <sup>2</sup>         | Hybrid, Mason and Kitsap Counties'             |
| <i>Arenaria paludicola</i> <sup>2</sup>          | Tacoma prairies south                          |
| <i>Aster curtus</i> <sup>2</sup>                 | On prairies at south end of Puget Sound        |
| <i>Boschniakia hookeri</i>                       | Kitsap and Mason Counties                      |
| <i>Botrychium virginianum</i>                    | Moist areas                                    |
| <i>Castanopsis chrysophylla</i>                  | Eastern edge of Olympic Peninsula              |
| <i>Delphinium nuttallii</i>                      | Outwash prairies                               |
| <i>Erythronium oregonum</i> <sup>2</sup>         |                                                |
| <i>Erythronium revolutum</i>                     |                                                |
| <i>Habenaria chorisiana</i>                      | One bog in Snohomish County                    |
| <i>Hemitomes congestum</i>                       | Coastal forests                                |
| <i>Howellia aquatilis</i>                        |                                                |
| <i>Iris missouriensis</i>                        | Disjunct on Whidbey Island                     |
| <i>Iris tenax</i>                                | Centralia south                                |
| <i>Isopyrum hallii</i>                           | Moist woods, Lewis and Thurston Counties south |
| <i>Juniperus scopulorum</i>                      | San Juan Islands                               |
| <i>Lepidium virginicum</i> var. <i>menziesii</i> | Littoral endemic                               |
| <i>Meconella oregana</i>                         |                                                |
| <i>Opuntia fragilis</i>                          | Disjuncts at Sequim and San Juan Islands       |
| <i>Pinus ponderosa</i>                           | Outwash in Tacoma-Olympia area                 |
| <i>Rhododendron macrophyllum</i>                 | Along Hood Canal                               |
| <i>Salix fluviatilis</i> <sup>2</sup>            | Along Columbia River                           |
| <i>Woodwardia fimbriata</i>                      | Few widely disjunct populations                |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 15.--*Established Research Natural Areas in the Puget Trough Province, Washington*

| Name                  | Principal features                                                                                                        | Agency <sup>1</sup> | Area |       |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------|------|-------|
|                       |                                                                                                                           |                     | Ha   | Acres |
| Blackwater Island RNA | Oregon white oak-Douglas-fir grassland, and willow, Oregon ash in lower portions of channeled basalt along Columbia River | FWS                 | 52   | 129   |
| Mima Mounds RNA       | Mima mound phenomenon and associated vegetation near Olympia, Washington                                                  | ESC                 | 222  | 548   |

<sup>1</sup>ESC = Evergreen State College, FWS = Fish and Wildlife Service.

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Table 16.--Additional Research Natural Areas needed in the Puget Trough Province, Washington

| Ecosystem or community                                                                    | Cells represented <sup>1</sup> | Remarks and possible locations                | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Predominantly terrestrial natural areas:</u>                                           |                                |                                               |                       |                          |                                            |                           |
| 1. Douglas-fir-western white pine on glacial till                                         | T-1<br>R&E-4                   |                                               | Medium                | Private                  | 88-89                                      | 0404                      |
| 2. Douglas-fir/salal and lodgepole pine/salal communities on glacial till                 | T-2,6                          | Douglas-fir should be over 100 years old      | Medium                | Private                  | 88-89                                      | 0404                      |
| 3. Douglas-fir-madrone/rhododendron community on glacial till                             | T-3<br>R&E-2,3                 | Located just west of Hood Canal               | High                  | State<br>Private         | 88-89                                      | 0404                      |
| 4. Mature Douglas-fir-western hemlock with mixed understory on fine-textured glacial till | T-4<br>R&E-4                   | Area in Pack Forest is potential site         | Medium                | State                    | 88-89                                      | 0402                      |
| 5. Western redcedar-western hemlock/swordfern community on residuum                       | T-5                            | Capitol Hills or eastern Willapa Hills        | High                  | State<br>Private         | 79-82                                      | 0202                      |
| 6. Ponderosa pine on glacial till                                                         | T-8<br>R&E-2,3                 | Fort Lewis area                               | Low                   | Department of Defense    | 88-89                                      | 0403                      |
| 7. Puget prairie-woodland mosaic with Oregon white oak                                    | T-9,10<br>R&E-2,3              |                                               | High                  | Private<br>State         | 88-89                                      | 0402<br>0403              |
| 8. Red alder/swordfern community on glacial till                                          | T-7                            | Alderwood soil                                | Low                   | Private                  | 82-89                                      | 0403<br>0404              |
| 9. Riparian black cottonwood-willow (along lower Columbia River)                          | T-13                           | Several FWS areas in process of establishment | Medium                | FWS                      | 295-296                                    |                           |
| 10. San Juan Islands forest-steppe mosaic with <i>Juniperus scopulorum</i>                | T-11,14                        |                                               | High                  | Private                  | 313                                        | 0402                      |
| 11. Serpentine vegetation plus basalt contact on an island in Puget Sound                 | T-15                           | Cypress Island is possible location           | High                  | Private                  | 309                                        | 0402                      |

See footnotes at end of table.

Table 16.--Additional Research Natural Areas needed in the Puget Trough Province, Washington (Continued)

| Ecosystem or community                                                               | Cells represented <sup>1</sup> | Remarks and possible locations | Priority <sup>2</sup> | Lead agency <sup>3</sup>            | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----------------------|-------------------------------------|--------------------------------------------|---------------------------|
| <u>Predominantly aquatic natural areas:</u>                                          |                                |                                |                       |                                     |                                            |                           |
| 12. Oligotrophic lake in glaciated topography and drainage basin of temperate forest | A- <u>1</u> , <u>3</u>         |                                | High                  | Private                             |                                            | 0403<br>0404              |
| 13. Eutrophic oxbow lake and drainage basin                                          | A- <u>2</u><br>R&E-1           |                                | High                  | Private                             |                                            | 0403<br>0404              |
| 14. Typical stream drainage                                                          | A- <u>4</u>                    | Fort Lewis area                | High                  | Private<br>Department<br>of Defense |                                            | 0402<br>0403              |
| 15. Large, upwelling cold spring                                                     | A- <u>5</u>                    |                                | Low                   | Private                             |                                            |                           |
| 16. Marshland area                                                                   | A- <u>6</u>                    |                                | High                  | Private                             |                                            | 0403                      |
| 17. <i>Ledum</i> bog                                                                 | A- <u>7</u>                    | Snohomish County               | Medium                | Private                             |                                            | 0403                      |

<sup>1</sup>For a description of these cells see table 11 for terrestrial (T) ecosystems, table 12 for aquatic (A) ecosystems, and table 13 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.



## **WESTERN SLOPES AND CREST PROVINCE, WASHINGTON CASCADES**

This province (fig. 1) is a rugged mountain region composed of two major geologic units. South of Snoqualmie Pass, bedrock is primarily Eocene to Miocene andesites and basalts. The northern portion of the province is made up of considerably older (largely Paleozoic and Cretaceous) sedimentary and metamorphic rocks, interspersed with large granitic intrusions.

Topographically, the southern section is characterized by generally accordant ridge crests separated by steep, deeply dissected valleys. Three Pleistocene volcanic cones tower above their surroundings—Mount Adams, Mount Rainier, and Mount St. Helens. An extensive area around Mount Adams is covered by recent lava flows and comprises a gently sloping plateau.

North of Snoqualmie Pass, the Cascade Range is extremely rugged. Valleys are deep and steep-sided, containing low-gradient streams. Glacially formed cirques and matterhorns are abundant, attesting to the profound effect glaciation has had in shaping landforms. Glaciers are still common; this region contains more active glaciers than any other area within the continental United States.

Soils in the southern portion of the Washington Cascades are most often Podzolic sandy loams or loamy sands formed in layers of pumice or volcanic ash overlying basalt or andesite. To the north, finer textured glacial and glaciolacustrine soils are especially common in many of the broad valley bottoms. On steep side slopes, shallow residual soils are commonly gravelly sandy loam in texture.

The natural communities of this province reflect the generally wet, moderate to cool climatic regime. Coniferous forests, arranged in three major elevational zones (western hemlock, Pacific silver fir, and mountain hemlock), dominate the slopes and valley bottoms. There is a substantial diversity in these coniferous forest communities reflecting differing environments and successional stages, largely as a consequence of periodic fires. Subalpine meadow-forest parklands cover the bulk of relatively narrow regions between closed forest and the regions of permanent snow and ice on the higher peaks. These parklands are typically intricate mosaics of many different community types.

Freshwater systems found in this province are largely streams and rivers including “milky” glacier-fed types and ponds and relatively small lakes over a broad range of elevations.

Specialized habitats add substantial diversity to the province. First there is the normal array of nonforested communities within a forest mosaic—bogs, marshes, shrub communities on scree and avalanche tracks, etc. A major serpentine outcrop (around Twin Sisters near Mount Baker), the unusually arid (for this province) Ross Lake region on the Skagit River, and the area around Columbia River Gorge provide major centers for distinctive biotic arrays. Lava flows, hot springs, and pumice fields are additional features associated with the major volcanic peaks.

Identified terrestrial cells total **31** (table **17**). The dominant coniferous forests and their associated biota are emphasized in the cellular listing, which recognizes the need to represent variations of some widespread types by providing Research Natural Areas in both the northern and southern half of the province. The list also reflects the need to provide examples of widespread community types representing relatively early successional stages (see cell Nos. **1**, **2**, and **15** in table **17**). The list of terrestrial cells is rounded out with subalpine meadow and parkland communities and other types representing unusual or youthful substrates (lava flows, serpentine) or extreme environments.

The list of aquatic cells (table **18**) provides for examples of the typical ecosystems found in the several life zones and totals **18**.

It is presumed that the terrestrial and freshwater areas will incorporate the typical complement of animal and plant species. There are eight vertebrate animal species which are listed for consideration as rare and endangered cells in Research Natural Area selection (table **19**). The plant list includes **13** species from the Smithsonian list of threatened and endangered plants (table **20**). There are several obvious areas of concentration—the Columbia River Gorge, high elevations around Mount Rainier and Mount Adams, and serpentine areas.

Substantial progress has been made in establishment of Research Natural Areas in this province. The 11 existing Research Natural Areas (table **21**), all in Federal ownership, provide coverage of nearly half of the identified cells (**24** out of **57** terrestrial, aquatic, and rare and endangered cells). Existing National Parks and Wilderness Areas also provide substantial protection for many of the rare and endangered species, provided they are considered in the management plans for these tracts.

Nevertheless, a substantial job in locating and establishing Research Natural Areas remains. We estimate 21 additional Research Natural Areas are needed to provide minimal coverage of all of the listed cells (table **22**).

Lead responsibility in this province lies with the Forest Service and National Park Service who control most of the land. The three large combined terrestrial and aquatic areas are most likely to be found in the North Cascades National Park complex. The low-elevation lake (need No. **13**) will probably be one of the most difficult to locate. A subalpine lake in City of Seattle ownership within the Cedar River watershed (Findley Lake) may fill need No. **14**. State ownership should also be considered in the search for need No. **4**, young Douglas-fir in an old burn.

Table 17.--*Terrestrial cells in the Western Slopes and Crest Province, Washington Cascades*

| Cell                                                                                 | SAF<br>timber<br>type No. | Present<br>representation                                                        | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Western Hemlock Zone :</u>                                                        |                           |                                                                                  |                                                  |
| * 1. Douglas-fir <75 years old<br>(old burn)                                         | 229                       | Token, need additional<br>area                                                   | 82-88                                            |
| * 2. Douglas-fir 100-150 years old                                                   | 229                       | Token, need additional<br>area                                                   | 82-88                                            |
| 3. Old-growth Douglas-fir-western<br>hemlock forest, northern portion<br>of province | 230                       | North Fork Nooksack RNA                                                          | 72-82                                            |
| 4. Old-growth Douglas-fir-western<br>hemlock forest, southern portion<br>of province | 230                       | Wind River and Cedar<br>Flats RNA's                                              | 72-82                                            |
| 5. Old-growth western hemlock forest,<br>northern portion of province                | 224                       | Long Creek RNA                                                                   | 72-82                                            |
| 6. Old-growth western hemlock forest,<br>southern portion of province                | 224                       | Wind River RNA                                                                   | 72-82                                            |
| * 7. Old-growth western redcedar forest,<br>northern portion of province             | 228                       | None                                                                             | 81-82                                            |
| 8. Old-growth western redcedar forest,<br>southern portion of province               | 228                       | Cedar Flats RNA                                                                  | 81-82                                            |
| 9. Old-growth western redcedar-western<br>hemlock forest                             | 227                       | North Fork Nooksack,<br>Long Creek, and<br>Lake Twentytwo RNA's                  | 81-82                                            |
| *10. Red alder forest                                                                | 221                       | Token stand of climax<br>red alder at Long<br>Creek RNA; need<br>additional area | 82-88                                            |
| <u>Pacific Silver Fir Zone:</u>                                                      |                           |                                                                                  |                                                  |
| 11. Pacific silver fir-western hemlock<br>forest, northern portion of province       | 226                       | North Fork Nooksack and<br>Lake Twentytwo RNA's                                  | 94-98                                            |
| 12. Pacific silver fir-western hemlock<br>forest, southern portion of province       | 226                       | Butter Creek and Sister<br>Rocks RNA's                                           | 94-98                                            |
| *13. Pacific silver fir forest, northern<br>portion of province                      | 226                       | None                                                                             | 94-98                                            |
| 14. Pacific silver fir forest, southern<br>portion of province                       | 226                       | Sister Rocks and Steam-<br>boat Mountain RNA's                                   | 94-98                                            |
| 15. Noble fir forest (typical)                                                       | 226                       | Butter Creek and Goat<br>Marsh RNA's                                             | 94-98                                            |

See footnote. at end of table.

Table 17.--*Terrestrial cells* in the Western Slopes and Crest Province, Washington Cascades (Continued)

| Cell                                                                                                                         | SAF<br>timber<br>type No. | Present<br>representation                                   | Page reference<br>(Franklin and<br>Dyrness 1973) |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------|--------------------------------------------------|
| <u>Mountain Hemlock Zone:</u>                                                                                                |                           |                                                             |                                                  |
| *16. Mountain hemlock-Pacific silver fir forest, northern portion                                                            | 205                       | None                                                        | 103-106                                          |
| 17. Mountain hemlock-Pacific silver fir forest, southern portion                                                             | 205                       | Steamboat Mountain and Butter Creek RNA's                   | 103-106                                          |
| 18. Typical subalpine fir forest                                                                                             | 206                       | Steamboat Mountain RNA                                      | 103-106                                          |
| *19. Alaska-cedar (In stand with mountain hemlock and subalpine fir)                                                         | 228                       | None                                                        | 103-106                                          |
| <u>Subalpine and alpine meadows and parkland:</u>                                                                            |                           |                                                             |                                                  |
| *20. Subalpine parkland mosaic (tree groups with a variety of meadow types)                                                  |                           | Token, need another area                                    | 250-268<br>277-281                               |
| *21. Heath -huckleberry communities                                                                                          |                           | Token, need another area                                    | 251-256                                          |
| *22. Subalpine lush herbaceous communities, including <i>Valerians-Veratrum</i> and <i>Rubus parvifolium-Pteridium</i> types |                           | Token, need another area                                    | 256-261                                          |
| 23. Subalpine green fescue community                                                                                         |                           | Butter Creek RNA                                            | 263-264                                          |
| *24. Alpine community mosaic with krummholz tree groups                                                                      |                           | None                                                        |                                                  |
| <u>Special types:</u>                                                                                                        |                           |                                                             |                                                  |
| *25. Lodgepole pine-Douglas-fir at Ross Lake                                                                                 | 216<br>229                | None                                                        | 312                                              |
| *26. Ponderosa pine forest at Ross Lake                                                                                      | 245                       | None                                                        | 312                                              |
| *27. Recent lava flow with open forest and shrub cover                                                                       |                           | None                                                        | 300-302                                          |
| 28. Recent mud flow with lodgepole pine cover                                                                                |                           | Goat Marsh RNA                                              | 302-304                                          |
| 29. Recently exposed glacial moraine and outwash                                                                             |                           | Boston Glacier RNA                                          | 284-290                                          |
| 30. Sitka alder and vine maple avalanche tracks                                                                              |                           | North Fork Nooksack, Lake Twentytwo, and Butter Creek RNA's | 91<br>100-101                                    |
| *31. Representative serpentine area in the North Cascades                                                                    |                           | None                                                        | 309                                              |

\*Cells presently lacking adequate representation.

Table 18.--*Aquatic cells in the Western Slopes and Crest Province, Washington Cascades*

| Cell <sup>1</sup>                                                                    | Present representation                                       | Remarks                     |
|--------------------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------|
| * 1. Major stream drainage covered with temperate coniferous forest                  | None                                                         |                             |
| 2. Major stream drainage covered with subalpine forest mosaic                        | Butter Creek RNA                                             |                             |
| * 3. River valley bottom mosaic of terrestrial, semiaquatic, and aquatic communities | None                                                         | Should be in North Cascades |
| * 4. Low elevation lake and drainage basin of temperate forest                       | None                                                         |                             |
| * 5. Lake and drainage basin of subalpine forest or forest and meadow, without fish  | None                                                         |                             |
| 6. Marsh and swamp ecosystem                                                         | Goat Marsh, Cedar Flats, Wind River, Steamboat Mountain RNAs |                             |
| 7. Cirque lake in alpine area                                                        | Pyramid Lake RNA                                             |                             |
| * 8. Lake and drainage basin of subalpine forest or forest and meadow, with fish     | None                                                         |                             |
| 9. Subalpine permanent ponds                                                         | Butter Creek RNA                                             |                             |
| *10. Alpine permanent ponds                                                          | None                                                         | Should be in North Cascades |
| 11. Subalpine vernal ponds                                                           | Butter Creek RNA                                             |                             |
| *12. Alpine vernal ponds                                                             | None                                                         |                             |
| *13. Subalpine stream which is glacially fed ("milkwater" stream)                    | None                                                         |                             |
| *14. Large, upwelling cold spring                                                    | None                                                         |                             |
| *15. Typical hot springs                                                             | None                                                         |                             |
| *16. Western redcedar swamp                                                          | Token representation on Cedar Flats RNA                      | Need additional area        |
| 17. Marsh area                                                                       | Goat Marsh RNA                                               |                             |
| 18. Bog area                                                                         | Steamboat Mountain and Goat Marsh RNAs                       |                             |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 19.--*Rare and endangered vertebrate animal cells in the Western Slopes and Crest Province, Washington Cascades*

| Cell                                                | Verified representation                               | Reference                                                                                                      |
|-----------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <u>Amphibians:</u>                                  |                                                       |                                                                                                                |
| *1. Larch Mountain salamander                       | None                                                  | Stebbins 1954                                                                                                  |
| <u>Reptiles:</u>                                    |                                                       |                                                                                                                |
| *2. Pacific ringnecked snake                        | None                                                  | Stebbins 1954                                                                                                  |
| *3. California mountain kingsnake                   | None                                                  | Stebbins 1954                                                                                                  |
| *4. Oregon alligator lizard                         | None                                                  | Stebbins 1954                                                                                                  |
| <u>Birds:</u>                                       |                                                       |                                                                                                                |
| *5. Cascade boreal chickadee                        | None                                                  | Alcorn 1971                                                                                                    |
| <u>Mammals:</u>                                     |                                                       |                                                                                                                |
| *6. Masked shrew<br>(subspecies <i>hollisteri</i> ) | None                                                  | Dalquest 1948                                                                                                  |
| *7. Heather vole                                    | Token at Steamboat Mountain RNA; need additional area | Dalquest 1948<br>Johnson and Johnson 1952<br>Maser and Storm 1970<br>Edwards 1955<br>Johnson 1973<br>Shaw 1924 |
| *8. Northern bog lemming                            | None                                                  | Dalquest 1948<br>Maser and Storm 1970                                                                          |

\*Cells presently lacking adequate representation.

## ERRATA SHEET

USDA Forest Service General Technical Report PNW-38 7975  
RESEARCH NATURAL AREA NEEDS IN THE PACIFIC NORTHWEST  
A Contribution To Land-Use Planning, by C. T. **Dyrness**, Jerry F.  
Franklin, Chris Maser, Stanton A. Cook, James D. Hall, and Glenda  
Faxon.

Please insert corrected page **45** for:

Table 20. -- Vascular plants of special interest in the Western  
Slopes and Crest Province, Washington Cascades

as shown on reverse side of this sheet.

PACIFIC NORTHWEST FOREST AND  
RANGE EXPERIMENT STATION  
**P. O. Box3141**  
Portland, Oregon 97208

Table 20.--*Vascular plants of special interest in the Western Slopes and Crest Province, Washington Cascades*

| Species <sup>1</sup>                                            | Distribution                                     |
|-----------------------------------------------------------------|--------------------------------------------------|
| <i>Andromeda polifolia</i>                                      | Bogs                                             |
| <i>Anemone occidentalis</i>                                     | Subalpine meadows, Mount Rainier south           |
| <i>Aspidotis densa</i>                                          | Serpentine areas                                 |
| <i>Asplenium trichomanes</i>                                    |                                                  |
| <i>Aster glaucescens</i> <sup>2</sup>                           | Mount Adams south to Columbia River, in valleys  |
| <i>Botrychium lanceolatum</i>                                   | Moist areas at high elevation                    |
| <i>Botrychium virginianum</i>                                   | Low to high elevations                           |
| <i>Calamagrostis canadensis</i> var. <i>imberbis</i>            | Mount Adams                                      |
| <i>Calamagrostis howellii</i> <sup>2</sup>                      | Columbia River Gorge                             |
| <i>Campanula lasiocarpa</i>                                     | Alpine from Snohomish County north               |
| <i>Carex limnophila</i>                                         | Mount Rainier                                    |
| <i>Carex pauciflora</i>                                         | Sphagnum bogs, Whatcom County                    |
| <i>Cassiope stelleriana</i>                                     | Mount Rainier north                              |
| <i>Castanopsis chrysophylla</i>                                 | Columbia River Gorge                             |
| <i>Castilleja cryptantha</i>                                    | Alpine at Mount Rainier                          |
| <i>Castilleja parviflora</i>                                    | Cascade Pass north                               |
| <i>Castilleja parviflora</i> var. <i>oreopola</i>               | Mount Rainier south                              |
| <i>Cimicifuga elata</i>                                         | Lower elevations                                 |
| <i>Cimicifuga laciniata</i> <sup>2</sup>                        | Silver Star Mountain, Skamania County            |
| <i>Claytonia lanceolata</i> var. <i>chrysantha</i> <sup>2</sup> | Mount Baker region                               |
| <i>Collomia larsenii</i>                                        | Mounts Rainier, St. Helens, and Adams            |
| <i>Coptis asplenifolia</i>                                      | Snohomish County north                           |
| <i>Delphinium nuttallii</i>                                     | Columbia Gorge area                              |
| <i>Dicentra uniflora</i>                                        | Broad elevational range                          |
| <i>Douglasia laevigata</i> <sup>2</sup>                         | Snohomish County south                           |
| <i>Draba aureola</i>                                            | Volcanic peaks, Mount Rainier south              |
| <i>Draba incerta</i>                                            | Subalpine                                        |
| <i>Draba ventosa</i> var. <i>ruaxes</i> <sup>2</sup>            | Glacier Peak                                     |
| <i>Dryas octopetala</i>                                         | High elevations                                  |
| <i>Eburophyton austinae</i>                                     | Deep forest                                      |
| <i>Epipactis gigantea</i>                                       | Wet areas                                        |
| <i>Eriogonum pyrolaeifolium</i>                                 | Subalpine pumice, Mount Rainier south            |
| <i>Fritillaria camschatcensis</i>                               | South Fork Stillaguamish River                   |
| <i>Garrya fremontii</i>                                         | Columbia River Gorge (Wind Mountain)             |
| <i>Gentiana douglasiana</i>                                     | Snoqualmie Pass north                            |
| <i>Habenaria orbiculata</i>                                     | Mid-elevation forest                             |
| <i>Hieracium longiberbe</i> <sup>2</sup>                        | Columbia River Gorge                             |
| <i>Howellia aquatilis</i>                                       | Ponds and lakes                                  |
| <i>Hulsea nana</i>                                              | Cinder cones and pumice from Mount Rainier south |
| <i>Isopyrum hallii</i>                                          | Columbia River Gorge                             |

See footnotes at end of table.

Table 20.--*Vascular plants of special interest in the Western Slopes and Crest Province, Washington Cascades* (Continued)

| Species <sup>1</sup>                               | Distribution                                                     |
|----------------------------------------------------|------------------------------------------------------------------|
| <i>Lewisia columbiana</i> var. <i>rupicola</i>     | Mount Rainier                                                    |
| <i>Loiseleuria procumbens</i>                      | Trapper Peak in Skagit River drainage                            |
| <i>Luina stricta</i>                               | Mount Rainier south                                              |
| <i>Luzula arcuata</i>                              | Mount Rainier                                                    |
| <i>Lycopodium obscurum</i>                         | Skagit County                                                    |
| <i>Myanthes trifoliata</i>                         | Montane lakes protected at Goat Marsh RNA                        |
| <i>Pedicularis bracteosa</i> var. <i>bracteosa</i> | Disjunct from Canada on Mount Adams                              |
| <i>Pedicularis rainierensis</i> <sup>2</sup>       | High-elevation Mount Rainier endemic                             |
| <i>Pellaea glabella</i> var. <i>simplex</i>        | Columbia River Gorge                                             |
| <i>Pleuricospora fimbriolata</i>                   |                                                                  |
| <i>Polemonium carneum</i>                          |                                                                  |
| <i>Polemonium elegans</i>                          | Alpine                                                           |
| <i>Polypodium montense</i>                         | Mainly Columbia River Gorge                                      |
| <i>Polystichum andersonii</i>                      |                                                                  |
| <i>Polystichum kruckebergii</i> <sup>2</sup>       | Bird Creek Meadows on Mount Adams                                |
| <i>Polystichum lonchitis</i>                       | Wet, moss-covered talus                                          |
| <i>Polystichum mohrioides</i>                      | On serpentine                                                    |
| <i>Ranunculus cooleyae</i>                         | Del Campo Peak, Snohomish County                                 |
| <i>Rhododendron macrophyllum</i>                   | Widely disjunct, Copper Creek near Mount Rainier, Wind River RNA |
| <i>Salix fluviatilis</i> <sup>2</sup>              | Along Columbia River                                             |
| <i>Saxifraga cernua</i>                            |                                                                  |
| <i>Saxifraga debilis</i>                           |                                                                  |
| <i>Saxifraga lyallii</i>                           | Whatcom County                                                   |
| <i>Saxifraga oppositifolia</i>                     |                                                                  |
| <i>Selaginella douglasii</i>                       | Columbia River Gorge                                             |
| <i>Senecio elmeri</i>                              | Alpine                                                           |
| <i>Senecio flettii</i>                             | Mid- to high-elevations, Mount Rainier area                      |
| <i>Silene douglasii</i> var. <i>monantha</i>       | Columbia Gorge area                                              |
| <i>Silene suksdorfii</i>                           | Mounts Rainier and Adams                                         |
| <i>Synthyris schizantha</i> <sup>2</sup>           | Moist shaded cliffs near Mount Rainier                           |
| <i>Tauschia stricklandii</i> <sup>2</sup>          | Endemic to Mount Rainier subalpine                               |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 20.--*Vascular plants of special interest in the Western Slopes and Crest Province, Washington Cascades* (Continued)

| Species <sup>1</sup>                               | Distribution                                                     |
|----------------------------------------------------|------------------------------------------------------------------|
| <i>Lewisia columbiana</i> var. <i>rupicola</i>     | Mount Rainier                                                    |
| <i>Loiseleuria procumbens</i>                      | Trapper Peak on Skagit River drainage                            |
| <i>Luina stricta</i>                               | Mount Rainier south                                              |
| <i>Luzula arcuata</i>                              | Mount Rainier                                                    |
| <i>Lycopodium obscurum</i>                         | Skagit County                                                    |
| <i>Manyanthes trifoliata</i>                       | Montane lakes protected at Goat Marsh RNA                        |
| <i>Pedicularis bracteosa</i> var. <i>bracteosa</i> | Disjunct from Canada on Mount Adams                              |
| <i>Pedicularis rainierensis</i> <sup>2</sup>       | High-elevation Mount Rainier endemic                             |
| <i>Pellaea glabella</i> var. <i>simplex</i>        | Columbia River Gorge                                             |
| <i>Pleuricospora fimbriolata</i>                   |                                                                  |
| <i>Polemonium carneum</i>                          |                                                                  |
| <i>Polemonium elegans</i>                          | Alpine                                                           |
| <i>Polypodium montense</i>                         | Mainly Columbia River Gorge                                      |
| <i>Polystichum andersonii</i>                      |                                                                  |
| <i>Polystichum kruckebergii</i> <sup>2</sup>       | Bird Creek Meadows on Mount Adams                                |
| <i>Polystichum lonchitis</i>                       | Wet, moss-covered talus                                          |
| <i>Polystichum mohrioides</i>                      | On serpentine                                                    |
| <i>Ranunculus cooleyae</i>                         | Del Campo Peak, Snohomish County                                 |
| <i>Rhododendron macrophyllum</i>                   | Widely disjunct, Copper Creek near Mount Rainier, Wind River RNA |
| <i>Salix fluviatilis</i> <sup>2</sup>              | Along Columbia River                                             |
| <i>Saxifraga cernua</i>                            |                                                                  |
| <i>Saxifraga debilis</i>                           |                                                                  |
| <i>Saxifraga tyallii</i>                           | Whatcom County                                                   |
| <i>Saxifraga oppositifolia</i>                     |                                                                  |
| <i>Selaginella douglasii</i>                       | Columbia River Gorge                                             |
| <i>Senecio elmeri</i>                              | Alpine                                                           |
| <i>Senecio flettii</i>                             | Mid- to high-elevations, Mount Rainier area                      |
| <i>Silene douglasii</i> var. <i>monantha</i>       | Columbia Gorge area                                              |
| <i>Silene suksdorfii</i>                           | Mounts Rainier and Adams                                         |
| <i>Synthyris schizantha</i> <sup>2</sup>           | Moist shaded cliffs near Mount Rainier                           |
| <i>Tauschia stricklandii</i> <sup>2</sup>          | Endemic to Mount Rainier subalpine                               |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian institution 1974).

Table 21.--*Established Research Natural Areas in the Western Slopes and Crest Province, Washington Cascades*

| Name                    | Principal features                                                                                             | Agency <sup>1</sup> | Area  |       |
|-------------------------|----------------------------------------------------------------------------------------------------------------|---------------------|-------|-------|
|                         |                                                                                                                |                     | Ha    | Acres |
| Boston Glacier RNA      | Major alpine glacier and cirque basin in northern Cascade Range including some recently deglaciated topography | NPS                 | 1 061 | 2,620 |
| Butter Creek RNA        | Subalpine mosaic of forest meadow and shrub communities with ponds and including a major stream drainage       | NPS                 | 810   | 2,000 |
| Cedar Flats RNA         | Western redcedar and associated swamps and marshes and Douglas-fir forest                                      | FS                  | 275   | 680   |
| Goat Marsh RNA          | Extensive mountain marshes, record noble fir forest, beaver swamp, ponds, and lodgepole pine on recent mudflow | FS                  | 484   | 1,195 |
| Lake Twentytwo RNA      | Western redcedar-western hemlock forests and subalpine lake                                                    | FS                  | 320   | 790   |
| Long Creek RNA          | Western hemlock forests                                                                                        | FS                  | 259   | 640   |
| North Fork Nooksack RNA | Douglas-fir and western hemlock forests                                                                        | FS                  | 605   | 1,495 |
| Pyramid Lake RNA        | Subalpine lake with surrounding conifer forest                                                                 | NPS                 | 48    | 119   |
| Sister Rocks RNA        | Pacific silver fir forests                                                                                     | FS                  | 87    | 215   |
| Steamboat Mountain RNA  | Subalpine fir, Pacific silver fir, and mountain hemlock forest along with pond and marshes                     | FS                  | 567   | 1,400 |
| Wind River RNA          | Douglas-fir-western hemlock forests                                                                            | FS                  | 478   | 1,180 |

<sup>1</sup> FS = Forest Service, NPS = National Park Service.

Table 22.--Additional Research Natural Areas needed in the Western Slopes and Crest Province, Washington Cascades

| Ecosystem or community                                                                             | Cells represented <sup>1</sup>  | Remarks and possible locations                                                                                                                                                          | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|----------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                             |                                 |                                                                                                                                                                                         |                       |                          |                                           |                           |
| 1. Mature coniferous forest mosaic and major stream drainage supporting full range of aquatic life | T-3,5,7,9,11<br>A-1<br>R&E-8    | Goodell Creek or Stetattle Creek in North Cascades National Park                                                                                                                        | High                  | NPS                      | 72-82                                     | 0701<br>0702<br>0703      |
| 2. River valley bottom mosaic of mature conifer forest, semiaquatic, and aquatic communities       | T-7,3,5,11<br>A-3,6,16,9<br>18- | Big Beaver Creek or Chilliwack River, North Cascades National Park                                                                                                                      | High                  | NPS                      | 72-82                                     | 0701                      |
| 3. Alpine community mosaic with krummholz and ponds                                                | T-24<br>A-10,12<br>R&E-6,7      | With attention to special plants, e.g., <i>Botrychium</i> ssp., <i>Collomia larseni</i> , <i>Draba aureola</i> , and <i>Hulsea nana</i> ; Mount Rainier or North Cascades National Park | Medium                | NPS                      | 276-290                                   | 0901<br>0704              |
| <u>Predominantly terrestrial natural areas:</u>                                                    |                                 |                                                                                                                                                                                         |                       |                          |                                           |                           |
| 4. Douglas-fir less than 75 years old in an old burn                                               | T-1                             | Yacolt Burn                                                                                                                                                                             | Low                   | FS                       | 82-88                                     | 0606                      |
| 5. Douglas-fir in the 100- to 150-year-old age class                                               | T-2                             | Wind River Experimental Forest                                                                                                                                                          | Low                   | FS                       | 82-88                                     | 0904                      |
| 6. Pacific silver fir and Pacific silver fir-mountain hemlock in the North Cascades                | T-13,16                         | North Cascades National Park                                                                                                                                                            | Low                   | NPS                      | 94-98<br>103-106                          | 0703                      |
| 7. Subalpine parkland mosaic with Alaska-cedar                                                     | T-19,20<br>A-11<br>R&E-5,6,7    | North Cascades National Park                                                                                                                                                            | Medium                | NPS                      | 250-268<br>277-281                        | 0704                      |
| 8. Subalpine heather-huckleberry and lush herbaceous communities                                   | T-21,22<br>R&E-7                | Proposed Green Mountain RNA would at least partially fill this need                                                                                                                     | Medium                | NPS                      | 251-261                                   | 0704                      |
| 9. Lodgepole pine-Douglas-fir and ponderosa pine forest in Ross Lake area                          | T-25,26                         | Ross Lake National Recreation Area                                                                                                                                                      | Low                   | NPS                      | 312                                       | 0702                      |
| 10. Recent lava flow and adjacent non-lava area                                                    | T-27                            | Big Lava Beds area (Gifford Pinchot National Forest)                                                                                                                                    | Medium                | FS                       | 300-302                                   | 0902                      |
| 11. Montane serpentine area in North Cascades                                                      | T-31                            | With special attention to endemic plant species; Twin Sisters Peak, Mount Baker National Forest                                                                                         | Low                   | FS                       | 309                                       | 0703                      |
| 12. Red alder forest including small stream drainage                                               | T-10                            |                                                                                                                                                                                         | Low                   | State FS                 |                                           | 0702                      |

See footnotes at end of table.

Table 22.--*Additional Research Natural Areas needed in the Western Slopes and Crest Province, Washington Cascades* (Continued)

| Ecosystem or community                                                                                                   | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                                               | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Predominantly aquatic natural areas:</u>                                                                              |                                |                                                                                                                                                              |                       |                          |                                            |                           |
| 13. <u>Low-elevation</u> lake and drainage basin of temperate forest                                                     | <u>A-4</u><br>R&E-2,3,4,6      |                                                                                                                                                              | High                  | FS<br>State              |                                            | 0603                      |
| 14. Subalpine lake and drainage basin (without fish)                                                                     | <u>A-5</u><br>R&E-5,6,7        | Findley Lake is good candidate                                                                                                                               | Medium                | City of<br>Seattle       |                                            | 0602                      |
| 15. Subalpine lake and drainage basin (with fish)                                                                        | <u>A-8</u><br>R&E-5,6,7        | If not too disturbed, Lake Twentytwo RNA may suffice                                                                                                         | Medium                | FS<br>NPS                |                                            | 0703                      |
| 16. Glacially fed subalpine stream and drainage                                                                          | <u>A-13</u><br>R&E-5,6,7       | Possibly can fill by enlarging Boston Glacier RNA                                                                                                            | Medium                | NPS                      |                                            | 0704                      |
| 17. Large, upwelling cold spring                                                                                         | <u>A-14</u>                    |                                                                                                                                                              | Low                   | NPS, FS<br>State         |                                            |                           |
| 18. Typical hot spring                                                                                                   | <u>A-15</u>                    |                                                                                                                                                              | Medium                | NPS, FS<br>State         |                                            |                           |
| <u>Natural areas for protection of rare or threatened species:</u>                                                       |                                |                                                                                                                                                              |                       |                          |                                            |                           |
| 19. <u>Subalpine</u> meadow area focused on concentration of plant species of special interest                           |                                | See table 20 for subalpine species of special interest; Mount Rainier National Park                                                                          | High                  | NPS                      |                                            | 0901                      |
| 20. Area along Perry Creek (South Fork Stillaguamish River) for preservation of a unique assemblage of rare fern species |                                | Species include <i>Asplenium trichomanes</i> , <i>Botrychium</i> spp., <i>Polystichum andersonii</i> , and <i>P. lonchitis</i> ; Mount Baker National Forest | High                  | FS                       |                                            | 0703                      |
| 21. Area in the western half of the Columbia Gorge region focused on rare and endangered organisms                       | <u>R&amp;E-1</u>               | See table 20 for vascular plants of special interest in Columbia Gorge region; possible sites include Silver Star or Larch Mountains                         | Medium                | State<br>FS              |                                            | 0606                      |

<sup>1</sup>For a description of these cells see table 17 for terrestrial (T) ecosystems, table 18 for aquatic (A) ecosystems, and table 19 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. FS = Forest Service, NPS = National Park Service.

<sup>4</sup>See appendix V.



## EASTERN SLOPES PROVINCE, WASHINGTON CASCADES

This province, similar to the adjacent Western Slopes and Crest Province, **has** two main sections, i.e., southern and northern, with the dividing line in the Snoqualmie Pass area (fig. 1). The northern section is characterized, for the most part, by extremely steep slopes and abundant evidence of glaciation. The southern portion, on the other hand, has more subdued relief, although steep slopes are locally present, especially adjacent to major drainages.

Geologically the northern portion of the province is made up of a variety of ancient (Paleozoic to Cretaceous) sedimentary and metamorphic rocks. Generally, these have undergone considerable tectonic deformation; as a result, bedding planes are often steeply tilted. Soils in the area are generally influenced to some extent by volcanic ash and, in some areas, loess. Soil profiles reflect the drier conditions under which they were formed; and poorly developed, stony soils are common. Because of sparse vegetation and low amounts of water-stable aggregates, certain soils—especially those derived from sandstone—are subject to serious surface erosion following disturbance.

The most abundant rock type in the southern section is Miocene basalt. These lavas flowed into the province from the east and are part of the extremely widespread Columbia River basalt flows. Pleistocene to Recent volcanic ash mantles the basalt in many areas, and loess deposits are also widespread. Other parent materials include sandstone, andesite, and glacial till. Most soils in this section tend to be finer textured than those to the north, with silt loams and loams most common.

The ecosystem types on the eastern slope of Washington's Cascade Range are many and diverse. The majority of the landscape is forested; but the forests are highly varied in composition as a consequence of environmental variation and disturbances, particularly fire (Franklin and Dyness 1973). At low- to mid-elevations, mixed forests are dominated by ponderosa pine, Douglas-fir, grand fir, western larch, and lodgepole pine. At higher elevations, subalpine fir and Engelmann spruce become dominants. A variety of subalpine parklands and meadow types are abundant at higher elevations. At lower elevations the forests of ponderosa pine form mosaics with grassland and sagebrush communities. These patterns reflect the increasing aridity with decreased elevation found on the lee (rain-shadow) slope of the Cascade Range. There is also a strong environmental gradient moving east from the Cascade Crest (to a drier, more continental climate) at a given elevation along major east-west secondary mountain ranges (Wenatchee, Entiat, and Chelan Mountains, for example). This gradient is also reflected in the biota of the communities. Geological substrate provides yet another contribution to diversity in this province. A unique array of communities and organisms is associated with serpentine portions of the Wenatchee Mountains.

The 21 terrestrial cells presently identified (table 23) are selected to provide minimal representation of the major forest, subalpine and alpine meadows, and shrub-steppe communities. Because of the variability in many of these broadly defined types, representation in both the northern and southern halves of the province is necessary. Eleven cells are for coniferous forests, four for subalpine and alpine mosaics, two for shrub-steppe communities, and four for other types, including serpentine vegetation.

Aquatic cells total 11 (table 24). These include a series of lakes, ponds, and vernal pools at higher elevations and montane stream drainages on normal and serpentine topography.

It is presumed that the terrestrial and aquatic cells will incorporate the normal array of plant and animal species associated with these ecosystems. Seven rare or endangered vertebrate animals have been listed as cells in Research Natural Area identification (table 25). There are a large number of vascular plants of special interest in the province (table 26); 32 of these are on the Smithsonian list as threatened and endangered. The Wenatchee Mountains, partially because of the serpentine outcrops, is the major contributor. The area around the eastern end of the Columbia River Gorge (mainly Klickitat County) also is an area where many of these rare and endangered plants are concentrated.

The job of Research Natural Area establishment has scarcely begun; only two small areas exist, both on Forest Service lands (table 27). Four cells, all terrestrial, out of a total of 39 identified for this province are filled. None of the plants of special interest are protected within Research Natural Areas; fortunately, existing and proposed Wilderness and Botanical Areas provide protection for many.

It is estimated that 21 additional Research Natural Areas are needed to provide minimal representation of the identified freshwater, terrestrial, and vertebrate animal cells, as well as several of the rare or threatened vascular plants (table 28). Three of these are relatively large drainages providing representation of widespread terrestrial and aquatic ecosystems. Eleven focus on terrestrial cells, four on special aquatic types, and three on rare and endangered vascular plants.

There is a very large job in selection and establishment of the necessary Research Natural Areas in this province. The lead responsibility clearly rests with the Forest Service (table 28). Washington State agencies, private institutions (especially along the Columbia River), and the National Park Service (because of the Lake Chelan National Recreation Area) may also have significant contributions to make in this province.

Expanding human activity at low- to mid-elevations, logging over the bulk of the province, and development near the Columbia River and urban centers make establishment of Research Natural Areas of high priority in these regions (table 28). Subalpine and alpine needs are generally of lower priority.

Table 23.--*Terrestrial cells in the Eastern Slopes Province, Washington Cascades*

| Cell                                                                                                                                                                                                                                   | SAF<br>timber<br>type No. | Present<br>representation                                                                           | Page reference<br>(Franklin and<br>Dyrness 1973) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Ponderosa Pine Zone:</u>                                                                                                                                                                                                            |                           |                                                                                                     |                                                  |
| 1. Ponderosa pine-bitterbrush community                                                                                                                                                                                                | 237                       | Wolf Creek RNA; also<br>proposed Boulder Creek<br>RNA                                               | 173-175                                          |
| <u>Grand Fir and Douglas-fir Zone:</u>                                                                                                                                                                                                 |                           |                                                                                                     |                                                  |
| 2. Ponderosa pine-Douglas-fir/snowberry/<br>bunchgrass community                                                                                                                                                                       | 214                       | Wolf Creek RNA                                                                                      | 191-192                                          |
| * 3. Ponderosa pine-Douglas-fir/pinegrass                                                                                                                                                                                              | 237                       | Token In Meeks Table RNA,<br>need additional area                                                   | 191-193                                          |
| * 4. Mixed conifer (ponderosa pine, grand<br>fir, Douglas-fir, western larch)/ shrub<br>communities ( <i>Pachistima</i> , snowbrush,<br>spiraea, snowberry, oceanspray, huckle-<br>berry) in northern section on a variety<br>of sites |                           | None                                                                                                | 191-192<br>195-199                               |
| * 5. Mixed conifer/shrub communities on a<br>variety of sites in central section                                                                                                                                                       |                           | None                                                                                                | 191-192<br>195-199                               |
| * 6. Mixed conifer/shrub communities on a<br>variety of sites in southern section                                                                                                                                                      |                           | None                                                                                                | 191-192<br>195-199                               |
| <u>Western Hemlock Zone :</u>                                                                                                                                                                                                          |                           |                                                                                                     |                                                  |
| * 7. Western redcedar-western hemlock<br>forest                                                                                                                                                                                        | 227                       | None                                                                                                | 202-204                                          |
| <u>Subalpine forest types:</u>                                                                                                                                                                                                         |                           |                                                                                                     |                                                  |
| * 8. Engelmann spruce-subalpine fir forest<br>with some on lower slopes and cold<br>bottom areas, including good represen-<br>tation of subalpine fir/ <i>Pachistima</i><br>association                                                | 206                       | None                                                                                                | 205-207                                          |
| * 9. Subalpine larch forest                                                                                                                                                                                                            | 208                       | None, but would be<br>partially filled with<br>establishment of<br>proposed Tiffany<br>Mountain RNA | 281                                              |
| *10. Pacific silver fir forest                                                                                                                                                                                                         |                           | None                                                                                                | 94-98                                            |
| See footnote at end of table.                                                                                                                                                                                                          |                           |                                                                                                     |                                                  |

Table 23.--*Terrestrial cells in the Eastern Slopes Province, Washington Cascades* (Continued)

| Cell                                                                                        | SAF<br>timber<br>type No. | Present<br>representation                                                     | Page reference<br>(Franklin and<br>Dyrness 1973) |
|---------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Subalpine and alpine parkland communities:</u>                                           |                           |                                                                               |                                                  |
| *11. Subalpine sagebrush ( <i>Artemisia tridentata</i> var. <i>vaseyana</i> ) parkland      |                           | None                                                                          | 207-208                                          |
| *12. Alpine community mosaic (including <i>Carex-Kobresia</i> turf)                         |                           | None                                                                          | 284-290                                          |
| *13. Subalpine parkland (north section) with good east-side dry meadow types (green fescue) |                           | None, but may be filled with establishment of proposed Tiffany Mountain RNA   | 250-268                                          |
| *14. Subalpine parkland (south section) with good east-side dry meadow types (green fescue) |                           | None                                                                          | 250-268                                          |
| <u>Shrub-steppe communities :</u>                                                           |                           |                                                                               |                                                  |
| 15. Bitterbrush/bunchgrass communities                                                      |                           | Wolf Creek RNA                                                                | 222-223                                          |
| 16. Stiff sagebrush/herb-grass community                                                    |                           | Meeks Table RNA                                                               | 201                                              |
| <u>Special types:</u>                                                                       |                           |                                                                               |                                                  |
| *17. Mountain meadow in grand fir zone dominated by <i>Deschampsia</i>                      |                           | None                                                                          | 199-201                                          |
| *18. Riparian hardwoods (black cottonwood-willow)                                           | 222                       | None                                                                          |                                                  |
| *19. Oregon white oak-conifer mosaic                                                        | 233                       | None                                                                          | 168<br>171<br>191                                |
| *20. Montane serpentine area                                                                |                           | None, but need would be met with establishment of proposed Eldorado Creek RNA | 307-309                                          |
| *21. Typical lodgepole pine forest                                                          | 216                       | None                                                                          | 192-193<br>197-198                               |

\*Cells presently lacking adequate representation.

Table 24.--*Aquatic cells in the Eastern Slopes Province, Washington Cascades*

| Cell <sup>1</sup>                                       | Present representation | Remarks                                             |
|---------------------------------------------------------|------------------------|-----------------------------------------------------|
| * 1. Low-elevation eutrophic lake and drainage basin    | None                   |                                                     |
| * 2. Oligotrophic lake and mixed-conifer drainage basin | None                   |                                                     |
| * 3. Low-elevation permanent ponds                      | None                   |                                                     |
| * 4. Mid-elevation permanent ponds                      | None                   |                                                     |
| * 5. Low-elevation vernal ponds                         | None                   |                                                     |
| * 6. Mid-elevation vernal ponds                         | None                   |                                                     |
| * 7. Large stream drainage with mixed-conifer forest    | None                   | Should extend from about 3,000-5,000-foot elevation |
| * 8. Stream drainage in a montane serpentine area       | None                   |                                                     |
| * 9. Large, upwelling cold spring                       | None                   |                                                     |
| *10. Typical hot spring                                 | None                   |                                                     |
| *11. Marshland-bog area                                 | None                   |                                                     |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 25.--*Rare and endangered vertebrate animal cells in the Eastern Slopes Province, Washington Cascades*

| Cell                                                  | Verified representation | Reference                                                                                                      |
|-------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------|
| <b><u>Reptiles:</u></b>                               |                         |                                                                                                                |
| *1. Pacific ringnecked snake                          | None                    | Stebbins 1954                                                                                                  |
| *2. Oregon alligator lizard                           | None                    | Stebbins 1954                                                                                                  |
| <b><u>Birds:</u></b>                                  |                         |                                                                                                                |
| *3. Cascade boreal chickadee                          | None                    | Alcorn 1971                                                                                                    |
| <b><u>Mammals:</u></b>                                |                         |                                                                                                                |
| *4. Masked shrew (subspecies <b><i>cinereus</i></b> ) | None                    | Dalquest 1948                                                                                                  |
| *5. Western gray squirrel                             | None                    | Dalquest 1948                                                                                                  |
| *6. Heather vole                                      | None                    | Dalquest 1948<br>Edwards 1955<br>Johnson 1973<br>Johnson and Johnson 1952<br>Maser and Storm 1970<br>Shaw 1924 |
| *7. Northern bog lemming                              | None                    | Dalquest 1948<br>Maser and Storm 1970                                                                          |

\*Cells presently lacking adequate representation.

Table 26.--Vascular plants of *special interest in the Eastern Slopes Province, Washington Cascades*

| Species <sup>1</sup>                                        | Distribution                                                                 |
|-------------------------------------------------------------|------------------------------------------------------------------------------|
| <i>Anemone drummondii</i>                                   | Wenatchee Mountains on serpentine                                            |
| <i>Arabis lemmonii</i> var. <i>paddoensis</i>               | Mount Adams and probably Wenatchee Mountains                                 |
| <i>Asplenium viride</i>                                     | On limestone                                                                 |
| <i>Astragalus pulsiferae</i>                                | Mount Adams and Falcon Valley                                                |
| <i>Astragalus whitneyi</i> var. <i>sonneanus</i>            | Often on serpentine                                                          |
| <i>Cacaliopsis nardosmia</i>                                | Typically in yellow pine stands                                              |
| <i>Calamagrostis howellii</i> <sup>2</sup>                  | Columbia River Gorge in Klickitat County                                     |
| <i>Campanula lasiocarpa</i>                                 | Alpine                                                                       |
| <i>Carex parryiana</i>                                      | Wenatchee Mountains                                                          |
| <i>Carex proposita</i>                                      | Alpine talus in Wenatchee Mountains                                          |
| <i>Cassiope tetragona</i>                                   | Alpine near Canadian border                                                  |
| <i>Castilleja elmeri</i>                                    | Mainly on serpentine in Wenatchee Mountains                                  |
| <i>Ceanothus prostratus</i>                                 | Yakima County south                                                          |
| <i>Chaenactis nevi</i> <sup>2</sup>                         | Wenatchee Mountains                                                          |
| <i>Chaenactis ramosa</i> <sup>2</sup>                       | Only Wenatchee Mountains                                                     |
| <i>Chaenactis thompsonii</i> <sup>2</sup>                   | On serpentine, Wenatchee Mountains only                                      |
| <i>Cheilanthes feei</i>                                     | Limestone crevices                                                           |
| <i>Claytonia megarhiza</i> var. <i>nivalis</i> <sup>2</sup> | Only in Mount Stuart area of serpentine                                      |
| <i>Clematis columbiana</i> var. <i>dissecta</i>             | Wenatchee Mountains                                                          |
| <i>Cryptantha thompsonii</i> <sup>2</sup>                   | On serpentine, Wenatchee Mountains only                                      |
| <i>Cryptogramma stelleri</i>                                |                                                                              |
| <i>Cypripedium calceolus</i>                                |                                                                              |
| <i>Cypripedium fasciculatum</i>                             |                                                                              |
| <i>Cypripedium montanum</i>                                 | Found around east end of Columbia River Gorge                                |
| <i>Delphinium lineapetalum</i>                              | Lower elevations in Wenatchee Mountains                                      |
| <i>Delphinium multiplex</i> <sup>2</sup>                    | Along intermittent streams in yellow pine and sagebrush, Wenatchee Mountains |
| <i>Delphinium viridescens</i> <sup>2</sup>                  | Moist meadowland, Wenatchee Mountains                                        |
| <i>Delphinium xantholeucum</i> <sup>2</sup>                 | Grassland and yellow pine, Chelan and Okanogan Counties                      |
| <i>Douglasia nivalis</i> var. <i>dentata</i>                | Wenatchee Mountains, on serpentine                                           |
| <i>Draba aurea</i>                                          |                                                                              |
| <i>Draba oligosperma</i>                                    |                                                                              |
| <i>Eleocharis atropurpurea</i>                              | Lake Chelan                                                                  |
| <i>Elmera racemosa</i>                                      |                                                                              |
| <i>Epipactis gigantea</i>                                   |                                                                              |
| <i>Erigeron leibergii</i> <sup>2</sup>                      | Moderate to high elevations, Wenatchee Mountains north                       |
| <i>Eriogonum pyrolaefolium</i>                              | On serpentine in Wenatchee Mountains                                         |
| <i>Eritrichium nanum</i> var. <i>elongatum</i>              | Okanogan County                                                              |
| <i>Fritillaria pudica</i>                                   | Sagebrush and yellow pine                                                    |

See footnotes at end of table.

Table 26.--*Vascular plants of special interest in the Eastern Slopes Province, Washington Cascades* (Continued)

| Species'                                                                             | Distribution                                           |
|--------------------------------------------------------------------------------------|--------------------------------------------------------|
| <i>Garrya fremontii</i>                                                              | Eastern end Columbia River Gorge, Klickitat County     |
| <i>Geum rivale</i>                                                                   | Okanogan County                                        |
| <i>Geum rossii</i> var. <i>depressum</i>                                             | Only in Wenatchee Mountains                            |
| <i>Habenaria orbiculata</i>                                                          | Mid-elevation forests                                  |
| <i>Haplopappus hallii</i> <sup>2</sup>                                               | East end of Columbia River Gorge                       |
| <i>Hedysarum sulphurescens</i>                                                       | Okanogan County                                        |
| <i>Heuchera grossulariifolia</i> var. <i>tenuifolia</i>                              | Columbia River Gorge                                   |
| <i>Hieracium longiberbe</i> <sup>2</sup>                                             | Columbia River Gorge                                   |
| <i>Hydrophyllum capitatum</i> var. <i>thompsoni</i> <sup>2</sup>                     | Columbia River Gorge north into Yakima County          |
| <i>Iliamna longisepala</i> <sup>2</sup>                                              | Low-elevation Klittitas to Chelan and Douglas Counties |
| <i>Iliamna rivularis</i>                                                             |                                                        |
| <i>Ivesia tweedyi</i> <sup>2</sup>                                                   | Chelan to central Yakima County, often on serpentine   |
| <i>Lathyrus nevadensis</i> ssp. <i>lanceolatus</i> var. <i>puniceus</i> <sup>2</sup> | Only in Wenatchee Mountains                            |
| <i>Ledum glandulosum</i> var. <i>columbianum</i>                                     | Wet serpentine areas in Wenatchee Mountains            |
| <i>Lewisia tweedyi</i> <sup>2</sup>                                                  | Only in Wenatchee Mountains                            |
| <i>Linanthus bakeri</i>                                                              | Klickitat County                                       |
| <i>Liparis loeselii</i>                                                              | Springs and bogs, Klickitat County                     |
| <i>Lithophragma tenella</i> var. <i>thompsonii</i>                                   | Okanogan, Grant, and Yakima Counties                   |
| <i>Lomatium brandegei</i>                                                            | Klittitas to southern Okanogan Counties                |
| <i>Lomatium columbianum</i>                                                          | Klickitat County to Yakima County near Columbia River  |
| <i>Lomatium cuspidatum</i> <sup>2</sup>                                              | On serpentine, Klittitas and Chelan Counties           |
| <i>Lomatium suksdorfii</i> <sup>2</sup>                                              | Western Klickitat County                               |
| <i>Lomatium thompsonii</i> <sup>2</sup>                                              | Wenatchee region, Chelan County                        |
| <i>Lupinus latifolius</i> var. <i>thompsonianus</i>                                  | Eastern end of Columbia River Gorge                    |
| <i>Mimulus jungermannioides</i> <sup>2</sup>                                         | Mossy mats at eastern end of Columbia River Gorge      |
| <i>Mimulus pulsiferae</i>                                                            | Klickitat County                                       |
| <i>Oryzopsis hendersonii</i>                                                         |                                                        |
| <i>Parnassia kotzebuei</i> var. <i>pumila</i> <sup>2</sup>                           | Near Gilbert, Okanogan County; possibly extinct        |
| <i>Pellaea glabella</i> var. <i>simplex</i>                                          | Columbia River Gorge                                   |
| <i>Penstemon barrettiae</i> <sup>2</sup>                                             | Eastern end of Columbia River Gorge, Klickitat County  |
| <i>Penstemon lyallii</i>                                                             | Possibly near Stevens Pass                             |

See footnotes at end of table.

