1975
USDA FOREST SERVICE GENERAL TECHNICAL REPORT PNW-33

Forest Residues Management Guidelines for the Pacific Northwest

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

ABSTRACT

Forest residues often require treatment to meet land management objectives. Guideline statements for managing forest residues are presented to provide direction for achieving these objectives. The latest research information and the best knowledge of experts in various land management disciplines were used to formulate these statements. A unique keying system is provided for determining which guidelines apply to a particular management activity, for a given site in a given location, and within a given forest species association type.

KEYWORDS: *Forest residues, forest residue treatment, residue management.*

See appendix 4 for metric conversion factors for measurements in this publication.

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FOREST RESIDUES MANAGEMENT GUIDELINES FOR THE PACIFIC NORTHWEST

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1975

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FOREST SERVICE **U.S. Department of Agriculture**

PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed **all** precautions on the labels.

Store pesticides in original containers under lock and key--out of reach of children and animals--and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, **do** not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. *Also*, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

Foreword

Forest residues accumulate as a result of logging and natural mortality. When management is first introduced through harvesting of the overmature forests of the Pacific Northwest, huge volumes of residue--up to 300 tons per acre--have been measured after logging is completed. Most of this residue, in the form of branches, limbs, tops, broken chunks, cull sections, plus remnants of past natural mortality, is below prevailing minimum utilization and quality standards or is not economically attractive to the wood-processing industry. We must look toward future improvements in markets and in machinery and equipment for handling and transporting forest residues to encourage and achieve a greater degree of utilization and thus reduce the volume remaining onsite. Until such time, however, we are faced with the problem of managing these residues to achieve rapid regeneration in a manner that meets a wide range of environmental requirements for multiple-use forestry.

How best to manage these residues to meet environmental considerations while providing for the many goods and services of our .forests is the subject of this publication. Old methods of treatment are being questioned; new ones are being evolved. Active public interest in all aspects of forest land management is manifest in the passage of significant legislation by Congress on multiple use of forest land and air and water quality, and in numerous court actions. Forest managers on both private and public lands share these concerns and are diligently developing forest practice guidelines, policy statements, and action plans to deal simultaneously with several major problem situations and with insuring the production of wood to satisfy the Nation's need.

Through the cooperation of representatives of Federal and State agencies,. forest protection associations, forest industry groups, and both large and small private landowners, this publication was possible. These cooperators supplemented the knowledge available from research with their long and varied experiences to develop these guidelines. This report is more than just a treatment of environmental issues associated with the management of forest residues. It also is a product of a unique and effective way of organizing the needed skills for developing, disseminating, and applying research findings in a manner that encourages their acceptance and insures their fullest application.

ROBERT E. BUCKMAN
Director

Preface

The work of developing, organizing, and assembling these materials has been undertaken by foresters, scientists, and technical specialists from several agencies in many related disciplines, as well as by forest landowners. In a sense, it is a capsule of the experience and thinking of scores of source-document authors and correspondents, of 54 panelists serving on nine specialized technical panels, of 16 panelists on two land management decisions panels, and of seven special advisors to the panels. Several supporting research personnel helped with making references available. In addition, many individuals who helped with prepublication reviews have contributed their time, interest, and knowledge to this effort. (For actual participants, see appendix 1.)

The procedure followed may help others who wish to use a similar technique in developing management guidelines or policies where a synthesis of knowledge and experience is needed.

Briefly, the nine technical panels met concurrently and independently developed and recommended management guidelines oriented to their respective disciplines.[1/] For this task, they used "Environmental Effects of Forest Residues--A State-of-Knowledge Compendium" (Cramer 1974) and other reference material necessary to substantiate each guideline statement. The panel chairmen then resolved technical conflicts between statements originating in the different technical panels. Any conflicts not resolved, due to policy or other constraints, were referred to two land management decision panels, each comprised of line officers with long experience and major management responsibility.

One management panel represented public agencies and the other panel represented private industry and forest land managers. These panels arbitrated unresolved conflicts and accepted, rejected, or modified each recommended guideline statement to assure that each was administratively attainable.

Final responsibility for preparing this publication rested with the compilers. Our principal task was to combine, separate, and edit statements to common language, while preserving the original context as nearly as possible. We also helped resolve some technical or management conflicts. Finally, we devised a system for sorting the guideline statements according to categories representing combinations of geomorphic provinces, species associations, and management activities.

Although sponsored by the Forest Service, this work is not identifiable with any individual or any organization. It is a unique team product, made possible by phasing, by a high degree of cooperation, and by a strong motivation on the part of all participants.

1/ Air quality, diseases, fire management, insects, recreation, silviculture, soils, terrestrial habitat, and water quality and aquatic habitat.

CONTENTS

CONTENTS (continued)

Chapter I. About this publication

OBTAINING AN OVERVIEW

Unlike most guideline publications, this one is not written to be read from cover to cover. Unlike most guidelines, statements are not structured so as to allow indepth study for ways each may be applied. Instead, the user is urged to first read this chapter to get an overview and then to quickly sample various other sections of the report. The section on organization in this chapter will help with that sampling.

Once an overview has been obtained, the user is urged to become familiar with the unique way the guidelines are matched to specific land management situations. Chapter II is "home base" for this matching process and should be thoroughly understood before any attempt is made to evaluate the guidelines.

OBJECTIVES

The overall objective of this publication is to organize the best that is known about forest residue[1/] management into guideline statements for use by forest managers in the Pacific Northwest. The statements specifically are not a guide for intensive forest management practices on commercially operable forest lands. Rather, they assume that prudent forest management goals, objectives, and practices prevail--with respect to development, harvest, and regeneration of the forest--and that these activities are accomplished in a professional manner and with minimum disruption of the environment. They further assume that, although the utilization of residues has been maximized, some quantity requiring additional treatment remains. Thus, these guidelines are meant to direct management to achieve the biological or ecological objectives of the land manager, under the best available technology. They do not touch directly on financial feasibility, nor on economic goals of the land manager, although obviously, these are also important aspects of the land management job.

Therefore, the land manager must plan his activities with these aspects equally in mind. He must do the best he can with the budget and manpower at his disposal. This may mean stopping short of total achievement of objectives; for example, where additional incremental gains would come only at inordinately high incremental costs. In this larger sense, a quality job would require a blending of effort to meet both environmental and economic goals.

The reasons for undertaking this work may be grasped best if the many interactions and variations of response occurring in nature, the multiple uses of forest land, and the demands of economic and social forces are thought of as taking place in one large dynamic model. Land managers must constantly

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1/ Along with other terms, "forest residue" is defined in the "Glossary."

attempt to integrate available knowledge about portions of this model to weigh the impact of alternatives on its operation. Often, the needed knowledge is only partially available--often, a generalization will encounter exceptions--yet decisions must be made.

To reduce the magnitude of generalizations about one portion of the model, forest residues, a unique system of localization has been used. Specificity and the most reasoned possible translations of knowledge into action terms have also been combined with a degree of risk-taking. The risks were taken when gaps in knowledge had to be bridged by use of experienced judgments to frame a suitable guideline statement. In taking these risks, we hoped a stimulus would be provided for aggressive new research and thereby these guidelines could be updated in the future.

A further objective has been to fully document the basis for each guideline statement so that both land managers and the public may draw upon common rationale.

HOW ORGANIZED

The three remaining chapters and six appendixes are organized in a scheme which recognizes the complexity of the material presented and anticipates that the user will turn directly to different segments as he searches for applicable management guidelines. The following is an overview of content in relation to this scheme.

Chapter II contains information essential to sorting guideline statements by activities and localities. Automatic data processing is suggested for large organizations intending to use these guidelines. This chapter also provides for use of these guidelines through manual sorting. As explained in the text, different colors of pages help the user turn rapidly to appropriate tables.

Chapter III contains separate guideline statements for public and private lands. This separation makes it important that the reader recognize that management goals are often different between public lands and private lands. Legislative, regulatory, and philosophical differences affect these goals as do differences in the need to operate forest ownerships sometimes for different social and economic purposes.

Chapter IV contains the documentation behind the guideline statements presented in chapter 111. It presents supporting information from literature and from deliberations of the experts involved in developing these guidelines. Each guideline statement is referenced to the supporting information in this chapter.

The appendixes include additional supporting information for guideline statements as well as detailed acknowledgments.

Chapter II. Sorting procedures for guidelines application

INTRODUCTION

A land manager or user of these residue management guidelines cannot scan the 214 guideline statements and determine readily which few are appropriate to his situation. Rather, *he can only determine the application of these guidelines by a unique keying system which considers his planned management activity for a given site in a given Zocation within a given species association type.*

This approach is necessary because only a very few broad general management guidelines can apply across all residue situations. To capture the full benefit of residue treatment objectives, the several factors which govern the choice and success of such treatments must be considered in structuring specific guidelines. For example, a species variable, such as thickness of bark, determines whether standing live trees can withstand a light prescribed underburning. Also, the depth, texture, angle of repose, and moisture content of soil have a significant bearing, not only on the amount of residue treatment, but on the choice of method.

Procedures presented in this chapter will deal with many other more complex combinations of biological, mechanical, and societal determinants.

SORTING PROCEDURES

Only a limited few of these guideline statements apply to every management situation. Most apply only to some given combination of a specific geomorphic province and a vegetative type. A few others apply only to special situations such as designated landscape management zones. Consequently, the only way to determine which guidelines appropriately apply to a given residue management situation is by a unique keying system.

Such a keying system can be designed for either automatic data processing or a manual sorting technique.

Automatic Data Processing

This system is recommended as best suited to an operational level in large organizations or firms where decisions are made for numerous timber sale contracts, slash disposal contracts, or work assignments, and other forest residue-related work. With this approach, a land manager would report sorting criteria to a central office (e.g., Rangers to Supervisors' Offices) and receive a printout of potentially applicable statements by return mail. Initial computer programing for the data processing system can be a straightforward matter adapted for a yes-no type of logic program. At the time individual guideline statements are stored in the system, any modifications needed to achieve conformance to agency policy can be made.

In addition to the obvious speed of obtaining a printout of applicable statements, this approach has the advantage of being easily updated when new laws, policies, or better knowledge dictate revisions of any statements.

Manual Sorting

When an automatic data processing system is not justified or not available, a manual procedure can provide a fairly rapid sorting of guideline statements. It cannot, however, lend itself as well to updating. Nonetheless, the following manual sorting procedure was developed so that immediate use can be made of these guidelines by any manager of forest land--large or small.

CRITERIA FOR MANUAL SORTING

The primary sorting is according to type of ownership--public lands or private lands. The secondary sorting is according to 16 management activities affecting residues. The additional sorting is according to Forest Residue Type Areas which divide Oregon and Washington into geographic units of like combinations of geomorphology and timber species associations.

Type of Ownership

Although there is common concern for the environmental effects of residue management, regardless of public or private ownership, there are some differences in management objectives which influence the applicability of residue management guidelines (see chapter 111) to warrant sorting according to these two ownership groups. Thus, separate sorting tables are provided for public lands and for private lands in chapter 111.

Management Activities

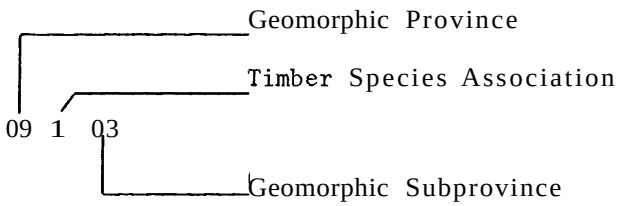
The 16 management activities considered in the development of these guidelines comprise 6 construction and 7 silvicultural operations and 1 each for treating natural residue, treating dying and damaged vegetation, and converting rangeland types.

For any planned forest operation involving two or more of these management activities, the manual sorting procedure requires a separate sorting for each activity. In this manner, two or more lists of guidelines which are applicable to the planned forest operation will be provided.

Forest Residue Type Areas (FR Types)

Both the geomorphology and the vegetative association of a location influence the creation and treatment of forest residues. The following forest residue type area classification scheme was synthesized from other classification schemes to simplify development and application of these guidelines. The FR Type Areas, as they will be called, are primarily geomorphic provinces, divided by timber species association and geomorphic subprovince. Figures 1 and 2 show these type areas for the Pacific Northwest.

A five-digit coding system is used for identifying the FR Type Areas. The first two digits represent the geomorphic province code. The third digit represents the timber species association code. The fourth and fifth digits represent the subprovince code.



In some cases, guideline statements have been identified by subprovince codes which do not appear in figures 1 and 2. These subprovinces were omitted ("00" as the last two digits in figures 1 and 2) when a significant area was not occupied by a commercial timber species, no management practice was anticipated that would create residue requiring treatment, and subprovinces were too scattered to be delineated clearly.

GEOMORPHIC PROVINCE CODES

01 Olympic Province

02 Coast Ranges Province

03 Siskiyou Province

04 Puget Sound Basin Province

05 Willamette Basin Province

06 Western Cascades Province

07 Northwestern Cascades Province

08 Northeastern Cascades Province

09 Recent (High) Cascades Province

10 Okanogan Highlands Province

11 Columbia Basin Province

12 Blue Mountains Province

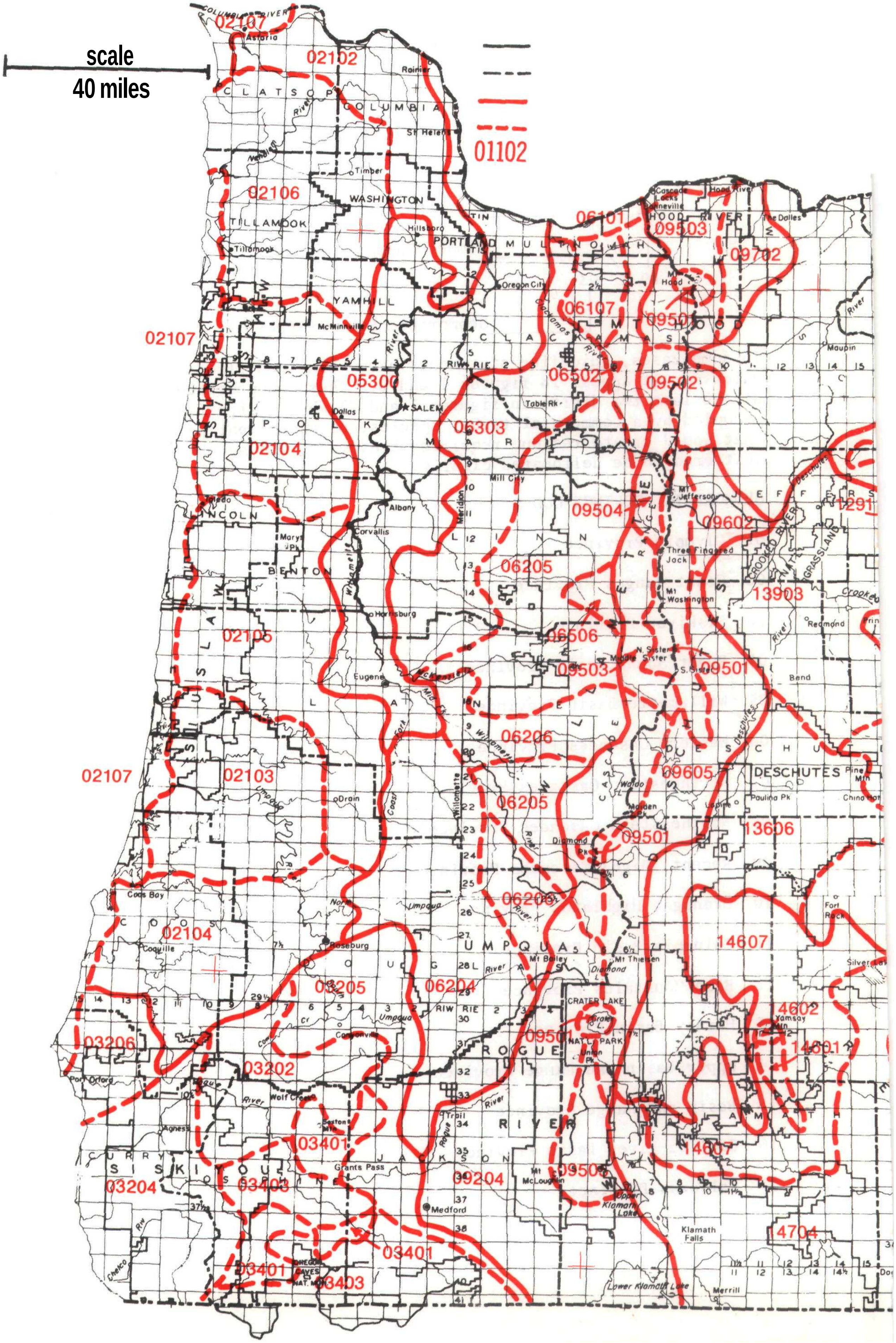
13 Harney Basin Province

14 Upper Basin and Range Province

15 Basin and Range Province

16 Cowlitz River Basin Province

17 Wallowas Province



scale
40 miles
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02107
02102
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09504
09602
09501
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09204
13903
13606
14607
14602
14601
14704
03205
Astoria
Rainier
St Helens
Timber
Hillsboro
Tillamook
McMinnville
Dallas
Salem
Albany
Corvallis
Harrisburg
Eugene
Drain
Coos Bay
Coquille
Roseburg
Port Orford
Agnes
Grants Pass
Medford
Oregon City
Table Rk
Mill City
The Dalles
Maupin
Redmond
Bend
Mt Jefferson
Three Fingered Jack
Mt Washington
N. Sister
Middle Sister
S. Sister
Diamond Pk
Mt Bailey
Mt Thielsen
Crater Lake Natl. Park
Union Pk
Mt McLoughlin
Upper Klamath Lake
Klamath Falls
Lower Klamath Lake
Merrill
Yamsay Mtn
Fort Rock
Paulina Pk
Oregon Caves Nat. Mon.
CLATSOP
COLUMBIA
WASHINGTON
TILLAMOOK
YAMHILL
MULTNOMAH
CLACKAMAS
HOOD RIVER
POLK
MARION
LINCOLN
BENTON
LINN
LANE
DOUGLAS
COOS
CURRY
JOSEPHINE
JACKSON
KLAMATH
DESCHUTES
Columbia River
Willamette River
Umpqua River
Rogue River
Deschutes
Crooked River
Crooked River National Grassland

Figure 1.—Forest Residue Type map, Oregon.

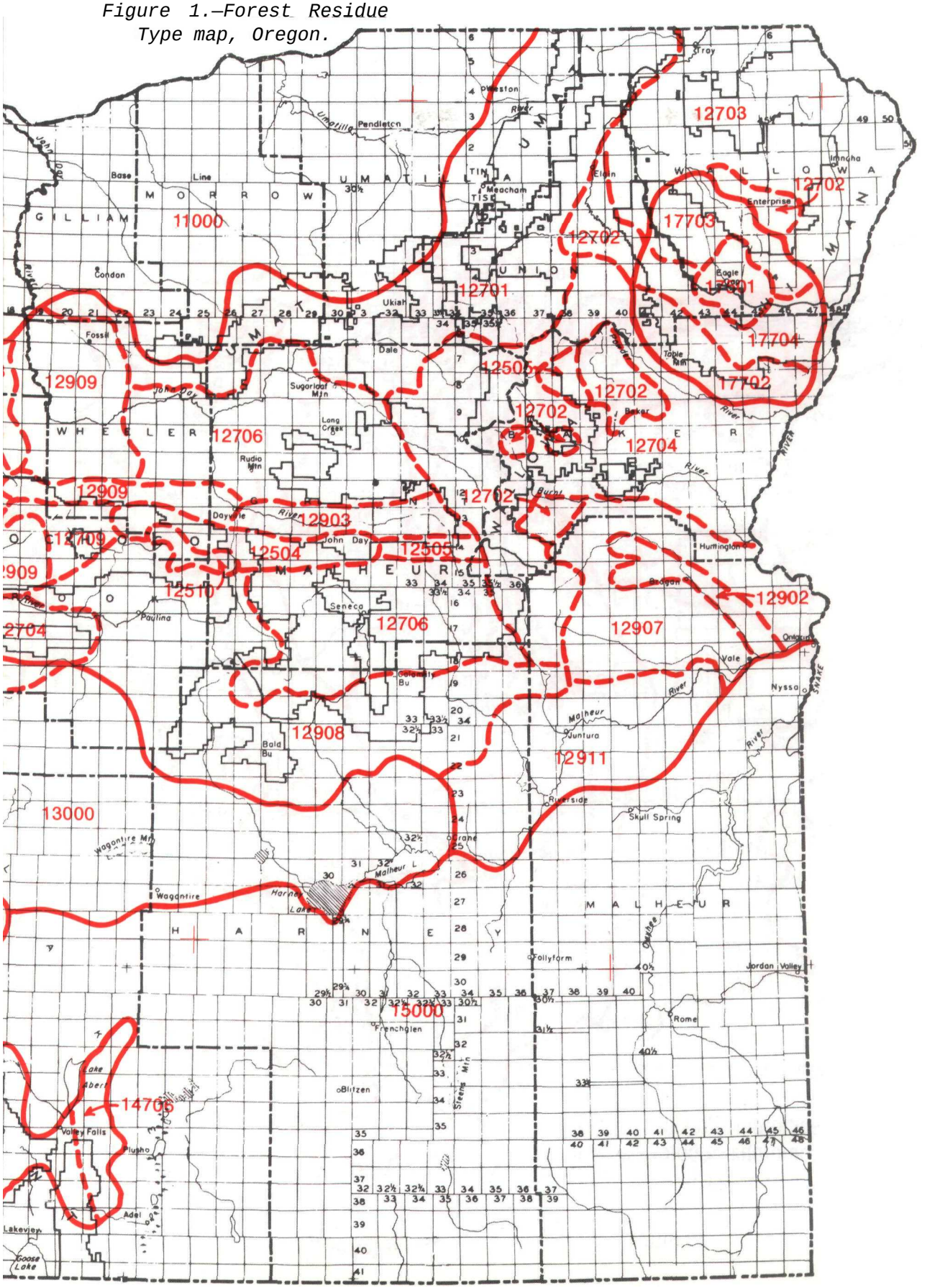
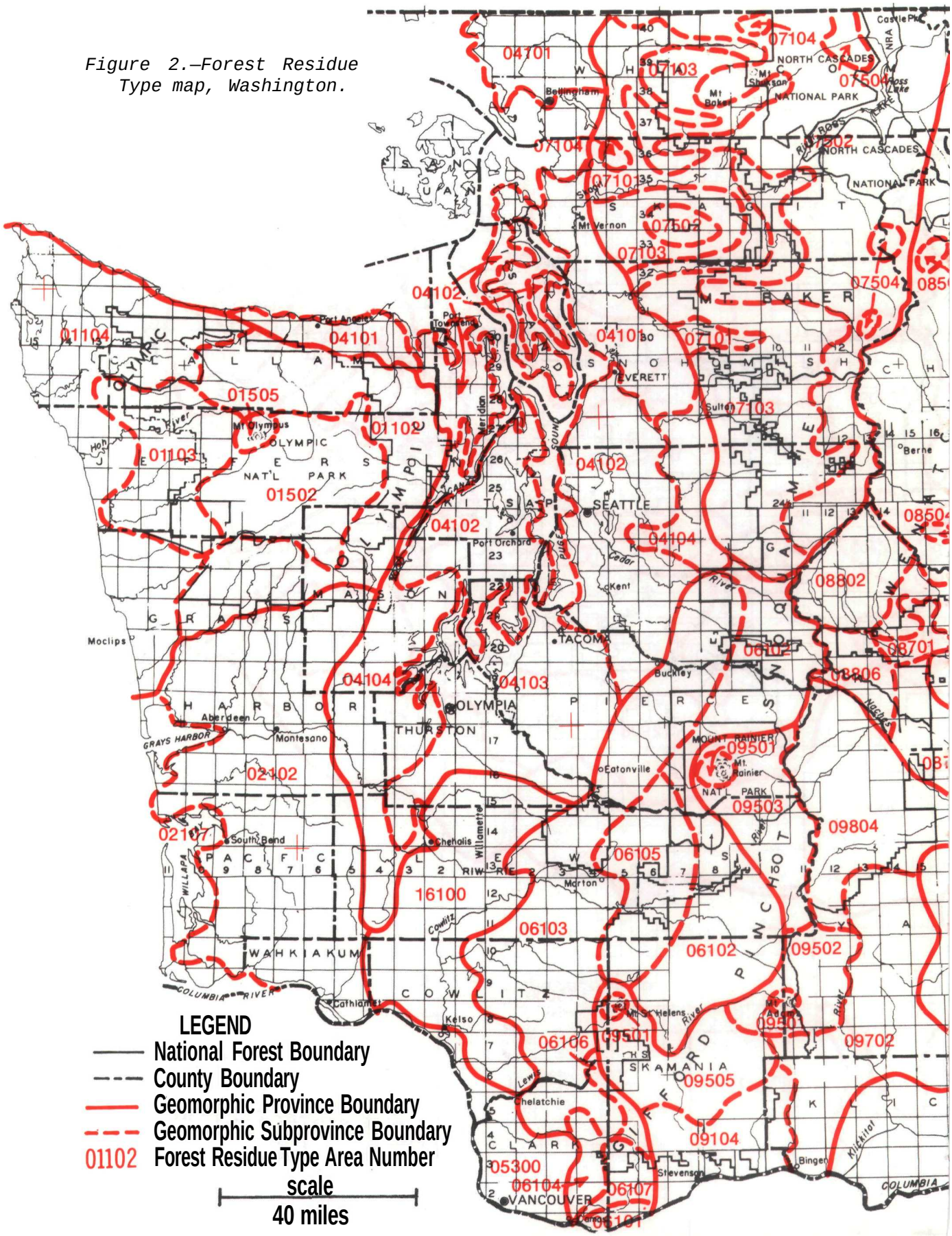
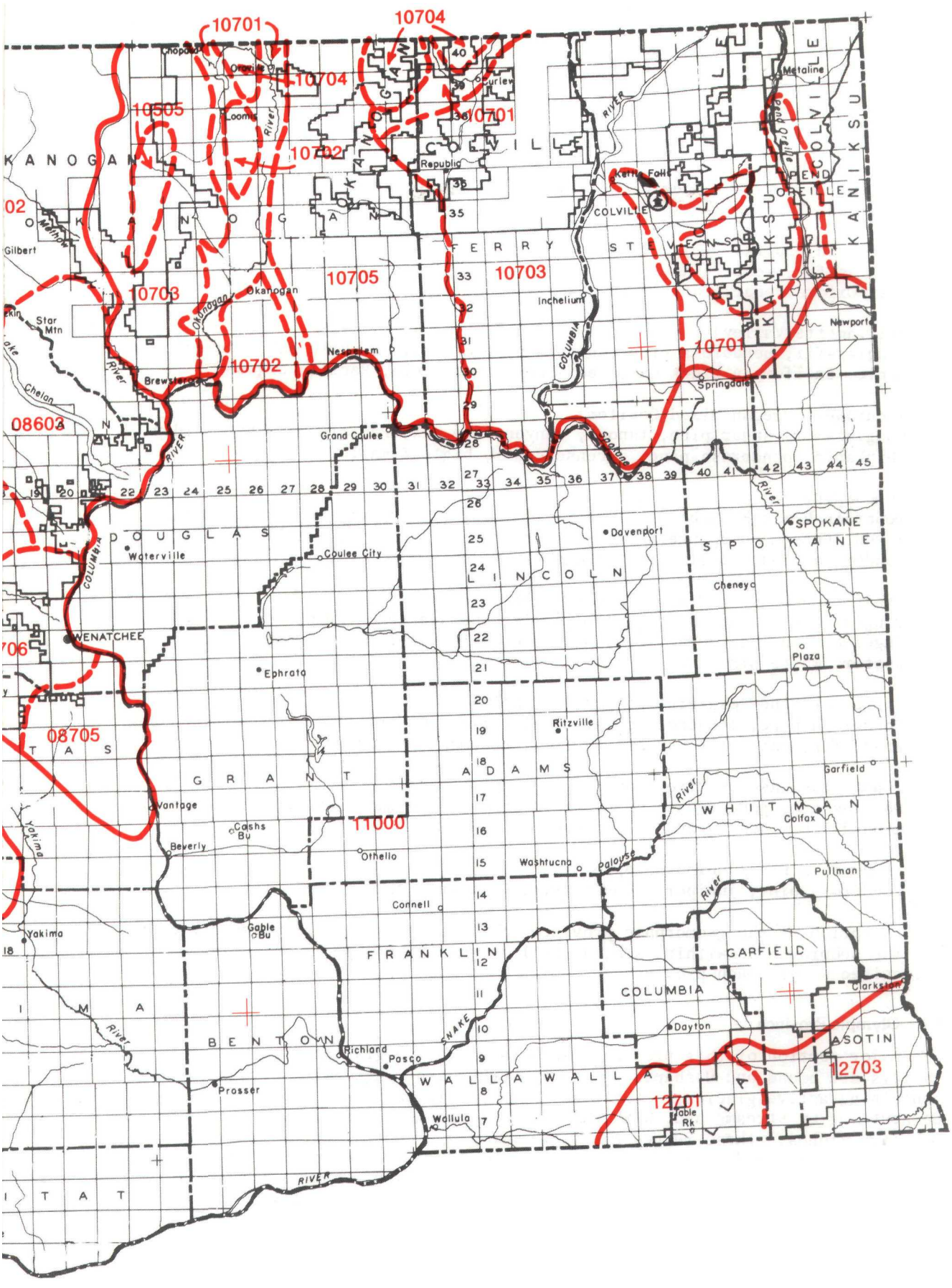


Figure 2.—Forest Residue Type map, Washington.




10701
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08705
11000
12703
12701
OKANOGAN
FERRY
STEVENS
PEND OREILLE
KANIKSU
DOUGLAS
LINCOLN
SPOKANE
GRANT
ADAMS
WHITMAN
FRANKLIN
BENTON
GARFIELD
COLUMBIA
WALLA WALLA
Omak
Okanogan
Republic
Curlew
Colville
Kettle Falls
Metaline
Inchelium
Newport
Springdale
Nespelem
Brewster
Grand Coulee
Waterville
Coulee City
Davenport
Cheney
WENATCHEE
Ephrata
Ritzville
Plaza
Vantage
Cashs Bu
Beverly
Othello
Washtucna
Colfax
Garfield
Pullman
Connell
Yakima
Gable Bu
Dayton
Clarkston
ASOTIN
Richland
Pasco
Prosser
Wallula
Table Rk
Star Mtn
Gilbert
Loomis
Chopaka
Columbia River
Okanogan River
Chelan River
Snake River
Yakima River
Palouse River
Spokane River
Pend Oreille River

TIMBER SPECIES ASSOCIATION CODES

1 (Northern Douglas-fir)
Douglas-fir, western hemlock, western redcedar, grand fir, Pacific silver fir, red alder, Sitka spruce, bigleaf maple, western white pine

2 (Southern Douglas-fir)
Douglas-fir, western hemlock, incense-cedar, sugar pine, ponderosa pine, Port-Orford-cedar, Pacific madrone, tanoak, canyon live oak

3 (Willamette Valley)
Douglas-fir, ponderosa pine, western hemlock, Oregon white oak, bigleaf maple, California black oak, red alder, vine maple, Pacific dogwood

4 (Southwest Oregon Mixed Conifer)
Douglas-fir, sugar pine, tanoak, canyon live oak, Pacific madrone, golden chinkapin, ponderosa pine, incense-cedar, bigleaf maple

5 (Subalpine)
Mountain hemlock, noble fir, Pacific silver fir, subalpine fir, western larch, Engelmann spruce, western white pine, grand fir, Shasta red fir, ponderosa pine, Douglas-fir, lodgepole pine

6 (East-side Cascade Mixed Conifer--Pumice Soils)
Douglas-fir, ponderosa pine, lodgepole pine, western larch, incense-cedar, Engelmann spruce, sugar pine, mountain hemlock, grand fir, subalpine fir, western white pine

7 (Interior Ponderosa Pine/Lodgepole Pine)
Ponderosa pine, lodgepole pine, Douglas-fir, western larch, western juniper, grand fir, white fir, subalpine fir, Engelmann spruce, western white pine

8 (East-side Cascade Mixed Conifer--Nonpumice Soils)
Douglas-fir, ponderosa pine, western larch, Engelmann spruce, subalpine fir, mountain hemlock, grand fir, lodgepole pine

9 (Ponderosa Pine/Juniper Steppe)
Ponderosa pine, juniper, Douglas-fir, western larch

A description of the geomorphic provinces follows, plus a description and codes for the subprovinces within each, as well as the Timber Species Associations recognized within each province.