Table 26.--*Vascular plants of special interest in the Eastern Slopes Province, Washington Cascades* (Continued)

| Species <sup>1</sup>                                   | Distribution                                                   |
|--------------------------------------------------------|----------------------------------------------------------------|
| <i>Penstemon subseratus</i> <sup>2</sup>               | Yakima, Klickitat, and eastern Skamania Counties               |
| <i>Penstemon washingtonensis</i> <sup>2</sup>          | Moderate elevations, Chelan and Okanogan Counties              |
| <i>Petasites warrenii</i> <sup>2</sup>                 | Swank Creek drainage, Kittitas County; possibly extinct        |
| <i>Phlox hendersonii</i>                               | Chelan County south                                            |
| <i>Physaria alpestris</i>                              | Subalpine talus and rocky ridges, Chelan County to Mount Adams |
| <i>Poa curtifolia</i> <sup>2</sup>                     | On serpentine in subalpine and alpine Wenatchee Mountains      |
| <i>Polystichum californicum</i>                        | Wenatchee Mountains south                                      |
| <i>Polystichum kruckebergii</i> <sup>2</sup>           | Mount Adams                                                    |
| <i>Polystichum mohrioides</i>                          | On serpentine, Kittitas and Chelan Counties                    |
| <i>Polystichum scopulinum</i>                          | Wenatchee Mountains                                            |
| <i>Salix brachycarpa</i>                               | Wenatchee Mountains                                            |
| <i>Salix vestita</i>                                   | Chelan County                                                  |
| <i>Saxifraga integrifolia</i> var. <i>apetala</i>      | Along base of Cascade Range, Okanogan to Yakima Counties       |
| <i>Saxifraga lyallii</i>                               | Okanogan County                                                |
| <i>Saxifraga occidentalis</i>                          | Disjunct in Tumwater Canyon                                    |
| <i>Saxifraga oppositifolia</i>                         |                                                                |
| <i>Sedum lanceolatum</i> var. <i>rupicolum</i>         | Wenatchee Mountains                                            |
| <i>Selaginella douglasii</i>                           | Columbia River Gorge                                           |
| <i>Senecio elmeri</i>                                  | Alpine areas                                                   |
| <i>Sidalcea oregana</i> var. <i>calva</i> <sup>2</sup> | Only in Wenatchee Mountains                                    |
| <i>Silene seelyi</i> <sup>2</sup>                      | Only in Wenatchee Mountains                                    |
| <i>Silene suksdorfii</i>                               | Wenatchee Mountains                                            |
| <i>Spiraea pyramidalis</i>                             | Natural hybrid                                                 |
| <i>Suksdorfia violacea</i>                             | Intermittently distributed from Columbia River Gorge to Canada |
| <i>Trifolium thompsonii</i> <sup>2</sup>               | Swakane Canyon, Chelan County                                  |
| <i>Valeriana columbiana</i> <sup>2</sup>               | Open slopes, eastern Wenatchee Mountains                       |
| <i>Viola sheltonii</i>                                 | Disjunct near Cle Elum                                         |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or their identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

**Table 27.**--*Established Research **Natural** Areas in the Eastern Slopes Province, Washington Cascades*

| Name               | Principal features                                     | Agency <sup>1</sup> | Area |       |
|--------------------|--------------------------------------------------------|---------------------|------|-------|
|                    |                                                        |                     | Ha   | Acres |
| Meeks Table<br>RNA | interior ponderosa<br>pine forest on<br>isolated butte | FS                  | 28   | 68    |
| Wolf Creek<br>RNA  | Bitterbrush and<br>bunchgrass<br>communities           | FS                  | 61   | 150   |

<sup>1</sup>FS = Forest Service.

Table 28.--Additional Research Natural Areas needed in the Eastern Slopes Province, Washington Cascades

| Ecosystem or community                                                                                                                 | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                 | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <b>Combined terrestrial and aquatic natural areas:</b>                                                                                 |                                |                                                                                                                |                       |                          |                                            |                           |
| 1. Large stream drainage (from 3,000 to 5,000 ft) with a variety of mixed-conifer (ponderosa pine, Douglas-fir, grand fir) communities | T-4<br>A-7,4,6<br>R&E-6,7      | In northern section, perhaps near Pasayten Wilderness Area or possibly in Lake Chelan National Recreation Area | High                  | FS<br>NPS                | 191-192<br>195-196<br>202-204              | 0803<br>0806<br>0807      |
| 2. Oligotrophic lake and ponds; surrounding mixed-conifer drainage basin                                                               | T-5<br>A-2,4,6                 | If possible, should be located in central section                                                              | High                  | FS<br>NPS                | 191-192<br>195-196                         | 0904                      |
| 3. Large stream drainage in a montane serpentine area, with a variety of endemic plant species                                         | T-20<br>A-8                    | Need will be met with establishment of proposed Eldorado Creek RNA                                             | High                  | FS                       | 307-309                                    | 0806                      |
| <b>Predominantly terrestrial natural areas:</b>                                                                                        |                                |                                                                                                                |                       |                          |                                            |                           |
| 4. Ponderosa pine-Douglas-fir/pinegrass community                                                                                      | T-3<br>A-5                     | Chiwaukum Creek-Tumwater Canyon area, Chelan County. Also proposed Boulder Creek RNA would help fill need      | Medium                | FS<br>State              | 191-192                                    | 0803<br>0805              |
| 5. Lodgepole pine forest                                                                                                               | T-21<br>R&E-5                  | Wenatchee or Okanogan National Forests                                                                         | Medium                | FS                       | 192-193<br>197-198                         | 0802<br>0803              |
| 6. Mixed conifer (ponderosa pine, Douglas-fir, grand fir, western larch)/shrub communities in southern part of the area                | T-6<br>R&E-4                   | Wenatchee National Forest (Naches or Tieton Districts)                                                         | High                  | FS                       | 191-192<br>195-199                         | 0902<br>0904              |
| 7. Subalpine fir-Engelmann spruce and Pacific silver fir forest types                                                                  | T-8,10<br>R&E-3                | Upper slope type in Wenatchee National Forest                                                                  | High                  | FS                       | 205-207                                    | 0802                      |
| 8. Mountain meadow in grand fir zone dominated by <i>Deschampsia</i>                                                                   | T-17                           | Select to span moisture gradient                                                                               | Medium                | FS                       | 199-201                                    | 0902<br>0904              |
| 9. Subalpine parkland with dry meadow type (green fescue) and subalpine larch forest                                                   | T-9,14                         | Expansion of proposed Tiffany Mountain RNA may fill this need                                                  | Medium                | FS<br>NPS                | 263-264<br>281                             | 0901                      |
| 10. Subalpine parkland in the southern portion of the area                                                                             | T-13                           | Wilderness Area                                                                                                | LOW                   | FS<br>NPS                | 250-268                                    | 0901                      |
| 11. Subalpine sagebrush parkland                                                                                                       | T-11                           | Swakane Canyon and Colockum are possibilities (in central portion)                                             | Medium                | FS<br>State              | 207-208                                    | 0804                      |
| 12. Riparian hardwoods (black cottonwood)                                                                                              | T-18                           |                                                                                                                | High                  | Private<br>FWS<br>State  |                                            |                           |

See footnotes at end of table.

Table 28.--*Additional Research Natural Areas needed in the Eastern Slopes Province, Washington Cascades* (Continued)

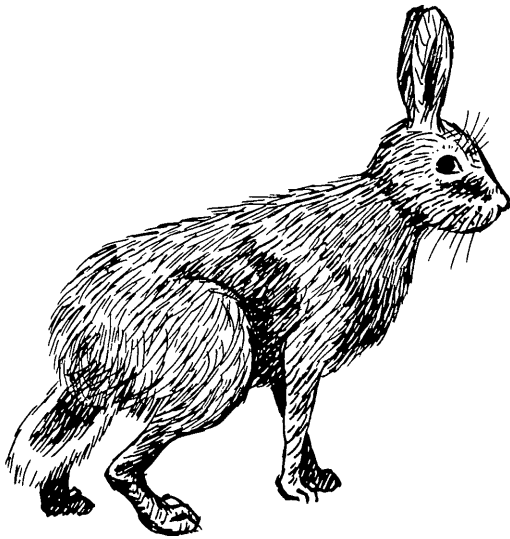
| Ecosystem or community                                                                                  | Cells represented <sup>1</sup> | Remarks and possible locations               | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|---------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 13. Alpine community mosaic                                                                             | <u>T-12</u>                    | Wilderness area in north or central Cascades | Low                   | FS<br>NPS                | 284-290                                    | 0804                      |
| 14. Oregon white oak-conifer mosaic                                                                     | <u>T-19</u><br>R&E-1,2         | Central or southern portions                 | Medium                | State                    | 168, 171,<br>191                           | 0902<br>1107              |
| <u>Predominantly aquatic natural areas:</u>                                                             |                                |                                              |                       |                          |                                            |                           |
| 15. Low-elevation eutrophic lake and ponds                                                              | A- <u>1,3,5</u>                |                                              | High                  | FS<br>State              |                                            |                           |
| 16. Large, upwelling cold spring                                                                        | A- <u>9</u>                    |                                              | Low                   | FS<br>NPS                |                                            |                           |
| 17. Typical hot springs                                                                                 | A- <u>10</u>                   |                                              | Medium                | FS<br>NPS                |                                            |                           |
| 18. Relatively large marsh and bog area                                                                 | A- <u>11</u><br>RfE-7          | Selma Meadows                                | High                  | FS<br>NPS                |                                            |                           |
| <u>Natural areas for protection of rare or threatened plant species:</u>                                |                                |                                              |                       |                          |                                            |                           |
| 19. Basalt rock areas along Klickitat River for protection of the very rare <i>Penstemon barrettiae</i> |                                | Klickitat County                             | High                  | State<br>Private         |                                            | 0904                      |
| 20. An area in Swakane Canyon for protection of <i>Trifolium thompsonii</i>                             |                                | RNA in process of establishment              | High                  | FS                       |                                            | 0804                      |
| 21. Area at east end of Columbia River Gorge with concentration of special-interest plant species       |                                | See table 26 for species of interest         | High                  | State<br>Private         |                                            |                           |

<sup>1</sup>For a description of these cells see table 23 for terrestrial (T) ecosystems, table 24 for aquatic (A) ecosystems, and table 25 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. FS = Forest Service, FWS = Fish and Wildlife Service, NPS = National Park Service.

<sup>4</sup>See appendix V.



## COLUMBIA BASIN PROVINCE, WASHINGTON

The Columbia Basin is the largest province, occupying roughly two-thirds of the area east of the Cascades in Washington (fig. 1). For the most part, topography in the province ranges from gently undulating to moderately hilly; steep slopes are generally restricted to isolated volcanic buttes or stream-cut canyons. Because of the subdued relief, elevations are generally low, ranging from about **150** to **600** m.

Columbia River basalt of Miocene age underlies virtually the entire province and is the feature which geologically sets it apart from adjacent provinces. In some places these thick layers of basalt were altered during the Pleistocene by tectonic deformation or stream dissection, thus producing ridges and valleys seen today. The most outstanding example of stream-cut topography is the Channeled Scablands, located near the center of the province. This gigantic series of deeply cut channels in the basalt was apparently formed by floodwaters originating from glacial lakes during the Pleistocene.

Pliocene-Pleistocene deposits cover the Columbia River basalt over extensive tracts. The most widespread deposit is Palouse loess, a massive tan-colored silt up to **4.5** m thick, which mantles an elliptical area **160** km long in southeastern Washington. This deposit is characterized by smoothly rolling hills and soils of high fertility.

Broad soil differences in the Columbia Basin are largely correlated with differences in annual precipitation. Although the entire province is, in general, an area of low precipitation, there are substantial differences in rainfall pattern. In general, precipitation is heaviest along the margins of the basin and gradually decreases toward the central portion. Consequently soils in the Palouse Hills (near the eastern margin) are generally deep, well-developed Prairie or Chernozem soils, formed under grassland vegetation. Typically they have a thick, dark-colored silt loam **A** horizon, underlain by a silty clay loam **B** horizon which lacks a zone of calcium carbonate accumulation. Adjacent to this zone at lower elevations are Chestnut soils, which reflect the more arid conditions. These soils have a moderately thick, brown silt loam **A** horizon and a poorly developed silt loam **B** horizon which includes a zone of calcium carbonate accumulation. In the central portion of the province, arid conditions prevail and, as a result, desertic soils predominate. Here the most common soils are Sierozems. These have thin, light-colored **A** horizons over clay-enriched **B** horizons containing a layer of calcium carbonate which is often cemented.

Steppe and shrub-steppe ecosystems typify the undeveloped lands of the Columbia Basin (Franklin and Dyrness 1973). Big sagebrush-bunchgrass and bunchgrass communities dominate the western and central portions of the basin, with forb-rich meadow steppe characteristic of the northern and eastern margins. Unusual soil conditions, such as the shallow soils associated with scablands, are sites occupied by a large array of distinctive shrub-bunchgrass communities, many dwarfed in stature. Areas of saline and alkali accumulations, riparian habitats, cliffs and scree slopes, and dunes add further to the diversity. Finally, ponderosa pine and quaking aspen communities intrude along the margins and canyons of the province.

Aquatic ecosystems are more abundant than might be expected in this arid province. They consist largely of ponds, lakes, vernal pools, and marshes of varying chemistry, many of them in channeled scablands. Streams are relatively uncommon.

Terrestrial cells which have been identified total **43** (table 29). This reflects several factors, including the large size and diversity of the province and the greater detailed knowledge of its ecosystems, largely because of the work of R. Daubenmire. Included are cells for all of the distinctive plant associations he has identified—ponderosa pine forest and various types of steppe, shrub-steppe, and meadow steppe including zonal types as well as communities found on specialized habitats.

Identified aquatic cells total **13** (table 30). There is a special need for a series of ponds and lakes representing a chemical gradient from freshwater to saline and alkali. A widespread and important new type of aquatic ecosystem associated with irrigation projects, “wasteways and potholes” (No. 13), is included in the list.

It is assumed that the various aquatic and terrestrial Research Natural Areas will incorporate the fauna and flora typical of these ecosystem types. Twelve rare or endangered animals are listed (table 31) for special consideration as cells in selecting and establishing Research Natural Areas. This relatively large number is because of the widespread conversion of most of the province to agricultural production and consequent loss of habitats for many species. There is also a relatively large number of vascular plants of special interest (table 32). A large proportion of these are on the Smithsonian list of threatened and endangered plants (**20** species), again reflecting a loss of habitat to agricultural and other developments, especially in the Palouse region.

Three Research Natural Areas and two preserves created through The Nature Conservancy presently exist in the Columbia Basin (table 33). Fortunately one of these—Rattlesnake Hills—is very large and includes many representative ecosystem types. Even so, only 11 of the 68 terrestrial, aquatic, and rare and endangered cells identified for the province have been filled. These fill 7 cells out of **43** terrestrial, 2 out of **13** aquatic, and 2 out of **12** vertebrate animal cells listed.

It was suggested at the workshop that **12** additional Research Natural Areas could provide for minimal representation of the remaining **57** cells (table 34). Considering the scarcity of large areas with natural or near-natural ecosystems and the large number and diversity of cells to be filled, this seems extremely optimistic (as several reviewers have pointed out). It is likely that more than **12** Research Natural Areas will be necessary, particularly if they are small. However, we have decided to leave the listing of remaining natural area needs as it is in the absence of better knowledge on how cells could be aggregated. Consequently, the reader should be particularly sensitive in this province to filling cellular needs (tables 29-31) rather than trying to locate tracts which meet all of the listed characteristics for the tentative and highly diverse Research Natural Areas in table 34 (for example, Nos. 1-4, 6, and 9).

In any case a very large job of natural area preservation exists in the Columbia Basin, and lead responsibility is probably more diverse than in most (table 34). State agencies and institutions, private organizations, and Fish and Wildlife Service have particularly large responsibilities but would be assisted by Bureau of Land Management, Energy Research and Development Administration, and Bureau of Reclamation, among others. Priorities are uniformly high because of rapid expansion of human developments in this already extensively altered province. Completion of the Research Natural Area system in the Columbia Basin may prove very difficult, not only because of rapid, large-scale conversion of natural communities to agricultural uses but also because of the large number of cells to be filled. The province should, receive major emphasis from State and private groups.

Table 29.--*Terrestrial cells in the Columbia Basin Province, Washington*

| Cell                                                                           | SAF<br>timber<br>type No. | Present<br>representation                                                                | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Ponderosa pine communities:</u>                                             |                           |                                                                                          |                                                  |
| 1. Ponderosa pine/Idaho fescue community                                       | 237                       | Turnbull Pine and Pine<br>Creek RNA's                                                    | 173-175                                          |
| * 2. Ponderosa pine/ninebark community                                         | 237                       | None                                                                                     | 173-175                                          |
| * 3. Ponderosa pine/snowberry community                                        | 237                       | Some representation at<br>Turnbull Pine RNA, need<br>additional area                     | 173-175                                          |
| * 4. Ponderosa pine/bluebunch wheatgrass<br>community                          | 237                       | None                                                                                     | 173-175                                          |
| * 5. Ponderosa pine/needlegrass community                                      | 237                       | None                                                                                     | 173-175                                          |
| <u>Zonal meadow-steppe associations:</u>                                       |                           |                                                                                          |                                                  |
| 6. <i>Festuca idahoensis</i> / <i>Symphoricarpos<br/>albus</i> community       |                           | Washington State University<br>preserves                                                 | 211-216<br>220-222                               |
| * 7. <i>Artemisia tripartita</i> / <i>Festuca<br/>idahoensis</i> community     |                           | None                                                                                     | 211-216<br>222                                   |
| * 8. <i>Festuca idahoensis</i> / <i>Hieracium<br/>cynoglossoides</i> community |                           | None                                                                                     | 211<br>224                                       |
| * 9. <i>Purshia tridentata</i> / <i>Festuca idahoensis</i><br>community        |                           | None                                                                                     | 211-216<br>222-223                               |
| *10. <i>Festuca idahoensis</i> / <i>Rosa nutkana</i><br>community              |                           | None                                                                                     | 211<br>224                                       |
| *11. <i>Purshia tridentata</i> / <i>Agropyron spicatum</i><br>community        |                           | None                                                                                     | 223                                              |
| <u>Zonal steppe associations:</u>                                              |                           |                                                                                          |                                                  |
| *12. <i>Artemisia tridentata</i> / <i>Agropyron<br/>spicatum</i> community     |                           | Well represented in Rattle-<br>snake Hills RNA, need<br>additional examples<br>elsewhere | 211-218                                          |
| *13. <i>Artemisia tridentata</i> / <i>Festuca<br/>idahoensis</i> community     |                           | None                                                                                     | 211-216<br>219                                   |
| *14. <i>Agropyron spicatum</i> - <i>Poa sandbergii</i><br>community            |                           | None                                                                                     | 211-216<br>225-227                               |
| *15. <i>Agropyron spicatum</i> - <i>Festuca<br/>idahoensis</i> community       |                           | None                                                                                     | 211-216<br>219-220                               |

See footnote at end of table.

Table 29.--*Terrestrial cells in the Columbia Basin Province, Washington (Continued)*

| Cell                                                                                         | SAF<br>timber<br>type No.                                                | Present<br>representation | Page reference<br>(Franklin and<br>Dyrness 1973) |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------|--------------------------------------------------|
| <u><i>Stipa comata</i> associations on deep gravelly<br/>or sandy soils:</u>                 |                                                                          |                           |                                                  |
| *16. <i>Artemisia tridentata</i> / <i>Stipa comata</i><br>community                          | None                                                                     |                           | 224-225                                          |
| *17. <i>Purshia tridentata</i> / <i>Stipa comata</i><br>community                            | None                                                                     |                           | 224-225                                          |
| *18. <i>Stipa comata</i> - <i>Poa sandbergii</i> community                                   | None                                                                     |                           | 224-225                                          |
| *19. <i>Artemisia tripartita</i> / <i>Stipa comata</i><br>community                          | None                                                                     |                           | 224-225                                          |
| <u>Associations on shallow soils:</u>                                                        |                                                                          |                           |                                                  |
| 20. <i>Eriogonum douglasii</i> / <i>Poa sandbergii</i><br>community                          | Rattlesnake Hills RNA                                                    |                           | 224-225                                          |
| *21. <i>Artemisia rigida</i> / <i>Poa sandbergii</i><br>community                            | None                                                                     |                           | 225-227                                          |
| *22. <i>Eriogonum niveum</i> / <i>Poa sandbergii</i>                                         | None                                                                     |                           | 225-227                                          |
| *23. <i>Eriogonum sphaerocephalum</i> / <i>Poa</i><br><i>sandbergii</i> community            | None                                                                     |                           | 225-227                                          |
| *24. <i>Eriogonum compositum</i> / <i>Poa sandbergii</i><br>community                        | None                                                                     |                           | 225-227                                          |
| *25. <i>Eriogonum thymoides</i> / <i>Poa sandbergii</i><br>community                         | None                                                                     |                           | 225-227                                          |
| *26. <i>Eriogonum microthecum</i> - <i>Physaria</i><br><i>oregana</i> community              | None                                                                     |                           | 225-227                                          |
| *27. <b>Lithosolic</b> <i>Agropyron spicatum</i> - <i>Poa</i><br><i>sandbergii</i> community | Some in Washington State<br>University preserve, need<br>additional area |                           | 225-227                                          |
| <u>Dry site shrub/<i>Poa</i> associations:</u>                                               |                                                                          |                           |                                                  |
| 28. <i>Artemisia tridentata</i> / <i>Poa sandbergii</i><br>community                         | Rattlesnake Hills RNA                                                    |                           | 228                                              |
| 29. <i>Grayia spinosa</i> / <i>Poa sandbergii</i><br>community                               | Rattlesnake Hills RNA                                                    |                           | 228                                              |
| 30. <i>Eurotia lanata</i> / <i>Poa sandbergii</i><br>community                               | Rattlesnake Hills RNA                                                    |                           | 228                                              |

See footnote at end of table.

Table 29.--*Terrestrial* cells in the *Columbia* Basin Province, Washington (Continued)

| Cell                                                                                | SAF<br>timber<br>type No. | Present<br>representation                                                         | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------|
| <u><i>Distichlis stricta</i> associations on saline<br/>and alkali soils:</u>       |                           |                                                                                   |                                                  |
| *31. <i>Distichlis stricta</i> communities                                          | None                      |                                                                                   | 227                                              |
| *32. <i>Elymus cinereus</i> - <i>Distichlis stricta</i><br>community                | None                      |                                                                                   | 227                                              |
| *33. <i>Sarcobatus vermiculatus</i> - <i>Distichlis</i><br><i>stricta</i> community | None                      |                                                                                   | 227                                              |
| <u><i>Crataegus</i> associations and related<br/>riparian types:</u>                |                           |                                                                                   |                                                  |
| *34. <i>Crataegus douglasii</i> / <i>Symphoricarpos</i><br><i>albus</i> community   |                           | Small amount in Washington<br>State University preserves,<br>need additional area | 227-228                                          |
| *35. <i>Crataegus douglasii</i> / <i>Heracleum</i><br><i>lanatum</i> community      | None                      |                                                                                   | 227-228                                          |
| *36. Riparian woodland with black<br>cottonwood and white alder                     | None                      |                                                                                   | 228                                              |
| <u>Associations on specialized habitats<br/>(including colluvium and talus):</u>    |                           |                                                                                   |                                                  |
| *37. <i>Sporobolus cryptandrus</i> - <i>Poa sandbergii</i><br>community             | None                      |                                                                                   | 228-229                                          |
| *38. <i>Aristida longiseta</i> - <i>Poa sandbergii</i><br>community                 | None                      |                                                                                   | 228-229                                          |
| *39. <i>Rhus glabra</i> community                                                   | None                      |                                                                                   | 229-230                                          |
| *40. <i>Celtis douglasii</i> / <i>Bromus tectorum</i><br>community                  | None                      |                                                                                   | 229-230                                          |
| *41. Basaltic talus slopes                                                          |                           | Some in Rattlesnake Hills<br>RNA, need additional<br>area                         | 229-230                                          |
| 42. Quaking aspen type                                                              | 217                       | Turnbull Pine and Pine Creek<br>RNA's                                             | 228                                              |
| *43. Columbia River sand dunes in<br>various stages of stabilization                | None                      |                                                                                   | 230-231                                          |

\*Cells presently lacking adequate representation.

Table 30.--*Aquatic cells in the Columbia Basin Province, Washington*

| Cell <sup>1</sup>                                                 | Present<br>representation |
|-------------------------------------------------------------------|---------------------------|
| * 1. Freshwater lake                                              | None                      |
| * 2. Alkaline lake                                                | None                      |
| * 3. Saline lake                                                  | None                      |
| * 4. Freshwater permanent ponds                                   | None                      |
| * 5. Alkaline permanent ponds                                     | None                      |
| * 6. Saline permanent ponds                                       | None                      |
| * 7. Typical vernal ponds                                         | None                      |
| 8. Large stream drainage in steppe and<br>shrub-steppe vegetation | Rattlesnake Hills RNA     |
| 9. Large, cold springs                                            | Rattlesnake Hills RNA     |
| *10. Typical hot springs                                          | None                      |
| *11. Freshwater marsh area                                        | None                      |
| *12. Saline marsh area                                            | None                      |
| *13. Wasteways and potholes                                       | None                      |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 31.--*Rare and endangered vertebrate animal cells in the Columbia Basin Province, Washington*

| Cell                            | Verified representation | Reference,                                                                                                                 |
|---------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <u>Amphibians :</u>             |                         |                                                                                                                            |
| * 1. Woodhouse toad             | None                    | Stebbins 1954                                                                                                              |
| <u>Reptiles :</u>               |                         |                                                                                                                            |
| * 2. Striped whipsnake          | None                    | Stebbins 1954                                                                                                              |
| * 3. Night snake                | None                    | Stebbins 1954                                                                                                              |
| <u>Birds :</u>                  |                         |                                                                                                                            |
| 4. Western burrowing owl        | Rattlesnake Hills RNA   | Alcorn 1971                                                                                                                |
| <u>Mammals :</u>                |                         |                                                                                                                            |
| * 5. Merriam shrew              | None                    | Dalquest 1948<br>Johnson and Clanton 1954                                                                                  |
| * 6. Pygmy rabbit               | None                    | Dalquest 1948                                                                                                              |
| * 7. White-tailed jack rabbit   | None                    | Dalquest 1948                                                                                                              |
| * 8. Washington ground squirrel | None                    | Dalquest 1948                                                                                                              |
| * 9. Ord kangaroo rat           | None                    | Dalquest 1948<br>Broadbooks 1969                                                                                           |
| 10. Northern grasshopper mouse  | Rattlesnake Hills RNA   | Dalquest 1948                                                                                                              |
| *11. Kinkaid meadow vole        | None                    | Dalquest 1948<br>Maser and Storm 1970                                                                                      |
| 12. Sagebrush vole              | Rattlesnake Hills RNA   | Clanton et al. 1971<br>Dalquest 1948<br>Johnson et al. 1948<br>Maser et al. 1974<br>Maser and Storm 1970<br>O'Farrell 1972 |

\*Cells presently lacking adequate representation.

Table 32.--Vascular plants of special interest in the Columbia Basin Province,  
Washington

| Species <sup>1</sup>                                             | Distribution                                                 |
|------------------------------------------------------------------|--------------------------------------------------------------|
| <i>Allium robinsonii</i> <sup>2</sup>                            | Along Columbia River, Vantage to John Day River              |
| <i>Angelica canbyi</i>                                           | General in province                                          |
| <i>Antennaria parvifolia</i>                                     | Disjunct from Great Plains                                   |
| <i>Aster jessicae</i> <sup>2</sup>                               | Palouse region                                               |
| <i>Astragalus columbianus</i> <sup>2</sup>                       | Probably extinct; at Priest's Rapids                         |
| <i>Astragalus diaphanus</i>                                      | Along Columbia River, Klickitat County                       |
| <i>Astragalus kentrophyta</i> var. <i>douglasii</i> <sup>2</sup> | Around Walla Walla with sagebrush                            |
| <i>Astragalus leibergii</i>                                      | Douglas, Chelan, and Kittitas Counties with sagebrush        |
| <i>Astragalus pulsiferae</i>                                     | Falcon Valley, Klickitat County                              |
| <i>Astragalus riparius</i>                                       | Lower Snake River, Whitman and Columbia Counties             |
| <i>Astragalus sinuatus</i> <sup>2</sup>                          | Along Colockum Creek, Chelan County                          |
| <i>Astragalus speirocarpus</i>                                   | Near Columbia River in lower Columbia Basin with sagebrush   |
| <i>Astragalus succumbens</i>                                     | Klickitat and Grant Counties, with sagebrush                 |
| <i>Astragalus tweedyi</i>                                        | Lower Columbia Basin with sagebrush                          |
| <i>Balsamorhiza hirsuta</i>                                      | Between Ellensburg and Yakima                                |
| <i>Balsamorhiza rosea</i> <sup>2</sup>                           | Widely disjunct in basin; protected in Rattlesnake Hills RNA |
| <i>Bolandra oregana</i>                                          | Moist mossy areas along Snake River                          |
| <i>Calochortus nitidus</i> <sup>2</sup>                          | Palouse region                                               |
| <i>Castilleja thompsonii</i>                                     | Sagebrush associate                                          |
| <i>Chaenactis douglasii</i> var. <i>glandulosa</i>               | Along Snake River                                            |
| <i>Cirsium brevifolium</i> <sup>2</sup>                          | Palouse region                                               |
| <i>Collinsia sparsiflora</i>                                     | Lower Columbia River                                         |
| <i>Crepis modocensis</i> ssp. <i>glareosa</i>                    | Around Ellensburg                                            |
| <i>Cryptantha fendleri</i>                                       | Franklin County                                              |
| <i>Cryptantha leucophaea</i>                                     | Along Columbia River from Wenatchee to The Dalles            |
| <i>Delphinium depauperatum</i>                                   | Moist areas in sagebrush valleys, Asotin County              |
| <i>Dicentra cucullaria</i>                                       | Sandy banks along Columbia River                             |
| <i>Erigeron basalticus</i>                                       | Crevices in rocky canyons, Yakima County                     |
| <i>Erigeron piperianus</i>                                       | With sagebrush                                               |
| <i>Eriogonum angulosum</i>                                       | Yakima County (disjunct from southeastern Oregon)            |
| <i>Eriogonum thymoides</i>                                       | With sagebrush                                               |
| <i>Hackelia arida</i>                                            | Western half of basin                                        |
| <i>Hackelia cinerea</i>                                          | Kittitas and Chelan Counties                                 |
| <i>Hackelia hispida</i> <sup>2</sup>                             | Grand Coulee and Snake River                                 |
| <i>Hackelia venusta</i> <sup>2</sup>                             | Chelan County                                                |

See footnotes at end of table.

Table 32.--Vascular plants of special interest in the Columbia Basin Province, Washington (Continued)

| Species <sup>1</sup>                              | Distribution                                                         |
|---------------------------------------------------|----------------------------------------------------------------------|
| <i>Haplopappus iatrorhizus</i> <sup>2</sup>       | Palouse region                                                       |
| <i>Helianthus cusickii</i>                        | Western basin north to Ellensburg                                    |
| <i>Iliamna longisepala</i> <sup>2</sup>           | Kittitas to Chelan and Douglas Counties                              |
| <i>Lathyrus bijugatus</i> <sup>2</sup>            | Palouse region                                                       |
| <i>Lomatium salmoniflorum</i>                     | Palouse region                                                       |
| <i>Lomatium tuberosum</i> <sup>2</sup>            | Fort Simcoe-White Swan area                                          |
| <i>Lomatium watsonii</i>                          | Kittitas County south                                                |
| <i>Lupinus sericeus</i> var. <i>asotinensis</i>   | Asotin and Whitman Counties                                          |
| <i>Marsilea vestita</i>                           | Mud of lakes and vernal pools                                        |
| <i>Mimulus clivicola</i>                          | Upper Snake River                                                    |
| <i>Mimulus washingtonensis</i>                    | Wet, open areas, Klickitat County                                    |
| <i>Navarretia tagetina</i>                        | Mouth of Klickitat River                                             |
| <i>Oenothera flava</i>                            | Along Yakima River                                                   |
| <i>Oryzopsis hendersonii</i>                      | Yakima and southern Kittitas Counties                                |
| <i>Pediocactus simpsonii</i>                      | Widespread but much collected                                        |
| <i>Penstemon deustus</i> var. <i>variabilis</i>   | Klickitat County                                                     |
| <i>Penstemon eriantherus</i> var. <i>whitedii</i> | Chelan and Douglas Counties                                          |
| <i>Penstemon gairdneri</i> var. <i>gairdneri</i>  | Scablands, northeastern basin                                        |
| <i>Petrophytum cinerascens</i> <sup>2</sup>       | Basalt cliffs along Columbia River, Chelan County                    |
| <i>Polemonium pectinatum</i> <sup>2</sup>         | Moist bottomlands, Whitman and Spokane Counties                      |
| <i>Ranunculus reconditus</i> <sup>2</sup>         | Sagebrush slopes, Klickitat County                                   |
| <i>Ribes cereum</i> var. <i>colubrinum</i>        | Along Snake River, Asotin County                                     |
| <i>Rubus nigerrimus</i> <sup>2</sup>              | Snake River Canyon, Whitman County                                   |
| <i>Salix drummondiana</i>                         | Palouse region                                                       |
| <i>Scirpus olneyi</i>                             | Grant County                                                         |
| <i>Silene spaldingii</i> <sup>2</sup>             | Palouse region; found in Washington State University steppe preserve |
| <i>Synthyris missurica</i>                        | Palouse region                                                       |
| <i>Talinum spinescens</i>                         | Scablands                                                            |
| <i>Tauschia hooveri</i> <sup>2</sup>              | Scablands, Yakima County                                             |
| <i>Tragopogon mirus</i>                           | Near Pullman and Palouse                                             |
| <i>Tragopogon miscellus</i>                       | Palouse region                                                       |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or their identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 33.--*Established Research Natural Areas in the Columbia Basin Province, Washington*

| Name                  | Principal features                                            | Agency <sup>1</sup> | Area   |        |
|-----------------------|---------------------------------------------------------------|---------------------|--------|--------|
|                       |                                                               |                     | Ha     | Acres  |
| Moxee Bog Preserve    | Floating sphagnum bog in steppe region of Yakima County       | YCC                 | 6      | 14     |
| Pine Creek RNA        | Interior ponderosa pine and grasslands                        | FWS                 | 65     | 160    |
| Rattlesnake Hills RNA | Dry Columbia Basin shrub steppe                               | ERDA                | 30 364 | 75,000 |
| Rose Creek Preserve   | Seminatural grassland and shrub communities in Palouse region | TNC                 | 5      | 12     |
| Turnbull Pine RNA     | Interior ponderosa pine, grassland, and ponds                 | FWS                 | 81     | 200    |

<sup>1</sup>ERDA = Energy Research and Development Administration, FWS = Fish and Wildlife Service, TNC = The Nature Conservancy, YCC = Yakima Community College.

Table 34.--Additional Research Natural Areas needed in the Columbia Basin Province, Washington

| Ecosystem or community                                                                                                                                             | Cells represented <sup>1</sup>                                                   | Remarks and possible locations                               | Priority <sup>2</sup> | Lead agency <sup>3</sup>  | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------|---------------------------|--------------------------------------------|---------------------------|
| <b>Predominantly terrestrial natural areas:</b>                                                                                                                    |                                                                                  |                                                              |                       |                           |                                            |                           |
| 1. Large area with big sagebrush/ bunchgrass communities but also with <i>Artemisia tripartita</i> , <i>Artemisia rigida</i> , and other communities               | T- <u>7,12,13,19,20,21,22,23,24,25,26,28</u><br>A-7<br>R&E-1,2,3,4,5,6,7,9,10,12 | Okanogan foothills, northeast of Spokane                     | High                  | FWS<br>BLM<br>State<br>FS | 211-219<br>222<br>226-227                  | 1003<br>1104              |
| 2. Bunchgrass communities ( <i>Agropyron spicatum</i> , <i>Festuca idahoensis</i> ) in the Palouse Hills                                                           | T- <u>8,10,14,15</u><br>A-7                                                      | Mostly private, so may have to be a Nature Conservancy Area  | High                  | Private                   | 219-224                                    | 1105                      |
| 3. Bunchgrass, <i>Stipa comata</i> , and <i>Eriogonum</i> communities in an area near Moses Lake                                                                   | T- <u>16,17,18,22,23,24,25,26,27,12,13,14,15</u><br>A-7<br>R&E-11                | Should span moist to dry sites                               | High                  | BR<br>State               | 224-227                                    | 1102<br>1104              |
| 4. Alkali saltgrass, greasewood, and giant wildrye-dominated communities on saline-alkali soils                                                                    | T- <u>31,32,33,29,30</u><br>A-7                                                  | Banks Lake area                                              | High                  | BR                        | 227                                        | 1108                      |
| 5. Riparian woodland (black cottonwood and white alder) and <i>Crataegus douglasii</i> communities                                                                 | T- <u>34,35,36</u>                                                               | Foothills of Okanogan Uplands; strip should be 1/8-mile wide | High                  | FWS<br>FS<br>BLM          | 227-228                                    | 1103<br>1104              |
| 6. <i>Sporobolus cryptandrus</i> , <i>Aristida longiseta</i> , <i>Rhus glabra</i> , and <i>Crataegus douglasii</i> communities with a 1,000-foot elevational range | T- <u>34,35,37,39,38</u>                                                         | Imnaha area; Asotin, Washington, and southward               | Medium                | FS                        | 227-229                                    | 1203                      |
| 7. Basalt talus area                                                                                                                                               | T- <u>41</u>                                                                     | Possible this may be found in another area                   | Low                   | BR<br>BLM<br>ERDA         | 229-230                                    | 1101<br>1103<br>1104      |

See footnotes at end of table.

Table 34.--*Additional Research Natural Areas* needed in the Columbia Basin Province, Washington (Continued)

| Ecosystem or community                                                                                                                                                                     | Cells represented <sup>1</sup>                    | Remarks and possible locations                                     | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 8. Area of Columbia River sand dunes, including dunes in various stages of stabilization                                                                                                   | T- <u>43</u>                                      |                                                                    | High                  | BLM State                | 230-231                                    | 1110                      |
| 9. Area with a variety of ponderosa pine communities on both north and south slopes. In addition, should include bitterbrush/Idaho fescue and bitterbrush/bluebunch wheatgrass communities | T- <u>1,2,3,4</u><br><u>5,9,11</u>                |                                                                    | High                  | Private<br>BLM State     | 173-176<br>222-223                         | 1106<br>1107              |
| <u>Predominantly aquatic natural areas:</u>                                                                                                                                                |                                                   |                                                                    |                       |                          |                                            |                           |
| 10. Scabland lakes and ponds with water quality ranging from fresh to saline in a matrix of bunchgrass or shrub-steppe vegetation                                                          | A- <u>1,2,3,4</u><br><u>5,6,11</u> ,<br><u>12</u> | Should include 6 to 10 lakes. Spokane or Sprague, Washington, area | High                  | FWS State                |                                            | 1104                      |
| 11. Typical hot springs                                                                                                                                                                    | A- <u>10</u>                                      |                                                                    | Medium                | BR<br>Private<br>FWS     |                                            |                           |
| 12. Wasteways and potholes area                                                                                                                                                            | A- <u>13</u><br>R&E-8                             | Areas result from damming and irrigation activities                | Medium                | BR                       |                                            | 1102                      |

<sup>1</sup>For a description of these cells see table 29 for terrestrial (T) ecosystems, table 30 for aquatic (A) ecosystems, and table 31 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, BR = Bureau of Reclamation, ERDA = Energy Research and Development Administration, FS = Forest Service, FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.



## OKANOGAN HIGHLANDS PROVINCE, NORTHEASTERN WASHINGTON

The Okanogan Highlands Province (fig. 1) is essentially a high plateau area, situated at elevations of 1200 to 2400 m, which is interrupted at intervals by a series of broad valleys containing south-flowing rivers (the Okanogan, Sanpoil, Columbia, Colville, and Pend Oreille Rivers). The upland areas are characterized by generally moderate slopes and broad, rounded summits. The area east of the Columbia River is generally considered to be a part of the Rocky Mountain system, and here slopes tend to be somewhat steeper.

Virtually the entire province was repeatedly covered by glacial ice during the Pleistocene. As a result, deposits of glacial drift are found throughout the area and are especially abundant in the eastern section (north of Spokane). The province contains an almost bewildering variety of rock types, ranging in age from Precambrian to late Tertiary. The oldest rock types are concentrated in the eastern, or Rocky Mountain, section of the province and include phyllite, quartzite, graywacke, slate, and argillite. Granitic rocks of Mesozoic age occupy most of the area in the western portion. Younger sedimentary rocks of Tertiary age are largely confined to areas adjacent to main river valleys.

The soil pattern in the Okanogan Highlands is closely tied to elevation. In the mountainous areas away from the major river valleys, forested soils derived from granitic parent materials tend to have shallow, coarse-textured (gravelly sandy loam), poorly developed profiles. Soils developed on glacial drift at comparable elevations are often influenced by aerially deposited volcanic ash and therefore tend to be deeper and considerably finer textured. At lower elevations, along the margins of river valleys, soils reflect the drier climate and transitional forest-grassland vegetation. Here, well-developed Chernozem soils have developed in glacial till parent materials. These are deep, productive soils with at least moderately thick, dark-colored A horizons.

Forest ecosystems dominate the landscape of the Okanogan Highlands. Many of the ecosystems are characteristic of the Rocky Mountains (Franklin and Dyness **1973**), reflecting the more continental climatic regime; as we have defined the province, it does, in fact, include some western outliers of the Rocky Mountain system in extreme northeastern Washington (fig. 1). Ponderosa pine, Douglas-fir, western larch, and lodgepole pine are characteristic forest dominants in low-to mid-elevations and Engelmann spruce, subalpine fir, and lodgepole pine at higher elevations. Grassland or shrub communities merge into forests at lower elevations and occur as openings in a forest matrix elsewhere. Subalpine and alpine meadow types occur at higher elevations.

Twenty-seven terrestrial cells have been identified which provide minimal coverage of the major forest ecosystems and three associated meadow types (table **35**). These include all the major forest communities which have been identified in the province. Forest ecosystem cells span the ponderosa pine, Douglas-fir, grand fir, western redcedar-western hemlock, and subalpine fir forest zones.

There are 11 identified aquatic cells (table **36**). Most of these result from a need for lake, pond, vernal pool, and stream representation in both low-elevation and subalpine environments.

It is assumed that Research Natural Areas established to fill terrestrial and aquatic cells will include the complement of typical plant and animal species. Three vertebrate animal cells are identified for special consideration as rare and endangered species (table **37**). Vascular plants of special interest include four species from the Smithsonian list of threatened and endangered plants (table **38**). A number of species listed in table **38** are boreal species finding their southern limits in the Okanogan Highlands.

There are three Research Natural Areas already established in the Okanogan Highlands (table **39**). These provide coverage for 7 of the 41 cells presently identified in the province.

Our present estimate is that 13 additional Research Natural Areas will provide for minimal representation of the terrestrial, aquatic, and animal cells (table **40**). Although the number is small, three of the areas could be relatively large, since they must include entire drainage basins and fill several terrestrial and aquatic cells.

Lead responsibility falls heavily on the Fish and Wildlife Service, the Forest Service, and Bureau of Land Management. The State of Washington may also contribute significantly in this province.

Table 35.--*Terrestrial cells in the Okanogan Highlands Province, northeastern Washington*

| Cell                                                                      | SAF<br>timber<br>type No. | Present<br>representation                              | Page reference<br>(Franklin and<br>Dyrness 1973) |
|---------------------------------------------------------------------------|---------------------------|--------------------------------------------------------|--------------------------------------------------|
| <u>Ponderosa Pine Zone:</u>                                               |                           |                                                        |                                                  |
| * 1. Ponderosa pine/bluebunch<br>wheatgrass community                     | 237                       | Token in Baird Basin<br>RNA, need additional<br>area   | 173-176                                          |
| * 2. Ponderosa pine/Idaho fescue<br>community                             | 237                       | Token in Baird Basin<br>RNA, need additional<br>area   | 173-175                                          |
| * 3. Ponderosa pine/ <i>Stipa</i> comata<br>community                     | 237                       | None                                                   | 173-175                                          |
| * 4. Ponderosa pine/snowberry<br>community                                | 237                       | None                                                   | 173-175                                          |
| * 5. Ponderosa pine/ninebark<br>community                                 | 237                       | None                                                   | 173-175                                          |
| * 6. Ponderosa pine/bitterbrush<br>community                              | 237                       | None                                                   | 173-179                                          |
| <u>Douglas-fir Zone:</u>                                                  |                           |                                                        |                                                  |
| * 7. Ponderosa pine/pinegrass<br>community                                | 237                       | None                                                   | 175-176                                          |
| * 8. Douglas-fir/pinegrass<br>community, including the<br>bearberry phase | 210                       | Token in Maitlen Creek<br>RNA, need additional<br>area | 191-192                                          |
| * 9. Douglas-fir/snowberry<br>community                                   | 210<br>212<br>214         | None                                                   | 191-192                                          |
| 10. Douglas-fir/ninebark<br>community                                     | 210<br>212<br>214         | Maitlen Creek and Baird<br>Basin RNA's                 | 192                                              |
| *11. Typical western larch forest                                         | 212 or<br>213             | Token in Baird Basin<br>RNA, need additional<br>area   | 198                                              |
| <u>Grand Fir Zone:</u>                                                    |                           |                                                        |                                                  |
| *12. Grand fir/Oregon boxwood<br>community                                | 213                       | Token in Maitlen Creek<br>RNA, need additional<br>area | 195<br>198                                       |

See footnote at end of table.

Table 35. --~~Terrestrial~~ cells in the Okanogan Highlands Province, northeastern Washington  
(Continued)

| Cell                                                                                            | SAF<br>timber<br>type No. | Present<br>representation                        | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------|--------------------------------------------------|
| <u>Western Redcedar-Western Hemlock Zone :</u>                                                  |                           |                                                  |                                                  |
| 13. Western hemlock/Oregon boxwood community                                                    | 227                       | Salmo RNA and token in Maitlen Creek RNA         | <b>202</b>                                       |
| *14. Western redcedar/Oregon boxwood community                                                  | 228                       | None                                             | <b>202</b><br>204                                |
| 15. Western redcedar/devilsclub community                                                       | 228                       | Salmo RNA                                        | 202                                              |
| 16. Typical western white pine forest                                                           | 215                       | Salmo RNA                                        | 202                                              |
| <u>Subalpine Fir Zone:</u>                                                                      |                           |                                                  |                                                  |
| *17. Subalpine fir/Oregon boxwood community                                                     | <b>206</b><br>1           | Token in Maitlen Creek RNA, need additional area | 207                                              |
| *18. Subalpine fir/beargrass community                                                          | <b>206</b>                | None                                             | <b>205</b>                                       |
| 19. Subalpine fir/rustyleaf ( <i>Menziesia ferruginea</i> ) community                           | 206                       | Salmo RNA and token in Maitlen Creek RNA         | 205                                              |
| *20. Subalpine fir/grouse huckleberry ( <i>Vaccinium scoparium</i> ) community                  | 206                       | None                                             | 205-207                                          |
| *21. Typical whitebark pine-subalpine fir forest                                                | 208                       | None                                             | 205-206                                          |
| <u>Special types :</u>                                                                          |                           |                                                  |                                                  |
| *22. Typical lodgepole pine forest                                                              | 218                       | Token in Baird Basin RNA, need additional area   | 192<br>197-198                                   |
| *23. Quaking aspen stands                                                                       | 217                       | None                                             | 184<br>193                                       |
| *24. Poplar-birch (including <i>Cornus cornuta</i> )                                            | <b>203</b>                | None                                             |                                                  |
| *25. Idaho fescue- <i>Eriogonum</i> openings in a forest area                                   |                           | None                                             |                                                  |
| *26. Typical south-slope bald (including <i>Festuca viridula</i> and <i>Xerophyllum tenax</i> ) |                           | None                                             | <b>207-208</b>                                   |
| *27. High-elevation mountain meadow and associated bogs                                         |                           | None                                             | 207-208                                          |

\*Cells presently lacking adequate representation.

Table 36.--*Aquatic cells in the Okanogan Highlands Province, northeastern Washington*

| Cell <sup>1</sup>                                    | Present representation |
|------------------------------------------------------|------------------------|
| * 1. Lake and drainage basin in mixed-conifer forest | None                   |
| * 2. Subalpine lake with spruce-fir drainage basin   | None                   |
| * 3. Low-elevation permanent ponds                   | None                   |
| * 4. Subalpine permanent ponds                       | None                   |
| * 5. Low-elevation vernal ponds                      | None                   |
| * 6. Subalpine vernal ponds                          | None                   |
| 7. Stream drainage with mixed-conifer forest         | Maitlen Creek RNA      |
| 8. Stream drainage with subalpine spruce-fir forest  | Salmo RNA              |
| * 9. Typical large cold spring                       | None                   |
| *10. Marsh area                                      | None                   |
| *11. Typical bog                                     | None                   |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 37.--*Rare and endangered vertebrate animal cells in the Okanogan Highlands Province, northeastern Washington*

| Cell                                                        | Verified representation | Reference                             |
|-------------------------------------------------------------|-------------------------|---------------------------------------|
| <b>Mammals :</b>                                            |                         |                                       |
| *1. Masked shrew (subspecies <i>cinereus</i> ) <sup>1</sup> | None                    | Dalquest 1948                         |
| *2. Pygmy shrew                                             | None                    | Dalquest 1948                         |
| *3. Northern bog lemming                                    | None                    | Dalquest 1948<br>Maser and Storm 1970 |

\*Cells presently lacking adequate representation.

Table 38.--*Vascular plants of special interest in the Okanogan Highlands Province, northeastern Washington*

| Species <sup>1</sup>                             | Distribution                                             |
|--------------------------------------------------|----------------------------------------------------------|
| <i>Carex backii</i>                              | Okanogan County                                          |
| <i>Cassiope tetragona</i>                        | High elevations, Okanogan County                         |
| <i>Castilleja cervina</i>                        |                                                          |
| <i>Chrysosplenium tetrandum</i>                  | Southern limit in Okanogan County                        |
| <i>Comandra livida</i>                           | Often near bogs                                          |
| <i>Cryptogramma stelleri</i>                     |                                                          |
| <i>Delphinium xantholeucum</i> <sup>2</sup>      | Grasslands and yellow pine, Okanogan County              |
| <i>Dryas drummondii</i>                          | Pend Oreille County                                      |
| <i>Erigeron laibergii</i> <sup>2</sup>           | Moderate to high elevations, Okanogan County             |
| <i>Geum rivale</i>                               | Southern limit in Okanogan County                        |
| <i>Lathyrus ochroleucus</i>                      | Northeastern Washington                                  |
| <i>Listera borealis</i>                          | Southern limit in Okanogan County                        |
| <i>Lobelia kalmii</i>                            | Peat bogs and shores in northeastern Washington          |
| <i>Lomatium orogenioides</i>                     | Meadows and moist bottomlands in northeastern Washington |
| <i>Lupinus lepidus</i> var. <i>cusickii</i>      | Disjunct in Okanogan County                              |
| <i>Lupinus sulphureus</i> var. <i>sulphureus</i> | Okanogan County                                          |
| <i>Parnassia kotzebuei pumila</i> <sup>2</sup>   | Near Gilbert, Okanogan County, possibly extinct          |
| <i>Penstemon lyallii</i>                         | Spokane County                                           |
| <i>Penstemon washingtonensis</i> <sup>2</sup>    | Moderate elevations, Okanogan County                     |
| <i>Petasites sagittatus</i>                      | Northeastern Washington                                  |
| <i>Physaria didymocarpa</i>                      | Stevens County and east                                  |
| <i>Talinum okanoganense</i>                      | Only in Okanogan County and adjacent Canada              |
| <i>Thalictrum dasycarpum</i>                     | Northeastern Washington                                  |
| <i>Viola renifolia</i>                           | Southern limit in Okanogan County                        |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or their identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 39.--*Established Research Natural Areas in the Okanogan Highlands Province, northeastern Washington*

| Name              | Principal features                                                                      | Agency <sup>1</sup> | Area |       |
|-------------------|-----------------------------------------------------------------------------------------|---------------------|------|-------|
|                   |                                                                                         |                     | Ha   | Acres |
| Baird Basin RNA   | Interior ponderosa pine, larch and Douglas-fir                                          | FWS                 | 65   | 160   |
| Maitlen Creek RNA | Douglas-fir/ ninebark forest with stream drainage                                       | FS                  | 259  | 640   |
| Salmo RNA         | interior subalpine fir and western hemlock-western redcedar forest with stream drainage | FS                  | 563  | 1,390 |

<sup>1</sup>FS = Forest Service, FWS = Fish and Wildlife Service.

Table 40. --*Additional Research Natural Areas needed in the Okanogan Highlands Province, Washington*

| Ecosystem or community                                                                                             | Cel Is represented <sup>1</sup>  | Remarks and possible locations                       | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                             |                                  |                                                      |                       |                          |                                            |                           |
| 1. Lake and drainage basin supporting mixed conifer (ponderosa pine, Douglas-fir, western larch/shrub) communities | T-4,5,9,<br>11,10<br>A-1,3,5,10  | Little Pend Oreille National Wildlife Refuge         | High                  | FWS<br>BLM               | 191-192<br>195-199                         | 1003<br>1004              |
| 2. High-elevation lake and drainage basin supporting subalpine fir/shrub communities                               | T-17,20,19<br>A-2,4,6<br>R&E-T,2 | Wilderness Area                                      | Medium                | FS                       | 205-207                                    | 1003<br>1004              |
| 3. High-elevation mountain meadow and bog                                                                          | T-27<br>A-11<br>R&E-3            | Bunchgrass Meadows (area "also contains rare plants) | High                  | FS                       | 207-208                                    | 1003<br>1004              |
| <u>Predominantly terrestrial natural areas :</u>                                                                   |                                  |                                                      |                       |                          |                                            |                           |
| 4. A variety of ponderosa pine/ grass communities in a forest-steppe ecotonal area                                 | T-1,2,3,<br>25,6                 |                                                      | Medium                | FS<br>FWS                | 173-175<br>220-222                         | 1001<br>1005              |
| 5. Ponderosa pine-Douglas-fir/ pinegrass communities                                                               | T-7,8,11                         | Sherman Creek                                        | Medium                | FS                       | 175-176<br>191-192                         | 1001<br>1005              |
| 6. High-elevation subalpine fir and whitebark pine-subalpine fir forest, including a south-slope bald              | T-18,21,26                       | Round Top Mountain                                   | High                  | FS                       | 205-208                                    | 1003<br>1004              |
| 7. Western redcedar/Oregon boxwood community                                                                       | T-14,13,15                       | Vicinity of Hooknose Mountain                        | Medium                | FS                       | 202<br>204                                 | 1003                      |

See footnotes at end of table.

Table 40.--*Additional Research Natural Areas needed in the Okanogan HighZands Province, Washington* (Continued)

| Ecosystem or community                              | Cells represented <sup>1</sup> | Remarks and possible locations                   | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-----------------------------------------------------|--------------------------------|--------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 8. Grand fir/Oregon boxwood community               | <u>T-12</u>                    |                                                  | Med um                | FS<br>FWS                | 195<br>198                                 | 1003<br>1004              |
| 9. Ponderosa pine/bitterbrush community             | <u>T-6</u> ,1,2                |                                                  | Med um                | FS<br>FWS                | 173-179                                    | 1001<br>1005              |
| 10. Lodgepole pine forest                           | <u>T-22</u>                    |                                                  | Med um                | FS                       | 192<br>197-198                             | 1003<br>1004              |
| 11. Quaking aspen stands                            | <u>T-23</u>                    | Little Pend Oreille National Wildlife Refuge     | Med um                | FWS<br>State<br>BLM      | 184<br>193                                 | 1001<br>1003              |
| 12. Poplar-birch (including <i>Cornus cornuta</i> ) | <u>T-24</u>                    | Along Pend Oreille River north of Metaline Falls | Med um                | FS<br>BLM                |                                            | 1001                      |
| <u>Predominantly aquatic natural areas:</u>         |                                |                                                  |                       |                          |                                            |                           |
| 13. Typical large, upwelling cold spring            | <u>A-9</u>                     |                                                  | High                  | FS<br>FWS<br>BLM         |                                            |                           |

<sup>1</sup>For a description of these cells see table 35 for terrestrial (T) ecosystems, table 36 for aquatic (A) ecosystems, and table 37 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FS = Forest Service, FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.



## OREGON COAST RANGES PROVINCE

The southern section of the Oregon Coast Ranges Province (fig. 1) is topographically mature, with extremely steep slopes and sharp ridges. However, with the exception of the areas drained by the Wilson and Trask Rivers, the proportion of steep slopes decreases in the northern section. Mountain passes are generally located on the eastern border of the range due to faster rates of headward erosion by the numerous westward-flowing streams. Elevations of main ridge summits in the province range from about 450 to 750 m. Scattered peaks, often capped with intrusive igneous rocks, rise well above surrounding ridges.

By far the dominant rock type in the southern section of the province is tuffaceous marine sandstone, which was laid down during the Eocene. Other rock types which are locally present include scattered igneous intrusions (Oligocene) and basalt headlands along the coast (Miocene). On forested steep slopes, soils derived from sandstone are generally shallow, stony loam textured, and brown to yellowish brown in color. On more gentle slopes and ridgetops, these sandstone parent materials give rise to deep, productive soils with well-developed profiles which are dominantly silt loam to silty clay loam in texture.

The northern section of the province is underlain by about equal amounts of basalt and sedimentary rocks (sandstone and siltstone). The sedimentaries are, for the most part, of Oligocene and Eocene age, while the major portion of the basalt is dated as Miocene. Here also, soil characteristics are closely related to topography as well as to parent material. On moderate upland slopes, soils derived from basalt tend to be deep, well-aggregated, and very productive for tree growth. These are reddish-brown in color and almost free of stones; surface textures are generally clay loam and the subsoil, a silty clay loam.

The province is a heavily forested region dominated by Douglas-fir, western hemlock, Sitka spruce, and other coniferous and hardwood tree species (Franklin and Dyrness 1973). There is, nonetheless, considerable diversity even in forest ecosystem types as a consequence of major climatic gradients, local environmental differences, and historical disturbances, especially by fire and logging. Ecosystems with Sitka spruce characterize the fog belt immediately adjacent to the coast, an array of Douglas-fir and western hemlock types occupy the bulk of the mountains, and drier forest communities become more common on the lower eastern slopes of the Coast Ranges. On a few higher peaks, subalpine forests of true firs occur. Extensive wildfires initiated numerous second-growth stands of conifers now 100 to 150 years old, and logging has converted much of the original forest to young stands of red alder and conifers.

Habitats along the edge of the Pacific Ocean contribute a great deal of the province's ecological diversity. Because of the varied and distinctive character, some reviewers suggested creating a separate province for these. Included are the dune ecosystems of both the central and northern coast and headland communities.

Aquatic ecosystems are mainly streams and rivers, swamps, and marshes with relatively few lakes and ponds. Anadromous fishes are important biologic features of many river and stream systems.

Terrestrial cells identified for the Oregon Coast Ranges total 23 (table 41). Fifteen of these are for coniferous forest ecosystems including geographic (north and south) representation of particularly important, widespread types. Younger examples of Douglas-fir forest as well as old growth need to be represented. The remaining cells are for dune, headland, riparian, and mountain meadow ecosystems, as well as red alder forest.

Identified aquatic cells total 13 (table 42). Five cells are for forested stream systems, two of which should contain anadromous fish. Three cells identify needs for a lake and ponds in coastal sand dune areas. A low-elevation inland lake, swamp, bog, and marshes complete the aquatic listing.

Animals and plants of special interest are listed in tables 43 and 44. There are four rare or endangered vertebrate animals identified as cells. Vascular plants of special interest fall mainly into two groups: species found on a few isolated peaks (notably Saddle and Sugarloaf Mountains and Onion Peak, all in Clatsop County) and species found in the coastal strip immediately adjacent to the ocean. Eleven of these vascular plants are on the Smithsonian list as threatened or endangered species.

There are presently two Federal Research Natural Areas and one Nature Conservancy reserve within the Oregon Coast Ranges (table 45). These tracts fill 5 of the 40 cells listed for this province; all of the filled cells are terrestrial.

It appears that 15 additional Research Natural Areas will be necessary to provide for minimal representation of the 35 unfilled terrestrial, aquatic, and vertebrate animal cells in the province (table 46). Six of the areas needed combine major terrestrial and aquatic cells, and three of these—two stream drainages with anadromous fish and a coastal dune mosaic—are of particular significance.

Conflicts with other resource values are frequently high in this province, much of it has been altered by human developments, and private lands dominate. Consequently, the task of completing the Research Natural Area system is large. Forest Service, Oregon State agencies, and Bureau of Land Management appear to have major responsibilities, but help from the private sector will probably be needed in the acquisition of several tracts. Priorities are generally high since many of these ecosystems are being rapidly committed to logging or incompatible recreational uses.

Table 41.--*Terrestrial cells in the Oregon Coast Ranges Province*

| Cell                                                                                                                 | SAF<br>timber<br>type No. | Present<br>representation                                                     | Page reference<br>(Franklin and<br>Dyrness 1973) |
|----------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Sitka Spruce Zone:</u>                                                                                            |                           |                                                                               |                                                  |
| *1. Sitka spruce/salal community on ocean front                                                                      | 223                       | None                                                                          | 59-60, 291                                       |
| *2. Lodgepole pine/salal community on ocean front                                                                    |                           | None                                                                          | 59-60, 291                                       |
| 3. Sitka spruce-western hemlock/swordfern community                                                                  | 223                       | Neskowin Crest RNA<br>(recommend<br>enlarging to pro-<br>vide more diversity) | 59-61                                            |
| <u>Western Hemlock Zone:</u>                                                                                         |                           |                                                                               |                                                  |
| * 4. Western hemlock/swordfern in central to northern portion                                                        | 224                       | None                                                                          | 79-80                                            |
| 5. Western hemlock/swordfern in southern portion                                                                     | 224                       | Cherry Creek RNA                                                              | 79-80                                            |
| * 6. Old-growth Douglas-fir-western hemlock/swordfern in central to northern portion                                 | 230                       | None                                                                          | 79-80                                            |
| 7. Old-growth Douglas-fir-western hemlock/swordfern in southern portion                                              | 230                       | Cherry Creek RNA                                                              | 79-80                                            |
| * 8. Old-growth Douglas-fir-western hemlock/rhododendron/Oregongrape in central to northern portion                  | 230                       | None                                                                          | 79-80                                            |
| 9. Old-growth Douglas-fir-western hemlock/rhododendron/Oregongrape in southern portion                               | 230                       | Cherry Creek RNA                                                              | 79-80                                            |
| *10. Douglas-fir/oceanspray/salal community                                                                          | 229                       | None                                                                          | 73-75, 79                                        |
| *11. Douglas-fir, 25-50 years old (old. burn)                                                                        | 229                       | None                                                                          | 85-87                                            |
| *12. Douglas-fir/salal community, 100-150 years old                                                                  | 229                       | None                                                                          | 79-80                                            |
| *13. Douglas-fir/swordfern community, 100-150 years old                                                              | 229                       | None                                                                          | 79-80                                            |
| *14. Upland red alder stand with two perennial streams                                                               | 221                       | None                                                                          | 61-63<br>85-87                                   |
| <u>Pacific Silver Fir Zone:</u>                                                                                      |                           |                                                                               |                                                  |
| *15. Old-growth noble fir forest                                                                                     |                           | None                                                                          | 98                                               |
| *16. Old-growth Pacific silver fir-western hemlock forest                                                            |                           | None                                                                          | 98                                               |
| <u>Special types:</u>                                                                                                |                           |                                                                               |                                                  |
| *17. Coastal dune mosaic with a variety of dune types, tree islands, deflation pla ns, and early successional stages |                           | None                                                                          | 291-295                                          |
| *18. Parabola dune complex and surround ngs                                                                          |                           | None                                                                          | 291-294                                          |
| 19. Coastal headland herbaceous commun ties                                                                          |                           | Cascade Head Nature<br>Conservancy Area                                       | 291-292<br>297                                   |
| *20. Grass bald on Coast Range mountain                                                                              |                           | None                                                                          | 90-91                                            |
| *21. "Rock garden" community on Coast Range mountain                                                                 |                           | None                                                                          | 90-91                                            |
| *22. Riparian hardwoods                                                                                              |                           | None                                                                          | 61-63                                            |
| *23. Coastal headlands shrub community                                                                               |                           | None                                                                          |                                                  |

\*Cells presently lacking adequate representation.

Table 42.--*Aquatic cells in the Oregon Coast Ranges Province*

| Cell <sup>1</sup>                                                                                       | Present representation                                                   | Remarks                                   |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------|
| * 1. Major stream drainage in Sitka spruce-western hemlock with anadromous fish                         | None                                                                     | Stream should drain directly to the ocean |
| * 2. Major stream drainage in Douglas-fir, with anadromous fish                                         | Would be filled by establishment of proposed Flynn Creek RNA             | Should be inland from the coast           |
| * 3. Two side-by-side perennial streams draining alder-dominated forest                                 | None                                                                     |                                           |
| * 4. Low-gradient coastal stream with a sandy bottom, with good riparian mammal habitat                 | None                                                                     | Should be south of Florence               |
| * 5. Typical headwaters section of a high-elevation stream, with noble fir or Pacific silver fir forest | None                                                                     |                                           |
| * 6. Freshwater lake in sand dunes                                                                      | None                                                                     |                                           |
| * 7. Low-elevation eutrophic lake                                                                       | None                                                                     |                                           |
| * 8. Permanent ponds in sand dunes                                                                      | None                                                                     |                                           |
| * 9. Vernal ponds in sand dunes                                                                         | None                                                                     |                                           |
| *10. Typical Sitka spruce swamp                                                                         | None                                                                     |                                           |
| *11. Typical skunk cabbage marsh                                                                        | None                                                                     |                                           |
| *12. Willow-sedge marsh area                                                                            | None                                                                     |                                           |
| *13. Coastal bog                                                                                        | Need would be filled with establishment of proposed Hunter Creek Bog RNA |                                           |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 43.--Rare and endangered vertebrate animal cells in the Oregon Coast Ranges

| Cell                                               | Verified<br>representation                                 | Reference                                                                                                               |
|----------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Birds :</b>                                     |                                                            |                                                                                                                         |
| *1. Northern spotted owl                           | Cherry Creek RNA,<br>need an<br>additional area            | Gabr elson and Jewett 1940                                                                                              |
| <b>Mammals :</b>                                   |                                                            |                                                                                                                         |
| *2. Botta pocket gopher<br>(2 subspecies involved) | None                                                       | Bailey 1936<br>Olterrnan and Verts 1972                                                                                 |
| 3. White-footed vole                               | Neskowin Crest RNA                                         | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olterman and Verts 1972  |
| *4. Red tree vole<br>(2 subspecies involved)       | Coquille River<br>Falls RNA,<br>need an<br>additional area | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olterrnan and Verts 1972 |

\*Cells presently lacking adequate representation.

Table 44.--*Vascular plants of special interest in the Oregon Coast Ranges Province*

| species'                                                             | Distribution                                                                                          |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <i>Anemone oregana</i> var. <i>felix</i> <sup>2</sup>                | Sphagnum bogs along immediate coast, Lincoln County                                                   |
| <i>Arenaria paludicola</i> <sup>2</sup>                              | Swamps along coast                                                                                    |
| <i>Cardamine pattersonii</i> <sup>2</sup>                            | Open slopes, Saddle and Sugarloaf Mountains and Onion Peak, Clatsop County                            |
| <i>Cladothamnus pyrolaeiflorus</i>                                   | Saddle Mountain and Onion Peak, Clatsop County; Blue Lake Lookout, Tillamook County                   |
| <i>Cordylanthus maritimus</i> <sup>2</sup>                           | Salt Marsh, Coos Bay                                                                                  |
| <i>Douglasia laevigata</i> var. <i>ciliolata</i> <sup>2</sup>        | Saddle Mountain, Clatsop County                                                                       |
| <i>Empetrum nigrum</i>                                               | Open bluffs along coast, Lincoln and Curry Counties                                                   |
| <i>Erigeron peregrinus</i> var. <i>peregrinus</i>                    | Saddle Mountain and Onion Peak, Clatsop County                                                        |
| <i>Erythronium revolutum</i> <sup>2</sup>                            | Saddle Mountain, Clatsop County and along north coast                                                 |
| <i>Filipendula occidentalis</i> <sup>2</sup>                         | Along rivers (Trask, Wilson, and Tillamook), Clatsop to Lincoln Counties                              |
| <i>Geum triflorum</i> var. <i>campanulatum</i>                       | Saddle Mountain and Onion Peak, Clatsop County                                                        |
| <i>Lasthenia minor</i> ssp. <i>maritima</i> <sup>2</sup>             | Rocky headlands, Lincoln County                                                                       |
| <i>Ledum groenlandicum</i>                                           | Bogs along coast, Clatsop and Tillamook Counties                                                      |
| <i>Lewisia columbiana</i> var. <i>rupicola</i> <sup>2</sup>          | Saddle Mountain and Onion Peak, Clatsop County                                                        |
| <i>Plantago macrocarpa</i>                                           | Cold, wet habitats near coast, Lincoln County                                                         |
| <i>Ranunculus lobbii</i>                                             | Vernal pools along coast                                                                              |
| <i>Rhinanthus crista-galli</i>                                       | Saddle Mountain, Clatsop County, and Tillamook prairie                                                |
| <i>Romanzoffia tracyi</i>                                            | Wet sea cliffs, Tillamook and Lincoln Counties                                                        |
| <i>Salix hookeriana</i>                                              | Clatsop County                                                                                        |
| <i>Saxifraga bronchialis</i> var. <i>vespertina</i>                  | Saddle and Sugarloaf Mountains and Onion Peak, Clatsop County                                         |
| <i>Saxifraga caespitosa</i> var. <i>emarginata</i>                   | Onion Peak, Clatsop County                                                                            |
| <i>Saxifraga occidentalis</i> var. <i>latipetiolata</i> <sup>2</sup> | Saddle and Sugarloaf Mountains and Onion Peak, Clatsop County                                         |
| <i>Scoliopus hallii</i>                                              | Damp woods along streams, Tillamook County south                                                      |
| <i>Senecio flettii</i>                                               | Onion Peak, Clatsop County                                                                            |
| <i>Sidalcea hendersonii</i>                                          | Sandy tidelands, mouth of Columbia River                                                              |
| <i>Sidalcea hirtipes</i>                                             | Coastal mountains to bluffs along the ocean, Saddle Mountain, Clatsop County, to north Lincoln County |
| <i>Silene douglasii</i> var. <i>oraria</i> <sup>2</sup>              | Bluff above sea, Tillamook Head                                                                       |
| <i>Sisyrinchium californicum</i>                                     | Wet ground along immediate coast, Lincoln and Lane Counties                                           |
| <i>Stellaria humifusa</i>                                            | Beaches and salt marshes, Lincoln County north                                                        |
| <i>Synthyris schizantha</i> <sup>2</sup>                             | Saddle Mountain and Onion Peak, Clatsop County                                                        |
| <i>Vaccinium oxycoccos</i> var. <i>intermedium</i>                   | Sphagnum bogs, Lincoln County north                                                                   |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or their identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>The species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 45.--*Established Research Natural Areas in the Oregon Coast Ranges Province*

| Name                  | Principal features                                                                | Agency <sup>1</sup> | Area |       |
|-----------------------|-----------------------------------------------------------------------------------|---------------------|------|-------|
|                       |                                                                                   |                     | Ha   | Acres |
| Cascade Head Preserve | Oregon coastal headland with extensive grassland and conifer and red alder forest | TNC                 | 121  | 300   |
| Cherry Creek RNA      | Coast Ranges Douglas-fir forest                                                   | BLM                 | 239  | 590   |
| Neskowin Crest RNA    | Sitka spruce-western hemlock forests                                              | FS                  | 278  | 686   |

<sup>1</sup>BLM = Bureau of Land Management, FS = Forest Service, TNC = The Nature Conservancy.

Table 46.--*Additional Research* Natural Areas *needed in the Oregon Coast Ranges Province*

| Ecosystem or community                                                                                                        | Cells represented <sup>1</sup>                     | Remarks and possible locations                                   | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                                        |                                                    |                                                                  |                       |                          |                                           |                           |
| 1. Stream drainage with <b>anadromous</b> fish and a small estuary in the Sitka spruce-Douglas-fir forest <b>type</b>         | T- <u>3,22</u> ,1,2<br>A- <u>1</u><br>R&E-1,3,4    | Reneke Creek, Cummins Creek area, Neptune State Park area        | High                  | FS State                 | 58-63                                     | 0204                      |
| 2. Major stream drainage with anadromous fish in the Douglas-fir-western hemlock type                                         | T- <u>13</u> ,12,14,24<br>A- <u>2</u><br>R&E-1,3,4 | Flynn Creek                                                      | High                  | FS                       | 79-80                                     | 0204                      |
| 3. Red alder area drained by two perennial streams (for purposes of studying nutrient cycling)                                | T- <u>14</u><br>A- <u>3</u><br>R&E-3               | Could be in either Sitka spruce or western hemlock zones         | LOW                   | BLM FS                   | 61-63<br>85-87                            | 0204<br>0205<br>0206      |
| 4. Coastal dune mosaic. (including tree islands, deflation plains, and most major dune types), with freshwater lake and ponds | T- <u>17</u><br>A- <u>6,8,9</u>                    | Umpqua Dunes Scenic Area (Oregon Dunes National Recreation Area) | High                  | FS                       | 291-295                                   | 0207                      |
| 5. Ocean-front Sitka <b>spruce/salal</b> and lodgepole <b>pine/salal</b> with swampy swales                                   | T- <u>1,2</u><br>A- <u>10</u>                      | Could be partially filled in Cape Lookout State Park             | Medium                | State                    | 59-60<br>291                              | 0207                      |
| 6. <b>Old-growth</b> Pacific silver fir-western hemlock forest with headwaters portion of a stream                            | T- <u>16</u><br>A- <u>5</u><br>R&E-1,3             | Northern Coast Range area                                        | Medium                | State Private            | 98                                        | 0206                      |
| <u>Predominantly terrestrial natural areas:</u>                                                                               |                                                    |                                                                  |                       |                          |                                           |                           |
| 7. <b>Old-growth</b> Douglas-fir-western hemlock/swordfern and western hemlock/swordfern                                      | T- <u>4,6</u><br>R&E- <u>4</u>                     | Should be in central to northern portion of Coast Ranges         | High                  | BLM State                | 79-80                                     | 0204<br>0206              |
| 8. <b>Old-growth</b> Douglas-fir-western hemlock/rhododendron/Oregon grape                                                    | T-8,10<br>R&E-4                                    | In central to northern portion                                   | High                  | BLM State                | 79-80                                     | 0204<br>0206              |

See footnotes at end of table.

Table 46.--Additional Research Natural Areas needed in the Oregon Coast Ranges Province (Continued)

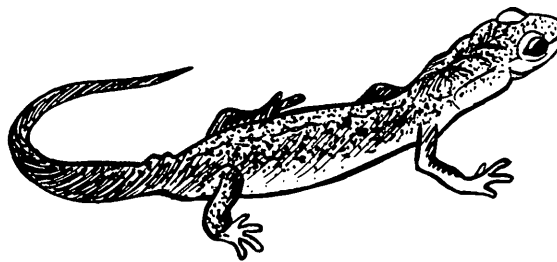
| Ecosystem or community                                                       | Cells represented <sup>1</sup>      | Remarks and possible locations                                  | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub- 4 province |
|------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|-----------------|
| 9. Douglas-fir, 25-50 years old on old burn, and adjacent stand of noble fir | <u>T-11,14</u>                      | Should be natural regeneration; Tillamook Burn is possible area | LOW                   | State                    | 85-87                                      | 0206            |
| 10. Parabola dune complex                                                    | <u>T-18</u>                         | Sand Lake area                                                  | High                  | FS                       | 291-294                                    | 0207            |
| 11. Grass bald and "rock garden" vegetation on a Coast Range peak            | <u>T-20,21</u>                      | Onion Peak                                                      | Medium                | State BLM                | 90-91                                      | 0206            |
| <u>Predominantly aquatic natural areas:</u>                                  |                                     |                                                                 |                       |                          |                                            |                 |
| 12. Small lake and surrounding temperate forest                              | <u>A-7</u>                          | Eutrophic lake at low elevation                                 | High                  | BLM Private              |                                            | 0205            |
| 13. Coastal bog                                                              | <u>A-13</u><br><u>R&amp;E-11,12</u> | Clatsop County                                                  | High                  | State Private            | 68-69                                      | 0202<br>0207    |
| 14. Low gradient coastal stream (sandy bottom) with skunk cabbage marsh      | <u>A-4,11</u><br><u>R&amp;E-3</u>   | Johnson Creek near Bandon or Tenmile Creek, Coos County         | Medium                | FS                       | 68-69                                      | 0207            |
| 15. Willow-sedge marsh                                                       | <u>A-12</u>                         | Three-Mile Creek                                                | High                  | FS                       | 68-69                                      | 0207            |

<sup>1</sup>For a description of these cells see table 41 for terrestrial (T) ecosystems, table 42 for aquatic (A) ecosystems, and table 43 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FS = Forest Service..

<sup>4</sup>See appendix V.



## WESTERN OREGON INTERIOR VALLEYS PROVINCE

The Western Oregon Interior Valleys Province includes the valley bottoms and lowlands enclosed by the Cascade Range on the east and the Coast Ranges or Siskiyou Mountains on the west (fig. 1). The major units within the province are the Umpqua, Rogue, and Willamette River valleys. Of the three, the Willamette Valley is by far the largest; therefore it will receive major emphasis. Because of their location in the rain shadow of the Coast Ranges or the Siskiyou Mountains, the valleys are relatively warm, dry regions, especially in comparison with the remainder of western Oregon.

The topography of the Willamette Valley is characterized by broad alluvial flats separated by groups of low, generally basaltic hills. One of its most unusual features is its substantial width, which generally varies from about **30** to 50 km. The valley floor has a very gentle, north-facing slope and is, for the most part, underlain by thick, nonmarine sedimentary deposits of Pliocene-Pleistocene age. During at least two episodes of the Pleistocene, the entire valley was drowned by water and partially filled by silt to a depth of about **30** m. Recent alluvial deposits are limited in extent and confined to areas immediately adjacent to the Willamette River.

Soils on the Willamette Valley floor, derived from silty alluvial and lacustrine deposits, were formed under dominantly grassland vegetation. Well-drained soils situated on the Willamette River flood plain are deep, moderately dark colored, and range from sandy loam to silty clay loam in texture. Soils on terraces show more profile development, typically having silt loam surface horizons underlain by silty clay loam. Except for poorly drained soils in depressions, these are highly productive soils which are intensively used for agriculture.

The dominant valley bottom landforms in the Umpqua and Rogue River valleys are alluvial fans, terraces, and flood plains. In well-drained terrace locations, deep, dark-colored Prairie soils are common which are generally loam textured. However, black, clay-textured soils which undergo considerable expansion and contraction with wetting and drying are also common in the vicinity of Roseburg and Medford. Valley foothill soils are generally shallow and stony and, thus, extremely droughty during the dry summer period.

The natural ecosystems of the interior valleys are poorly known since these valleys were the first areas settled, with lands converted to agricultural and other uses. Nevertheless, many examples of natural or near-natural communities remain which indicate the valleys were mosaics of coniferous forests (especially on marginal hills), oak savannas and woodland, riparian or gallery forest, extensive and varied grasslands, and, in the southern valleys, chaparral-like shrub fields. Substantial variability in the characteristics of each of these ecosystem groupings is associated with a latitudinal change in climate; the progression is from the Willamette Valley, which is the coolest and wettest, south to the Rogue River valley, which is the warmest and driest. Additional variation in communities has been introduced by various disturbances such as fire, grazing, and logging. Aquatic ecosystems are varied and tend to be eutrophic in character even in their unpolluted state. Sloughs and slow-moving streams are associated with the major valley rivers, and marshes and ponds are common, particularly in the Willamette Valley.

Of terrestrial cells, 26 have been identified for the interior valleys of western Oregon (table 4'7). The basic strategy is to provide for representation of coniferous forest, oak woodlands, grasslands, and riparian hardwoods in each of the three major valley systems (Willamette, Umpqua, and Rogue Rivers). This should insure necessary diversity in these types for the natural area system.

Nine aquatic cells are listed for the interior valleys (table 48). Six of these are for valley-bottom ecosystems (ponds, oxbow lake, marshes, and slough segment) and the majority will probably be located within the Willamette Valley. Small valley-margin stream systems and a spring are also identified as necessary elements in a Research Natural Area system.

The areas selected to fill terrestrial and aquatic cells are expected to include the typical array of plant and animal species. Six vertebrate animals have been identified as rare and endangered cells requiring specific attention in selection and establishment of Research Natural Areas (table 49). Vascular plants of special interest include 19 from the Smithsonian list of threatened and endangered plants—a high proportion of the total list (table 50).

There are nine Federal Research Natural Areas and two reserves developed by The Nature Conservancy in the interior valleys of western Oregon (table 51). Since most of the areas are small they fill only 9 cells of a total of 41 identified cells in the province; 8 of the filled cells are terrestrial and 1 is aquatic.

Twenty-two additional Research Natural Areas should provide minimal representation of all identified terrestrial, aquatic, and rare and endangered cells (table 52). Because of the diverse nature of the cells and the relatively small size of potential sites for Research Natural Areas, most of these needed reserves have only one or two cells as essential elements.

Lead responsibilities in this heavily developed province rest primarily with State institutions, Bureau of Land Management, and private organizations (table 52). It is difficult to establish priorities in this province since the pace of urban and other developments is so rapid. As a generality, aquatic ecosystems and types suitable for agricultural development or logging need quickest attention.

Table 47.--*Terrestrial cells in Western Oregon Interior Valleys Province*

| Cell                                                                        | SAF<br>timber<br>type No. | Present<br>representation                                                   | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-----------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------|--------------------------------------------------|
| <u>Conifer forests:</u>                                                     |                           |                                                                             |                                                  |
| 1. Dry-site Douglas-fir forest on Willamette Valley foothills               | 229                       | Camas Swale and Fox Hollow RNA's                                            | 116-118                                          |
| 2. Douglas-fir-western hemlock forest on Willamette Valley foothills        | 230                       | Mohawk and Little Sink RNA's                                                | 116-118                                          |
| 3. Ponderosa pine-Douglas-fir forest in Willamette Valley margin location   |                           | Fox Hollow RNA                                                              | 116-118                                          |
| * 4. Western redcedar and associated conifers, northern Willamette Valley   | 227                       | None                                                                        | 116-118                                          |
| * 5. Coniferous forest mixture, Umpqua Valley                               | Probably 229              | None                                                                        | 118-119                                          |
| * 6. Mixed coniferous forest (Douglas-fir, probably dominant), Rogue Valley | 243 or 244 or 229         | None                                                                        | 118-119                                          |
| * 7. Grand fir forest in the Willamette Valley                              |                           | None                                                                        | 116-118                                          |
| <u>Oak woodland :</u>                                                       |                           |                                                                             |                                                  |
| * 8. Oregon white oak-grass savanna in the Willamette Valley                | 233                       | Token in Maple Knoll RNA and Cogswell-Foster Preserve, need additional area | 111-114                                          |
| * 9. Oregon white oak/snowberry forest in the Willamette Valley             | 233                       | None                                                                        | 111-114                                          |
| 10. Oregon white oak/poison oak forest in the Willamette Valley             | 233                       | Pigeon Butte and Maple Knoll RNA's                                          | 113                                              |
| *11. Oak woodland in the Umpqua Valley                                      | 233                       | None                                                                        | 114-115                                          |
| *12. Oregon white oak woodland in the Rogue Valley                          | 233                       | None                                                                        | 114-115                                          |
| *13. Oak-madrone wood and in the Rogue Valley                               | 234                       | None                                                                        |                                                  |
| *14. California black oak woodland in the Rogue Valley                      | 246                       | None.                                                                       | 114-115                                          |
| See footnote at end of table.                                               |                           |                                                                             |                                                  |

Table 47.--*Terrestrial cells in Western Oregon Interior Valleys Province* (Continued)

| Cell                                                                                       | SAF<br>timber<br>type No. | Present<br>representation                                      | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------|--------------------------------------------------|
| <u>Grasslands :</u>                                                                        |                           |                                                                |                                                  |
| *15. Steep slope, xeric, valley margin prairie with rock outcrops in the Willamette Valley |                           | None                                                           | 119-123                                          |
| *16. Gentle slope or valley bottom mesic prairie in the Willamette Valley                  |                           | None                                                           | 119-123                                          |
| 17. Wet, poorly drained valley bottom prairie in the Willamette Valley                     |                           | Willamette Floodplain<br>RNA                                   | 119-123                                          |
| *18. Typ cal grassland in the Umpqua Valley                                                |                           | None                                                           | 119-123                                          |
| *19. Typ cal grassland in the Rogue Valley                                                 |                           | None                                                           | 119-123                                          |
| <u>Riparian and other hardwood communities:</u>                                            |                           |                                                                |                                                  |
| 20. Riparian black cottonwood/willow along the Columbia River                              |                           | Tenasillahe Island RNA                                         | 124-126                                          |
| *21. Riparian black cottonwood/willow along the Willamette River                           |                           | None                                                           | 124-126                                          |
| *22. Oregon ash in the Willamette Valley                                                   |                           | Token in Willamette<br>Floodplain RNA, need<br>additional area | 124-126                                          |
| 23. Riparian woodland in the Umpqua Valley                                                 |                           | Myrtle Island RNA                                              | 124-127                                          |
| *24. Riparian woodland in the Rogue Valley                                                 |                           | None                                                           | 124-127                                          |
| 25. Bigleaf maple forest                                                                   |                           | Maple Knoll and Little<br>Sink RNA's                           |                                                  |
| <u>Shrub communities:</u>                                                                  |                           |                                                                |                                                  |
| *26. Chaparral ( <i>Ceanothus-Arctostaphylos</i> ) in the Rogue Valley                     |                           | None                                                           | 124                                              |

\*Cells presently lacking adequate representation.

Table 48.--*Aquatic cells in Western Oregon Interior Valleys Province*

| Cell <sup>1</sup>                                                      | Present representation    | Remarks                                                |
|------------------------------------------------------------------------|---------------------------|--------------------------------------------------------|
| *1. Oxbow lake in the Willamette Valley                                | None                      |                                                        |
| *2. Eutrophic permanent pond                                           | Little Sink RNA           | Only token representation in RNA, need additional area |
| "3. Typical vernal pond                                                | None                      |                                                        |
| *4. Small stream drainage along the east side of the Willamette Valley | None                      |                                                        |
| "5. Small stream drainage along the west side of the Willamette Valley | None                      |                                                        |
| 6. Typical slough along large stream in the Willamette Valley          | Willamette Floodplain RNA |                                                        |
| "7. Mineral spring in valley fringe area                               | None                      |                                                        |
| *8. Valley bottom marsh in the Willamette Valley                       | None                      |                                                        |
| "9. Valley bottom marsh in the Umpqua or Rogue River Valley            | None                      |                                                        |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 49.--*Rare and endangered vertebrate animal cells in the Western Oregon Interior Valleys Province*

| Cell                                 | Verified<br>representation | Reference                                                                                                              |
|--------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| <u>Amphibians :</u>                  |                            |                                                                                                                        |
| *1. Marys Peak salamander            | None                       |                                                                                                                        |
| <u>Reptiles:</u>                     |                            |                                                                                                                        |
| *2. Sharp-tailed snake               | None                       | Stebbins 1954<br>Storm 1966                                                                                            |
| *3. California mountain<br>kingsnake | None                       | Stebbins 1954                                                                                                          |
| *4. Common kingsnake                 | None                       | Stebbins 1954                                                                                                          |
| *5. Western rattlesnake              | None                       | Stebbins 1954<br>Storm 1966                                                                                            |
| <u>Mammals :</u>                     |                            |                                                                                                                        |
| *6. White-footed vole                | None                       | Bailey 1936<br>Maser and Storm 1970<br>Olterman and Verts 1972<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967 |

\*Cells presently lacking adequate representation.

Table 50.--Vascular plants of special interest in the Western Oregon Interior Valleys Province

| Species <sup>1</sup>                                            | Distribution                                                                                                           |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <i>Allium unifolium</i>                                         | Near Willamina, Yamhill County                                                                                         |
| <i>Androsace acuta</i>                                          | Rogue River Valley                                                                                                     |
| <i>Aster chilensis</i> ssp. <i>hallii</i> <sup>2</sup>          | Grasslands, Willamette Valley                                                                                          |
| <i>Aster curtus</i>                                             | Grasslands, northern Willamette Valley                                                                                 |
| <i>Aster vialis</i> <sup>2</sup>                                | Oak woodlands, Lane and Douglas Counties                                                                               |
| <i>Brodiaea venusta</i>                                         | Garden Valley, Douglas County                                                                                          |
| <i>Camassia leichtlinii</i> var. <i>leichtlinii</i>             | Moist fields and along highway near Roseburg, Douglas County                                                           |
| <i>Cardamine penduliflora</i> <sup>2</sup>                      | Lowland ponds and marshes, Willamette Valley east of Coast Ranges                                                      |
| <i>Castilleja levisecta</i>                                     | Swamps, northern Willamette Valley                                                                                     |
| <i>Delphinium leucophaeum</i> <sup>2</sup>                      | Fields, northern Willamette Valley; now largely restricted to ditches and fence rows                                   |
| <i>Delphinium nuttallii</i>                                     | Gravelly outwash "prairies" and basaltic cliffs, Clackamas County                                                      |
| <i>Delphinium pavonaceum</i> <sup>2</sup>                       | Fields in Benton, Polk, and Clackamas Counties; mainly along fence rows                                                |
| <i>Erigeron decumbens</i> <sup>2</sup>                          | Grassland, Willamette Valley                                                                                           |
| <i>Eryngium petiolatum</i> <sup>2</sup>                         | Open ground, especially in spring-wet and summer-dry habitats, Willamette Valley and along Columbia River to the Gorge |
| <i>Euonymus occidentalis</i>                                    | Near Portland, Clackamas County (Tryon Creek State Park)                                                               |
| <i>Howellia aquatilis</i>                                       | In ponds on Sauvie Island, Columbia County, and near Salem, Marion County                                              |
| <i>Iris tenax</i> var. <i>gormanii</i>                          | Along Scoggins Creek, Washington County, and Dairy Creek, Columbia County                                              |
| <i>Lathyrus holochlorus</i> <sup>2</sup>                        | Fence rows and partially cleared land, Willamette Valley                                                               |
| <i>Limnanthes floccosa</i> ssp. <i>grandiflora</i> <sup>2</sup> | Near White City, Jackson County                                                                                        |
| <i>Limnanthes floccosa</i> ssp. <i>pumila</i> <sup>2</sup>      | Vernal rocky flats, Table Rock, Jackson County                                                                         |
| <i>Limnanthes gracilis</i> <sup>2</sup>                         | Seepage slopes, Rogue River Valley                                                                                     |
| <i>Lomatium bradshawii</i> <sup>2</sup>                         | Willamette Valley from Salem to Eugene; present in Willamette Floodplain RNA                                           |
| <i>Lotus pinnatus</i>                                           | Streambanks and meadows in valleys west of Cascade Mountains                                                           |
| <i>Microcala quadrangularis</i>                                 | Moist prairies, Willamette and Umpqua Valleys                                                                          |
| <i>Microseris acuminata</i>                                     | Grassy flats, Sam's Valley, Jackson County                                                                             |
| <i>Microseris laciniata</i> ssp. <i>leptosepala</i>             | Grasslands, northern Willamette Valley                                                                                 |

See footnotes at end of table.

Table 50.--*Vascular plants of special interest in the Western Oregon Interior Valleys Province (Continued)*

| Species <sup>1</sup>                                                  | Distribution                                                                                          |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <i>Mimulus tricolor</i>                                               | Vernal pools, central Willamette Valley                                                               |
| <i>Pellaea andromedaefolia</i>                                        | Dry stony areas, Douglas County                                                                       |
| <i>Perideridia erythrorhiza</i> <sup>2</sup>                          | Grasslands, Umpqua Valley to Grants Pass                                                              |
| <i>Phacelia verna</i> <sup>2</sup>                                    | Basalt cliffs, Umpqua Valley                                                                          |
| <i>Plagiobothrys hirtus</i> <sup>2</sup>                              | Boggy ground near Drain, Umpqua Valley                                                                |
| <i>Plagiobothrys hirtus</i> var.<br><i>corallicarpus</i> <sup>2</sup> | Grasslands, Rogue River Valley near Grants Pass                                                       |
| <i>Plagiobothrys lamprocarpus</i> <sup>2</sup>                        | Grants Pass, Josephine County                                                                         |
| <i>Poa laxiflora</i>                                                  | Multnomah, Clackamas, and Benton Counties                                                             |
| <i>Pogogyne ziziphoroides</i>                                         | Agate desert, Jackson County                                                                          |
| <i>Ranunculus austro-oreganus</i>                                     | Dry ground near Medford, Jackson County                                                               |
| <i>Sagittaria latifolia</i>                                           | In shallow water along streams and in swamps, northern Willamette Valley                              |
| <i>Sedum stenopetalum</i> ssp. <i>ciliolum</i>                        | Dry cliffs, Umpqua Valley near Roseburg, Douglas County                                               |
| <i>Sidalcea campestris</i> <sup>2</sup>                               | In pastures and along roadsides, Willamette Valley; present in Willamette Floodplain RNA              |
| <i>Sidalcea cusickii</i> <sup>2</sup>                                 | Open fields and roadsides, Coquille and Umpqua River Valleys                                          |
| <i>Sidalcea nelsoniana</i> <sup>2</sup>                               | Moist open ground, Willamette Valley between Portland and Salem; present in Willamette Floodplain RNA |
| <i>Silene hookeri</i> ssp. <i>pulverulenta</i>                        | Grasslands, Josephine and Jackson Counties                                                            |
| <i>Trillium chloropetalum</i>                                         | Streambanks to damp woods, Willamette Valley                                                          |
| <i>Viola douglasii</i>                                                | Open grasslands, Jackson County                                                                       |
| <i>Viola hallii</i>                                                   | Grasslands, Douglas and Josephine Counties                                                            |
| <i>Viola howellii</i>                                                 | Moist woods and farmlands, Willamette Valley                                                          |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 51.--Established *Research Natural Areas in Western Oregon Interior Valleys*  
Province

| Name                      | Principal features                                                                                | Agency <sup>1</sup> | Area      |            |
|---------------------------|---------------------------------------------------------------------------------------------------|---------------------|-----------|------------|
|                           |                                                                                                   |                     | Ha        | Acres      |
| Camassia Natural Area     | Oak, madrone, camas, and aspen associated with openings, floristically rich                       | LCC<br>TNC          | 9         | 23         |
| Camas Swale RNA           | Dry Douglas-fir forest in foothills of Willamette Valley                                          | BLM                 | 130       | <b>320</b> |
| Cogswell-Foster Preserve  | Oregon white oak and Oregon ash woodlands and seminatural grasslands in central Willamette Valley | TNC                 | 34        | <b>83</b>  |
| Fox Hollow RNA            | Dry Douglas-fir and ponderosa pine forest in foothills of the Willamette Valley                   | BLM                 | 51        | 125        |
| Little Sink RNA           | Slump ponds and conifer-bigleaf maple forest on margin of the Willamette Valley                   | BLM                 | 32        | <b>80</b>  |
| Maple Knoll RNA           | Bigleaf maple stands on knoll in Willamette Valley                                                | FWS                 | 40        | <b>100</b> |
| Mohawk RNA                | Douglas-fir, western hemlock, and western redcedar forest in foothills of the Willamette Valley   | BLM                 | 61        | <b>150</b> |
| Myrtle Island RNA         | California laurel stands on an island in the Umpqua River                                         | BLM                 | 11        | 28         |
| Pigeon Butte RNA          | Oregon white oak stands on a knoll in the Willamette Valley                                       | FWS                 | 28        | <b>70</b>  |
| Tenasillahe Island RNA    | Black cottonwood-willow stand on island in lower Columbia River                                   | FWS                 | <b>75</b> | 185        |
| Willamette Floodplain RNA | Willamette Valley bottomland grass and Oregon ash communities                                     | FWS                 | 97        | <b>239</b> |

<sup>1</sup>BLM = Bureau of Land Management, FWS = Fish and Wildlife Service, LCC = Lewis and Clark College, TNC = The Nature Conservancy.

Table 52. --*Additional Research Natural Areas needed in the Western Oregon Interior Valleys Province*

| Ecosystem or community                                                                 | Cells represented <sup>1</sup>          | Remarks and possible locations               | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub- 4 province |
|----------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------|-----------------------|--------------------------|--------------------------------------------|-----------------|
| <u>Combined terrestrial and aquatic natural area:</u>                                  |                                         |                                              |                       |                          |                                            |                 |
| 1. Oregon ash forest with eutrophic permanent pond and vernal pond                     | T- <u>22</u><br>A- <u>2,3</u>           | Preferably in southern Willamette Valley     | Medium                | State<br>Private         | 124-126                                    | 0501            |
| <u>Predominantly terrestrial natural areas:</u>                                        |                                         |                                              |                       |                          |                                            |                 |
| 2. Western redcedar and associated conifers                                            | T- <u>4</u>                             | In northern portion of the Willamette Valley | Medium                | State<br>Private         | 116-118                                    | 0502<br>0503    |
| 3. Oregon white oak savanna                                                            | T- <u>8</u><br>R&E- <u>2,3,4</u>        | Willamette Valley                            | High                  | State<br>Private         | 111-114                                    | 0502            |
| 4. Oregon white oak/snowberry forest                                                   | T- <u>9</u>                             | Willamette Valley                            | High                  | State<br>Private         | 111-114                                    | 0502            |
| 5. Grand fir forest in the Willamette Valley                                           | T- <u>7,8,9</u>                         | MacDonald State Forest                       | Medium                | State                    | 116-118                                    | 0502            |
| 6. Riparian black cottonwood-willow forest                                             | T- <u>21</u>                            | Along the Willamette River                   | Low                   | State                    | 124-126                                    | 0501            |
| 7. Steep slope, xeric, valley-margin prairie, with talus areas and western rattlesnake | T- <u>15</u><br>R&E- <u>5</u>           | Willamette Valley                            | High                  | State<br>Private         | 119-123                                    | 0503            |
| 8. Gentle slope or valley bottom mesic prairie                                         | T- <u>16</u>                            | Willamette Valley                            | High                  | State<br>Private         | 119-123                                    | 0502            |
| 9. Coniferous forest mixture in the Umpqua River valley                                | T- <u>5</u>                             |                                              | High                  | BLM                      | 118-119                                    |                 |
| 10. Oak woodland-grassland mosaic in the Umpqua Valley                                 | T- <u>11,18</u><br>R&E- <u>2,3,4</u>    |                                              | High                  | BLM<br>Private           | 114-115<br>119-123                         |                 |
| 11. Mixed coniferous forest in the Rogue River valley                                  | T- <u>6</u><br>R&E- <u>3,4</u>          |                                              | High                  | BLM                      | 118-119                                    | 0301            |
| 12. Oregon white oak and oak-madrone forest mixed with grassland, Rogue Valley         | T- <u>12,13,19</u><br>R&E- <u>2,3,4</u> |                                              | High                  | BLM<br>Private           | 114-115<br>119-123                         | 0301            |
| 13. California black oak in the Rogue River valley                                     | T- <u>14</u><br>R&E- <u>2,3,4</u>       |                                              | Medium                | BLM                      | 114-115                                    | 0301            |

See footnotes at end of table.

Table 52.--Additional Research Natural Areas needed in the Western Oregon Interior Valleys Province (Continued)

| Ecosystem or community                                                                                                  | Cells represented <sup>1</sup>   | Remarks and possible locations                                                                                                                           | Priority <sup>2</sup> | Lead agency <sup>3</sup>          | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------|-------------------------------------------|---------------------------|
| 14. Chaparral ( <i>Ceanothus</i> - <i>Arctostaphylos</i> ) in the Rogue Valley                                          | <u>T-26</u>                      | Possibly with oak or ponderosa pine                                                                                                                      | Low                   | BLM                               | 124                                       | 0301                      |
| 15. Riparian woodland along a major stream in the Rogue Valley                                                          | <u>T-24</u>                      | To provide comparison with west-side riparian type                                                                                                       | Medium                | State<br>BLM                      | 124-127                                   | 0301                      |
| <u>Predominantly aquatic natural areas:</u>                                                                             |                                  |                                                                                                                                                          |                       |                                   |                                           |                           |
| 16. Oxbow lake in the Willamette Valley                                                                                 | <u>A-1</u>                       |                                                                                                                                                          | Medium                | Private<br>State                  |                                           | 0501                      |
| 17. Small stream drainage on the east side of the Willamette Valley                                                     | <u>A-4</u>                       |                                                                                                                                                          | High                  | Private<br>State                  |                                           | 0503                      |
| 18. Small stream drainage on the west side of the Willamette Valley                                                     | <u>A-5</u><br><u>R&amp;E-1,6</u> | East slope of Marys Peak-Summit area                                                                                                                     | High                  | Private<br>State                  |                                           | 0503                      |
| 19. Mineral spring in valley fringe area frequented by band-tailed pigeons                                              | <u>A-7</u>                       |                                                                                                                                                          | High                  | Private<br>BLM                    |                                           |                           |
| 20. Valley bottom marsh in the Willamette Valley                                                                        | <u>A-8</u>                       | McFadden Marsh in W. L. Finley National Wildlife Refuge                                                                                                  | High                  | FWS<br>State<br>Private           |                                           | 0501                      |
| 21. Valley bottom marsh in the Umpqua or Rogue Valley                                                                   | <u>A-9</u>                       |                                                                                                                                                          | High                  | BLM<br>State<br>Private           |                                           |                           |
| <u>Natural area for protection of rare or threatened species:</u>                                                       |                                  |                                                                                                                                                          |                       |                                   |                                           |                           |
| 22. Table Rock area north of Medford--for protection of rare plant species. Should include vernal ponds and stony flats |                                  | Located just north of Rogue River. Species to be protected include <i>Pilularia americana</i> , <i>Limnanthes floccosa</i> , and <i>Mimulus tricolor</i> | High                  | Private<br>State<br>County<br>BLM |                                           | 0301                      |

<sup>1</sup>For a description of these cells see table 47 for terrestrial (T) ecosystems, table 48 for aquatic (A) ecosystems, and table 49 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership.  
BLM = Bureau of Land Management, FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.

## SISKIYOU MOUNTAINS PROVINCE, SOUTHWESTERN OREGON



The Siskiyou Mountains Province (fig. 1) is largely a region of extremely rugged, deeply dissected terrain. Mountain crests, comprised of steeply folded and faulted pre-Tertiary strata, range in elevation from 600 m near the coast to approximately 1200 m in the east. Ridge accordance suggests an ancient and now greatly dissected peneplain. Many peaks rise above this summit peneplain, the highest of which is Mount Ashland.

Most of the rock types in the Siskiyou Mountains are extremely old and have undergone at least some metamorphism. Sedimentary and volcanic rocks, dating from the Paleozoic to the Jurassic, have been altered to a variety of metamorphic rock types, including schists, gneisses, marbles, and other metavolcanic or metasedimentary rocks. Large-scale intrusions of ultramafic rocks, which subsequently have been largely altered to serpentine, occurred during late Jurassic to early Cretaceous times. At approximately the same time, a variety of granitic rocks were intruded in the vicinity of Grants Pass and Ashland. These granitics and, to a larger extent, serpentine parent materials are extremely important in influencing plant distribution within the Siskiyou Mountains.

Soils fall into two main groupings—those in the western portion and those in the east. Soils in the eastern half generally reflect the effects of drier conditions, especially during the summer, whereas soils to the west tend to remain moist for longer periods of the year. Upland soils in the western portion are, for the most part, deep and well developed; typically they have a silty clay loam A horizon and a silty clay B horizon. Soils derived from serpentine are invariably unproductive, having very shallow and stony profiles. As a result of the drier conditions, soils in the eastern portion of the province tend to be less well developed and contain larger amounts of gravels and cobbles, and bedrock is generally within 1 m of the surface.

The ecosystems and biota are extremely diverse (Franklin and Dyrness 1973), the most diverse of any of the provinces in the two States. Environmental complexity—bedrock geology, climatic gradients from the ocean across the range to the eastern slopes, physiography—added to a history of frequent, severe fires produces a bewildering array of ecosystems. Contributing to complexity is a very large array of plant and animal species which are a mixture of endemic types with Californian and northwestern species at their northern and southern limits, respectively.

Forest ecosystems predominate, with conifers dominant along the coast (Douglas-fir, western hemlock, Port-Orford-cedar, and redwood), at higher elevations (white and Shasta red firs and Brewer spruce), and in some inland areas (ponderosa and sugar pines and Douglas-fir). The “mixed evergreen” forests of Douglas-fir with tanoak, Pacific madrone, and other evergreen hardwoods form perhaps the most distinctive body of forested ecosystems. Serpentine areas have open forests or savanna communities of Jeffrey pine and other tree species. Other ecosystems include forests, shrub fields, and herb lands on the ocean front, chaparral, pygmy pine forests, knobcone pine stands, and mountain balds.

Streams and rivers are the most characteristic aquatic ecosystems, although small lakes, ponds, vernal pools, and bogs occur over a wide range of elevations and on both serpentine and normal rock types.

The **26** identified terrestrial cells (table **53**) are minimal; they allow for very little representation of variants of the more widespread ecosystems. The majority (**14**) identify what might be termed the typical, closed forest communities. Four cells are for ecosystems on serpentine, two for ocean-front types, and the remaining six identify a variety of special types from chaparral to ash-alder swamps.

The **14** identified aquatic cells (table **54**) include stream systems associated with coniferous and mixed evergreen forests, lakes, ponds, and vernal pools at low and high elevations, and a coastal bog. Aquatic ecosystems in serpentine areas differ significantly in structure, composition, and function from those occurring on more chemically balanced geologic formations. Consequently, three cells are identified for a lake, stream system, and bog on serpentine bedrock.

It is assumed that the characteristic array of plant and animal species will be associated with these terrestrial and aquatic ecosystems. Eight vertebrate animals are identified as cells because of their rare or endangered status (table **55**); several of these are endemic. There are many vascular plants of special interest in the Siskiyou Mountain region (table **56**). Many of these are endemic, typically on serpentine areas; and 36 of the listed plants are on the Smithsonian list of threatened and endangered plants. This province is by far the richest in plants of special interest as well as having the largest number from the Smithsonian list.

There are five Federal Research Natural Areas in the Siskiyou Mountains Province (table **57**) with three of these along the coastal margin of the mountains. These existing areas fill **11** of the **48** identified cells; **7** of these filled cells are terrestrial, **2** are aquatic, and **2** are rare and endangered animal cells. Aside from Research Natural Areas, the Kalmiopsis Wilderness and several botanical (such as Big Craggies) and other special areas provide protection for many of the plants of special interest.

Addition of **24** Research Natural Areas should provide for minimal representation of all of the terrestrial, aquatic, and animal cells identified in the province (table **58**); this number should also provide for representative populations of many of the plants of special interest. Of the needed Research Natural Areas, five combine major terrestrial and aquatic cells; and the three which involve major stream drainages are of particular consequence. Ten of the Research Natural Area needs are mainly for terrestrial ecosystems, including two focused on unusual tree species — Baker cypress and Brewer spruce. Six needs relate to aquatic cells. The only Research Natural Area need in the two States exclusively aimed at rare and endangered vertebrates is a moist talus area in the Applegate River valley for two species of salamanders (No. **22**). Finally, two areas are identified to protect concentrations of special interest vascular plants.

Completing a series of Research Natural Areas in this diverse province will be a large job. Identifying and establishing the three large stream drainages needed as Research Natural Areas is a particularly challenging part of the job although candidate areas are known for each. The heaviest lead responsibility lies with the Forest Service, although the Bureau of Land Management and Oregon State agencies (along the coast) must also play major roles.

Priorities are greatest for terrestrial ecosystems representing major timber resources, almost all of the aquatic ecosystems (since these are subject to increasing disturbance), and areas outside the Kalmiopsis Wilderness which contain concentrations of rare and endangered species.

Table 53.--*Terrestrial cells in the Siskiyou Mountains Province, southwestern Oregon*

| Cell                                                                                 | SAF<br>timber<br>type No. | Present<br>representation                              | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------|--------------------------------------------------|
| <u>Sitka Spruce Zone:</u>                                                            |                           |                                                        |                                                  |
| * 1. Ocean-front coniferous forest<br>(probably Sitka spruce and<br>western hemlock) |                           | None                                                   | 58-61                                            |
| 2. Redwood forest near the northern<br>limits of its range                           | 232                       | Wheeler Creek RNA                                      | 67-68                                            |
| <u>Western Hemlock Zone :</u>                                                        |                           |                                                        |                                                  |
| 3. Port-Orford-cedar-Douglas-fir<br>on normal soils                                  | 231                       | Port Orford Cedar<br>and Coquille River<br>Falls RNA's | 92-93                                            |
| 4. Douglas-fir-western hemlock forest                                                | 230                       | Port Orford Cedar<br>RNA                               | 72-80                                            |
| <u>Mixed-Conifer Zone :</u>                                                          |                           |                                                        |                                                  |
| 5. Pacific ponderosa pine with Douglas-<br>fir in the eastern Siskiyou               | 244<br>245                | Ashland RNA                                            | 138-139                                          |
| * 6. Pacific ponderosa pine with Douglas-<br>fir in the western Siskiyou             | 244<br>245                | None                                                   | 138-139                                          |
| 7. Mixed-conifer forest with sugar<br>pine, Douglas-fir, and ponderosa<br>pine       | 243                       | Ashland RNA                                            | 138-139                                          |
| <u>Mixed-Evergreen Zone :</u>                                                        |                           |                                                        |                                                  |
| * 8. Mixed-evergreen forest (Douglas-<br>fir and evergreen hardwoods)                | 234                       | None                                                   | 133-136                                          |
| * 9. Tanoak-madrone forest                                                           | 234                       | None                                                   | 134-135                                          |
| *10. Canyon live oak                                                                 | 249                       | None                                                   | 134-136                                          |
| *11. Knobcone pine                                                                   | 248                       | None                                                   | 134-135                                          |

See footnote at end of table.

Table 53.--*Terrestrial cells in the Siskiyou Mountains Province, southwestern Oregon* (Continued)

| Cell                                                                                                | SAF<br>timber<br>type No. | Present<br>representation | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-----------------------------------------------------------------------------------------------------|---------------------------|---------------------------|--------------------------------------------------|
| <u>White Fir and Shasta Red Fir Zone:</u>                                                           |                           |                           |                                                  |
| *12. Shasta red fir-white fir forest                                                                | 207                       | None                      | 150-155                                          |
| 13. Brewer spruce on a poor site                                                                    |                           | Brewer Spruce RNA         |                                                  |
| *14. Brewer spruce showing maximum development                                                      |                           | None                      |                                                  |
| <u>Special types:</u>                                                                               |                           |                           |                                                  |
| *15. Jeffrey pine-grass on serpentine soils at low elevation                                        | 247                       | None                      | 306-307                                          |
| *16. Jeffrey pine-grass on serpentine soils at high elevation                                       | 247                       | None                      | 306-307                                          |
| *17. Port-Orford-cedar-Douglas-fir on serpentine soils                                              | 231                       | None                      | 306-307                                          |
| *18. Serpentine vegetation matrix and normal soil island with good representation of contacts       |                           | None                      | 306-307                                          |
| *19. Ocean-front shrub lands                                                                        |                           | None                      | 298-300                                          |
| *20. Ocean-front herb lands                                                                         |                           | None                      | 298-300                                          |
| *21. Typical chaparral communities                                                                  |                           | None                      | 136                                              |
| *22. Pygmy lodgepole pine forest on Blacklock soil                                                  |                           | None                      |                                                  |
| *23. Riparian hardwood forest along a major west-side river (with alder, bigleaf maple, and myrtle) |                           | None                      |                                                  |
| *24. Baker cypress in the eastern Siskiyou                                                          |                           | None                      |                                                  |
| 25. Ash-alder swamp                                                                                 |                           | Port Orford Cedar RNA     |                                                  |
| *26. Mountain herb lands at high elevations (grassland balds)                                       |                           | None                      | 136                                              |

\*Cells presently lacking adequate representation.

Table 54.--*Aquatic cells in Siskiyou Mountains Province, southwestern Oregon*

| Cell <sup>1</sup>                                               | Present representation | Remarks                  |
|-----------------------------------------------------------------|------------------------|--------------------------|
| * 1. Major stream drainage in coniferous forest                 | None                   |                          |
| * 2. Major stream drainage in mixed-evergreen forest            | None                   |                          |
| * 3. Typical low-elevation lake                                 | None                   |                          |
| * 4. Typical subalpine lake                                     | None                   |                          |
| * 5. Lake in serpentine area at mid- to high-elevations         | None                   |                          |
| 6. Permanent pond at low elevation in mixed coniferous forest   | Port Orford Cedar RNA  |                          |
| 7. Permanent pond at mid- to high-elevation in subalpine forest | Brewer Spruce RNA      | Rabbit Lake              |
| * 8. Typical vernal pond at low elevation                       | None                   |                          |
| * 9. Typical vernal pond at mid- to high-elevation              | None                   |                          |
| *10. Stream drainage in serpentine at mid- to high-elevation    | None                   |                          |
| *11. Cave and large cold springs                                | None                   |                          |
| *12. Typical marsh area                                         | None                   |                          |
| *13. Typical coastal bog                                        | None                   |                          |
| *14. Mountain bog in serpentine area                            | None                   | With <i>Darlingtonia</i> |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 55.--Rare and endangered vertebrate animal cells in the Siskiyou Mountains Province, southwestern Oregon

| Cell                                               | Verified representation                                              | Reference                                                                                                              |
|----------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <u>Amphibians :</u>                                |                                                                      |                                                                                                                        |
| 1. Del Norte salamander                            | Wheeler Creek and Port Orford Cedar RNA's                            | Stebbins 1954                                                                                                          |
| *2. Siskiyou Mountain salamander                   | None                                                                 | Stebbins 1954<br>Storm 1966                                                                                            |
| 3. California slender salamander                   | Wheeler Creek RNA                                                    | Stebbins 1954                                                                                                          |
| *4. Black salamander                               | Verified minimal representation in Ashland RNA, need additional area | Stebbins 1954<br>Storm 1966                                                                                            |
| <u>Mammals :</u>                                   |                                                                      |                                                                                                                        |
| *5. Ashland shrew                                  | None--probably in Ashland RNA                                        | Bailey 1936<br>Olterman and Verts 1972                                                                                 |
| *6. Pinon muse (subspecies <i>sequoiensis</i> )    | None                                                                 | Bailey 1936                                                                                                            |
| *7. White-footed vole                              | None                                                                 | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olterman and Verts 1972 |
| *8. Red tree vole (subspecies <i>longicaudus</i> ) | None                                                                 | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olterman and Verts 1972 |

\*Cells presently lacking adequate representation.