01 Olympic Province

The major portion of this province exhibits extensive glaciation. Main river valleys are broad and U-shaped, and major peaks are ringed with cirques, many containing active glaciers. Extremely high precipitation has caused rapid downcutting by streams and, with past glacial erosion, has created precipitous mountain slopes. These rugged mountains provide a central core surrounded by almost level lowlands which are the result of deposition of glacial outwash. Vegetation is characterized by extremely dense stands of Douglas-fir, western hemlock, and western redcedar, with Sitka spruce along the western edges.

Timber Species Associations recognized: 1 and 5

Subprovince number	Shown on map	Description
01	No	Glaciated, steep, long mountain slopes
02	Yes	Glaciated, steep, long mountain slopes
03	Yes	Glaciated, steep, long, dissected mountain slopes
04	Yes	Coastal plain
05	Yes	Snow-covered peaks .and subalpine and alpine peaks

02 Coast Ranges Province

This province contains steep mountain slopes with ridges that are often extremely sharp. The ridge system is usually parallel to the coast but, being extremely dissected, is expressed subtly. The topography varies from nearly level along the dunal sheet through abrupt and steep lands along the western edges to more gentle lands along the eastern fringes. Scattered peaks, often barren, rise well above surrounding ridges. Vegetation is characterized by dense stands of Douglas-fir and western hemlock, with Sitka spruce and lodgepole (shore) pine along the western edges.

Timber Species Associations recognized: 1

Subprovince number	Shown on map	Description
01	No	Coastal headlands
02	Yes	Rounded dissected slopes
03	Yes	Short, highly dissected slopes
04	Yes	Steep, uneven mountain slopes and broad ridgetops
05	Yes	Complex of steep, dissected, and uneven mountain slopes
06	Yes	Steep, long mountain slopes
07	Yes	Dunal sheet, coastal headlands, and estuaries

03 Siskiyou Province

This province exhibits an ancient and now greatly dissected, uplifted plain; however, some peaks rise above the general accordant ridge. Vegetation reflects elements of the California north coast, and eastern Oregon flora with many

species indigenous only to the Siskiyou character type. Major communities are distributed in relation to moisture and elevation and include: pine-oak-fir, fir-broadleaved species, pine-fir-cedar-true firs, white fir, Shasta red fir, western hemlock, and Sitka spruce. This climatic diversity combines with a long history of disturbance, primarily fire, to produce an extremely varied array of communities.

Timber Species Associations recognized: 2 and 4

Subprovince number	Shown on map	Description
01	Yes	Drainage basin
02	Yes	Steep, uneven, dissected mountain slopes
03	Yes	Steep, long, mountain slopes
04	Yes	Steep, uneven, highly dissected mountain slopes
05	Yes	Steep, uneven mountain slopes
06	Yes	Steep, long, highly dissected mountain slopes

04 Puget Sound Basin Province

This province was subjected to massive continental glaciation, which formed an area of low relief broken by sounds, low moraine ridge systems and rounded hummocks, and many included lakes. Vegetation is characterized by Douglas-fir, western hemlock, western redcedar, and grand fir. Some stands of lodgepole pine are found on moraine remnants.

Timber Species Associations recognized: 1

Subprovince number	Shown on map	Description
01	Yes	Coastal plain
02	Yes	Morainal features with islands
03	Yes	Outwash plain
04	Yes	Rolling morainal deposits

05 Willamette Basin Province

This province reflects a structural depression with hills of low relief and alluvium deposited from ancient floods. The valley floor slopes very gently to the north and is interspersed with sluggish streams with many meanders. The natural vegetation mosaic consists of grasslands, oak woodlands, coniferous forest, and streambank (riparian) communities.

Timber Species Associations recognized: **3**

Subprovince number	Shown on map	Description
01	No	Recent flood plain
02	No	Lacustrine plains
03	No	Foothills
04	No	Steep, short mountain slopes

06 Western Cascades Province

This province is composed of a slightly folded and uplifted accumulation of weathered volcanic flows. The area is characterized by a general conformity in ridge crests separated by deep valleys with steep, highly dissected side slopes. In the southern portion of this province, major valleys are V-shaped. Throughout the entire province glacial features are evident but not pronounced. Vegetation is characterized by Douglas-fir, western hemlock, grand fir, and subalpine fir.

Timber Species Associations recognized: **1, 2, 3,** and 5

Subprovince number	Shown on map	Description
01	Yes	Columbia River Gorge
02	Yes	Glaciated, steep, long mountain slopes
03	Yes	Foothills
04	Yes	Steep, dissected mountain slopes
05	Yes	Steep, long mountain slopes
06	Yes	Steep, uneven mountain slopes
07	Yes	Rolling plateau remnants

07 Northwestern Cascades Province

This province is composed of sharp, jagged peaks and deep 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 such as morainal deposits on side slopes are common. Main stream valleys also contain deep accumulations of glacial debris. Vegetation is characterized by western hemlock, Douglas-fir, grand fir, and subalpine fir.

Timber Species Associations recognized: 1 and 5

Subprovince number	Shown on map	Description
01	Yes	Glacial valleys
02	Yes	Glaciated, steep, long mountain slopes with snow chutes
03	Yes	Glaciated, steep, long mountain slopes
04	Yes	Alpine and subalpine and snowcapped peaks

08 Northeastern Cascades Province

This province exhibits 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, and sedimentary rocks with ridgetops having approximately uniform crest elevations. Vegetation is characterized by subalpine fir, grand fir, Douglas-fir, western larch, and some ponderosa and lodgepole pine.

Timber Species Associations recognized: 5, 6, 7, 8, and 9

Subprovince number	Shown on map	Description
01	Yes	Glacial valleys
02	Yes	Glaciated, steep, long mountain slopes with snow chutes
03	Yes	Glaciated, steep, long mountain slopes
04	Yes	Alpine and subalpine and snowcapped peaks
05	Yes	Plateau remnants
06	Yes	Dissected mountain slopes
07	Yes	Tilted, dissected plateau land
08	No	Finger lake

09 Recent (High) Cascades Province

This province consists of a volcanic plateau capped by shield volcanoes, cinder cones, and other volcanic forms, all of which are in various stages of disintegration. 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. Much of the area is mantled with pumice and volcanic ash. Vegetation is characterized by Douglas-fir, grand fir, subalpine fir, hemlock, and ponderosa and lodgepole pine.

Timber Species Associations recognized: 1, 2, 5, 6, 7, and 8

Subprovince number	Shown on map	Description
01	Yes	Alpine and subalpine and snowcapped peaks
02	Yes	Plateaus
03	Yes	Glaciated, steep, long mountain slopes with snow chutes (north half)
04	Yes	Glaciated, steep, long mountain slopes
05	Yes	Pumice-mantled outwash plain and dissected plateau with craters and lakes

10 Okanogan Highlands Province

This province reflects repeated continental glaciation, resulting .in a generally rolling terrain of moderate slopes and broad, rounded summits. Scattered peaks rise 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. Vegetation is characterized by grand fir and Douglas-fir with larch and ponderosa pine. Arid grasslands (steppe) are present along the western and southern edges.

Timber Species Associations recognized: 5, 6, 7, 8, and 9

Subprovince number	Shown on mar,	Description
01	Yes	Glaciated valleys
02	Yes	Plateaus
03	Yes	Glaciated, steep, long mountain slopes
04	Yes	Glaciated, rolling mountain slopes
05	Yes	Low, rolling uplands and morainal features
06	No	Canyon lands

11 Columbia Basin Province

This province includes the Columbia River basalt plateau which was 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. Vegetation is characterized by ponderosa pine along the western edge, becoming grass-shrub to grass in the central and eastern portions.

Timber Species Associations recognized: None

Subprovince number	Shown on map	Description
01	No	Dissected basalt plateau land
02	No	Lacustrine plains
03	No	Coulees
04	No	Channeled scablands
05	No	Rolling loess hills
06	No	Outwash valleys
07	No	Folded basalt ridges
08	No	Outwash plain
09	No	Basalt plateau
10	No	Sand dunes

12 Blue Mountains Province

This province is composed of several ranges of mountains separated by faulted valleys, synclinal (downfolded) basins, canyon lands, and lava plateaus. Topographic relief in the mountains is highly variable with moderately steep side slopes common. Dissection of the lava plateaus has also created steep canyon side slopes. Vegetation is characterized by ponderosa pine, grand fir, Douglas-fir, some subalpine fir communities, and shrub-grass communities.

Timber Species Associations recognized: 5, 6, 7, 8, and 9

Subprovince number	Shown on map	Description
01	Yes	Dissected basalt and plateau land
02	Yes	Lacustrine plains
03	Yes	Dissected basalt plateau land
04	Yes	Steep, long mountain slopes
05	Yes	Subalpine and alpine and snowcapped peaks
06	Yes	Steep, short, dissected mountain slopes and basins
07	Yes	Steep, short, highly dissected rolling lands
08	Yes	Dissected rhyolite plateau land - transition forest
09	Yes	Badlands and dissected plateau remnants
10	Yes	Lacustrine plain and basin high desert
11	Yes	Canyon lands

13 Harney Basin Province

This province exhibits a young, relatively uniform expanse of lava flows of moderate relief and dotted with scattered cinder cones and lava buttes. Porous soils, resulting from pumice and ash falls, and bedrock under scanty rainfall produce many seasonal streams. Undrained basins, 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 the dominant example. Outstanding examples of very recent lava flows are near Lava Butte and Fort Rock. Vegetation is characterized by ponderosa pine, lodgepole pine, grand fir, some Douglas-fir, juniper, grass-shrub, grass, and desert shrub communities.

Timber Species Associations recognized: 6, 7, 8, and 9

Subprovince number	Shown on map	Description
01	No	Rhyolite plateau land
02	No	Rhyolite plateau land, lacustrine basin--lakebeds, volcano
03	Yes	Pumice and ash mantled, cinder cone, plateau 1and
04	No	Volcano-caldera
05	No	Recent basalt flow
06	Yes	Pumice mantled plateau land

14 Upper Basin and Range Province

This province exhibits fault-block mountains enclosing basin 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, occurring mostly as snow; most streams are perennial; and numerous undrained basins contain shallow lakes and marshes. Vegetation is characterized by mixed conifer, ponderosa pine, lodgepole pine, and grass-shrub communities. Unique are alpine and subalpine areas.

Timber Species Associations recognized: 6, 7, 8, and 9

Subprovince number	Shown on map	Description
01	Yes	Fault-block mountains, high elevation
02	Yes	Graben valleys
03	No	Rolling sagebrush lands
04	Yes	Dissected plateau lands, rolling sagebrush lands and lacustrine basin
05	No	Lacustrine basin--marshes
06	Yes	Fault-block mountains, lower elevation
07	Yes	Pumice-mantled rolling hills, high elevation alpine and subalpine

15 Basin and Range Province

This province consists of fault-block mountains with enclosed basins. Except for scarp 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. Vegetation is characterized by ponderosa pine, mixed conifer, lodgepole pine, grass-shrub, desert shrub, and juniper communities. Included in this province are alpine and subalpine areas.

Timber Species Associations recognized: 9

Subprovince number	Shown on map	Description
01	No	Alpine and subalpine
02	No	Lacustrine basin--lakebeds
03	No	Active sand dunes
04	No	Canyon lands
05	No	Fault-block mountain
06	No	Graben valleys
07	No	Rolling sagebrush land, low relief
08	No	Pumice-mantled plateau land

16 Cowlitz River Basin Province

This province reflects a structural depression occupied by the lower and middle Cowlitz River. Uplands of low rolling hills developed on volcanic 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. The natural vegetation mosaic consists of conifers and hardwoods with heavy understory of mesophyllic shrubs and forbs.

Timber Species Associations recognized: 1

Subprovince number	Shown on map	Description
01	No	Flood plains
02	No	Outwash plains
03	No	Foothills
04	No	Steep, short mountain slopes

17 Wallowas Province

This province consists of a mountainous "island" surrounded by lava plateaus. These mountains are part of the Blue Mountains Province but are distinctive, since alpine glaciation has created a very precipitous and rugged mountainous area. The relief is much greater than in the Blue Mountains type. Vegetation is characterized by grand fir, Douglas-fir, subalpine fir, and mountain hemlock.

Timber Species Associations recognized: 5, 6, 7, 8, and 9

Subprovince number	Shown on mar,	Description
01	Yes	Alpine and subalpine and snowcapped peaks
02	Yes	Basalt plateau
03	Yes	Dissected basalt plateau
04	Yes	Glaciated, steep, long mountain slopes

TABLES

The following colored pages contain sets of tables to be searched for applicable guideline statement numbers. These tables were structured so that every guideline statement appears only for the specified FR Type Area(s) to which it applies. Thus, it may be possible that a given statement with across-the-board application appears in all tables and will sort out for all FR Types. Conversely, another statement will sort out only for the one FR Type to which it applies.

Two major sets of tables are provided: Those for Public Lands are printed on yellow and blue paper; those for Private Lands are printed on pink and green paper.

The yellow and pink pages [labeled Table Set ,I and Table Set 11, respectively) each contain 16 sorting sets of tables. Each sorting set covers a different land management activity relating to forest residues creation and treatment, regardless of the FR Type.

The blue pages, labeled Table Set IA, and the green pages, labeled Table Set IIA, contain supplemental tabulations for verifying the applicability of each management activity related guideline to a specified FR Type Area. This cross-check is an important step in selecting only statements applicable to a given FR type from a large list of activity-related guideline statements evolving from the search process.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET A

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM ROAD CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.717	1.801	1.901	2.201	2.301	3.601	3.813
	1.718	1.802	1.902	2.202	2.302	3.607	
			1.903		2.303		
			1.904		2.306		
			1.905		2.307		
			1.906				

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.102
1.103
1.104
1.105
1.106
1.107
1.109
1.110
1.111
1.112
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.525	1.525	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.525	1.524	1.523	
	1.525	1.527	1.527	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET A CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.723	1.719	1.719	1.719	1.720	1.719	1.719	1.720	2.401		1.727	2.401	2.402		1.719	1.719
2.401	2.206	1.721	1.721	2.401	2.206	2.401	2.401	2.481	2.402		2.401	2.407	2.407		2.401	2.401
3.602	2.401	2.401	2.401	2.408	2.401	2.402	2.402	2.402	2.407		2.402	2.408	2.408		3.603	2.402
	3.602	2.407		2.409	2.402	2.408	2.407	2.407	2.408		2.407	2.409	2.409			2.407
		2.408		2.410	2.407	2.409	2.408	2.408	2.409		2.408	2.410	2.410			2.408
		2.409			2.408	2.410	2.419	2.409	2.410		2.409	3.603	3.603			2.410
		2.410			2.409		2.410	2.410			2.410					
		3.603			2.410			*3.603*			*3.603*					
					3.603											

NO GUIDELINES APPLICABLE IN THIS SET UNDER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET B

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM TRAIL CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.717	1.801	1.901	2.201	2.301	3.607	3.809
	1.718	1.802	1.902	2.202	2.302		3.813
			1.933		2.303		
			1.994		2.306		
			1.905		2.307		
			1.906				

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.152
1.103
1.104
1.105
1.105
1.107
1.109
1.110
1.111
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507	1.503	1.520	1.515	1.514	1.526
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509	1.513	1.525	1.519	1.518	
	1.520	1.525	1.525	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.526	1.527	1.524	1.523	
	1.525	1.527	1.527	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518			1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET 3 CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AQEAS

PROVINCE NUMBER																
01	02	03	04	05	06	a7	08	09	10	11	12	13	14	15	16	17
1.722	1.728	1.719	1.719	1.719	1.720	1.719	1.719	1.720	2.401		1.727	1.738	2.402		1.719	1.719
2.401	1.738	1.721	1.721	2.401	2.206	2.401	1.738	1.738	2.402		1.738	2.401	2.407		2.401	2.401
	2.206	1.738	2.401	2.408	2.401	2.402	2.401	2.401	2.407		2.401	2.407	2.408			2.402
	2.401	2.401			2.402	2.408	2.402	2.402	2.408		2.402	2.408				2.407
		2.407			2.407		2.437	2.437			2.407					2.408
		2.408			2.408		2.408	2.408			2.408					

NO GUICELINES APPLICABLE IN THIS SET UNOER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET C

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM CAMPGROUND CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.717	1.801	1.931	2.201	2.301	3.607	3.813
	1.718	1.802	1.902	2.232	2.302		
			1.903	2.203	2.306		
			1.904		2.307		
			1.905				
			1.906				

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.102
1.103
1.104
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1.107
1.109
1.110
1.111
1.112
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.517	1.517	1.517	1.506	1.506	1.517	1.517	1.517	1.504	1.504	1.517	1.506	1.517		1.521	1.515	1.514	
	1.521	1.521	1.521	1.508	1.517	1.519	1.519	1.519	1.508	1.508	1.518	1.517	1.518		1.527	1.519	1.518	
	1.527	1.527	1.527	1.517	1.519	1.521	1.521	1.521	1.517	1.517	1.521	1.518	1.521			1.521	1.521	
				1.519	1.521	1.524	1.524	1.524	1.518	1.518	1.523	1.521	1.523			1.524	1.523	
				1.521	1.524	1.527	1.527	1.527	1.521	1.521	1.527	1.523	1.527			1.527	1.527	
				1.527	1.527				1.522	1.523		1.527						
									1.527	1.527								

SORTING SET C CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	25	06	07	08	09	10	11	12	13	14	15	16	17
1.722	**1.723**	1.719	1.719	**1.719**	**1.720**	1.719	1.719	1.720	1.723		1.723	1.723	1.723	**1.723**	1.719	1.719
2.401	**1.724**	**1.721**	1.721	1.725	**1.724**	1.723	**1.723**	1.723	1.724		1.724	1.724	**1.724**	1.724	1.725	1.723
2.403	1.725	1.723	2.401	2.401	1.725	2.401	1.7>4	**1.725**	**1.725**		1.725	1.725	1.725	1.725	2.401	10724
	1.728	1.724		2.408	2.236	2.402	1.725	1.738	**2.401**		1.727	1.738	2.402	2.406		2.401
	1.738	1.725		2.409	2.401	2.403	1.738	2.401	2.402		1.738	2.401	2.405			2.402
	2.206	1.738		2.410	2.402	2.408	2.401	2.402	2.405		2.401	***2.405***	2.406			2.405
	2.401	2.401			2.403	2.439	2.402	2.403	2.406		2.402	2.406	2.407			**2.406**
		2.403			2.407	2.410	2.403	2.405	2.407		**2.405**	**2.407**	**2.408**			**2.407**
		2.406			2.408		2.475	2.406	2.408		2.406	2.408	2.409			2.408
		2.407			2.459		2.406	2.407	2.409		2.407	2.409	2.410			2.409
		2.408			2.410		2.407	2.408	2.410		**2.408**	**2.410**				**2.410**
		2.409					**2.408**	2.409			***2.409***					
		2.410					2.409	2.413			2.410					
							2.410									

NO GUIDELINES APPLICABLE IN THIS SET UNOER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET D

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
STRUCTURE CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.801	1.901	2.201	2.301	3.501	3.813
	1.802	1.902	2.202	2.302	3.607	
		1.903	2.203	2.306		
		1.904		2.307		
		1.905				
		1.906				

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.102
1.103
1.104
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1.112
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.504	1.504	1.517	1.517	1.517	1.503	1.516	1.515	1.514	1.526
	1.521	1.521	1.521	1.519	1.519	1.519	1.519	1.519	1.517	1.517	1.516	1.518	1.518	1.513	1.521	1.519	1.518	
	1.527	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.518	1.518	1.521	1.521	1.521	1.526	1.527	1.521	1.521	
				1.527	1.524	1.524	1.524	1.524	1.521	1.521	1.523	1.523	1.523			1.524	1.523	
					1.527	1.527	1.527	1.527	1.522	1.523	1.527	1.527	1.527			1.527	1.527	
									1.527	1.527								

SORTING SET D CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.401	2.206	2.401	2.401	2.401	2.206	2.401	2.401	2.401	2.401		2.401	2.401	2.402	2.406	2.401	2.401
	2.401	2.406		2.408	2.401	2.402	2.402	2.402	2.402		2.402	2.405	2.405			2.402
		2.407		2.409	2.402	2.408	2.405	2.405	2.405		2.405	2.406	2.406			2.405
		2.408		2.410	2.407	2.409	2.406	2.406	2.406		2.406	2.407	2.407			2.406
		2.409			2.408	2.410	2.407	2.407	2.407		2.407	2.408	2.408			2.407
		2.410			2.409		2.408	2.408	2.408		2.408	2.409	2.409			2.408
					2.410		2.409	2.409	2.409		2.409	2.410	2.410			2.409
							2.410	2.410	2.410		2.410					2.410

NO GUIDELINES APPLICABLE IN THIS SET UNDER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET E

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM SKI RUN CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.717	1.801	1.901	2.201	2.301	3.607	3.804
	1.718	1.802	1.902	2.202	2.302		3.813
			1.903	2.203			
			1.904				
			1.905				
			1.906				

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.102
1.103
1.104
1.105
1.106
1.107
1.109
1.110
1.111
1.112
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.508	1.508	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.517	1.517	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.518	1.518	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.521	1.521	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.522	1.523	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.527	1.527	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527			1.527	1.527	1.527					

SORTING SET E CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.738	1.719	1.719	1.719	1.720	1.719	1.719	1.720	2.401		1.738	1.738	20402		1.719	1.719
2.401	2.206	1.721	1.721	2.401	2.206	2.401	1.738	1.738	2.402		2.401	2.401	2.409		2.401	2.401
2.403	2.401	1.738	2.401	2.409	2.401	2.402	2.401	2.401	2.409		2.402	2.409	2.410			2.402
		2.401		2.410	2.402	2.403	2.402	2.402	2.410		2.409	2.410				2.409
		2.403			2.403	2.409	2.403	2.403			2.410					20410
		2.409			2.409	2.410	2.409	2.409								
		2.410			2.410		2.410	2.410								

NO GUIDELINES APPLICABLE IN THIS SET UNDER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET F

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM UTILITY RIGHT-OF-WAY

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.902		2.302	3.606	3.805
	1.717	1.803	1.903			3.607	3.806
	1.718		1.904				3.812
			1.905				3.813
			1.906				3.814
							3.817
							3.818

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101
1.102
1.103
1.104
1.105
1.106
1.107
1.109
1.110
1.111
1.112
1.113

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET F CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724		1.724	1.724	1.723	1.724	1.725	1.723
3.602	1.724	1.721	1.721	2.401	1.725	2.401	1.724	1.725	1.725		1.725	1.725	1.724	1.725	2.401	1.724
3.605	1.725	1.723	2.401	2.408	2.206	2.402	1.725	2.401	2.401		1.727	2.401	1.725	2.406	3.603	2.401
	1.728	1.724		2.409	2.401	2.408	2.401	2.402	2.402		2.401	2.405	2.402	3.605	3.605	2.402
	2.206	1.725		2.410	2.402	2.409	2.402	2.405	2.405		2.402	2.406	2.405	3.807		2.405
	2.401	2.401		3.605	2.407	2.410	2.415	2.406	2.406		2.405	2.407	2.406			
	3.602	2.406			2.408		2.406	2.407	2.407		2.406	2.408	2.407			2.407
	3.605	2.407			2.409		2.407	2.408	2.408		2.407	2.409	2.408			2.408
		2.408			2.410		2.408	2.409	2.439		2.408	2.410	2.409			2.409
		2.409			3.603		2.409	2.410	2.410		2.469	3.603	2.410			2.410
		2.410			3.605		2.410	3.603	3.807		2.410	3.605	3.603			3.605
		3.603					3.807	3.605			3.603	3.807	3.605			3.807
		3.605									3.807	3.808	3.807			
		3.807											3.808			

NO GUIDELINES APPLICABLE EN THIS SET UNDER TABLE 5.

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET G

GUIDELINES FOR TREATMENT OF RESIDUES *RESULTING* FROM
INDIVIDUAL TREE SELECTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.501	3.804
	1.713	1.802	1.902	2.202	2.302	3.506	3.806
	1.717	1.803	1.903		2.303	3.507	3.809
	1.718		1.904		2.306		3.813
	1.729		1.995		2.307		3.815
	1.732)		1.906				3.816

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.L23		
1.104		
1.106		
1.107		
1.109		
1.110		
1.111		
1.112		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.521	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	0b	c7	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	1.723	1.723	10723	1.724		1.724	1.724	10723	1.724	1.725	1.723
2.403	1.724	1.721	1.721	2.401	1.725	10731	1.724	1.725	1.725		1o725	1.725	1.724	1.725	2.401	1.724
	1.725	1.723	2.401	2.408	1.731	2.401	1.725	1.731	1.731		1.727	1.731	1.725	1.731		1.731
	1.728	1.724		2.409	2.206	2.402	1.731	1.732	1.732		1.731	1.732	1.731	2.406		2.401
	1.732	1.725		2.410	2.401	2.403	1.732	1.733	1.733		1.732	1.733	1.732	3.807		2.402
	1.735	1.731			2.402	2.408	1.733	1.738	2.401		1.733	1.738	1.733			2.405
	1.738	1.738			2.403	2.409	1.736	2.401	2.402		1.734	2.401	1.734			2.406
	2.206	2.401			2.407	2.410	1.738	2.402	2.405		1.738	2.405	2.402			2.40 7
	2.401	2.403			2.408		2.401	20 403	2.406		2.401	2.406	2.405			2.408
		2.406			5.409		2.402	20 405	2.407		2.402	2.407	2.406			2.409
		2.407			2.410		2.403	2.406	2.408		2.405	2.408	2.40 7			2.41e
		2.408					2.405	2.407	2.409		2.406	2.409	2.408			3.807
		2.409					2.406	2.400	2.410		2.407	2.410	2.409			
		2.410					2.407	2.409	30608		2.408	30608	2.410			
		3.807					2.408	2.410	3.807		2.409	3.807	3.608			
							2.409				2.410	3.808	3.807			
							2.410				3.608		3.808			
							3.608				3.897					
							3.807									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
10704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	10705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	10709	1.708		1.706	1.708	1.708	1.708	1.709	10706
	1.709	1.707			1.709		1.708		1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.709				1.708					
		1.709									1.709					

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SIT H

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
SHELTERWOOD CUTTING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.902	2.202	2.302	3.606	3.806
	1.717	1.803	1.903		2.303	3.607	3.809
	1.718		1.904		2.306		3.813
	1.729		1.905		2.307		3.814
	1.730		1.906				3.815
							3.816

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.103		
1.104		
1.106		
1.107		
1.109		
1.110		
1.111		
1.112		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	10720	1.723	3.604	1.723	1.723	I.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724	3.807	1.724	1.724	1.723	1.724	1.725	1.723
2.403	1.724	1.721	1.721	2.401	1.725	1.731	1.724	1.725	1.725		1.725	1.725	1.724	1.725	2.401	1.724
3.602	1.725	1.723	2.401	2.408	1.731	2.401	1.725	1.731	1.731		1.727	1.731	1.725	1.731	3.603	1.731
3.604	1.728	1.724		2.409	2.206	2.402	1.731	1.732	1.732		1.731	1.732	1.731	2.406	3.604	2.401
	1.732	1.725		2.410	2.401	2.403	1.732	1.733	1.733		1.732	1.733	1.732	3.604		2.402
	1.735	1.731		3.604	2.402	2.408	1.733	1.738	2.401		1.733	1.738	1.733	3.807		2.405
	1.738	1.738			2.403	2.409	1.736	2.401	2.402		1.734	2.401	1.734			2.406
	2.206	2.401			2.407	2.410	1.738	20402	2.405		1.738	2.405	2.402			2.407
	2.401	2.403			20438	3.604	2.401	*2.403*	2.406		2.401	2.406	2.405			2.408
	3.602	2.406			2.409		2.402	2.403	2.407		2.402	2.407	2.406			2.409
	3.604	2.407			2.410		2.403	2.406	2.408		2.405	2.408	2.407			2.410
		2.408			3.603		2.405	2.407	2.409		2.406	2.409	2.408			3.604
		2.499			3.604		2.406	2.408	2.410		2.407	2.410	2.409			3.807
		2.410					2.407	2.409	3.604		2.408	3.603	2.410			
		3.603					2 .408	2.410	3.608		2.409	3.604	3.603			
		3.604					2.409	3.603	3.807		2.410	3.608	3.604			
		3.807					2.410	3.60t			3.603	3.807	3.608			
							3.604				3.608	3.808	3.807			
							3.608				3.807		3.808			
							3.807									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES HILL BE BURNED

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	10703	1.703	1.707	10707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.703		1.738		1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.739				1.708					
		1.709									1.709					

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET J

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM GROUP SELECTION CUTTING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.902	2.202	2.302	3.606	3.806
	1.717	1.803	1.903	2.205	2.303	3.607	3.809
	1.718		1.904		2.306		3.812
	1.729		1.905		2.307		3.813
	1.730		1.906				3.814
							3.815
							3.816
							3.817
							3.818

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.103		
1.104		
1.106		
1.107		
1.109		
1.110		
1.111		
1.112		
1.113		