Table 56.--*Vascular plants of special interest in the Siskiyou Mountains Province, southwestern Oregon*

| species <sup>1</sup>                                      | Distribution                                                   |
|-----------------------------------------------------------|----------------------------------------------------------------|
| <i>Adiantum jordanii</i>                                  | Rocky canyons, lower Rogue River                               |
| <i>Allium bolanderi</i>                                   | Stony flats, Douglas and Josephine Counties                    |
| <i>Allium falcifolium</i>                                 | Serpentine slopes, southern Josephine County                   |
| <i>Allium siskiyouense</i>                                | Grassy slopes, Siskiyou Summit, Jackson County                 |
| <i>Antennaria suffrutescens</i> <sup>2</sup>              | Rocky hillsides, Illinois Valley, Josephine and Curry Counties |
| <i>Arabis aculeolata</i> <sup>2</sup>                     | On serpentine, Josephine and Curry Counties                    |
| <i>Arabis koehleri</i> var. <i>koehleri</i>               | Rocky banks along Umpqua River near Roseburg, Douglas County   |
| <i>Arabis koehleri</i> var. <i>stipitata</i> <sup>2</sup> | Rocky banks, Illinois Valley, Josephine County                 |
| <i>Arabis modesta</i>                                     | Rocky banks, Rogue River Canyon near Galice, Josephine County  |
| <i>Arabis oregona</i> <sup>2</sup>                        | Rocky hillsides, southern Jackson and Josephine Counties       |
| <i>Arctostaphylos cinerea</i>                             | Brushlands, Illinois Valley, southern Josephine County         |
| <i>Arctostaphylos hispidula</i>                           | Rocky summits, Josephine and Curry Counties                    |
| <i>Arenaria howellii</i>                                  | On serpentine, Josephine and Curry Counties                    |
| <i>Arnica cernua</i>                                      | On serpentine, Illinois Valley, Josephine County               |
| <i>Arnica spathulata</i>                                  | Open woods, Curry and Josephine Counties                       |
| <i>Asplenium septentrionale</i>                           | Along North Umpqua River, Douglas County                       |
| <i>Aster brickelliioides</i> <sup>2</sup>                 | Dry rocky slopes, Josephine and Curry Counties                 |
| <i>Aster siskiyouensis</i>                                | Forested slopes                                                |
| <i>Astragalus accidens</i> var. <i>hendersonii</i>        | Open hillsides, Josephine County                               |
| <i>Astragalus umbraticus</i>                              | Dry woods, Douglas and Josephine Counties                      |
| <i>Balsamorhiza platylepis</i>                            | On serpentine, central Josephine County                        |
| <i>Bensoniella oregana</i>                                | Mountain bogs, southern Josephine and Curry Counties           |
| <i>Brodiaea dissimulata</i>                               | Dry hills, Josephine County                                    |
| <i>Calochortus greenii</i> <sup>2</sup>                   | Thickets, southern Jackson County                              |
| <i>Calochortus howellii</i>                               | Dry slopes, Umpqua and Illinois Valleys                        |
| <i>Calochortus indecorus</i>                              | Open slopes, Sexton Mountain, Josephine County                 |
| <i>Calochortus uniflorus</i>                              | Wet meadows, Illinois Valley, Josephine County                 |
| <i>Camassia howellii</i>                                  | Meadows, Josephine and Jackson Counties                        |
| <i>Castilleja brevilibata</i> <sup>2</sup>                | Rocky slopes, Josephine County                                 |
| <i>Castilleja elata</i>                                   | In bogs, usually on serpentine, southern Josephine County      |
| <i>Cirsium acanthodontum</i>                              | Lower Rogue River Canyon to the coast, Curry County            |
| <i>Cirsium ciliolatum</i> <sup>2</sup>                    | Dry hillsides near Ashland, Jackson County                     |
| <i>Clarkia amoena</i> var. <i>pacifica</i>                | High ocean bluffs, Lincoln and Curry Counties                  |
| <i>Clintonia andrewsiana</i>                              | Under redwoods, southern Curry County                          |
| <i>Cordylanthus viscidus</i>                              | On serpentine, Josephine and Jackson Counties                  |

See footnotes at end of table.

Table 56.--*Vascular plants of special interest in the Siskiyou Mountains Province, southwestern Oregon* (Continued)

| Species <sup>1</sup>                                            | Distribution                                                            |
|-----------------------------------------------------------------|-------------------------------------------------------------------------|
| <i>Cupressus bakeri</i>                                         | Open woods, northern Jackson and southern Josephine Counties            |
| <i>Cypripedium calceolus</i> var. <i>parviflorum</i>            | Mount Peavine, Josephine County                                         |
| <i>Cypripedium californicum</i> <sup>2</sup>                    | Bogs and springs, Josephine and Curry Counties                          |
| <i>Cypripedium fasciculatum</i>                                 | Coniferous forests, Josephine and Jackson Counties                      |
| <i>Darlingtonia californica</i> <sup>2</sup>                    | Sphagnum bogs, Josephine and Curry Counties (and along coast)           |
| <i>Dentaria gemmata</i>                                         | Streamsides, Josephine County                                           |
| <i>Dicentra formosa</i> ssp. <i>oregana</i> <sup>2</sup>        | Southwestern Josephine and Curry Counties                               |
| <i>Dicentra pauciflora</i>                                      | High altitudes                                                          |
| <i>Draba howellii</i>                                           | High rocky summits                                                      |
| <i>Empetrum nigrum</i>                                          | Open coastal bluffs, Lincoln and Curry Counties                         |
| <i>Epilobium rigidum</i>                                        | Dry rocky washes, Curry and Josephine Counties                          |
| <i>Erigeron bloomeri</i> var. <i>nudatus</i> <sup>2</sup>       | On serpentine, Josephine and Curry Counties                             |
| <i>Erigeron cervinus</i>                                        | Meadows and canyon banks, Curry to Jackson Counties                     |
| <i>Erigeron delicatus</i> <sup>2</sup>                          | Along streams, central Curry County                                     |
| <i>Erigeron petrophilus</i>                                     | Dry cliffs, Curry to Jackson Counties                                   |
| <i>Eriogonella membranacea</i>                                  | Dry slopes, Jackson County                                              |
| <i>Eriogonum incanum</i>                                        | Summit of Mount Ashland, Jackson County                                 |
| <i>Eriogonum pendulum</i>                                       | Dry stony ground, southern Josephine County                             |
| <i>Eriogonum ternatum</i>                                       | Gravelly flats, southern Josephine County                               |
| <i>Erythronium citrinum</i>                                     | Open woods, southern Josephine County                                   |
| <i>Erythronium howellii</i> <sup>2</sup>                        | Open woods along Illinois River, southern Josephine County              |
| <i>Fritillaria gentneri</i>                                     | Oak woodlands in foothills, Jackson and Josephine Counties              |
| <i>Fritillaria glauca</i>                                       | On serpentine, Josephine and Curry Counties                             |
| <i>Fritillaria recurva</i>                                      | Open woods in foothills                                                 |
| <i>Gentiana bisetata</i> <sup>2</sup>                           | Seepage slopes, Josephine and Curry Counties                            |
| <i>Haplopappus racemosus</i> ssp. <i>congestus</i> <sup>2</sup> | On serpentine, Josephine County                                         |
| <i>Hieracium bolanderi</i>                                      | Mountains of Curry, Josephine, and Jackson Counties                     |
| <i>Horkelia congesta</i> ssp. <i>nemorosa</i>                   | Douglas, Josephine, and Jackson Counties                                |
| <i>Horkelia hendersonii</i>                                     | Rocky summit of Mount Ashland, Jackson County                           |
| <i>Horkelia sericata</i>                                        | On serpentine, Josephine, Jackson, and Curry Counties                   |
| <i>Hydrocotyle verticillata</i>                                 | Garrison Lake, Curry County                                             |
| <i>Iris bracteata</i>                                           | Pine forest, southern Josephine and Curry Counties                      |
| <i>Iris innominata</i>                                          | Wooded banks, Illinois River drainage, present in Port Orford Cedar RNA |
| <i>Juniperus communis</i> var. <i>jackii</i>                    | On serpentine                                                           |
| <i>Kalmiopsis leachiana</i>                                     | Dry mountain slopes, Curry County, Kalmiopsis Wilderness Area           |

See footnotes at end of table.

Table 56.--Vascular plants of special interest in the Siskiyou Mountains Province,  
southwestern Oregon (Continued)

| Species <sup>1</sup>                                           | Distribution                                                     |
|----------------------------------------------------------------|------------------------------------------------------------------|
| <i>Lasthenia macrantha</i> ssp. <i>prisca</i> <sup>2</sup>     | Bluffs north of Gold Beach, Curry County                         |
| <i>Lathyrus delnorticus</i>                                    | Along streams, Josephine and Curry Counties                      |
| <i>Leucothoe davisiae</i> <sup>2</sup>                         | Hillside bogs, Curry County                                      |
| <i>Lewisia cotyledon</i> <sup>2</sup>                          | Jackson, Josephine, and Curry Counties                           |
| <i>Lewisia oppositifolia</i> <sup>2</sup>                      | Moist serpentine slopes, Josephine and Curry Counties            |
| <i>Lilium bolanderi</i>                                        | Open hillsides, southern Josephine and Curry Counties            |
| <i>Lilium kelloggii</i>                                        | Open woods, southern Josephine County                            |
| <i>Lilium occidentale</i> <sup>2</sup>                         | Sphagnum bogs, Curry County                                      |
| <i>Lilium pardalinum</i>                                       | Bogs and springs                                                 |
| <i>Lilium parvum</i>                                           | Mountain bogs and springs, southern Josephine County             |
| <i>Lilium rubescens</i>                                        | Wooded slopes, southern Josephine and Jackson Counties           |
| <i>Lilium vollmeri</i> <sup>2</sup>                            | Hillside bogs, Josephine and Jackson Counties                    |
| <i>Lomatium howellii</i>                                       | Southern Jackson and Josephine Counties                          |
| <i>Lomatium tracyi</i>                                         | On serpentine                                                    |
| <i>Lupinus aridus</i> var. <i>ashlandicus</i>                  | Stony slopes, Mount Ashland, Jackson County                      |
| <i>Lupinus mucronulatus</i>                                    | On serpentine, Waldo area, Josephine County                      |
| <i>Microseris bigelovii</i>                                    | Coastal bluffs, Cape Blanco, Curry County                        |
| <i>Microseris howellii</i> <sup>2</sup>                        | On serpentine, Josephine and Jackson Counties                    |
| <i>Microseris laciniata</i> ssp. <i>detlingii</i> <sup>2</sup> | Grasslands, Siskiyou Pass, Jackson County                        |
| <i>Microseris nutans</i> ssp. <i>siskiyouensis</i>             | Open rocky area near Waldo, Josephine County                     |
| <i>Mirabilis greenii</i>                                       | Southern Jackson County                                          |
| <i>Monardella purpurea</i>                                     | Dry ground, northern Curry to southern Josephine Counties        |
| <i>Navarretia heterandra</i>                                   | Vernal pools, Jackson County                                     |
| <i>Orthocarpus cuspidatus</i>                                  | Grasslands, southern Klamath and Jackson Counties                |
| <i>Oxalis oregana</i> var. <i>smallii</i>                      | Rogue River canyon near Galice, Josephine County                 |
| <i>Pedicularis howellii</i>                                    | Coniferous forest along summits, Josephine County                |
| <i>Pellaea brachyptera</i>                                     | Dry rocky slopes, mountains of Jackson and Josephine Counties    |
| <i>Penstemon newberryi</i> ssp. <i>berryi</i>                  | Summit of Siskiyou Mountains near Oregon Caves, Josephine County |
| <i>Penstemon parvulus</i>                                      | Summit of Mount Ashland, Jackson County                          |
| <i>Phacelia argentea</i>                                       | On old coastal dunes, Curry County                               |
| <i>Phacelia capitata</i> <sup>2</sup>                          | On serpentine, along Coquille River, Coos County                 |
| <i>Phacelia leonis</i> <sup>2</sup>                            | Southern Josephine County                                        |
| <i>Phacelia peckii</i> <sup>2</sup>                            | Moist flats, southern Jackson County                             |
| <i>Picea breweriana</i>                                        | Southern Josephine County                                        |
| <i>Pinus sabiniana</i>                                         | Along Rogue River, Josephine County                              |
| <i>Polystichum californicum</i>                                | Coastal forest., Curry County                                    |
| <i>Polystichum mohrioides</i>                                  | On serpentine, mountain slopes                                   |
| <i>Potentilla glandulosa</i> ssp. <i>ashlandica</i>            | Wet meadows, Mount Ashland, Jackson County                       |
| <i>Potentilla glandulosa</i> ssp. <i>globosa</i>               | Mount Ashland, Jackson County                                    |
| <i>Quercus morehus</i>                                         | Northern Douglas and southern Josephine Counties                 |

See footnotes at end of table.

Table 56.--*Vascular plants of special interest in the Siskiyou Mountains Province, southwestern Oregon* (Continued)

| Species <sup>1</sup>                                           | Distribution                                                                      |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <i>Quercus sadleriana</i>                                      | Mountains in Douglas, Josephine, Curry, and Jackson Counties                      |
| <i>Romanzoffia tracyi</i>                                      | Wet sea cliffs, Curry County                                                      |
| <i>Rudbeckia californica</i> var. <i>glauca</i>                | Bogs, Douglas, Curry, and Josephine Counties                                      |
| <i>Sanicula peckiana</i>                                       | On serpentine, Josephine and Curry Counties                                       |
| <i>Sanicula tracyi</i>                                         | On serpentine, southern Josephine County                                          |
| <i>Saxifraga fragarioides</i>                                  | Mountain cliffs, Josephine and Jackson Counties                                   |
| <i>Saxifraga howellii</i>                                      | Upper Coquille to lower Umpqua River, and along the Rogue River, Josephine County |
| <i>Schoenolirion bracteosum</i> <sup>2</sup>                   | Mountain meadows, southern Jackson and Josephine Counties                         |
| <i>Sedum glanduliferum</i>                                     | Rock outcrops along Rogue River, Josephine County                                 |
| <i>Sedum laxum</i> ssp. <i>heckneri</i> <sup>2</sup>           | Dry cliffs, Jackson County                                                        |
| <i>Sedum laxum</i> ssp. <i>laxum</i>                           | On serpentine, Josephine County                                                   |
| <i>Sedum laxum</i> ssp. <i>perplexum</i>                       | Coastal cliffs, Curry County                                                      |
| <i>Sedum purdyi</i>                                            | Associated with Brewer spruce, southern Jackson County                            |
| <i>Senecio hesperius</i> <sup>2</sup>                          | Mountain bogs on serpentine, Josephine County                                     |
| <i>Sidalcea malvaeflora</i> ssp. <i>elegans</i> <sup>2</sup>   | On serpentine, southern Josephine County                                          |
| <i>Sidalcea malvaeflora</i> ssp. <i>patula</i>                 | Grassy slopes along immediate coast, Curry County                                 |
| <i>Sidalcea setosa</i> <sup>2</sup>                            | Josephine County                                                                  |
| <i>Sisyrinchium californicum</i>                               | Unique population of pink form near Pilot Rock, Jackson County                    |
| <i>Sophora leachiana</i> <sup>2</sup>                          | Oak-madrone forest, Mount Peavine, Josephine County                               |
| <i>Streptanthus howellii</i>                                   | On serpentine, mountains of Josephine and Curry Counties                          |
| <i>Synthyris reniformis</i> var. <i>cordata</i>                | Mixed woodlands on serpentine, Josephine and Curry Counties                       |
| <i>Tauschia glauca</i>                                         | Woods along Rogue and Umpqua Rivers, Josephine and Curry Counties                 |
| <i>Tauschia howellii</i> <sup>2</sup>                          | Dry slopes, southwestern Jackson County                                           |
| <i>Thlaspi montanum</i> var. <i>siskiyouensis</i> <sup>2</sup> | On serpentine, Josephine County                                                   |
| <i>Trifolium howellii</i>                                      | Moist slopes in woods, mountains of Josephine and Jackson Counties                |
| <i>Trillium rivale</i>                                         | Streambanks, Josephine and Curry Counties                                         |
| <i>Vaccinium coccinium</i> <sup>2</sup>                        | Sandy slopes and ridges, mountains of Josephine County                            |
| <i>Vancouveria chrysantha</i> <sup>2</sup>                     | Illinois River Valley, Josephine and Curry Counties                               |
| <i>Vancouveria planipetala</i>                                 | Dry woods, coastal Curry County                                                   |
| <i>Viola lanceolata</i> var. <i>occidentalis</i> <sup>2</sup>  | Sphagnum bogs, southern Josephine County                                          |
| <i>Viola lobata</i> var. <i>psychodes</i>                      | Coniferous forests, O'Brien area, Josephine County                                |
| <i>Viola ocellata</i>                                          | Woodlands, Douglas and Curry Counties                                             |
| <i>Noodwardia fimbriata</i>                                    | Wet banks, southern Josephine County                                              |
| <i>Zauschneria latifolia</i>                                   | Along lower Rogue and Illinois Rivers, Curry and Josephine Counties               |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 57.--*Established Research Natural Areas in the Siskiyou Mountains Province, southwestern Oregon*

| Name                     | Principal features                                                           | Agency <sup>1</sup> | Area |       |
|--------------------------|------------------------------------------------------------------------------|---------------------|------|-------|
|                          |                                                                              |                     | Ha   | Acres |
| Ashland RNA              | "Pacific" ponderosa pine, pure and mixed with Douglas-fir, on granitic soils | FS                  | 570  | 1,408 |
| Brewer Spruce RNA        | Brewer spruce with many other conifers                                       | BLM                 | 85   | 210   |
| Coquille River Falls RNA | Port-Orford-cedar stands                                                     | FS                  | 202  | 500   |
| Port Orford Cedar RNA    | Port-Orford-cedar and Douglas-fir stands                                     | FS                  | 454  | 1,122 |
| Wheeler Creek RNA        | Redwood-Douglas-fir forests near the northern limits of redwood              | FS                  | 135  | 334   |

<sup>1</sup>BLM = Bureau of Land Management, FS = Forest Service.

Table 58.--*Additional* Research Natural Areas needed in the Siskiyou Mountains Province, southwestern Oregon

| Ecosystem or community                                                                                                                                                                                                                  | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                     | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                                                                                                                                                  |                                |                                                                                                                                    |                       |                          |                                           |                           |
| 1. Coniferous forest and major stream drainage (at low- to mid-elevations)                                                                                                                                                              | T-4,6,9<br>A-1<br>R&E-7,8      | Anvil Creek (Powers District, Siskiyou National Forest)                                                                            | High                  | FS<br>BLM                | 79-80<br>136-143                          | 0306                      |
| 2. Mixed-evergreen forest (Douglas-fir-evergreen hardwoods) and major stream drainage                                                                                                                                                   | T-8,9,18<br>A-2                | Proposed Store Gulch RNA or Dry Creek in Sixes River drainage                                                                      | Medium                | FS<br>State              | 133-136                                   | 0302                      |
| 3. Large mid- to high-elevation area with serpentine vegetation matrix and normal soil island or contact-- should include typical serpentine Port-Orford-cedar--Douglas-fir, Jeffrey pine-grass, plus a small lake, and stream drainage | T-16,17,18<br>A-5,10           | Baldface Creek drainage (Chetco District, Siskiyou National Forest). Will include many serpentine endemic plant species (table 56) | Low                   | FS                       | 306-307                                   | 0302<br>0304              |
| 4. Coastal pigmy forest (lodgepole) and Blacklock soil with vernal pond                                                                                                                                                                 | T-22<br>A-8                    | Blacklock Point area in Floras Lake State Park                                                                                     | High                  | State<br>Private         |                                           | 0207                      |
| 5. Shasta red fir-white fir forest with vernal pond                                                                                                                                                                                     | T-12<br>A-9                    | Applegate drainage                                                                                                                 | Low                   | BLM<br>FS                | 150-155                                   | 0303                      |
| <u>Predominantly terrestrial natural areas:</u>                                                                                                                                                                                         |                                |                                                                                                                                    |                       |                          |                                           |                           |
| 6. Coastal coniferous forest (Douglas-fir-Sitka spruce-western hemlock)                                                                                                                                                                 | T-1<br>R&E-7,8                 | Samuel Boardman State Park                                                                                                         | Medium                | State                    | 58-61                                     | 0304                      |
| 7. Pacific ponderosa pine with Douglas-fir in the western Siskiyou                                                                                                                                                                      | T-6                            | Myers Flat (Galice District, Siskiyou National Forest)                                                                             | High                  | FS                       | 138-139                                   | 0305                      |
| 8. Tan'oak-madrone and knobcone pine forest                                                                                                                                                                                             | T-9,11<br>R&E-6                | Chetco District, Siskiyou National Forest                                                                                          | Medium                | FS                       | 134-135                                   | 0304                      |
| 9. Canyon live oak type                                                                                                                                                                                                                 | T-10<br>R&E-6                  |                                                                                                                                    | Low                   | FS                       | 134-136                                   | 0304                      |

See footnotes at end of table.

Table 58.--*Additional Research Natural Areas needed in the Siskiyou Mountains Province, southwestern Oregon* (Continued)

| Ecosystem or community                                                          | Cells represented <sup>1</sup>  | Remarks and possible locations             | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|---------------------------------------------------------------------------------|---------------------------------|--------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 10. Coastal shrublands on ocean-facing slopes                                   | T- <u>19</u>                    | South of Humbug Mountain State Park        | Medium                | State                    | 298-300                                    | 0304                      |
| 11. Coastal herb lands on ocean-facing slopes                                   | T- <u>20</u>                    |                                            | Medium                | State                    | 298-300                                    | 0304                      |
| 12. Large chaparral area also containing mountain herb lands (grass land balds) | T- <u>21,26</u>                 | Big Craggies Botanical Area                | Low                   | FS                       | 136                                        | 0304                      |
| 13. Riparian hardwood forest along a major west-side stream                     | T- <u>23</u>                    | Containing alder, big leaf maple, myrtle   | Low                   | FS<br>BLM                |                                            | 0301                      |
| 14. Baker cypress ( <i>Cupressus bakeri</i> )                                   | T- <u>24</u><br>R&E- <u>2,4</u> | In eastern Siskiyou near California border | Low                   | BLM<br>FS                |                                            | 0303                      |
| 15. Brewer spruce showing maximum development on a good site                    | T- <u>14</u>                    | Sanger Lake                                | Low                   | FS                       |                                            | 0304                      |
| <u>Predominantly aquatic natural areas:</u>                                     |                                 |                                            |                       |                          |                                            |                           |
| 16. Low-elevation lake                                                          | A- <u>3</u>                     |                                            | High                  | BLM<br>FS                |                                            |                           |
| 17. Mid- to high-elevation lake (subalpine)                                     | A- <u>4</u>                     |                                            | High                  | FS<br>BLM                |                                            |                           |
| 18. Cave with large, cold springs                                               | A- <u>11</u>                    | Near Oregon Caves                          | High                  | State<br>Private         |                                            | 0303                      |
| 19. Typical marsh area                                                          | A- <u>12</u>                    |                                            | High                  | State<br>Private<br>FS   |                                            |                           |
| 20. Mountain bog in serpentine area                                             | A- <u>14</u>                    | Proposed Hunter Creek Bog RNA              | High                  | BLM                      |                                            | 0306                      |
| 21. Coastal bog                                                                 | A- <u>13</u>                    | Should include <i>Lilium occidentale</i>   | High                  | BLM<br>FS                |                                            | 0207                      |

See footnotes at end of table.

Table 58.--*Additional* Research Natural Areas needed in the Siskiyou Mountains Province, southwestern Oregon (Continued)

| Ecosystem or community                                                                                                        | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                                                                                                                                                                         | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub- <sup>4</sup> province |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|----------------------------|
| <u>Natural area for protection of rare or endangered animal species:</u>                                                      |                                |                                                                                                                                                                                                                                                                                        |                       |                          |                                            |                            |
| 22. Moist talus areas in the Applegate River valley--habitats for Siskiyou Mountain salamander and black salamander           | <u>R&amp;E-2,3</u>             | Areas to be selected                                                                                                                                                                                                                                                                   | High                  |                          |                                            | 0303                       |
| <u>Natural areas for protection of plant species of special interest:</u>                                                     |                                |                                                                                                                                                                                                                                                                                        |                       |                          |                                            |                            |
| 23. Illinois River Valley including bog area--for protection of a large number of serpentine and serpentine bog plant species |                                | Near Rough and Ready Creek. Species protected to include <i>Erythronium howellii</i> , <i>Lilium rubescens</i> , <i>Cypripedium mntanum</i> , <i>Isopyrum hollii</i> , <i>Viola occidentalis</i> , <i>Gentiana bisetaea</i> , <i>Castilleja elata</i> , and <i>Microseris howellii</i> | High                  | FS                       |                                            | 0303                       |
| 24. Hobson Horn area--includes Sadler oak, Brewer spruce, and a variety of rare plants                                        |                                | Siskiyou National Forest, west of Galice. Species protected to include <i>Sophora leachiana</i> , <i>Tauschia glauca</i> , <i>Tauschia howellii</i> , and <i>Sarcodes sanguinea</i>                                                                                                    | High                  | FS                       |                                            | 0305                       |

<sup>1</sup>For a description of these cells see table 53 for terrestrial (T) ecosystems, table 54 for aquatic (A) ecosystems, and table 55 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FS = Forest Service.

<sup>4</sup>See appendix V.

There are several outstanding sites with concentrations of special interest plants. Waldo, near O'Brien in Josephine County, has the largest group. "Hanging Bog" above Josephine Creek, Eight Dollar Mountain, and Limpy Creek are other major sites in Josephine County.



## WESTERN SLOPES AND CREST PROVINCE, OREGON CASCADES

The Cascades in Oregon include two distinct physiographic and geologic areas—the Western Cascades and the High Cascades (fig. 1). The High Cascades, on the east, include all major peaks of the range (e.g., Mount Hood, Mount Jefferson, Three Sisters) and originated during late Pliocene to Pleistocene times. The Western Cascades consist of older volcanic flows laid down during the Oligocene and Miocene.

The relief of the Western Cascades is generally rugged in the eastern portions, but slopes are more gentle to the west. Over much of the area there is a striking accord of main ridge crests at an average elevation of about 1500 m. Some glaciation occurred in the Western Cascades during the Pleistocene, but glaciers were largely confined to the principal stream valleys and had little effect on shaping present day landforms. The topographic characteristics of the younger High Cascades are considerably different. The High Cascades area is essentially a gently rolling high plateau interrupted at intervals by deep glaciated stream channels and volcanic cones and peaks. Volcanic activity, which reached its maximum during the Pleistocene, has continued until recently; some flows of lava are only several hundred years old.

Basalt, andesite, and pyroclastics (tuffs and breccias) are the most common bedrock materials in the Western Cascades. Since pyroclastic parent materials are readily weatherable, soils from these materials tend to be deep and fine textured, especially on gentler slopes. Pyroclastic soils are frequently imperfectly drained, and mass soil movements (e.g., slumps and earthflows) are common. Soils derived from basalt and andesite in the Western Cascades are generally well drained and tend to be stonier and coarser textured. On steep slopes profiles are poorly developed with dark-brown gravelly loam or sandy loam surface horizons. At higher elevations these soils often contain noticeable amounts of aerally deposited volcanic ash and pumice.

The High Cascades is an area dominated by immature soils developed in volcanic ejecta and soils showing more profile development which are derived from glacially deposited materials. Soils on glacial till are most common in the northern section and are characteristically deep and well drained with stony or gravelly sandy loam or loam textures. In the central and southern portions of the High Cascades, extensive areas are mantled with deposits of volcanic ejecta, such

as pumice, cinders, and ash. Soils in these materials show little profile development beyond the formation of thin, dark-colored A horizons.

Dense coniferous forests are dominant ecosystems on the western slopes and crest of the Oregon Cascade Range (Franklin and Dyrness **1973**). Major patterns of variability in composition and productivity of these forests are associated with elevation and with regional and local climatic gradients; the most notable of these gradients is the pattern of increasing temperature and decreasing precipitation moving from north to south along the range.

In the northern half of the province, forests of Douglas-fir, western hemlock, and western redcedar grade into communities characterized by Pacific silver and noble firs at higher elevations. Subalpine forests of mountain hemlock occur only on the highest ridges and peaks in the Western Cascades but are very extensively distributed along the entire crest of the High Cascades. In the southern half of the province (south of the Willamette-Umpqua River divide), montane forests are mixtures of Douglas-fir, sugar pine, incense-cedar, and white fir; Shasta red and white fir forests occupy the lower subalpine zone, below the mountain hemlock. A variety of meadow communities is associated with the higher ridges of the Western Cascades and subalpine parklands of the High Cascades; lava flows, pumice fields, riparian habitats, and rock cliffs and scree provide additional biotic diversity in the province.

Rivers and streams are the dominant aquatic ecosystems in the Western Cascades. Lakes and ponds, on the other hand, are common to abundant along the crest of the range in the High Cascades.

Twenty-seven terrestrial cells have been identified for the province (table **59**). Eighteen cells provide for representation of the important forest ecosystems including variants of widespread or highly variable types. It is critical that the commercially important Douglas-fir and western hemlock forests in the Western Cascades be well represented, since these will be sites for research relevant to management of these forests. Nine cells identify montane and subalpine meadow and related subalpine and alpine ecosystems.

Identified aquatic cells total 17 (table **60**). The majority provide for representation of streams, lakes, and ponds in contrasting habitats—for example, at low and high elevations and in southern and northern portions of the Cascade Range. Marshes, bogs, and hot springs round out the aquatic ecosystems needed.

Research Natural Areas established for the terrestrial and aquatic cells will presumably include the array of plant and animal species characteristic of these ecosystems. Seven rare or endangered vertebrate animal species have been identified which require specific consideration in selection and establishment of natural areas (table **61**). Vascular plants of special interest include **21** from the Smithsonian list of endangered or threatened plants (table **62**). The greatest concentration of these plants is in the Columbia River gorge, with the subalpine and alpine slopes of the major volcanic peaks (most notably Mount Hood and Crater Lake) as habitat for a second major group.

Six Research Natural Areas have already been established (table **63**). These areas provide adequate coverage of **11** of the 51 identified cells—7 of the terrestrial, **3** of the aquatic and **1** rare and endangered animal. Existing Wilderness Areas, Crater Lake National Park, and other specially designated tracts already provide protection for a substantial number of the plant species.

Addition of **22** Research Natural Areas should provide for minimal representation of all identified terrestrial, aquatic, and animal cells (table **64**). Five of these are for combined coverage of major terrestrial and aquatic cells.

Leadership in selection and establishment of the needed Research Natural Areas lies primarily with the Forest Service, but substantial contributions from the Bureau of Land Management, National Park Service, and Oregon State agencies are essential (table **64**). Considerable progress has already been made in locating candidate areas, with at least 9 of the **22** needed areas identified or in process of establishment. Ecosystems which represent major timber types have high priority for action because of the rapid pace of logging and other activities (table **64**). Low-elevation aquatic ecosystems also need early attention. Subalpine and alpine ecosystems, many of which are presently free from excessive pressure for development, have relatively low priority.

Table 59.--*Terrestrial cells in the Western Slopes and Crest Province, Oregon Cascades*

| Cell                                                                                                                                                          | SAF<br>timber<br>type No.   | Present<br>representation                                                | Page reference<br>(Franklin and<br>Dyrness 1973) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------|--------------------------------------------------|
| <u>Western Hemlock Zone :</u>                                                                                                                                 |                             |                                                                          |                                                  |
| * 1. Douglas-fir forest, <b>100-150</b> years old with range in understory from dry to moist communities (in Western Cascades and northern half of the State) | <b>229</b>                  | None.(Search under way in Willamette National Forest)                    | <b>72-88</b>                                     |
| 2. Douglas-fir-western hemlock forest about <b>250</b> years old                                                                                              | <b>229</b><br><b>230</b>    | Bagby RNA                                                                | <b>72-88</b>                                     |
| * 3. Old-growth Douglas-fir-western hemlock forest with representative range in understory communities                                                        | <b>230</b><br><b>229</b>    | Need will be filled with establishment of proposed Middle Santiam RNA    | <b>72-80</b>                                     |
| * 4. Typical low-site western hemlock stands occupying the summit of the High Cascades south of Mount Hood                                                    | <b>224</b>                  | None (Search under way in Mount Hood National Forest)                    | <b>99</b>                                        |
| * 5. Old-growth western redcedar in the Western Cascades                                                                                                      |                             | None                                                                     | <b>81-82</b>                                     |
| <u>Pacific Silver Fir Zone:</u>                                                                                                                               |                             |                                                                          |                                                  |
| 6. Upper- slope mixed-conifer forest (Pacific silver fir-western hemlock, mountain hemlock-subalpine fir, etc.)                                               | <b>226</b>                  | Bull Run, Olallie Ridge, and Wildcat Mountain RNA's                      | <b>94-98</b>                                     |
| 7. Typical noble fir forest                                                                                                                                   | <b>226</b>                  | Wildcat Mountain and Bull Run RNA's                                      | <b>94-98</b>                                     |
| 8. Mountain meadow-forest mosaic in the northern portion of the Western Cascades                                                                              | <b>227</b> or<br><b>228</b> | Olallie Ridge RNA                                                        | <b>152-153</b>                                   |
| <u>Mountain Conifer Zone:</u>                                                                                                                                 |                             |                                                                          |                                                  |
| 9. Typical mountain hemlock forest in the Western Cascades                                                                                                    | <b>205</b>                  | Wildcat Mountain RNA                                                     | <b>103-106</b>                                   |
| *10. Typical mountain hemlock forest in the High Cascades                                                                                                     | <b>205</b>                  | Need would be met by proposed area near Waldo Lake                       | <b>103-106</b>                                   |
| 11. Engelmann spruce-subalpine fir forest                                                                                                                     | <b>206</b>                  | Gold Lake Bog RNA                                                        | <b>103-109</b>                                   |
| <u>Mixed-Conifer Zone:</u>                                                                                                                                    |                             |                                                                          |                                                  |
| 12. Mixed-conifer forest at high elevations                                                                                                                   | <b>243</b>                  | Abbott Creek RNA                                                         | <b>139-143</b>                                   |
| *13. Southwestern Oregon mixed-conifer forest at low elevations (Douglas-fir-incense-cedar-ponderosa pine with a variety of understory types)                 |                             | None (Search under way in South Umpqua drainage, Umpqua National Forest) | <b>138-145</b>                                   |
| See footnote at end of table.                                                                                                                                 |                             |                                                                          |                                                  |

Table 59.--*Terrestrial cells in the Western Slopes and Crest Province, Oregon Cascades* (Continued)

| Cell                                                                                                                    | SAF<br>timber<br>type No. | Present<br>representation                                     | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------|--------------------------------------------------|
| <u>White Fir and Shasta Red Fir Zones :</u>                                                                             |                           |                                                               |                                                  |
| *14. Mature white fir-Douglas-fir forest in the High Cascades                                                           | 211                       | None                                                          | 150-152                                          |
| *15. Typical Shasta red fir forest in the High Cascades covering a range of habitats                                    | 207                       | Establishment of proposed Wickiup Springs RNA would fill need | 155-158                                          |
| *16. Mountain meadow-forest mosaic in the southern portion of the Western Cascades                                      |                           | Establishment of proposed Cougar Butte RNA will fill need     | 152-153                                          |
| <u>Subalpine and alpine communities:</u>                                                                                |                           |                                                               |                                                  |
| *17. Whitebark pine in the High Cascades                                                                                | 208                       | None                                                          | 272-275                                          |
| *18. Subalpine meadow community mosaic in the High Cascades (with as many major communities represented as possible)    |                           | None                                                          | 269-270                                          |
| *19. Subalpine pumice and ash fields ("pumice deserts")                                                                 |                           | None                                                          | 270                                              |
| *20. Subalpine lava flow with representative vegetation                                                                 |                           | None                                                          | 300-302                                          |
| *21. Green fescue in the Mount Hood area                                                                                |                           | None                                                          | 269-272                                          |
| *22. Alpine needlegrass in the southern portion of the High Cascades                                                    |                           | None                                                          |                                                  |
| *23. Alpine community mosaic                                                                                            |                           | None                                                          | 284-290                                          |
| <u>Special types:</u>                                                                                                   |                           |                                                               |                                                  |
| *24. Swale or swamp forest, Umpqua region (Oregon ash and ponderosa pine)                                               |                           | None                                                          |                                                  |
| *25. Moist temperate river terrace forest with Douglas-fir, western hemlock, western redcedar, and associated hardwoods | 230                       | Some will be included in proposed Middle Santiam RNA          | 72-82                                            |
| *26. Lodgepole pine at high elevations on pumice and ash soils                                                          | 218                       | None                                                          | 106-108                                          |
| *27. Bigleaf and vine maple communities on talus slopes in the Columbia Gorge                                           |                           | None                                                          | 91                                               |

"Cells presently lacking adequate representation.

Table 60.--*Aquatic cells in the Western Slopes and Crest Province, Oregon Cascades*

| Cell <sup>1</sup>                                                                                          | Present representation |
|------------------------------------------------------------------------------------------------------------|------------------------|
| * 1. Low-elevation lake surrounded by Douglas-fir-western hemlock, in the northern portion of the province | None                   |
| * 2. Low-elevation lake surrounded by mixed-conifer forest in the southern portion of the province         | None                   |
| * 3. Subalpine lake in the Western Cascades                                                                | None                   |
| * 4. Subalpine lake in the High Cascades                                                                   | None                   |
| * 5. Typical alpine lake in the High Cascades                                                              | None                   |
| * 6. Low-elevation permanent pond, in the northern portion of the province                                 | None                   |
| 7. Subalpine permanent pond                                                                                | Gold Lake Bog RNA      |
| * 8. Alpine permanent pond                                                                                 | None                   |
| * 9. Low-elevation vernal pond, in the northern portion of the province                                    | None                   |
| *10. Subalpine vernal pond                                                                                 | None                   |
| *11. Alpine vernal pond                                                                                    | None                   |
| *12. Low-elevation stream drainage in Douglas-fir-western hemlock, with anadromous fish                    | None                   |
| 13. Low- to mid-elevation stream drainage in mixed-conifer forest                                          | Abbott Creek RNA       |
| *14. Subalpine stream drainage with Pacific silver fir-western hemlock forest                              | None                   |
| *15. Typical hot springs                                                                                   | None                   |
| *16. Bulrush-sedge marsh                                                                                   | None                   |
| 17. Typical subalpine bog                                                                                  | Gold Lake Bog RNA      |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation

Table 61.--*Rare and endangered vertebrate animal cells in the Western Slopes and Crest Province, Oregon Cascades*

| Cell                                         | Verified representation | Reference                                                                                                              |
|----------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------|
| <u>Amphibians :</u>                          |                         |                                                                                                                        |
| *1. Larch Mountain salamander                | None                    | Stebbins 1954<br>Storm 1966                                                                                            |
| *2. Oregon slender salamander                | None                    | Stebbins 1954<br>Storm 1966                                                                                            |
| 3. Spotted frog                              | Gold Lake Bog RNA       | Stebbins 1954<br>Storm 1966                                                                                            |
| <u>Birds:</u>                                |                         |                                                                                                                        |
| *4. Northern spotted owl                     | None                    | Gabrielson and Jewett 1940<br>Marshall 1969                                                                            |
| <u>Mammals:</u>                              |                         |                                                                                                                        |
| *5. Heather vole                             | None                    | Bailey 1936<br>Edwards 1955<br>Johnson 1973<br>Maser and Storm 1970<br>Olterman and Verts 1972<br>Shaw 1924            |
| *6. White-footed vole                        | None                    | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olternan and Verts 1972 |
| *7. Red tree vole<br>(2 subspecies involved) | None                    | Bailey 1936<br>Johnson 1973<br>Maser 1966<br>Maser and Johnson 1967<br>Maser and Storm 1970<br>Olterman and Verts 1972 |

\*Cells presently lacking adequate representation.

Table 62.--*Vascular plants of special interest in the Western Slopes and Crest Province, Oregon Cascades*

| Species <sup>1</sup>                                 | Distribution                                                                                                        |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <i>Agoseris elata</i>                                | Open woods, middle altitude, Cascade Range                                                                          |
| <i>Agrostis howellii</i> <sup>2</sup>                | Moist cliffs, south side of Columbia River Gorge                                                                    |
| <i>Allium schoenoprasum</i>                          | Wet rocky ground, between low and high water along Columbia River gorge                                             |
| <i>Alnus sinuata</i>                                 | Unusual population on Angels Rest, Columbia River Gorge at low elevation                                            |
| <i>Anemone adamsiana</i>                             | Along road from Tiller to Trail, Douglas and Jackson Counties                                                       |
| <i>Arabis sparsiflora</i> var. <i>atrorubens</i>     | Open grassy slope, Columbia River Gorge, Klickitat County, Washington                                               |
| <i>Arabis suffrutescens</i> var. <i>horizontalis</i> | Crater Lake National Park                                                                                           |
| <i>Arenaria pumicola</i>                             | Crater Lake and Mount McLoughlin, to Mount Jefferson                                                                |
| <i>Arnica viscosa</i> <sup>2</sup>                   | Near timberline, Crater Lake and Three Sisters                                                                      |
| <i>Asarum caudatum</i> var. <i>viridiflorum</i>      | Lake of the Woods, Klamath County                                                                                   |
| <i>Aster gormanii</i> <sup>2</sup>                   | Mount Jefferson to Breitenbush Lake, Marion County                                                                  |
| <i>Betula glandulosa</i> var. <i>glandulosa</i>      | Bogs at lower elevation, Cascade Mountains (Clackamas Lake, Clackamas County)                                       |
| <i>Bolandra oregona</i>                              | Wet mossy rocks, both sides of Columbia River Gorge and along lower Willamette River                                |
| <i>Botrychium pumicola</i>                           | Crater Lake area and Paulina Mountains                                                                              |
| <i>Calamagrostis breweri</i>                         | Alpine meadows, Mount Hood and Mount Jefferson                                                                      |
| <i>Calamagrostis howellii</i> <sup>2</sup>           | Cliffs of Columbia River Gorge, Multnomah and Hood River Counties, Oregon; Clark and Klickitat Counties, Washington |
| <i>Carex macrochaeta</i>                             | Multnomah Falls, Columbia River Gorge                                                                               |
| <i>Cimicifuga laciniata</i> <sup>2</sup>             | Wooded slopes, base of Mount Hood and in Columbia River Gorge                                                       |
| <i>Collomia larsenii</i>                             | Talus slopes on alpine peaks, Cascade Range                                                                         |
| <i>Collomia mazama</i> <sup>2</sup>                  | Dry woods at high altitude, Mount McLoughlin and Crater Lake                                                        |
| <i>Corallorhiza mertensiana</i><br>(Yellow phase)    | Coniferous forests, near Mount Hood and in Columbia River Gorge                                                     |
| <i>Corydalis aquae-gelidae</i> <sup>2</sup>          | Very cold springs, upper Clackamas River drainage                                                                   |
| <i>Cypripedium mntanum</i>                           | Usually in open woods                                                                                               |
| <i>Dicentra cucullaria</i>                           | Moist woods, Columbia River gorge, and along Sandy River tributary                                                  |
| <i>Dodecatheon dentatum</i>                          | Wet cliffs, Columbia River Gorge                                                                                    |
| <i>Douglasia laevigata</i> <sup>2</sup>              | Cliffs and talus slopes, Columbia River Gorge                                                                       |

See footnotes at end of table.

Table 62.--*Vascular plants of special interest in the Western Slopes and Crest Province, Oregon Cascades* (Continued)

| Species <sup>1</sup>                                              | Distribution                                                                                        |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <i>Draba aureola</i>                                              | Alpine summits of volcanic peaks (Three Sisters)                                                    |
| <i>Elmera racemosa</i>                                            | Rock crevices, alpine slopes; Mount Washington, Deschutes County, and Cow Horn Peak, Klamath County |
| <i>Erigeron howellii</i> <sup>2</sup>                             | Moist rocky places, south side of Columbia River Gorge                                              |
| <i>Erigeron oreganus</i> <sup>2</sup>                             | Shady ledges, Columbia River Gorge, primarily on Oregon side                                        |
| <i>Eriogonum umbellatum</i> var. <i>hausknechtii</i>              | High mountain meadows                                                                               |
| <i>Erythronium klamathense</i>                                    | Woods, southwestern Klamath and southeastern Jackson Counties                                       |
| <i>Frasera umpquaensis</i> <sup>2</sup>                           | Open woods and meadows, Rogue-Umpqua Divide, present in Abbott Creek RNA                            |
| <i>Fritillaria adamantina</i> <sup>2</sup>                        | Grassy slopes, Diamond Lake, Douglas County                                                         |
| <i>Gentiana newberryi</i>                                         | Alpine meadows, Three Sisters region                                                                |
| <i>Habenaria orbiculata</i>                                       | Moist rich woods, Cascade Range of northern Oregon                                                  |
| <i>Haplopappus hallii</i> <sup>2</sup>                            | Dry slopes, Columbia River Gorge south; present in Olallie Ridge RNA                                |
| <i>Hieracium longiberbe</i> <sup>2</sup>                          | Rocky bluffs, Columbia River Gorge; Multnomah County, Oregon; and Skamania County, Washington       |
| <i>Hulsea nana</i>                                                | Alpine summits and cinder cones, Cascade peaks                                                      |
| <i>Isopyrum hallii</i>                                            | Moist woods, Cascade Range from Columbia River Gorge to Marion County                               |
| <i>Isopyrum stipitatum</i>                                        | Woods at middle altitude, southern Cascades, Douglas to Lake Counties                               |
| <i>Lewisia columbiana</i> var. <i>columbiana</i>                  | Open rocky slopes, Columbia River Gorge                                                             |
| <i>Lilium washingtonianum</i>                                     | Open woods at moderate altitude, Cascade Range                                                      |
| <i>Limnanthes floccosa</i> ssp. <i>bellingermana</i> <sup>2</sup> | Rocky flats, southeastern Jackson and southwestern Klamath Counties                                 |
| <i>Orobancha uniflora</i> f. <i>inundata</i>                      | Sandy River flood plain, Columbia River Gorge                                                       |
| <i>Parnassia fimbriata</i> var. <i>hoodiana</i>                   | Bogs and alpine meadows, vicinity of Mount Hood                                                     |
| <i>Phlox hendersonii</i>                                          | Open rocky slopes, Mount Hood                                                                       |
| <i>Pityopus californicus</i> <sup>2</sup>                         | Deep coniferous woods, west slope of Cascade Range                                                  |

See footnotes at end of table.

Table 62.--*Vascular plants of special interest in the Western Slopes and Crest Province, Oregon Cascades* (Continued)

| Species <sup>1</sup>                                         | Distribution                                                                                                                |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <i>Poa suksdorfii</i>                                        | High summits of Cascade peaks (also in Wallowa Mountains)                                                                   |
| <i>Polygonum cascadense</i> <sup>2</sup>                     | Mountain meadows, southern Lane County                                                                                      |
| <i>Polystichum andersonii</i>                                | Damp ground at mid-elevation, Columbia River Gorge (and along west base of Mount Hood)                                      |
| <i>Polystichum californicum</i>                              | Woods and rocky slopes, Cascade (and Siskiyou) Range                                                                        |
| <i>Populus tremuloides</i>                                   | Unique population at low elevations and west of Cascade Range on Angels Rest, Columbia River Gorge                          |
| <i>Potentilla villosa</i>                                    | Alpine ridges and talus, Mount Hood                                                                                         |
| <i>Salix fluviatilis</i> <sup>2</sup>                        | Banks along the Columbia River                                                                                              |
| <i>Saxifraga bronchialis</i> var. <i>vespertina</i>          | Wet cliffs, Columbia River Gorge and south in Coast and Cascade Ranges; present in Wildcat Mountain and Olallie Ridge RNA's |
| <i>Sedum divergens</i>                                       | Rocky alpine slopes present in Wildcat Mountain and Olallie Ridge RNA's                                                     |
| <i>Selaginella douglasii</i>                                 | Cliffs, moist banks, and tree trunks, Columbia River Gorge west to Portland and north to Cowlitz County, Washington         |
| <i>Silene douglasii</i> var. <i>monantha</i>                 | Lower Columbia River Gorge                                                                                                  |
| <i>Silene suksdorfii</i>                                     | High slopes above timberline; Mount Hood, Three Sisters region, Mount Thielsen                                              |
| <i>Smelowskia ovalis</i>                                     | High altitude in Cascades, Three Sisters north                                                                              |
| <i>Sullivantia oregana</i> <sup>2</sup>                      | Wet cliffs near waterfalls, Columbia River Gorge and lower Willamette River                                                 |
| <i>Synthyris missurica</i> ssp. <i>hirsuta</i> <sup>2</sup>  | Cascade Range, northern Douglas County                                                                                      |
| <i>Synthyris missurica</i> var. <i>stellata</i> <sup>2</sup> | Moist shady cliffs, Columbia River Gorge                                                                                    |
| <i>Thelypteris nevadensis</i>                                | Moist woods, western slopes, Cascade Range (and Siskiyou Mountains)                                                         |
| <i>Vaccinium oxycoccos</i> var. <i>intermedium</i>           | Sphagnum bogs, Cascade Range south to Marion County (and along coast to Lincoln County)                                     |
| <i>Viola adunca</i> var. <i>uncinulata</i>                   | Mountain meadows, especially near Crater Lake                                                                               |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, **dis**junct populations, or identification nationally (in the Smithsonian institution **list**) as threatened or endangered species.

<sup>2</sup>**Species** is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 63.--Established Research Natural Areas in the Western Slopes and Crest Province, Oregon Cascades

| Name                 | Principal features                                                                                       | Agency <sup>1</sup> | Area  |              |
|----------------------|----------------------------------------------------------------------------------------------------------|---------------------|-------|--------------|
|                      |                                                                                                          |                     | Ha    | Acres        |
| Abbott Creek RNA     | Sierran-type mixed conifer forest and stream drainage                                                    | FS                  | 1 077 | <b>2,660</b> |
| Bagby RNA            | Douglas-fir-western hemlock forests                                                                      | FS                  | 227   | <b>560</b>   |
| Bull Run RNA         | Noble fir, Pacific silver fir, and western hemlock forests                                               | FS                  | 146   | <b>361</b>   |
| Gold Lake Bog RNA    | Subalpine bog communities and permanent ponds                                                            | FS                  | 188   | <b>463</b>   |
| Olallie Ridge RNA    | Subalpine mountain meadows with rich flora and mixed conifer forests                                     | FS                  | 291   | <b>720</b>   |
| Wildcat Mountain RNA | Noble fir, Pacific silver fir, and mountain hemlock forests associated with meadow and shrub communities | FS                  | 405   | 1,000        |

<sup>1</sup>FS = Forest Service.

Table 64.--*Additional Research Natural Areas needed in the Western Slopes and Crest Province, Oregon Cascades*

| Ecosystem or community                                                                          | Cells represented <sup>1</sup>                            | Remarks and possible locations                                                     | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                          |                                                           |                                                                                    |                       |                          |                                            |                           |
| 1. Subalpine forest with lake (Pacific silver fir-western hemlock and western redcedar forests) | T- <u>5,6</u><br>A- <u>3,12</u>                           | Proposed Crabtree Lake RNA                                                         | High                  | BLM                      | 72-82<br>94-98                             | 0603                      |
| 2. Old-growth Douglas-fir-western hemlock forest with major stream drainages                    | T- <u>3,25,6</u><br>A- <u>12</u><br>R&E- <u>2,3,4,6,7</u> | Proposed Middle Santiam RNA                                                        | High                  | FS                       | 72-80                                      | 0605                      |
| 3. High Cascades subalpine lakes and ponds surrounded by mountain hemlock forest                | T- <u>10</u><br>A- <u>4,10,7</u><br>R&E- <u>5</u>         | Near Waldo Lake, Willamette National Forest                                        | Medium                | FS                       | 103-106                                    | 0901                      |
| 4. Subalpine forest with major stream drainage                                                  | T- <u>6</u><br>A- <u>14</u>                               | Enlargement of Bull Run RNA                                                        | Medium                | FS                       | 94-98                                      | 0607                      |
| 5. Alpine community mosaic with lake and ponds                                                  | T- <u>23</u><br>A- <u>5,8,11</u><br>R&E- <u>5</u>         | Wilderness Area                                                                    | Low                   | FS                       | 284-290                                    | 0901                      |
| <u>Predominantly terrestrial natural areas:</u>                                                 |                                                           |                                                                                    |                       |                          |                                            |                           |
| 6. Douglas-fir forest, 100-150 years old in western Cascades                                    | T- <u>1</u><br>R&E- <u>3,6,7</u>                          | Tributary drainage to South Fork of McKenzie River, Willamette National Forest     | High                  | FS                       | 72-88                                      | 0605<br>0606              |
| 7. Southwestern Oregon mixed coniferous forest with ash swales                                  | T- <u>13,24</u>                                           | Several areas under consideration in South Umpqua drainage, Umpqua National Forest | High                  | FS                       | 138-145                                    | 0604<br>0606              |

See footnotes at end of table.

Table 64.--*Additional Research Natural Areas needed in the Western Slopes and Crest Province, Oregon Cascades* (Continued)

| Ecosystem or community                                                                     | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                 | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| 8. White fir-Douglas-fir mature forest, High Cascades                                      | T- <u>14</u>                   | Dead Indian or Lake-of-the-Woods area                                                                                          | High                  | BLM<br>FS                | 150-152                                   | 0904<br>0905              |
| 9. Maple/talus communities in the Columbia Gorge (with a small waterfall and moist cliffs) | T- <u>27</u>                   | In a State park, should include a variety of plant species of special interest (table 62)                                      | Low                   | State<br>FS              | 91                                        | 0601                      |
| 10. Low-site western hemlock in the northern portion of the High Cascades                  | T- <u>4</u>                    | Proposed Abbott Pass area or two-part area (near Timothy Lake and across from Bear Paw Campground), Mount Hood National Forest | High                  | FS                       | 99                                        | 0902                      |
| 11. Shasta red fir forest in the High Cascades                                             | T- <u>15</u>                   | Proposed Wickiup Springs RNA                                                                                                   | High                  | FS                       | 155-158                                   | 0905                      |
| 12. High-elevation lodgepole pine with subalpine pumice and ash fields                     | T- <u>19,26</u><br>R&E-5       | Crater Lake National Park                                                                                                      | Low                   | NPS                      | 106-108                                   | 0901                      |
| 13. Whitebark pine area                                                                    | T- <u>17</u>                   | Crater Lake National Park or Wilderness Area                                                                                   | LOW                   | NPS<br>FS                | 272-275                                   | 0901                      |
| 14. Mountain meadow-forest mosaic in the southern part of the western Cascades             | T- <u>16</u>                   | Proposed Cougar Butte RNA, Umpqua National Forest                                                                              | High                  | FS                       | 152-153                                   | 0604                      |
| 15. Subalpine meadow community mosaic in the high Cascades                                 | T- <u>18</u><br>R&E-5          | Wilderness area should incorporate most of major communities                                                                   | Low                   | FS                       | 269-270                                   | 0901                      |
| 16. Subalpine lava flow                                                                    | T- <u>20</u>                   | Between McKenzie and Santiam Highways                                                                                          | Low                   | FS                       | 300-302                                   | 0901                      |

See footnotes at end of table.

Table 64.--*Additional Research Natural Areas needed in the Western Slopes and Crest Province, Oregon Cascades* (Continued)

| Ecosystem or community                                                            | Cells represented <sup>1</sup>       | Remarks and possible locations       | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-----------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 17. Alpine needlegrass                                                            | <u>T-22</u>                          | In southern portion of High Cascades | Medium                | FS                       |                                            | 0905                      |
| 18. Green fescue ( <i>Festuca viridula</i> )                                      | <u>T-21</u>                          | On east slopes of Mount Hood         | Medium                | FS                       | 269-272                                    | 0901                      |
| <u>Predominantly aquatic natural areas:</u>                                       |                                      |                                      |                       |                          |                                            |                           |
| 19. Low-elevation lake and ponds in Douglas-fir-western hemlock, northern portion | <u>A-1,6,9</u><br><u>R&amp;E-6,7</u> |                                      | High                  | State                    |                                            | 0603<br>0605              |
| 20. Low-elevation lake in mixed-conifer forest, southern portion                  | A-2<br>R6-6,7                        |                                      | High                  | State                    |                                            | 0604<br>0606              |
| 21. Hot springs                                                                   | <u>A-15</u>                          |                                      | High                  | FS<br>Private            |                                            |                           |
| 22. Bulrush-sedge marsh area                                                      | <u>A-16</u>                          |                                      | High                  | FS<br>BLM                | 108-109                                    |                           |

<sup>1</sup>For a description of these cells see table 59 for terrestrial (T) ecosystems, table 60 for aquatic (A) ecosystems, and table 61 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership.  
BLM = Bureau Of Land Management, FS = Forest Service, NPS = National Park Service.

<sup>4</sup>See appendix V.



## **EASTERN SLOPES PROVINCE, OREGON CASCADES**

The name of this province is really somewhat misleading, since much of it is a high plateau region (fig. 1) dotted with numerous volcanic cones and buttes. Evidence of extensive volcanic activity during Pleistocene and Recent times is abundant. The largest volcanic peak is the Paulina Peak shield volcano which contains Newberry Crater. Pumice, resulting from an eruption of this volcano about 4,000 years ago, mantles an extensive area to the north and east of the crater. Deposits of pumice originating from Mount Mazama in the High Cascades are also widespread and extend from Bend almost to the California border. Broad areas of Pleistocene lava flows are a notable feature in the vicinity of Bend. In addition, outstanding examples of Recent lava flows are situated south of Bend in the Lava Butte area. North of Bend the most abundant rock type is basalt, most of which was laid down during the Miocene. Here volcanic buttes are not as abundant and the most outstanding topographic features are deep, stream-cut canyons.

Virtually all the soils south of Bend are formed in deep deposits of pumice. These soils have immature, regosolic profiles consisting of a moderately thick, loamy coarse sand surface layer with some organic matter accumulation, overlying nearly unweathered, yellow- and buff-colored pumice gravel and sand. Although these soils have high water holding capacities, low soil fertility limits plant root penetration into the largely unweathered pumice; thus many sites appear droughty. North of Bend the soils derived from basalt tend to be shallow and stony and are generally of loam or sandy loam texture.

Although primarily a province of forest ecosystems, major variations in composition and structure of the forests are associated with the rapid decline in annual precipitation eastward from the crest (Franklin and Dyrness 1973). Bunchgrass, sagebrush, and western juniper communities are characteristic of the most arid regions. Ecosystems dominated by a mixture of conifers (ponderosa pine, Douglas-fir, white fir, western larch, and incense-cedar) occupy the main body of the eastern slopes in the north with pure ponderosa pine forests characteristic of the drier, lower fringes. In the south, a region of gentle to flat topography mantled with volcanic pumice, lodgepole pine forests are very extensive and are often associated with large moist meadows. Ponderosa pine stands occur on sloping land forms and white fir forests are encountered at higher elevations. Lava flows and cinder cones provide habitat for distinctive ecosystems in the southern half of the province, and the Columbia River gorge enriches the biotic diversity in the north.