TABLE 3. GUIDELINES APPLYIAG IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	3	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	92	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	**1.719**	1.720	1.719	**1.719**	1.720	1.723	3.604	1.723	1.723	1.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724	3.807	1.724	1.724	1.723	1.724	**1.725**	**1.723**
2.403	1.724	1.721	1.721	**2.401**	1.725	1.731	1.724	1.725	1.725		1.725	**1.725**	1.724	1.725	**2.401**	**1.724**
3.602	1.725	1.723	2.401	2.408	1.731	**2.401**	1.725	**1.726**	1.726		1.726	1.726	1.725	1.726	3.603	**1.726**
3.604	1.728	1.724		2.409	**2.206**	2.402	**1.726**	1.731	1.731		1.727	**1.731**	1.726	**1.731**	3.604	**1.731**
	1.732	1.725		2.410	2.401	2.403	**1.731**	**1.732**	1.732		1.731	1.732	1.731	2.406		**2.401**
	1.735	1.731		3.604	2.402	2.408	**1.732**	1.733	1.733		1.732	1.733	**1.732**	3.604		**2.402**
	1.738	1.738			2.403	2.409	1.733	**1.738**	2.401		**1.733**	1.738	**1.733**	3.807		**2.405**
	2.206	2.401			2.407	2.410	1.736	**2.401**	2.402		1.734	2.401	**1.734**			2.406
	2.401	**2.403**			2.408	**3.604**	**1.738**	2.402	2.405		1.738	2.405	2.402			2.407
	3.602	2.406			2.409		2.401	2.403	2.406		2.401	2.406	**2.405**			2.408
	3.604	2.407			2.410		2.412	2.405	2.407		2.402	**2.407**	2.406			2.409
		2.408			**3.603**		2.403	2.406	2.408		2.405	2.408	2.40 7			**2.410**
		2.409			3.604		2.405	2.407	2.409		2.406	2.409	**2.408**			3.604
		2.410					2.406	2.408	2.410		2.407	2.410	2.409			3.807
		3.603					2.407	2.409	3.604		2.408	3.603	**2.410**			
		3.604					2.418	2.410	3.608		2.409	**3.604**	3.603			
		3.807					2.409	3.603	3.807		2.410	3.608	**3.604**			
							2.410	3.604			3.603	3.807	**3.608**			
							3.604				3.608	3.808	3.807			
							3.608				3.807		3.808			
							3.807									

TABLE 5 GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIOUES WILL BE BURNEO

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		**1.703**	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.708	1.710	**1.709**		1.707	1.709	1.709	**1.709**		**1.709**
	1.711	1.708					1.709		1.710		1.708	1.710	1.710	1.710		10710
		1.709					**1.710**				**1.709**					
											1.710					

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET K

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM CLEARCUTTING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.932	2.202	2.302	3.606	3.805
	1.717	1.803	1.903	2.205	2.306	3.607	3.806
	1.718		1.904		2.307		3.809
	1.729		1.905				3.812
	1.730		1.906				3.813
							3.814
							3.817
							3.818

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	3.811
1.102	1.702	
1.103		
1.104		
1.105		
1.106		
1.107		
1.108		
1.109		
1.110		
1.111		
1.112		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.517	1.517	1.517	1.511	1.517	1.517	1.517	1.517	1.517	1.517		1.516	1.515	1.514	
	1.517	1.520	1.520	1.525	1.524	1.524	1.517	1.524	1.518	1.518	1.518	1.518	1.518		1.520	1.524	1.518	
	1.520	1.525	1.525	1.527	1.527	1.527	1.524	1.527	1.527	1.527	1.527	1.527	1.527		1.525	1.527	1.527	
	1.525	1.527	1.527				1.527								1.527			
	1.527																	

TABLE 4. GUIDELINES APPLYXNC IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.604	1.723	1.723	1.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	1.723	1.723	■Z23	1.724		1.724	1.724	1.723	1.724	1.725	1.723
2.403	1.724	1.721	1.721	2.401	1.725	1.731	1.724	1.725	1.725		1.725	1.725	1.724	1.725	2.401	1.724
3.602	1.725	1.723	2.401	2.408	1.731	2.401	1.725	1.725	1.726		1.726	1.726	1.725	1.726	3.603	1.726
3.604	1.728	1.724		2.409	2.206	2.402	1.726	1.731	1.731		1.727	1e731	1.726	1.731	3.604	1.731
3.605	1.732	1.725		2.410	2.401	2.403	1.731	1.732	1.732		1.731	1.732	1.731	2.406	3.605	2.401
	1.735	1.731		3.604	2.402	2.408	1.732	1.733	1.733		1.732	1.733	1.732	3.604		2.402
	1.738	1.738		3.605	2.403	2.409	1.733	1.738	2.401		1.733	1.738	1.733	3.605		2.405
	2.206	2.401			2.407	2.410	■736	2.401	2.402		1.734	2.401	1.734			2.406
	2.401	2.403			2.408	3.604	1.737	2.402	2.405		1.738	2.405	2.402			2.407
	3.602	2.406			2.409		■738	2.403	2.406		2.401	2.406	2.405			2.408
	3.604	2.407			2.410		2.401	2.405	2.407		2.402	2.407	2.406			2.409
	3.605	2.408			3.603		2.402	2.406	2.408		2.405	2.408	2.407			2.410
		2.409			3.604		2.403	2.407	2.409		2.406	2.409	2.408			3.604
		2.410			3.605		2.405	2.408	2.410		2.407	2.410	2.409			3.605
		3.603					2.436	2.409	3.604		2.408	3.603	2.410			
		3.604					2.407	2.410			2.409	3.604	3.603			
		3.605					2.408	3.603			2.410	3.605	3.604			
							2.409	3.604			3.603	3.808	3.605			
							2.410	3.605					3.808			
							3.604									

TABLE 5. CUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES HILL BE BURNED

PROVINCE NUMBER

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	10708	1.708	10709	1.708
	1.709	1.707			1.709		1.708	1.710	1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.709		1.710		1.708	1.710	1.710	1.710		1.710
		1.709					1.710				1.709					
											1.710					

TABLE SET ■
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET L

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM PRECOMMERCIAL THINNING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.902	2.202	2.302	3.607	3.806
	1.717	1.803	1.903		2.303		3.809
	I.718		1.904		2.304		3.813
	1.729		1.905		2.305		3.814
	1.730		1.906		2.306		3.815
					2.307		3.816

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.103		
1.10%		
1.105		
1.107		
1.109		
1. 110		
1.111		
1.112		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	'1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519.	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET L CONTINUE0

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NJMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724		1.724	1.724	1.723	1.724	1.725	1.723
	1.724	1.721	1.721	2.408	1.725	1.731	1.724	1.725	1.725		1.725	1.725	1.724	1.725		1.724
	1.725	1.723			1.731	2.408	1.725	1.731	1.731		1.727	1.731	1.725	1.731		1.731
	1.728	1.724			2.206		1.731	1.732	1.732		1.731	1.732	1.731	2.406		2.405
	1.732	1.725			2.407		1.732	1.733	1.733		1.732	1.733	1.732	3.807		2.406
	1.735	1.731			2.408		1.733	1.738	2.405		1.733	1.738	1.733			2.407
	1.738	1.738					1.736	2.405	2.406		1.734	2.405	1.734			2.408
	2.206	2.406					1.738	2.406	2.407		1.738	2.406	2.405			3.807
		2.437					2.435	2.407	2.408		2.405	2.407	2.406			
		2.408					2.406	2.406	3.608		2.406	2.408	2.407			
		3.807					2.407		3.807		2.407	3.608	2.408			
							2.438				2.408	3.807	3.608			
							3.608				3.608	3.808	3.807			
							3.807				3.807		3.808			

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS HHEN RESIDUES HILL BE BURNEO

PROVINCE NJMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.708	1.710	1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.709		1.710		1.708	1.710	1.710	1.710		1.710
		1.709					1.710				1.709					
											1.710					

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET M

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM COHHERCIAL THINNING

TABLE la GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.601	3.804
	1.713	1.802	1.902	2.202	2.302	3.607	3.806
	1.717	1.803	1.903		2.303		3.809
	1.718		1.904		2-306		3.813
	1.729		1.905		2.307		3.815
	1.730		1.906				3.816

TABLE 2. GJIDELINES APPLICABLE IF RESIDUES WILL BE BURNEO

1.101	1.701	2.204
1.102	1.702	
1.103		
1.104		
1.106		
1.107		
1.109		
1.110		
1 .111		
1. 112		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS .

PROVINCE NUMBER																
01	02	03	04	05	06	07	98	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1e719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
2.401	1.723	1.719	1.719	1.725	1.724	10723	1.723	1.723	1.724		1.724	1.724	1.723	1.724	1.725	1.723
2.403	1.724	1.721	1.721	2.401	1.725	1.731	1.724	1.725	1.725		1.725	1.725	1.724	1.725	2.401	1.724
	1.725	1.723	2.401	2.408	1.731	2.401	1.725	1.731	1.731		1.727	1.731	1.725	1.731		1.731
	1.728	1.724			Eo296	2.402	1.731	1.732	1.732		1.731	1.732	1.731	2.406		2.40
	1.732	10725			2.401	2.403	1.732	1.733	1.733		1.732	1.733	1.732	3.807		2.402
	1.735	1.731			2.402	2.408	10733	10738	2.401		10733	1.738	1.733			2.405
	1.738	1.738			2.403		1.736	2.401	2.402		1.734	2e401	1.734			2.406
	2.206	2.401			2.407		1.738	2.402	2.405		1.738	2.405	2.402			2.408
	2.401	2.403			2.408		2.401	2.403	2.406		2.401	2e406	2.405			
		2.406					2.402	2.405	2.407		2.402	2.407	2.406			3.807
		2.407					2.413	2.406	2.408		2.405	2.408	2.407			
		2.408					2.405	2.407	3.608		2.406	30608	2.408			
		3.807					2.406	2.408	3.807		20407	3.807	3.608			
							2.407				2.408	3.808	3.807			
							2e408				3.608		3.808			
							3.608				3.807					
							30807									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES HILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.708		1.709		1.708	1.709	1.709	1.709		1.709
	1.711	1.708					1.709									
		1.709									1.709					

TABLE SET ■
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING *SET* N

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM TYPE CONVERSION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	**3.601**	**3.804**
	1.713	1.802	**1.902**	2.202	2.302	**3.607**	**3.805**
	1.717	1.803	1.904		**2.303**		**3.806**
	1.718		1.905		2.306		3.809
	1.729		1.906		**2.307**		3.812
	1.730						**3.813**
							3.814
							3.815
							3.816

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	**2.204**
1.102	1.702	
1.103		
1.104		
1.105		
1.106		
1.107		
1.108		
1.109		
1.110		
1.111		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	**1.506**	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	**1.515**	**1.514**	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	**1.521**	1.521	1.521	1.521	1.521	1.521	**1.521**	1.521	**1.521**	1.521		1.527	1.527	**1.527**	
	1.527			1.525	1.524	1.524	1.524	1.524	1.527	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527		1.527	1.527	**1.527**	**1.527**					

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
3.602	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724		1.724	1.724	1.723	1.724	1.725	1.723
3.605	1.724	1.721	1.721	3.605	1.725	1.731	1.724	1.725	1.725		1.725	1.725	1.724	1.725	3.603	1.724
	t.725	1.723			1.731		1.725	1.731	1.731		1.727	1.731	1.725	1.731	3.605	1.731
	1.728	1.724			2.206		1.731	1.732	1.732		1.731	1.732	1.731	3.605		3.605
	1 .732	1.725			3.603		1.732	1.733	1.733		1.732	1.733	1.732	3.807		3.807
	1 .735	1.731			3.605		1.733	1.738	3.807		1.733	1.738	1.733			
	1.738	1.738					1.736	3.603			1.734	3.603	1.734			
	2.206	3.603					1.738	3.605			1.738	3.605	3.603			
	3.632	3.605					3.807				3.603	3.807	3.605			
	3.605	3.807									3.807	3.808	3.807			
													3.808			

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES HILL BE BURNEO

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.708	1.710	1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.759		1.710		1.708	le710	1.710	1.710		1.710
		1.709					1.710				1o709					
											1.710					

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET 0

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FRON
NATURAL RESIDUE TREATHENT

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	2.306	3.601	3.810
	2.308	3.606	
	2.309		

TABLE 2. GJIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.103		
1.104		
1.105		
1.107		
1.109		
1.110		
1.111		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507	1.526	1.516	1.515	1.514	1.526
	1.517	1.520	1.520	1.508	1.503	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.513	1.513	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET a CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
3.602	3.602	2.406 3.603			3.603		2.310 2.405 2.406	2.405 2.406 3.603	2.310 2.405 2.406	2.310	2.310 2.405 2.406 3.603	2.310 2.405 2.406 3.603	2.310 2.405 2.406 3.603	2.310 2.406	3.603	2.310 2.405 2.406

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESXOUES HILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704 1.706	1.707 1.708 1.709 1.711	1.703 1.704 1.707 1.708 1.709	1.703 1.704	1.705 1.709	1.705 1.708 1.709	1.703 1.707	1.703 1.707 1.708 1.709	1.707 1.709	1.707 1.708 1.709		1.703 1.706 1.707 1.708 1.709	1.707 1.708 1.709	1.707 1.708 1.709	1.707 1.708 1.709	1.705 1.709	1.707 1.708 1.709

TABLE SET I
GUIDELINES APPLYING TO PUBLIC LANOS
SORTING SET P

GUIDELINES FOX TREATMENT OF RESIDUES RESULTING FROM DYING AND DAHAGEO VEGETATION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	2.306	3.601

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.101	1.701	2.204
1.102	1.702	
1.103		
1.104		
1.105		
1.105		
1.107		
1.109		
1.110		
1.111		
1.113		

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507	1.526	1.516	1.515	1.514	1.526
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING SET P CONTINUE0

TABLE 4. GUIDELINES AFPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NJMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.401	2.401	2.401	2.401	2.401	20451	2.401	2.401	2.401	20401		2.401	2.401	2.402		2.401	2.401
2.411	2.411	2.409	2.411	2.409	2.402	2.402	2.402	2.402	2.402		2.402	2.404	2.404		2.411	2.402
3.602	3.602	2.410		2.410	2.404	2.409	2.409	2.404	2.409		2.409	2.409	2.409		30603	2.409
		2.411		2.411	2.409	2.410	2.410	2.409	2.410		2.410	2.410	2.410			2.410
		3.603			2.410	2.411	2.411	2.410	2.411		2.411	2.411	3.603			2.411
					2.411			2.411			3.603	3.603				
					3.603			3.603								

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL BE BURNED

PROVINCE NJMBER																
01	02	03	04	05	06	07	0a	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	10707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.737	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.738		1.709		1.707	1.709	10709	1.709		1.709
	1.711	1.708					1.739				1.708					
		1.709									1.709					

TABLE SET ■
GUIDELINES APPLYING TO PUBLIC LANDS
SORTING SET Q

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
RANGELAND TYPE CONVERSION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.502	1.712	1.801	1.901	2.201	2.301	3.804
	1.713	1.802	1.902		2.302	3.806
	1.717	1.803	1.904		2.306	3.813
	1.718		1.905		2.307	3.814
			1.906		2.309	3.815

TABLE 2. GUIDELINES APPLICABLE I F RESIDUES HILL BE BURNEO

1.101	1.701
1.102	1.702
1.103	
1.104	
1.105	
1.106	
1.107	
1.108	
1.109	
1.110	
1.111	
1.113	

TABLE 3. GUIDELINES APPLYING IN CLASSIFIED VISUAL MANAGEMENT ZONES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.501	1.511	1.517	1.517	1.506	1.506	1.507	1.510	1.510	1.504	1.504	1.505	1.506	1.507		1.516	1.515	1.514	
	1.517	1.520	1.520	1.508	1.509	1.510	1.511	1.512	1.508	1.508	1.509	1.509	1.509		1.520	1.519	1.518	
	1.520	1.521	1.521	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517	1.517		1.521	1.521	1.521	
	1.521	1.525	1.525	1.519	1.519	1.519	1.519	1.519	1.518	1.518	1.518	1.518	1.518		1.525	1.524	1.523	
	1.525	1.527	1.527	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.521		1.527	1.527	1.527	
	1.527			1.525	1.524	1.524	1.524	1.524	1.522	1.523	1.523	1.523	1.523					
				1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527	1.527					

SORTING *SET* Q CONTINUE0

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.722	1.716	1.715	1.714	1.719	1.720	1.719	1.719	1.720	1.723	3.807	1.723	1.723	1.715	1.723	1.719	1.719
	1.723	1.719	1.719	1.725	1.724	1.723	1.723	1.723	1.724		1.724	1.724	1.723	1.724	1.725	1.723
	1.724	1.721	1.721		1.725		1.724	1.725	1.725		1.725	1.725	1.724	1.725		1.724
	1.725	1.723					1.725	1.738	3.807		1.727	1.738	1.725	3.807		3.807
	1.728	1.724					1.738				1.738	3.807	3.807			
	1.738	1.725					3.8 07				3.807					
		1 e738														
		3.807														

TABLE 5. GUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.704	1.707	1.703	1.703	1.705	1.705	1.703	1.703	1.707	1.707		1.703	1.707	1.707	1.707	1.705	1.707
1.706	1.708	1.704	1.704	1.709	1.708	1.707	1.707	1.709	1.708		1.706	1.708	1.708	1.708	1.709	1.708
	1.709	1.707			1.709		1.738	1.710	1.709		1.707	1.709	1.709	1.709		1.709
	1.711	1.708					1.739		1.710		1.708	1.710	1.710	1.710		1.710
		1.709					1.710				1.709					
											1.710					

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 01
OLYMPIG

SUBPROVINCE NO.

	01	02	03	04	05
SPECIES ASSOCIATION 1	2.401 2.403 2.411	1.706 1.722 2.401 2.403 2.411 3.602 3.604 3.605	1.706 1.722 2.401 2.403 2.411 3.602 3.604 3.605	1.722 2.401 2.403 2.411 3.602 3.604 3.605	2.401 2.403 2.411
SPECIES ASSOCIATION 2	2.401 2.403 2.411 3.602 3.604 3.605	1.704 1.722 2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411	1.704 1.722 2.401 2.403 2.411 3.602 3.604 3.605

TABLE SET IA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 02
COAST RANGES

SUBPROVINCE NO.

	01	92	03	04	05	06	07
SPECIES ASSOCIATION 1	1.709 1.725 1.732 2.401 2.411 3.602 3.604 3.605	2.401 2.411 3.602 3.604 3.605	1.709 1.725 1.732 2.206 2.401 2.411 3.602 3.604 3.605	2.206 2.401 2.411 3.602 3.604 3.605	1.708 1.724 2.401 2.411 3.602 3.604 3.605	1.707 1.708 1.723 1.724 2.401 2.411 3.602 3.604 3.605	1.711 1.716 1.728 I. 735 1.738 2.401 2.411 3.602 3.604 3.605

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 03
SISKIYOU

SUBPROVINCE NO.

	01	02	03	04	05	06
SPECIES ASSOCIATION 2	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.807	1.707 1.723 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.603 3.604 3.605 3.857	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.807	1.703 1.707 1.708 1.709 1.719 1.723 1.724 1.725 1.731 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.604 3.605 3.807	1.703 1.709 1.719 1.725 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.604 3.605 3.807	1.703 1.719 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.604 3.605 3.807
SPECIES ASSOCIATION 4	1.703 1.704 1.709 1.715 1.719 1.721 1.725 1.738 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.603 3.604 3.605 3.807	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.8G7	1.704 1.721 1.731 1.738 2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.605 3.807	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.807	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.807	2.401 2.403 2.407 2.408 2.409 2.410 2.411 3.807

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 04
PUGET SOUND BASIN

SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 1	2.401 2.411	1.703 1.704 1.714 1.719 1.721 2.401 2.411	1.719 2.401 2.411	2.401. 2.411

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 05
WILLAMETTE BASIN

SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 3	2.401 2.408 2.409 2.410 2.411 3.604 3.605	2.401 2.408 2.409 2.410 2.411 3.604 3.605	1.705 1.709 1.719 1.725 2.401 2.408 2.409 2.410 2.411 3.604 3.605	1.705 1.709 1.719 1.725 2.401 2.408 2.409 2.410 2.411 3.604 3.605

TABLE SET I A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE *TO* PUBLIC LAND

PROVINCE NO. 06
WESTERN CASCAOES

SUBPROVINCE NO.

	01	02	03	04	55	06	07
SPECIES ASSOCIATION 1	1.708 1.724 2.401 2.403 2.411 3.604 3.605	1.703 1.724 2.401 2.403 2.411 3.604 3.605	1.705 1.720 2.401 2.403 2.411 3.604 3.605	1.708 1.724 2.401 2.403 2.411 3.604 3.605	1.708 1.724 2.401 2.403 2.411 3.604 3.605	1.705 1.708 1.720 1.724 2.401 2.403 2.411 3.604 3.605	2.401 2.403 2.411 3.604 3.605
SPECIES ASSOCIATION 2	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411	1.708 1.709 1.724 1.725 2.206 2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411 3.603 3.604 3.605	1.708 1.724 2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411 3.604 3.605	1.708 1.724 2.206 2.401 2.413 2.406 2.407 2.408 2.410 2.411 3.606 3.605	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411
SPECIES ASSOCIATION 3	2.401 2.403 2.408 2.409 2.410 2.411	2.401 2.403 2.408 2.409 2.410 2.411	1.731 2.401 2.403 2.408 2.409 2.410 2.411	2.401 2.403 2.408 2.409 2.410 2.411	2.401 2.403 2.408 2.409 2.410 2.411	2.401 2.403 2.408 2.409 2.410 2.411	2.401 2.403 2.408 2.409 2.410 2.411
SPECIES ASSOCIATION 5	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411 3.604 3.605	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE: NO. 07
NORTHWESTERN CASCADES

SUBPROVINCE NO.

	01	02	03	04	05	06	07
SPECIES ASSOCIATIOH 1	1.703 1.719 1.723 1.731 2.401 2.403 2.411	2.401 2.403 2.411	1.703 1.719 1.723 1.731 2.451 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411
SPECIES ASSOCIATION 5	2.401 2.402 2.403 2.408 2.409 2.410 2.411	1.707 1.723 1.731 2.401 2.402 2.403 2.408 2.409 2.410 2.411 3.604	2.401 2.402 2.403 2.408 2.409 2.410 2.411	1.707 1.723 1.731 2.401 2.402 2.403 2.408 2.409 2.410 2.411 3.604	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.192 2.403 2.408 2.409 2.410 2.411

TABLE *SET* I A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE TO PUBLIC LANO

PROVINCE NO. 08
NORTHEASTERN CASCADES

SUBPROVINCE NO.

	01	02	03	04	05	06	07	08
SPECIES ASSOCIATION 5	2.401 2.402 2.403 2.408 2.409 2.410 2.411	1.7 07 1.7 09 1.710 1.723 1.725 1.726 1.731 1.732 1.733 1.736 2.401 2.402 2.403 2.408 2.409 2.410 2.411 3.604	2.401 2.402 2.403 2.408 2.409 2.410 2.411	1.707 1.709 1.710 1.723 1.725 1.726 1.731 1.732 1.733 1.736 2.401 2.402 2.403 2.408 2.409 2.410 2.411 3.604	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411	2.401 2.402 2.403 2.408 2.409 2.410 2.411
SPECIES ASSOCIATION 6	2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2.409 2.410 2.411 3.608 3.807	2.310 2.401 2.602 2.403 2.405 2.406 2.407 2.408 2.409 2.410 2.411 3.608 3.807	1.707 1.708 1.709 1.710 1.723 1.724 1.725 1.726 1.731 1.732 1.733 1.738 2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2 409 2.410 2.411 3.608 3.807	2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2.409 2.410 2.411 3.608 3.807	2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2.4U9 2.410 2.411 3.608 3.807	2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2.403 2.410 2.411 3.608 3.807	2.310 2.401 2.402 2.403 2.405 2.406 2.407 2.408 2.409 2.410 2.411 3.608 3.807	2.310 2 401 2.402 2.403 2.405 2.406 2.407 2.408 2.409 2.410 2.411 3.608 3.807

(CONTINUED)

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LANO

PROVINCE NO. 09
RECENT (HIGH) CASCAOES

SUBPROVINCE NO.

	01	02	03	04	05
SPESIES ASSOCIATION 1	2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411	2.401 2.403 2.411
SPECIES ASSOCIATION 2	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411	2.401 2.403 2.404 2.407 2.408 2.409 2.418 2.411	1.707 1.709 1.723 1.725 1.731 1.732 2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411 3.604 3.605	2.401 2.403 2.404 2.407 2.408 2.409 2.410 2.411
SPECIES ASSOCIATION 3	2.401 2.408 2.409 2.410 2 411 3.604 3.605	1.707 1.709 1.710 1.723 1.725 1.726 1.731 1.732 1.733 2.401 2.402 2.408 2.409 2 410 2.411 3.604 3.605	1.707 1.709 1.710 1.723 1.725 1.726 1.731 1.732 1.733 2.401 2.402 2.408 2.409 2.410 2.411 3.604 3.605	1.707 1.709 1.710 1.723 1.725 1.726 1.731 1.732 1.733 2.401 2.402 2.404 2.408 2.409 2.410 2.411 3.604 3.605	1.707 1.709 1.710 1.723 1.725 1.726 1.731 1.732 1.733 2.401 2.402 2.408 2.409 2.410 2 411 3.604 3.605

(CONTINUED)

SPECIES ASSOCIATION 7								
	2.310	2.310	2.310	2.310	1.709	1.707	1.703	2.310
	2.401	2.401	2.401	2.401	1.710	1.708	1.709	2.401
	2.402	2.402	2.402	2 402	1.725	1.709	1.719	2.402
	2.403	2.403	2.403	2.403	1.726	1.723	1.732	2.403
	2.405	2.405	2.405	2.405	1.732	1.724	2.310	2.405
	2.406	2.406	2.406	2.406	I. 733	1.725	2.401	2.406
	2.407	2.407	2.407	2.407	2.310	1.731	2.402	2.407
	2.408	2.408	2 408	2.408	2.401	1.732	2.403	2.408
	2.409	2.409	2.409	2.409	2.402	1.737	2.405	2.409
	2.410	2.410	2.410	2.410	2.403	1.738	2.406	2.410
	2.411	2.411	2.411	2.411	2.405	2.310	2.407	2.411
	3.608	3.608	3.608	3.608	2.406	2.401	2.408	3.608
	3.807	3.807	3.807	3.807	2.407	2.402	2.409	3.807
					2.408	2.403	2.410	
					2.409	2.405	2.411	
					2.416	2.406	3.608	
					2.411	2.407	3.807	
					3.608	2.408		
					3.807	2.409		
						2.410		
						2.411		
						3.608		
						3.807		

SPECIES ASSOCIATION 8								
	2.310	2.310	2.310	2.310	2.310	1.709	2.310	2.310
	2.401	2.401	2.401	2.401	2.401	1.724	2.401	2.401
	2.402	24 02	2.402	2.402	2.402	1.725	2.402	2.402
	2.403	2.403	2.403	2.403	2.403	2.310	2.403	2.403
	2.405	2.405	2.405	2. 405	2.405	2.401	2. 405	2.405
	2.406	2.406	2.406	2.406	2.406	2.402	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.403	2.407	2.407
	2.408	2.408	2.408	2.408	2,408	2.405	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.406	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.407	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.408	2.411	2.411
	3,608	3.608	3.608	3.608	3.608	2.409	3.608	3.608
	3.807	38 07	3.807	3.807	3.807	2.410	3.807	3.807
						2.411		
						3.608		
						3.807		

SPECIES ASSOCIATION 9								
	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310
	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	3.807	3.807	3.807	3.807	3.807	3.807	3.807	3.807

SPECIES ASSOCIATION b					
	2.401	1.707	2.401	2.401	1.707
	2.402	1.709	2.402	2.402	1.709
	2.405	1.710	2.405	2.405	1.710
	2.406	1.723	2.406	2.406	1.723
	2.407	1.725	2.407	2.407	1.725
	2.408	1.726	2.408	2.408	1.726
	2.403	1.731	2.609	2.409	1.731
	2.410	1.732	2.410	2.410	1.732
	2.411	1.733	2.411	2.411	1.733
	3.603	2.401	3.603	3.603	2.401
		2.402			2.402
		2.404			2.404
		2.405			2.405
		2.406			2.406
		2.407			
		2.408			2.408
		2.409			2.409
		2.410			2.410
		2.411			2.411
		3.603			3.603

SPECIES ASSOCIATION 7					
	2.401	1.707	2.401	2.401	2.401
	2.402	1.709	2.402	2.402	2.402
	2.405	1.710	2.405	2.405	2.405
	2.406	1.723	2.406	2.406	2.406
	2.407	1.725	2.407	2.407	
	2.408	1.726	2.408	2.408	2.408
	2.409	1.731	2.409	2.409	2.409
	2.410	1.732	2.410	2.410	2.410
	2.411	1.733	2.411	2.411	2.411
	3.603	2.401	3.603	3.603	3.603
	3.604	2.402	3.604	3.604	3.604
		2.405			
		2.406			
		2.407			
		2.408			
		2.409			
		2.410			
		2.411			
		3.603			
		3.604			

SPECIES ASSOCIATION 8					
	2.401	1.710	2.401	1.710	2.401
	2.402	1.720	2.402	1.720	2.402
	2.405	1.726	2.405	1.726	2.405
	2.406	1.733	2.406	1.733	2.406
	2.407	1.738	2.407	1.738	2.407
	2.408	2.401	2.408	2.401	2.408
	2.409	2.402	2.409	2.402	2.409
	2.410	2.405	2.410	2.405	2.410
	2.411	2.406	2.411	2.406	2.411
	3.603	2.407	3.603	2.407	3.603
		2.408		2.408	
		2.409		2.409	
		2.410		2.410	
		2.411		2.411	
		3.603		3.603	

TABLE SET IA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 10
OKANOGAN HIGHLANDS

SUBPROVINCE NO.

	01	02	03	04	05	06	07
SPECIES ASSOCIATION 5	2.401	2.401	2.401	2.401	2.401	2.401	1.707
	2.402	2.402	2.402	2.402	2.402	2.402	1.709
	2.408	2.408	2.408	2.408	2.408	2.408	1.723
	2.409	2.409	2.409	2.409	2.409	2.409	1.725
	2.410	2.410	2.410	2.410	2.410	2.410	1.731
	2.411	2.411	2.411	2.411	2.411	2.411	1.732
					3.604		2.401
							2.402
							2.408
							2.409
							2.410
							2.411
SPECIES ASSOCIATION 6	2.310	2.310	2.310	2.310	2.310	2.310	2.310
	2.401	2.401	2.401	2.401	2.401	2.401	2.401
	2.405	2.405	2.405	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807	3.807	3.807	3.807

(CONTINUED)

PROVINCE NO. 10
(CONTINUED)

SPECIES	1.707	1.707	1.707	1.707	2.310	2.310	2.310
ASSOCIATION	1.708	1.708	1.708	1.708	2.401	2.401	2.401
7	1.709	1.709	1.709	1.709	2.402	2.402	20402
	1.710	1.710	1.710	1.710	2.405	2.405	2.405
	1.723	1.723	1.723	1.723	2.406	2.406	20406
	1.724	1.724	1.724	1.724	2.407	2.407	2.407
	1.725	1.725	1.725	1.725	2.408	2.408	2.408
	1.726	1.726	1.726	1.726	2.409	2.409	2.409
	1.731	1.731	1.731	1.731	2.410	2.410	2.410
	1.732	1.732	1.732	1.732	2.411	2.411	2.411
	1.733	1.733	1.733	1.733	3.807	3.608	3.807
	2.310	2.310	2.310	2.310		3.807	
	2.401	2.401	2.401	2.401			
	2.402	2.402	2.402	2.402			
	2.405	2.405	2.405	2.405			
	2.406	2.406	2.406	2.406			
	2.407	2.407	2.407	2.407			
	2.408	2.408	2.408	2.408			
	2.409	2.409	2.409	2.409			
	2.410	2.410	2.410	2.410			
	2.411	2.411	2.411	2.411			
	3.608	3.608	3.608	3.608			
	3.807	3.807	3.807	3.807			

SPECIES	2.310	2.310	2.310	2.310	2.310	2.310	2.310
ASSOCIATION	2.401	2.401	2.401	2.401	2.401	2.401	2.401
8	2.405	2.405	2.405	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807	3.807	3.807	3.807

SPECIES	2.310	2.310	2.310	2.310	2.310	2.310	2.310
ASSOCIATION	2.406	2.406	2.406	2.406	2.406	2.406	20406
9	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	20408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	3.807	3.807	3.807	3.807	3.807	3.807	3.807

TABLE SET I A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 11
COLUHSIA BASIN

SUBPROVINCE NO.