The northern and southern segments of the province also offer major contrasts in aquatic ecosystems. Small streams are relatively common in the north. In the south, however, smaller streams are not common; larger streams and rivers often arise directly from large springs. Large lakes, reservoirs, and marshlands are also abundant in some areas.

Seventeen terrestrial cells have been identified on the eastern slopes of the Oregon Cascade Range (table 65). Nine of these provide for representation of the major forest ecosystems.<sup>2</sup> Three cells focus on juniper, bunchgrass, and sagebrush ecosystems. Special types identified as cells include two in the Columbia River area and two geologically Recent volcanic formations (cinder cone and lava flow).

Eight aquatic cells are listed for the province (table 66). There is no geographic replication, each cell representing a different category of ecosystem—lake, pond, vernal pool, stream, cold spring, hot spring, marsh, and bog.

Research Natural Areas established to fill terrestrial and aquatic cells are expected to include the typical array of plant and animal species. Only two vertebrate animals are listed as rare and endangered cells (table 67). Vascular plants of special interest include 13 species from the Smithsonian list of threatened or endangered plants (table 68).

There are five Federal Research Natural Areas (table 69) plus an additional area (Persia M. Robinson) originally established by the Forest Service and recently given to the Warm Springs Confederation by Congress. These six reserves provide adequate representation of 8 of the 27 terrestrial, aquatic, and animal cells identified in this province; all of the filled cells are terrestrial.

We estimate that 14 additional Research Natural Areas will provide for minimal coverage of the remaining unfilled cells in this province (table 70). Two of the needed tracts combine important terrestrial and aquatic cells—a lake and a stream drainage associated with mixed-conifer forest. Other areas needed include two at the eastern end of the Columbia Gorge for concentrations of plants of special interest.

The Forest Service has lead responsibility for a majority of the required Research Natural Areas (table 70). Assistance from private organizations will almost certainly be necessary in a few cases. Aquatic ecosystems and terrestrial communities on private lands or which represent major timber resources have highest priority for selection and establishment.

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<sup>2</sup>A larger number of cells could be listed to recognize major geographic variations in several forest types. For example, a series of three lodgepole pine/bitterbrush communities (cell No. 5) is necessary to include significant variations in the pumice soils on which the community occurs; differences in the composition, productivity, and management potential of the ecosystem are associated with the soil variability. Existing and proposed Research Natural Areas adequately cover this range in lodgepole pine/bitterbrush communities, however, so we have listed only a single cell. Similar situations exist with terrestrial cell Nos. 3, 4, and 7.

Table 65.--*Terrestrial cells in the Eastern Slopes Province, Oregon Cascades*

| Cell                                                                                                              | SAF<br>timber<br>type No. | Present<br>representation                                                                               | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Western Juniper Zone:</u>                                                                                      |                           |                                                                                                         |                                                  |
| 1. Western juniper/big sagebrush community                                                                        | 238                       | Goodlow Mountain RNA                                                                                    | 165-167                                          |
| <u>Ponderosa Pine Zone:</u>                                                                                       |                           |                                                                                                         |                                                  |
| * 2. Ponderosa pine/western juniper/sagebrush savanna                                                             | 237                       | None                                                                                                    | 160-161<br>171-180                               |
| 3. Ponderosa pine/bitterbrush community                                                                           | 237                       | Metolius, Pringle Falls, Bluejay, and Goodlow Mountain RNA's                                            | 171-180                                          |
| 4. Ponderosa pine/manzanita community                                                                             | 237                       | Metolius and Goodlow Mountain RNA's                                                                     | 171-180                                          |
| <u>Lodgepole Pine Zone:</u>                                                                                       |                           |                                                                                                         |                                                  |
| 5. Lodgepole pine/bitterbrush community                                                                           | 216                       | Pringle Falls and Bluejay RNA's; need will be satisfied with establishment of proposed Cannon Wells RNA | 187-188                                          |
| * 6. Lodgepole pine/grass-herb communities on moist sites                                                         | 216                       | Token in Pringle Falls RNA, need additional area                                                        | 187-188                                          |
| <u>White Fir and Douglas-fir Zones:</u>                                                                           |                           |                                                                                                         |                                                  |
| 7. Ponderosa pine-Douglas-fir forest                                                                              | 214                       | Mill Creek, Persia M. Robinson, and Metolius RNA's                                                      | 191-192                                          |
| 8. Ponderosa pine-white fir/Ross' sedge community                                                                 | 214                       | Goodlow Mountain RNA                                                                                    | 195-196                                          |
| * 9. Mixed-conifer forest (pine, Douglas-fir, Abies). Also, if possible including western larch and incense-cedar | 215                       | Token in Persia M. Robinson and Metolius RNA's, need additional area                                    | 190-196                                          |
| *10. White fir/Ceanothus community                                                                                | 213                       | None                                                                                                    |                                                  |
| <u>Steppe and shrub-steppe communities:</u>                                                                       |                           |                                                                                                         |                                                  |
| 11. Bunchgrass communities                                                                                        |                           | Mill Creek RNA                                                                                          | 211-212<br>215-216                               |
| 12. Low sagebrush/Sandberg's bluegrass community                                                                  |                           | Goodlow Mountain RNA                                                                                    | 239-241                                          |
| <u>Special types:</u>                                                                                             |                           |                                                                                                         |                                                  |
| 13. Oregon white oak-grassland communities                                                                        | 233                       | Mill Creek RNA                                                                                          |                                                  |
| *14. Moist meadows associated with lodgepole pine flats                                                           |                           | None                                                                                                    | 187-190                                          |
| *15. Eastern Columbia Gorge rock fall with forest complex                                                         |                           | None                                                                                                    | 310-311                                          |
| *16. Entire undisturbed, forested cinder cone, preferably in Abies grandis                                        |                           | None                                                                                                    | 193-201                                          |
| *17. Low elevation, Recent lava flow with representative vegetation                                               |                           | None                                                                                                    |                                                  |

\*Cells presently lacking adequate representation.

Table 66.--*Aquatic cells in the Eastern Slopes Province, Oregon Cascades*

| Cell <sup>1</sup>                                                        | Present representation |
|--------------------------------------------------------------------------|------------------------|
| *1. Lake at moderate elevations surrounded by mixed-conifer forest       | None                   |
| *2. Permanent subalpine pond                                             | None                   |
| *3. Vernal ponds at moderate elevation                                   | None                   |
| *4. Large stream drainage at moderate elevations in mixed-conifer forest | None                   |
| *5. Large, upwelling cold spring                                         | None                   |
| *6. Typical hot spring                                                   | None                   |
| *7. Marshland                                                            | None                   |
| *8. Typical bog at mid- to high-elevations                               | None                   |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation,

Table 67.--*Rare and endangered vertebrate animal cells in the Eastern Slopes Province, Oregon Cascades*

| Cell                | Verified representation | Reference                                                                                                   |
|---------------------|-------------------------|-------------------------------------------------------------------------------------------------------------|
| <u>Amphibians :</u> |                         |                                                                                                             |
| *1. Spotted frog    | None                    | Stebbins 1954<br>Storm 1966                                                                                 |
| <u>Mammals :</u>    |                         |                                                                                                             |
| *2. Heather vole    | None                    | Bailey 1936<br>Edwards 1955<br>Johnson 1973<br>Maser and Storm 1970<br>Olterman and Verts 1972<br>Shaw 1924 |

\*Cells presently lacking adequate representation.

Table 68.--*Vascular plants of special interest in the Eastern Slopes Province, Oregon Cascades*

| Species <sup>1</sup>                                              | Distribution                                                                                          |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <i>Alisma gramineum</i> var. <i>gramineum</i>                     | Vernal ponds at east end of Columbia River Gorge, near The Dalles and in Klickitat County, Washington |
| <i>Astragalus applegatei</i> <sup>2</sup>                         | Moist meadows near Klamath Falls, Klamath County                                                      |
| <i>Astragalus hoodianus</i>                                       | Grassy slopes, Columbia River Gorge, Hood River County, Oregon, and Klickitat County, Washington      |
| <i>Botrychium pumicola</i> <sup>2</sup>                           | Pumice slopes, Crater Lake and Paulina Mountains                                                      |
| <i>Castilleja applegatei</i>                                      | On pumice, Three Sisters to Crater Lake                                                               |
| <i>Castilleja chlorotica</i> <sup>2</sup>                         | Mountains, southern Lake County (Gearhart Mountain); Three Sisters                                    |
| <i>Cicuta bulbifera</i>                                           | Swamps around Klamath Lake                                                                            |
| <i>Crepis bakeri</i> ssp. <i>cusickii</i>                         | Dry slopes, Jackson and Lake Counties                                                                 |
| <i>Cypripedium montanum</i> <sup>2</sup>                          | Usually in open woods                                                                                 |
| <i>Dodecatheon poeticum</i> <sup>2</sup>                          | Grassland, east end of Columbia River Gorge                                                           |
| <i>Eriogonum prociduum</i>                                        | Volcanic outcrops, Lake County                                                                        |
| <i>Eriogonum pyrolaefolium</i> var. <i>bellingerianum</i>         | Summit of Broken Top Mountain, Deschutes County                                                       |
| <i>Eriogonum umbellatum</i> var. <i>glaberrimum</i>               | Warner Mountains, southern Lake County                                                                |
| <i>Eriogonum umbellatum</i> var. <i>hausknechtii</i>              | High mountain meadows                                                                                 |
| <i>Haplopappus hallii</i> <sup>2</sup>                            | Dry slopes, east end of Columbia River Gorge                                                          |
| <i>Heuchera grossulariifolia</i> var. <i>tenuifolia</i>           | Grassy hillsides, east end of Columbia River Gorge                                                    |
| <i>Hydrophyllum capitatum</i> var. <i>thompsonii</i> <sup>2</sup> | Near oaks, Columbia River Gorge and Hood River County                                                 |
| <i>Lomatium columbianum</i>                                       | Open rocky slopes, east end of Columbia River Gorge                                                   |
| <i>Lomatium laevigatum</i> <sup>2</sup>                           | Basaltic slopes, east end of Columbia River Gorge                                                     |
| <i>Lomatium peckianum</i>                                         | Dry hillside and pine woods near Bly, Klamath County                                                  |
| <i>Lomatium suksdorfii</i> <sup>2</sup>                           | Rocky soil, east end of Columbia River Gorge                                                          |
| <i>Lupinus latifolius</i> var. <i>thompsonianus</i> <sup>2</sup>  | Dry hillsides, east end of Columbia River Gorge                                                       |
| <i>Mimulus jungermannioides</i> <sup>2</sup>                      | Moist moss mats, east end of Columbia River Gorge and along lower Deschutes River                     |
| <i>Mimulus pulsiferae</i>                                         | Moist open places along eastern base of Cascade Mountains                                             |

See footnotes at end of table.

Table 68.--*Vascular plants of special interest in the Eastern Slopes Province, Oregon Cascades* (Continued)

| Species <sup>1</sup>                        | Distribution                                                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|
| <i>Penstemon barrettiae</i> <sup>2</sup>    | Basaltic cliffs and talus, east end of Columbia River Gorge                         |
| <i>Penstemon euglaucus</i>                  | Forest openings at middle altitudes, Three Sisters to Mount Hood (Blue Grass Ridge) |
| <i>Penstemon glandulosus</i>                | Rocky slopes, east end of Columbia River Gorge; disjunct to Snake River             |
| <i>Penstemon glaucinus</i> <sup>2</sup>     | Pine forest, Gearhart Mountain, Lake County                                         |
| <i>Penstemon peckii</i> <sup>2</sup>        | Open pine woods, eastern base of Cascades, Mount Hood to Three Sisters              |
| <i>Penstemon subserratus</i>                | Open woods, eastern slope of Mount Hood, Hood River County                          |
| <i>Ribes watsonianum</i>                    | East side of Mount Hood, Hood River County                                          |
| <i>Salix laevigata</i>                      | Along streams, southern Klamath County                                              |
| <i>Silene nuda</i> ssp. <i>insectivora</i>  | Along Sprague River, Klamath County                                                 |
| <i>Spiraea pyramidata</i>                   | Eastern side of Cascade Range                                                       |
| <i>Suksdorfia violacea</i>                  | Wet cliffs and mossy banks, east end of Columbia River Gorge                        |
| <i>Viola adunca</i> var. <i>cascadensis</i> | Open pine woods, eastern base of Cascade Range, Deschutes and Jefferson Counties    |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 69.--*Established Research Natural Areas in the Eastern Slopes Province, Oregon Cascades*

| Name                   | Principal features                                                                      | Agency <sup>1</sup> | Area |       |
|------------------------|-----------------------------------------------------------------------------------------|---------------------|------|-------|
|                        |                                                                                         |                     | Ha   | Acres |
| Bluejay RNA            | Ponderosa and lodgepole pine on coarse pumice so; Is                                    | FS                  | 85   | 210   |
| Goodlow Mountain RNA   | Interior ponderosa pine forest and associated ecosystems                                | FS                  | 510  | 1,260 |
| Metolius RNA           | interior ponderosa pine forests                                                         | FS                  | 583  | 1,440 |
| Mill Creek RNA         | Mosaic of interior mixed conifer and Oregon white oak forest and grass and shrub-steppe | FS                  | 330  | 815   |
| Persia M. Robinson RNA | Douglas-fir and ponderosa pine forests                                                  | WSIR                | 219  | 540   |
| Pringle Falls RNA      | Lodgepole and ponderosa pine forests on pumice soils                                    | FS                  | 470  | 1,160 |

<sup>1</sup>FS = Forest Service, WSIR = Warm Springs Indian Reservation.

Table 70.--*Additional Research Natural Areas needed in the Eastern Slopes Province, Oregon Cascades*

| Ecosystem or community                                                               | Cells represented <sup>1</sup> | Remarks and possible locations                                                      | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub- 4 province      |
|--------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|----------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                               |                                |                                                                                     |                       |                          |                                            |                      |
| 1. Mixed-conifer forest (pine, Douglas-fir, and Abies) with major stream drainage    | T-9,5,10<br>A-4                | Mount Hood National Forest or Sisters area of Deschutes National Forest             | High                  | FS                       | 190-196                                    | 0902<br>0903<br>0905 |
| 2. Mixed-conifer forest (pine, Douglas-fir, and Abies) with lake                     | T-9,5,10<br>A-1<br>R&E-1       | Deschutes or Winema National Forest at higher elevations than Metolius RNA          | High                  | FS<br>NPS                | 190-196                                    | 0905                 |
| 3. Moist meadow and associated wet lodgepole pine area, with vernal ponds            | T-6,14,5<br>A-3                | Winema National Forest (small representation in Cannon Wells RNA being established) | Medium                | FS                       | 187-190                                    | 0905                 |
| <u>Predominantly terrestrial natural areas:</u>                                      |                                |                                                                                     |                       |                          |                                            |                      |
| 4. White fir/ <i>Ceanothus</i> community, with <i>Castanopsis</i>                    | T-10,4,9                       | Should be on residual soils, not Mazama pumice                                      | High                  | FS                       | 176-177<br>196                             | 0902                 |
| 5. Lodgepole pine/bitterbrush community                                              | T-5,14                         | Cannon Wells RNA being established                                                  | High                  | FS                       | 187-188                                    | 0905                 |
| 6. Ponderosa pine/western juniper/sagebrush savanna                                  | T-2,1,3,<br>12                 | Fort Rock or Silver Lake area                                                       | High                  | FS                       | 160-161<br>171-180                         | 1306                 |
| 7. Eastern Columbia Gorge rock fall area with forest complex                         | T-15,7,9,<br>13                | Hood River area. May contain a variety of plants of special interest (table 68)     | Medium                | FS                       | 310-311                                    | 0904                 |
| 8. Entire undisturbed, forested cinder cone, preferably in <i>Abies grandis</i> zone | T-16                           | Graham Butte, west of Sisters                                                       | High                  | FS                       | 193-201                                    | 0905                 |
| 9. Low-elevation, recent lava flow with representative vegetation                    | T-17                           | Lava Butte area                                                                     | Medium                | FS                       |                                            | 0905                 |
| See footnotes at end of table.                                                       |                                |                                                                                     |                       |                          |                                            |                      |

Table 70.--*Additional Research Natural Areas needed in the Eastern Slopes Province, Oregon Cascades* (Continued)

| Ecosystem or community                                                                                                        | Cells represented <sup>1</sup> | Remarks and possible locations                                                                                                                                                                                                                                       | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Predominantly aquatic natural areas:</u>                                                                                   |                                |                                                                                                                                                                                                                                                                      |                       |                          |                                            |                           |
| 10. Subalpine permanent ponds and bog area                                                                                    | <u>A-2,8</u><br>R&E-1          | Just east of Santiam Pass (south of highway) is possible location                                                                                                                                                                                                    | Medium                | FS                       | 108-109                                    | 0901                      |
| 11. Large, upwelling cold spring                                                                                              | <u>A-5</u><br>R&E-1            | Headwaters of the Metolius River                                                                                                                                                                                                                                     | Medium                | FS<br>Private            |                                            | 0905                      |
| 12. Typical hot spring                                                                                                        | <u>A-6</u>                     |                                                                                                                                                                                                                                                                      | High                  | FS<br>Private            |                                            |                           |
| 13. Marshland                                                                                                                 | <u>A-7</u>                     | Enlargement of Pringle Falls RNA will at least partially fill this need                                                                                                                                                                                              | High                  | FS                       |                                            | 0905                      |
| <u>Natural area for protection of vascular plants of special interest:</u>                                                    |                                |                                                                                                                                                                                                                                                                      |                       |                          |                                            |                           |
| 14. An area near the eastern end of the Columbia River Gorge for the protection of vascular plant species of special interest |                                | Private land near Mosier, Oregon. Species to be protected include <i>Lomatium columbianum</i> , <i>L. laevigatum</i> , <i>L. suksdorfii</i> , <i>Dodecatheon poeticum</i> , <i>Penstemon barrettiae</i> , <i>Orobanch uniflora</i> , and <i>Artemisia tridentata</i> | High                  | Private                  |                                            | 0904                      |

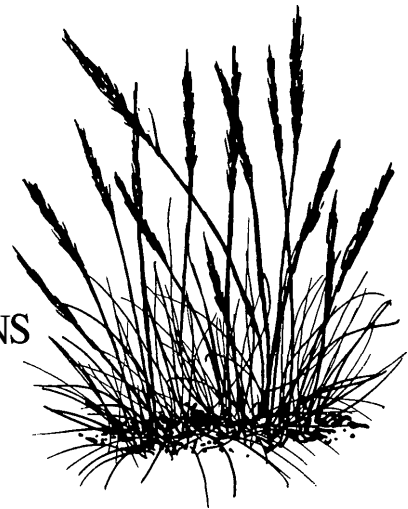
<sup>1</sup>For a description of these cells see table 65 for terrestrial (T) ecosystems, table 66 for aquatic (A) ecosystems, and table 67 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of that type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. FS = Forest Service, NPS = National Park Service.

<sup>4</sup>See appendix V.

## OCHOCO, BLUE, AND WALLOWA MOUNTAINS PROVINCE, NORTHEASTERN OREGON AND SOUTHEASTERN WASHINGTON



This province is made up of three principal mountain ranges separated by faulted valleys and synclinal basins (fig. 1). Relief is highly variable; moderate slopes are common in the Ochoco and Blue Mountains, whereas the heavily glaciated Wallowa Mountains have a much higher proportion of steep slopes. Maximum elevations range from about 2100 m in the Ochocos to 2900 at Eagle Cap in the Wallowas. Valley floor elevations are about 750 m in the Ochocos and 900 m in the broad basin between the Blue and Wallowa Mountains. Spectacular Hells Canyon, 1660 m deep, comprises the eastern boundary of the province.

Geologically, the province is separated into eastern and western units, with the dividing line just east of John Day. The western unit contains some of the oldest rocks in Oregon which include Paleozoic to Jurassic formations of conglomerate, sandstone, siltstone, shale, and limestone. In addition, Columbia River basalt, extruded during the Miocene, occupies large areas within the western Blue Mountains and also extends into the eastern section where it forms the major portion of the northern slopes. The eastern portion of the province was subjected to considerable alpine glaciation during the Pleistocene, as indicated by numerous cirques, glacial lakes, and moraines. Bedrock in the Wallowa Mountains is largely made up of Triassic sedimentary formations (sandstone, siltstone, shale, and limestone) and granitic intrusions.

During the late Pleistocene, much of the area within the central and northern portions of the Blue Mountains was covered by a layer of volcanic ash and fine pumice. Subsequent erosion has largely removed the ash from south-facing slopes; however, other locations are typically mantled by the material. In addition, many upland areas, especially in the eastern portion, are mantled by loess deposits.

Obviously, with such a wide range of parent materials, vegetation, and climate, soils within the province are highly variable and only a few of the major types will be mentioned. Forested soils derived from volcanic ash are poorly developed, generally dark brown in color, and fine sandy loam to silt loam in texture. Forested soils in loess deposits are generally Brown Podzolics, having deep, silt-textured profiles. The most widespread soils supporting grassland and shrub-grassland vegetation are classed as Prairie soils and Chernozems. These vary in texture depending on parent material, but are generally silt loam to clay loam, with fine-textured B horizons.

Since three major mountain blocks and a wide range of elevations are present in this province, there is a relatively large number of ecosystems represented as well as considerable variation in those ecosystems. Mixed-conifer forests (Douglas-fir, grand fir, ponderosa and western white pines, and western larch) dominate the landscape, with ponderosa pine and western juniper communities on more arid habitats and Engelmann spruce-subalpine fir forests on cool, moist subalpine areas. Subalpine and alpine meadow communities occur on the highest ridges and summits, and grassland and sagebrush ecosystems are common at low elevations, particularly in the canyons of the Snake River and its tributaries. Streams, lakes, and ponds of various types are well represented in the province.

Twenty-five terrestrial cells have been identified (table 71). Eleven of these provide for representation of the principal forest ecosystems. The remainder are equally divided between steppe and shrub-steppe ecosystems and mountain meadows of various types.

Nine of the 13 identified aquatic cells (table 72) provide for representation of lakes, ponds, and vernal pools in three elevational zones—montane, subalpine, and alpine. Two stream drainages, one each in subalpine and montane environments, are viewed as essential cells in a natural area system. A marsh and bog complete the list.

It is presumed that areas established for terrestrial and aquatic cells will include the array of plant and animal species typical of those ecosystems. Five vertebrate animal species have been identified which should receive specific consideration in selection of Research Natural Areas because of their rare or endangered status (table 73). There are many vascular plants of special interest including 30 listed as threatened or endangered on the Smithsonian list (table 74). The greatest concentration of these is in the Snake River Canyon. Many of the remaining species occur on subalpine and alpine habitats, particularly in the Wallowa Mountains. Nineteen of the species listed by the Smithsonian Institution are accounted for between the Snake River Canyon and alpine reaches of the Wallowa Mountains.

Four Federal Research Natural Areas have been established within the province (table 75). These provide adequate coverage for 6 of the 43 cells identified for this province; all of the filled cells are terrestrial. Substantial populations of many of the special interest plants are undoubtedly already protected within the Eagle Cap and Strawberry Mountain Wilderness and in other scenic reserves along the Snake River.

There is a need for 18 additional Research Natural Areas for minimal representation of all identified terrestrial, aquatic, and animal cells (table 76). Two of the largest areas should be major stream drainages with associated mixed-conifer forest; three other areas should combine essential terrestrial and aquatic cells. Most of the remaining areas focus on a single terrestrial or aquatic ecosystem or, in a few cases, an intricate mosaic of terrestrial ecosystems. One area is needed in the Snake River Canyon (need No. 14) which incorporates several distinctive communities as well as habitat for a variety of special interest plant species.

The responsibility for establishment of the necessary Research Natural Areas lies almost entirely with the Forest Service (table 76). Bureau of Land Management is lead agency for two aquatic areas, although it is not certain that a lake and a bog suitable for designation as Research Natural Areas exist. Highest priority is given selection of natural areas representing commercial forest types and low elevation aquatic ecosystems.

Table 71.--*Terrestrial cells in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington*

| Cell                                                                      | SAF<br>timber<br>type No. | present<br>representation                                                                                | Page reference<br>(Franklin and<br>Dyrness 1973) |
|---------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Western Juniper Zone:</u>                                              |                           |                                                                                                          |                                                  |
| 1. Western juniper/bluebunch wheatgrass community                         | 238                       | Ochoco Divide and Canyon Creek RNA's                                                                     | 165-167                                          |
| <u>Ponderosa Pine Zone :</u>                                              |                           |                                                                                                          |                                                  |
| * 2. Ponderosa pine/bunchgrass communities in the northern Blue Mountains | 237                       | None                                                                                                     | 171-176                                          |
| * 3. Ponderosa pine/bitterbrush/bunchgrass communities                    | 237                       | None                                                                                                     | 175                                              |
| <u>Douglas-fir Zone:</u>                                                  |                           |                                                                                                          |                                                  |
| 4. Ponderosa pine/pinegrass community                                     | 237                       | Ochoco Divide and Canyon Creek RNA's                                                                     | 175-176<br>191-192                               |
| 5. Douglas-fir-ponderosa pine/pinegrass community                         | 214                       | Ochoco Divide and Canyon Creek RNA's                                                                     | 191-192                                          |
| * 6. Douglas-fir-ponderosa pine/shrub community                           | 214                       | None, proposed Moore Flat RNA may fill need                                                              | 191-192                                          |
| <u>Grand Fir Zone:</u>                                                    |                           |                                                                                                          |                                                  |
| 7. Mixed-conifer forest with western larch dominance                      | 213                       | Rainbow Creek RNA                                                                                        | 195-199                                          |
| 8. Mixed-conifer forest with western white pine dominance                 | 215                       | Rainbow Creek RNA                                                                                        | 195-199                                          |
| * 9. Grand fir/thinleaf huckleberry community                             | 213                       | Some representation on Rainbow Creek and Pataha Bunchgrass RNA's, need additional area                   | 196                                              |
| <u>Subalpine Fir Zone:</u>                                                |                           |                                                                                                          |                                                  |
| *10. Engelmann spruce-subalpine fir forest                                | 206                       | None                                                                                                     | 205-206                                          |
| <u>Steppe communities :</u>                                               |                           |                                                                                                          |                                                  |
| 11. Bluebunch wheatgrass-Sandberg's bluegrass community                   |                           | Rainbow Creek RNA                                                                                        | 226                                              |
| *12. Idaho fescue-bluebunch wheatgrass community                          |                           | Present in Pataha Bunchgrass RNA, need additional area at higher elevations in Blue or Wallowa Mountains | 219-220                                          |

See footnote at end of table.

Table 71.--*Terrestrial cells in the Ochoco, BZue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington (Continued)*

| Cell                                                                                                                                                | SAF<br>timber<br>type No. | Present<br>representation | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|--------------------------------------------------|
| <u>Steppe communities:</u> (Continued)                                                                                                              |                           |                           |                                                  |
| *13. Sandberg's bluegrass-onespike oatgrass community                                                                                               |                           | None                      | 245                                              |
| *14. <i>Sporobolus cryptandrus</i> / <i>Poa sandbergii</i> and <i>Aristida longiseta</i> / <i>Poa sandbergii</i> associations along the Snake River |                           | None                      | 228-229                                          |
| <u>Shrub-steppe communities:</u>                                                                                                                    |                           |                           |                                                  |
| *15. Big sagebrush/bunchgrass community inside forest zone                                                                                          |                           | None.                     | 216-219                                          |
| *16. Low sagebrush/bunchgrass community inside forest zone                                                                                          |                           | None                      | 239-241                                          |
| *17. Rigid sagebrush scabland'                                                                                                                      |                           | None                      | 242                                              |
| <u>Subalpine and alpine meadow communities:</u>                                                                                                     |                           |                           |                                                  |
| *18. Alpine Idaho fescue community                                                                                                                  |                           | None                      |                                                  |
| *19. Green fescue community in the Wallowa Mountains                                                                                                |                           | None                      | 271-272                                          |
| *20. Alpine sagebrush community in the Blue Mountains                                                                                               |                           | None                      |                                                  |
| *21. Black sedge community in the Wallowa Mountains                                                                                                 |                           | None                      | 271-272                                          |
| <u>Special types:</u>                                                                                                                               |                           |                           |                                                  |
| "22. Lodgepole pine/dwarf huckleberry/pinegrass community in the Blue Mountains (with minimal fir regeneration)                                     | 218                       | None                      | 197-198                                          |
| *23. Moist bluegrass meadow in the Blue Mountains                                                                                                   |                           | None                      | 199-200                                          |
| *24. Moist bluegrass meadow in the Wallowa Mountains                                                                                                |                           | None                      | 199-200                                          |
| *25. Typical wet meadow (tufted hairgrass and sedges)                                                                                               |                           | None                      | 199-201                                          |

\*

Cells presently lacking adequate representation.

Table 72.--*Aquatic cells in the Ochoco, Blue, and Willowa Mountains Province, northeastern Oregon and southeastern Washington*

| Cell <sup>1</sup>                                          | Present representation |
|------------------------------------------------------------|------------------------|
| * 1. Low-elevation lake surrounded by mixed-conifer forest | None                   |
| * 2. Typical subalpine lake                                | None                   |
| * 3. Alpine lake                                           | None                   |
| * 4. Permanent ponds at low elevations                     | None                   |
| * 5. Subalpine permanent ponds                             | None                   |
| * 6. Alpine permanent ponds                                | None                   |
| * 7. Vernal ponds at low elevation                         | None                   |
| * 8. Subalpine vernal ponds                                | None                   |
| * 9. Alpine vernal ponds                                   | None                   |
| *10. Large stream drainage in mixed-conifer forest         | None                   |
| *11. Large subalpine stream drainage                       | None                   |
| *12. Marshland                                             | None                   |
| *13. Typical bog                                           | None                   |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\* Cells presently lacking adequate representation.

Table 73.--*Rare and endangered vertebrate animal cells in the Ochoco, Blue, and Wallawa Mountains Province, northeastern Oregon and southeastern Washington*

| Cell                        | Veri f ied<br>representation | Reference                                                                                                    |
|-----------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------|
| <u>Fish:</u>                |                              |                                                                                                              |
| *1. Malheur sculpin         | None                         | Bond 1966                                                                                                    |
| <u>Amphibians:</u>          |                              |                                                                                                              |
| *2. Tailed frog             | None                         | Stebbins 1954<br>Storm 1966                                                                                  |
| <u>Mammals:</u>             |                              |                                                                                                              |
| *3. Malheur or Preble shrew | None                         | Bailey 1936<br>Olterrnan and Verts 1972                                                                      |
| *4. Washington<br>squirrel  | None                         | Bailey 1936<br>Olterman and Verts 1972                                                                       |
| *5. Heather vole            | None                         | Bailey 1936<br>Edwards 1955<br>Johnson 1973<br>Maser and Storm 1970<br>Olterrnan and Verts 1972<br>Shaw 1924 |

\*Cells presently lacking adequate representation.

Table 74.--*Vascular plants of special interest in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington*

| Species <sup>1</sup>                                              | Distribution                                                                     |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <i>Allium madidum</i> <sup>2</sup>                                | Seasonally wet meadows, Blue Mountains                                           |
| <i>Aquilegia flavescens</i>                                       | Alpine meadows, Wallowa Mountains                                                |
| <i>Asplenium viride</i>                                           | Moist cliffs, especially on limestone, Wallowa Mountains                         |
| <i>Astragalus arthurii</i>                                        | Arid slopes, Blue and Wallowa Mountains, Wallowa and Umatilla Counties           |
| <i>Astragalus cusickii</i> var. <i>cusickii</i>                   | Snake River canyon and tributaries from west, Baker and Wallowa Counties         |
| <i>Astragalus robbinsii</i> var. <i>alpiniformis</i> <sup>2</sup> | Alpine stream banks, high peaks of Wallowa Mountains                             |
| <i>Astragalus vallaris</i>                                        | Snake River canyon, Wallowa County                                               |
| <i>Balsamorhiza hirsuta</i>                                       | Dry plains, Union County (Grande Ronde prairie)                                  |
| <i>Botrychium boreale</i>                                         | Deep mossy woods, Wallowa Mountains                                              |
| <i>Botrychium lanceolatum</i>                                     | Alpine slopes, Wallowa Mountains                                                 |
| <i>Botrychium virginianum</i>                                     | Moist rich woods, Wallowa Mountains                                              |
| <i>Calochortus longibarbatulus</i> var. <i>peckii</i>             | Meadows, Ochoco Mountains, Crook County                                          |
| <i>Calochortus nitidus</i>                                        | Open slopes, Blue Mountains                                                      |
| <i>Camassia cusickii</i> <sup>2</sup>                             | Seeps in canyons along Pine Creek, Baker County, to Snake River                  |
| <i>Campanula sacajawana</i> <sup>2</sup>                          | Stony alpine slopes, Wallowa Mountains                                           |
| <i>Carex concinna</i>                                             | Coniferous woods, Hurricane Creek canyon, Wallowa County                         |
| <i>Carex limnophila</i>                                           | Moist places at mid-elevation, Wallowa Mountains                                 |
| <i>Castilleja chrysantha</i> <sup>2</sup>                         | Alpine meadows, Wallowa and Blue Mountains                                       |
| <i>Castilleja fraterna</i> <sup>2</sup>                           | Willow thickets, alpine meadows, Wallowa Mountains                               |
| <i>Castilleja glandulifera</i> <sup>2</sup>                       | Rocky slopes, Blue Mountains                                                     |
| <i>Castilleja oresbia</i> <sup>2</sup>                            | Endemic in Blue Mountains where it is common on stony soils with stiff sagebrush |
| <i>Castilleja ownbeyana</i> <sup>2</sup>                          | Alpine meadows, Wallowa Mountains                                                |
| <i>Castilleja rubida</i>                                          | Alpine summits, Wallowa Mountains                                                |
| <i>Chaenactis cusickii</i>                                        | Sandy hills, Baker and Malheur Counties                                          |
| <i>Cheilanthes feei</i>                                           | Cliff crevices, Snake River canyon                                               |
| <i>Claytonia megarhiza</i> var. <i>bellidifolia</i> <sup>2</sup>  | Talus slopes at high altitude, Blue and Wallowa Mountains                        |
| <i>Corallorhiza trifida</i>                                       | Deep moist woods, Wallowa Mountains                                              |
| <i>Cryptogramma stelleri</i>                                      | Moist shaded cliffs, Wallowa Mountains                                           |
| <i>Draba lemmonii</i> var. <i>cyclomorpha</i> <sup>2</sup>        | High peaks of Wallowa Mountains                                                  |
| <i>Dryas drummondii</i>                                           | Rocky slopes and summits, Wallowa Mountains                                      |
| <i>Dryas octopetala</i> var. <i>hookeriana</i>                    | Alpine peaks, Wallowa Mountains                                                  |
| <i>Dryopteris filix-mas</i>                                       | Moist woods, northeastern Oregon                                                 |
| <i>Erigeron disparipilus</i>                                      | Snake River canyon                                                               |
| <i>Eriogonum scopulorum</i>                                       | High ridges, Wallowa Mountains                                                   |
| <i>Eritrichium nanum</i>                                          | High rocky slopes, Wallowa Mountains                                             |

See footnotes at end of table.

Table 74.--*Vascular plants of special interest in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington* (Continued)

| Species <sup>1</sup>                                           | Distribution                                                                |
|----------------------------------------------------------------|-----------------------------------------------------------------------------|
| <i>Geum gracilipes</i>                                         | Moist cliff, head of Anthony Creek, Baker County                            |
| <i>Habenaria obtusata</i>                                      | Open woods, Hurricane Creek canyon, Wallowa County                          |
| <i>Hackelia hispida</i> <sup>2</sup>                           | Cliffs and talus slopes, Snake River canyon                                 |
| <i>Haplopappus radiatus</i> <sup>2</sup>                       | Dry hillsides in and near Snake River canyon                                |
| <i>Hedysarum boreale</i> var. <i>boreale</i>                   | Wallowa Mountains                                                           |
| <i>Heuchera grossulariifolia</i> var. <i>grossulariifolia</i>  | Cliffs, Baker and Wallowa Counties                                          |
| <i>Hulsea algida</i>                                           | Talus slopes, especially in granitic sand, Wallowa Mountains                |
| <i>Kobresia bellardii</i>                                      | Alpine ridges, Wallowa Mountains                                            |
| <i>Kobresia simpliciuscula</i>                                 | Banks of Hurricane Creek, Wallowa County                                    |
| <i>Leptodactylon hazelae</i> <sup>2</sup>                      | Dry rocky slopes of Hells Canyon, Snake River                               |
| <i>Lesquerella sherwoodii</i>                                  | High slopes of Wallowa Mountains                                            |
| <i>Lewisia columbiana</i> var. <i>wallowensis</i> <sup>2</sup> | Rocky slopes, Wallowa Mountains                                             |
| <i>Lomatium cusickii</i>                                       | Alpine ridges, Wallowa Mountains                                            |
| <i>Lomatium greenmanii</i> <sup>2</sup>                        | Rocky ridges, head of Keystone Creek, Wallowa Mountains                     |
| <i>Lomatium oreganum</i> <sup>2</sup>                          | Rocky ridges, Blue and Wallowa Mountains                                    |
| <i>Lomatium rollinsii</i> <sup>2</sup>                         | Open slopes, Snake River canyon, Wallowa County                             |
| <i>Lomatium salmoniflorum</i>                                  | Basaltic slopes, Snake River canyon, Wallowa County                         |
| <i>Lomatium serpentinum</i> <sup>2</sup>                       | Dry rocky slopes, Snake River canyon                                        |
| <i>Lomatium watsonii</i>                                       | Dry slopes, Blue Mountains (also Jefferson and Wasco Counties)              |
| <i>Lupinus sabinii</i> <sup>2</sup>                            | Endemic in Blue Mountains at high elevation but locally common there        |
| <i>Mimulus clivicola</i>                                       | South end of Snake River canyon                                             |
| <i>Mirabilis macfarlanei</i> <sup>2</sup>                      | Slope of Snake River canyon, Wallowa County                                 |
| <i>Nemophila kirtleyi</i>                                      | Shady banks, Snake River canyon and tributaries, Wallowa and Baker Counties |
| <i>Oryzopsis hendersonii</i>                                   | Sagebrush, Ochoco National Forest, Jefferson County                         |
| <i>Pedicularis bracteosa</i> var. <i>pachyrhiza</i>            | Coniferous forest, Blue and Wallowa Mountains                               |
| <i>Pediocactus simpsonii</i> var. <i>robustior</i>             | Arid areas, Wallowa County                                                  |
| <i>Pellaea breweri</i>                                         | Open granite slopes, Wallowa Mountains                                      |
| <i>Pellaea bridgesii</i>                                       | Granite slopes at high altitude, Wallowa Mountains                          |
| <i>Penstemon elegantulus</i> <sup>2</sup>                      | Grassland overlooking Snake River canyon, Wallowa County                    |
| <i>Penstemon fruticosus</i> var. <i>serratus</i>               | Mountains east of Imnaha River, Wallowa County                              |
| <i>Penstemon payettensis</i>                                   | Open slopes in well-drained soil, Wallowa Mountains                         |
| <i>penstemon spathulatus</i> <sup>2</sup>                      | High rocky slopes, Wallowa Mountains                                        |
| <i>Penstemon triphyllus</i>                                    | Dry hills, Snake River and tributaries, Baker and Wallowa Counties          |

See footnotes at end of table.

Table 74.--*Vascular plants of special interest in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington (Continued)*

| Species <sup>1</sup>                                        | Distribution                                                        |
|-------------------------------------------------------------|---------------------------------------------------------------------|
| <i>Phacelia minutissima</i>                                 | Damp ground at mid-elevation, Wallowa Mountains                     |
| <i>Phlox colubrina</i>                                      | Rocky banks, Snake River and lower Imnaha River canyons             |
| <i>Pinus flexilis</i>                                       | High slopes, Wallowa Mountains                                      |
| <i>Pleuropogon oregonus</i>                                 | Blue Mountains                                                      |
| <i>Polystichum kruckebergii</i> <sup>2</sup>                | Rocky open slopes, Wallowa Mountains and Snake River canyon         |
| <i>Primula cusickiana</i> <sup>2</sup>                      | Rocky slopes, Wallowa Mountains                                     |
| <i>Ranunculus oresterus</i>                                 | Swales, Blue Mountains, eastern Grant and Union Counties            |
| <i>Ribes cereum</i> var. <i>colubrinum</i>                  | Snake River canyon, Wallowa County                                  |
| <i>Ribes irriguum</i>                                       | Streambanks in Blue Mountains, northeastern Oregon                  |
| <i>Rubus bartonianus</i> <sup>2</sup>                       | Rocky slopes, Snake River canyon, Wallowa County                    |
| <i>Salix arctica</i>                                        | Alpine summits, Wallowa Mountains                                   |
| <i>Salix brachycarpa</i>                                    | Moist places at high altitude, Wallowa Mountains                    |
| <i>Salix drummondiana</i>                                   | Stream banks and meadows, Wallowa Mountains (and Steens Mountains)  |
| <i>Salix vestita</i>                                        | High peaks, Wallowa Mountains                                       |
| <i>Salix wolfii</i> var. <i>idahoensis</i>                  | Stream banks and moist ground, high altitude in Wallowa Mountains   |
| <i>Saxifraga adscendens</i>                                 | High alpine meadows, Wallowa Mountains                              |
| <i>Saxifraga oppositifolia</i>                              | Alpine scree, Wallowa Mountains                                     |
| <i>Selaginella watsonii</i>                                 | Exposed rocky sites, Wallowa Mountains                              |
| <i>Senecio porteri</i> <sup>2</sup>                         | Open rocky peaks, Wallowa Mountains                                 |
| <i>Silene spaldingii</i> <sup>2</sup>                       | Sagebrush and pine forest, Wallowa and Union Counties               |
| <i>Smelowskia calycina</i>                                  | Alpine slopes in Wallowa Mountains                                  |
| <i>Thalictrum alpinum</i> var. <i>hebetum</i>               | Alpine meadows, Wallowa Mountains                                   |
| <i>Thelypodium eucosmum</i> <sup>2</sup>                    | Lower canyons, Blue Mountains of Grant, Baker, and Wheeler Counties |
| <i>Tonella floribunda</i>                                   | Snake River canyon and Pine Creek, Wallowa and Baker Counties       |
| <i>Townsendia parryi</i>                                    | Subalpine ridges of Wallowa Mountains                               |
| <i>Trifolium plumosum</i> var. <i>plumosum</i> <sup>2</sup> | Endemic in Blue Mountains but common there                          |
| <i>Viola adunca</i> var. <i>bellidifolia</i>                | Wet meadows, Wallowa (and Cascade) Mountains                        |
| <i>Viola canadensis</i> var. <i>rugulosa</i>                | Woods of Imnaha and Snake River canyons                             |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 75.--*Established Research Natural Areas in the Ochoco, Blue, and  
Wallowa Mountains Province, northeastern Oregon and  
southeastern Washington*

| Name                       | Principal features                                                                              | Agency <sup>1</sup> | Area |       |
|----------------------------|-------------------------------------------------------------------------------------------------|---------------------|------|-------|
|                            |                                                                                                 |                     | Ha   | Acres |
| Canyon Creek<br>RNA        | Interior ponderosa pine<br>forest (Washington)                                                  | FS                  | 283  | 700   |
| Ochoco Divide<br>RNA       | Ponderosa pine-Douglas-<br>fir and grand fir-<br>western larch-Douglas-<br>fir forests (Oregon) | FS                  | 777  | 1,920 |
| Pataha Bunch-<br>grass RNA | Bluebunch wheatgrass<br>stands (Washington)                                                     | FS                  | 21   | 51    |
| Rainbow Creek<br>RNA       | Interior mixed conifer<br>forest with abundant<br>western white pine<br>(Oregon)                | FS                  | 170  | 420   |

<sup>1</sup>FS = Forest Service.

Table 76.--*Additional Research Natural Areas needed in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington*

| Ecosystem or community                                                                                            | Cells represented <sup>1</sup>                        | Remarks and possible locations                                                                                                        | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                            |                                                       |                                                                                                                                       |                       |                          |                                            |                           |
| 1. Mixed-conifer forest and major stream drainage extending from moderate elevations into the subalpine           | T-10,22,25<br>2,3,4,5,<br>6,7,8<br>A-11,12<br>R&E-2,3 | Ideally should have a range 2,000 to 6,000 feet in elevation. Possibly could enlarge Rainbow Creek RNA sufficiently to fill this need | Medium                | FS                       | 190-196<br>204-206                         | 1201                      |
| 2. Juniper, pine, mixed conifer, and meadow vegetation with large stream drainage                                 | T-1,2,3,4,<br>5,7,17,25<br>A-10<br>R&E-1              | Headwaters area of Silver Creek, Snow Mountain District, Ochoco National Forest                                                       | Medium                | FS                       | 165-167<br>171-180<br>195-201              | 1204<br>1208              |
| 3. Grand fir/thinleaf huckleberry community and marsh area                                                        | T-9,10,22,<br>25<br>A-12                              | Central Blue Mountains                                                                                                                | High                  | FS                       | 195-196                                    | 1204<br>1206              |
| 4. Green fescue, alpine sagebrush, and black sedge communities with headwaters of stream in the Wallowa Mountains | T-19,20,21<br>10<br>A-11<br>R&E-2                     | Hurricane Creek in Eagle Cap Wilderness Area. Should contain several plant species of special interest (table 74)                     | Medium                | FS                       | 207-208<br>271-272                         | 1701                      |
| 5. Mixed-conifer forest with lake and/or permanent pond                                                           | T-6,7,8,<br>9,25<br>A-2,5,8<br>i2-                    | Possibly in Strawberry Mountain or Eagle Cap Wilderness Area                                                                          | LOW                   | FS                       | 190-196<br>204-206                         | 1205<br>1701              |
| <u>Predominantly terrestrial natural areas:</u>                                                                   |                                                       |                                                                                                                                       |                       |                          |                                            |                           |
| 6. Ponderosa pine/bunchgrass communities                                                                          | T-2,4,5,<br>12,13                                     | Starkey Experimental Range is possible location                                                                                       | High                  | FS                       | 171-176                                    | 1206                      |

See footnotes at end of table.

Table 76.--*Additional Research Natural Areas needed in the Ochoco, Blue, and Wallowa Mountains Province, northeastern Oregon and southeastern Washington* (Continued)

| Ecosystem or community                                                                                                        | Cells represented <sup>1</sup>      | Remarks and possible locations                                                                                   | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 7. Ponderosa pine/<br>bitterbrush/bunchgrass,<br>big sagebrush/<br>bunchgrass, and low<br>sagebrush/bunchgrass<br>communities | T- <u>3,15,16</u>                   | Southern Blue Mountains                                                                                          | High                  | FS                       | 171-180<br>183-184                         | 1206<br>1208              |
| 8. Alpine Idaho fescue<br>community                                                                                           | T- <u>18,20,9,</u><br><u>10,22</u>  | Malheur National<br>Forest-Field Creek,<br>Brady Mountains.<br>Also in Strawberry<br>Mountain Wilderness<br>Area | Low                   | FS                       |                                            | 1205                      |
| 9. Moist bluegrass meadow<br>in Blue Mountains                                                                                | T- <u>23,4,5,</u><br><u>9</u>       |                                                                                                                  | Medium                | FS                       | 199-200                                    | 1206<br>1208              |
| 10. Moist bluegrass meadow<br>in Wallowa Mountains                                                                            | T- <u>24,4,5,</u><br><u>9</u>       |                                                                                                                  | Medium                | FS                       | 199-200                                    | 1702<br>1703              |
| 11. Idaho fescue/bluebunch<br>wheatgrass community                                                                            | T- <u>12,2</u>                      | Blue or Wallowa<br>Mountains. Should<br>be at higher elevation<br>than Patoka Bunchgrass<br>RNA                  | Medium                | FS                       | 244                                        | 1203<br>1703              |
| 12. Sandberg's bluegrass-<br>onespike oatgrass<br>community                                                                   | T- <u>13,2,4,</u><br><u>5,12</u>    | Starkey Experimental<br>Range is possible<br>location                                                            | Medium                | FS                       | 245                                        | 1206                      |
| 13. Rigid sagebrush<br>scabland                                                                                               | T- <u>17,3,4,</u><br><u>5,15,16</u> | Southern Blue<br>Mountains (Ochoco<br>or Malheur National<br>Forest)                                             | Medium                | FS                       | 242                                        | 1208                      |

See footnotes at end of table.

Table 76.--*Additional Research Natural Areas needed in the Ochoco, BZue, and Wallawa Mountains Province, northeastern Oregon and southeastern Washington* (Continued)

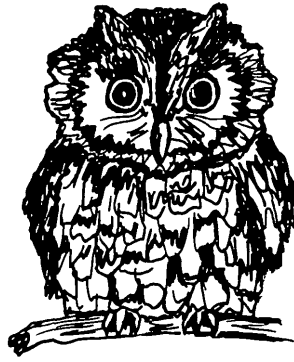
| Ecosystem or community                                                                                                                               | Cells represented <sup>1</sup>                                  | Remarks and possible locations                                                                                                                            | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 14. <i>Sporobolus cryptandrus</i> /<br><i>Poa sandbergii</i> and <i>Aristida longiseta</i> / <i>P. sandbergii</i> associations along the Snake River | <u>T-14</u> , <u>2</u> , <u>15</u><br><u>R&amp;E-4</u>          | Southern Snake River Canyon--should have elevational range of 800 to 3,000 feet. Should contain a variety of plant species of special interest (table 74) | Medium                | FS                       | 228-229                                    | 1211                      |
| <u>Predominantly aquatic natural areas:</u>                                                                                                          |                                                                 |                                                                                                                                                           |                       |                          |                                            |                           |
| 15. Low-elevation lake and ponds                                                                                                                     | <u>A-1</u> , <u>4</u> , <u>7</u>                                | May be difficult to find                                                                                                                                  | High                  | BLM                      |                                            | 1201<br>1208              |
| 16. Alpine lake and ponds                                                                                                                            | <u>A-3</u> , <u>6</u> , <u>9</u><br><u>R&amp;E-2</u> , <u>5</u> | Eagle Cap Wilderness Area                                                                                                                                 | Medium                | FS                       |                                            | 1701                      |
| 17. Typical bog area                                                                                                                                 | <u>A-13</u>                                                     | May not be available                                                                                                                                      | High                  | BLM<br>FS                |                                            |                           |
| 18. Tule marsh                                                                                                                                       | <u>A-12</u>                                                     | Suitable area may occur in Ladd Marsh refuge                                                                                                              | High                  | OSFWC                    |                                            | 1201                      |

<sup>1</sup>For a description of these cells see table 71 for terrestrial (T) ecosystems, table 72 for aquatic (A) ecosystems, and table 73 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate cells considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of that type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FS = Forest Service, OSFWC = Oregon State Fish and Wildlife Commission.

<sup>4</sup>See appendix V.



## BASIN AND RANGE PROVINCE, EASTERN OREGON

The Basin and Range Province (fig. 1) is characterized by a series of fault-block mountains enclosing basins with internal drainage. Elevations range from about 1200 m to 2930 m atop Steens Mountain. Except for the precipitous fault scarps (e.g., Winter Rim and Abert Rim), much of the area is gently rolling with low relief. Since annual precipitation in the area averages only 180 to 300 mm, most streams are intermittent, and numerous undrained basins contain shallow, saline lakes.

Virtually all of the rocks which outcrop in the province date from Miocene to Recent epochs. Most of the rock types present are igneous, with basalt and andesite being the most common. Other rocks of more minor occurrence include rhyolite, dacite, tuffs, and tuffaceous sedimentaries. Evidences of glaciation are confined to Steens Mountain where most channels are glacially carved and contain cirques at their head.

Soils developed on basic igneous rocks under grass-shrub vegetation commonly have a very stony loam surface horizon underlain by a clay or stony loam subsoil. In some locations these soils have a silica-cemented hardpan at depths of 2 to 5 dm.

Shrub-steppe ecosystems dominated by various species of sagebrush and bunchgrasses are most characteristic (Franklin and Dyrness 1973). Desert or salt desert shrub communities of shadscale, salt sage, greasewood, and similar species occupy low-lying areas with saline or alkali soils. Western juniper, mountain mahogany, and along the province's western margin, ponderosa pine typify savanna ecosystems which are present. Steens Mountain adds substantial biotic diversity to the province; alpine ecosystems are found on the summit; and a variety of ecosystems, notably quaking aspen and western juniper woodlands, clothe much of the slopes. Permanent and vernal ponds and lakes of varying salinity are the most characteristic aquatic ecosystems.

Of the 19 terrestrial cells identified (table 77), over half provide for representation of the distinctive sagebrush and desert shrub ecosystems. Five major savanna communities and several ecosystems confined to Steens Mountain are also listed.

Of the 14 aquatic cells, 9 identify ponds and lakes in a variety of environments (desert to subalpine) and include both fresh and saline types (table 78). One stream ecosystem on Steens Mountain and a tule marsh on the western edge of the province are also considered essential elements.

Areas to be established for terrestrial and aquatic cells are expected to include the array of plant and animal species typical of these ecosystems. Ten vertebrate animal species are recognized specifically as cells because of their rare or endangered status (table 79); 3 of these are fish. Vascular plants of special interest include eight from the Smithsonian list of threatened and endangered plants (table 80); several of these are on Steens Mountain.

There are no established Research Natural Areas in the Basin and Range Province, although several are being considered on Steens Mountain. At least 10 areas will be required to provide minimal representation of the 43 identified terrestrial, aquatic, and animal cells (table 81). Several of the proposed Research Natural Areas (see Nos. 1, 2, 4, and 5) incorporate five to seven cells and, unless the selected areas are very large, inclusion of this many elements may not be possible. Consequently, more natural areas may actually prove necessary. In any case, most of the Research Natural Areas will include ecosystem mosaics in mountain and basin habitats.

The Bureau of Land Management is expected to carry most of the lead responsibility in this province with some contribution from Fish and Wildlife Service, State agencies, and the private sector (table 81).

Table 77.--*Terrestrial cells in the Basin and Range Province, eastern Oregon*

| Cell                                                                                                                                                                                                                                                                                                                                | SAF<br>timber<br>type No. | Present<br>representation | Page reference<br>(Franklin and<br>Dyrness 1973) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|--------------------------------------------------|
| <u>Ponderosa pine and western juniper communities:</u>                                                                                                                                                                                                                                                                              |                           |                           |                                                  |
| * 1. Ponderosa pine/bitterbrush/Idaho fescue savanna                                                                                                                                                                                                                                                                                | 237                       | None                      | 176-180                                          |
| * 2. Western juniper/big sagebrush/bluebunch wheatgrass community                                                                                                                                                                                                                                                                   | 238                       | None                      | 165-167                                          |
| * 3. Western juniper/big sagebrush-bitterbrush community                                                                                                                                                                                                                                                                            | 238                       | None                      | 165-167                                          |
| * 4. Western juniper/bluebunch wheatgrass community                                                                                                                                                                                                                                                                                 | 238                       | None                      | 165-167                                          |
| <u>Sagebrush communities:</u>                                                                                                                                                                                                                                                                                                       |                           |                           |                                                  |
| * 5. <i>Artemisia tridentata</i> / <i>Agropyron spicatum</i> community                                                                                                                                                                                                                                                              |                           | None                      | 236-237                                          |
| * 6. <i>Artemisia tridentata</i> / <i>Festuca idahoensis</i> community                                                                                                                                                                                                                                                              |                           | None                      | 238                                              |
| * 7. <i>Artemisia arbuscula</i> / <i>Agropyron spicatum</i> community                                                                                                                                                                                                                                                               |                           | None                      | 239-241                                          |
| * 8. <i>Artemisia arbuscula</i> / <i>Festuca idahoensis</i> community                                                                                                                                                                                                                                                               |                           | None                      | 239-241                                          |
| * 9. <i>Artemisia cana</i> community                                                                                                                                                                                                                                                                                                |                           | None                      | 242                                              |
| *10. <i>Artemisia arbuscula</i> / <i>Danthonia unispicata</i> / <i>Koeleria cristata</i> communities in Silver Lake area                                                                                                                                                                                                            |                           | None                      | 239-241                                          |
| *11. Big sagebrush-bitterbrush/Idaho fescue community                                                                                                                                                                                                                                                                               |                           | None                      | 238-239                                          |
| <u>Desert or salt desert shrub communities:</u>                                                                                                                                                                                                                                                                                     |                           |                           |                                                  |
| *12. Salt desert shrub, desert shrub shade-scale, salt sage, greasewood communities, with full range of shrub and shrub/grass communities on saline and alkali soils (dominants are <i>Atriplex confertifolia</i> , <i>A. nuttallii</i> , <i>Sarcobatus</i> , <i>Distichlis</i> , <i>Elymus</i> , and <i>Artemisia spinescens</i> ) |                           | None                      | 245                                              |
| *13. <i>Grayia spinosa</i> community                                                                                                                                                                                                                                                                                                |                           | None                      | 245                                              |
| *14. <i>Eurotia lanata</i> community                                                                                                                                                                                                                                                                                                |                           | None                      | 245                                              |
| <u>Other shrub communities:</u>                                                                                                                                                                                                                                                                                                     |                           |                           |                                                  |
| *15. <i>Cercocarpus</i> (mountain mahogany) community                                                                                                                                                                                                                                                                               |                           | None                      | 243-244                                          |
| *16. Bitterbrush/bunchgrass community                                                                                                                                                                                                                                                                                               |                           | None                      | 244                                              |
| <u>Special types:</u>                                                                                                                                                                                                                                                                                                               |                           |                           |                                                  |
| *17. Aspen type on Steens Mountain                                                                                                                                                                                                                                                                                                  | 217                       | None                      | 245-246                                          |
| *18. Alpine communities on Steens Mountain                                                                                                                                                                                                                                                                                          |                           | None                      |                                                  |
| *19. Outlying stand of white fir, Steens Mountain                                                                                                                                                                                                                                                                                   |                           | None                      |                                                  |

"Cells presently lacking adequate representation.