ANY

ANY	2.310
SPECIES	3.807

TABLE SET IA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 12
BLUE MOUNTAINS

SUBPROVINCE NO.

	01	02	03	04	05	06	07	08	09	10	11
SPECIES ASSOCIATION 5	2.401	2.401	2.401	1.707	1.703	2.401	2.401	2.401	2.401	2.401	2.401
	2.402	2.402	2.402	1.708	1.707	2.402	2.402	2.402	2.402	2.402	2.402
	2.408	2.408	2.408	1.709	1.708	2.408	2.408	*2.408*	2.408	2.408	2.408
	2.409	2.409	2.409	1.710	1.709	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	1.723	1.710	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	1.724	1.723	2.411	2.411	2.411	2.411	2.411	2.411
		3.604		1.725	1.724						
				1.726	1.725						
				1.731	1.726						
				1.732	1.731						
				1.733	1.732						
				1.734	1.733						
				2.401	1.734						
				2.402	2.401						
				2.408	2.402						
				2.409	2.408						
				2.410	2.409						
				2.411	2.410						
				3.604	2.411						
SPECIES ASSOCIATION 6	2.310	2.310	2.310	1.703	2.310	1.703	2.310	2.310	2.310	2.310	2.310
	2.401	2.401	2.401	1.707	2.401	1.707	2.401	2.401	2.401	2.401	2.401
	2.405	2.405	2.405	1.709	2.405	1.709	2.405	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	1.723	2.406	1.723	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	1.725	2.407	1.731	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	1.731	2.408	1.732	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	1.732	2.409	2.310	2.409	2.409	2.409	2.409	2.409
	2.410	2.410'	2.410	2.310	2.410	2.401	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.401	2.411	2.405	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	2.405	3.807	2.406	3.807	3.837	3.807	3.807	3.807
				2.406		2.407					
				2.407		2.408					
				2.408		2.409					
				2.409		2.410					
				2.410		2.411					
				2.411		3.807					
				3.807							

(CONTINUED)

PROVINCE NO. 12
(CONTINUED)

SPECIES	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310
ASSOCIATION	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401
7	2.402	2.402	2.402	2.402	2.402	2.402	2.402	2.402	2.402	2.402	2.402
	2.405	2.405	2.405	2.405	2.405	2.405	2.405	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.457	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411
	3.608	3.608	3.608	3.807	3.807	3.608	3.807	3.807	3.807	3.807	3.807
	3.807	3.807	3.807			3.807					
SPECIES	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310	2.310
ASSOCIATION	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401	2.401
8	2.405	2.405	2.405	2.405	2.405	2.405	2.405	2.455	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807	3.807	3.807	3.807	3.807	3.807	3.807	3.807
SPECIES	2.310	2.310	2.310	2.310	2.310	2.310	2.310	1.706	2.310	2.310	1.706
ASSOCIATION	2.406	2.406	2.406	2.406	2.406	2.406	2.406	1.727	2.406	2.406	1.727
9	2.407	2.407	2.407	2.407	2.407	2.407	2.407	1.731	2.407	2.407	1.731
	2.408	2.408	2.408	2.408	2.408	2.408	2.408	1.732	2.408	2.408	1.732
	2.409	2.409	2.409	2.409	2.409	2.409	2.409	1.738	2.409	2.409	2.310
	2.410	2.410	2.410	2.410	2.410	2.410	2.410	2.310	2.410	2.410	2.406
	3.608	3.608	3.608	3.807	3.807	3.608	3.807	2.406	3.807	3.807	2.407
	3.807	3.807	3.807			3.807		2.407			2.408
								2.408			2.409
								2.409			2.410
								2.410			3.807
								3.807			

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE 10 PUBLIC LAND

PROVINCE NO. 13
HARNEY BASIN

SUBPROVINCE NO.

	01	02	03	04	95	06
SPECIES ASSOCIATION b	2.310	2.310	2.310	2.310	2.310	1.707
	2.401	2.401	2.401	2.401	2.401	1.708
	2.405	2.405	*2.435*	2.405	2.405	1.709
	2.406	2.406	2.406	2.406	2.406	1.710
	2.407	2.407	2.407	2.407	2.407	1.723
	2.408	2.408	2.408	2.408	2.408	1.724
	2.409	2.409	2.409	2.409	2.409	1.725
	2.410	2.410	2.410	2.410	2.410	1.726
	2.411	2.411	2.411	2.411	2.411	1.731
	3.603	3.603	3.603	3.603	3.603	1.732
	3.605	3.605	3.605	3.605	3.605	1.733
	3.807	3.807	3.608	3.807	3.807	1.738
			3.807			2.310
						2.401
						2.404
						2.405
						2.406
						2.407
						2.408
						2.403
						2.410
						2.411
						3.603
						3.605
						3.608
						3.808
SPECIES ASSOCIATION 7	2.310	2.310	2.313	2.310	2.310	2.310
	2.401	2.401	2.401	2.401	2.401	2.401
	2.405	2.405	*2.405*	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807	3.807	3.807

(CONTINUED)

TABLE SET I A
FOR VERIFYING STATEMENT NUHBERS
APPLICABLE 10 PUBLIC LAND

PROVINCE NO. 14
UPPER BASIN AND RANGE

SUBPROVINCE NO.

	01	02	03	04	35	06	07
SPECIES ASSOCIATION b	1.707	2.310	2.310	2.310	2.310	1.717	1.707
	1.708	2.402	2.402	2.402	2.402	1.708	1.708
	1.709	2.404	2.404	2.404	2.404	1.709	1.709
	1.710	*2.405*	2.405	2.405	2.405	1.710	1.710
	1.715	2.406	2.406	*2.406*	2.406	1.715	1.715
	1.723	2.407	2.407	2.407	2.407	1e723	1.723
	1.724	2.408	2.408	2.408	2.408	1.724	1.724
	1.725	2.409	2.409	2.409	2.409	1.725	1.725
	1.726	2.410	2.410	2.410	2.410	1.726	1.726
	1.731	3.608	3.608	3.608	3.608	1.731	1.731
	1.732	3.807	3.807	3.807	3.807	1.732	1.732
	1.733					1.733	1.733
	1.734					1.734	1.734
	2.310					2.310	2.310
	2.402					2.402	2.602
	2.404					2.404	2.404
	2e405					2.405	2.405
	2.406					2.406	2.406
	2.407					2.407	2.407
	2.408					2.408	2.408
	2.409					2.409	2.409
	2.410					2.410	2.410
	3.608					3.608	3.608
	3.807					3.807	3.808

(CONTINUED)

PROVINCE NO. 13 (CONTINUED)

SPECIES ASSOCIATION a						
	23 10	2.310	2.310	2.310	2.310	2.310
	2a401	2.401	2.401	2.401	2.401	2.401
	2.405	2.405	2.405	2.405	2.405	2.435
	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409
	2.4 10	2.410	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807	3.807	3.807

SPECIES ASSOCIATION 9						
	2.310	2.310	1.707	2.310	2.313	2.310
	2.406	2.406	1.708	2.406	2.406	2.406
	2.407	2 407	1.718	2.407	2.407	2.407
	2.408	2.408	1.723	2.408	2.408	2.408
	2.409	2.409	1.724	2.409	2.409	2.409
	2.410	2. 410	1.726	2.410	2.410	2.410
	3.604	3.604	1.731	3.604	3.604	3.604
	3.605	3.605	1.732	3.605	3.605	3.605
	3.807	3.807	1.733	3.807	3.807	3.608
			1.738			3.807
			2.310			
			2.406			
			2.407			
			2.408			
			2.409			
			2.410			
			3.604			
			3.605			
			3.608			
			3.807			

PROVINCE NO. 14 (CONTINUED)

SPECIES ASSOCIATION 7							
	2.310	2.310	2.310	1.708	2.310	2,310	1.715
	2.402	2.402	2.402	1.709	2.402	2.402	2.310
	2.404	2.404	2.404	1.710	2.404	2.404	2.402
	2.405	2.405	2.405	1.724	2.405	2.405	2.404
	2.406	2.406	2.406	1.725	2.406	2.406	2.405
	2.407	2.407	2.407	1.726	2.407	2.407	2.406
	2.408	2.408	2.408	1.732	2.408	2.408	2.407
	2.409	2.409	2.409	1.733	2.409	2.409	2.408
	2.410	2.410	2.410	1.734	2.410	2.410	2.409
	3.603	3.603	3.603	2.310	3.603	3.603	2.410
	3 a604	3.604	3.604	2.402	3.604	3.604	3.603
	3.605	3.605	3.605	2.404	3.605	3.605	3.604
	3.608	3.608	3.608	2.405	3.608	3.608	3.605
	3.807	3.807	3.807	2.406	3.807	3.807	3.608
				2.407			3.807
				2.408			
				2.409			
				2.410			
				3.603			
				3.604			
				3.605			
				3.608			
				3.807			

SPECIES ASSOCIATION 8							
	2.310	2.310	2.310	2.310	2.310	2.310	2.310
	2.405	2.405	2.405	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2,410
	3.807	3.807	3.807	3.807	3.807	3.807	3.807

SPECIES ASSOCIATIOY 9							
	2.310	2.310	2.310	2.310	2.310	2.310	2.310
	2.405	2.406	2.406	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407	2.407	2.408	2.407
	2.408	2.408	2.408	2.408	2.408		2.408
	2.409	2.409	2.409	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410	2.410	2.410	2.410
	3.807	3.807	3.807	3.807	3.807	3.807	3 807

TABLE SET I A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 15
BASIN AND RANGE

SUBPROVINCE NO.

	05
SPECIES ASSOCIATION 9	1.707
	1.708
	1.709
	1.710
	1.723
	1.724
	1.725
	1.726
	1.731
	2.310
	2.406
	3.603
	3.604
	3.605
	3.807

TABLE SET I A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PUBLIC LAND

PROVINCE NO. 16
COWLITZ RIVER BASIN

SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 1	2.401	2.401	1.705	1.705
	2.411	2.411	1.709	1.709
	3.604	3.604	1.719	1.719
	3.605	3.605	1.725	1.725
			2.401	2.401
			2.411	2.411
			3.604	3.604
			3.605	3.605

TABLE SET IA
FOR VERIFYING STATEHENT NUMBERS
APPL■CABLE TO PUBLIC LAND

PROVINCE NO. 17
WALLOWAS

	SUBPROVINCE NO.			
	01	02	03	04
SPECIES ASSOCIATION 5	1.707	2.401	2.401	2.401
	1.708	2.402	2.402	2.402
	1.709	2.408	2.408	2.408
	1.723	2.409	2.409	2.409
	1.724	2.410	2.410	2.410
	1.726	2.411	2.411	2.411
	1.731	3.603	3.603	3.603
	2.401	3.604	3.604	3.604
	2.402	3.605	3.605	3.605
	2.408			
	2.409			
	2.410			
	2.411			
	3.603			
	3.604			
	3.605			
SPECIES ASSOCIATION 6	2.310	2.310	2.310	1.713
	2.401	2.401	2.401	2.310
	2.405	2.405	2.405	2.401
	2.406	2.406	2.406	2.405
	2.407	2.407	2.407	2.406
	2.408	2.408	2.408	2.407
	2.409	2.409	2.409	2.408
	2.410	2.410	2.410	2.409
	2.411	2.411	2.411	2.410
	3.807	3.807	3.807	2.411
				3.807

	SUBPROVINCE NO.			
	01	02	03	04
SPECIES ASSOCIATION 7	2.310	1.708	1.708	1.708
	2.401	1.709	1.709	1.709
	2.402	1.710	1.710	1.710
	2.405	1.724	1.724	1.724
	2.406	1.726	1.726	1.726
	2.407	2.310	2.310	1.731
	2.408	2.401	2.401	2.310
	2.409	2.402	2.402	2.401
	2.410	2.405	2.405	2.402
	2.411	2.406	2.406	2.405
	3.603	2.407	2.407	2.406
	3.604	2.408	2.408	2.407
	3.605	2.409	2.409	2.408
	3.807	2.410	2.410	2.409
		2.411	2.411	2.410
		3.603	3.603	2.411
		3.60 4	3.604	3.603
		3.605	3.605	3.604
		3.807	3.807	3.605
				3.807
SPECIES ASSOCIATION 8	2.310	2.310	2.310	2.310
	2.401	2.401	2.401	2.401
	2.405	2.405	2.405	2.405
	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410
	2.411	2.411	2.411	2.411
	3.807	3.807	3.807	3.807
SPECIES ASSOCIATION 9	2.310	2.310	2.310	2.310
	2.406	2.406	2.406	2.406
	2.407	2.407	2.407	2.407
	2.408	2.408	2.408	2.408
	2.409	2.409	2.409	2.409
	2.410	2.410	2.410	2.410
	3.807	3.807	3.807	3.807

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET A

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM ROAD CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.951	2.352	3.651
	1.952	2.353	3.655
	1.953	2.354	3.657
	1.954	2.355	
		2.356	
		2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.851	1.955	2.351
1.152		1.956	
1.153			
1.154			
1.155			
1.156			
1.157			
1.159			
1.160			
1.161			
1.162			
1.163			

TABLE SET II DOES NOT CONTAIN A TABLE 3.

SORTING SET A CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	1.773	1.773	2.451	2.451	1.770	1.773	1.773	1.770	1.773		1.773	1.773	1.773	1.773	2.451	1.773
	2.252	2.451		2.457	2.252	2.451	2.451	1.773	2.451		2.451	2.451	2.452			2.451
	2.451	2.457			2.451	2.452	2.452	2.451	2.452		2.452	2.457	2.457			2.452
					2.452	2.457	2.457	2.452	2.457		2.457					2.457
					2.457			2.457								

SORTING SET A OOES NOT CONTAIN ANY GUIDELINES I N TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET B

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
TRAIL CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.951	2.352
	1.952	2.353
	1.953	2.354
	1.954	2.355
		2.357

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.955	2.351
1.152	1.956	
1.153		
1.154		
1.155		
1.156		
1.157		
1.159		
1.160		
1.161		
1.162		
1.163		

TABLE SET II DOES NOT CONTAIN A TABLE 3.

SORTING SET e CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	1.773	1.773	2.451	2.451	1.770	1.773	1.773	1.770	1.773		1.773	1.773	1.773	1.773	2.451	1.773
	1.778	1.778			2.252	2.451	1.778	1.773	2.451		1.777	1.779	2.452			2.451
	2.252	2.451			2.451	2.452	2.451	1.778	2.452		1.778	2.451				2.452
	2.451				2.452		2.452	2.451			2.451					
								2.452			2.452					

SORTING SET B DOES NOT CONTAIN ANY GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET C

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM CAMPGROUND CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.767	1.952	2.352	3.657
	1.768	1.953	2.353	
		1.954	2.354	
			2.355	
			2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.955	2.351
1.152	1.956	
1.153		
1.154		
1.155		
1.156		
1.157		
1.159		
1.160		
1.161		
1.162		
1.163		

TABLE SET II DOES NOT CONTAIN A TABLE 3.

SORTING SET C CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	10773	1.769	1.769	1.769	1.770	1.769	1.769	1.770	1.773		1.773	1.773	1.773	1.773	1.769	1.769
2.453	1.775	1.771	1.771	1.775	1.775	1.773	1.773	1.773	1.775		1.775	1.775	1.775	1.775	1.775	1.773
	2.252	1.773	2.451	2.451	2.252	2.451	1.775	1.775	2.451		1.777	2.451	2.452	2.456	2.451	2.451
	2.451	1.775		2.457	2.451	2.452	2.451	2.451	2.452		2.451	2.455	2.455			2.452
	2.453	2.451			2.452	2.453	2.452	2.452	2.455		2.452	2.456	2.456			2.455
		2.453			2.453	2.457	2.453	2.453	2.456		2.455	2.457	2.457			2.456
		2.456			2.457		2.455	2.455	2.457		2.456					2.457
		2.457					2.456	2.456			2.457					
							2.457	2.457								

SORTING SET C DOES NOT CONTAIN ANI GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET D

GUIDELINES FOR TREATMENT OF RESIDUES SESULTING FROM STRUCTURE CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

le551	1.952	2.352	3.655
	1.953	2.353	
	[illegible]e954	2.354	
		2.355	
		2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.955	2.351
1.152	1.956	
1.153		
1.154		
1.155		
1.156		
1.157		
1.159		
1.160		
1.161		
1.162		
1.163		

TABLE SET II DOES NOT CONTAIN A TABLE 3.

SORTING SET 0 CONTINUE0

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	2.252	2.451	2.451	2.451	2.252	2.451	2.451	2.451	2.451		2.451	2.451	2.452	2.456	2.451	2.451
	2.451	2.456		2.457	2.451	2.452	2.452	2.452	2.452		2.452	2.455	2.455			2.452
		2.457			2.452	2.457	2.455	2.455	2.455		2.455	2.456	2.456			2.455
					2.457		2.456	2.456	20456		2.456	2.457	2.457			2.456
							2.457	2.457	2.457		2.457					2.457

SOQTING SET 0 DOES NOT CONTAIN ANY GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET E

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROH
SKI RUN CONSTRUCTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHHEST

1.551	1.767	1.952	2.352	3.655
		1.953	2.353	
		1.954	2e354	
			2e355	
			2e357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.955	2.351
1.152	1.956	
1.153		
1.154		
1.155		
1.156		
1.157		
1.159		
1.160		
1.161		
1.162		
1.163		

TABLE SET II OOES NOT CONTAIN A TABLE 3.

SORTING SET E CONTINUE0

TABLE 4. CUIOECENES APPLYING IN SPECIFIC GEOGSAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	1.778	1.769	1.769	1.769	1.770	1.769	1.769	1.770	2.451		1.778	1.778	2.452		1.769	1.769
2.453	2.252	1.778	2.451	2.451	2.252	2.451	1.778	1.778	2.452		2.451	2.451	2.457		2.451	2.451
	2.451	2.451		2.457	2.451	2.452	2.451	2.451	2.457		2.452	2.457				2.452
	2.453	2.453			2.452	2.453	2.452	2.452			2.457					2.457
		2.457			2.453	2.457	2.453	2.453								
					2.457		2.457	2.457								

SORTING SET E OOES NOT CONTAIN ANY GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET F

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
UTILITY RIGHT-OF-WAY

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.352	3.651
	1.764	1.952	2.353	3.654
		1.953	2.354	3.655
		1.954	2.355	3.657
			2.357	3.659

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.851	1.955	2.351
1.152		1.956	
1.153			
1.154			
1.155			
1.156			
1.157			
1.159			
1.160			
1.161			
1.162			
1.163			

TABLE SET II DOES NOT CONTAIN A TARLE 3.

SORTING SET F CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	1.775	1.769	1.765	1.769	1.770	1.769	1.769	1.770	1.775	3.852	1.775	1.775	1.775	1.775	1.769	1.769
3.653	2.252	1.775	1.769	1.775	1.775	2.451	1.775	1.775	2.451		1.777	2.451	2.452	2.456	1.775	2.451
	2.451	2.451	2.451	2.451	2.252	2.452	2.451	2.451	2.452		2.451	2.455	2.455	3.653	2.451	2.452
	3.653	2.456		2.457	2.451	2.457	2.452	2.452	2.455		2.452	2.455	2.456	3.852	3.653	2.455
		2.457		3.653	2.452		2.455	2.455	2.456		2.455	2.457	2.457			2.456
		3.653			2.457		2.456	2.456	2.457		2.456	3.653	3.653			2.457
		3.852			3.653		2.457	2.457	3.852		2.457	3.852	3.852			3.653
							3.852	3.653			3.852	3.853	3.853			3.852

SORTING SET F DOES NOT CONTAIN ANY GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET G

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM INDIVIDUAL TREE SELECTION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.352	3.654
	1.764	1.952	2.353	3.655
	1.767	1.953	2.354	3.659
	1.768	1.954	2.355	
			2.356	
			2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.751	1.851	1.955	2.351
1.152	1.752		1.956	
1.153	1.753			
1.154				
1.156				
1.157				
1.159				
1.160				
1.161				
1.162				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	1.770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
2.451	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
2.453	1.774	1.771	1.771	2.451	1.775	2.451	1.774	1.775	1.775		1.775	1.775	1.774	1.775	3.451	1.774
3.658	1.775	1.773	2.451	2.457	2.252	2.452	1.775	1.778	2.451		1.777	1.778	1.775	2.456		2.451
	1.778	1.774			2.451	2.453	1.778	2.451	2.452		1.779	2.451	2.452	3.852		2.452
	2.252	1.775			2.452	2.457	2.451	2.452	2.455		2.451	2.455	2.455			2.455
	2.451	1.778			2.453	3.658	2.452	2.453	2.456		2.452	2.455	2.456			2.456
	2.453	2.451			2.457		2.453	2.455	2.457		2.455	2.457	2.457			2.457
		2.453			3.658		2.455	2.456	3.658		2.456	3.852	3.852			3.852
		2.456					2.456	2.457	3.852		2.457	3.853	3.953			
		2.457					2.457	3.658			3.658					
		3.852					3.658				3.852					
							3.852									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES HILL BE BURNED

PROVINCE NUMBER															
01	02	u3	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.759	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759		1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760				1.759					
		1.760									1.760					

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING' SET H

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
SHELTERWOOD CUTTING

TABLE 1. GUIDELINES APPLICABLE THQOUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.352	3.651
	1.764	1.952	2.353	3.654
	1.767	1.953	2.354	3.655
	1.768	1.954	2.355	3.659
			2.356	
			2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.751	1.851	1.955	2.351
1.152	1.752		1.956	
1.153	1.753			
1.154				
1.156				
1.157				
1.159				
1.160				
1.161				
1.162				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. GUIDELINES APPLYING IN SPECIFIC 'GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	1.770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
2.451	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
2.453	1.774	1.771	1.771	2.451	1.775	2.451	1.774	1.775	1.775		1.775	1.775	1.774	1.775	2.451	1.774
3.652	1.775	1.773	2.451	2.457	2.252	2.452	1.775	1.778	2.451		1.777	1.779	1.775	2.456	3.652	2.451
3.658	1.778	1.774		3.652	2.451	2.453	1.778	2.451	2.452		1.778	2.451	2.452	3.652		2.452
	2.252	1.775			2.452	2.457	2.451	2.452	2.455		2.451	2.455	2.455	3.852		2.455
	2.G51	1.778			2.453	3.652	2.452	2.453	2.456		2.452	2.456	2.456			2.456
	2 b53	2.451			2.457	3.658	2.453	2.455	2.457		2.455	2.457	2.457			2.457
	3.652	2.453			3.652		2.455	2.456	3.652		2.456	3.652	3.652			3.652
		2.456			3.658		2.456	2.457	3.658		2.457	3.e52	3.852			3.852
		2.657					2.457	3.652	3.852		3.652	3.853	3.853			
		3.652					3.652	3.658			3.658					
		3.852					3.658				3.852					
							3.852									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL BE BUQNEU

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.758	1.758	1.759	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759		1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760		3.656		1.759	3.656	3.656			
		1.760					3.656				1.760					
											3.656					

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET J

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM GROUP SELECTION CUTTING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.251	2.352	3.651
	1.764	1.952		2.353	3.654
	1.767	1.953		2.354	3.655
	1.768	1.954		2.355	3.659
				2.356	
				2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.751	1.851	1.955	2.351
1.152	1.752		1.956	
1.153	1.753			
1.154				
1.156				
1.157				
1.158				
1.160				
1.161				
1.162				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. GUIDELINES APPLYING I N SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	**1.765**	1.769	**1.770**	**1.769**	1.769	1.770	**1.773**	**3.852**	1.773	**1.773**	1.766	**1.773**	1.769	**1.769**
2.451	**1.773**	1.769	1.769	1.775	**1.774**	1.773	1.773	**1.773**	1.774		1.774	1.774	1.773	1.774	1.775	1.773
2.453	**1.774**	**1.771**	**1.771**	2.451	1.775	2.451	**1.774**	[illegible]775	1.775		**1.775**	1.775	1.774	**1.775**	**2.451**	**1.774**
3.652	1.775	**1.773**	2.451	**2.457**	2.252	2.452	1.775	**1.776**	1.776		1.776	1.776	1.775	1.776	3.652	**1.776**
3.658	**1.778**	1.774		3.652	**2.451**	**2.453**	1.776	**1.778**	2.451		1.777	**1.778**	1.776	2.456		**2.451**
	2.252	1.775			**2.452**	3.652	**1.778**	2.451	2.452		1.778	2.451	2.452	3.652		2.452
	2.451	1.778			2.453	3.658	2.451	2.452	2.455		**2.451**	**2.455**	2.455	3.852		2.455
	2 e53	**2.451**			2.457		**2.452**	2.453	2.456		2.452	2.455	2.456			2.456
	3.652	**2.453**			**3.652**		2.453	2.455	2.457		2.455	**2.457**	**2.457**			2 **457**
		2.456			**3.658**		2.455	2.456	3.652		2.456	3.652	3.652			3.652
		2.457					2.456	**2.457**	3.658		2.457	3.852	3.852			3.852
		3.652					2.C57	**3.652**	3.852		3.652	3.853	3.353			
		3.852					3.652	**3.b58**			**3.658**					
							3.658				3.852					
							3.852									

TABLE 5. GUIDELINES APPLYING I N SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL RE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	**1.754**	**1.754**	**1.756**	1.756	**1.754**	**1.754**	**1.758**	**1.758**		1.754	**1.758**	**1.758**	**1.758**	1.756	**1.758**
1.757	**1.759**	1.755	1.755	**1.760**	1.759	1.758	**1.758**	**1.760**	**1.759**		**1.757**	1.759	**1.759**	**1.759**	**1.760**	**1.759**
	1.760	**1.758**			**1.760**		**1.759**	**1.761**	**1.760**		**1.758**	**1.760**	**1.760**	**1.760**		**1.760**
		1.759					**1.760**		1.761		1.759	10761	1.761	**1.761**		**1.761**
		1.760					1.761		3.656		**1.760**	3.656	30656			
							3.656				**1.761**					
											3.656					

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET K

GUIDELINES FOR TREATMENT OF QESIDUES RESULTING FROM CLEARCUTTING

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.251	2.352	3.651
	1.764	1.952		2.353	3.654
	1.767	1.953		2.354	3.655
	1.768	1.954		2.355	3.659
				2.356	
				2.357	

TABLE 2. GUIDELINES APPLICABLE I F RESIOUES WILL BE BURNED

1.151	1.751	1.851	1.955	2.351
1.152	1.752		1.956	
1.153	1.753			
1.154				
1.155				
1.156				
1.157				
1.158				
1.159				
1.160				
1.161				
1.162				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4 GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AQEQS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	10766	1.765	1.769	1.770	1.769	10769	1.770	1.773		1.773	1.773	1.766	10773	10769	1.769
2.451	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	10774	1.773	1.774	1.775	1.773
2.453	1.774	1.771	1.771	20451	1.775	2.451	1.774	10775	10775		10775	1.775	1.774	1.775	20451	1.774
3.653	1.775	1.773	2.451	2.457	20252	2.452	1.775	1.776	1.776		1.776	1.776	1.775	1.776	3.653	1.776
3.658	1.778	1.774		30653	2.451	2.453	1.776	1.778	2.451		1.777	1.778	10776	3.653		2.451
	2.252	1.775			2.452	2.457	1.778	2.451	2.452		1.778	2.451	2.452			2.452
	2.451	1.778			2.453	30658	2.451	20452	2.455		2.451	2.455	2.455			20455
	2.453	20451			2.457		2.452	2.453	2.457		2.452	2.457	2.457			2.457
	3.653	2.453			3.653		2.453	2.455.	3.658		2.455	3.653	3.653			3.653
		2.457			3.658		2.455	2.457			20457	3.853	3.853			
		3.653					2.457	3.653			3.658					
							3.658	3.658								

TABLE 5. GUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIOUES WILL 9E BURNED

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		10754	1.758	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	10750	10760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759	1.761	1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760		1.761		1.759	1.761	1.761	1.761		1.761
		1.760					10761				10760					
											1o761					

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET L

GUIDELINES COR TREATMENT OF RESIDUES RESULTING FROM PRECOMMERCIAL THINNING

TABLE 1. GUIOELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	I.951	2.352	3.654
	1.764	1.952	2 a353	3.655
	1.767	1.953	2.354	3.657
	1.768	1.954	2.355	
			2.357	

TABLE 2. GUIDELINES APPLICABLE I F RESIDUES WILL BE BURNED

l e151	1.751	1.851	la955	2.351
1.152	1.752		1a956	
la153	l a753			
la154				
1.156				
la157				
1.159				
1.160				
1.161				
1.162				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	1.770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
3.658	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
	1.774	1.771	1.771		1.775	3.658	1.774	1.775	1.775		1.775	1.775	1.774	1.775		1.774
	1.775	1.773			2.252		1.775	1.778	2.455		1.777	1.778	1.775	2.456		2.455
	1.778	1.774			3.658		1.778	2.455	2.456		1.778	2.455	2.455	3.852		2.456
	2.252	1.775					2.455	2.456	3.658		2.455	2.456	2.456			3.852
		1.778					2.456	3.658	3.852		2.456	3.852	3.852			
		2.456					3.658				3.658	3.853	3.853			
		3.852					3.852				3.852					

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS HHEN RESIOUES WILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	35	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.758	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759	1.761	1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760		1.761		1.759	1.761	1.761	1.761		1.761
		1.760					1.761		3.656		1.760	3.656	3.656			
							3.656				1.761					
											3.656					

TABLE SET IT
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET M

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
COMMERCIAL THINNING

TABLE 1e GUIDELINES APPLICABLE THSOUGHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.352	3.654
	1e764	1.952	2e353	3e655
	1e767	1.953	2.354	
	1.768	1.954	2.355	
			2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES HILL BE BURNED

1.151	1.751	1.851	1.955	2.351
1.152	1.752		1.956	
1.153	1.753			
1.154				
1.156				
1.157				
1.159				
1.160				
1.161				
1-16?				
1.163				

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. CUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	1.770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
2.451	1.773	1.769	1.769	1.775	I.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
2.453	1.774	1.771	1.771	2.451	1.775	2.451	1.774	1.775	1.775		1.775	1.775	1.774	1.775	2.451	1.774
3.658	1.775	1.773	2.451		2.252	2.452	1.775	1.778	2.451		1.777	1.778	1.775	2.456		2.451
	1.778	1.774			2.451	2.453	1.778	2.451	2.452		1.778	2.451	2.452	3.852		2.452
	2.252	1.775			2.452	3.658	2.451	2.452	2.455		2.451	2.455	2.455			2.455
	2.451	1.778			2.453		2.452	2.453	2.456		2.452	2.456	2.456			2.456
	2.453	2.451			3.658		2.453	2.455	3.658		2.455	3-85?	3.852			3.852
		2.453					2.455	2.456	3.852		2.456	3.853	3.853			
		2.456					2.456	3.658			3.658					
		3.852					3.658				3.852					
							3.852									

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS WHEN RESIDUES WILL BE BURNED

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.759	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759		1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760		3.656		1.759	3.656	3.656			
		1.760					3.656				1.760					
											3.656					

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET N

CUIOELINES FOR TREATMENT OF RESIOUES RESULTING FROM TYPE CONVERSION

TABLE 1. GUIDELINES APPLICABLE TYROUCHOUT THE PACIFIC NORTHWEST

1.551	1.763	1.951	2.352	3.651
	1.764	1.952	2.353	3.654
	1.767	1.953	2.354	3.655
	1.768	1.954	2.355	3.657
			2.357	3.659

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.751	1.851	2.351
1.152	1.752		
1.153	1.753		
1.154			
1.155			
1.156			
1.157			
1.158			
1.159			
1.160			
1.161			
1.162			
1.163			

TABLE SET II DOES NOT CONTAIN A TABLE 3.