Table 78.--*Aquatic cells in the Basin and Range Province, eastern Oregon*

| Cell <sup>1</sup>                                               | Present<br>representation |
|-----------------------------------------------------------------|---------------------------|
| * 1. Low-elevation saline lake in a desert setting              | None                      |
| * 2. Low-elevation playa lake                                   | None                      |
| * 3. Low-elevation freshwater lake                              | None                      |
| * 4. Subalpine lake in the Steens Mountain area                 | None                      |
| * 5. Low-elevation, permanent saline ponds                      | None                      |
| * 6. Low-elevation, permanent freshwater ponds                  | None                      |
| * 7. Subalpine permanent ponds in the Steens Mountain area      | None                      |
| * 8. Typical vernal pond or marsh area adjacent to a playa lake | None                      |
| * 9. Typical subalpine vernal pond                              | None                      |
| *10. Subalpine stream drainage in the Steens Mountain area      | None                      |
| *11. Tule marsh in the western portion of the province          | None                      |
| *12. Typical low-elevation stream drainage                      | None                      |
| *13. Typical hot springs                                        | None                      |
| *14. Typical cold springs                                       | None                      |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

"Cells presently lacking adequate representation.

Table 79.--*Rare and endangered vertebrate animal cells in the Basin and Range Province, eastern Oregon*

| Cell                           | Verified<br>representation | Reference                                                                                                                                                          |
|--------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Fish:</u>                   |                            |                                                                                                                                                                    |
| * 1. California roach          | None                       | Bond <b>1966</b>                                                                                                                                                   |
| * 2. Lahontan redbside         | None                       | Bond <b>1966</b>                                                                                                                                                   |
| * 3. Tahoe sucker              | None                       | Bond <b>1966</b>                                                                                                                                                   |
| <u>Birds :</u>                 |                            |                                                                                                                                                                    |
| * 4. Western burrowing owl     | None                       | Gabrielson and Jewett <b>1940</b>                                                                                                                                  |
| <u>Mammals :</u>               |                            |                                                                                                                                                                    |
| * 5. Malheur or Preble shrew   | None                       | Bailey <b>1936</b><br>Hansen <b>1956</b><br>Olternan and Verts <b>1972</b>                                                                                         |
| * 6. Merriam shrew             | None                       | Bailey <b>1936</b><br>Hansen <b>1956</b><br>Johnson and Clanton <b>1954</b><br>Olternan and Verts <b>1972</b>                                                      |
| * 7. Pygmy rabbit              | None                       | Bailey <b>1936</b><br>Hansen <b>1956</b><br>Olternan and Verts <b>1972</b>                                                                                         |
| * 8. White-tailed jack rabbit  | None                       | Bailey <b>1936</b><br>Hansen <b>1956</b><br>Olternan and Verts <b>1972</b>                                                                                         |
| * 9. Northern grasshopper muse | None                       | Bailey <b>1936</b><br>Hansen <b>1956</b>                                                                                                                           |
| *10. Sagebrush vole            | None                       | Bailey <b>1936</b><br>Clanton et al. <b>1971</b><br>Hansen <b>1956</b><br>Johnson et al. <b>1948</b><br>Maser et al. <b>1974</b><br>Olterman and Verts <b>1972</b> |

\*Cells presently lacking adequate representation.

Table 80.--*Vascular plants of special interest in the Basin and Range Province, eastern Oregon*

| Species <sup>1</sup>                                              | Distribution                                                                                      |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <i>Aquastache cusickii</i>                                        | Known only from Steens Mountain, Harney County                                                    |
| <i>Allium 'punctum</i>                                            | Stony flats along Blitzen River, Harney County                                                    |
| <i>Astragalus alvordensis</i> <sup>2</sup>                        | Sandy plains and hills, southern Harney and Malheur Counties (Alvord Valley)                      |
| <i>Castilleja steensensis</i> <sup>2</sup>                        | Steens Mountain, Harney County                                                                    |
| <i>Cirsium peckii</i>                                             | Streambanks, eastern slopes of Steens and Pueblo Mountains, Harney County                         |
| <i>Claytonia nevadensis</i>                                       | Steens Mountain, Harney County                                                                    |
| <i>Claytonia umbellata</i>                                        | Steens Mountain, Harney County                                                                    |
| <i>Cymopterus bipinnatus</i>                                      | Dry slopes, Steens Mountain, Harney County                                                        |
| <i>Draba sphaeroides</i> var. <i>cusickii</i> <sup>2</sup>        | Steens Mountain                                                                                   |
| <i>Ephedra nevadensis</i>                                         | Open gravelly flats, Pueblo Mountains; near Oregon-Nevada border                                  |
| <i>Ephedra viridis</i>                                            | Dry ridges, southern Harney County near Nevada border                                             |
| <i>Eriogonum chrysops</i> <sup>2</sup>                            | Alpine slopes, Steens Mountain, Harney County                                                     |
| <i>Eriogonum cusickii</i> <sup>2</sup>                            | Rocky sagebrush areas                                                                             |
| <i>Eriogonum umbellatum</i> var. <i>hausknechtii</i> <sup>2</sup> | Steens Mountain                                                                                   |
| <i>Lupinus biddlei</i> <sup>2</sup>                               | Dry plains, southern Harney and Malheur Counties                                                  |
| <i>Pleuropogon oreanus</i>                                        | Swampy ground, Lake and Union Counties                                                            |
| <i>Potamogeton diversifolius</i>                                  | Ponds, Steens Mountain, Harney County                                                             |
| <i>Ranunculus andersonii</i>                                      | Sagebrush desert and ponderosa pine forest; southern Lake County and southern Malheur County      |
| <i>Rhysopterus plurijugus</i> <sup>2</sup>                        | On diatomite, Malheur, Harney, and eastern Lake Counties                                          |
| <i>Salix drummondiana</i>                                         | Streambanks and most meadows in mountains; Steens Mountain, Harney County (and Wallowa Mountains) |
| <i>Sedum debile</i>                                               | Rocky ledges to alpine talus slopes; Steens Mountain                                              |
| <i>Senecio werneriaefolius</i>                                    | Steens Mountain, Harney County at high elevation                                                  |
| <i>Thelypodium brachycarpum</i> <sup>2</sup>                      | Low, chiefly alkaline areas, southeast Oregon                                                     |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (In the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 81.--*Research Natural Areas needed in the Basin and Range Province, eastern Oregon*

| Ecosystem or community                                                                                                                                                                                                                | Cells represented <sup>1</sup>                       | Remarks and possible locations                                                                                                                                | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub- <sup>4</sup> province |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|----------------------------|
| <u>Combined terrestrial and aquatic natural areas:</u>                                                                                                                                                                                |                                                      |                                                                                                                                                               |                       |                          |                                            |                            |
| 1. Large area on Steens Mountain. To include juniper/sage, juniper/bluebunch wheatgrass, aspen, alpine communities, a large stream drainage, and ponds (also lake, if available)                                                      | T-2,4,17,<br>18-<br>A-7,9,10<br>4<br>R&E-1,2,3,<br>5 | 3-Mile Creek or Trout Creek drainages. Elevation range should be from 6,000 to 8,000 feet. May also include some plant species of special interest (table 80) | Medium                | BLM<br>State             | 165-167<br>246<br>249<br>271-272           | 1501<br>1505               |
| 2. A variety of big sagebrush and low sagebrush communities plus a small freshwater lake                                                                                                                                              | T-5,6,7,<br>8,9<br>A-3<br>R&E-1,2,3                  | Warner Valley area                                                                                                                                            | Medium                | BLM<br>FWS               | 234-242                                    | 1506<br>1507               |
| 3. Playa lake, vernal pond, or marsh, with <i>Artemisia cana</i> community                                                                                                                                                            | T-9,12,13<br>14<br>A-2,8                             |                                                                                                                                                               | Medium                | BLM<br>State<br>FWS      | 234<br>242                                 | 1502                       |
| 4. Saline lake and ponds; salt desert shrub, desert shrub, shadscale, salt sage, and greasewood communities; <i>Grayia spinosa</i> community; and <i>Eurotia lanata</i> community                                                     | T-12,13,14<br>A-1,5<br>R&E-6                         | Borax Lake in the Alvord Desert and surrounding area                                                                                                          | Medium                | BLM<br>Private           | 245                                        | 1502<br>1506               |
| <u>Predominantly terrestrial natural areas:</u>                                                                                                                                                                                       |                                                      |                                                                                                                                                               |                       |                          |                                            |                            |
| 5. Big sagebrush/bitterbrush/Idaho fescue community interspersed with areas of ponderosa pine/bitterbrush/Idaho fescue savanna. Also should include at least small areas of mountain mahogany, low sagebrush, and juniper communities | T-1,3,10<br>11,15,16<br>7,8<br>R&E-6,7,8<br>9,10     | Located from Silver Lake area southward                                                                                                                       | High                  | BLM<br>FS<br>Private     | 176-179<br>238-244                         | 1507<br>1508               |

See footnotes at end of table.

Table 81.--*Research Natural* Areas needed in the *Basin and Range Province*, eastern Oregon (Continued)

| Ecosystem or community                      | Cells represented <sup>1</sup> | Remarks and possible locations                        | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|---------------------------------------------|--------------------------------|-------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| 6. Outlying stand of white fir              | <u>T-19</u>                    | Steens Mountain                                       | Medium                | Private<br>BLM           |                                            | 1501                      |
| <u>Predominantly aquatic natural areas:</u> |                                |                                                       |                       |                          |                                            |                           |
| 7. Tule marsh area                          | <u>A-11</u>                    | Klamath Marsh or Sycan Marsh are possible locations   | High                  | Private<br>FWS<br>State  |                                            | 1405                      |
| 8. Low-elevation stream drainage            | <u>A-12</u>                    | Silver Creek (may be difficult to find suitable area) | High                  | Private<br>FWS           |                                            | 1507<br>1508              |
| 9. Hot springs                              | <u>A-13</u>                    | Alvord Desert                                         | High                  | BLM<br>Private           |                                            | 1502                      |
| 10. Cold springs                            | <u>A-14</u>                    | Fosket Spring                                         | High                  | BLM<br>Private           |                                            | 1502<br>1506              |

<sup>1</sup>For a description of these cells see table 77 for terrestrial (T) ecosystems, table 78 for aquatic (A) ecosystems, and table 79 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate those cells which are considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential components.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of the type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FS = Forest Service, FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.

## HIGH LAVA PLAINS AND COLUMBIA BASIN PROVINCE, EASTERN OREGON



This province is made up of two distinct areas — that portion of the Columbia Basin which is located in Oregon and the High Lava Plains which occupy much of central Oregon (fig. 1). The High Lava Plains are characterized by young lava flows of moderate relief interrupted by scattered cinder cones and basaltic buttes. As a result of porous bedrock and scanty rainfall, many streams are seasonal. Undrained basins containing playa lakes, some dry and others with fluctuating levels, are common. Most of the area has a base elevation of about 1200 m above sea level.

Geologic formations in the High Lava Plains consist largely of Pliocene and Pleistocene lavas, tuffs, and alluvium. In many areas, Quarternary valley fill deposits overlie the older volcanic flows. These are comprised of alluvium, lake deposits, and eolian sediments, all derived from volcanic rocks of the uplands. The most common soil types are derived from basalt or tuff and commonly have very stony loam textures. In some locations these soils have a silica-cemented hardpan at a depth of approximately one-half m. In the eastern section, Solonetz soils have formed in lacustrine deposits in old lakebeds. These are deep, silty soils with a subsurface horizon of clay and sodium accumulation.

The major portion of the Columbia Basin section in Oregon is underlain by Columbia River basalt of Miocene age. Loess deposits cover the basalt near Moro and in Grass Valley. In addition, a large area near Boardman is mantled by unconsolidated sand of apparently Pleistocene age. For the most part, slopes are moderate with the exception of isolated basaltic buttes or canyons cut by major rivers (e.g., the Deschutes River canyon). Elevations range from about 150 m, adjacent to the Columbia River, to 600 m. Lithosols (shallow, stony, and very poorly developed) and Brown soils are probably the most common soil types in the Oregon Columbia Basin. The Brown soils tend to be minimally developed and are characteristically loam textured.

Steppe and shrub-steppe ecosystems of bunchgrasses and sagebrush cover most of the area (Franklin and Dyrness 1973). In many areas western juniper is present, forming a savanna. Variability in ecosystems is associated mainly with shifts in the composition and structure of the savanna, steppe, and shrub-steppe communities; these shifts are, in large measure, responses to variations in soil characteristics. Some diversity in terrestrial ecosystems is provided by playa and sand dune habitats. Aquatic ecosystems are not abundant and consist mainly of springs, ponds, and marshes; as mentioned earlier many streams are intermittent.

Of the 19 terrestrial cells identified in this province (table 82), 6 provide for representation of western juniper savanna, each representing a distinctive ecosystem, and 5 are for sagebrush-dominated ecosystems ranging from rigid sagebrush on scablands to big sagebrush/bunchgrass types. Grassland ecosystems are identified by four cells, and dune-based ecosystems complete the list.

Springs and a tule marsh make up four of the six aquatic cells identified (table 83). A pond and small stream drainage are also identified as essential cells.

It is assumed that natural areas selected to represent the aquatic and terrestrial cells will include the complement of plant and animal species typical of those ecosystems. Eight vertebrate animal species have been specifically identified as cells because of their rare or endangered status (table 84). Vascular plants of special interest include 12 from the Smithsonian list of endangered or threatened plants (table 85). Over two-thirds of these plants are in the Columbia Basin section of this province.

Two Federal Research Natural Areas and a Nature Conservancy reserve have been established (table 86). Lost Forest, the largest of these, takes in a large dune area and an isolated ponderosa pine forest associated with it. The existing natural areas fill 8 of the 33 cells identified for this province; all of the filled cells are terrestrial.

Nine additional Research Natural Areas should provide minimal coverage of the 25 unfilled cells (table 87). There is considerable question as to whether a single area can be found which includes adequate coverage of three different western juniper types (see need No. 2 in table 87), so two areas may be necessary. No large combined terrestrial and aquatic areas are proposed.

Several State and Federal agencies and private organizations have lead responsibilities (table 87). Oregon State and the Bureau of Land Management are most likely to have suitable lands for most of the terrestrial natural areas, and Fish and Wildlife Service (Malheur National Wildlife Refuge) should have several of the aquatic ecosystems. Priorities are highest for aquatic areas and terrestrial ecosystems subject to heavy grazing or suitable for agricultural use.

Table 82.--*Terrestrial cells in the High Lava Plains and Columbia Basin Province, eastern Oregon*

| Cell                                                                                                   | SAF<br>timber<br>type No. | Present<br>representation                                                                              | Page reference<br>(Franklin and<br>Dyrness 1973) |
|--------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <u>Ponderosa pine and western juniper communities:</u>                                                 |                           |                                                                                                        |                                                  |
| 1. Ponderosa pine/big sagebrush community (isolated stand within steppe)                               | 237                       | Lost Forest RNA                                                                                        | 171-180                                          |
| 2. Ponderosa pine/bitterbrush community (isolated stand within steppe)                                 | 237                       | Lost Forest RNA                                                                                        | 171-180                                          |
| 3. Western juniper-ponderosa pine/sagebrush                                                            | 237<br>238                | Lost Forest RNA                                                                                        | 165-167<br>171-180                               |
| 4. Western juniper/big sagebrush/threadleaf sedge community                                            | 238                       | Horse Ridge RNA                                                                                        | 165-167                                          |
| * 5. Western juniper/big sagebrush/bluebunch wheatgrass community                                      | 238                       | Horse Ridge and Lost Forest RNA's, but need additional area (may be filled by proposed The Island RNA) | 165-167                                          |
| * 6. Western juniper/Idaho fescue community                                                            | 238                       | Token in Lost Forest RNA, additional area is needed                                                    | 165-167                                          |
| * 7. Western juniper/bluebunch wheatgrass                                                              | 238                       | None                                                                                                   | 165-167                                          |
| * 8. Western juniper/big sagebrush-bitterbrush                                                         | 238                       | None                                                                                                   | 165-167                                          |
| <u>Sagebrush communities:</u>                                                                          |                           |                                                                                                        |                                                  |
| * 9. <i>Artemisia tridentata</i> / <i>Agropyron spicatum</i> community                                 |                           | None                                                                                                   | 234-237                                          |
| *10. <i>Artemisia tridentata</i> / <i>Festuca idahoensis</i> community                                 |                           | None                                                                                                   | 235, 238                                         |
| *11. <i>Artemisia arbuscula</i> / <i>Agropyron spicatum</i> community                                  |                           | None                                                                                                   | 235, 239-241                                     |
| *12. <i>Artemisia arbuscula</i> / <i>Festuca idahoensis</i> community                                  |                           | None                                                                                                   | 235, 239-241                                     |
| *13. <i>Artemisia rigida</i> / <i>Poa sandbergii</i> community                                         |                           | None                                                                                                   | 235, 242                                         |
| <u>Grassland communities:</u>                                                                          |                           |                                                                                                        |                                                  |
| 14. <i>Agropyron spicatum</i> - <i>Poa sandbergii</i> community                                        |                           | Lawrence Grasslands Memorial Preserve                                                                  | 223                                              |
| *15. <i>Eriogonum</i> - <i>Poa sandbergii</i> scrubland                                                |                           | Token in Lawrence Grasslands Memorial Preserve, need additional area                                   | 225-227                                          |
| *16. <i>Poa sandbergii</i> - <i>Danthonia unispicata</i> community                                     |                           | None                                                                                                   | 244-245                                          |
| 17. <i>Festuca idahoensis</i> - <i>Agropyron spicatum</i> and associated communities in Columbia Basin |                           | None                                                                                                   | 244                                              |
| <u>Special types:</u>                                                                                  |                           |                                                                                                        |                                                  |
| 18. Dunes and shifting sand                                                                            |                           | Lost Forest RNA                                                                                        |                                                  |
| 19. Playas                                                                                             |                           | Lost Forest RNA                                                                                        |                                                  |

\*Cells presently lacking adequate representation.

Table 83.--*Aquatic cells in the High Lava Plains and Columbia Basin Province, eastern Oregon*

| Cell <sup>1</sup>                                          | Present representation |
|------------------------------------------------------------|------------------------|
| *1. Permanent freshwater pond                              | None                   |
| *2. Typical stream drainage at lower elevations            | None                   |
| *3. Large, upwelling cold spring                           | None                   |
| *4. Cave with cold spring                                  | None                   |
| *5. Tule marsh area in the eastern portion of the province | None                   |
| *6. Typical hot spring area                                | None                   |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 84.--*Rare and endangered vertebrate animal cells in the High Lava Plains and Columbia Basin Province, eastern Oregon*

| Cell                                         | Verified representation | Reference                                                                                                                         |
|----------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <u>Fish:</u>                                 |                         |                                                                                                                                   |
| *1. Malheur sculpin                          | None                    | Bond 1966                                                                                                                         |
| <u>Birds:</u>                                |                         |                                                                                                                                   |
| *2. Western burrowing owl                    | None                    | Gabrielson and Jewett 1940                                                                                                        |
| <u>Mammals:</u>                              |                         |                                                                                                                                   |
| *3. Malheur or Preble shrew                  | None                    | Bailey 1936<br>Olterman and Verts 1972                                                                                            |
| *4. Merriam shrew                            | None                    | Bailey 1936<br>Johnson and Clanton 1954<br>Olterman and Verts 1972                                                                |
| *5. Pygmy rabbit                             | None                    | Bailey 1936<br>Olterman and Verts 1972                                                                                            |
| *6. Pinon mouse (subspecies <i>preblei</i> ) | None                    | Bailey 1936                                                                                                                       |
| *7. Northern grasshopper mouse               | None                    | Bailey 1936                                                                                                                       |
| *8. Sagebrush vole                           | None                    | Bailey 1936<br>Clanton et al. 1971<br>Johnson et al. 1948<br>Maser et al. 1974<br>Maser and Storm 1970<br>Olterman and Verts 1972 |

\*Cells presently lacking adequate representation.

Table 85.--Vascular plants of special interest in the High Lava Plains and Columbia Basin Province, eastern Oregon

| Species <sup>1</sup>                                           | Distribution                                                                         |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <i>Allium pleianthum</i> <sup>2</sup>                          | John Day Valley, Wheeler County                                                      |
| <i>Allium robinsonii</i>                                       | Lower benches of Columbia River                                                      |
| <i>Arenaria franklinii</i> var. <i>thompsonii</i> <sup>2</sup> | Sagebrush plains along the Columbia River; Wasco, Gilliam, and Morrow Counties       |
| <i>Artemisia lindleyana</i>                                    | Along Columbia River and tributaries                                                 |
| <i>Astragalus collinus</i> var. <i>laurentii</i>               | Sandy slopes near Heppner, Morrow County                                             |
| <i>Astragalus diaphanus</i>                                    | Sandy ground, lower John Day River valley                                            |
| <i>Astragalus howellii</i>                                     | Sagebrush plains along Columbia River; Wasco, Sherman, Morrow, and Umatilla Counties |
| <i>Astragalus misellus</i>                                     | Upper forks of Deschutes and John Day Rivers, Wheeler and Grant Counties             |
| <i>Astragalus peckii</i>                                       | Dry sandy ground, west of Tumalo, Deschutes County                                   |
| <i>Astragalus succumbens</i>                                   | Sagebrush desert, Umatilla and Gilliam Counties                                      |
| <i>Astragalus tegetarioides</i>                                | Pine forest, Silvies River, Harney County                                            |
| <i>Astragalus tyghensis</i>                                    | Tygh Valley, Wasco County                                                            |
| <i>Castilleja xanthotricha</i> <sup>2</sup>                    | Sagebrush flats, John Day Valley near Clarno                                         |
| <i>Chaenactis nevii</i> <sup>2</sup>                           | Dry slopes, John Day Valley                                                          |
| <i>Claytonia umbellata</i>                                     | Rocky ground, Wasco County; also in Steens Mountains                                 |
| <i>Collomia macrocalyx</i> <sup>2</sup>                        | Dry open ground near Lone Rock, Gilliam County                                       |
| <i>Cryptantha leucophæa</i>                                    | Sandy soil along the Columbia River east of The Dalles                               |
| <i>Eriogonum cusickii</i> <sup>2</sup>                         | Rocky, sagebrush area                                                                |
| <i>Lomatium frenchii</i>                                       | Sagebrush, Wasco County near Madras                                                  |
| <i>Lomatium hambleniae</i>                                     | Scablands, Wasco County                                                              |
| <i>Lomatium hendersonii</i> <sup>2</sup>                       | Dry hills, John Day Valley, Jefferson and Wheeler Counties                           |
| <i>Lomatium minus</i> <sup>2</sup>                             | Scablands, Wasco, Wheeler, and Grant Counties                                        |
| <i>Lomatium watsonii</i>                                       | Dry hillsides, Wasco and Jefferson Counties                                          |
| <i>Luina serpentina</i> <sup>2</sup>                           | Steep serpentine slopes near Dayville, Grant County                                  |
| <i>Myosurus clavicaulis</i>                                    | Dry watercourses, Silver Creek valley, Harney County                                 |
| <i>Penstemon eriantherus</i> var. <i>argillosus</i>            | Dry slopes, Deschutes and John Day River valleys                                     |
| <i>Penstemon seorsus</i>                                       | Dry stony ridges; Jefferson, Crook, Harney, and Malheur Counties                     |
| <i>Pilularia americana</i>                                     | In mud of vernal pools, Crook County to California                                   |
| <i>Potentilla glandulosa</i> var. <i>campanulata</i>           | John Day River valley near Dayville                                                  |
| <i>Ranunculus reconditus</i> <sup>2</sup>                      | Sagebrush slopes, Wasco County                                                       |
| <i>Silene scaposa</i> var. <i>scaposa</i> <sup>2</sup>         | Gilliam and Wheeler Counties to Blue Mountains                                       |
| <i>Sisyrinchium douglasii</i>                                  | White color form found near Maupin, Wasco County                                     |
| <i>Stephanomeria malheurensis</i> <sup>2</sup>                 | Sagebrush, Narrows, Harney County                                                    |
| <i>Talinum spinescens</i>                                      | Scablands, Wasco County                                                              |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

Table 86.--*Established Research Natura2 Areas in the High Lava Plains and Columbia Basin Province, eastern Oregon*

| Name                                  | Principal features                                                                                         | Agency <sup>1</sup> | Area  |       |
|---------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------|-------|-------|
|                                       |                                                                                                            |                     | Ha    | Acres |
| Horse Ridge RNA                       | Western juniper savanna                                                                                    | BLM                 | 243   | 600   |
| Lawrence Grasslands Memorial Preserve | Bluegrass-bunchgrass Community on biscuit scabland near Shaniko, Oregon                                    | TNC                 | 153   | 378   |
| Lost Forest RNA                       | Isolated ponderosa pine stands and sand dunes within a low rainfall, shrub-steppe region in central Oregon | BLM                 | 3 628 | 8,960 |

<sup>1</sup>BLM = Bureau of Land Management, TNC = The Nature Conservancy.

Table 87.--*Additional* Research Natural Areas needed in the High Lava Plains and Columbia Basin Province, eastern Oregon

| Ecosystem or community                                                                                                                                 | Cells represented <sup>1</sup>                                              | Remarks and possible locations                                                                          | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyness 1973) | Sub-province <sup>4</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|---------------------------|
| <u>Predominantly terrestrial natural areas:</u>                                                                                                        |                                                                             |                                                                                                         |                       |                          |                                           |                           |
| 1. A variety of big sagebrush and low sagebrush communities                                                                                            | T- <u>9,10,11</u> ,<br><u>12,5,6,7</u><br>R&E- <u>2,4,5</u> ,<br><u>6,7</u> | Squaw Butte Experimental Range is a possible candidate                                                  | High                  | State<br>FWS<br>BLM      | 234-242                                   | 1300                      |
| 2. Western juniper/big sagebrush/bluebunch wheatgrass, western juniper/bluebunch wheatgrass, and western juniper/big sagebrush-bitterbrush communities | T- <u>2,5,7,8</u> ,<br><u>6,15</u>                                          | Pine Ridge, Gray Buttes, Juniper Butte. (The Island RNA (proposed) will also partially fill this need.) | Low                   | BLM<br>State<br>FS       | 165-167                                   | 1303                      |
| 3. Scabland with stiff sagebrush-Poa and Eriogonum-Poa communities                                                                                     | T- <u>13,15,16</u>                                                          |                                                                                                         | Medium                | BLM<br>Private           | 225-227<br>242, 245                       | 1109                      |
| 4. Idaho fescue-bluebunch wheatgrass associated communities in Columbia Basin area                                                                     | T- <u>17</u>                                                                |                                                                                                         | High                  | State<br>Private         | 244                                       |                           |
| <u>Predominantly aquatic natural areas:</u>                                                                                                            |                                                                             |                                                                                                         |                       |                          |                                           |                           |
| 5. Typical stream drainage at low elevations                                                                                                           | A- <u>2</u>                                                                 | May not be available                                                                                    | Medium                | BLM<br>Private           |                                           |                           |
| 6. Large, upwelling cold spring                                                                                                                        | A- <u>3</u><br>R&E- <u>3</u>                                                | Stinking Lake, Malheur National Wildlife Refuge                                                         | High                  | FWS                      |                                           |                           |
| 7. Cave with cold spring                                                                                                                               | A- <u>4</u>                                                                 | Malheur Cave                                                                                            | High                  | Private                  |                                           | 300                       |
| 8. Hot spring                                                                                                                                          | A- <u>6</u>                                                                 | 00 Ranch (Malheur National Wildlife Refuge)                                                             | High                  | FWS                      |                                           | 300                       |
| 9. Tule marsh with permanent ponds                                                                                                                     | A- <u>1,5</u><br>R&E- <u>3</u>                                              | Malheur National Wildlife Refuge                                                                        | High                  | FWS                      |                                           | <b>300</b>                |

<sup>1</sup>For a description of these cells see table 82 for terrestrial (T) ecosystems, table 83 for aquatic (A) ecosystems, and table 84 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate cells considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of that type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management, FWS = Fish and Wildlife Service.

<sup>4</sup>See appendix V.



## OWYHEE UPLAND PROVINCE, SOUTHEASTERN OREGON

The Owyhee Upland Province is, for the most part, a gently sloping north-facing basin which is drained by the Owyhee River (fig. 1). Steep slopes are largely restricted to areas adjacent to the river, especially as it approaches its confluence with the Snake River. Much of the area is a high, gently rolling plateau with a base elevation of approximately 1200 m.

The most common geologic formations are Miocene and Pliocene beds of tuffaceous sedimentary rocks capped by flows of rhyolite and basalt. In addition, thick beds of quartzose sandstone, siltstone, and conglomerate outcrop near the mouth of the Owyhee River. The most recent volcanic activity in the area occurred during the Pleistocene and resulted in basalt flows of limited extent at Diamond and Cow Lake Craters.

Soils in the Owyhee Upland Province fall largely into the Sierozem and Brown great soil groups and reflect the effects of **low** amounts of precipitation. On basaltic parent materials, these soils have a very stony loam surface horizon underlain by either a clay or stony loam subsoil which may include a silica-cemented hardpan.

Sagebrush/bunchgrass communities dominate the Owyhee Uplands (Franklin and Dyrness 1973). In some upland areas, western juniper or mountain mahogany join with shrub and grass species in savanna ecosystems. In low-lying areas, often associated with vernal pools or playas, are communities with *Artemisia cana*, *Elymus cinereus*, or *Atriplex*. Areas of recent vulcanism and the Owyhee River canyon and associated tributaries are sites providing additional ecosystem and species diversity. Small permanent and vernal ponds of varying chemistry are the most common aquatic communities.

Research Natural Areas established to fill terrestrial (table 88) and aquatic (table 89) cells should include the typical array of plant and animal species. Six vertebrate animals are identified as species which should receive specific attention because of their rare or endangered status (table 90). Seventeen vascular plant species are known to be of special interest, and 10 of these are on the Smithsonian list of endangered or threatened plants (table 91). The majority of the latter plants are located in or near the Owyhee River canyon.

A minimum of eight Research Natural Areas should provide for representation of identified terrestrial, aquatic, and animal cells (table 92). None exist at present, although Jordan Craters is an area under consideration for Research Natural Area establishment. Lead responsibility in this province appears to lie almost entirely with the Bureau of Land Management.

Table 88.--*Terrestrial cells for the Owyhee Upland Province, southeastern Oregon*

| Cell                                                                                                 | SAF<br>timber<br>type No. | Present<br>representation | Page reference<br>(Franklin and<br>Dyrness 1973) |
|------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|--------------------------------------------------|
| <u>Western juniper communities:</u>                                                                  |                           |                           |                                                  |
| * 1. Western juniper/big sagebrush/bluebunch wheatgrass community                                    | 238                       | None                      | 165-167                                          |
| * 2. Western juniper/Idaho fescue community                                                          | 238                       | None                      | 165-167                                          |
| * 3. Western juniper/bluebunch wheatgrass community                                                  | 238                       | None                      | 165-167                                          |
| <u>Sagebrush communities :</u>                                                                       |                           |                           |                                                  |
| * 4. <i>Artemisia tridentata</i> / <i>Agropyron spicatum</i> community                               |                           | None                      | 235-237                                          |
| * 5. <i>Artemisia tridentata</i> / <i>Festuca idahoensis</i> community                               |                           | None                      | 235, 238                                         |
| * 6. <i>Artemisia arbuscula</i> / <i>Agropyron spicatum</i> community                                |                           | None                      | 235<br>239-241                                   |
| * 7. <i>Artemisia arbuscula</i> / <i>Festuca idahoensis</i> community                                |                           | None                      | 235<br>239-241                                   |
| * 8. <i>Artemisia arbuscula</i> / <i>Danthonia unispicata</i> / <i>Koeleria cristata</i> communities |                           | None                      | 239-241                                          |
| * 9. <i>Artemisia tridentata</i> / <i>Elymus cinereus</i> community                                  |                           | None                      | 235, 239                                         |
| "10. <i>Artemisia rigida</i> / <i>Poa sandbergii</i> community                                       |                           | None                      | 237                                              |
| *11. <i>Artemisia cana</i> community                                                                 |                           | None                      | 242-243                                          |
| <u>Other ecosystems :</u>                                                                            |                           |                           |                                                  |
| *12. Mountain mahogany savanna                                                                       |                           | None                      | 243-244                                          |
| *13. <i>Elymus cinereus</i> community                                                                |                           | None                      | 246                                              |
| *14. <i>Atriplex confertifolia</i> - <i>Grayia spinosa</i> community                                 |                           | None                      | 245                                              |
| *15. Lava flow area                                                                                  |                           | None                      | 34-35                                            |

"Cells presently lacking adequate representation.

Table 89.--*Aquatic cells for the Owyhee Upland Province, southeastern Oregon*

| Cell <sup>1</sup>       | Present representation | Remarks                                     |
|-------------------------|------------------------|---------------------------------------------|
| *1. Lowland lake        | None                   | Proposed Jordan Craters RNA would fill need |
| *2. Permanent pond      | None                   | Proposed Jordan Craters RNA would fill need |
| *3. Vernal ponds        | None                   | Proposed Jordan Craters RNA would fill need |
| *4. Swamp               | None                   | Proposed Jordan Craters RNA would fill need |
| *5. Marsh               | None                   | Proposed Jordan Craters RNA would fill need |
| *6. Stream              | None                   |                                             |
| *7. Springs             | None                   |                                             |
| *8. Alkali vernal ponds | None                   | Coyote Lake (playa)                         |

<sup>1</sup>Each aquatic cell identified is assumed to include the functional groups of organisms and dominant species which typify the listed ecosystem.

\*Cells presently lacking adequate representation.

Table 90.--*Rare and endangered vertebrate animal cells in the Owyhee Upland Province, southeastern Oregon*

| Cell                           | Verified representation | Reference                                                                                                                         |
|--------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <u>Mammals:</u>                |                         |                                                                                                                                   |
| *1. Merriam shrew              | None                    | Bailey 1936<br>Johnson and Clanton 1954<br>Olterman and Verts 1972                                                                |
| *2. White-tailed jack rabbit   | None                    | Bailey 1936<br>Olterman and Verts 1972                                                                                            |
| *3. Richardson ground squirrel | None                    | Bailey 1936<br>Olterman and Verts 1972                                                                                            |
| *4. Little pocket mouse        | None                    | Bailey 1936<br>Olterman and Verts 1972                                                                                            |
| *5. Northern grasshopper mouse | None                    | Bailey 1936                                                                                                                       |
| *6. Sagebrush vole             | None                    | Bailey 1936<br>Clanton et al. 1971<br>Johnson et al. 1948<br>Maser et al. 1974<br>Maser and Storm 1970<br>Olterman and Verts 1972 |

\*Cells presently lacking adequate representation.

Table 91.--Vascular plants of special interest in the Owyhee Upland Province, southeastern Oregon

| Species <sup>1</sup>                                                                                                                                                                                                 | Distribution                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Astragalus iodanthus</i> var. <i>vipereus</i><br><i>Astragalus mulfordae</i> <sup>2</sup>                                                                                                                         | Bluffs, eastern Malheur County<br>Dry sandy ground, lower Owyhee River, eastern Malheur County                                                                                                                       |
| <i>Astragalus nudisiliquus</i><br><i>Astragalus purshii</i> var. <i>ophiogenes</i> <sup>2</sup>                                                                                                                      | Gravelly bluffs, northeastern Malheur County<br>Sagebrush desert, Owyhee River, Malheur County                                                                                                                       |
| <i>Astragalus solitarius</i> <sup>2</sup>                                                                                                                                                                            | Usually in sagebrush, Owyhee River, Malheur County                                                                                                                                                                   |
| <i>Astragalus sterilis</i> <sup>2</sup><br><i>Cryptantha propria</i><br><i>Cymopterus corrugatus</i> <sup>2</sup><br><i>Eriogonum novonudum</i> <sup>2</sup><br><i>Eriogonum ochrocephalum</i> ssp. <i>calcareum</i> | Clay hills, Sucker Creek, Malheur County<br>Dry hillsides, northern Malheur County<br>Dry hills, southern Malheur County<br>Stony clay hills, eastern Malheur County<br>In loose, white volcanic ash, Malheur County |
| <i>Hackelia cronquistii</i> <sup>2</sup><br><i>Hackelia ophiobia</i> <sup>2</sup>                                                                                                                                    | Cliffs, 3 forks of Owyhee River, Malheur County                                                                                                                                                                      |
| <i>Hackelia patens</i> <sup>2</sup><br><i>Mentzelia mollis</i> <sup>2</sup><br><i>Mirabilis bigelovii</i>                                                                                                            | Between Vale and Harper, Malheur County<br>Clay slopes, eastern Malheur County<br>Canyon of Owyhee River, Malheur County                                                                                             |
| <i>Silene scaposa</i> var. <i>lobata</i> <sup>2</sup><br><i>Trifolium owyheense</i>                                                                                                                                  | Dry slopes, Sucker Creek, Malheur County                                                                                                                                                                             |

<sup>1</sup>These plants are tentatively identified as deserving special consideration in land management activities, including selection of Research Natural Areas. Reasons for listing include known or probable rare or endemic status, disjunct populations, or identification nationally (in the Smithsonian Institution list) as threatened or endangered species.

<sup>2</sup>Species is on the national list of threatened and endangered plants (Smithsonian Institution 1974).

†

Table 92.--Research **Natural** Areas needed in the *Owyhee Upland* Province, **southeastern Oregon**

| Ecosystem or community                                                                | Cells represented <sup>1</sup>                                        | Remarks and possible locations                         | Priority <sup>2</sup> | Lead agency <sup>3</sup> | Page reference (Franklin and Dyrness 1973) | Sub-province <sup>4</sup> |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------|-----------------------|--------------------------|--------------------------------------------|---------------------------|
| <u>Combined terrestrial and aquatic areas :</u>                                       |                                                                       |                                                        |                       |                          |                                            |                           |
| 1. Area with lake, ponds, and marshes, recent lava flows, and some surrounding upland | T- <u>9,13,15</u><br>A- <u>1,2,3,</u><br><u>4,5</u>                   | Proposed Jordan Craters RNA will fill this need        | High                  | BLM                      | 34-35                                      | 1507                      |
| 2. Alkali vernal ponds and <i>Artemisia cana</i> communities                          | T- <u>11</u><br>A- <u>8</u>                                           | Coyote Lake                                            | High                  | BLM                      | 242-243                                    | 1502                      |
| <u>Predominantly terrestrial areas :</u>                                              |                                                                       |                                                        |                       |                          |                                            |                           |
| 3. Area with variety of big and low sagebrush communities                             | T- <u>4,5,6,7</u><br>R&E- <u>1,2,3,</u><br><u>4,5,6</u>               | Sucker Creek area; consider plants of special interest | Low                   | BLM<br>State             | 234-242                                    | 1507                      |
| 4. Juniper and sagebrush communities                                                  | T- <u>1,2,3,</u><br><u>8,10</u><br>R&E- <u>1,2,3,</u><br><u>4,5,6</u> |                                                        | High                  | BLM<br>State             | 165-167                                    | 1504<br>1507              |
| 5. Mountainmahogany savanna                                                           | T- <u>12</u>                                                          |                                                        | Medium                | BLM                      | 243-244                                    | 1505                      |
| 6. Shadscale and winterfat communities                                                | T- <u>14</u>                                                          |                                                        | High                  | BLM                      | 245                                        | 1507                      |
| <u>Predominantly aquatic areas :</u>                                                  |                                                                       |                                                        |                       |                          |                                            |                           |
| 7. Springs and stream                                                                 | A- <u>6,7</u>                                                         |                                                        | High                  | BLM                      |                                            | 1504<br>1507              |
| <u>Areas for plants of special interest:</u>                                          |                                                                       |                                                        |                       |                          |                                            |                           |
| 8. Concentration of rare and endangered plants along Owyhee River                     |                                                                       | See table 91                                           | Medium                | BLM                      |                                            | 1504                      |

<sup>1</sup>For a description of these cells see table 88 for terrestrial (T) ecosystems, table 89 for aquatic (A) ecosystems, and table 90 for rare and endangered (R&E) vertebrate animals. Underlined cell numbers indicate cells considered essential components of the proposed Research Natural Area. Those not underlined represent cells which would be desirable but not essential.

<sup>2</sup>Based mainly upon how endangered areas of that type are believed to be, not how extensive the type is, i.e., the danger that all examples of that type will be lost to other uses. Acquisition urgency.

<sup>3</sup>Agency or institution most likely to have or to be able to acquire a tract of the desired type based on land ownership. BLM = Bureau of Land Management.

<sup>4</sup>See appendix V.

# *Part 111.*

## *Marine and Estuarine Research Natural Area Needs*

Developing an approach to selection of a series of marine and estuarine Research Natural Areas turned out to be difficult in this biologically and legally complex coastal region.

The objective was to outline the type and number of natural areas needed to preserve examples of the varied types of coastal and near-shore ecosystems found along the Oregon and Washington coasts. The initial approach was to break down the coastline into districts or provinces (open coasts of the two States and northern and southern segments of Puget Sound) and subdivide each district into major habitats—estuaries and related types, exposed intertidal and subtidal strand on open coast, cliffs and rocks, and subtidal communities as well as unique ecosystems or organisms. This was an obvious attempt to develop a cellular matrix as was followed in developing natural area needs for inland waters.

In fact, developing a cellular matrix proved very difficult. The working group was small and did not have sufficient knowledge of all areas. Many marine and estuarine ecosystems are unique. Furthermore, any plan must recognize the limitations imposed by present human developments, i.e., relatively few potential sites are suitable as sites for Research Natural Areas. Nevertheless, a list of natural area needs was developed in the framework of the provinces and habitat subdivisions outlined above. Many of the listed needs identified specific areas for exemplary purposes rather than cells in the sense of the other working groups.

The initial list was subjected to an extensive review process and received considerable, constructive criticism from experts in the area of coastal and estuarine ecosystems. As a consequence, an additional meeting of the working group was held in November 1974 to develop a revised listing of Research Natural Area needs.<sup>3</sup>

The objective in the listings which follow is to identify a series of areas which in their totality encompass the important variations in habitats, communities, and organisms. The areas listed include some which are essential because they are the last remaining example, are unique biologically, or have an established history of research. Some of the other areas are listed as examples of particular kinds of habitats, and better sites as Research Natural Areas might exist.

The geographic subdivisions used in the listings are:

- a. Open coast of Oregon,
- b. Open coast of Washington,
- c. Puget Sound,
- d. Straits of Georgia and Rosario Straits,
- e. Waters of San Juan archipelago.

The Puget Sound subdivision includes those water bodies entered by way of Admiralty Inlet and Deception Pass, including the Hood Canal. The waters to the north and west of these inlets to the Canadian border constitute the region known as the Straits of Georgia and Rosario Straits. The waters around the San Juan archipelago and Cypress Island are recognized as a special unit because of their distinctive biology and the long history of research by the Friday Harbor Laboratories of the University of Washington; they also have unique legal status as a marine biological preserve under a Washington State law.

The habitat subdivisions, under which specific sites are generally categorized, are divided in two ways—estuarine and open coast areas. Natural areas in *estuaries* should be chosen to represent the range in estuary size from small to large, and range in salinity characteristics from low to high. By this crude two-dimensional initial breakdown, the possibility of including the full spectrum of estuary conditions within a system of Research Natural Areas will be greatly enhanced. Tidal flushing, sediment flow, dissolved minerals, and seasonal and lunar cycles of salinity will vary with the size of the estuary and the volume of fresh water pouring into it. Smaller estuaries are much more likely to be in a nearly undisturbed state; most are not influenced by urban wastes; and they generally have not been dredged. Smaller estuaries would be expected to have still waters, and larger ones generally have considerably more wave action.

We do not envision setting aside entire large estuaries as Research Natural Areas; natural areas in this situation should consist of relatively undisturbed arms or portions of the entire embayment or slough. However, it is our expectation that areas designated within large sloughs will, in some cases, extend from high marsh and swamp (foreexample, *Picea* forest) through the intertidal to the subtidal, and that in the subtidal different bottom sediments will be represented.

In the case of small estuaries, it may be possible to find examples with unmanaged, natural mouths where hydrologic processes are naturally played out. In these instances, the entire estuary and its margin should be placed in natural area status. A significant factor in selection may be the presence of sometimes submerged sandbars that drastically alter community structure.

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<sup>3</sup>Many people have contributed to this effort besides the original working group. Special gratitude is due Robert L. Fernald (University of Washington); Austin Pritchard, Vicki Osis, and Chris Bayne (Oregon State University); Laimons Osis (Oregon Fish Commission); and R. L. Bacon (University of Oregon). These individuals attended the meeting in November 1974 at which the revised lists were developed. Robert Fernald and Austin Pritchard made outstanding contributions in the revision of the lists for Washington and Oregon, respectively. Other valuable suggestions were offered by Jefferson J. Gonor, Robert Waaland, Richard Norris, Thomas Mumford, Peter B. Taylor, Peter W. Frank, Paul P. Rudy, and Robert T. Paine.

Along *exposed shorelines*, variables of temperature, salinity, wave action, depth, slope gradient, and substrate present a variety of habitats with associated communities. In these situations we envision linear natural areas which extend perpendicularly to the shore from above the splash zone out into the subtidal. Each area should include approximately one-fourth to 1 mile of shoreline. The series of Research Natural Areas should include intertidal habitats on a wide variety of substrate types—ranging from sandstone to serpentine in mineralogy and from coherent rock to sands and gravels. Selection of rocky sites should include consideration of a variety of tidal pools, surge channels, and rock configurations, as well as the chemical makeup of the rock.

*Ocean-front cliffs* and *offshore islands* often comprise important rookeries for both birds and mammals. For this reason, many of these areas are already protected from disturbance by such agencies as the U.S. Department of Interior, Fish and Wildlife Service. However, we feel that at least a small number of the most typical of these areas should also be designated as Research Natural Areas: In most cases areas so designated should also include the adjacent intertidal zone which, for example, may be influenced by excrement. We would also recommend the inclusion of bluffs present on some of the larger islands in Puget Sound and the outer coast as well. The distinctive nesting sites of burrowing and cliff- and slope-nesting birds should be taken into account. In addition, several rookeries and hauling-out areas of seals and sea lions should be given natural area status.

Finally, there is a need for at least two extensive areas that include not only a fringe of shore but also a generous portion of a coastal terrestrial ecosystem. These will provide areas for the study of interconnections between marine and terrestrial systems, especially of mammals and birds which utilize both types of environments. Mink, otters, raccoons, and bald eagles are examples of such animals. Possibly these large combined natural areas could be established in conjunction with estuarine or exposed coast ecosystems.

Research Natural Area needs are identified in tables 93-98. These total 68. We again caution the reader that this is a first approximation. We have tried to include examples of the major coastal and estuarine habitats, ecosystems, and organisms, as well as to identify unique sites which must be preserved. Future revision will be essential, but it is hoped that this list will assist land planners in coastal areas in identifying areas critical for research and preservation of exemplary organisms and ecosystems.

Table 93.--Areas suggested for Research Natural Areas representative of estuarine ecosystems on the coast of Oregon

| Estuary                                                                                 | Comments and priority                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sand Island and Baker Bay near the mouth of Columbia River estuary                      | A large, high-salinity area of high to intermediate priority.                                                                                                                                                                                                       |
| Nehalem River estuary, specifically Lazarus Island, Dean Point, and adjoining tidelands | A low-salinity area in a small, low-salinity estuary. Intermediate priority.                                                                                                                                                                                        |
| Tillamook Bay                                                                           | A large estuary with variable salinity. An undisturbed arm of the bay required, assuming one exists. Low priority.                                                                                                                                                  |
| Netarts Bay and sand spit                                                               | A small, high-salinity estuary that is relatively undisturbed. Portion of the estuary and salt marsh required. High priority. Cape Lookout State Park adjoins salt marsh and controls sand spit.                                                                    |
| Nestucca River estuary and sand spit, including confluence with Little Nestucca River   | A small, low-salinity estuary that is relatively undisturbed. High priority.                                                                                                                                                                                        |
| Salmon River estuary                                                                    | A small, high-salinity area at the mouth. Some distinctive animal communities. Adjoins Nature Conservancy land and is in newly designated "Scenic Research Area." High priority.                                                                                    |
| Siletz estuary, specifically the rocky intertidal area where Schooner Creek enters      | Very limited area which is habitat for the only stable population of <i>Littorina sitkana</i> in Oregon. Low priority.                                                                                                                                              |
| Yaquina Bay, specifically:                                                              |                                                                                                                                                                                                                                                                     |
| a. Idaho Flat tideflat                                                                  | A high-salinity area in a large estuary of varied salinity. High priority. Area deeded to Oregon State University by Georgia-Pacific Corporation.                                                                                                                   |
| b. McCaffery and Poole Sloughs                                                          | A relatively undisturbed, low-salinity area of high priority.                                                                                                                                                                                                       |
| c. Boone and Nute Sloughs                                                               | A low-salinity area that is an old river oxbow. This area has been blocked off from tidal action by road fill and tide gates but proposed road alignment presents an opportunity to install adequate culverts to restore marsh areas. Low to intermediate priority. |

Table 93.--Areas suggested for Research Natural Areas representative of estuarine ecosystems at the coast of Oregon (Continued)

| Estuary                                                                                                  | Comments and priority                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alsea Bay, specifically:                                                                                 |                                                                                                                                                                                                               |
| a. Barview mudflat area                                                                                  | A large, relatively undisturbed mudflat in a large, low-salinity estuary. High priority.                                                                                                                      |
| b. Area where Drift Creek enters Alsea River estuary                                                     | Area about 5 miles from mouth of estuary, low salinity, high priority. Relatively undisturbed. Extensively studied in upper reaches of Drift Creek by Oregon Wildlife Commission and Oregon State University. |
| Sluslaw River estuary, specifically Cox island and surrounding areas                                     | Relatively undisturbed island and tide-flats in a small, low-salinity estuary. High to intermediate priority.                                                                                                 |
| Umpqua River estuary                                                                                     | Large, low-salinity estuary. Low priority.                                                                                                                                                                    |
| Coos Bay, specifically:                                                                                  |                                                                                                                                                                                                               |
| a. South Slough                                                                                          | High-salinity slough in a large estuary with varied salinities. High priority. The area is being processed as an estuarine sanctuary.                                                                         |
| b. Additional areas in main estuary and North Slough                                                     | Variable salinity. High priority. May be difficult to find areas not encroached by road fills and urbanization pressures.                                                                                     |
| Coquille River estuary, specifically tide-lands and marshes between Bullards Beach State Park and Bandon | Low-salinity, relatively undisturbed area in a small, low-salinity estuary. Intermediate priority.                                                                                                            |

Table 94.--Areas suggested for Research Natural Areas representative of *intertidal ecosystems on the open coast of Oregon*

| Area                                                                              | Comments and priority                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ecola Point and adjacent sandy beaches                                            | Part of Ecola State Park; high priority. Headland and beach communities typical of the northern Oregon coast.                                                                                                                                                                                                 |
| Sandy beach between Seal Rock and Beaver Creek (Lincoln County)                   | Area typical of the central coast. Intermediate priority.                                                                                                                                                                                                                                                     |
| Neptune State Park including Strawberry Hill area                                 | High priority. A mixture of basaltic bedrock shelves, tide channels and pools, and gravel and sandy beaches on central Oregon coast. Strawberry Hill area contains relatively large numbers of certain invertebrates (nudibranchs, large tube worms) not common in other Oregon outer coast intertidal areas. |
| North Cove of Cape Arago including Shell Island and adjacent reefs                | A varied invertebrate community and diverse habitat. Several species reach their northern limits here. High priority.                                                                                                                                                                                         |
| Cape Blanco                                                                       | A relatively isolated headland on southern Oregon coast. Adjoins a recently developed State Park. High priority.                                                                                                                                                                                              |
| Brookings area-Harris Beach State Park                                            | Between 42° 1' and 40° 2' Is an excellent area for marine algae of a great variety. Extensively studied by Doty and Norris. High priority.                                                                                                                                                                    |
| Section of sand beach between Florence and Coos Bay                               | Representative sand beach area along the dune sheet. High priority.                                                                                                                                                                                                                                           |
| Sandy beach of Clatsop Plains of northern Oregon                                  | Good sand beach area representative of the northern Oregon coast region. High priority.                                                                                                                                                                                                                       |
| Rocky shores in Port Orford area, possibly around closed U.S. Coast Guard Station | Rocky shore habitats representative of the southern Oregon open coast. Area near Port Orford is used by Oregon State University biologists. High priority.                                                                                                                                                    |
| Boiler Bay                                                                        | Field of boulders that is exposed to the northwest and protected from the southwest by high reefs. Good for both marine plants and animals. Unusually rich in biota and habitat diversity. High priority.                                                                                                     |
| Yaquina Head near Newport Marine Laboratory                                       | For fauna and flora one of the most important headlands in Oregon. Tip is already Federal property and a sea bird and mammal sanctuary. High priority.                                                                                                                                                        |
| "Marine gardens" area at Otter Rock                                               | Excellent area where collecting has been prohibited for at least a decade. Access is limited. Intertidal bench of sandstone and basalt dikes with northern exposure. High priority.                                                                                                                           |
| Whale Cove                                                                        | Undisturbed pocket cove which has been protected from collecting; diverse fauna and flora. Intermediate priority.                                                                                                                                                                                             |

Table 95.--Areas suggested for Research Natural Areas representative of exposed intertidal ecosystems on the open coast of Washington including Straits of Juan de Fuca<sup>1</sup>

| Area                                                                                 | Comments and priority                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Copalis Beach                                                                        | Open sandy beach and razor clam populations. Area has received considerable attention in diatom productivity studies dating from 1930. High priority.                                                                                          |
| Destruction Island off the coast of Washington near Ruby Beach                       | Isolated, highly exposed small island. Wildlife sanctuary and site of marine bird population studies.                                                                                                                                          |
| Cape Alava and Flattery Rocks                                                        | Exposed rocky shoreline associated with extensive sandy beaches. Natural protection by removal from roads and easy access. Diverse fauna and flora. Part of Olympic National Park shores. High priority.                                       |
| Point of the Arches and offshore islets                                              | Exposed rocky shores and sandy beaches. Diversity of habitats accessible by trail.                                                                                                                                                             |
| Shi Shi Reef and beach area with Portage Head                                        | Complex of exposed rocky intertidal region with sandy and gravelly beaches. Base for studies in marine ecology and population biology. Protected by limited accessibility. High priority.                                                      |
| Tatoosh Island                                                                       | Offshore island near Cape Flattery with diverse habitats having varying exposure to tidal influences. Excellent for faunistic and floristic studies requiring high degree of protection from human intrusion. High priority.                   |
| Waada Island                                                                         | Offers areas with high degree of exposure and protection. Diversity of flora and fauna. High priority.                                                                                                                                         |
| Slip Point on Clallam Bay                                                            | Excellent populations of <i>Strongylocentrotus purpuratus</i> and associated exposed intertidal fauna and flora. On property controlled by the U.S. Coast Guard. High priority.                                                                |
| Pillar Point                                                                         | Predominantly rocky intertidal region of moderate exposure.                                                                                                                                                                                    |
| Tongue Point and Crescent Beach, Clallam County Park                                 | Rocky intertidal region of moderate exposure and associated mud-sand beach. Good populations of three species of sea urchins and associated flora and fauna. Good semi-protected beach habitat. High priority.                                 |
| Dungeness Spit                                                                       | Exposed sandy gravel beach with typical flora and fauna. Diverse beach dwelling polychaetes, bivalves, crustaceans, etc. High priority.                                                                                                        |
| Protection Island, Jefferson County, at entrance to Discovery Bay near Port Townsend | The Nature Conservancy has purchased 48 acres at the west end of island as a preserve for a nesting colony of rhinoceros auklets. Harlequin ducks, seals, scoters, etc., also inhabit its shores. Interesting intertidal areas. High priority. |

<sup>1</sup>Series of areas are suggested along the straits which offer varying degrees of exposure.

Table 96. --**Areas** suggested for Research Natural **Areas** representative of estuarine ecosystems **on** the open coast of Washington

| Estuary                                                              | Comments and priority                                                                                                                                                                                                                       |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Portion of Willapa Bay including Leadbetter Point                    | Excellent protected bay with sand and mud substrate. Bivalves (including oysters), crabs, etc., with good population of an enteropneust, <i>Saccoglossus</i> sp. Introduced population of <i>Ilyanassa</i> <b>obsoleta</b> . High priority. |
| Marshlands at Campbell Slough and Oyhut in North Bay of Grays Harbor | Protected estuarine area with limited marshlands associated with mud-sand flats, High priority.                                                                                                                                             |
| Queets River estuary                                                 | Relatively small estuary representative of central coast of Washington.                                                                                                                                                                     |

Table 97.--Areas suggested **for Research** Natural Areas representative of estuarine ecosystems in Puget Sound and in the Straits of Georgia and Rosario Straits

| Estuary                                                         | Comments and priority                                                                                                                                                                    |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Burn's Point and cove on Totten Inlet, lower Puget Sound        | Representative of the lower Puget Sound estuarine areas. High priority.                                                                                                                  |
| Steamboat Island at mouth of Totten Inlet                       | An area representing both gravelly and boulder shores. High priority.                                                                                                                    |
| Nisqually River delta                                           | Diverse habitats including marsh areas in one of the largest undeveloped estuarine areas in Puget Sound. Recently acquired by the Fish and Wildlife Service. High priority.              |
| The Narrows-Tacoma, south-west from Salmon Bay                  | Rocky fill with rapid tidal currents. Artificially developed area of high diversity in fauna and flora. Excellent for many invertebrate forms including Octopus dofleini. High priority. |
| Quartermaster Harbor on Vashon Island                           | Good mud bay with representative populations of bivalves, crabs, etc.                                                                                                                    |
| Double Bluff, on Whidbey Island between Mutiny and Useless Bays | Sandy beaches with some rocky outcrops.                                                                                                                                                  |
| Skagit Flats and Goat Island                                    | Excellent and extensive mudflats with rocky island shores and associated marshes. Large populations of resident and migratory marine birds, etc. High priority.                          |
| Sister's Point at Great Bend of Hood Canal                      | Selected as area representative of the lower Hood Canal region. Mud-shell substrate. High priority.                                                                                      |
| A portion of Dabob Bay                                          | Associated with upper Hood Canal. Mud substrate and associated fauna. High priority.                                                                                                     |
| Big Beef Creek (east side of Hood Canal)                        | Stream contains established runs of chum and coho salmon and steelhead trout. Area owned by University of Washington, College of Fisheries. High priority.                               |
| Foulweather Bluff                                               | Exposed rocky shores at entrance to Hood Canal. Excellent for diversity of flora and fauna. High priority.                                                                               |
| Padilla Bay and Saddlebag Island                                | Large mud bay between mainland and northern end of Fidalgo Island. Island is small and State-owned.                                                                                      |
| Nooksack River delta and part of Lummi Bay                      | North branch of Nooksack entering Lummi Bay is part of Lummi Indian Reservation but is representative of northernmost estuary in Whatcom County. High priority.                          |
| Cobblestone beach, Sandy Point to Point Whitehorn (portion of)  | Excellent in spite of several oil refineries in area. High priority.                                                                                                                     |

'Areas associated with Straits of Georgia and Rosario Straits.

Table 98.--*Areas suggested as Research Natural Areas representative of exposed intertidal ecosystems in waters of the San Juan archipelago and at the confluence of Rosario Straits and Straits of Georgia*

| Area <sup>1</sup>                                              | Comments and priority                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fidalgo Head including Shannon Point - RGS                     | Diverse rocky intertidal region. High priority.                                                                                                                                                                                                                                                                                                                                                                            |
| Clayton Beach off Samish Bay near Larrabee State Park - RGS    | The only real sandy beach in this region. Excellent example of sand fauna, etc. High priority.                                                                                                                                                                                                                                                                                                                             |
| Marine park area between south Bellingham and Post Point - RGS | Cobblestone and rocks with shelving mud and sand at lower depths.                                                                                                                                                                                                                                                                                                                                                          |
| Chuckanut Island and rock in Chuckanut Bay - RGS               | Excellent small areas for rocky intertidal and subtidal fauna and flora. Rock controlled by Bureau of Land Management. High priority.                                                                                                                                                                                                                                                                                      |
| Lummi Rocks off Lummi Island - RGS                             | Small rocky intertidal and subtidal area. Excellent for representative forms. Controlled by Bureau of Land Management. High priority.                                                                                                                                                                                                                                                                                      |
| Partridge Point and Partridge Bank on Whidbey Island - S&J     | Area of considerable interest for diverse marine flora. High priority.                                                                                                                                                                                                                                                                                                                                                     |
| Smith Island - S&J                                             | Highly diverse intertidal and benthic areas. Excellent for both marine invertebrates and algae. Rock, sand, and gravel with varying exposure to tidal currents. Enjoys excellent protection from general public. High priority.                                                                                                                                                                                            |
| Deception Pass and Deception Island - S&J                      | Unique area with exposure to varying currents and tides.                                                                                                                                                                                                                                                                                                                                                                   |
| San Juan archipelago and Cypress Island - SJA                  | This highly diverse, rich area has been a Marine Biological Preserve by State of Washington law since 1923. The area has been intensively used as a base for scientific research for over 70 years. Optimally it would be desirable to implement and extend the provisions of the law. It would be important to provide some protection from commercial exploitation of edible invertebrates in the region. High priority. |

<sup>1</sup>RGS = confluence of Rosario Straits and Straits of Georgia; SEJ = confluence of Straits of Juan de Fuca and waters of the San Juan archipelago; and SJA = waters of San Juan archipelago, also known as Washington Sound or a part of Straits of Georgia.

# *Part IV.*

## *Reports of Working Groups*

### REPORT OF TERRESTRIAL WORKING GROUPS

Two terrestrial working groups were organized at the workshop — one group for provinces west of the Cascade crest (West-side Terrestrial Working Group), and the other for provinces in eastern Oregon and Washington (East-side Terrestrial Working Group). The participants in these working groups are listed in appendix VII.

The groups were charged with the responsibility of identifying those terrestrial ecosystems in Oregon and Washington which should have adequate representation in a well-rounded system of Research Natural Areas. Before the workshop, preliminary lists of terrestrial natural area needs had been developed for each province by Jerry F. Franklin and Curt Wiberg. The working groups used these lists as a point of departure. The general procedure was to go through these lists area by area, evaluating each in turn, and making such revisions as necessary.

Our ultimate aim was to construct a list of terrestrial ecosystem cells which should ideally be well represented in a minimal natural area system. Our working definition of a cell — community, organism, or habitat to be represented within a Research Natural Area — has already been more fully covered in part I of this report. In dealing with terrestrial ecosystems, a cell may be a timber type (“mixed-conifer forest with western larch dominance”), a plant community (“Douglas-fir/swordfern”), or a specialized habitat (“shifting dunes”). In some instances, we also used cells to designate geographic location. For example, in the Oregon Coast Ranges Province two western hemlock/swordfern community cells are listed — one in the northern portion of the province and one in the southern. This was judged necessary in order to provide an adequate sample of the diversity which exists in this very widely distributed forest community.

In order to insure as complete coverage as possible, we attempted to include, at a minimum, virtually all major vegetation types described in *Natural Vegetation of Oregon and Washington* (Franklin and Dyrness 1973). In eastern Washington the vegetation classification is based almost entirely on the work of Daubenmire and Daubenmire (1968) and Daubenmire (1970).

The total number of terrestrial cells, both filled and unfilled, is shown by province in table 99. The unfilled terrestrial cells (i.e., those not adequately represented in already established Research Natural Areas) were first arranged into combinations which could be expected to occur in the field, then interfaced with aquatic and rare and endangered animal cells, to finally produce the lists of Research Natural Area needs which appear in part 11.

Table 99.--Number of filled and unfilled terrestrial cells, by State and province

| Province                                      | Number of filled cells | Number of unfilled cells | Total     |
|-----------------------------------------------|------------------------|--------------------------|-----------|
| <u>Washington:</u>                            |                        |                          |           |
| Olympic Peninsula and Southwestern Washington | 8                      | 19                       | 27        |
| Puget Trough                                  | 2                      | 14                       | 16        |
| Western Slopes and Crest, Washington Cascades | 16                     | 15                       | 31        |
| Eastern Slopes                                |                        |                          |           |
| Washington Cascades                           | 4                      | 17                       | 21        |
| Columbia Basin, Washington                    | 7                      | 36                       | 43        |
| Okanogan Highlands                            | <u>5</u>               | <u>22</u>                | <u>27</u> |
| Total                                         | 42                     | 123                      | 165       |
| <u>Oregon :</u>                               |                        |                          |           |
| Oregon Coast Ranges                           | 5                      | 18                       | 23        |
| Western Oregon Interior                       |                        |                          |           |
| Valleys                                       | 8                      | 18                       | 26        |
| Siskiyou Mountains                            | 7                      | 19                       | 26        |
| Western Slopes and Crest, Oregon Cascades     | 7                      | 20                       | 27        |
| Eastern Slopes                                |                        |                          |           |
| Oregon Cascades                               | 9                      | 8                        | 17        |
| Ochoco, Blue, and Wallowa Mountains           | 6                      | 19                       | 25        |
| Basin and Range                               | 0                      | 19                       | 19        |
| High Lava Plains and Columbia Basin, Oregon   | 8                      | 11                       | 19        |
| Owyhee Upland                                 | <u>0</u>               | <u>15</u>                | <u>15</u> |
| Total                                         | 50                     | 147                      | 197       |
| TOTAL                                         | 92                     | 270                      | 362       |

## REPORT OF AQUATIC (FRESHWATER) WORKING GROUP

We believe that the same rationale under which terrestrial areas have been protected in Research Natural Areas applies also to aquatic areas; i.e., benchmark areas, centers for research activity, and gene pools. Accordingly, we have devised a scheme that we think includes most of the needed Research Natural Areas in Oregon and Washington. We have attempted to include all types of aquatic habitat, concentrating on typical areas and representative faunas, but also considering unique habitats. The urgency of this effort is underscored by the fact that some natural aquatic habitats that should be in the system are simply no longer available, due to man's activities.

We encountered two basic problems in setting up our classification scheme—(1) uncertainty as to how fine a classification to employ, and (2) concern over the difficulty of maintaining aquatic areas in a “natural” state.

There is no commonly accepted classification scheme for aquatic habitats analogous to the plant community types that form the basis for terrestrial Research Natural Areas. For the tentative listing, we have selected a classification that is essentially geographical, emphasizing elevation range within physiographic provinces. Within that framework we have made some further subdivisions, but some important types may have been overlooked. For example, geologic and hydrologic criteria should be added.

A major problem in the establishment of aquatic Research Natural Areas is the extent to which aquatic systems are affected by man's activity on the watershed. It is possible to designate a terrestrial area of 100 acres in many locations and provide for its complete protection from man-caused change. Unless the entire drainage area of a lake, or the watershed area above a stream section, is maintained, however, there is no assurance of protection for aquatic areas. This is particularly true in watersheds subject to logging, but other disturbances can also be important, e.g., pesticide application. The influence is more likely to be of concern in streams than lakes; and it is possible that we might establish certain lakes as Research Natural Areas without including the entire drainage basin, depending on the size and runoff characteristics of the basin. Our present recommendation is that streams not be included unless the entire watershed can be included within the boundaries of the Research Natural Area.

This, of course, limits the size of stream that can be included. Large streams and rivers will be excluded by this criterion. We do feel that a need exists to identify research areas in such waters, but suggest that some classification other than Research Natural Area be employed (perhaps incorporating the Wild and Scenic Rivers Act, for example).

We have, thus, tentatively recommended inclusion of only those areas that can most likely be protected from man's influence. However, this decision should be subject to further discussion. For one thing, even the terrestrial areas are not entirely immune from outside influence (consider the ubiquitous nature of DDT, for example). The distinction we have made may be only one of degree, and we perhaps should consider whether classification of such large streams and rivers might provide additional incentive for maintaining them in as close to natural condition as possible.

The basic classification scheme shown in tables 100 and 101 draws considerably on the preliminary work of Franklin and Wiberg. We have made the following basic classification of aquatic habitats: lake, permanent pond (less than 5 acres, shallow, rooted vegetation throughout), vernal pond (temporary), stream, springs (hot and cold), swamp, marsh, and bog. On this classification we have imposed a matrix of elevation and physiographic province. In general, we have included only one representative cell in each square, hoping that this will fulfill the objective. In several instances, when we were aware of significant variation within a square, we included more than one cell. Our limited familiarity with some regions of Oregon and Washington has undoubtedly resulted in some omissions.

We were uncertain as to how to explicitly handle many factors that we recognize as important in the establishment of aquatic Research Natural Areas. For example, in stream classification, gradient and total dissolved solids are important variables affecting productivity. Likewise with lakes, temperature regime, nutrient level, geological origin, and other factors are important. Our present decision is simply to list these variables (and others that may be recommended) as among those criteria that should be considered in the total system. Efforts should be made to incorporate gradients of these elements within each aquatic class over the Pacific Northwest. We believe, in fact, that the system as set up will naturally provide for many of these gradients—for example, a range from oligotrophy to eutrophy in lakes and ponds.

We are still uncertain as to how some manmade bodies of water should be handled. In the Columbia Basin of Washington, for example, are a series of potholes and wasteways. These are the result of irrigation flooding and are more or less permanent bodies. However, they cannot be controlled in the sense of maintaining “natural” conditions, so perhaps should fall into the same category as large river segments. Another problem comes from impoundments, which are common in eastern Washington and Oregon. Although man made, they are usually subject to more control and perhaps should be considered for Research Natural Area status. They are not listed in our present structure.

Tables 100 and 101 show how aquatic cells were selected for the 15 provinces in Oregon and Washington. At present, only 18 aquatic cells are filled out of a total of 180 cells (table 102). It is apparent that much work remains to be done in setting aside typical aquatic ecosystems for research and educational purposes.

The concept of aquatic Research Natural Areas is a new one. Suggestions for improvement in the classification scheme and identification of areas that have been omitted are sincerely solicited.

Table 100.--*Selection criteria of aquatic cells for the six physiographic provinces in Washington*

| Type              | Olympic Peninsula<br>and Southwestern<br>Washington                                                                        | Puget Trough                           | Washington Cascades                                          |                                                                | Columbia Basin                                                        | Okanogan<br>Highlands                 |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------|
|                   |                                                                                                                            |                                        | Western Slopes<br>and Crest                                  | Eastern<br>Slopes                                              |                                                                       |                                       |
| Lakes :           |                                                                                                                            |                                        |                                                              |                                                                |                                                                       |                                       |
| Lowland           | Western hemlock <sup>1</sup><br>Fern Lake <sup>2</sup>                                                                     | Eutrophic<br>Oligotrophic <sup>7</sup> | Typical <sup>1</sup>                                         | Eutrophic                                                      | Fresh <sup>14</sup><br>Alkaline <sup>14</sup><br>Saline <sup>14</sup> | Mixed conifer <sup>11</sup>           |
| Subalpine         | Pacific silver fir <sup>3</sup>                                                                                            |                                        | Findley Lake <sup>9</sup><br>North Cascades                  | Oligotrophic <sup>12</sup>                                     |                                                                       | Engelmann<br>spruce-<br>subalpine-fir |
| Alpine            | Typical                                                                                                                    |                                        | Typical                                                      |                                                                |                                                                       |                                       |
| Permanent ponds : |                                                                                                                            |                                        |                                                              |                                                                |                                                                       |                                       |
| Lowland           | Typical                                                                                                                    | Typical                                |                                                              | Typical                                                        | Fresh <sup>14</sup><br>Alkaline <sup>14</sup><br>Saline <sup>14</sup> | Typical                               |
| Subalpine         | Typical                                                                                                                    |                                        | Typical                                                      | Typical                                                        |                                                                       | Typical                               |
| Alpine            | Typical                                                                                                                    |                                        | Typical                                                      |                                                                |                                                                       |                                       |
| Vernal ponds:     |                                                                                                                            |                                        |                                                              |                                                                |                                                                       |                                       |
| Lowland           | Typical                                                                                                                    |                                        |                                                              | Typical                                                        | Typical                                                               | Typical                               |
| Subalpine         | Typical                                                                                                                    |                                        | Typical                                                      | Typical                                                        |                                                                       | Typical                               |
| Alpine            |                                                                                                                            |                                        | Typical                                                      |                                                                |                                                                       |                                       |
| Streams:          |                                                                                                                            |                                        |                                                              |                                                                |                                                                       |                                       |
| Lowland           | Sitka spruce-western<br>hemlock <sup>4</sup><br>Douglas-fir-western<br>hemlock <sup>5</sup><br>Redcedar swamp <sup>6</sup> | Typical <sup>1</sup>                   | Mature conifer <sup>10</sup>                                 | Mixed conifer <sup>13</sup>                                    | Typical<br>(Rattlesnake<br>Creek)                                     | Mixed conifer <sup>15</sup>           |
| Subalpine         | Glacial and non-<br>glacial                                                                                                |                                        | Typical<br>(Butter Creek) <sup>11</sup><br>"Milkwater" creek | Mixed conifer <sup>13</sup><br>Serpentine<br>(El Dorado Creek) |                                                                       | Engelmann<br>spruce-<br>subalpine-fir |

See footnotes at end of table.

Table 100.--*Selection criteria of aquatic cells for the six physiographic provinces in Washington* (Continued)

| Type      | Olympic Peninsula<br>and, Southwestern<br>Washington | Puget Trough | Washington Cascades         |                   | Columbia Basin                             | Okanogan<br>Highlands |
|-----------|------------------------------------------------------|--------------|-----------------------------|-------------------|--------------------------------------------|-----------------------|
|           |                                                      |              | Western Slopes<br>and Crest | Eastern<br>Slopes |                                            |                       |
| Springs : |                                                      |              |                             |                   |                                            |                       |
| Cold      | Typical                                              | Typical      | Typical                     | Typical           | Typical                                    | Typical               |
| Hot       | Typical                                              |              | Typical                     | Typical           | Typical                                    |                       |
| Swamp     | Redcedar                                             |              | Redcedar                    |                   |                                            |                       |
| Marsh     | Typical                                              | Typical      | Typical                     | Typical           | Typical<br>freshwater<br>Typical<br>saline | Typical               |
| Bog       | Typical                                              | Typical      | Typical                     | Typical           |                                            | Typical               |

- <sup>1</sup>Lake and drainage basin of temperate forest.
- <sup>2</sup>Existing study area that could be designated as an RNA.
- <sup>3</sup>Lake and drainage basin of subalpine forest and meadow.
- <sup>4</sup>Sitka spruce-western hemlock forest and major stream drainage (west slope of peninsula). Anadromous fish run.
- <sup>5</sup>Douglas-fir-western hemlock forest and major stream drainage (east slope of peninsula).
- <sup>6</sup>Stream fed by redcedar swamp. Anadromous fish run. Should be combined with swamp cell.
- <sup>7</sup>Lake in glaciated topography and drainage basin of temperate forest.
- <sup>8</sup>Douglas-fir-western hemlock major combined terrestrial and aquatic ecosystem.
- <sup>9</sup>Existing study area that could be designated as an RNA. No fish present. Lake recommended for North Cascades should have fish present.
- <sup>10</sup>Temperate conifer forest and major stream drainage.
- <sup>11</sup>Subalpine forest mosaic and major stream drainage.
- <sup>12</sup>Mixed-conifer forest and lake.
- <sup>13</sup>Mixed-conifer (ponderosa pine, Douglas-fir, grand fir, etc.) forest and major stream drainage. Extends through both lowland and subalpine.
- <sup>14</sup>Series of scabland lakes of varying water chemistry with shrub-steppe communities.
- <sup>15</sup>Mixed-conifer forest and stream drainage.

Table 101.--*Selection criteria of aquatic cells for the nine physiographic provinces in Oregon*

| Type              | Oregon Coast Ranges                                                                                                            | Western Oregon Interior Valleys                    | Siskiyou Mountains                         | Oregon Cascades                                                                                                 |                             | Ochoco, Blue, and Willamette Mountains | Basin and Range, High Lava Plains and Columbia Basin, Owyhee Upland |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------|---------------------------------------------------------------------|
|                   |                                                                                                                                |                                                    |                                            | Western Slopes and Crest                                                                                        | Eastern Slopes              |                                        |                                                                     |
| Lakes :           |                                                                                                                                |                                                    |                                            |                                                                                                                 |                             |                                        |                                                                     |
| Lowland           | Sand dune lake<br>Coastal lake                                                                                                 | Oxbow-<br>Willamette<br>Valley <sup>5</sup>        | Typical                                    | Douglas-fir-<br>western<br>hemlock <sup>6</sup><br>(north)<br><br>Douglas-fir-<br>western<br>hemlock<br>(south) |                             | Mixed conifer                          | Saline (borax<br>lake)<br>Freshwater<br>Playa lake                  |
| Subalpine         |                                                                                                                                |                                                    | Typical<br>Serpentine                      | Western<br>Cascades'<br>High Cascades <sup>7</sup>                                                              | Mixed conifer <sup>10</sup> | Typical                                | Steens Mountain                                                     |
| Alpine            |                                                                                                                                |                                                    |                                            | Typical                                                                                                         |                             | Typical                                |                                                                     |
| Permanent ponds : |                                                                                                                                |                                                    |                                            |                                                                                                                 |                             |                                        |                                                                     |
| Lowland           | Sand dune                                                                                                                      | Eutrophic                                          | Typical                                    | Northern<br>Cascades                                                                                            |                             | Typical                                | Saline<br>Freshwater                                                |
| Subalpine         |                                                                                                                                |                                                    | Typical                                    | Typical                                                                                                         | Typical                     | Typical                                | Steens Mountain                                                     |
| Alpine            |                                                                                                                                |                                                    |                                            | Typical                                                                                                         |                             | Typical                                |                                                                     |
| Vernal ponds:     |                                                                                                                                |                                                    |                                            |                                                                                                                 |                             |                                        |                                                                     |
| Lowland           | Sand dune                                                                                                                      | Typical                                            | Typical                                    | Typical                                                                                                         |                             | Typical                                | Typical                                                             |
| Subalpine         |                                                                                                                                |                                                    | Typical                                    | Typical                                                                                                         | Typical                     | Typical                                | Typical                                                             |
| Alpine            |                                                                                                                                |                                                    |                                            | Typical                                                                                                         |                             | Typical                                |                                                                     |
| Streams :         |                                                                                                                                |                                                    |                                            |                                                                                                                 |                             |                                        |                                                                     |
| Lowland           | Sitka spruce-<br>western<br>hemlock <sup>1</sup><br>Douglas-fir <sup>2</sup><br>Alder <sup>3</sup><br>Sand bottom <sup>4</sup> | East-side<br>small<br>West-side<br>small<br>Slough | Mixed<br>evergreen<br>Coniferous<br>forest | Douglas-fir-<br>western<br>hemlock <sup>8</sup><br>Mixed conifer <sup>9</sup>                                   |                             | Mixed conifer                          | Typical                                                             |
| Subalpine         | Typical<br>headwaters                                                                                                          |                                                    | Serpentine                                 | Typical                                                                                                         | Mixed conifer"              | Typical                                | Sagebrush-<br>juniper <sup>11</sup>                                 |

See footnotes at end of table.

Table 101.--Selection *criteria* of aquatic *cells* for the nine physiographic provinces in Oregon (Continued)

| Type      | Oregon Coast Ranges           | Western Oregon Interior Valleys | Siskiyou Mountains | Oregon Cascades          |                     | Ochoco, Blue, and Willowa Mountains | Basin and Range, High Lava Plains and Columbia Basin, Owyhee Upland |
|-----------|-------------------------------|---------------------------------|--------------------|--------------------------|---------------------|-------------------------------------|---------------------------------------------------------------------|
|           |                               |                                 |                    | Western Slopes and Crest | Eastern Slopes      |                                     |                                                                     |
| Springs : |                               | Mineral                         | Cave               |                          |                     |                                     |                                                                     |
|           |                               |                                 |                    |                          | Metolius headwaters |                                     | Typical Malheur Cave                                                |
| Hot       |                               |                                 |                    | Typical                  | Typical             |                                     | Typical                                                             |
| Swamp     | Sitka spruce                  |                                 |                    |                          |                     |                                     |                                                                     |
| Marsh     | Skunk cabbage<br>Willow-sedge | North                           | Typical            | Bulrush-sedge            | Typical             | Typical                             | Tule west <sup>12</sup>                                             |
|           |                               | South                           |                    |                          |                     |                                     | Tule east <sup>12</sup>                                             |
| Bog       | Coastal                       |                                 | Coastal mountain   | Subalpine                | Typical             | Typical                             |                                                                     |

<sup>1</sup>Combined with terrestrial, includes anadromous fish, includes hardwoods (alder, maple) along stream, should include a drainage directly to ocean with small estuary.

<sup>2</sup>Combined with terrestrial, includes hardwoods (maple, alder) along stream, includes anadromous fish--away from coast.

<sup>3</sup>Combined with terrestrial, includes at least two perennial streams.

<sup>4</sup>Central coastal plain (Florence and south)--small, stable, low gradient. Alder-salmonberry overstory; water-oriented animal refuge.

<sup>5</sup>Probably eutrophic.

<sup>6</sup>Combined with terrestrial (temperate forest).

<sup>7</sup>One or other should be combined with terrestrial (Crabtree Creek might fill need).

<sup>8</sup>Combined with terrestrial (Middle Santiam might fill need), need anadromous fish if possible.

<sup>9</sup>Combined with terrestrial, Abbott Creek RNA fills need.

<sup>10</sup>Combined with terrestrial.

<sup>11</sup>Combined with terrestrial, probably Steens Mountain.

<sup>12</sup>Western tule marsh probably around Klamath Lakes; eastern tule marsh probably around Malheur Lake.

Table 102.--*Number of filled and unfilled aquatic (freshwater) cells, by State and province*

| Province                                         | Number of<br>filled cells | Number of<br>unfilled cells | Total     |
|--------------------------------------------------|---------------------------|-----------------------------|-----------|
| <u>Washington :</u>                              |                           |                             |           |
| Olympic Peninsula and<br>Southwestern Washington | 0                         | 17                          | 17        |
| Puget Trough                                     | 1                         | 7                           | 8         |
| Western Slopes and Crest,<br>Washington Cascades | 7                         | 11                          | 18        |
| Eastern Slopes,<br>Washington Cascades           | 0                         | 11                          | 11        |
| Columbia Basin, Washington                       | 2                         | 11                          | 13        |
| Okanogan Highlands                               | <u>2</u>                  | <u>9</u>                    | <u>11</u> |
| Total                                            | 12                        | 66                          | 78        |
| <br><u>Oregon :</u>                              |                           |                             |           |
| Oregon Coast Ranges                              | 0                         | 13                          | 13        |
| Western Oregon Interior<br>Valleys               | 1                         | 8                           | 9         |
| Siskiyou Mountains                               | 2                         | 12                          | 14        |
| Western Slopes and Crest,<br>Oregon Cascades     | 3                         | 14                          | 17        |
| Eastern Slopes,<br>Oregon Cascades               | 0                         | 8                           | 8         |
| Ochoco, Blue, and Wallowa<br>Mountains           | 0                         | 13                          | 13        |
| Basin and Range                                  | 0                         | 14                          | 14        |
| High Lava Plains and<br>Columbia Basin, Oregon   | 0                         | 6                           | 6         |
| Owyhee Upland                                    | 0                         | <u>8</u>                    | <u>8</u>  |
| Total                                            | 6                         | 96                          | 102       |
| <br>TOTAL                                        | 18                        | 162                         | 180       |

## REPORT OF RARE AND ENDANGERED SPECIES WORKING GROUP

In recent years, there has been much national concern for rare and endangered species. For our purposes, two types of criteria for classification of species into categories are presented: (1) criteria by which a species is selected for preservation within Research Natural Areas;<sup>4</sup> and (2) criteria by which to characterize a species' status.<sup>5</sup> Every attempt has been made to adhere to sound biological principles and objectivity. It is stressed that both sets of criteria are intended to be dynamic, amended, and updated as need dictates.

The aim of obtaining Research Natural Areas is neither strict preservation of a species in a "hands off" concept nor uncontrolled utilization as a "scientific resource." When a Research Natural Area contains a rare, uncommon, threatened, or endangered species, the Research Natural Area becomes an irreplaceable, unique, natural research laboratory. Research within a Research Natural Area is a privilege and must be conducted wisely and with the highest ethical standards.

In Research Natural Areas: (1) Species can be protected that otherwise would not receive protection; (2) species can be protected before they reach the brink of extinction; (3) species and populations can be monitored and knowledge of their requirements and status obtained; and (4) Research Natural Areas will act as refugia for species whose habitats are being destroyed.

If human population growth and land development continue as present trends indicate, sooner or later we will be faced with the prospect of deciding which species are practical to save and which will have to be allowed to decline to extinction. By protecting species, as well as diverse habitats, within Research Natural Areas now, we may be able to forestall or eliminate the necessity of some of those decisions; many or most of the less common species will be included in Research Natural Areas established for other purposes. It is anticipated that very few Research Natural Areas will be established specifically for the protection of individual species; but when necessary, a recognized authority should appraise the candidate areas to ensure the best possible selection.

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<sup>4</sup>These criteria are a direct result of the working group for rare and endangered species of the Research Natural Area workshop.

<sup>5</sup>Murray L. Johnson, Curator of Mammals, Museum of Natural History, University of Puget Sound, Tacoma, Washington, has kindly allowed the use of his unpublished "Terms Related to Populations and Survival Status of Mammals." Johnson's criteria are an excellent beginning to the development of objective criteria for characterization of a species' status. They can be adapted to animal species other than mammals. Unfortunately, as yet only the mammals in Oregon and Washington have been categorized through the use of Johnson's criteria (app. VI). Hopefully, other species will be so treated eventually. Johnson has reserved the right to publish his concepts elsewhere when they have been further refined.

# Criteria by Which a Species Is Selected for Preservation Within Research Natural Areas

## Taxonomic Level

The taxonomic level considered to be compatible with the concept of a minimal RNA system must remain flexible. Species and subspecies should be considered on an individual basis as needs become apparent.

## Kinds of Species

Requirements for compatibility of a species or subspecies with the RNA concept are:

- (1) A species must not necessitate management practices that would alter the RNA in order for the species to survive.
- (2) An animal species must be neither migratory nor wide-ranging, and its entire habitat requirements must be satisfied within RNA boundaries.
- (3) A population must be of sufficient size to remain viable within the RNA.

## Introduced or Reintroduced Species

Introduced or reintroduced species are generally considered to be noncompatible with the RNA concept, except as noted below.

- (1) Under certain circumstances, reintroductions that originate from native gene pools may be considered on an individual basis.
- (2) Native species of North America that have been introduced or relocated would be considered on an individual basis if the species as a whole were determined to be endangered.

## Peripheral Species

Species and, in certain instances, subspecies at the extremes of their known geographical distributions, irrespective of political boundaries, should be considered on an individual basis. Such populations are genetically and evolutionarily important because: (1) they either are adapting genetically or are genetic relics, (2) they are more constrained and influenced by their immediate environment than is the species as a whole, and (3) studies of such populations will facilitate understanding of the adaptability of the species as a whole. Other considerations are as follows:

- (1) A population must be recognized as a natural resident of the area — not as transient, introduced, or relocated.
- (2) It should be determined, based upon the best information, that a population's survival is threatened.

## Working Inventory and Management of Adjacent Areas

A list of species and, in some cases, subspecies within a State or region should be developed at the time of RNA selection or, at the latest, establishment of the RNA. Taxons should be identified with reference to their status (see criteria for status in the two following animal and plant sections) and compatibility with Research Natural Area management concepts as indicated earlier.

**In certain cases, species which are noncompatible with the RNA concept, but are of special interest (rare, uncommon, etc.), may occur within a Research Natural Area. In selected instances, the region adjacent to the Research Natural Area should be managed in such a way as to ensure the survival of the species within the region with the Research Natural Area as its focal point. Management recommendations should be made on an individual basis with respect to the species and the agency concerned.**

## **Terms Related to Populations and Survival Status of Mammals<sup>6</sup>**

### Introduction

There is a need for clearly defining the several terms that are used in lists and published articles related to "rare," "endangered," or "threatened" species. The terms defined have for years been used with impreciseness by individuals or organizations interested in and dedicated to the cause of conservation. The diversity of interest of authors creates a diversity of viewpoints. This in turn results in different meanings or interpretations of the same word.

As a person experienced and reasonably competent in the field of mammalogy, I am frequently asked for my opinion regarding the status of a species. Lists are given me for criticism, related to different accents, different purposes, and honest and thoughtful appraisal at times required qualifying statements that may be frustrating to both me and my respondent.

- In the interest of better communication this paper was organized. It is to be looked upon not as anything new or different, but as a synthesis of definitions and criteria used by many experienced persons. Selection of arbitrary figures were necessary in order to establish a baseline. There is nothing of deeper significance in the numerical portions of the definitions.

"RARE" and "UNCOMMON" are more often than not terms based upon subjective bases. This situation is unsatisfactory. Because the words imply quantification, they should be clearly defined and subject to reproducible evaluation. However, there is no way that a single criterion may be used with all groups of mammals, or with other living things for that matter. This is because of the basic differences of the available methods that can be applied to any quantifying analysis, imposed by the facts of natural history of the organisms themselves.

Therefore mammals have been grouped into general categories related to methods of obtaining data:

- a) Small terrestrial mammals usually observed by collecting in mouse-size or rat-size traps.
- b) Larger terrestrial mammals and seals usually observed by visual means (including aerial survey) and collected by larger traps, guns or camera; game managers frequently have data on these species.
- c) Bats which may be collected by nets or by a variety of means from their day-time retreats or hibernacula; exact information may be secured from bat-banders.
- d) Cetaceans, the most difficult group to census, except in several outstanding examples such as the gray whale; any attempt to quantitate populations in a local or regional area is frustrating. Collecting data is available from commercial or indigenous catches, widely scattered, selective and declining. Visual observation and strandings are opportunistic and not systematically organized at this time. Appraisal of species of this group must accept a great degree of subjectivity.

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<sup>6</sup>This entire section is a direct quotation from an unpublished paper by Murray L. Johnson. See footnote 5.

Another serious consideration in stating relative abundance of any species is related to the amount of study and collecting efforts that have been applied to that species. A species, if intensively and expertly studied, may have more scientific specimens available than a common but less well studied species.

"ENDANGERED" and "THREATENED" are terms related to future events. As such the inherent uncertainties mitigate against quantification in establishing criteria. Although a model could be set up that would incorporate quantified data, this I believe would greatly magnify the chances of error and lessen the benefits to be derived. These terms therefore are best designated by opinions of experts. As defined here, the term "ENDANGERED" is compatible with the usage "Endangered" in the Red Book of the IUCN (International Union for Conservation of Nature) and Resource Publications of the [U.S.] Bureau of Sport Fisheries and Wildlife, U.S. Department of Interior, number 34 (1966, revised 1968) and number 114 (1973), and as listed in the U.S. Federal Register. The term "THREATENED" embodies in part the concepts suggested in Resource Publication 114 (1973). It should be particularly useful as applied to lists of States, Provinces or other restricted geographical areas.

In defining terms, the above considerations are made, these covering the major variables related to most species of mammals. However, the reader must accept with the author the varied imprecision of the applied terms.

## DEFINITIONS

### Definition of Quantification

- RARE: (R) A species or subspecies is considered RARE within a State or Province when any of the following conditions exist:
- a) Small terrestrial mammals
    - 1) Fewer than 25 specimens are in scientific collections.
    - 2) The present range within the State or Province is less than 10 mi<sup>2</sup> (25.9 km<sup>2</sup>).
    - 3) In cases of easily observed species, fewer than 25 individuals can be regularly observed during two full days field observations by one person, in an optimum habitat.
    - 4) In cases where intensive expert study has been done, only one individual or less can usually be secured per 500 trap nights, in optimum habitat, or when only one animal or less can usually be secured in two full days of field work by one person.
  - b) Large terrestrial mammals and seals
    - 1) Fewer than 12 specimens are in scientific collections:
    - 2) In cases of easily observed species, fewer than 25 individuals can be regularly observed during two full days field observations by one person, in an optimum habitat.
    - 3) The present range is less than 10 mi<sup>2</sup> (25.9 km<sup>2</sup>).
    - 4) Data from game management files indicates rarity because of direct observations, trapping or hunting.
  - c) Bats
    - 1) Fewer than 25 specimens are in scientific collections.

- 2) Fewer than 25 individuals can be regularly observed during two full days of field observation, in optimum habitat and season.
  - 3) The present range is less than 10 mi<sup>2</sup> (25.9 km<sup>2</sup>).
- d) Cetaceans
- 1) In cases of smaller whales and porpoises, fewer than 5 specimens in scientific collections.
  - 2) Fewer than two individuals can regularly be observed by a single person during two full days field observations, in optimum habitat.
  - 3) Fewer than 2 observations from all sources per year—confirmed, identified sightings, photographs (all within 200 mile limit from shore) or strandings.

UNCOMMON: (U) A species or subspecies is considered UNCOMMON within a State or Province when any of the following conditions exist:

- a) Small terrestrial mammals
- 1) Fewer than 50 specimens (more than 25) are in scientific collections.
  - 2) The present range within the State or Province is less than 30 mi<sup>2</sup> (87.7 km<sup>2</sup>).
  - 3) In cases of easily observed species, fewer than 50 individuals can be regularly observed during two full days field observations by one person, in an optimum habitat.
  - 4) In cases where intensive expert study has been done, only one individual or less can usually be secured per 200 trap nights in optimum habitat, or when only one animal can usually be secured in one full day of field work.
- b) Large terrestrial mammals and seals
- 1) Fewer than 25 specimens are in scientific collections.
  - 2) In cases of easily observed specimens: fewer than 25 individuals can regularly be seen during one full day of field observation in an optimum habitat.
  - 3) The present range is less than 30 mi<sup>2</sup> (87.7 km<sup>2</sup>).
  - 4) Data from game management files indicate unusual status because of direct observations, trapping or hunting.
- c) Bats
- 1) Fewer than 50 specimens are in scientific collections.
  - 2) Fewer than 50 individuals can be regularly observed during one full day of field observation, in optimum habitat and season.

3) The present range is less than 30 mi<sup>2</sup> (87.7 km<sup>2</sup>).

d) Cetaceans

- 1) In cases of smaller whales and porpoises: fewer than 10 specimens in scientific collections.
- 2) Fewer than 2 individuals can regularly be observed during one day of field observation, in optimum habitat.
- 3) Fewer than 4 observations from all sources per year; confirmed, identified sightings, photographs (within 200 mi from shore) or strandings.

Definitions Related to Survival

ENDANGERED: (E) Any species or subspecies considered likely to become extinct in its total range during the next 10 years if present trends continue. Related to population estimates and dynamics, and to habitat destruction.

THREATENED: (TH) Any species or subspecies not on the ENDANGERED list, but which is considered likely to be extirpated from a localized area such as a State or Province or lesser area within the next 10 years if present trends continue.

EXTINCT: (EX) Any species or subspecies that has not been reliably reported within any State or Province during the past 10 years, and which may be reasonably considered extinct by reason of reliability of information and state of knowledge that exists regarding the species.

Qualifying Definitions

STATUS  
UNDETERMINED: (SU) May be appended to any designation in cases where up-to-date information is not available or where the status information is especially suspect or tenuous.

PERIPHERAL: (P) May be appended to any designation in cases where the species has a major or extended range in a contiguous State or Province. PERIPHERAL is of biological importance when the locality represents the extreme of range or an isolated island of population; it is of political importance only when it represents an incidental crossing of border.

ACCIDENTAL: (A) May be appended to any designation whenever the situation logically suggests that an individual observation or collection was the result of wandering beyond a natural range.

UNIQUE: (UN) May be appended to any designation whenever the range of the species or subspecies lies entirely within a given political boundary such as a State or Province.

## APPLICATION OF TERMS TO OTHER GROUPS OF ORGANISMS

Although the definitions and criteria noted in this paper are primarily related to mammals of the North Pacific area of North America, they may with similar benefit be applied to other organisms and other areas. For instance, other terrestrial plants and animals may be assigned RARE or UNCOMMON status by applying the criteria for small terrestrial mammals. Species of birds may appropriately be classified as under small or large terrestrial mammals. Definitions of survival and qualifying definitions should not be significantly different for any biologic group.

## SUMMARY STATEMENT

Terms are defined and the criteria are suggested that will help to unify reference to rare and endangered species of mammals. It is to be stressed that this subject is dynamic and status of any form may change in a single year. Continued re-evaluation is necessary for proper use of the definitions suggested.<sup>7</sup>

## Vascular Plants of Special Interest

Vascular plants of special interest are approached on a somewhat different basis from vertebrate animals.<sup>8</sup> There are many more plant than animal species of unique interest. Lists were compiled for each State by botanists from literature and herbarium surveys and questioning of professional and amateur botanists familiar with the region. Additional suggestions came from preliminary editions of the national list of threatened and endangered plants (Smithsonian Institution 1974).

Criteria used to select plants of special interest were the following:

### A. Rare

1. Range limited and circumscribed
  - a. Local endemic (found only in a small area, e.g., a single mountain)
  - b. Regional endemic (found only in a region, e.g., Siskiyou Mountains)
  - c. Disjunct population (widely separated from main body of a species' range)
  - d. Marginal population (at edge of species' range, including outliers)
2. Range widespread but with relatively few individuals per site or relatively few sites or both

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<sup>7</sup>End of Johnson quotation.

<sup>8</sup>Only vascular plants are considered at this time; necessary information on other plant groups could not be accumulated easily or is incomplete.

B. Endangered

1. Habitat being destroyed, e.g., by agricultural or hydroelectric developments
2. Plants being destroyed, e.g., by collectors or selective grazing

These criteria could be used in only a general way, however, because the real status of many plants is unknown. Furthermore it was not possible to do field checks for verification of presumed status.

Complete lists are presented of vascular plants of special interest which were developed for each province. This has been done for a variety of reasons. First, land managers in each area need a single reference to all vascular plants presently known or believed to be worthy of special attention in planning and management activities. Second, unusual species should be identified which can be considered in selection of Research Natural Areas representative of terrestrial and aquatic ecosystems and incorporated as adjunct elements. Third, areas must be designated where concentrations of special interest plants warrant selection and establishment of Research Natural Areas specifically for their protection and study.

The purpose of these lists is to summarize present knowledge on the status of vascular plant species, stimulate interest, solicit information, and thus, hopefully, to improve chances of survival for the plants of interest. They do not constitute unofficial or official lists of "endangered" plants. The only indication of "status" we have provided, other than to describe the group in general as special interest or rare and endangered plants, is identification of those plants included in the Smithsonian list (Smithsonian Institution 1974). These are proposed for, and by the time this report appears may have received, official designation as Threatened or Endangered species under the Endangered Species Act of 1973. We also assume that individuals engaged in selection of Research Natural Areas for terrestrial and aquatic interest will try to incorporate populations of special interest species when possible.

None of the plants listed have been identified as essential elements or cells in a system of Research Natural Areas. A majority of the species could probably be included in the sense that maintenance of viable populations would not require activities incompatible with the Research Natural Area concept. However, only a subset of these compatible species requires a strict reserve of this nature for their protection and study. Many can be preserved in National and State Parks, Botanical Areas, Wilderness and other roadless areas, etc., provided that they are recognized and accommodated in management plans for these tracts. What we have done is to identify the need for Research Natural Areas in several areas where there are concentrations of special interest plants, particularly those on the Smithsonian list which have some official status as Threatened and Endangered. Among the most notable of these areas are the Columbia River Gorge (listed in four provinces), Siskiyou Mountains, Wenatchee Mountains, Snake River Canyon, Owyhee Canyon, and northeastern Olympic Peninsula.

Frequent reevaluation of the lists of special interest plants with additions and deletions is expected. In fact, periodic evaluations are viewed as essential if the lists are to reflect our current knowledge regarding distinctive species in our regional flora.

Nomenclature of plants generally follows that of Hitchcock et al. (1955-69) supplemented by Peck (1961) in southern Oregon. A few species are not described in either.

# *Part V*

## *Conclusions and Recommendations*

In the course of deliberations the workshop participants surfaced a variety of concerns relating to implementation of the Research Natural Area recommendations. These relate to actual selection of areas, use of established Research Natural Areas, considerations of scientific values in management of areas which are not dedicated to research, and resolution of some problems regarding how some types of aquatic tracts should be dealt with.

### **SELECTION OF AREAS**

It is clear that the major task is to get on with identification and dedication of areas which satisfy the remaining Research Natural Area needs. While the program in the Pacific Northwest has been progressing well, a great deal remains to be done. Hopefully this document makes clear the extent of the task as well as the priorities with regard to ecosystem types, ownerships, and geographic regions. A consideration of the existing system makes clear the most glaring deficiencies in the system with regard to each of these items. For example, marine ecosystems are almost totally lacking in the existing system, freshwater ecosystems are only a little better off, and even in the case of terrestrial types, great gaps exist in the steppes east of the Cascade Range, the heavily populated Puget Trough and Western Oregon Interior Valleys, and in southwestern and eastern Oregon.

Consequently, we believe that all participants should greatly expand their efforts aimed at identifying and reserving the needed areas. It is feasible to suggest a goal of 50 percent completion of the system in 5 years and 80 to 90 percent in 10 years.

It is also clear that selection of areas will require more effort than has been typical in the past. For example, in many cases it has become apparent that the wisest course is, when possible, to select areas which incorporate as many cells or needs as possible. That is, we should be looking for areas with a greater variety of ecosystems, habitats, and organisms rather than looking for an area representative of a single feature.

The selection of multiple-cell Research Natural Areas has several implications. For one thing we will often be seeking larger individual tracts than would have been the case with single-feature areas. As the size and consequent land investment increase, it must be more clearly established that the selected tract is the best area available. Therefore evaluation of a proposed tract should include a representation of more scientific disciplines and better documentation of the scientific values before it is established.

We recommend that, insofar as possible, tracts proposed for multicellular Research Natural Areas be evaluated by teams or individuals representing the several disciplines appropriate to each cell (e.g., limnologist, terrestrial plant and animal ecologists, soil scientist).

Care in selection should include the very important consideration that Research Natural Areas should be established on soils and landforms representative of broad land segments. It is only in this way that they can realize their full potential as baseline or control areas and that results of research can have their widest application. Even though individual soils and landforms are not recognized as cells in this report, the need for attention to these elements is considered implicit and is aided through designation of subprovince location in the natural area needs listings (pt. II).

Two steps are proposed to assist in assuring representation of soils and landforms. First, we recommend that the U.S. Department of Agriculture, Forest Service, the Soil Conservation Service, and other agencies conducting soil-landform surveys be encouraged to provide, as data become available, a tabulation of the soil type-landform mapping units on the ownerships they are surveying and their importance (acreage). Second, soils and landforms should be adequately described as part of the documentation process on proposed Research Natural Areas.

The increased concern for representation of aquatic systems and rare and endangered animals as well as important soils and landforms leads us to encourage the agencies to improve their knowledge of existing Research Natural Areas. There is clearly a need to know better what is already protected, and the Federal agencies are to be commended for their recent efforts along these lines.

Related to the additional study of existing Research Natural Areas is the need to reexamine several of the older tracts to determine whether boundaries can be adjusted to provide new or better representation of additional cells. Many of the early areas were set up with a single community or ecosystem in mind; with alteration, they could serve several needs.

All of this can be summarized by a recommendation to take a retrospective look at what is already preserved as Research Natural Areas and determine if adjustments are desirable to increase the areas' value.

The emphasis on multicellular Research Natural Areas should not obscure the fact that many, if not the majority, of Research Natural Areas will be smaller areas focused on single ecosystems or habitats. Much work remains to be done in identifying and dedicating these types of areas. Similarly, excessive pursuit of an ideal area, which contains many cells, must not be allowed to become a major roadblock. It may not be possible to locate an ideal area as hypothesized in the listing, and the involved agencies and scientists should be prepared to alter cellular makeups as necessary.

## RARE AND ENDANGERED ORGANISMS

Much work remains to be done in identifying the best way to handle rare and endangered organisms, particularly plants. We were able to largely resolve the needs insofar as rare and endangered vertebrates are concerned, i.e., identify those which can and should be handled in a Research Natural Area context and those which cannot. The situation is much less clear with regard to invertebrates and plants; we lack even acceptable lists for many of these organisms.

There are several important items to keep in mind as we proceed in the future. First of all, there must be close coordination with the threatened and endangered organism program of the U.S. Department of Interior, Fish and Wildlife Service. The national program is developing lists which we can use as a working base in regional programs; two of these have been used in preparing this document.

At least as important is the recognition that many of the rare and endangered plants and, perhaps, invertebrates can be protected by a variety of procedures short of establishing Research Natural Areas specifically for them. Included are identified tracts open to a wider array of uses but within which management is designed to protect the rare and endangered populations—Botanical Areas, State and National Parks, and Wilderness Areas, as examples. The scientist should make the land manager aware of a valid rare and endangered organism and advise measures necessary for its perpetuation which will often be compatible with many other uses. Awareness is one reason for the extensive tables on vascular plants of special interest.

Many rare and endangered organisms are, of course, already protected in Research Natural Areas and more should be. Therefore, what remains to be done? First, we need improved knowledge of the rare and endangered organisms which may be present in Research Natural Areas. This goes back to the earlier recommendation for better descriptions of the natural features of existing Research Natural Areas.

With regard to scientific use of Research Natural Areas there are, however, some special management problems. Theoretically, all research use of these reserves is approved by the managing agency, and approval is held to those studies which will not significantly alter the natural feature or natural processes affecting it. We believe some guidance to institutions would be helpful in evaluating proposed research on rare and endangered organisms and, indeed, all animal studies. These guidelines should not be construed as overly restrictive. Rather, they are intended to protect the species of interest while at the same time insuring the proper accumulation of knowledge and maintaining the individual-freedom of the researcher.

Suggested guidelines follow.

1. In addition to the agency personnel and the appropriate Research Natural Area Committee, a recognized authority should review each research proposal to determine the following:
  - a. Is the study worthwhile?
  - b. Will the type of study be compatible with the survival of the species?
  - c. Does the study necessitate the removal of specimens (collecting)?
  - d. How many specimens can be removed without endangering the survival of the population?
2. If specimens are to be collected, the proper permits (State, Federal, etc.) should be required.
3. Minimum standards of data recording should be required.
4. All possible data should be gathered, recorded, and preserved with respect to the particular species that Research Natural Area has been established to protect.
5. All individuals of the particular species which the Research Natural Area has been established to protect should be prepared as proper specimens; such specimens should be placed in a bona fide repository. The location of the specimens as well as pertinent data should be on file with the proper agency for other students to use.

6. A file of all research proposals should be maintained to insure that studies conducted on a particular species, within a particular Research Natural Area, are such that knowledge is enhanced and that unnecessary duplication is avoided.
7. Copies of articles resulting from studies conducted within a Research Natural Area should be required and maintained in a central library.
8. Long-term, nondestructive studies for Rare, Uncommon, Threatened, or Endangered species should be encouraged within Research Natural Areas.

We strongly recommend that the rare and endangered species component of the Research Natural Area program be closely coordinated with the Fish and Wildlife Service's program under the new Endangered Species Act. Beyond this, working relationships should be developed with the State game departments for fur-bearing and nongame animals. Cooperative working relationships should be developed so that these departments are completely aware of the Research Natural Areas, their purpose and location, and so that they are closed to nonconforming, animal-removal activities.

## AQUATIC AREAS

As mentioned earlier, progress has been slowest in establishment of aquatically oriented Research Natural Areas. Several serious conceptual problems remain also. We never resolved the question of how examples of the aquatic communities of large river systems can be preserved for study. Setting aside river segments can do the job for riparian biota but will not satisfactorily preserve the river community itself. One suggestion was that it may be possible to provide examples of such ecosystems for study in the context of Wilderness Areas or of Wild and Scenic Rivers. This may well be the case, but if so, exemplary rivers should be identified so both managers and scientists are aware of them and their specific scientific values.

Perhaps more relevant to the natural area program is the question of whether it is necessary to protect the complete drainage of a lake, pond, or stream before it is acceptable as a Research Natural Area. There was no question that such a situation is preferred, i.e., control of the complete watershed. However, it might be possible to accept something less, depending upon the surrounding topography, use of adjacent lands, etc. Perhaps this question can be resolved on a case-by-case basis, but the Steering Committee may also wish to ask for general advice from a group of aquatic biologists.

## USING RESEARCH NATURAL AREAS

Research Natural Areas are already receiving a surprising amount of use in the Pacific Northwest (app. 11). However, certain types of research use require encouragement, and any use requires careful monitoring to insure it is nondestructive. As already mentioned, one of the greatest needs is for better knowledge of the organisms and ecosystems found in existing Research Natural Areas. We would go further, however, and suggest agencies and institutions

should be strongly encouraged to establish baseline study plots, e.g., permanent vegetation plots and photo points, in existing Research Natural Areas, so that they can better function as controls. Further, we would encourage agencies involved in surveys of vegetation, soil, landforms, etc., to give high priority to inventories and mapping of Research Natural Areas. In summary, baseline studies of all types should be given first priority for any funding and first priority as candidates in baseline monitoring and inventory.

In order to provide the necessary coordination of research activities on natural areas, the Steering Committee should consider ways of establishing a central file, library, or data bank on existing Research Natural Areas. This would also provide a source of information for land managers and scientists for both research and management purposes.

Finally, the review of proposals for scientific use of Research Natural Areas should be considered. The question of conforming or nonconforming use is not as clear as it seems. What can be tolerated in the research use of one area (collections, soil pits, litter treatment) is unacceptable in another. The biota, habitat, size, and topography of the area are among the several considerations. Agencies or other groups responsible for natural areas should consider establishment of ad hoc or formal advisory bodies of scientists to advise them as to the merit and appropriateness of borderline research proposals.

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# APPENDIX I.

## AREAS UNDER SERIOUS CONSIDERATION FOR DESIGNATION AS FEDERAL RESEARCH NATURAL AREAS

| <u>Name</u>     | <u>Principal features</u>                                                                                                  | <u>Responsible agency<sup>1</sup></u> |
|-----------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Bachelor Island | Black cottonwood-willow stands on part of island in Columbia River                                                         | FWS                                   |
| Beatty Creek    | Jeffrey pine near northern range limits in southwestern Oregon                                                             | BLM                                   |
| Boulder Creek   | Ponderosa pine/bunchgrass forest on steep, granitic stream drainage on eastern slopes of northern Washington Cascade Range | FS                                    |
| Cannon Wells    | Lodgepole pine/bitterbrush forest on coarse Mazama pumice east of Crater Lake                                              | FS                                    |
| Cougar Butte    | Mountain meadow and associated vegetation along Rogue-Umpqua River divide in southwestern Oregon                           | FS                                    |
| Crabtree Lake   | Subalpine lake and drainage and western redcedar forest on western slopes of Oregon Cascade Range                          | BLM                                   |
| Eldorado Creek  | Serpentine area in Wenatchee Mountains on eastern slopes of Washington Cascade Range                                       | FS                                    |
| Flynn Creek     | Stream drainage in Oregon Coast Ranges with anadromous fish and second-growth Douglas-fir forest                           | FS                                    |

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<sup>1</sup> BLM= Bureau of Land Management, FS= Forest Service, NPS= National Park Service, FWS= Fish and Wildlife Service.

| <u>Name</u>                  | <u>Principal features</u>                                                                                                   | <u>Responsible agency<sup>1</sup></u> |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Government Draw              | Mosaic of grassland and coniferous forest communities in Wallowa Mountains of northeastern Oregon                           | FS                                    |
| Green Mountain               | Subalpine meadows and parkland on western slopes of northern Washington Cascade Range                                       | FS                                    |
| Head of Little Blitzen Gorge | Bunchgrass steppe and associated vegetation over 3,000-foot elevation range                                                 | BLM                                   |
| Hunter Creek Bog             | Bog community along Oregon Coast                                                                                            | FS-BLM                                |
| Jordan Craters               | Area of Pleistocene volcanic activity, shrub-steppe, and lakes and ponds in southeastern Oregon                             | BLM                                   |
| Kiger Gorge Plateau          | Bunchgrass steppe over 2,000-foot elevational range                                                                         | BLM                                   |
| Middle Santiam               | Old-growth Douglas-fir-western hemlock forest and stream drainage on western slopes of Oregon Cascade Range                 | FS                                    |
| Moore Flat                   | Mixed-conifer forest, including ponderosa pine, Douglas-fir, and grand fir in Blue Mountains                                | FS                                    |
| Mountain Hemlock             | Stands of mountain hemlock and associated ponds along crest of Oregon Cascade Range near Waldo Lake                         | FS                                    |
| North Hunting Island         | Black cottonwood-Sitka spruce-willow community on island in lower Columbia River                                            | FWS                                   |
| Store Gulch                  | Mixed-evergreen forest and stream drainage along Illinois River on east slopes of Siskiyou Mountains in southwestern Oregon | FS                                    |
| Swakane Canyon               | Rare <i>Trifolium thompsonii</i> and associated meadow on eastern slopes of northern Washington Cascade Range               | FS                                    |
| The Island                   | Western juniper and big sagebrush on isolated plateau in Deschutes River of eastern Oregon                                  | BLM-FS                                |
| Tiffany Mountain             | Subalpine larch, alpine meadows, and ponds on eastern slopes of northern Washington Cascade Range                           | FS                                    |
| Twin Creek                   | Enlarged area to include stream drainages in Sitka spruce-western hemlock forests on western slopes of Olympic Mountains    | NPS                                   |
| Twinbutte Creek              | Southwestern Oregon mixed-conifer forest in South Umpqua River drainage                                                     | FS                                    |
| Wickiup Springs              | Shasta red fir forest over an elevational range on western slopes of southern Oregon Cascade Range                          | FS                                    |

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<sup>1</sup> BLM= Bureau of Land Management, FS= Forest Service, NPS= National Park Service, FWS= Fish and Wildlife Service.