TABLE 4. GUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	1.770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
3.653	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
	1.774	1.771	1.771	3.653	1.775		1.774	1.775	1.775		1.775	1.775	1.774	1.775	3.653	1.774
	1.775	1.773			2.252		1.775	1.778	3.852		1.777	1.778	1.775	3.653		3.653
	1.778	1.774			3.653		1.778	3.653			1.778	3.653	3.653	3.852		3.852
	2.252	1.775					3.852				3.852	3.852	3.852			
	3.653	1.778										3.853	3.853			
		3.653														
		3.852														

TABLE 5. GUIOELINES APPLYING IN SPECIFIC GEOGQAPHIC AREAS WHEN RESIDUES HILL 9E BURNED

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.758	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.759
	1.760	1.758			1.760		1.759	1.761	1.760		1.758	1.760	1.760	1.760		1.760
		1.759					1.760		1.761		1.759	1.761	1.761	1.761		1.761
		1.760					1.761				1.760					
											1.761					

TABLE SET II
GUIOELINES APPLYING 10 PRIVATE LAND
SORTING SET 0

GUIDELINES FOR TREATMENT OF QESIDUES RESULTING FROM
NATURAL RESIOUE TREATMENT

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	2.352	3.651
	2.353	
	2.354	
	2.355	
	2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	2.351
1.152	
1.153	
1.154	
1.156	
1.157	
1.159	
1.160	
1.161	
1.162	
1.163	

TABLE SET II OOES NOT CONTAIN 4 TARLE 3.

'SORTING SET 0 CONTINUE0

TABLE 4. GUIOELINES APPLYING IN SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER															
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
		2.456					2.455 2.456	2.455 2.456	2.455 2.456		2.455 2.456	2.454 2.456	2.455 2.456	2.456		2.4656 .

SORTING SET 0 DOES NOT CONTAIN ANY GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRIVATE LAND
SORTING SET P

GUIDELINES FOR TREATMENT OF RESIDUES RESULTING FROM
DYING AND DAMAGED VEGETATION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	2e352	3.651
	2.353	
	2.354	
	2.355	
	2e357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	2.351
1.152	
1.153	
1.154	
1.155	
1.156	
1.157	
1.159	
1.160	
1.161	
1.162	
1.163	

TABLE SET II DOES NOT CONTAIN A TABLE 3.

SORTING SET P CONTINUED

TABLE 4. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AQEAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
2.451	2.451	2.451 2.457	2.451	2.451 2.457	2.451 2.452 2.454 2.457	2.451 2.452 2.457	2.451 2.452 2.457	2.451 2.452 2.454 2.457	2.451 2.452 2.457		2.451 2.452 2.457	2.451 2.454 2.457	2.452 2.454 2.457		2.451	2.451 2.452 2.457

SORTING SET P DOES NOT CONTAIN AN7 GUIDELINES IN TABLE 5.

TABLE SET II
GUIDELINES APPLYING TO PRTVATE LAND
SORTING SET Q

GUIDELINES FOR TREATMENT OF RESIOUES RESULTING FROM
QANGELANO TYPE CONVERSION

TABLE 1. GUIDELINES APPLICABLE THROUGHOUT THE PACIFIC NORTHWEST

1.551	10763	1.951	2.352	3.655
	1.764	1.952	2.353	
	1.767	1.953	2.354	
		1.954	2.355	
			2.357	

TABLE 2. GUIDELINES APPLICABLE IF RESIDUES WILL BE BURNED

1.151	1.751	1.851	2.351
1.152	1.752		
1.153	1.753		
1.154			
1.155			
1.156			
1.157			
1.158			
1.159			
1.160			
1.161			
1.162			
1.163			

TABLE SET II OOES NOT CONTAIN A TABLE 30

TABLE 4. GUIOELINES APPLYING I N SPECIFIC GEOGRAPHIC AREAS

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.772	1.762	1.766	1.765	1.769	1.770	1.769	1.769	10770	1.773	3.852	1.773	1.773	1.766	1.773	1.769	1.769
	1.773	1.769	1.769	1.775	1.774	1.773	1.773	1.773	1.774		1.774	1.774	1.773	1.774	1.775	1.773
	1.774	1.771	10711		1.775		1.774	1.775	1.775		1.775	1.775	1.774	1.775		1.774
	1.775	1.773					1.775	1.778	3.852		1.777	1.778	1.775	3.852		3.852
	10770	1.774					1.778				10770	3.852	3.852			
		1.775					3.852				3.852					
		1.778														
		3.852														

TABLE 5. GUIDELINES APPLYING IN SPECIFIC GEOGRAPHIC AQEAS HHEN RESIDUES WILL BE BURNED

PROVINCE NUMBER																
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
1.755	1.758	1.754	1.754	1.756	1.756	1.754	1.754	1.758	1.758		1.754	1.758	1.758	1.758	1.756	1.758
1.757	1.759	1.755	1.755	1.760	1.759	1.758	1.758	1.760	1.759		1.757	1.759	1.759	1.759	1.760	1.760
	1.760	1.758			10760		1.759	1.761	1.760		1.758	1.760	1.760	1.760		.
		1.759					1.760		1.761		1.759	1.761	1.761	1.761		1.761
		1.760					1.761				1.760					
											1.761					

TABLE SET IIA
FOR UERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LANO

PROVINCE NO. 01
OLYMPIC

SUBPROVINCE YO.

	01	02	03	04	05
SPECIES ASSOCIATION 1	2.451 2.453	1.757 1.772 2.451 2.453 3.652 3.653	1.757 1.772 2.451 2.453 3.652 3.653	1.772 2.451 2.453 3.652 3.653	2.451 2.453
SPECIES ASSOCIATION 5	2.451 2.453 3.652 3.653 3.658	1.755 1.772 2.451 2.453	2.451 2.453	2.451 2.453	1.755 1.772 2.451 2.453 3.652 3.653 3.658

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LANO

PROVINCE NO. 02
COAST RANGES

SUBPROVINCE NO.

	01	02	03	04	05	06	07
SPECIES ASSOCIATION 1	1.760 1.775 2.451 3.652 3.653	2.451 3.652 3.653	1.760 1.775 2.451 3.652 3.653	2.451 3.652 3.653	1.759 1.774 2.451 3.652 30653	1.758 1.759 1.773 1.774 2.451 3.652 3.653	1.762 1.778 2.451 3.652 3.653

TABLE SET IIA
FOR VERIFYING STATEHENT NUMBERS APPLICABLE TO PRIVATE LAND

PROVINCE NO. 03
SISKIYOU

SUBPROWINCE YO.

	01	02	03	04	05	06
SPECIES ASSOCIATION 2	2.451 2.453 2.457 3.852	1.758 1.773 2.451 2.853 2.457 3.652 3.653 3.852	2.451 2.453 2.457 3.852	1.754 1.758 1.759 1.760 1.769 1.773 1.774 1.775 2.451 2.453 2.457 3.652 3.653 3.852	1,758 1.760 1.769 1.775 2.451 2.453 2.457 3.652 3.653 3.852	1.754 1.769 2.451 2.453 2.457 3.652 3.653 3.852
SPECIES ASSOCIATION 4	1.754 1.755 1.760 1.766 1.769 1.771 1.775 1.778 2.451 2.453 2.457 3.652 3.653 3.852	2.451 2.453 2.457 3.852	1.755 1.771 1.778 2.451 2.453 2.457 3.652 3.653 3.852	2.451 2.453 2.457 3.852	2.451 2.453 2.457 3.852	2.451 2.453 2.457 3.852

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS APPLICABLE TO PHIJATE LAND

PROVINCE NO. 04
PUGET SOUND BASIN

. SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 1	2.451	1.754 1.755 1.765 1.769 1.771 2.451	1.769 2.451	2.451

TABLE SET IIA
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE TO PRIVATE LANO

PROVINCE NO. 05
WILLAMETTE BASIN

SUBPROWINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 3	2.451 2.457 3.652 3.653	2.451 2.457 3.652 3.653	1.756 1.760 1.769 1.775 2.451 2.457 3.652 3.653	1.756 1.760 1.769 1.775 2.451 2.457 3.652 3.653

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LANO

PROVINCE NO. 06
WESTERN CASCAOES

SUBPROVINCE NO.

	01	02	03	04	35	06	07
SPECIES ASSOCIATIOH 1	10759 1.774 2.451 2.453 3.652 3.653	1.759 1.774 2.451 2.453 3.652 3.653	1.756 1.770 2.451 2.453 3.652 3.653	1.759 1.774 2.451 2.453 3.652 3.653	1.759 1.774 2.451 2.453 3.652 3.653	1.756 1.759 1.770 1.774 2.451 2.453 3.652 3.653	2.451 2.453 3.652 3.653
SPECIES ASSOCIATION 2	2.451 2.453 2.454 2.457	2.451 2.453 2.454 2.457	2.451 2.453 2.454 2.457	1.759 1.760 1.774 1.775 2.451 2.453 2.454 2.457 3.652 3.653	1.759 1.774 2.451 2.453 2.454 2.457 3.652 3.653	1.759 1.774 2.451 2.453 2.454 2.457 3.652 3.653	2.451 2.453 2.454 2.457
SPECIES ASSOCIATION 3	2.451 2.453 2.457	2.451 2.453 2.457	2.451 2.453 2.457	2.451 2.453 2.457	2.451 2.453 2.457	2.451 2.453 2.457	2.451 2.453 2.457
SPEC ■ES ASSOCIATION 5	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457 30 652 3.653 3.658	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIJATE LAND

PROVINCE NO. 07
NORTHWESTERN CASCADES

	SUBPROVINCE NO.						
	01	02	03	04	05	06	07
SPECIES ASSOCIATION 1	1.754 1.769 1.773 2.451 2.453	2.451 2.453	1.754 1.769 1.773 2.451 2.453	2.451 2.453	2.451 2.453	2.451 2.453	2.451 2.453
SPECIES ASSOCIATION 5	2.451 2.452 2.453 2.457	1.758 1.773 2.451 2.452 2.453 2.457 3.652 3.658	2.451 2.452 2.453 2.457	1.758 1.773 2.451 2.452 2.453 2.457 3.652 3.558	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 08
NORTHEASTERN CASCADES

SUBPROVINCE NO.

	01	02	03	04	05	06	07	08
SPECIES ASSOCIATION 5	2.451 2.452 2.453 2.457	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.452 2.453 2.457 3.652 3.658	2.451 2.452 2.453 2.457	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.652 2.453 2.457 3.652 3.658	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457	2.451 2.452 2.453 2.457
SPECIES ASSOCIATION 6	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	1.758 1.759 1.760 1.761 1.773 1.774 1.775 1.776 1.778 2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.052	2.451 2.452 2.453 2.455 2.456 2.447 3.656 3.852	2.451 2.452 2.453 2.455 2.455 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852

(CONTINUED)

PROVINCE NO. 08
(CONTINUED)

SPECIES ASSOCIATION 7	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 20453 2.455 2.456 20457 3.656 3.852	2 451 2.452 2.453 2.455 2.456 2.457 3.656 3.052	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	1.760 1.761 1.775 1.776 2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	1.758 1.759 1.760 1.773 1.774 1.775 1.778 2.451 2.452 2.453 2.455 2 456 2.457 3.656 3.852	1.754 1.760 1.769 2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852
SPECIES ASSOCIATION 8	2.451 2.452 2.453 2.455 2.056 2.457 3.636 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	1.760 1.774 1.775 2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852	2.451 2.452 2.453 2.455 2.456 2.457 3.656 3.852
SPECIES ASSOCIATION 9	2.456 2.457 3.852	2.456 2.457 3.855	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852

TABLE SET II A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIJATE LAND

PROVINCE NO. 09
RECENT (HIGH) CASCADES

	SUBPROVINCE NO. 01	02	03	04	05
SPECIES ASSOCIATION 1	2.451 2.453	2.451 2.453	2.451 2.453	2.451 2.453	2.451 2.453
SPECIES ASSOCIATION 2	2.451 2.453 2.454 2.457	2.451 2.453 2.454 2.457	2.451 2.453 2.454 2.457	1.758 1.760 1.773 1.775 2.451 2.453 2.454 2.457 3.652 3.653	2.451 2.453 2.454 2.457
SPECIES ASSOCIATION 5	2.451 2.452 2.457 3.652 3.653 3.658	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.452 2.457 3.652 3.653 3.658	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.452 2.457 3.652 3.653 3.658	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.452 2.454 2.457 3.652 3.653 3.658	1.758 1.760 1.761 1.773 1.775 1.776 2.451 2.452 2.457 3.652 3.653 3.658

(CONTINUED)

PROVINCE NO. 09
(CONTINUED)

SPECIES ASSOCIATION 6	2.451	1.758	2.451	2.451	1.758
	2.452	1.760	2.452	2.452	1.760
	2.455	1.761	2.455	2.455	1.761
	2.456	1.773	2.456	2.456	1.773
	2.457	1.775	2.457	2.457	1.775
		1.776			1.776
		2.451			2.451
		2.452			2.452
		2.454			2.454
		2.455			2.455
		2.456			2.456
		2.457			2.457
SPECIES ASSOCIATION 7	2.451	1.758	2.451	2.451	2.451
	2.452	1.760	2.452	2.452	2.452
	2.455	1.761	2.455	2.455	2.455
	2.456	1.773	2.456	2.456	2.456
	2.457	1.775	2.457	2.457	2.457
	3.652	1.776	3.652	3.652	3.652
		2.451			
		2.452			
		2.455			
		2.456			
		2.457			
		3.652			
SPECIES ASSOCIATION 8	2.451	1.761	2.451	1.761	2.451
	2.452	1.770	2.452	1.770	2.452
	2.455	1.776	2.455	1.776	2.455
	2.456	1.778	2.456	1.778	2.456
	2.457	2,451	2.457	2.451	2.457
		2.452		2.452	
		2.455		2.455	
		2.456		2.456	
		2.457		2.457	

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS APPLICABLE TO PRIVATE LAND

PROVINCE NO. 10
OKANOGAN HIGHLANDS

SUBPROVINCE NO.

	01	02	03	04	05	06	07
SPECIES ASSOCIATION 5	**2.451** 2.452 2.457	2.451 2.452 **2.457**	**2.451** 2.452 2.457	2.451 2.452 2.457	2.451 **2.452** **2.457** 3.652 3.658	2.451 **2.452** **2.457**	**1.758** **1.760** 1.7.73 **1.775** **2.451** 2.452 2.457
SPECIES ASSOCIATION b	**2.451** 2.455 **2.456** 2.457 3.852	2.451 2.455 2.456 **2.457** 3.852	**2.451** **2.455** **2.456** **2.457** 3.852	2.451 2.455 2.456 2.457 3.852	**2.451** **2.455** **2.456** **2.457** 3.852	2.451 2.455 2.456 **2.457** **3.852**	**2.451** **2.155** 2.456 ***2.457*** **3.052**
SPECIES ASSOCIATION 7	1.758 1.759 1.760 1.761 **1.773** **1.774** 1.775 1.776 **2.451** **2.452** **2.455** 2.456 2.457 3.656 **3.852**	**1.758** **1.759** 1.760 **1.761** **1.773** 1.774 1.775 1.776 2.451 **2.452** **2.455** **2.456** ***2.457*** **3.656** 3.852	**1.758** **1.759** 1.760 1.761 **1.773** 1.774 1.775 **1.776** **2.451** 2.452 **2.455** **2.456** **2.457** 3.656 **3.852**	**1.758** 1.759 1.760 14761 **1.773** 1.774 **1.775** 1.776 2.451 2.452 **2.455** 2.456 **2.457** **3.656** **3.852**	**2.451** 2.452 ***2.455*** 2.456 2.457 3.852	**2.451** ***2.452*** 2.455 ***2.456*** ***2.457*** 34656 3.852	**2.451** **2.452** 2.455 2.456 **2.157** 3.052
SPECIES ASSOCIATION 8	2.451 **2.455** **2.456** **2.457** 3.852	**2.451** ***2.455*** **2.456** **2.457** 3.852	**2.451** 2.455 **2.456** ***2.457*** 3.052	2.451 **2.455** 2.456 2.457 3.852	2.451 **2.455** **2.456** **2.457** **3.852**	2.451 2.455 2.456 2.457 **3.852**	2.451 ***2.455*** 2.456 2.457 **3.052**
SPECIES ASSOCIATION 9	2.456 2.457 **3.852**	**2.456** ***2.457*** 3.852	**2.456** 2.457 3.852	2.456 2.457 3.852	2.456 ***2.457*** **3.852**	2.456 2.457 **3.852**	2.456 ***2.457*** 3.852

TABLE SET IIA
FOR VERIFYXNG STATEMENT NUMBERS
APPLICABLE 1O PRIVATE LAND

PROVINCE NO. 11
COLUMBIA BASIN

SUBPROVINCE NO.

ANY

ANY SPECIES 3.852

TABLE SET II A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 12
BLUE MOUNTAINS

.SUBPROVINCE NO.

	01	02	03	04	05	06	37	08	09	10	11
SPECIES ASSOCIATION 5	2.451 2.452 2.457	**2.451** 2.452 2.457 3.652 3.658	2.451 **2.452** 2.457	1.758 **1.759** 1.760 1.761 1.773 1.774 1.775 1.776 ***2.451*** 2.452 2.457 3.652 3.658	**1.754** **1.758** 1.759 1.760 1.761 1.773 1.774 1.775 1.776 2.451 2.452 2.457	2.451 2.452 2.457	2.451 ***2.452*** 2.457	2.451 2.452 2.457	2.451 **2.452** **2.457**	2.451 2.452 2.457	2.451 **2.452** 2.457
SPECIES ASSOCIATION *6*	2.451 2.455 2.456 2.457 3.852	**2.451** 2.455 **2.456** 2.457 **3.852**	**2.451** 2.455 **2.456** **2.457** **3.852**	1.754 1.758 1.760 1.773 1.775 **2.451** **2.455** **2.456** 2.457 **3.852**	2.451 2.455 **2.456** 2.457 **3.852**	1.754 1.758 1.760 1.773 2.451 **2.455** 2.456 **2.457** **3.852**	2.451 2.455 2.456 2.457 **3.852**	2.451 2.455 2.456 2.457 **3.852**	2.451 2.455 2.456 2.457 **3.852**	2.451 2.455 **2.456** 2.457 3.852	2.451 2.455 **2.456** 2.457 3.852

(CONTINUED)

PROVINCE NO. 12
(CONTINUED)

SPECIES	2.451	2.451	2.451	2.451	2.451	2.451	2.451	**2.451**	2.451	2.451	**2.451**
ASSOCIATION	2.452	2.452	2.452	2.452	**2.452**	2.452	2.452	2.452	2.952	2.452	2.452
7	2.455	**2.455**	2.455	2.455	2.455	**2.455**	2.455	2.455	**2.455**	2.455	2.455
	2.456	**2.456**	**2.456**	2.456	2.456	2.456	2.456	2.456	2.456	2.456	2.456
	2.457	2.457	2.457	2.457	2.457	2.457	2.457	2.457	**2.457**	2.457	**2.457**
	3.656	**,30656**	3.656	3.852	3.852	3.656	3.852	3.852	3.852	3.852	**3.852**
	3.852	**3.852**	3.852			3.052					
SPECIES	2.451	2.451	2.451	2.451	2.451	2.451	2.451	2.451	2.451	2.451	2.451
ASSOCIATION	2.455	2.455	2.455	**2.455**	**2.455**	2.455	2.455	**2.455**	2.455	2.455	2.455
8	2.456	2.456	2.456	2.456	2.456	2.456	2.456	2.456	2.456	2.456	2.156
	2.457	2.457	**2.457**	2.457	2.457	2.457	**2.457**	2.457	2.457	**2.457**	**2.457**
	3.852	3.852	**3.852**	3.852	3.852	3.852	3.852	**3.852**	**3.852**	3.852	**3.852**
SPECIES	2.456	**2.456**	2.456	2.456	2.456	2.456	2.456	1.757	2.456	2.456	1.757
ASSOCIA T ION	**2.457**	2.457	**2.457**	2.457	2.457	2.457	2.457	1.777	2.457	2.457	1.777
9	3.656	3.656	3.656	**3.852**	3.852	**3.656**	3.852	1.778	3.852	3.852	2.456
	3.852	3.852	**3.852**			**3.852**		2.456			**2.457**
								2.457			3.852
								3.852			

TABLE SET II A
FOR VERIFYING STATEHENT NUMBERS
APPLICABLE *TO* PRIVATE LAND

PROVINCE' NO. 13
HARNEY BASIN

SUBPROYINCE NO.

	01	02	03	04	05	06
SPECIES ASSOCIATION 6	2.451 2.455 2.456 2.457 3.653 3.852	2.451 2.455 2.456 2.457 3.653 3.852	2.451 2.455 2.456 2.457 3.653 3.656 3.852	2.451 2.455 2.456 2.457 3.653 3.852	2.451 2.455 2.456 2.457 3.653 3.852	1.758 1.759 1.760 1.761 1.773 1.774 1.775 1.776 1.778 2.451 2.454 2.455 2.456 2.457 3.653 3.656 3.053
SPECIES ASSOCIATION 7	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852
SPECIES ASSOCIATION 8	2.451 2.455 2.456 2.457 3.852	2.451 2.455' 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852
SPECIES ASSOCIATION 9	2.456 2.457 3.652 3.653 3.852	2.456 2.457 3.652 3.653 3.852	1.758 1.759 1.761 1.773 1.774 1.776 1.778 2.456 2.457 3.652 3.653 3.656 3.852	2.456 2.457 3.652 3.653 3.052	2.456 2.457 3.652 3.653 3.852	2.456 2.457 3.652 3.653 3.656 3. a52

TABLE SET II A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 14
UPPER BASIN AND RANGE

SUBPROVINCE NO0

	01	02	03	04	35	06	07
SPECIES ASSOCIATION 6	1.750 1.759 1.760 1.761 1.766 1.773 1.774 1.775 1.776 2.652 2.454 2.455 2.456 2.457 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.656 3.852	2.452 2.454 2.455 2.456 3.656 3.852	1.758 1.759 1.760 1.761 1.766 1.773 1.774 1.775 1.776 2.452 2.454 2.455 2.456 2.457 3.656 3.852	1.758 1.759 1.760 1.761 1.766 1.773 1.774 1.775 1.776 2.452 2.454 2.455 2.456 2.457 3.656 3.853
SPECIES ASSOCIATION 7	2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852	1.759 1.760 1.761 1.774 1.775 1.776 2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852	2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852	2.452 2.454 2.155 2.456 2.457 3.652 3.653 3.656 3.852	1.766 2.452 2.454 2.455 2.456 2.457 3.652 3.653 3.656 3.852
SPECIES ASSOCIATION 8	2.455 2.456 2.457 3.852	2.455 2.456 2.457 3.852	2.455 2.456 2.457 3.852	2.455 2.456 2.457 3.852	2.455 2.456 2.457 3852	2.455 2.456 2.457 3.852	2.455 2.456 2.457 3.852
SPECIES ASSOCIATION 9	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 15
BASIN AND RANGE

SUBPROJINCE NO.

	05
SPECIES ASSOCIATION 9	1.758
	1.759
	1.760
	1.761
	1.773
	1.774
	1.775
	1.776
	2.456
	3.652
	3.653
	3.852

TABLE SET IIA
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 16
COWLITZ RIVER BASIN

SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 1	2.451	2.451	1.756	1.756
	3.652	3.652	1.760	1.760
	3.653	3.653	1.769	1.769
			1.775	1.775
			2.451	2.451
			3.652	3.652
			3.653	3.653

TABLE SET II A
FOR VERIFYING STATEMENT NUMBERS
APPLICABLE TO PRIVATE LAND

PROVINCE NO. 17
WALLOWAS

SUBPROVINCE NO.

	01	02	03	04
SPECIES ASSOCIATION 5	1.758 1.759 1.760 1.773 1.774 1.776 2.451 2.452 2.457 3.652 3.653	2.451 2.452 2.457 3.652 3.653	2.451 2.452 2.457 3.652 3.653	2.451 2.452 2.457 3.652 3.653
SPECIES ASSOCIATION 6	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	1.769 2.451 2.455 2.456 2.457 3.852
SPECIES ASSOCIATION 7	2.451 2.452 2.455 2.456 2.457 3.652 3.653 3.852	1.759 1.760 1.761 1.774 1.776 2.451 2.452 2.455 2.456 2.457 3.652 3.653 3.852	1.759 1.760 1.761 1.774 1.776 2.451 2.452 2.455 2.456 2.457 3.652 3.653 3.852	1.759 1.760 1.761 1.774 1.776 2.451 2.452 2.455 2.456 2.457 3.652 3.653 3.852
SPECIES ASSOCIATION 8	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852	2.451 2.455 2.456 2.457 3.852
SPECIES ASSOCIATION 9	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852	2.456 2.457 3.852

USER'S WORK FORM

The User's Work Form shown in appendix 6 provides a "master" for making copies. A completed form follows for a hypothetical example of a residues management situation. From the steps and entries shown, one can follow the procedure for use of the form and other portions of this chapter to key out applicable guideline statements. Note that the example involves only timber harvesting by group selection cutting (see Input Block 2). Had road construction also been involved for the planned timber harvest, a second User's Work Form would need to be completed for the road construction activity. Thus, the combined two lists of guideline statements would govern the total residue management situation.

USER'S WORK FORM

GUIDELINES FOR FOREST RESIDUES MANAGEMENT

Project name or other identifiers: DANDY SALE

This form has been developed to help users sort for guideline statements believed to apply to specified land management situations. It is intended for use with the publication:

> Pierovich, John M., Edward H. Clarke, Stewart G. Pickford, and Franklin R. Ward. 1975. Forest residues management guidelines for the Pacific Northwest. Pacific Northwest Forest and Range Experiment Station USDA Forest Service General Technical Report PNW-33.

STEP 1 Enter the information requested in Input Blocks 1 through 5 of this form.

Input Block 1

This work form applies to (circle only one):

(PUBLIC LAND) PRIVATE LAND

Administrative unit name or other identifiers: EXAMPLE

Input Block 2

This work form applies to (check only one):

- [ ] A. Road construction
- [ ] B. Trail construction
- [ ] C. Campground construction
- [ ] D. Structure construction
- [ ] E. Ski run construction
- [ ] F. Utility right-of-way construction
- [ ] G. Timber harvest by individual tree selection cutting
- [ ] H. Timber harvest by shelterwood cutting
- [✓] J. Timber harvest by group selection cutting
- [ ] K. Timber harvest by clearcutting
- [ ] L. Precommercial thinning
- [ ] M. Commercial thinning
- [ ] N. Type conversion, except rangeland
- [ ] O. Treatment of natural residue
- [ ] P. Treatment of dying and damaged vegetation
- [ ] Q. Rangeland type conversion

USER'S WORK FORM (cont.)

STEP 3 Within the Table Set (I or 11) chosen in step 2, turn to the Sorting Set letter corresponding to the letter checked in Input Block 2. Note that there are either four or five tables within this Sorting Set. Refer to Table 1 now and list all statement numbers shown in the box below:

Statement List 1 (from Table 1):

1.502	1.901	2.302	3.812
1.712	1.902	2.303	3.813
1.713	1.903	2.306	3.814
1.717	1.904	2.307	3.815
1.718	1.905	3.601	3.816
1.729	1.906	3.606	3.817
1.730	2.201	3.607	3.818
1.801	2.202	3.804	
1.802	2.205	3.806	
1.803	2.301	3.809	

Input Block 3

This work form applies (circle only one):

(where residues will or may be burned) — where residues will not be burned

STEP 4 If residues will be or may be burned, refer to Table 2 now and list the statement numbers shown in the box below:

If residues will not be burned, check here and proceed to step 5----- ☐

Statement List 2 (from Table 2):

1.101	1.106	1.111	1.702
1.102	1.107	1.112	2.204
1.103	1.109	1.113	
1.104	1.110	1.701	

USER'S WORK FORM (cont.)

STEP 5 If Input Block 4 is for Private Land, check here and go to Step 6 - ☐

If Input Block **4** is for Public Land and the notation "Skip Table 3" is circled in Input Block 4, check here and go to step 6 - - - - - - - ☐

If Input Block 4 is for Public Land and a **column** number is circled in Input Block **4,** enter the column number in the space labeled "from Table **3,** column ____" in the box below. Find this **column** number in Table **3** and enter all the statement numbers found there in the box below.

Statement List **3** (from Table *3*, column 4):

1.517 1.527
1.520
1.521
1.525

Input Block **4**

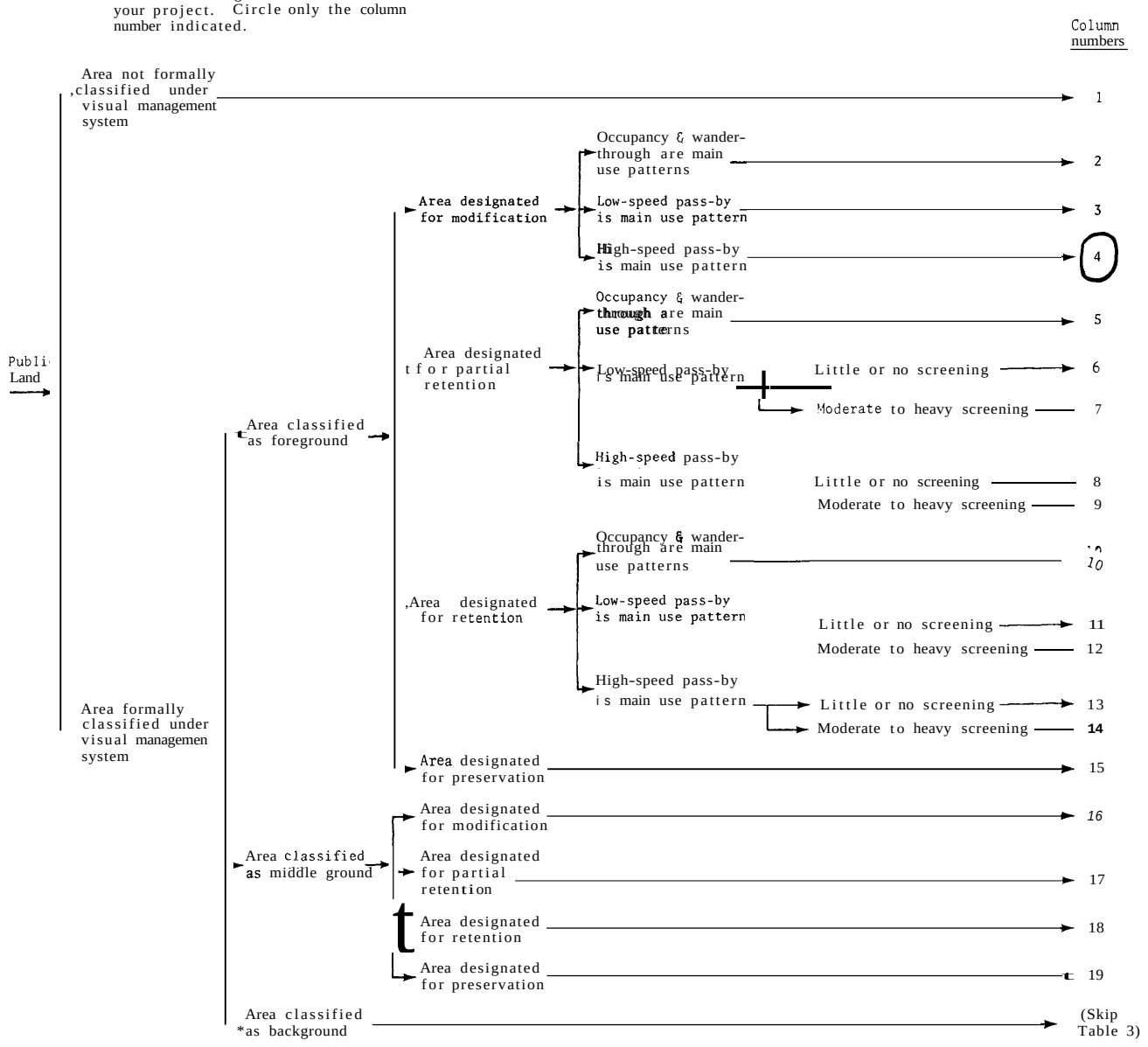
This work form will be for (circle only one):

Public Land

If for public land, proceed to trace from left to right along the path describing the visual management classification for your project. Circle only the column number indicated.

Private Land

If for private land, skip this block and check here: _____



Input Block 5

a. Refer to the Forest Residue Type Area maps in the Guidelines publication (chapter 11, Figure 1 or 2), and locate the type area for which this work form applies. Enter here the five-digit code for this area below:

Province	Subprovince	Timber Spp. Assoc.
1	2	702

b. Refer to the Forest Residue Type Area discussion (Guidelines publication, chapter 11). Using your knowledge of the specific area for which this worksheet applies, review the descriptions of the Timber Species Associations and of those geomorphic subprovinces, within your province, for accuracy. Because the Forest Residue Type Area map must be somewhat generalized, you may find a description which better fits your situation.

After your review, enter below a final, confirmed (from part a, above), or revised identifying number.

(CAUTION - use only Subprovince numbers and Timber Species Associations numbers listed as "recognized" for your province):

Province	Subprovince	Timber Spp. Assoc.
1	2	704

STEP 6 Enter the Province number (first two digits in part b of Input Block 5, above) in the space labeled "from Table **4,** column ____" in the box below. Then list all statement numbers in this column of Table **4** in the box below.

Statement List 4 (from Table 4, column 12):

~~1.723~~ [1/]	~~1.733~~	2.407
~~1.724~~	~~1.734~~	2.408
~~1.725~~	~~1.738~~	2.409
~~1.726~~	2.401	2.410
~~1.727~~	2.402	~~3.603~~
~~1.731~~	2.405	~~3.608~~
~~1.732~~	2.406	3.807

STEP 7 For some management activities, there will be a Table 5. If there is no Table 5 in your sorting set, check here and go to step 8 - ☐

If there is a Table 5, refer back to Input Block **3.**

If residues will not be burned, check here and go to step 8 - ☐

If residues will be or may be burned, enter the Province number (first two digits from Input Block 5) in the space labeled, "Table 5, column ___," in the box below.

In the box below, list all statement numbers shown in that column.

Statement List 5 (from Table 5, column 12):

~~1.703~~	~~1.709~~
~~1.706~~	~~1.710~~
~~1.707~~	
~~1.708~~	

[1/] Crossed off numbers are explained in steps 8-11.

STEP 8 If you are using Table Set I, for public lands, turn to Table Set IA (blue paper). If you are using Table Set 11, for private lands, turn to Table Set IIA (green paper).

STEP 9 Use the Province number (first two digits from Input Block 5), to locate in your Table Set the appropriate tabulation of statement numbers for your Province.

STEP 10 Within this Province, find the Timber Species Association identifying number (third digit, part b, of Input Block 5). These rows of statement numbers apply to your Timber Species Association. Then use the Subprovince identifying number (last two digits from part b of Input Block 5), to locate the column for your Subprovince.

Use this column and these rows to verify the applicability of statement numbers in Statement Lists 4 and 5. ONLY THE STATEMENT NUMBERS LISTED PREVIOUSLY IN LISTS 4 AND 5 AND THEN FOUND AGAIN HERE ARE VERIFIED. CROSS OUT ALL STATEMENT NUMBERS IN LISTS 4 AND 5 WHICH ARE NOT VERIFIED.

STEP 11 You now have a complete set of Statement numbers (from Lists 1 through 5) which should be applicable to most situations like the one for which you have prepared this form. Use these numbers to locate the actual statements listed in chapter 111, p. 135-157, for Public Lands and in chapter 111, p. 160-172, for Private Lands. You will want to note carefully all EXCEPTIONS to any statement to determine if your situation may be one for which a certain guideline was not intended to apply.

You may wish to attach to this form a record of departures from recommended guidelines, as well as any other notes regarding modifications or limits you may develop. In this way, this work form and attachments will be available for future reviews of the decisions you have made regarding forest residues management.

DANDY SALE — *RECORD* OF DEPARTURES & NOTES ON RESIDUES GUIDELINES

1.729	Waiving of suspension requirement to be when exposed mineral soil will not be more than 20% (per exception)
3.815 & 3.816	Will apply — no fuel break involved
2.406	Meet this requirement by post-sale stand improvement project
2.408	Not applicable - not a precommercial thinning

J James
TMA

Chapter III. Public and private guideline statements

USING THIS CHAPTER

Sorting for Application

As previously set forth, the guidelines in this chapter are not intended to be reviewed one after the other for determining possible application. Familiarity with procedures in chapter II is essential for properly sorting these guidelines for application.

Numbering

Prefix numerals.--The prefix numeral for each guideline indicates if it has come from List 1.000, List 2.000, or List 3.000. The prefix is a means of grouping guidelines into logical management components. List 1.000 details statements most concerned with the environmental elements of air, esthetics, and soil and water quality. List 2.000 groups statements intended to protect or minimize damage to the forest from fire, insects, or disease. List 3.000 details statements intended to enhance the forest environment through manipulative practices. They are presented as three separate but interrelated lists.

In the event of conflicts between statements, the land manager's judgment as to which best meets his established objectives and goals with the least environmental disruption must prevail. We recognize that changes in technology, economic conditions, and other external factors could and should force a continual reassignment of priorities. When the guidelines are grouped into like management components from which selections are made, the impact of this continual reordering may be avoided. Thus, when selections are made to meet objectives, guidelines drawn from all three lists should be considered and their applications evaluated.

Series numbering within lists.--The statements originating with each of the nine Technical Panels are numbered in separate hundreds-series to identify them with their sources and to permit orderly revisions or future additions within a series. No rank-ordering within each series is intended or implied.

In addition, the statements listed within each hundreds-series have been assigned to separate serial sets; one for Public and one for Private Lands. The set numbered serially between 01 and 49 is for Public Lands and the set numbered between 51 and 99 is for Private Lands. This allows for similar groupings but still insures that any guideline can be identified with the type of land ownership for which it was intended.

The following is an index to the hundreds-series assigned:

Starting number assigned Public Lands Guidelines	Starting number assigned Private Lands Guidelines	Originating Technical Panel
101	151	Air Quality
201	251	Diseases
301	351	Fire Management
401	451	Insects
501	551	Recreation
601	651	Silviculture
701	751	Soils
801	851	Terrestrial Habitat
901	951	Water Quality and Aquatic Habitat

Judgments

Except as agencies or firms may indicate otherwise, these statements are intended only as guidelines. They were judged initially on a technical basis before being recommended to the Land Management Decisions Panels for policy judgment. They were often modified by the policy review and compilation process.[1/] As products of this intensive judging and modifying sequence, the guidelines may be regarded as generally acceptable for specified situations.

General acceptance is not always an adequate basis for choosing to follow a guideline. Very small differences in local environments may dictate a different course. Intimate knowledge of local situations can be expected to influence applicability of some statements in the judgment of individual land managers. Most Panelists expressed a desire that final determination of application be left to unit managers, and this is the intent of expressing statements as guidelines rather than proposed regulations or standards.

Moreover, the Land Management Decisions Panels judged each statement as to its desirability and attainability. A few were judged as desirable, but not universally attainable (D, NUA). Guidelines, or parts of guidelines, so judged by either the Public or Private Land Management Decisions Panel carry the notation "D, NUA" in parentheses at the end of the statement (see, for example, Guideline 1.112). Individual land managers may temper their own decisions to follow this judgment or to depart from it.

1/ During the compilation process, many statements were edited and rewritten to .incorporate additional clarifying language as to intent or measurable results, to consolidate those which were consistently applied to the same situation, and to separate some which were sufficiently diverse to call for independent treatment. In the process, every effort was made to maintain the original intent and context.

References to Documentation

Each statement carries a designation entered in the DOCUMENTATION COLUMN which refers to supporting information in chapter IV. These references may be used to trace each statement to its technical bases, as well as to obtain amplification of the intent of the statement or to provide suggested rules-of-thumb and cross-referencing where needed. The two prefix characters identify the Technical Panel originating the statement, as follows:

AI	Air Quality
RE	Recreation
SO	Soils
TE	Terrestrial Habitat
WA	Water Quality and Aquatic Habitat
DI	Diseases
FI	Fire Management
IN	Insects
SI	Silviculture

PUBLIC LANDS GUIDELINES

Objectives and Goals for Public Lands

One public agency might consistently modify certain statements to be mandatory for its lands in the Northwest, and another might not. The difference of guideline applicability between agencies responsible for management of public lands is founded in differences in the goals and other direction contained in the legislation which established the agencies and authorizes their operations. The following quoted excerpts are provided to show the objectives and activities, as related to these guidelines, of public agencies involved in managing residues on forest lands.

Bureau of Indian Affairs, U.S. Department of the Interior (Office of the Federal Register 1972, p. 261-262):

> Objectives...to actively encourage and train Indian and Alaskan Native people to manage their own affairs under the trust relationship to the Federal Government...full development of their human and natural resource potentials....
>
> Functions...(4) works with them in the development and implementation of programs for their economic advancement and for full utilization of their natural resources consistent with the principles of resource conservation; and (5) acts as trustee of their lands and monies held in trust by the United States, assisting them to realize maximum benefits from such resources.

Bureau of Land Management, U.S. Department of the Interior (Office of the Federal Register 1972, p. 262-263):

> Activities...Public land resources...include timber, minerals, wildlife habitat, livestock forage, public recreation values, and open space. Bureau programs provide for the protection, orderly development, and use of all these resources under principles of multiple use and sustained yield, and for a quality environment. It manages watersheds to protect soil and enhance water quality, develops recreation opportunity on public land....

Forest Service, U.S. Department of Agriculture (Office of the Federal Register 1972, p. 97-98):

> Objectives.. .Federal responsibility for leadership in forestry...(1) promote and achieve a pattern of natural resource uses that will best meet the needs of people now and in the future; (2) protect and improve the quality of air, water, soil, and natural beauty; (3) help protect and improve the quality of open space environment in urban and community areas; (4) generate forestry opportunities to accelerate rural community growth; (5) encourage the growth and development of forestry-based enterprises that readily respond to consumers' changing needs...(10) expand public understanding of environmental conservation....
>
> Functions and Activities. National Forest System...under the principles of multiple use and sustained yield.... The Nation's tremendous need for wood and paper products is balanced with the other vital renewable resources or benefits.. .. The guiding principle is the greatest good to the greatest number in the long run.... These lands are protected as much as possible from wildfire, epidemics of disease and insect pests, erosion, floods, and water and air pollution....

National Park Service, U.S. Department of the Interior (Office of the Federal Register 1972, p. 258):[2/]

> Objectives...to administer the properties under its jurisdiction for the enjoyment and education of our citizens, to protect the natural environment of the areas, and to assist the States, local governments, and citizen groups in the development of park areas, the protection of the natural environment, and the preservation of historic properties....

2/ Although included in these excerpts for comparison purposes, National Park Service participation was not invited in development of these guidelines because of the difference of objectives between this agency and other use-oriented agencies responsible for lands where residues are a recognized challenge. This exclusion does not intend to convey that there are no residue problems in National Parks, but rather, that guidelines for National Parks must be different in many circumstances.

Oregon State Department of Forestry:/

> The objective of the management of State forest lands is to achieve optimum growth and harvest of forest products consistent with the protection of watersheds, fish and wildlife habitat, and recreation and aesthetic considerations. Management plans for all State forest lands will also recognize other appropriate uses, such as grazing, erosion control, mining, research and education, and administrative use; whenever possible, management practices should be designed to provide for such uses without complete elimination of timber harvesting or other uses.

Washington State Department of Natural Resources [n.d.]:

> ...endorses management of State lands to provide the following:
>
> 1. Obtain maximum sustained economic benefits to the trust to which the land is dedicated, while fulfilling basic social obligations to all large forest and range land ownerships.
>
> 2. When not in conflict with the first objective, maximize social benefit to the people of the State...
>
> ...Maintenance of the environment will be a prime consideration in management of State lands....

Comparison of the above excerpts will show differing emphasis on economic, social, and environmental considerations. These differences will influence the applicability of forest residue guidelines because evaluations of trade offs will be in different contexts. Nevertheless, there exists a common thread of concern for environment. This environmental concern has been evolving over many years from earlier, more exploitative origins; these origins and foundation laws still must often influence the ultimate trade-off decisions to follow or forego environmental protection measures. For example, despite its ever deepening concerns for environmental protection, the Forest Service remains under mandate to provide for the Nation's timber supply, just as it did in 1908 when the following was written about the National Forests:

> National Forests are created to preserve a perpetual supply of timber for home industries, to prevent destruction of the forest cover which regulates the flow of streams, and to protect local residents from unfair competition in the use of forest and range. They are patrolled and protected at Government expense for the benefit of the community and the home builder. (USDA Forest Service 1908.)

Comparison of the 1908 with the 1972 quotation, above, will readily show what important changes have taken place, and yet will also show the agency's continuing mission for timber products as a vital renewable resource.

3/ Memo to Pacific Northwest Forest and Range Experiment Station from State Forester, September 12, 1974, Salem, Oregon.

Public Lands Guideline Lists

List 3.000 - Public Lands statements intended to protect the environmental elements--air, soil, water quality, and esthetics

This list contains statements numbered as follows:

1.101 - 1.113, Originating with Air Quality Technical Panel

1.501 - 1.527, Originating with Recreation Technical Panel

1.701 - 1.738, Originating with Soils Technical Panel

1.801 - 1.803, Originating with Terrestrial Habitat Technical Panel/

1.901 - 1.906, Originating with Water Quality and Aquatic Habitat Technical Panel

Statement No.	Public Lands Statements	Documentation
	AIR QUALITY	
1.101	From the standpoint of air quality, methods of treatment other than open burning are preferred. When, however, it has been determined that overall environmental quality is best served by some form of open burning treatment, the burning will be accomplished in compliance with an approved smoke management plan. (See proposed Model Smoke Management Plan in appendix 2.) EXCEPTION: See statement 1.103.	AI-13
1.102	Within a land management administrative unit or subunit, the land manager should determine the annual average number of available burning days and use this determination in establishing burning priorities and objectives that are within the unit's capability to meet air quality standards.	AI-1
1.103	When burning can be accomplished without visible or otherwise objectionable emissions (such as with use of air curtain-type equipment), compliance with the smoke management plan is assumed.	AI-12

4/ These three statements are closely allied with soils and are thus included in List 1.000. Other statements originating with this Panel are found in List 3.000.

State-ment No.	Public Lands Statements	Documen-tation
1.104	Concentrations of forest residues threatening to result in a smoke episode from wildfire are candidates for treatment by burning. When an analysis shows the threat to a smoke-sensitive area from a wildfire is a greater potential nuisance than would be the smoke from the burning operation, burning shall be undertaken.[5/]	AI-10 FI-12
1.105	A firing sequence for prescribed burning must be designed to achieve maximum rate of energy output where a strong convection column is needed for dispersal to higher levels. EXCEPTION: Prescribed underburning which can be accommodated within localized areas where there is no smoke-sensitive area.	AI-11
1.106	When the potential exists for adversely affecting air quality in a smoke-sensitive area, piles or windrows should be mopped up when burning objectives have been met.	AI-7
1.107	Piles and windrows should be made as large as possible within the constraints of safety, piling method, machinery, surrounding resource, and available residue.	AI-8
1.108	If broadcast burning is the prescribed treatment for clearcut residues control, then fuels 4 inches or less in diameter (small end) should ignite readily and support rapid fire spread. In meeting this guideline, fuel moisture sticks may be used to indicate favorable fuel condition.	AI-9
1.109	When smoke from any burning operation may interfere with vehicular traffic, the person responsible for the job will provide safety measures acceptable to local traffic safety law enforcement agencies.	AI-2
1.110	When smoke from any burning operation may interfere with airport operations, the administrator of the smoke management plan should notify the Federal Aviation Administration and the airport manager as far in advance as possible.	AI-3

5/ See AI-IO **(p.** 175) in chapter IV for suggested rule-of-thumb to use in analysis.

State-ment No.	Public Lands Statements	Documen-tation
1.111	Where forest residues are to be burned in piles or windrows, such piles and windrows should be sufficiently free of dirt and be compact enough to achieve a hot fire, and should not be burned without fuel or ventilation boosters unless heavy fuels are dry enough to burn unaided.	AI-4
1.112	Stumps over 24 inches top diameter which are to be burned in piles should be split (D, NUA).	AI-5
1.113	Chunking-in, if needed, should be done at intervals sufficient to maintain a hot fire.	AI-6
	RECREATION	
1.501	In areas not under formal classification as part of a Visual Management System, but where the land manager has determined that scenic values will be given special consideration (such as roadside strips or areas where public use is encouraged), the following goals for residues treatment will apply: a. Disposal of all man-caused residue which is not visually subordinate to the characteristic landscape. b. Camouflaging of tree stumps. c. Minimization of scorched tree crowns when fire is used as a treatment. If public use is less intense but not discouraged, the following goals for residues treatment will be applied on an as-needed basis: a. Enhancing the appearance of naturalness by treatments which will hasten decomposition where volumes of debris are relatively small. b. Creating an appearance of "managed concern" by yarding, windrowing, or piling and burning concentrations of residues.	RE-1 6/

6/ Because much of the subject matter of esthetics defies exact measurements, this vital element of the environment has been interpreted through what is best known about the recreational use of forests.

Statement No.	Public Lands Statements	Documentation
	c. Avoiding appearances of waste by selling practices which encourage removal of low-value material.	
1.502	All manufactured items (such as oilcans, cable, cable spools) which are discarded will be removed to an agency approved disposal area.	RE-1 6/
1.503	In all areas formally classified as Preservation, 7/ improvements will be located or relocated so that the man-caused residues resulting from the improvement activity will be minimized.	RE-1 6/
1.504	A desirable objective for man-caused residues will be 90-percent disposal of all material 1- to 3-inch diameter (large end) and 100 percent of all larger material, provided that any remaining material is less than 3 inches deep. EXCEPTION: When statements 3.605, 3.805, or 3.806 apply, they shall govern.	RE-1 6/
1.505	All man-caused and disturbed residues which cannot be hidden from view will receive 100 percent disposal treatment. 7/ EXCEPTION: When statements 3.605, 3.805, or 3.806 apply, they shall govern.	RE-1 6/ RE-3
1.506	All residues larger than 2-inch diameter (large end) will receive 100-percent disposal treatment, and all smaller residues must be scattered so as to form an intermittent ground cover no more than 6 inches deep. EXCEPTION: When statements 3.605, 3.805, or 3.806 apply, they shall govern.	RE-1 6/
1.507	All man-caused and disturbed residues larger than 2-inch diameter (large end) which cannot be hidden	RE-1 6/

7/ This statement applies only to National Forest areas formally classified under a Visual Management System. Oregon and Washington have visual management classification systems that do not adapt well to the application o.f this guideline. No statements have been prepared for are'as classified as background under this system. Application of statements can be determined only through use of the methods described in chapter 11.

State-ment No.	Public Lands Statements	Documen-tation
	from view of the route of travel will receive 100-percent disposal treatment, and all smaller residues must be scattered so as to form an intermittent ground cover no more than 6 inches deep.	
1.508	When chipping has been selected as a residue disposal treatment, chips should form an intermittent cover in no place thicker than 1 inch.	RE-1 6/
1.509	When chipping has been selected as a residue disposal treatment, evident chips should form an intermittent cover in no place thicker than 1 inch.	RE-1 6/
1.510	When chipping has been selected as a residue disposal treatment, any evident chip piles should be visually subordinate to the characteristic landscape.	RE-1 6/
1.511	A desirable objective will be to dispose of all man-caused and disturbed residues larger than 3-inch diameter (large end). EXCEPTION: When statements 3.605, 3.805, or 3.806 apply, they shall govern.	RE-1 6/
1.512	A desirable objective will be to dispose of all man-caused and disturbed residues larger than 3-inch diameter (large end) which cannot be hidden.	RE-1 6/
1.513	Man-caused residue will be removed from the sight of trails, camps, or other frequently used areas. EXCEPTION: Felled trees or naturally down logs which require bucking and are too large to be moved with primitive equipment may be bucked for disposal of all material found within 8 feet horizontal distance from the point of use.	RE-1 6/
1.514	Treat man-caused and disturbed residues so that they are not evident. (Exact sizes and densities of material which can be left primarily depend on distance from observer, duration of view, type of screen. These call for judgment on a case-by case basis.)	RE-1 6/
1.515	Treat man-caused and disturbed residues so that they, in combination with other visual effects of the management activity, are visually subordinate to the characteristic landscape.	RE-1 6/

State-ment No.	Public Lands Statements	Documen-tation
1.516	Treat man-caused and disturbed residues so that they are visually subordinate to the rest of the scene resulting from the activity.	RE-1 6/
1.517	Cut stumps 12 inches or lower, and camouflage where necessary to meet foreground visual management objectives. EXCEPTIONS: When State law or other safety considerations must be met.	RE-1 6/
1.518	Evident soil disturbance will be avoided; and for any which does result from residue treatment, restoration will be promptly initiated through repairing and reseeding or replanting which provides for the disturbance to become inconspicuous.	RE-1 6/
1.519	Evident soil disturbance (such as high-contrast, small bare areas; low-contrast, large bare areas; eroding soil; and pushed-up soil) should remain subordinate to the characteristic landscape. Remedial treatments to achieve this requirement must be judged on a case-by-case basis.	RE-1 6/
1.520	Soil disturbance should remain visually subordinate to the rest of the scene resulting from the management activity. Remedial treatments to achieve this requirement must be judged on a case-by-case basis.	RE-1 6/
1.521	When any treatment is undertaken for meeting the objectives of disease control (statement 2.205), of fire management (statements 2.307, 2.308, and 2.309), of insect control (statements 2.402, 2.403, 2.405, 2.406, and 2.410), or of silviculture as a part of recreation management (statements 3.602, 3.603, 3.604, and 3.606), sufficient vegetation should be retained so that the form and texture at the edges of treated areas blend with adjoining, untreated areas. A further requirement of this statement is that any modification to the existing character in areas of treatment not be in evident contrast with nearby, untreated areas.	RE-1 6/ RE-3 RE-4
1.522	When fire is used as a residue treatment, there will be no evident burn scars (such as partly burned piles, charred logs, and scorched trees) by the next recreation use season.	RE-1 6/

State-ment No.	Public Lands Statements	Documen-tation
1.523	When fire is used as a residue treatment, burn scars (such as partly burned piles, charred logs, burned areas, and scorched trees) will be further treated so as to become inconspicuous by the second recreation use season.	RE-1 6/
1.524	When fire is used as a residue treatment, burn scars (such as blackened ground and scorched trees or vegetation) will be further treated so as to be visually subordinate to the characteristic landscape by the second recreation use season.	RE-1 6/
1.525	When fire is used as a treatment, burn scars (such as blackened ground and scorched trees or vegetation) will be further treated so as to be visually subordinate to the scene resulting from the management activity by the second recreation use season.	RE-1 6/
1.526	When fire is used to reduce fuel buildup or to achieve a specific ecological effect (e.g., meadow perpetuation), goals will include: a. No evident damage to overstory crowns. b. Visual impact of the fire to be subordinate to returning vegetation within 2 years. c. Visual impact of the fire control measures to be minimal and short lived.	RE-1 6/
1.527	The goal should be to complete work toward meeting the requirements of statements 1.502 through 1.525 according to the following: a. When man-caused residues are created before or during the recreation use season: Immediately, for areas classified as "Retention," within 1 month for areas classified as,"Partial Retention," within 1 year for areas classified as "Modification." b. When man-caused residues are created after the recreation use season: Before the next recreation use season for "Retention" and "Partial Retention" areas. c. For other than man-caused residues, or if a or b cannot be met for "Retention" and "Partial Retention" areas: Within 1 year. (EXCEPTION on p. 142.)	RE-1 6/

State-ment No.	Public Lands Statements	Documen-tation
	EXCEPTION: Where revegetation or greening up of vegetation is expected, a longer time period may be required.	
	SOILS	
1.701	Broadcast burning is not desirable when:	
	a. Soil organic matter is less than 3 percent (D, NUA), or	SO-3
	b. Soil depth is less than 24 inches (D, NUA), or	SO-4
	c. Soil fertility is low (D, NUA), and (EXCEPTION: When fertilizer is applied to proper specifications after burning)	SO-5
	d. Litter depth is less than 1 inch, and (EXCEPTION: In pure ponderosa pine and pure juniper stands of eastern Oregon and Washington)	SO-7
	e. Slope is greater than 60 percent (EXCEPTION: When no more-than 20 percent of duff layer will be destroyed).	so-9
1.702	Broadcast burning will be permitted within 100 feet of live streams provided statements 1.905 and 1.906 can be met.	so-10
1.703	Broadcast burning should be avoided on fine- or medium-textured soils where more than 20 percent of the area will have exposed mineral soil.	SO-3
1.704	Broadcast burning will not be permitted to burn the duff layer on coarse soils where the available soil moisture holding capacity is less than 2 inches per foot of depth.	so-2
1.705	Broadcast burning should be avoided when it will burn the duff layer and expose mineral soils on fine-textured soils.	SO-3
1.706	Broadcast burning should be avoided when it will expose mineral soil on more than 20 percent of the area on coarse-textured soils on south slopes where available soil moisture holding capacity is less than 2 inches per foot of depth (D, NUA).	SO-2 SO-6 SO-12

State-ment No.	Public Lands Statements	Documen-tation
1.707	Broadcast burning should be avoided when it will expose mineral soil on more than 20 percent of the area on coarse-textured soils.	SO-2
1.708	Broadcast burning should be avoided when it will expose mineral soil on more than 20 percent of the area on soils of any texture or on any slope where available soil moisture holding capacity is less than 2 inches per foot of depth (D, NUA).	SO-6
1.709	Broadcast burning should be avoided when it will expose mineral soil on more than 20 percent of the area on soils of any texture or on any slope where the exposure is southerly.	so-12
1.710	Broadcast burning should be avoided where soils are subject to frost heaving.	SO-13
1.711	Broadcast burning should be avoided on all coarse-textured soils.	SO-15
1.712	When fine- or medium-textured soils are present, crushing of residues will be avoided wherever soil moisture in the surface 6 inches exceeds 10 percent.	SO-1
1.713	When slope exceeds 30 percent, crushing of residues by other than systems suspended by cable will be avoided.	SO-8
1.714	On all soils and on all slopes, crushing of residues should be avoided where available soil moisture holding capacity is less than 2 inches per foot of depth.	SO-6
1.715	On all soils and on all slope gradients, crushing of residues should be avoided when it will result in soil shade cover on less than 25 percent of any southerly facing slope.	so-12
1.716	On coarse-textured soil, crushing of residues will be avoided.	SO-15
1.717	Piling of residues by tracked or wheeled equipment is not desirable when:	
	a. Soil organic matter is less than 3 percent (D, NUA), or	SO-3
	b. Soil depth is less than 24 inches (D, NUA), or	SO-4

State-ment No.	Public Lands Statements	Documen-tation
	c. Soil fertility is low (D, NUA), and	SO-5
	d. Litter depth is less than 1 inch, and	SO-7
	e. Slope is greater than 30 percent.	SO-8
	EXCEPTIONS: This statement does not apply to (a) fuel break construction (statements 2.305 and 2.307) or (b) road prisms. Also, machine piling of materials larger than 3 inches in diameter may be done when the soil is frozen and slopes are less than 30 percent.	
1.718	Piling of residues by tracked or wheeled equipment will be permitted within 100 feet of live streams provided statements 1.905 and 1.906 can be met.	SO-10
1.719	Piling by tracked or wheeled equipment should be avoided when soil texture is fine or medium, and when soil moisture in the surface 6 inches exceeds 10 percent.	SO-1
	EXCEPTION: This statement does not apply in road prisms.	
1.720	Piling by tracked or wheeled equipment should be avoided when soil texture is fine, and when soil moisture in the surface 6 inches exceeds 10 percent.	SO-1
	EXCEPTION: This statement does not apply in road prisms.	
1.721	Piling of residues by tracked or wheeled equipment which will result in soil shade cover of less than 25 percent should be avoided when soil texture is coarse, and when available soil moisture holding capacity is less than 2 inches per foot of depth.	SO-2 SO-6
	EXCEPTION: This statement does not apply in road prisms.	
1.722	Piling by tracked or wheeled equipment which will result in soil shade cover of less than 25 percent on southerly exposure should be avoided when soil texture is coarse.	SO-2 SO-12
	EXCEPTION: This statement does not apply in road prisms.	