# APPENDIX 11.

## PARTIAL LIST OF PAST AND CURRENT STUDIES

### ON RESEARCH NATURAL AREAS

| <u>Research<br/>Natural Area</u> | <u>Subject of study</u>                                                | <u>status</u> | <u>Institution</u>                 |
|----------------------------------|------------------------------------------------------------------------|---------------|------------------------------------|
| Abbott Creek                     | Vegetation classification of southwestern Oregon mixed-conifer forests | Completed     | Oregon State University            |
| Bluejay                          | Classification of ecosystems of Mazama pumice region                   | Current       | U.S. Forest Service                |
| Butter Creek                     | Classification of subalpine meadow communities of Washington Cascades  | Current       | Oregon and Utah State Universities |
| Coquille River Falls             | Progression of <i>Phytophthora</i> root rot                            | Current       | Oregon State University            |
|                                  | Ecology of Port-Orford-cedar                                           | Current       | Oregon State University            |
| Goat Marsh                       | Productivity analysis of super-lative noble fir stand                  | Current       | Coniferous Forest Biome (IBP)      |
| Gold Lake Bog                    | Taxonomy of frogs                                                      | Completed     | Oregon State University            |
| Horse Ridge                      | Baseline bird and mammal populations in juniper savanna                | Current       | U.S. Fish and Wildlife Service     |
|                                  | Classification of juniper forests of eastern Oregon                    | Completed     | U.S. Forest Service                |
| Jackson Creek                    | Study of Olympic rain forest                                           | Current       | Western Washington State College   |
| Little Sink                      | Floral and faunal studies of Willamette foothill forests and ponds     | Current       | Oregon College of Education        |
| Lost Forest                      | Characteristics and explanation of the disjunct pine forest            | Completed     | Oregon State University            |
| Maple Knoll                      | Bird communities in Willamette Valley forest communities               | Completed     | Oregon State University            |
| Meeks Table                      | Range communities of Meeks Table                                       | Completed     | U.S. Forest Service                |
|                                  | Soils of eastern Washington Cascade Range                              | Current       | U.S. Forest Service                |

| <u>Research<br/>Natural Area</u> | <u>Subject of study</u>                                                                                                                                                                                                                                        | <u>Status</u> | <u>Institution</u>                                                                                                              |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------|
| Metolius                         | Environmental effects on forest productivity                                                                                                                                                                                                                   | Current       | Coniferous Forest Biome (IBP)                                                                                                   |
| Neskowin Crest                   | Mammals of the Oregon coast                                                                                                                                                                                                                                    | Current       | University of Puget Sound                                                                                                       |
| North Fork Nooksack              | Characteristics of litter layers in northwestern forests                                                                                                                                                                                                       | Completed     | University of Washington                                                                                                        |
| Ochoco Divide                    | Classification of the forests of the Blue Mountain region                                                                                                                                                                                                      | Completed     | U.S. Forest Service                                                                                                             |
| Olallie Ridge                    | Disjunct flora of Oregon Cascades                                                                                                                                                                                                                              | Completed     | University of Oregon                                                                                                            |
| Pigeon Butte                     | Bird communities in Willamette Valley forest communities                                                                                                                                                                                                       | Completed     | Oregon State University                                                                                                         |
| Port Orford Cedar                | Progression of <i>Phytophthora</i> root rot                                                                                                                                                                                                                    | Current       | Oregon State University                                                                                                         |
|                                  | Ecology of Port-Orford-cedar                                                                                                                                                                                                                                   | Current       | Oregon State University                                                                                                         |
| Pringle Falls                    | Litter decomposition in pine forests                                                                                                                                                                                                                           | Current       | Coniferous Forest Biome (IBP)                                                                                                   |
|                                  | Growth of ponderosa and lodgepole pine forests                                                                                                                                                                                                                 | Completed     | U.S. Forest Service                                                                                                             |
|                                  | Seed production by ponderosa and lodgepole pine                                                                                                                                                                                                                | Current       | U.S. Forest Service                                                                                                             |
|                                  | Baseline bird and mammal population in ponderosa and lodgepole pine forests                                                                                                                                                                                    | Current       | U.S. Fish and Wildlife Service                                                                                                  |
| Rainbow Creek                    | Insect studies in larch forests                                                                                                                                                                                                                                | Current       | U.S. Forest Service                                                                                                             |
| Rattlesnake Hills                | Variety of studies including productivity and cycling in different ecosystems, environment-community relationships, meteorology, vertebrate and invertebrate populations, food habits, hydrology, geology, soils, effects of burning on ecosystems, succession | Current       | Battelle Memorial Institute, Energy Research and Development Administration, Washington State University, Grassland Biome (IBP) |
|                                  | Plant communities of the Columbia Basin                                                                                                                                                                                                                        | Completed     | Washington State University                                                                                                     |

| <u>Research<br/>Natural Area</u> | <u>Subject of study</u>                                                              | <u>status</u> | <u>Institution</u>                                  |
|----------------------------------|--------------------------------------------------------------------------------------|---------------|-----------------------------------------------------|
| Sister Rocks                     | Classification of subalpine communities in southern Washington                       | Completed     | U.S. Forest Service                                 |
| Steamboat Mountain               | Cone and seed production by subalpine fir                                            | Current       | U.S. Forest Service                                 |
|                                  | Growth and succession in subalpine fir forest                                        | Current       | U.S. Forest Service                                 |
|                                  | Classification of subalpine communities in southern Washington                       | Current       | U.S. Forest Service                                 |
| Twin Creek                       | Vegetative study of Olympic rain forest                                              | Current       | Western Washington State College                    |
| Wheeler Creek                    | Mammals of the Oregon coast                                                          | Current       | University of Puget Sound                           |
| Wildcat Mountain                 | Cone and seed production by noble and silver firs and mountain hemlock               | Current       | U.S. Forest Service                                 |
|                                  | Litter fall and decomposition in true fir-hemlock forests                            | Current       | Coniferous Forest Biome (IBP)                       |
|                                  | Productivity and nutrient balance in true fir-hemlock forests                        | Current       | Coniferous Forest Biome (IBP)                       |
|                                  | Classification of Oregon Cascade forest communities                                  | Current       | U.S. Forest Service                                 |
|                                  | Environment-forest community relationships in Oregon Cascade Range                   | Current       | Coniferous Forest Biome (IBP)                       |
|                                  | Distribution of vertebrate animals in relation to forest communities and environment | Current       | Coniferous Forest Biome (IBP)                       |
| Willamette Floodplain            | Composition, succession, and productivity in Willamette grasslands                   | Current       | U.S. Forest Service, U.S. Fish and Wildlife Service |
|                                  | Small mammal populations in Willamette prairies                                      | Current       | U.S. Forest Service, U.S. Fish and Wildlife Service |
| Wind River                       | Growth and mortality in old-growth Douglas-fir-hemlock forest                        | Current       | U.S. Forest Service                                 |
|                                  | Seed survival of Douglas-fir in forest floor                                         | Completed     | U.S. Forest Service                                 |

# **APPENDIX 111.**

## **WASHINGTON LEGISLATION ON RESEARCH NATURAL AREAS**

HOUSE BILL NO. 482

State of Washington  
42nd Legislature

by Representatives North,  
Moon and Cunningham

Second Extraordinary Session

Read first time January 19, 1972, and referred to Committee on Natural Resources and Ecology

AN ACT Relating to natural resources: and adding a new chapter to Title 79 RCW.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

NEW SECTION. Section 1. The purpose of this chapter is to establish a state system of natural area preserves and a means whereby the preservation of these aquatic and land areas can be accomplished.

All areas within the state, except those which are expressly dedicated by law for preservation and protection in their natural conditions, are subject to alteration by human activity. Natural lands, together with the plants and animals living thereon in natural ecological systems, are valuable for the purposes of scientific research, teaching, as habitats of rare and vanishing species, as places of natural historic and natural interest and scenic beauty, and as living museums of the original heritage of the state.

It is, therefore, the public policy of the state of Washington to secure for the people of present and future generations the benefit of an enduring resource of natural areas by establishing a system of natural area preserves, and to provide for the protection of these natural areas.

NEW SECTION. Sec. 2. For the purposes of this chapter:

(1) "Department" shall mean the department of natural resources.

(2) "Natural areas" and "natural area preserves" shall mean such public or private areas of land or water which have retained their natural character, although not necessarily completely natural and undisturbed, or which are important in preserving rare or vanishing flora, fauna, archaeological, natural historical or similar features of scientific or educational value.

(3) "Public lands" and "state lands" shall have the meaning set out in RCW 79.01.004.

(4) "Committee" shall mean the Washington state natural preserves advisory committee created in section 5 of this chapter.

NEW SECTION. Sec. 3. In order to set aside, preserve and protect natural areas within the state, the department is authorized, in addition to any other powers, to:

(1) Establish by rule and regulation the criteria for selection, acquisition, management, protection and use of such natural areas;

(2) Cooperate and contract with any federal, state, or local governmental agency, private organizations or individuals in carrying out the purpose of this chapter;

(3) Acquire by gift, device, purchase, grant, dedication, or means other than eminent domain, the fee or any lesser right or interest in real property which shall be held and managed as a natural area; and

(4) Acquire by gift, device, grant or donation any personal property to be used in the acquisition and/or management of natural areas;

(5) Inventory existing public, state and private lands in cooperation with the committee to assess possible natural areas to be preserved within the state.

NEW SECTION. Sec. 4. The department is further authorized to purchase, lease, set aside or exchange any public land or state-owned trust lands which are deemed to be natural areas: PROVIDED, That the appropriate state land trust receives the fair market value for any interests that are disposed of: ,PROVIDED, FURTHER, That such transactions are approved by the board of natural resources.

An area consisting of public land or state-owned trust lands designated as a natural area preserve shall be held in trust and shall not be alienated except to another public use upon a finding by the department of natural resources of imperative and unavoidable public necessity.

NEW SECTION. Sec. 5. A Washington state natural preserves advisory committee is hereby created within the department of natural resources to assist the department in carrying out the intent of this chapter. Such committee shall consist of seven members appointed by the commissioner of the department. Any vacancies shall be filled in the same manner. Members shall be chosen from persons with an interest in the establishment of natural areas and shall serve a period of three years.

NEW SECTION. Sec. 6. Nothing in this chapter is intended to supersede or otherwise affect any existing legislation.

Passed the House February 16, 1972.

Speaker of the House.

Passed the Senate February 12, 1972.

President of the Senate.

Approved February 24, 1972

Governor of the State of Washington

# **APPENDIX IV.**

## **OREGON LEGISLATION ON RESEARCH NATURAL AREAS**

OREGON LEGISLATIVE ASSEMBLY—1973 REGULAR SESSION

HOUSE BILL 2232

Ordered by the Senate June 23

(Including Amendments by House Committee on Environment  
and Land Use March 22 and by Senate June 5 and June 23)

Sponsored by Representatives INGALLS, PAULUS, PERRY, FADELEY, KATZ, WHITING

Authorizes State Land Board to establish natural area preserves for educational and scientific use of natural areas. Defines "natural area." Provides that no land be included within natural area unless it is in public ownership on effective date of Act or is acquired after effective date of Act by method requiring no expenditure of public funds for acquisition. Prohibits use, by board, of condemnation to acquire lands or interests therein for natural area preserves. Prescribes procedures for establishment of natural areas under jurisdiction of board or by agreement with other public agency. Creates Natural Area Preserves Advisory Committee within board to assist board in carrying out Act. Provides for composition, term, and compensation of committee members.

Establishes Natural Area Preserves Account. Appropriates moneys in account for purpose of carrying out this Act.

### **A BILL FOR AN ACT**

Relating to the preservation of natural areas; and appropriating money.

Be it Enacted by the People of the State of Oregon:

SECTION 1. (1) The Legislative Assembly finds that all public lands and waters within the state that constitute natural areas are subject to alteration by human activities unless such public lands and waters are preserved and protected for the use and benefit of the people of this state. The Legislative Assembly further finds that natural areas are valuable to the people of this state for educational and scientific uses, for habitats for plant, animal, and marine species, for the preservation of the paleontological resources and the natural historic features of such public lands and waters, for public benefits from the features of such public lands and waters and for the purpose of preserving such public lands and waters as living museums of the natural heritage of this state.

(2) The Legislative Assembly, therefore, declares that it is the public policy of the State of Oregon to secure for the people of this state the benefits of an enduring resource of natural areas by establishing a system of natural area preserves and by providing for the management and protection of such natural area preserves.

SECTION 2. As used in this Act, unless the context requires otherwise:

(1) "Board" means the State Land Board.

(2) "Committee" means the Natural Area Preserves Advisory Committee created in section 3 of this Act.

(3) "Natural area" includes land and water that has substantially retained its natural character and land and water that, although altered in character, is important as habitats for plant, animal or marine life, for the study of its natural historical, scientific or paleontological features, or for the appreciation of its natural features.

SECTION 3. (1) There hereby is created a Natural Area Preserves Advisory Committee as an advisory committee to the State Land Board. The committee shall assist the board in carrying out the provisions of this Act.

(2) The committee shall consist of seven members appointed by the Governor. Of the seven members appointed by the Governor to the committee, one member shall be an individual with an advanced degree in botany, one member shall be an individual with an advanced degree in zoology, one member shall be an individual with an advanced degree in aquatic biology, one member shall be an individual with an advanced degree in geology and three members shall be individuals interested in the preservation of natural areas in this state.

(3) In addition to the seven members appointed by the Governor, the State Game Director, the State Forester, the Administrator of Highways and the Chancellor of the State Board of Higher Education or an authorized representative of each such officer, shall serve as ex officio, nonvoting members of the committee.

(4) The term of office of a member, appointed under subsection (2) of this section, is three years, but each such member serves at the pleasure of the Governor. Before the expiration of the term of each such member, the Governor shall appoint a successor whose term of office begins on July 1 next following. A member, appointed under subsection (2) of this section, is eligible for reappointment. If there is a vacancy for any cause, the Governor shall make an appointment to become immediately effective for the unexpired term.

SECTION 4. (1) In carrying out the provisions of this Act, the board, with the advice of the committee, and within available funds, may:

(a) Adopt, in accordance with the applicable provisions of ORS chapter 183, rules that it considers necessary in carrying out this Act;

(b) Adopt policy guidelines for its use in the selection, acquisition, management, protection and use of public lands included within the boundaries of natural area preserves established under section 5 of this Act; and

(c) Conduct a survey of lands in this state to locate lands that it considers suitable for inclusion within a natural area preserve established under this Act and maintain a registry of such lands.

(2) In carrying out the provisions of this Act, the board may:

(a) Cooperate and contract with any federal, state or local governmental agency or private organization;

(b) Acquire by gift, devise, grant, dedication or other method, other than by the exercise of the power of eminent domain, any private or public land or interest therein for inclusion in a natural area preserve established under this Act;

(c) Acquire by gift, devise, grant, dedication or other method, other than by the exercise of the power of eminent domain, any personal property that the board considers necessary;

(d) Apply for and accept grants, contributions and assistance from any federal, state or local governmental agency and any private foundation; and

(3) Perform other duties considered by it to be necessary in carrying out this Act.

SECTION 5. (1) With the advice of the committee, the board, in compliance with CRS chapter 183, may:

(a) Establish, by order, natural area preserves on lands in public ownership composed of contiguous lands; and

(b) Change the boundaries of natural area preserves and alter the uses and conditions for use of such preserves upon a finding by it that such change or alteration is necessary in carrying out the purposes of this Act.

(2) Each order of the board establishing a natural area preserve shall contain a legal description of the lands within the preserve, the reasons for the establishment of the preserve, any conditions upon the use of the lands in the preserve and other matters that the board considers necessary. Each such order shall be in compliance with the policy guidelines adopted by the board under paragraph (b) of subsection (1) of section 4 of this Act.

(3) The lands within a natural area preserve established under subsection (1) of this section shall be held for public use as may be specified by the board. Such lands may not be leased, sold, exchanged or otherwise transferred by the board except for another purpose upon a finding by the board, after consultation with the committee, of imperative and unavoidable necessity.

SECTION 6. (1) The board may enter into agreements with any public agency, having public lands suitable for inclusion within a natural area preserve under its jurisdiction, for the inclusion of such lands within a natural area preserve.

(2) Each such agreement shall specify the term of the agreement, the uses and conditions for the use of the public land as a part of a natural area preserve and a finding by the board and the public agency that the use of the public land subject to the agreement as a part of a natural area preserve is in the best interests of the people of this state. Each such agreement shall establish the respective responsibilities of the board and the public agency in the management and protection of such land.

(3) The board may include within the boundaries of a natural area preserve any state-owned lands under its jurisdiction.

SECTION 7. (1) All agencies, departments, boards and commissions of this state shall cooperate with and assist the State Land Board in carrying out this Act.

(2) The Legislative Assembly declares that the inclusion of suitable state-owned lands within natural area preserves constitutes a valid public purpose for the use of such lands.

SECTION 8. The Natural Area Preserves Account is established within the General Fund of the State Treasury. All moneys in the account are continuously appropriated for the use of the board in carrying out this Act.

SECTION 9. No land shall be included within a natural area unless it is either:

(1) In public ownership on the effective date of this Act; or

(2) Is acquired after the effective date of this Act by gift, devise, grant, dedication or other method requiring no expenditure of public funds for the acquisition.

## APPENDIX V.

### A CLASSIFICATION OF GEOMORPHIC PROVINCES AND SUBPROVINCES FOR OREGON AND WASHINGTON

It is important that the Research Natural Area System represent the major landforms and soil types found in Oregon and Washington. That is, in selecting areas representative of different terrestrial and freshwater ecosystems, topography and soils should be considered and weighted toward areas typical of broader areas. In this way the baseline data and research findings from a Research Natural Area can be more readily extrapolated to the extensively managed areas of similar type. As a first step toward insuring good representation of geologic and edaphic features, we have related many of the listed Research Natural Area needs to the geomorphic classification of the region outlined below. The system has been developed and is being used by the Pacific Northwest Region (Region 6), U.S. Forest Service, and was provided by John Corliss of that office.

#### Olympic Province

Character type reflects extensive glaciation. All main river valleys are broad and U-shaped, while major peaks are ringed with cirques, many containing active glaciers. Extremely high precipitation has caused rapid downcutting by streams and with glaciation has resulted in precipitous mountain slopes. These rugged mountains provide a central core surrounded by almost level lowlands which have resulted from deposition of glacial outwash.

| <u>Subprovince<br/>code No.</u> | <u>Description</u>                                                            |
|---------------------------------|-------------------------------------------------------------------------------|
| 0101                            | Glaciated, steep, long mountain slopes (National Park)                        |
| 0102                            | Glaciated, steep, long mountain slopes, timbered (Shelton Ranger District)    |
| 0103                            | Glaciated, steep, long, dissected mountain slopes, timbered (Forks Burn area) |
| 0104                            | Coastal plain (Lapush)                                                        |
| 0105                            | Subalpine and alpine peaks                                                    |

## Coast Range Province

This character type reflects steep mountain slopes with ridges that are often extremely sharp. The ridge system is usually parallel to the coast but, being extremely dissected, often appears confused. The topography varies from nearly level along the dunal sheet, to abrupt and steep along the western edges, to more gentle along the eastern fringes. Scattered peaks, often barren, rise well above surrounding ridges.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                                                 |
|---------------------------------------|------------------------------------------------------------------------------------|
| <b>0201</b>                           | Coastal headlands (Cascade Head)                                                   |
| <b>0202</b>                           | Rounded, dissected mountain slopes (Willapa Hills)                                 |
| <b>0203</b>                           | Short, highly dissected mountain slopes (Smith River)                              |
| <b>0204</b>                           | Steep, long mountain slopes (Mount Hebo)                                           |
| <b>0205</b>                           | Complex of steep, dissected, and uneven mountain slopes (Mapleton Ranger District) |
| <b>0206</b>                           | Steep, long mountain slopes (Tillamook volcanics)                                  |
| <b>0207</b>                           | Dunal sheet (Dunes National Recreation Area)                                       |

## Siskiyou Province

This character type reflects an ancient and now greatly dissected, uplifted plain; however, some peaks rise above this dissected surface.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                                |
|---------------------------------------|-------------------------------------------------------------------|
| <b>0301</b>                           | Drainage basin (Medford-Grants Pass)                              |
| <b>0302</b>                           | Steep, uneven, dissected mountain slopes (Powers Ranger District) |
| <b>0303</b>                           | Steep, long mountain slopes (Mount Ashland)                       |
| <b>0304</b>                           | Steep, uneven, highly dissected mountain slopes (Mineral Hill)    |
| <b>0305</b>                           | Steep, uneven mountain slopes                                     |
| <b>0306</b>                           | Steep, long, highly dissected mountain slopes                     |

## Puget Sound Basin Province

Character type reflects massive continental glaciation, which formed an area of low relief broken by sounds, low moraine ridge systems, rounded hummocks, and lakes.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>             |
|---------------------------------------|--------------------------------|
| <b>0401</b>                           | Coastal plain                  |
| <b>0402</b>                           | Morainal features with islands |
| <b>0403</b>                           | Outwash plain                  |
| <b>0404</b>                           | Rolling moraine                |

## Willamette Basin Province

This character type reflects a structural depression, modified visually by hills of low relief and alluvium deposited from ancient floods. The valley floor has a very gentle northerly slope, interspersed with sluggish, meandering streams.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                  |
|---------------------------------------|-----------------------------------------------------|
| 0501                                  | Flood plain—Recent (Willamette River and tributary) |
| 0502                                  | Lacustrine plains (agricultural lands)              |
| 0503                                  | Foothills (Salem hills)                             |
| 0504                                  | Steep, short mountain slopes (Chehalem Mountain)    |

## Western Cascades Province

This character type reflects a slightly folded and uplifted accumulation of weathered volcanic flows. The area is characterized by general conformity in ridge crests separated by deep valleys with steep, highly dissected slopes. Glacial features are evident but, being the result of less alpine glaciation, not as pronounced as found in the northwestern Cascades character. In the southern portion of the western Cascades, major valleys are V-shaped. Peaks over 7,000 feet are uncommon.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                                 |
|---------------------------------------|--------------------------------------------------------------------|
| 0601                                  | Gorge                                                              |
| 0602                                  | Glaciated, steep, long mountain slopes (Salmon River)              |
| 0603                                  | Foothills (Silver Falls)                                           |
| 0604                                  | Steep, dissected mountain slopes (Bohemia)                         |
| 0605                                  | Steep, long mountain slopes (Rhododendron Ridge—Bull of the Woods) |
| 0606                                  | Steep, uneven mountain slopes (Dickey Creek)                       |
| 0607                                  | Rolling, plateau remnants (Bull Run country)                       |

## Northwestern Cascades Province

This character type is composed of sharp, jagged peaks and deep, steep-sloped valleys resulting mostly from alpine glaciation. A striking topographic feature is the approximately uniform elevation of the main ridgetops. Towering above these relatively even crests are two dormant volcanoes (Mount Baker and Glacier Peak) as well as several granitic peaks of exceptional height. Glacial features are common with literally hundreds of cirques; and some peaks ringed by cirques have been eroded to horns. Main stream valleys contain deep accumulations of glacial debris.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                       |
|---------------------------------------|----------------------------------------------------------|
| 0701                                  | Glacial valleys (Skagit River)                           |
| 0702                                  | Glaciated, steep, long mountain slopes with snow chutes  |
| 0703                                  | Glaciated, steep, long mountain slopes—timbered          |
| 0704                                  | Alpine and subalpine (Mount Baker) (peaks, meadow, etc.) |

## Northeastern Cascades Province

This character type is glacial sculpturing which has created an area of great relief with steep-sided, very deep valleys and long finger lakes. The area is made up of granitic batholiths, folded and in part metamorphosed, sedimentary rocks with ridgetops having approximately uniform crest elevations. The area reflects extensive glaciation, but cirques and horns are not as common as in the Northwestern Cascades character type.

**Subprovince****code No.****Description**

|      |                                                                        |
|------|------------------------------------------------------------------------|
| 0801 | Glacial valleys (Cle Elum)                                             |
| 0802 | Glaciated, steep, long mountain slopes with snow chutes (Stevens Pass) |
| 0803 | Glaciated, steep, long mountain slopes—timbered (Entiat)               |
| 0804 | Alpine and subalpine (peaks, meadows, etc.)                            |
| 0805 | Plateau remnants (Table Mountain)                                      |
| 0806 | Dissected mountain slopes (Mission Ridge)                              |
| 0807 | Tilted, dissected plateau land (Taneum)                                |
| 0808 | Finger lake (Lake Chelan)                                              |

**Recent (High) Cascades Province**

This character type consists of a volcanic plateau capped by shield volcanoes, cinder cones, and other volcanic forms, all of which are in various stages of dissection. It is essentially an area of gently sloping terrain interrupted at intervals by glaciated channels in the major drainages. The area is dotted with volcanic peaks and cones rising 150 to 5,000 feet above the surrounding landscape.

**Subprovince****code No.****Description**

|      |                                                                            |
|------|----------------------------------------------------------------------------|
| 0901 | Alpine and subalpine (Mount Hood)                                          |
| 0902 | Plateau (Huckleberry Mountain)                                             |
| 0903 | Glaciated, steep, long mountain slopes with snow chutes (northern half)    |
| 0904 | Glaciated, steep, long mountain slopes                                     |
| 0905 | Pumice-mantled outwash plain with craters and lakes (Cascade Lake Highway) |

**Okanogan Highlands Province**

This character type reflects repeated continental glaciation, resulting in a generally rolling terrain of moderate slopes and broad, rounded summits. There is a scattering of peaks rising 3,000 to 4,000 feet above the general terrain, dividing the area into several upland areas separated by a series of broad north-south river valleys.

**Subprovince****code No.****Description**

|      |                                                         |
|------|---------------------------------------------------------|
| 1001 | Glaciated valleys (Methow)                              |
| 1002 | Plateaus (Omak Plateau)                                 |
| 1003 | Glaciated, steep, long mountain slopes (Okanogan Range) |
| 1004 | Glaciated, rolling mountain slopes                      |
| 1005 | Low, rolling morainal features—grass covered            |
| 1006 | Canyon lands (Columbia River)                           |

## Columbia Basin Province

This character type reflects the Columbia River basalt plateau which has been modified by glacial outwash floods and wind to form coulees, scablands, and rolling loess hills. Steep slopes are of limited occurrence and restricted to isolated basaltic buttes or canyons carved by some of the major rivers.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                     |
|---------------------------------------|----------------------------------------|
| 1101                                  | Dissected basalt plateau land (Condon) |
| 1102                                  | Lacustrine plains (Quincy Basin)       |
| 1103                                  | Coulees (Grand Coulee)                 |
| 1104                                  | Channeled scablands (Crab Creek)       |
| 1105                                  | Rolling loess hills (Palouse)          |
| 1106                                  | Outwash valleys (Yakima)               |
| 1107                                  | Folded basalt ridges (Horse Heaven)    |
| 1108                                  | Outwash plain (Waterville Plateau)     |
| 1109                                  | Basalt plateau (Rattlesnake Ridge)     |
| 1110                                  | Sand dunes (Richland)                  |

## Blue Mountains Province

This character type reflects several ranges of mountains separated by faulted valleys, synclinal.(downfolded) basins, and lava plateaus. Topographic relief in the mountains is highly variable, with moderately steep slopes common.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                                |
|---------------------------------------|-------------------------------------------------------------------|
| 1201                                  | Dissected basalt and plateau land (Pendleton Ranger District)     |
| 1202                                  | Lacustrine plains (Baker, Enterprise)                             |
| 1203                                  | Dissected basalt plateau land, grass covered (Imnaha)             |
| 1204                                  | Steep, long mountain slopes (Dixie Mountain)                      |
| 1205                                  | Subalpine and alpine (Strawberry Mountain)                        |
| 1206                                  | Steep, short, dissected mountain slopes (Murderers Creek)         |
| 1207                                  | Steep, short, highly dissected rolling lands (Vale)               |
| 1208                                  | Dissected rhyolite plateau land-transition forest (Sagehen Hills) |
| 1209                                  | Badlands (Painted Hills)                                          |
| 1210                                  | Lacustrine plain-high desert (Summit Prairie and Fox Basin)       |
| 1211                                  | Canyon lands (Snake River)                                        |

## Harney Basin Province

This character type reflects a young, relatively uniform expanse of lava flows of moderate relief in part mantled by pumice and ash falls and dotted with scattered cinder cones and lava buttes. Porous soil and bedrock and scanty rainfall cause many streams to be seasonal. Undrained basins containing shallow lakes, some dry and others with fluctuating levels, are common. Evidence of violent volcanic activity is abundant in the western portions, with the Paulina Peak shield volcano being the dominant feature. Outstanding examples of recent lava flows are near Lava Butte and Fort Rock.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                               |
|---------------------------------------|--------------------------------------------------|
| 1301                                  | Rhyolite plateau land (Dog Mountain)             |
| 1302                                  | Lacustrine basin-lakebeds (Harney Basin)         |
| 1303                                  | Pumice-mantled, cinder cone, plateau land (Bend) |
| 1304                                  | Volcano-caldera (Newberry)                       |
| 1305                                  | Recent basalt flow (Lava Butte)                  |
| 1306                                  | Pumice-mantled plateau land (Fort Rock)          |

## Upper Basin and Range Province

This character type reflects fault block mountains enclosing basins with internal drainage at generally higher elevations than the main Basin and Range Province. These formations create predominantly horizontal profiles in mountain silhouette with occasional cone-shaped features. Precipitation is moderate, coming mostly as snow; most streams are perennial; and numerous undrained basins contain shallow lakes and marshes.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                                           |
|---------------------------------------|--------------------------------------------------------------|
| 1401                                  | Fault block mountains (Yainax Butte)                         |
| 1402                                  | Graben valleys                                               |
| 1403                                  | Rolling sagebrush lands (Bly Ranger District)                |
| 1404                                  | Dissected plateau lands (Paisley Ranger District)            |
| 1405                                  | Lacustrine basin-marshes (Klamath)                           |
| 1406                                  | Pumice-mantled rolling hills—high elevation (Antelope Flats) |
| 1407                                  | Alpine and subalpine (Yamsay Mountain)                       |

## Basin and Range Province

This character type reflects fault block mountains enclosing basins with internal drainage. These formations create predominantly horizontal profiles in mountain silhouette. Except for slopes of the fault block mountains, the area is rolling with low relief. Rainfall is scanty, most streams are intermittent, and numerous undrained basins contain shallow, saline lakes.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                     |
|---------------------------------------|----------------------------------------|
| 1501                                  | Alpine and subalpine (Steens Mountain) |
| 1502                                  | Lacustrine basin-lake beds             |
| 1503                                  | Active sand dunes                      |
| 1504                                  | Canyon lands (Owyhee)                  |
| 1505                                  | Fault block mountain (Hart Mountain)   |
| 1506                                  | Graben valleys (Alvord Desert)         |
| 1507                                  | Rolling sagebrush land, low relief     |
| 1508                                  | Pumice-mantled plateau land (Chemult)  |

## Cowlitz River Basin Province

This character type reflects a structural depression occupied by the lower and middle Cowlitz River. Uplands of rolling hills of low relief composed of volcanic geologic materials are the dominant terrain feature. Lacustrine plains, terraces, and flood plains adjacent to the rivers occupy proportionately less area than in the Willamette Basin Province. The area has an overall southerly slope.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>           |
|---------------------------------------|------------------------------|
| <b>1601</b>                           | Flood plain                  |
| <b>1602</b>                           | Outwash plain                |
| <b>1603</b>                           | Foothills                    |
| <b>1604</b>                           | Steep, short mountain slopes |

## Wallowas Province

This character type reflects a mountainous “island” surrounded by lava plateaus. These mountains are part of the Blue Mountains Province but are distinctive, as alpine glaciation has created a very precipitous and rugged mountainous area. Cirques, glacial lakes, and moraines are common. The relief in the Wallowas is much greater than in the Blue Mountains type.

| <u>Subprovince</u><br><u>code No.</u> | <u>Description</u>                     |
|---------------------------------------|----------------------------------------|
| <b>1701</b>                           | Alpine and subalpine                   |
| <b>1702</b>                           | Basalt plateau (Tamarack Flat)         |
| <b>1703</b>                           | Dissected basalt plateau (Minam)       |
| <b>1704</b>                           | Glaciated, steep, long mountain slopes |

## APPENDIX VI.

### LISTS OF VERTEBRATE ANIMALS OF SPECIAL INTEREST IN WASHINGTON AND OREGON

These inventories of animals considered to be of special interest are aimed at calling attention to them. Only those species marked with an asterisk were included in rare and endangered cells, as they were considered to be compatible with protection in Research Natural Areas. The animals listed represent a fragile segment of our biological heritage and, as such, merit our constant surveillance and stewardship.

Vertebrate animals in the following lists which also appear in the 1973 edition of "Threatened Wildlife of the United States" (Red Book) (U.S. Bureau of Sport Fisheries and Wildlife) are so indicated.

The vertebrate animal species which appear in the following lists may be in one of a number of different categories defined in the report of the Rare and Endangered Species Working Group. These categories include rare, uncommon, endangered, threatened, peripheral, unique, and status undetermined. Since these criteria have been used thus far solely for the classification of mammals of special interest in Oregon and Washington, they are the only lists in which status is indicated for each species.

Mammal species identified as "threatened" or "endangered" in these lists are according to the criteria laid down in "Report of Rare and Endangered Species Working Group" (pt. IV) and carry no official status. The only species having legal status as threatened or endangered are those so designated by the Secretary of the Interior according to the provisions of the Endangered Species Act of 1973.

#### Fishes of Special Interest in Washington<sup>1</sup>

\**Novumbra hubbsi*, Olympic mudminnow  
*Rhinichthys falcatus*, leopard dace  
*Percopsis transmontana*, sand roller  
*Gasterosteus aculeatus microcephalus*, black stickleback

#### Fishes of Special Interest in Oregon<sup>2</sup>

*Lampetra ayresi*, river lamprey  
*Lampetra richardsoni*, Western brook lamprey  
*Lampetra lethophaga*, Pit-Klamath brook lamprey  
*Salmo clarki* subsp., Alvord cutthroat trout  
*Salmo* sp., redband trout  
*Salvelinus malma*, Klamath Basin representative of Dolly Varden  
*Gila* ~~bicolor~~ subsp., catlow tui chub  
*Gila alvordensis*, Alvord chub  
\**Hesperoleucus symmetricus*, California roach

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<sup>1</sup> Richard S. Wydoski compiled this list in 1973; it was sent to us by Dick Whitney, University of Washington, in 1974.

<sup>2</sup> Carl E. Bond, Oregon State University, updated this list in 1974.

\*Animal has been identified as a rare and endangered cell.

*Hybopsis crameri*, Oregon chub  
*Rhinichthys cataractae* subsp., Millicoma dace  
*Rhinichthys osculus* subsp., Fosket Spring dace  
*Rhinichthys falcatus*, leopard, dace  
 \**Richardsonius egregius*, Lahontan redbside  
*Catostomus luxatus*, Lost River sucker  
*Catostomus (rimiculus)* subsp. ?), Jenny Creek sucker  
 \**Catostomus tahoensis*, Tahoe sucker  
*Catostomus warnerensis*, Warner sucker  
*Chasmistes brevirostris*, shortnose sucker  
*Percopsis transmontana*, sand roller  
 \**Cottus bairdi* subsp., Malheur sculpin  
*Cottus princeps*, Klamath Lake sculpin

### Reptiles and Amphibians of Special Interest in Washington<sup>3</sup>

\**Plethodon dunni*, Dunn salamander  
 \**Plethodon larselli*, Larch Mountain salamander  
 \**Bufo woodhousei*, Woodhouse toad  
*Rana clamitans*, green frog  
 \**Clemmys marmorata*, western pond turtle  
 \**Gerrhonotus multicarinatus scincicauda*, Oregon alligator lizard  
 \**Diadophis punctatus amabilis*, Pacific ringnecked snake  
 \**Contia tenuis*, sharp-tailed snake  
 \**Masticophis taeniatus*, striped whipsnake  
 \**Lampropeltis zonata*, California mountain kingsnake  
 \**Hypsiglena torquata*, night snake

### Reptiles and Amphibians of Special Interest in Oregon<sup>4</sup>

\**Plethodon larselli*, Larch Mountain salamander  
 \**Plethodon elongatus*, Del Norte salamander  
 \**Plethodon stormi*, Siskiyou Mountain salamander  
 \**Plethodon gordonii*, Marys Peak salamander  
 \**Batrachoseps wrighti*, Oregon slender salamander  
 \**Batrachoseps attenuatus*, California slender salamander  
 \**Aneides flavipunctatus*, black salamander  
 \**Ascaphus truei*, tailed frog  
 \**Rana pretiosa*, spotted frog  
*Crotaphytus collaris*, collared lizard  
*Crotaphytus wislizeni*, leopard lizard  
*Phrynosoma platyrhinos*, desert horned lizard  
*Cnemidophorus tigris*, Western whiptail  
 \**Contia tenuis*, sharp-tailed snake  
 \**Lampropeltis getulus*, common kingsnake  
 \**Lampropeltis zonata*, California mountain kingsnake  
 \**Crotalus viridis*, Western rattlesnake

<sup>3</sup> Murray I. Johnson, University of Puget Sound, prepared this list in 1974.

<sup>4</sup> Robert M. Storm, Oregon State University, updated this list in 1974.

\*Animal has been identified as a rare and endangered cell.

## Birds of Special Interest in Washington<sup>5 6</sup>

*Diomedea cauta cauta*, Tasmanian white-capped albatross  
*Puffinus carneipes*, pale-footed shearwater  
*Puffinus bulleri*, New Zealand shearwater  
*Puffinus puffinus opisthomelas*, black-vented shearwater  
*Phaeton aethereus mesonauta*, Northern red-billed tropic-bird  
*Pelecanus erythrorhynchos*, white pelican  
*Pelecanus occidentalis californicus*, California brown pelican<sup>7</sup>  
*Sula nebouxii nebouxii*, Northern blue-footed booby  
*Butorides virescens anthonyi*, Anthony's green heron  
*Bulbucus ibis ibis*, cattle egret  
*Casmerodius albus egretta*, common egret  
*Leucophoyx thula brewsteri*, Brewster's snowy egret  
*Botaurus lentiginosus*, American bittern  
*Plegadis chihi*, white-faced ibis  
*Olor buccinator*, trumpeter swan  
*Branta canadensis leucopareia*, Aleutian Canada goose<sup>7</sup>  
*Branta canadensis parvipes*, lesser Canada goose  
*Branta bernicla hrota*, American brant  
*Philacte canagica*, emperor goose  
*Dendrocygna bicolor helva*, Northern fulvous tree duck  
*Anas rubripes*, black duck  
*Anas penelope*, European widgeon  
*Somateria mollissima nigra*, Pacific common eider  
*Somateria spectabilis*, king eider  
*Melanitta deglandi deglandi*, white-winged scoter  
*Cathartes aura teter*, turkey vulture  
*Gymnogyps californianus*, California condor  
*Buteo jamaicensis alascensis*, Alaska red-tailed hawk  
*Buteo lagopus johannis*, American rough-legged hawk  
*Buteo regalis*, ferruginous hawk  
*Aquila chrysaetos canadensis*, golden eagle  
*Haliaeetus leucocephalus alascanus*, Northern bald eagle  
*Pandion haliaetus carolinensis*, American osprey  
*Caracara cheriway audubonii*, caracara  
*Falco rusticolus obsoletus*, gyrfalcon  
*Falco rusticolus uralensis*, Asiatic gyrfalcon  
*Falco mexicanus*, prairie falcon  
*Falco peregrinus anatum*, American peregrine falcon  
*Falco peregrinus pealei*, Peale's falcon  
*Falco columbarius suckleyi*, black pigeon hawk  
*Falco columbarius bendirei*, Western pigeon hawk  
*Falco sparverius sparverius*, Western sparrow hawk  
*Dendragapus obscurus richardsonii*, Richardson's blue grouse  
*Pediacetes phasianellus columbianus*, Columbian sharp-tailed grouse  
*Centrocercus urophasianus phaios*, Western sage grouse  
*Rallus limicola limicola*, Virginia rail  
*Coturnicops noveboracensis noveboracensis*, yellow rail  
*Eupoda montana*, mountain plover

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<sup>5</sup> Because of their wide-ranging habit, only two species have been given natural area cell status.

<sup>6</sup> Gordon D. Alcorn, University of Puget Sound, updated this list in 1974.

<sup>7</sup> Species is on national list of threatened and endangered animals (U.S. Bureau of Sport Fisheries and Wildlife 1973).

*Eudromias morinellus*, dotterel  
*Numenius americanus parvus*, long-billed curlew  
*Bartramia longicauda*, upland plover  
*Tringa solitaria solitaria*, solitary sandpiper  
*Catoptrophorus semipalmatus inornatus*, western willet  
*Calidris canutus canutus*, Pacific knot  
*Calidris canutus rufa*, American knot  
*Calidris acuminata*, sharp-tailed sandpiper  
*Calidris fuscicollis*, white-rumped sandpiper  
*Calidris bairdii*, Baird's sandpiper  
*Calidris pusilla*, semipalmated sandpiper  
*Tryngites subruficollis*, buff-breasted sandpiper  
*Limosafedoa*, marbled godwit  
*Limosa haemastica*, Hudsonian godwit  
*Himantopus mexicanus*, black-necked stilt  
*Stercorarius pomarinus*, pomarine jaeger  
*Stercorarius longicaudus*, long-tailed jaeger  
*Catharacta skua antarctica*, Falkland skua  
*Catharacta skua lonnbergz*, brown skua  
*Larus hyperboreus barrovianus*, glaucous gull  
*Larus glaucoides glaucoides*, Iceland gull  
*Larus pipixcan*, Franklin's gull  
*Sterna paradisaea*, Arctic tern  
*Hydroprogne caspia*, Caspian tern  
*Endomychura hypoleuca scrippsi*, Xantus' murrelet  
*Fratercula corniculata*, horned puffin  
*Bybo virginianus wapacuthu*, Arctic horned owl  
*Nyctea scandiaca*, snowy owl  
*Surnia ulula caparoch*, American hawk-owl  
*\*Speotyto cunicularia hypugaea*, Western burrowing owl  
*Strix varia*, barred owl  
*Strix nebulosa nebulosa*, great gray owl  
*Aegolius funereus richardsoni*, boreal owl  
*Eremophila alpestris strigata*, streaked horned lark  
*Aphelocoma coerulescens immanis*, Oregon scrub jay  
*\*Parus hudsonicus cascadenis*, Cascade boreal chickadee  
*Pam rufescens rufescens*, chestnut-backed chickadee  
*Psaltiriparus minimus minimus*, coast bushtit  
*Sitta canadensis*, red-breasted nuthatch  
*Certhia familiaris occidentalis*, tawny brown creeper  
*Chamaea fasciata phaea*, wrentit  
*Telmatodytes palustris paludicola*, Tule wren  
*Catharus guttatus polionta*, white mountain hermit thrush  
*Sialia mexicana occidentalis*, Western bluebird  
*Regulus satrapa olivaceus*, Western golden-crowned kinglet  
*Regulus calendula grinnelli*, Sitka kinglet  
*Acridotheres cristatellus cristatellus*, crested myna  
*Vireo huttoni huttoni*, Hutton's vireo  
*Vireo solitarius cassinii*, Cassin's vireo  
*Vireo olivaceus*, red-eyed vireo  
*Vireo gilvus swainsonii*, Western warbling vireo  
*Mniotilta varia*, black-and-white warbler  
*Vermivora peregrina*, Tennessee warbler

\*Animal has been identified as a rare and endangered cell.

*Vermivora celata celata*, orange-crowned warbler  
*Vermivora celata lutescens*, lutescent warbler  
*Dendroica coronata coronata*, myrtle warbler  
*Dendroica coronata auduboni*, Audubon's warbler  
*Dendroica coronata memorabilis*, Western Audubon's warbler  
*Dendroica nigrescens*, black-throated gray warbler  
*Seiurus noveboracensis notabilis*, Northern waterthrush  
*Oporornis tolmiei tolmiei*, McGillivray's warbler  
*Geothlypis trichas campicola*, Western yellowthroat  
*Geothlypis trichas arizela*, Pacific yellowthroat  
*Setophaga ruticilla tricolora*, North American redstart  
*Sturnella neglecta confluenta*, Western meadowlark  
*Passerina amoena*, Lazuli bunting  
*Pinicola enucleator alascensis*, Alaska pine grosbeak  
*Pinicola enucleator flammula*, Kodiak pine grosbeak  
*Leucosticte tephrocotis tephrocotis*, Swainson's gray-crowned rosy finch  
*Poocetes aramineus affinis*, Oregon vesper sparrow  
*Junco hyemalis cismontanus*, Cassiar slate-colored junco  
*Junco hyemalis montanus*, interior slate-colored Oregon junco  
*Spizella arborea ochracea*, tree sparrow  
*Zonotrichia querula*, Harris' sparrow  
*Passerella iliaca zaboria*, Yukon fox sparrow  
*Melospiza melodia montana*, mountain song sparrow  
*Melospiza melodia kenaiensis*, Kenai song sparrow  
*Melospiza melodia caurina*, Yakutat song sparrow

### Birds of Special Interest in Oregon<sup>8 9</sup>

*Podiceps griseigena holbollii*, Holboell's red-necked grebe  
*Podiceps auritus*, horned grebe  
*Oceanodroma furcata plumbea*, Southern fork-tailed petrel  
*Pelecanus erythrorhynchos*, white pelican  
*Pelecanus occidentalis californicus*, California brown pelican<sup>10</sup>  
*Casmerodius albus egretta*, common egret  
*Leucophox thula brewsteri*, Brewster's snowy egret  
*Ixobrychus exilis hesperis*, Western least bittern  
*Plegadis chihi*, white-faced ibis  
*Olor buccinator*, trumpeter swan  
*Branta canadensis leucopareia*, Aleutian Canada goose<sup>10</sup>  
*Anser albifrons gambelli*, Tule white-fronted goose  
*Aythya collaris*, ring-necked duck  
*Aythya affinis*, lesser scaup  
*Bucephala islandica*, Barrow's goldeneye  
*Bucephala albeola*, bufflehead  
*Histrionicus histrionicus*, harlequin duck  
*Buteo swainsoni*, Swainson's hawk  
*Buteo regalis*, ferruginous hawk  
*Haliaeetus leucocephalus ahcanus*, Northern bald eagle  
*Pandion haliaetus carolinensis*, American osprey  
*Falco mexicanus*, prairie falcon  
*Falco peregrinus anatum*, American peregrine falcon<sup>10</sup>

<sup>8</sup> Because of their wide-ranging habit, only two species have been given natural area cell status.

<sup>9</sup> David B. Marshall, U.S. Fish and Wildlife Service, prepared this list in 1969.

<sup>10</sup> Species is on national list of threatened and endangered animals (U.S. Bureau of Sport Fisheries and Wildlife 1373).

*Falco columbarius bendirei*, Western pigeon hawk  
*Dendragapus obscurius sierrae*, Sierra blue grouse  
*Canachites canadensis franklinii*, Franklin's spruce grouse  
*Pedioecetes phasianellus columbianus*, Columbian sharp-tailed grouse  
*Grus canadensis tabida*, greater sandhill crane  
*Coturnicops noveboracensis noveboracensis*, yellow rail  
*Charadrius alexandrinus nivosus*, Western snowy plover  
*Bartramia longicauda*, upland plover  
*Limnodromus griseus caurinus*, Alaskan short-billed dowitcher  
*Himantopus mexicanus*, Black-necked stilt  
*Larus pipixcan*, Franklin's gull  
*Hydroprogne caspia*, Caspian tern  
*Brachyrhamphus marmoratum marmoratum*, American marbled murrelet  
*Cerorhinca monocerata*, rhinoceros auklet  
*Coccyzus americanus occidentalis*, California yellow-billed cuckoo  
*Otus asio bendirei*, California screech owl  
*Otus flammeolus*, flammulated owl  
*Glaucidium gnoma californicum*, California pygmy owl  
*\*Strix occidentalis caurina*, Northern spotted owl  
*Strix nebulosa nebulosa*, great gray owl  
*\*Speotyto cunicularia hypugaea*, Western burrowing owl  
*Phalaenoptilus nuttallii californicus*, dusky poor-will  
*Selasphorus sasin*, Allen's hummingbird  
*Picoides tridactylus fasciatus*, Alaska Northern three-toed woodpecker  
*Sayornis phoebe*, Eastern phoebe  
*Sayornis nigricans semiatra*, black phoebe  
*Progne subis subis*, Northern purple martin  
*Aphelocoma coerulescens nevadae*, Nevada scrubjay  
*Aphelocoma coerulescens oocleptica*, Nicasio scrubjay  
*Parus inornatus zaleptus*, Warner Valley titmouse  
*Thryomanes bewickii atrestus*, Warner Valley Bewick's wren  
*Mimus polyglottos leucopterus*, Western mockingbird  
*Dumetella carolinensis*, catbird  
*Hylocichla fuscescens salicicola*, willow veery  
*Poliophtila caerulea amoenissima*, Western blue-gray gnatcatcher  
*Anthus spinoletta pacificus*, Western water pipit  
*Bombycilla garrula pallidiceps*, Bohemian waxwing  
*Vireo huttoni huttoni*, Hutton's vireo  
*Setophaga ruticilla tricolora*, North American redstart  
*Dolichonyx oryzivorus*, bobolink  
*Agelaius tricolor*, tricolored blackbird  
*Pinicola enucleator montana*, Rocky Mountain pine grosbeak  
*Leucosticte tephrocotis wallowa*, Wallowa gray-crowned rosy finch  
*Leucosticte atrata*, black rosy finch  
*Ammodramus savannarum perpallidus*, Western grasshopper sparrow  
*Amphispiza bilineata deserticola*, desert black-throated sparrow

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\*Animal has been identified as a rare and endangered cell.

## 'Mammals of Special Interest in Washington'<sup>1</sup>

- Didelphis virginiana*, Virginia opossum (introduced), Uncommon  
\**Sorex cinereus hollisteri*, masked shrew, Rare  
\**Sorex cinereus cinereus*, masked shrew, Uncommon  
\**Sorex preblei*, Malheur or Preble shrew, Rare  
\**Sorex merriumi*, Merriam shrew, Rare  
\**Microsorex hoyi*, pygmy shrew, Rare  
*Myotis keeni*, Keen bat, Rare  
*Myotis evotis*, long-eared bat, Uncommon  
*Myotis thysanodes*, fringed bat, Rare  
*Myotis volans*, long-legged bat, Rare  
*Myotis leibii*, small-footed bat, Rare  
*Lasionycteris noctuagans*, silver-haired bat, Rare  
*Lasiurus cinereus*, hoary bat, Rare  
*Antrozous pallidus*, pallid bat, Rare  
\**Sylvilagus idahoensis*, pygmy rabbit, Threatened  
\**Lepus townsendi*, white-tailed jack rabbit, Uncommon  
\**Spermophilus washingtoni*, Washington ground squirrel, Uncommon  
\**Sciurus griseus*, Western gray squirrel, Uncommon  
*Sciurus niger*, fox squirrel (introduced), Uncommon  
*Thomomys talpoides limosus*, Northern pocket gopher, Uncommon  
*Thomomys talpoides douglasi*, Northern pocket gopher, Threatened  
*Thomomys mazama couchi*, Western pocket gopher, Rare  
*Thomomys mazama glacialis*, Western pocket gopher, Rare  
*Thomomys mazama louiei*, Western pocket gopher, Rare  
\**Thomomys mazama melanops*, Western pocket gopher, Rare  
*Thomomys mazama tacomensis*, Western pocket gopher, Endangered  
*Thomomys mazama tumuli*, Western pocket gopher, Rare  
\**Dipodomys ordi*, Ord kangaroo rat, Rare  
\**Onychomys leucogaster*, Northern grasshopper mouse, Rare  
\**Phenacomys intermedius*, heather vole, Uncommon  
\**Microtus pennsylvanicus kinkaidi*, Kinkaid meadow vole, Uncommon  
*Microtus canicaudus*, gray-tailed vole, Rare  
\**Lagurus curtatus*, sagebrush vole, Uncommon  
\**Synaptomys borealis*, Northern bog lemming, Rare  
*Mesoplodon carlhubbsi*, Moore beaked whale, Rare  
*Stenella caeruleoalba*, striped porpoise, Uncommon  
*Lissodelphis borealis*, Northern right-whale dolphin, Uncommon  
*Lagenorhynchus obliquidens*, Pacific white-sided dolphin, Uncommon  
*Grampus griseus*, grampus, Uncommon  
*Pseudorca crassidens*, false killer whale, Uncommon  
*Globicephala macrorhyncha*, short-finned pilot whale, Uncommon  
*Balaenoptera acutorostrata*, little piked whale, Uncommon  
*Balaenoptera musculus*, blue whale, Rare  
*Balaena glacialis*, right whale, Uncommon  
*Canis lupus*, gray wolf, Extinct  
*Vulpes vulpes macroura*, red fox, Rare

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<sup>11</sup> Murray L. Johnson, University of Puget Sound, compiled this list in 1974. Status of mammal is according to his classification system (see pt. IV).

\*Animal has been identified as a rare and endangered cell.

*Ursus arctos*, grizzly bear, Threatened  
*Martes pennanti*, fisher, Uncommon  
*Gulo gulo*, wolverine, Rare  
*Enhydra lutris*, sea otter (reintroduced), Rare  
*Lynx lynx*, lynx, Rare  
*Zalophus californianus*, California sea lion, Uncommon  
*Mirounga angustirostris*, Northern elephant seal, Rare  
*Odocoileus virginianus leucurus*, Columbia white-tailed deer, Endangered<sup>12</sup>  
*Alces alces*, American moose, Uncommon  
*Rangifer tarandus*, caribou, Threatened  
*Antilocapra americana*, pronghorn (reintroduced), Rare  
**Bison** bison, bison, Extinct  
*Ovis canadensis*, mountain sheep (reintroduced), Uncommon

### Mammals of Special Interest in Oregon<sup>13</sup>

\**Sorex preblei*, Malheur or Preble shrew, Rare  
 \**Sorex trigonirostris*, Ashland shrew, Rare  
 \**Sorex merriami*, Merriam shrew, Rare  
*Myotis evotis*, long-eared bat, Uncommon  
*Myotis thysanodes*, fringed bat, Rare  
*Myotis volans*, long-legged bat, Rare  
*Myotis leibii*, small-footed bat, Rare  
*Lasionycteris noctivagans*, silver-haired bat, Rare  
*Pipistrellus hesperus*, Western pipistrelle, Rare  
*Lasiurus cinereus*, hoary bat, Rare  
*Antrozous pallidus*, pallid bat, Rare  
*Tadarida brasiliensis*, Brazilian free-tailed bat, Rare  
 \**Sylvilagus idahoensis*, pygmy rabbit, Uncommon  
 \**Lepus townsendi*, white-tailed jack rabbit, Uncommon  
 \**Spermophilus washingtoni*, Washington ground squirrel, Threatened  
 \**Spermophilus richardsoni*, Richardson ground squirrel, Rare  
**Sciurus** *carolinensis*, Eastern gray squirrel (introduced), Uncommon  
*Sciurus niger*, fox squirrel (introduced), Rare  
 \**Thomomys bottae detumidus*, Botta pocket gopher, Rare  
 \**Thomomys bottae laticeps*, Botta pocket gopher, Rare  
 \**Perognathus longimembris*, little pocket mouse, Rare  
 \**Peromyscus truei sequoiensis*, pinon mouse, Uncommon  
 \**Peromyscus truei preblei*, pinon mouse, Uncommon  
 \**Onychomys leucogaster*, Northern grasshopper mouse, Uncommon  
 \**Phenacomys intermedius*, heather vole, Uncommon  
 \**Arborimus albipes*, white-footed vole, Rare  
 \**Arborimus longicaudus longicaudus*, red tree vole, Uncommon  
 \**Arborimus longicaudus silvicolu*, red tree vole, Uncommon  
 \**Lagurus curtatus*, sagebrush vole, Uncommon  
*Mesoplodon carlhubbsi*, Moore beaked whale, Rare  
*Stenella caeruleoalba*, striped porpoise, Uncommon

<sup>12</sup> Species is on national list of threatened and endangered animals (U.S. Bureau of Sport Fisheries and Wildlife 1973).

<sup>13</sup> Murray L. Johnson and Chris Maser, University of Puget Sound, compiled this list in 1974. Status of mammal is according to Johnson's classification system (see pt. IV).

\*Animal has been identified as a rare and endangered cell.

*Lissodelphis borealis*, Northern right-whale dolphin, Uncommon  
*Lagenorhynchus obliquidens*, Pacific white-sided dolphin, Uncommon  
*Grampus griseus*, grampus, Uncommon  
*Pseudorca crassidens*, false killer whale, Uncommon  
*Globicephala macrorhyncha*, short-finned pilot whale, Uncommon  
*Balaenoptera acutorostrata*, little piked whale, Uncommon  
*Balaenoptera musculus*, blue whale, Rare  
*Canis lupus*, gray wolf, Extinct  
*Vulpes vulpes cascadiensis*, red **fox**, Uncommon  
*Vulpes vulpes macroura*, red fox, Rare  
*Vulpes macrotis*, kit **fox**, Threatened  
*Ursus arctos*, grizzly bear, Extinct  
*Bassariscus astutus*, ringtail, Rare  
*Martes pennanti*, fisher, Rare  
*Gulo gulo*, wolverine, Threatened  
*Enhydra lutris*, sea otter (reintroduced), Uncommon  
*Lynx lynx*, lynx, Extinct  
*Callorhinus ursinus*, Northern fur seal, Uncommon  
*Eumetopias jubata*, Northern sea lion, Uncommon  
*Phoca vitulina*, harbor seal, Rare  
*Mirounga angustirostris*, Northern elephant seal, Rare  
*Odocoileus virginianus leucurus*, Columbia white-tailed deer, **Rare**<sup>14</sup>  
*Odocoileus virginianus ochrourus*, white-tailed deer, Rare  
*Antilocapra americana*, pronghorn, Uncommon  
*Bison bison*, bison, Extinct  
*Oreamnos americanus*, mountain goat (introduced), Rare  
*Ovis canadensis*, mountain sheep (reintroduced), Rare

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<sup>14</sup> Species is on national list of threatened and endangered animals (U.S. Bureau of Sport Fisheries and Wildlife 1973).

## APPENDIX VII.

### LIST OF WORKSHOP PARTICIPANTS

#### Workshop Chairman

Jerry F. Franklin, Program Director, Ecosystem Studies, National Science Foundation, 1800 G. Street, N.W., Washington, D.C. 20550.

#### Steering Committee

Chairman: Robert E. Buckman, Director, Pacific Northwest Forest and Range Experiment Station, P.O. Box 3141, Portland, Ore. 97208.

Archie D. Craft, State Director, represented by Irving W. Anderson, Chief, Branch of Land & Mineral Operations, U.S. Bureau of Land Management, P.O. **Box** 2965, Portland, Ore. 97208.

Don Lee Fraser, Supervisor, Department of Natural Resources, represented by Howard Stolaas, Deputy Supervisor, Department of Natural Resources, State of Washington, Olympia, Wash. 98504.

A. R. Kruckeberg, Professor and Chairman, Department of Botany, University of Washington, Seattle, Wash. 98195.

Kenneth R. Margolis, Northwest Representative, The Nature Conservancy, 1234 N.W. 25th Ave., Portland, Ore. 97210.

R. Kahler Martinson, Regional Director, U.S. Fish and Wildlife Service, P.O. Box 3737, Portland, Ore. 97208.

John A. Rutter, Regional Director, National Park Service, 5234th and Pike Bldg., Seattle, Wash. 98101.

Theodore A. Schlapfer, Regional Forester, U.S. Forest Service, Region 6, P.O. **Box** 3623, Portland, Ore. 97208.

#### Working Group Participants

##### West-Side Terrestrial Working Group

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2. Developing and evaluating alternative methods and levels of resource management.
3. Achieving optimum sustained resource productivity consistent with maintaining a high quality forest environment.

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