State-ment No.	Public Lands Statements	Documen-tation
1.723	Piling by tracked or wheeled equipment which will expose more than 20 percent of the mineral soil should be avoided when soil texture is coarse.	SO-2
1.724	Piling by tracked or wheeled equipment should be avoided on all soils and on all slopes, when available soil moisture holding capacity is less than 2 inches per foot of depth (D, NUA).	SO-6
1.725	Piling by tracked or wheeled equipment which will result in less than 25-percent soil shade cover should be avoided on all soils and on all southerly exposed slopes.	so-12
1.726	Piling by tracked or wheeled equipment which will result in less than 25-percent soil shade cover should be avoided on all soils and on all slopes where the area is subject to frost heaving.	**SO-13**
1.727	Piling with tracked or wheeled equipment where the total soil displacement will exceed 15 percent of the area should be avoided on coarse-textured soils and on southerly exposures where available soil moisture holding capacity is less than 2 inches per foot of depth (D, NLJA). EXCEPTION: This statement does not apply in road prisms.	SO-2 so-12
1.728	Piling by tracked or wheeled equipment should be avoided on coarse-textured soils. EXCEPTION: This statement does not **apply** in road prisms.	so-15
1.729	Yarding of residues will be accomplished with at least one end of all turns suspended when (D, NUA): a. Soil texture is fine or medium and the soil moisture in the surface 6 inches exceeds 10 percent. b. Slope exceeds 60 percent. EXCEPTIONS: When ground is frozen, the suspension requirements do not apply. Also, in pure ponderosa pine stands of eastern Oregon, the suspension requirement may be waived when exposed mineral soil will not be more than 15 percent of the treated area for fine-textured soils, or not more than 20 percent for other soils. (For this purpose, soil exposure	SO-9

Statement No.	Public Lands Statements	Documentation
	is defined as displacement of litter, live plants, or rock and/or gravel mulch.)	
1.730	When the soil organic matter is less than 3 percent or when the soil fertility is low, yarding of residues will be limited to materials larger than 3 inches in diameter.	so-5
1.731	When soil texture is coarse, yarding of residues will be accomplished so as to minimize soil disturbance.	so-2
1.732	For all soil conditions, exposures, and slopes, yarding of residues will be accomplished so that soil shade cover on the treated area is not less than 25 percent (D, NUA).	so-12
1.733	For all soil conditions, exposures, and slopes where soils are subject to frost heaving, yarding of residues will be accomplished so that soil shade cover on the treated area is not less than 25 percent (D, NUA).	SO-13
1.734	On all soils and on all slopes when available soil moisture holding capacity is less than 2 inches per foot of depth, yarding of residues should be accomplished so as to minimize soil disturbance and should be limited to material larger than 3 inches in diameter and 5 feet long (D, NUA).	SO-6
1.735	On dunal sheet of coarse-textured soils, yarding of residues will be accomplished to avoid ground contact (D, NUA).	so-15
1.736	When litter depth is equal to or greater than 5 inches and where some surface scarification will be acceptable for reestablishing timber regeneration, ground contact yarding of residues may be used, providing no more than 30 percent of the mineral soil will be exposed.	SO-14
1.737	When soils are of medium or coarse texture, no yarding of residues in contact with the ground will be permitted to result in soil displacement on more than 15 percent of the treated area (D, NUA). EXCEPTION: Soils of basaltic origin.	SO-1 SO-2
1.738	On soil of any texture, on any exposure, and any slope, lopping and scattering of residues will be the preferred treatment, provided the resulting	SO-16

Statement No.	Public Lands Statements	Documentation
	fuel rating for the overall area does not exceed an "MM" [8/] rating, or as defined by land management agency standards; otherwise, preattack planning and fuel break installation will be accomplished per statements 2.306 and 2.307.	
	TERRESTRIAL HABITAT	
1.801	Forest soils which have been exposed by fire or machine should be reseeded while still loose and friable. The seed will consist of ground cover species appropriate to the site, animals benefited, or other proposed use of the land. EXCEPTIONS: This statement does not apply when statements 3.602, 3.603, 3.604, or 3.606 are applicable, or if the seeding would result in fuels exceeding the requirements of statements 2.308 or 2.309.	TE-1
1.802	Areas where slash is buried (see **2.202)** should have the topsoil replaced and be seeded to plants appropriate to the site and planned uses.	**TE-2**
1.803	As a site protection measure when machine piling for burning of residues in or near a stand of trees, soil should not be pushed into the pile. (See also statement **1.111** for similar air quality requirement covering all piled residues.)	TE-4
	WATER QUALITY AND AQUATIC HABITAT	
1.901	Stable residue (that which has become incorporated into streambanks and stream channels) will not be removed unless fish migration is blocked or channel erosion is occurring.	WA-1
1.902	Unstable residues will be removed from streams in a manner meeting requirements of statements 1.904, 1.905, and 1.906, where their presence will:	WA-2 WA-3

[8/] See FI-2 **(p.** 183) in chapter IV for definition of fuel type classifications and determination of equivalencies.

State-ment No.	Public Lands Statements	Documen-tation
	a. Increase frequency and/or magnitude of flush-out. b. Threaten damage to downstream uses and property.	
1.903	Man-caused residues should not be allowed to enter live streams. When such residues have entered live streams, statements 1.901 and 1.902 apply.	**WA-3** ~~WA-5~~ ~~WA-6~~ WA-7
1.904	Removal of residues from streams will be accomplished in the manner least damaging to streambanks and channels.	~~WA-4~~
1.905	When treating residues along live streams, a goal should be to leave in place sufficient living riparian vegetation to shade the water surface and thus prevent increases in stream temperature in excess of that permitted in Federal, State, and local water criteria contained in: Public Law (P.L.) 92-500, 1972, p. 60; Oregon Administration Rules **(OAR)** 41-005 to 41-070, 1970, p. **37;** Revised Code of Washington **(RCW)** 90.48, 1973, Sec. 2. EXCEPTION: In the case of seriously disease- or insect-infested stands of timber, the goal may be modified to avoid further deterioration of the affected watershed.[9/]	WA-8 ~~WA-9~~
1.906	Riparian residues, both live and dead, will not be treated in a manner which would result in:	WA-6 **WA-8**
	a. Levels of any introduced chemical exceeding established Federal, State, and local water quality criteria contained in: P.L. 92-500, 1972, p. 60; **OAR** 41-005 to 41-070, 1970, p. 37; **RCW** 90.48, 1973, Sec. 2.	**WA-10** WA-**11** **WA**-12 WA-13
	b. Exposure of streambank soils *to* erosion.	
	c. Deterioration of fish habitat.	

9/ Land Managers are cautioned that this exception may be at variance with existing laws on occasion. One such occasion is this specific exception.

List 2.000 - Public Lands Statements intended to protect or minimize forest damage from diseases, fire, and insects

This list contains statements numbered as follows:

2.201 - 2.206, Originating with Diseases Technical Panel

2.301 - 2.310, Originating with Fire Management Panel

2.401 - 2.411, Originating with Insects Panel

Statement No.	Public Lands Statements	Documentation
	DISEASES	
2.201	To reduce the incidence of root disease and decay in established trees, no more than 20 percent of timber stand shall be permitted to sustain bark penetrating wounds during residue treatment operations.	**DI-1**
2.202	To reduce the incidence of infection in a new or established timber stand, residues known to be colonized by root decay fungi such as *Armillaria mellea*, *Fomes annosus*, or *Poria weirii* shall not be buried or worked into the soil as a planned disposal practice.	DI-2
2.203	Freshly cut stumps of all coniferous species located within and immediately adjacent to developed recreation sites and tree seed orchards should be treated with powdered borax to prevent *Fomes annosus* infection.	DI-3
2.204	When underburning is used as a means of residue reduction in coniferous stands, care shall be taken to hold any cambial damage to less than 20 percent of the established trees.	DI-1
2.205	All living dwarf mistletoe-infected trees over 4 feet high remaining after final harvest cutting should be killed and the requirements of statement 2.203 met in areas where applicable.	**DI-4**
2.206	Before equipment is moved from a Port-Orford-cedar stand infested with *Phytophthora lateralis* to an uninfested stand, soil clumps on such equipment shall be removed by high pressure washing. No forest residue may be moved from an infested to an uninfested stand.	DI-5

State-ment No.	Public Lands Statements	Documen-tation
	FIRE	
2.301	In all categories of value-at-risk fire-planned areas, a goal will be to dispose of all man-caused residue concentrations (such as landings, portable-sawmill debris piles) and to modify the remainder of the area of the activity to a fuel hazard rating equivalent to, or lower than, an MM classification, or as otherwise defined by land management agency standards (D, NUA). EXCEPTION: In areas other than strategic locations identified in preattack planning, where statements are applied calling for treatments benefiting silviculture, soils, or wildlife habitat, these statements will override.	FI-1 FI-2 FI-3 FI-4 FI-5
2.302	In all high and medium value-at-risk fire-planned areas, a goal will be to exceed the **minimum** treatment set forth in 2.301 by at least returning the area to a fuel hazard rating no greater than that which existed before undertaking any activity, provided the prior rating was lower than MM, or as otherwise defined by land management agency standards (D, NUA).	FI-1 FI-6
2.303	In all high and medium value-at-risk fire-planned areas, residue treatment associated with any man-caused residues will include disposal of snags. EXCEPTION: In areas other than on and adjacent to strategic locations identified in preattack planning (see statement 2.306), statements 3.815 through 3.818 apply.	FI-1 FI-8
2.304	In high value-at-risk fire-planned areas, residues from precommercial thinning should be modified to a fuel hazard rating equivalent to, or lower than, an MM classification, or as otherwise defined by land management agency standards (D, NUA).	FI-1 FI-2 FI-3 FI-4 FI-5
2.305	In medium value-at-risk fire-planned areas, a goal will be to develop preattack plans which include installing and maintaining fuel breaks concurrently with precommercial thinning whenever the fuel hazard exceeds a rating of an MM classification, or as otherwise defined by land management agency standards.	FI-1 FI-5 FI-9 FI-10
2.306	A goal will be to develop fire preattack plans for all areas.	FI-9

Statement No.	Public Lands Statements	Documentation
2.307	In high and medium value-at-risk fire-planned areas, a goal will be to install and maintain shaded fuel breaks in strategic locations (such as along ridgetops and along suitable roads) as determined by fire preattack planning.	FI-1 FI-7 FI-9 FI-10 FI-12
2.308	In high value-at-risk fire-planned areas, a goal will be to reduce natural fuel hazard to a rating equivalent to or lower than an MM classification, or as otherwise defined by land management agency standards.	FI-1 FI-2 FI-3 FI-4 FI-5 FI-7
2.309	In medium or low value-at-risk fire-planned areas, where natural fuel hazards and fire risk are high in concentrated locations, a goal will be to reduce the fuel hazard of the concentrations to a rating equivalent to or lower than an MM classification, or as otherwise defined by land management agency standards (D, NUA).	FI-1 FI-2 FI-3 FI-4 FI-5 FI-7
2.310	Prescribed burning will be the preferred method of fuel hazard reduction, provided no more than 20 percent of established trees will sustain cambial damage (D, NUA).	FI-11
	INSECTS	
2.401	When an epidemic population of the Douglas-fir beetle is present, green Douglas-fir residue 8 inches or larger in diameter should be disposed of, or moved at least 35 feet from the nearest standing Douglas-fir, before the residue is attacked. Residue in selection-cut areas should have highest priority for treatment. If the residue becomes infested, it should be disposed of before the broods emerge (D, NUA).	IN-1
2.402	Whenever an epidemic spruce bark beetle population occurs in an Engelmann spruce stand and the area is accessible, infested merchantable trees should be removed within 1 year of infestation to prevent a beetle outbreak (D, NUA).	IN-2
2.403	All Pacific silver and subalpine fir trees, including advance reproduction, infested with balsam woolly aphid should be felled during cutting operations and/or destroyed during residue treatment.	IN-3

Statement No.	Public Lands Statements	Documentation
2.404	Whenever mountain pine beetles are present in the sugar pine forest type, any windthrown timber in accessible areas should be removed within 1 year of blowdown to prevent a beetle outbreak (D, NUA).	IN-4
2.405	When a mountain pine beetle outbreak occurs in an overmature (80-year-old) lodgepole pine stand, all infested trees as well as all noninfested trees should be removed before the new brood emerges. EXCEPTION: Merchantable noninfested trees needed for shelterwood and regeneration as prescribed by a silviculturist will not be removed.	IN-5
2.406	An accessible overstocked pole-size ponderosa pine stand should be thinned to reduce the basal area, improve tree vigor, and reduce susceptibility to mountain pine beetle attacks.	IN-6
2.407	Ponderosa pine residues infested with pine engraver beetle broods should not be piled against uncut timber.	IN-7
2.408	Precommercial thinning of ponderosa pine should be done in accord with the following: a. If done following overstory removal in the same stand, thinning should be delayed until after emergence of pine engraver beetle broods from the most recent logging slash. b. If there is an existing high hazard of tree-killing by the pine engraver beetle, thinning should not be done in the spring or summer.	IN-8
2.409	Where the western pine beetle is present, green ponderosa pine logging residue larger than 12 inches in diameter (large end) should not be left within 35 feet of standing pine trees.	IN-9
2.410	When western pine beetle is present in an accessible ponderosa pine stand, any infested windthrown or fire-injured trees should be removed before the broods emerge.	IN-10
2.411	To prevent a buildup of Douglas-fir beetle populations, fresh windthrow and fire-injured trees should be removed within a 12-month period. Shaded blowdown poses a greater hazard and should have the highest priority for treatment (D, NUA).	IN-1

List 3.000 - Public Lands Statements intended to enhance the forest environment through manipulative practices

This list contains statements numbered as follows:

3.601 - 3.608, Originating with Silviculture Technical Panel

3.804 - 3.818, Originating with Terrestrial Habitat Technical Panel 10/

Statement No.	Public Lands Statements	Documentation
	SILVICULTURE	
3.601	Forest residues created by a silvicultural operation should be treated so that crop trees are not damaged and the area is accessible for future harvest or silvicultural activities.	SI-1
3.602	When any timber harvest operation reduces the number of crop trees 11-inch d.b.h. or larger below 70 trees per acre and planting will be the method of reestablishing preferred timber species, the residue should be treated so that at least 350 planting spots and/or established seedlings or saplings are uniformly' distributed on each acre. EXCEPTION: That portion of any area needed to meet the requirements of statements 3.805 and 3.806, where applicable, is excluded from this requirement.	SI-1
3.603	When any timber harvest operation reduces the number of crop trees 11-inch d.b.h. or larger below 40 trees per acre and planting will be the method of reestablishing preferred timber species, the residue should be treated so that at least 190 planting spots and/or established seedlings or saplings are uniformly distributed on each acre. EXCEPTION: That portion of any area needed to meet the requirements of statements 3.805 and 3.806, where applicable, is excluded from this requirement.	SI-2

10/ Note that Terrestrial Habitat Technical Panel statements .801 through .803 have been made part of List 1.000.

Statement No.	Public Lands Statements	Documentation
3.604	When either natural or direct seeding is the method of restocking in stands where the number of trees 11-inch d.b.h. or larger is below minimum stocking level (see 3.602 or 3.603 for appropriate minimum stocking level), forest residues should be treated so that enough uniformly distributed mineral soil is exposed to achieve regeneration objectives. EXCEPTION: That portion of any area needed to meet the requirements of statements 3.805 and 3.806, where applicable, is excluded from this requirement.	SI-2
3.605	Where the number of trees 11-inch d.b.h. or larger is below minimum stocking (see 3.602 or 3.603 for appropriate minimum stocking level) after a harvest, 80-cubic-foot or larger residue pieces should be reduced to five or fewer pieces per acre. Smaller material shall be left in place to protect against temperature extremes and to retain soil moisture, provided the requirements of statements 3.602 through 3.604 are also met (D, NUA). EXCEPTIONS: Strategic locations identified by preattack planning are specifically excluded from applicability of this statement. Where statement 3.607 applies, it shall govern.	SI-2 SI-3
3.606	Live residues competing with crop trees should be controlled as follows: a. During the first 5 years after establishment of crop trees, brush species should be controlled as needed before loss of dominance by the crop trees and as needed before there is a marked effect on sunlight and/or available soil moisture necessary for crop-tree survival. b. After the first 5 years, competing live residues should be controlled whenever the height of the competition exceeds two-thirds of crop tree height. EXCEPTIONS: That portion of any area needed to meet the requirements of statements 3.805 and 3.806, where applicable, is excluded from this requirement. When statement 3.812 applies, it shall govern unless statement 3.607 also applies, in which case statement 3.607 takes precedence.	**SI-4**

State-ment No.	Public Lands Statements	Documen-tation
3.607	Forest residues that encourage buildup of animal populations which will prevent establishment and growth of an adequate number of crop trees should be treated.	**SI-5**
3.608	Forest residues should be treated so that prescribed fire can be used to control invading vegetation which will reduce growth rate by at least 20 percent and to prepare seed bed for natural or direct seeding.	**SI-6**
	TERRESTRIAL HABITAT	
3.804	When broadcast burning is used for residue reduction, at least 50 percent of the area should be burned.	**TE-3**
3.805	When unmerchantable material is yarded in lieu of other treatments on clearcuts used by wildlife, 10 percent of the area should be left suitable for big game cover. (Suitable big game cover in large clearcuts is defined for this purpose as undisturbed residue in an area of at least 5,000 square feet and measuring **3-6** feet high over 70 percent of the area.) Such areas should be distributed throughout the clearcut, preferably placed on locations of low productivity and/or which are inoperable or marginal for tracked or wheeled equipment. **EXCEPTIONS:** Strategic locations identified by pre-attack planning are specifically excluded from applicability of this statement. Also, if meeting this statement will interfere with crop tree establishment or growth, statement **3.607** will apply.	**TE-5**
3.806	When residue is treated on slopes of less than 30 percent to enhance domestic livestock and big game habitat, 10 percent of the area will remain suitable for big game cover. When treatment of residue is not otherwise required, such areas should receive treatment so that at least **75** percent of the area not in game cover is left in a condition that will facilitate movement of animals. (Suitable big game cover is defined for this purpose the same as in statement **3.805,** except that in partially cut timber stands an equivalency thereto may be determined on the ground from a combination of uncut timber, undisturbed understory vegetation, and residues to be piled.) **(EXCEPTIONS** on p. 156.)	**TE-6** **TE-9**

Statement No.	Public Lands Statements	Documentation
	EXCEPTIONS: Strategic locations identified by preattack planning are specifically excluded from applicability of this statement. Also, if meeting this statement will interfere with crop tree establishment or growth, statement 3.607 will apply.	
3.807	On designated crucial winter ranges in forested areas with bitterbrush, residue will be treated so that at least 90 percent of the bitterbrush plants survive. (Survive means that plants remain alive and have the ability to sprout the following year.)	TE-7
3.808	In the lodgepole-bitterbrush community, at least 50 percent of the original bitterbrush plants must survive logging and residue treatment. (Survive means that plants remain alive and have the ability to sprout the following year.)	TE-8
3.809	On designated livestock and big game trails and along all fence lines, 100 percent of all logging and/or land clearing residue larger than 3-inch diameter will be removed and the remaining material will not exceed 6-inch depth.	TE-9
3.810	When removing encroaching trees for preservation of large huckleberry fields, three to five fir or hemlock trees per acre will be retained.	TE-10
3.811	On clearcuts where temporary huckleberry production is proposed, logs larger than 20-inch diameter and 20-foot length will be removed and the area broadcast burned.	TE-11
3.812	Where silvicultural planning calls for chemical or other control of 10-acre or larger brushfields important for wildlife habitat, not more than one-half of each area should be treated in any 5-year period. If a brushfield exceeds 100 acres, treatment will be discontinuous throughout the area. EXCEPTIONS: Strategic locations identified by preattack planning are specifically excluded from applicability of this statement. Also, if meeting this statement will seriously interfere with crop tree establishment or growth, statement 3.607 will apply.	TE-12
3.813	Where forest residue is chipped, depth of chips in areas expected to grow vegetation shall not exceed 1 inch.	TE-13

State-ment No.	Public Lands Statements	Documen-tation
3.814	When residues are windrowed, breaks will be provided for passage of big game animals and/or livestock whenever windrows cross a natural route of travel. Breaks will be about 10 feet wide and at intervals of not more than 200 feet.	TE-14
3.815	Where there are snags in partial cut areas, an average of two snags per acre should be left.11/ Unmerchantable snags that pose a serious fire or safety hazard will be removed. EXCEPTION: This statement is specifically excluded from application to areas on and adjacent to strategic locations identified in preattack planning (see statements 2.303 and 2.306).	TE-15
3.816	Where cull trees in the dominant crown position are found in partial cut areas and bird habitat requirements need to be met, at least one but preferably two to five cull trees should be left per acre. EXCEPTION: In areas on and adjacent to strategic locations identified in preattack planning, cull trees to be left will exclude those judged likely to become snags or snag tops during the interval before the next cutting cycle (see statements 2.303 and 2.306).	TE-15 TE-16
3.817	When possible, at least one stub per acre, less than 12 feet high, will be left in clearcut areas. EXCEPTION: This statement is Specifically excluded from application to areas on and adjacent to strategic locations identified in preattack planning (see statements 2.303 and 2.306).	TE-15
3.818	Snags should be left in groups of two to five or more per acre within leave strips bordering clearcut areas. EXCEPTION: This statement is specifically excluded from application to areas on and adjacent to strategic locations identified in preattack planning (see statements 2.303 and 2.306).	TE-15

11/ Land managers are cautioned that there are safety laws and other laws relative to this statement.

PRIVATE **LANDS** GUIDELINES

Objectives and Goals for Private Lands

Nearly all forest land owners regard proper land management as a responsibility to society. Wood and wood-fiber building materials and other products from private forest lands contribute significantly to the comfort and well-being of mankind and will gain in importance as social and economic costs of substitute materials continue to escalate. In developing guidelines for private lands, the Private Lands Management Decisions Panel recognized a need to maintain a realistic balance between all of man's needs.

Private property rights and resource ownership have been and are important factors in the economic development and strengths of the United States.[12/] This pride of ownership and the income derived from forest resource uses and manufacturing products have provided key incentives to improve forestry. Benefits from forest land can accrue to private owners only as incomes exceed costs. Esthetic benefits and opportunities for recreation are achieved on private land as byproducts. Uneconomic residue treatments over and beyond that necessary for hazard reduction and site preparation can thus have little need or intrinsic value in management of private land except where public good will is involved. Tree farmers believe that the presence of all stages of a productive vigorous forest on their properties, including the small part of the dynamic natural mosaic that is being harvested, is both necessary and pleasing to see on working tree farms.

Private forest land ownership encompasses a large number of individuals and corporations with land holdings of many different sizes. Quite obviously, management objectives will vary with different ownerships. Private forest land holdings may be as little as 5 acres or as large as hundreds of thousands of acres. Management objectives may vary from retention for esthetic reasons to commercial timber production. Ownership may vary from absentee individual owners to large corporations with well-equipped forestry staffs. Such a diversity of owners and objectives also reflects a difference in physical and financial capabilities to carry out prescribed forest practices.

Any guideline statements written for forest residue reduction on these lands must take into account this diversity of ownerships, ob'jectives, and capabilities through flexibility. In some instances, financial incentives for accomplishing certain stated goals are necessary, Some guidelines must, of necessity, be simply stated as worthy goals to be attained if they are within the landowner's objectives and capabilities. On the other hand, some should be stated as minimum requirements necessary to insure the shared responsibility for protection of contiguous lands, flow-through streams, ambient air quality, and fish and wildlife. The Panel members believed, however, that hard and fast rules that go beyond achieving these specific purposes, and that interfere with the landowner's right to manage and use his property in accordance with his objectives, would not be workable. They also recognized that loss of private

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12/ See also the discussion of private property and its relation to the doctrine of natural rights, FI-14 (p. 196) of chapter IV.

property rights must often be compensated for and that any undue requirements placed on private lands for the public benefit should thus be more appropriately paid for by the public.

The evolution of Forest Practices Acts within the States of Oregon and Washington and the development of self-regulating forest practice rules by committees of private forest land owners are a matter of special pride. They are also evidence of a high level of cooperation that exists between these individual or corporate owners and the public regulatory agencies, progressing steadily forward since the late 1930's. It was then that better economic stability and a diminished danger of loss from fire provided a solid basis for planned reforestation.[12/]

The Private Lands Management Decisions Panel has carefully considered many technical recommendations for forest residue reduction within the brief time and resources available to it. It has accepted many of the technical recommendations as generally desirable, yet has found it necessary to reject others as going beyond the necessary environmental objectives for private lands, and as interfering with the flexibility of management needed for these lands. This chapter reflects the desire of Panel members to press forward in achieving retention of ecological and environmental integrity on forest lands in the Pacific Northwest.

Private Lands Guideline Lists

List 1.000 - Private Lands Statements intended to protect the environmental elements--air, soil, water quality, and esthetics

This list contains statements numbered as follows:

1.151 - 1.163, Originating with Air Quality Technical Panel

1.551, Originating with Recreation Technical Panel

1.751 - 1.778, Originating with Soils Technical Panel

1.851, Originating with Terrestrial Habitat Technical Panel[13/]

1.951 - 1.956, Originating with Water Quality and Aquatic Habitat Technical Panel

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[13/] This statement is closely allied with soils and is thus included in List 1.000. Other statements originating with this Panel are found in List 3.000.

Statement No.	Private Lands Statements	Documentation
	AIR QUALITY	
1.151	Whenever it has been determined that overall environmental quality is best served by providing some kind of fire treatment of forest residues, such burning will be done in conformity with the smoke management plan specified by State law (see proposed Model Smoke Management Plan in appendix 2).	AI-13
1.152	Within a land management administrative unit or subunit, the land manager should determine the annual average number of available burning days and use this determination in establishing burning priorities and objectives that are within the unit's capability to meet air quality standards.	AI-1
1.153	When burning can be accomplished without visible or otherwise objectionable emissions (such as with use of air curtain type equipment), compliance with the smoke management plan is assumed.	AI-12
1.154	Concentrations of forest residues threatening to result in a smoke episode from wildfire are candidates for treatment by burning. When analysis shows the threat to a smoke-sensitive area from a wildfire is a greater potential nuisance than would be the smoke from the burning operation, burning may be undertaken.	AI-10 FI-12
1.155	A firing sequence must be designed to achieve maximum rate of energy output where a strong convection column is needed for smoke dispersal at high levels.	AI-11
1.156	Piles or windrows must be mopped up when burning objectives have been met.	AI-7
1.157	Piles or windrows should be made sufficiently large, consistent with safety considerations, to afford complete combustion within the constraints of piling method, machinery, and surrounding stand.	AI-8
1.158	If broadcast burning is the prescribed treatment for clearcut residue control, fuels 4 inches and under should readily ignite and support rapid spread. In meeting this requirement, fuel moisture sticks may be used to indicate favorable fuel condition.	AI-9
1.159	When treatment is to be by burning and smoke from any burning operation may interfere with vehicular traffic, the person responsible for the job will	AI-2

Statement No.	Private Lands Statements	Documentation
	provide flagmen, signs, and other measures acceptable to local traffic safety law enforcement agencies.	
1.160	When smoke from any burning operation may interfere with airport operations, the administrator of the smoke management plan should notify the Federal Aviation Administration and the airport manager as far in advance of burning as possible.	AI-3
1.161	Where residues are to be burned in piles or windrows, such must be sufficiently free of dirt and be compact enough to achieve a fire sufficiently hot to meet smoke management objectives.	AI-4
1.162	Chunking-in, if required, should be done at intervals sufficient to maintain a hot fire.	AI-6
1.163	When no alternative to burning is available, residue may be left if, in the judgment of the land manager, the risk of a wildfire smoke episode is acceptably low.	AI-10
	RECREATION	
1.551	Where the forest land manager has determined that scenic values will be given special consideration (as in roadside strips or where public use is encouraged), objectionable forest residues should be modified in a manner which will minimize the time required to revegetate the area and enhance its appearance.	RE-2
	SOILS	
1.751	Broadcast burning is not desirable when:	
	a. Soil organic matter is less than 3 percent, or	SO-3
	b. Soil depth is less than 24 inches, or	SO-4
	c. Soil fertility is low.	SO-5
	EXCEPTION: When fertility alone limits broadcast burning, alternatives may be either to burn and then apply fertilizer to upgrade fertility or to burn and accept a temporary lessening of timber growth as a trade off for protection against fire, insects, and disease.	

State-ment No.	Private Lands Statements	Documen-tation
1.752	Broadcast burning is generally not advisable when litter depth is less than I inch. EXCEPTION: In pure ponderosa pine and pure juniper stands of eastern Oregon and Washington.	SO-7
1.753	Broadcast burning should be used on slopes greater than 60 percent only where necessary to abate an extreme fire hazard or to accomplish a silvicultural objective. In all cases, care must be taken to insure that the humus layer is not destroyed by a fire hotter than necessary.	SO-9 FI-11 FI-12 SI-6
1.754	Broadcast burning is permitted on fine- and medium-textured soils providing the duff layer is not destroyed.	SO-1
1.755	Broadcast burning should be done with reasonable precautions taken to protect the duff layer on coarse soils where the available soil moisture holding capacity is less than 2 inches per foot of depth.	SO-2
1.756	Broadcast burning should be done with reasonable precautions taken to protect the duff layer on fine-textured soils.	SO-1
1.757	When broadcast burning is done, reasonable precautions should be taken to protect the duff layer on south slopes where soil texture is coarse and available soil moisture holding capacity is less than 2 inches per foot of depth.	SO-2 SO-6 SO-11 SO-12
1.758	Broadcast burning should be done with reasonable precautions taken to protect the duff layer where the soil texture is coarse.	SO-2 SO-11
1.759	Broadcast burning should be performed in a manner that will not destroy the duff layer on soils of any texture or on any slope where the soil moisture holding capacity is less than 2 inches per foot of depth.	SO-6 SO-11
1.760	Broadcast burning should be done only when reasonable precautions are taken to protect the duff layer on soils of any texture and on any slope where the exposure is southerly.	SO-11 SO-12
1.761	Broadcast burning is not recommended at high elevations where soils are subject to frost heaving.	SO-13

State-ment No.	Private Lands Statement	Documen-tation
1.762	Lopping and scattering shall be the preferred method of treatment on coarse-textured soils. EXCEPTION: When in conflict, the State requirements shall govern.	so-15
1.763	When fine- or medium-textured soils are wet, it is good practice to avoid crushing of residues (i.e., moisture exceeds 10 percent in the top 6 inches).	SO-1
1.764	When the slope exceeds 30 percent, crushing of residues by other than systems suspended by cable should be avoided.	SO-8
1.765	On any slope or on soil of any texture, and where crushing is the only available alternative for residue treatment, no less than a 25-percent soil shade cover should be left where the available soil moisture holding capacity is less than 2 inches per foot of depth.	SO-6
1.766	On any slope or on soil of any texture, crushing of residues will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment.	so-12 SI-3
1.767	Machine-piling of residues is acceptable provided material of less than 3 inches in diameter is left on the ground when:	
	a. Soil organic matter is less than 3 percent.	SO-3
	b. Soil depth is less than 24 inches.	SO-4
	c. Soil fertility is low.	so-5
	d. Litter depth is less than 1 inch.	SO-7
1.768	Machine-piling of residues on slopes of over 35 percent should be discouraged except where such operation can be performed without permanent or long lasting soil damage. EXCEPTION: In the Siskiyou Province (Province 03), 30 percent should be the maximum in this statement.	SO-8
1.769	When soil texture is fine or medium, and when available soil moisture in the surface 6 inches exceeds 10 percent, machine-piling of residues should be avoided. (EXCEPTIONS on p. 164.)	SO-1

State-ment No.	Private Lands Statements	Documen-tation
	EXCEPTIONS:	
	a. Road rights-of-way.	
	b. Equipment exerting less than 3½ pounds per square inch of bearing surface.	
1.770	When soil texture is fine and when soil moisture in the surface 6 inches exceeds 10 percent, machine-piling of residues should be avoided to prevent compaction of soil.	SO-1
	EXCEPTIONS:	
	a. Road rights-of-way	
	b. Equipment exerting less than 3½ pounds per square inch of bearing surface.	
1.771	When soil texture is coarse and when soil moisture holding capacity is less than 2 inches per foot of depth, machine-piling of residues will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment.	SO-2 SO-6
1.772	When soil texture is coarse, machine-piling of residues will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment on southerly exposures.	SO-2 SO-12
1.773	When soil texture is coarse, machine-piling should not remove the duff layer.	SO-2
1.774	On all soils and on all slopes, when available soil moisture holding capacity is less than 2 inches per foot of depth, machine-piling of residues will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment.	SO-6
1.775	On all soils and on all southerly exposed slopes, machine-piling will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment.	SO-12
1.776	At high elevations and on all soils and all slopes where the area is subject to frost heaving, machine-piling of residues will be permitted provided sufficient soil shade cover is maintained for successful seedling establishment.	SO-13

State-ment No.	Private Lands Statements,	Documen-tation
1.777	On coarse-textured soils and on southerly exposures where available soil moisture holding capacity is less than 2 inches per foot of depth, machine-piling of residues is not desirable where the total soil displacement from all treatments will exceed 15 percent of the area.	so-2 SO-12
1.778	On soil of any texture, on any exposure and any slope, lopping and scattering is the preferred method of treating forest residues unless otherwise specifically excluded by preceding statements.	SO-16
	TERRESTRIAL HABITAT	
1.851	As a site protection measure when machine-piling for burning of residues in or near a stand of trees, care should be taken to minimize soil being pushed into the piles of debris. (See statement 1.161, for similar air quality requirement covering all piled residues.)	**TE-4**
	WATER QUALITY AND AQUATIC HABITAT	
1.951	Generally, stable residue (that which has become incorporated into streambanks and stream channels) should not be removed unless fish migration is blocked or channel erosion is occurring and then only if approval for the removal is secured from the State fishery agency.	**WA-1**
1.952	Man-caused residues will not be allowed to remain in perennial streams, provided their removal is in compliance with State law and their removal will not damage streambanks and channels, when their presence will result in: a. Streambank erosion before, during, or after stream clearance operations. b. Reduction of surface dissolved oxygen levels below that required by State law. c. Deposition of quantities of fine debris on the streambed which will decrease dissolved oxygen levels or reduce waterflow in the subgravel environment below levels required by State law.	**WA-3** **WA-4** **WA-5** **WA-6** **WA-7**

State-ment No.	Private Lands Statements	Documen-tation
1.953	When residues are treated along perennial streams, sufficient live riparian residues (streambank shrubs and trees) providing shade to the water surface should be left in place to prevent unacceptable increases in stream temperature, except as permitted in established Federal and State water quality criteria contained in Public Law 92-500, 1972, p. 60; Oregon Administration Rules (OAR) 41-005 to 41-070, 1970, p. 37; Revised Code of Washington (RCW) 90.48, 1973, Sec. 2.	WA-8
1.954	Riparian residues, live and dead, will not be treated in any manner which will result in:	WA-4 WA-5 WA-6 WA-8 WA-10 WA-12 WA-13
	a. Levels of any introduced 'chemical exceeding established Federal and State water quality criteria contained in Public Law 92-500, 1972, p. 60; OAR 41-005 to 41-070, 1970, p. 37; RCW 90.48, 1973, Sec. 2.	
	b. Deterioration of streamside environment below levels adequate to support native, resident fish. (See also statement 2.355.)	
1.955	When prescribed fire is used for removal of residues from side slopes, the following principles should be recognized to minimize addition of sediment and chemicals to water:	WA-10
	a. Broadcast burning on steep topography may result in increased bare soil and accelerate natural downslope movement of soil particles.	
	b. Intensity of fire can be controlled so that not more than 10 percent of an area is burned to the mineral soil. Excessively steep slopes over 80 percent should not be burned.	
	c. Controlled broadcast burning of residues on a steep, 100-percent logged watershed can increase the concentration of some chemicals above water quality standards for brief periods and in local areas.	
1.956	Dissolved chemicals in streams are expected to increase in proportion to the amount of drainage burned. In this context, it must be recognized that when water from treated areas joins water from untreated areas of a watershed, dilution may be expected to reduce dissolved chemical amounts to within established water quality standards.	WA-10

List 2.000 - Private Lands Statements intended to protect or minimize damage to the forest from diseases, fire, and insects

This list contains statements numbered as follows:

2.251 - 2.252, Originating with Diseases Technical Panel

2.351 - 2.357, Originating with Fire Management Panel

2.451 - 2.457, Originating with Insects Panel

Statement No.	Private Lands Statements	Documentation
	DISEASES	
2.251	It is a desirable practice after harvesting to kill all dwarf mistletoe-infected residual trees over 4 feet high.	DI-4
2.252	Before equipment is moved from a Port-Orford-cedar stand infested with *Phytophthora lateralis* to an uninfested stand, soil clumps on such equipment should be removed by high pressure washing. No forest residue should be moved from an infested to an uninfested stand.	DI-5
	FIRE	
2.351	The use of prescribed fire is to be encouraged for fuel hazard reduction and silviculture whenever it is not specifically excluded by other private lands statements.	FI-11 FI-12 SI-6
2.352	The land manager should work with the appropriate protection organization to evaluate each area of land in terms of its threat to and from adjoining lands as a basis for determining the appropriate degree of fuel hazard reduction.	FI-14
2.353	Prefire planning is desirable as a vital preparedness measure undertaken cooperatively with the appropriate protective organization.	FI-9 FI-14
2.354	Fire risk and values at stake should be evaluated by individual owners or by contiguous owners working together. Potential losses due to fire can be mitigated by closures to public entry during periods of high fire danger.	FI-13 FI-14

Statement No.	Private Lands Statements	Documentation
2.355	When fire risk is sufficiently high and when closures to public entry will not adequately mitigate the potential for losses due to fire, individual owners or contiguous owners working together with the appropriate protection organization, and in accordance with existing State regulation, should modify fuel concentrations and take such other measures as appropriate to reduce the hazard.	FI-1 FI-2 FI-3 FI-4 FI-12 FI-14
2.356	Snags should be removed in conformance with the land manager's objectives and State forest law.	FI-8
2.357	The trade off of holding fuel hazard buildup to acceptable levels must be an element of determination when evaluating the use of forest chemicals to prevent tree mortality from insect or disease epidemic along with the requirements of Statement 1.954.	FI-1 FI-2 FI-3 FI-4 FI-8 WA-10
	INSECTS	
2.451	Where an epidemic Douglas-fir beetle population is present and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, green infested Douglas-fir residue 8 inches and larger in diameter should be disposed of or moved at least 35 feet from the nearest residual Douglas-fir before broods emerge.	IN-1 IN-11
2.452	Where an epidemic spruce bark beetle population is present and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, action should be taken to remove the merchantable stemwood and infested trees within the first full operating season to prevent further beetle outbreak.	IN-2
2.453	In areas of Pacific silver and subalpine firs where there is an infestation of balsam woolly aphid and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, all infested trees, including advance reproduction, should be felled during cutting operations and disposed of during residue treatment.	IN-3 IN-11

Statement No.	Private Lands Statements	Documentation
2.454	When an epidemic mountain pine beetle population is present and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, action should be taken to remove merchantable windthrow within 1 year after the blowdown to prevent a beetle outbreak.	IN-4 IN-11
2.455	When a mountain pine beetle outbreak occurs in an overmature (80- to 100-year-old) lodgepole pine stand and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, all infested trees as well as all noninfested merchantable trees should be removed before the new brood emerges. EXCEPTION: Merchantable noninfested trees needed for shelterwood and regeneration as prescribed by a silviculturist may be allowed to remain.	IN-5
2.456	It is desirable that overstocked ponderosa pine pole-size stands be thinned to reduce the basal area to improve tree vigor and reduce susceptibility to mountain pine beetle attacks, provided an economic market is available.	IN-6
2.457	Where an epidemic western pine beetle population is present and when the State Forester declares a zone of epidemic insect infestation for which public funds are available to undertake control as a benefit to all forests, green logging residue larger than 12 inches in diameter should not be left within 35 feet of remaining pine trees larger than 20-inch d.b.h.	IN-9

List 3.000 - Private Lands Statements intended to enhance the forest environment through manipulative practices

This list contains statements numbered as follows:

3.651 - 3.659, Originating with Silviculture Technical, Panel

3.852 - 3.854, Originating with Terrestrial Habitat Technical Panel 14/

Statement No.	Private Lands Statements	Documentation
	SILVICULTURE	
3.651	Forest residues will be treated, rearranged, or disposed of in such a manner that adequate regeneration may be accomplished and in accordance with the minimum requirements of the State Forest Practices Act.	SI-1 SI-2 SI-3
3.652	When the number of trees 11-inch d.b.h. or larger is below minimum stocking level and when seeding is to be practiced or natural regeneration will be the means of restocking, forest residues should be treated so that enough uniformly distributed mineral soil is exposed to achieve regeneration objectives of State Forest Practices Act.	SI-2
3.653	To the degree that regeneration is not inhibited and an unacceptable fire hazard created, smaller material may be left in place to protect against temperature extremes, to retain soil moisture, to stabilize soil movement, to provide nutrients, and to reduce the establishment of competing vegetative cover. EXCEPTION: Where such material may be within a flood plain and may subsequently enter live streams, it should not be left.	SI-2 SI-3
3.654	Live residues competing with crop trees should be controlled: a. During the first 5 years after establishment of crop trees, brush species will be controlled as needed before loss of dominance by the crop trees and as needed before there is a marked effect on sunlight and/or available soil moisture necessary for crop-tree survival and establishment.	SI-4

14/ Note that Terrestrial Habitat Technical Panel Statement .851 was made part of List 1.000.

Statement No.	Private Lands Statements	Documentation
	b. When it appears that live residues will inhibit the establishment and/or development of a forest crop, such residues should be controlled.	
3.655	Forest residues should be treated where they encourage animal populations which will prevent establishment and growth of an adequate number of crop trees.	**SI-5**
3.656	When prescribed fire is to be used for future control of invading vegetation, including conifer trees which would significantly reduce the growth of crop trees, or for seed bed preparation for natural or direct seeding, forest residues should first be reduced or rearranged to the point that residual crop trees will not suffer fire damage.	**SI-6**
3.657	Where forest residues are to be treated or rearranged after precommercial thinning to accomplish fire management objectives, the residues should be arranged so that residual trees are not damaged and are accessible for future harvest.	**DI-1** SI-1
3.658	Sufficient residue should be retained to provide nutrients, conserve soil moisture, and reduce establishment of competing vegetation.	**SI-3** SO-5
3.659	Where slopes exceed 50 percent, sufficient amounts of dead residue and/or uniformly distributed live residue should be left to reduce soil movement that prevents seedling establishment.	SI-3 SO-8
	TERRESTRIAL HABITAT	
3.852	On designated crucial winter ranges used by big game and/or domestic livestock in forested areas with bitterbrush, residue will be treated so that 90 percent of the bitterbrush plants survive logging and residue disposal. (Survive means that plants may be damaged but remain alive above ground and have the ability to sprout, producing new growth the following year.) **(D,** NUA)	TE-7
3.853	At least 50 percent of the original bitterbrush plants must survive logging and residue disposal in the lodgepole-bitterbrush community. (Survive means that plants may be damaged but remain alive above ground and have the ability to sprout, producing new growth the following year.) (D, **NUA)**	TE-8

State-ment No.	Private Lands Statements	Documen-tation
3.854	When residues are windrowed, breaks should be provided to afford passage of big game animals and/or livestock whenever windrows will cross a natural route of travel to water and at intervals of not more than 200 feet. Breaks will be about 10 feet wide.	TE-14

LITERATURE CITED

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1972. United States Government organization manual 1972/73. Natl. Arch. & Rec. Serv., Gen. Serv. Adm. 809 p.

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1908. The use book--regulations and instructions for the use of the National Forests. 341 p. Washington, D.C.

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[n.d.] Departmental manual. Olympia, Wash.

Chapter IV. Documentation

The purposes of this chapter are to: (1) provide land managers with additional information and "rules-of-thumb" which may make application of the guideline statements easier, and in some cases, more meaningful; (2) help policymakers evaluate the basis for guideline statements; (3) identify the basis for guidelines--either documented research or consensus of specialists--so that it may be compared with conflicting or later information; and (4) help persons responsible for assigning research and development priorities.

Skeleton discussions and some literature citations were initially supplied by each Technical Panel as documentation for its recommended guideline statements. In some cases, only simple editing has been done to the materials supplied. In other cases, the compilers have interpreted and made reference to sources not available to the Technical Panels in the short time they had to do their work. Several completely new documenting statements were added by the compilers. Some of these were necessary where Land Management Decision Panels extensively modified or added to a guideline statement to resolve conflicts; others were called for as a result of the further literature review made by the compilers. Thus, although the entire compilation has been reviewed technically subsequent to compilation, the final responsibility for proper documentary interpretation rests with the compilers.

Following is an index to the guideline supporting information. Each item is identified with a prefix and number. These correspond to those shown in the DOCUMENTATION column of guideline statements in Chapter III. The prefix identifies the originating Technical Panel:

Prefix	Technical Panel
AI	Air Quality Panel
DI	Diseases Panel
FI	Fire Management Panel
IN	Insects Panel
RE	Recreation Panel
SI	Silviculture Panel
SO	Soils Panel
TE	Terrestrial Habitat Panel
WA	Water Quality and Aquatic Habitat Panel

AI--AIR QUALITY GUIDELINES SUPPORTING INFORMATION

AI-1 Need for Local Climatologies

There is a seeming tendency to plan for more disposal of residues by burning than can be accommodated under manpower and related constraints in the average yearly total number of days when conditions are favorable for both burning and proper smoke dispersal. A climatological basis is needed to indicate the probable number of days annually when favorable burning and smoke dispersion conditions may be expected for different types of burning on different administrative units. A method of accomplishing this has been demonstrated (Cramer and Westwood 1970) which should be adapted to local situations in each land management administrative unit.

AI-2 Vehicular Traffic Hazard

Traffic congestion and accidents have occurred when smoke from prescribed burning obscured visibility on highways and on forest roads. In this situation, smoke is an important safety hazard. The consensus of the Air Quality Panel is that local traffic law enforcement agencies should be consulted when such incidents may occur.

AI-3 Air Traffic Hazard

Although interference with air traffic by smoke from prescribed burning is not known to the Air Quality Panel, it is desirable to provide for the possibility, Smoke from wildfires has caused such problems. Advance notification (for emergency procedure planning and for aviation advisories) could be needed by both airport managers and the Federal Aviation Authority.

AI-4 Avoidance of Prolonged Smoldering

When piles of slash include soil, prolonged smoldering may be expected (Cramer 1974, p. F-13). Combustion will occur at a maximum rate when fuel arrangement is sufficiently compact to provide optimum heat exchange between fuel particles while providing for adequate ventilation (Martin and Brackebusch 1974, p. G-6; Cramer 1974, p. F-13). Moist fuels will reduce fire intensity and produce more smoke (Cramer 1974, p. F-11 and F-32).

AI-5 More Complete Combustion from Splitting Stumps

Drying and ignition occur more rapidly as the ratio of surface area to volume increases (Martin and Brackebusch 1974, p. G-5). Therefore, for more complete combustion, large residues such as stumps and rootwads should be broken into smaller pieces. By Air Quality Panel consensus, it is desirable to require splitting of stumps with top diameters over 24 inches.

AI-6 Avoidance of Low Energy Fire

When piles are chunked in, the full-fire stage may be prolonged, reducing the smoke which can be expected from low energy fire (Cramer 1374, p. F-14).

AI-7 Need for Mopup

During the final stage of burning when the fire is of low energy, smoke may accumulate and drift at fire elevation (Cramer 1974, p. F-14).

AI-8 Reason for Larger Piles

Larger piles (or windrows) have less edge-effect, and thus, less incomplete combustion (Cramer 1974, p. F-14). Greater smoke dispersal is achieved by the hottest fire with the strongest convection column (or more efficient "chimney") (Cramer 1974, p. F-16).

AI-9 Flammability and Fuel Moisture

Damp fuels produce more dense smoke (Cramer 1974, p. F-32) and do not carry fire well. By Air Quality Panel consensus, 4-inch diameter (small end) and smaller fuels should ignite and burn readily to meet the 3-inch size specified by Fire Management Panel (see FI-3, p. 184) as desirable to be removed. Tables by Morris (1966) relate fuel moisture stick values to fuel moisture favorable for prescription burning.

AI-10 Smoke Episode Risk as a Basis for Use of Prescribed Fire

The recurrence of fire of natural origin is fairly well established for most northwestern forest types (Martin and Brackebusch 1974, p. G-3; Cramer 1974, p. F-6 to F-8). Fire, then, has played natural roles in the shaping of our forests. These natural functions of fire in unprotected forests include periodically removing dead fuel accumulation on the forest floor, limiting the density of reproduction, providing seed bed, and in some cases, killing all vegetation to start new cycles of growth. In other cases, natural fire destroys only part of the vegetation, including ground cover or overstory timber (either as individual trees or as groups of trees). Forest management imitates these roles by substituting prescribed fire **or** mechanical treatments that also help to exclude destructive fires. Unfortunately, we have not always been able to completely substitute management practices for the natural roles of fire which are beneficial. It is thus suggested that forest management be extended further through more use of fire by prescription.

Fire control specialists and ecologists recognize that complete fire exclusion has increased the potential for wildfire and smoke (Cramer 1974, p. F-9). Disposal of logging slash is decreasing, particularly in partial cut stands--a cutting practice being extended markedly in some forest areas. This decrease in slash disposal is in part due to air quality concerns, but the net result may be an increase both in destructive fires and in unwanted smoke episodes (Cramer 1974, p. F-7).

Because a reduction in fuels by prescribed fires, under conditions when smoke can be managed, can reduce the potential for conflagrations, this is a favorable trade off--a small amount of smoke under control traded for a future smoke pollution episode (Cramer 1974, p. F-19).

Effectiveness of forest residues management in terms of air quality and fire hazard abatement cannot be fully determined in a **short** timespan because of variations in seasonal fire load severity resulting from yearly differences in weather (Cramer 1974, p. F-8). An environmentally balanced decisionmaking

aid is needed by which long-term losses, including loss of air quality, can be evaluated (Cramer 1974, p. **F-44).** But at present we have only the interim rule-of-thumb procedure presented below that is based on:

1. Likelihood of serious wildfire with no residue treatment;

2. Amounts of fuel consumed, hence smoke produced, by

   a. Wildfire in untreated fuel,

   b. Prescribed residue treatment by fire;

3. Susceptibility of the area to

   a. Smoke management,

   b. Wildfire smoke episode.

Rule-of-thumb for Judging Prescribed Fire as a Smoke Episode Prevention Measure

Step 1: Through all columns in the tabulation below, trace the decision path best describing the situation being judged.

Step 2: Calculate the estimated tons of fuel which would be consumed:

   a. By the time an uncontrolled fire is controlled, based on expert opinion using preattack or similar planning of strategic locations, expected fire behavior, and knowledge of available suppression forces.

   b. By the prescribed burning needed to reduce the likelihood of the uncontrolled fire.

Step 3: Using expert opinion to evaluate fire risk in terms of lightning occurrence, uses, and experience in similar areas, assign an annual percentage of the likelihood of the uncontrolled fire occurring. For example, if six such fires occur annually in 300,000 similar acres, and the area under consideration (determined in Step 2a) is 30,000 acres, then the likelihood

$$P = 6 \frac{30,000}{(300,000)} = 0.6,$$

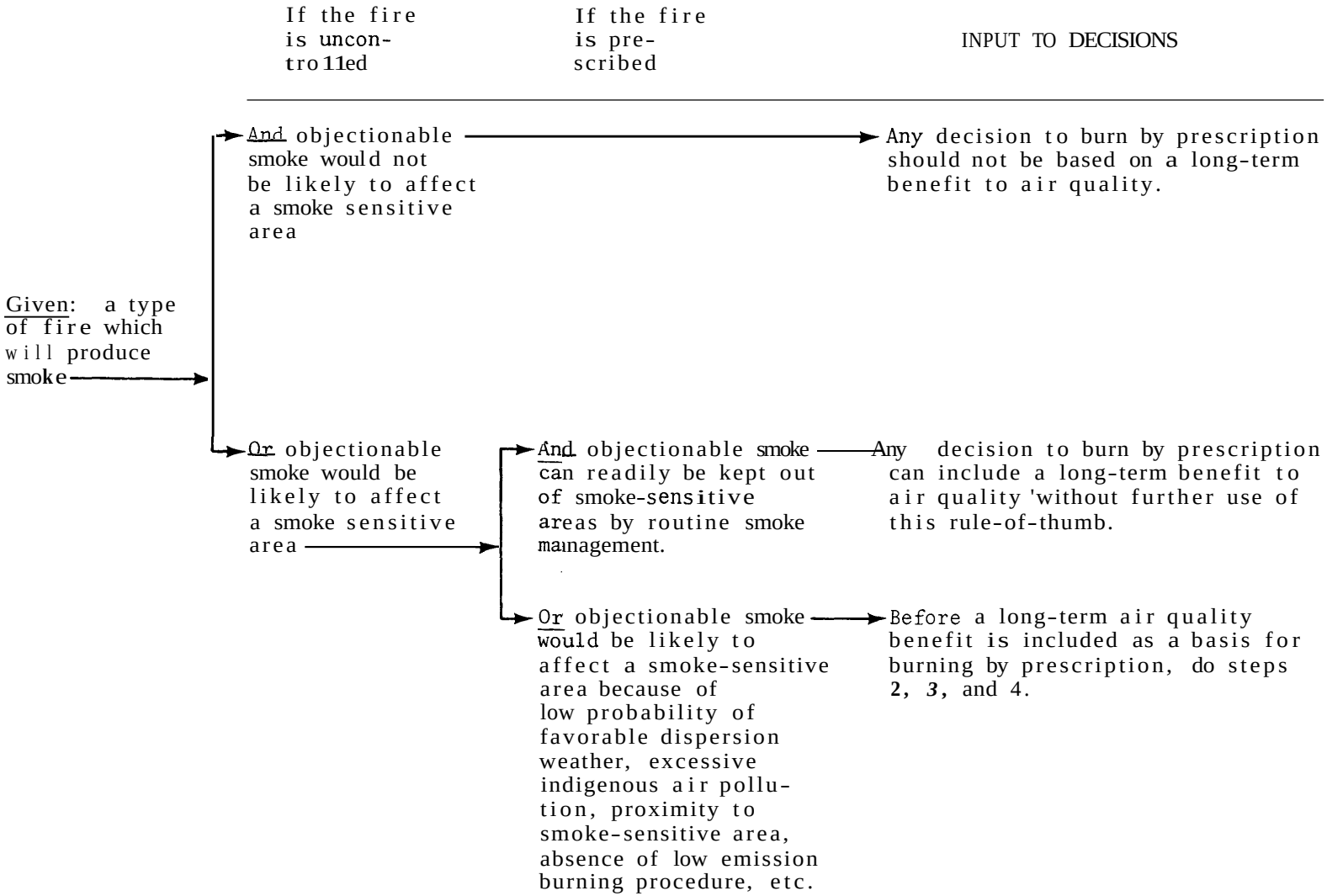
or 60 percent chance that an uncontrolled fire will occur.

Step 4: Substitute the above determined values in the following formula,

$$P > \frac{C}{L-c}$$

where: P is the decimal equivalent of the percentage of likelihood of an uncontrolled fire (smoke episode) in Step **3;** C is the cost to prevent the occurrence of a wildfire smoke episode, here expressed in tons of fuel which would be burned by prescription in Step 2b; L is the loss if the wildfire smoke episode occurs, expressed in terms of the tons of fuel consumed by wildfire (Step 2a). If the substituted values meet the terms of the formula, benefit to long-term air quality may be included as a basis for deciding to burn.

Considering the known climatology



The formula used here is an adaptation of the concept: Before an expenditure is made to prevent a loss, the probability (P) of the event causing the loss must be greater than or equal to the ratio of the prevention cost (C) to the loss (L). Since the fuel consumed in the wildfire smoke episode (L) includes the fuel consumed in the prescribed fire used to prevent the episode (C), in this adaptation C is deducted from L in the ratio. Tons of fuel are used in this rule-of-thumb application due to the difficulty of assigning a meaningful dollar value to the smoke episode.1/

AI-11 Strong Convection

The strong, very hot convection column sustains the greatest upward momentum and mixes comparatively little with the ambient air through which it rises (Cramer 1974, p. F-16). Ignition patterns, firing sequence, and timing can be prescribed to produce strong convection.

An exception to prescribing a hot fire and strong convection may be allowed for prescribed underburning conducted when there is a substantial mixing layer and the wind direction is away from any smoke sensitive area.

AI-12 Equipment Exempt From Air Quality Limitations

It has been suggested that permanent injury to human health from the products of forest fuel combustion is not established, but rather, the greatest penalty is in a decrease in visibility (Hall 1972). Forced-air systems, such as those employing the air-curtain type of blower, have been demonstrated to be effective for burning even damp material almost without visible emission (Cramer 1974, p. F-32). By Air Quality Panel consensus, no air quality limitations are deemed necessary for this type of burning.

AI-13 Need for Approved Smoke Management Plan

Any combination of broadcast burning is likely to be a conglomerate of dry, hot-burning and damp, slow-burning fuels. Duff and rotten wood by themselves burn slowly and with considerable smoke (Cramer 1974, p. F-12). Most open burning is to some degree affected by such fuel mixtures as well as by other combustion phenomena and is thus, from an air quality standpoint, a least preferable residue treatment. But open burning is often the only feasible treatment and is also preferable for other reasons. Nevertheless, the smoke from open burning must be managed if air quality is to be maintained. Smoke management is based on variables related to smoke production and dispersion (Cramer 1974, p. F-33). When such smoke management plans are developed and used cooperatively, they can be most effective (Cramer and Graham 1971).

The Air Quality Panel reviewed smoke management plans being followed in the States of Oregon and Washington. From the best of the existing plans and new knowledge available to it, members of the Panel developed a "Model Smoke Management Plan" presented in appendix 2.

1/ For derivation of the formula and a similar application, see Thompson and Brier (1955).

DI--DISEASES GUIDELINES SUPPORTING INFORMATION

DI-1 Reducing Incidence of Root Disease by Limiting Tree Scarring

Logging operations (especially when tracked vehicles or rubber-tired skidders are used) or underburning with high intensity fires can cause wounds on many residual trees. These wounds are ideal entrance courts for several wood-decaying fungi (Hunt and Krueger 1962, Boyce 1961). Wright and Isaac (1956) and Hunt and Krueger (1962) reported that wounds in contact with the ground are more frequently infected than those found farther up the bole of the tree. During logging operations or underburning, most wounding occurs at or near the bases of trees. Wright and Isaac (1956) also showed that the percentage of decay increased with increasing size of scar.

It is therefore desirable to prevent, or at least minimize, wounding of residual trees during logging operations or underburning. It is the consensus of the Diseases Panel that wounding of no more than 20 percent of the residual trees would keep the incidence of root rot diseases to an acceptable level.

DI-2 Reducing Incidence of Root Disease Through Residue Burying Restrictions

Burying of forest residues has been under limited investigation as a disposal alternative for some circumstances. In an examination of residue in pits buried for 2 years in an eastern Oregon ponderosa pine forest area, no evidence of transferred root rot colonization was found./

Nevertheless, the hazard of certain diseases spreading from already infected residues is believed sufficient to call for formal exclusion of at least diseased material from burying. Three root rot diseases associated with forest residues are of primary concern in the Pacific Northwest.

Armillaria mellea may colonize any wood residue buried or partially buried in the soil. The larger the residue, the more likely are its chances of becoming a source of inoculum. Specialized fungus strands (rhizomorphs) radiate outward in the soil from colonies to infect nearby trees. Younger trees are more susceptible, with mortality seldom occurring in older, more vigorous trees (Nelson and Harvey 1974, p. S-3 and S-4).

Fomes annosus has been observed to spread through roots at a rate of 1 to 6.6 feet per year, depending on species and climate (Johnson and Harvey 1974). Mycelium in colonized roots or residue is capable of infecting healthy conifer roots that contact the infected material, thus spreading infection. As with *A. mellea*, the larger the buried residue, the more likely is it to be an effective source of inoculum (Bega 1963). Although western hemlock is the most

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2/ L. E. Roth. Pathological implications of forest residue disposal by burial and by prescribed underburning. Unpublished manuscript on file at Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, 1973.

vulnerable species in the Pacific Northwest, F. *annosus* has a large host range, attacking both conifers and hardwoods throughout the world. Foresters should consider the possibility of *F. annosus* damage to coniferous forests in any zone (Nelson and Harvey, 1974, p. S-4 and S-5).

Poria weirii is principally a problem root pathogen where Douglas-fir predominates, but it also causes severe damage in some areas of high-elevation mixed conifers. It is the most destructive of the root diseases of the Northwest and has an amazing potential to survive in forest residues. Many cases of survival for 50 or more years have been reported (Nelson and Harvey 1974, p. S-5; Boyce 1961; Childs and Nelson 1971), and one report (Childs 1955) estimated survival for more than a century. Although the potential for colonization of residues by P. *weirii* is open to question, it has been demonstrated to invade Douglas-fir heartwood buried 12 months. Logging debris, other than stumps, is probably of minor importance to continuation of the disease unless it contains *P. weirii* when cut and is buried or partially buried. Infection of roots of healthy trees occurs in much the same way as with *F. annosus* (Nelson and Harvey 1974, p. S-6).

DI-3 Treating Freshly Cut Stumps

Fomes annosus will readily colonize fresh conifer stumps (Russell et al. 1973). If the roots of these stumps are in contact with the roots of living trees, the mycelium may infect the healthy roots. Coating freshly cut stumps with borax is an effective way of preventing this colonization. In a study by Graham (1971), less than 1 percent of pine stumps treated with borax and inoculated with *F. annosus* became infected. In the same study, about 60 percent of untreated stumps became infected when inoculated with F. *annosus*. Russell et al. (1973) also reported from another study that only 3 percent of western hemlock stumps treated with borax became infected as contrasted with 45 percent for untreated stumps. The Diseases Panel concluded that, due to the very high value of developed campgrounds and seed tree orchards, stumps in or near these facilities should be coated with borax to prevent infection of remaining trees.

DI-4 Controlling Dwarf Mistletoe

Dwarf mistletoes are widespread in North America and cause extensive damage to the coniferous forests in the West. This disease will attack trees of all ages, especially seedlings and saplings, causing reductions in yield or mortality (Boyce 1961, Hawksworth and Wiens 1972, Baranyay and Smith 1972).

The best means of control is by cutting or killing all residual trees within and adjacent to an infested tree or stand. Chemicals are not available for direct control of dwarf mistletoe. Although cutting or killing all trees in an infected stand is not always practical nor economical, the disease can be reduced to levels of little growth loss or mortality by proper sanitation measures (Baranyay and Smith 1972).

If dwarf mistletoes are present in living trees remaining after final harvest, the infections may spread to developing regeneration. It takes only 10 or fewer evenly distributed infected trees per acre to cast dwarf mistletoe seeds over the entire acre (Shea and Stewart 1972, Baranyay and Smith 1972). The greatest spread of dwarf mistletoe seed occurs from dwarf mistletoe plants

high above the ground (Hawksworth 1961). If infected trees over 4 feet high were cut or killed, the disease incidence would be minimized to a manageable level.[3/]

DI-5 Sanitizing Equipment to Prevent Spread of *Phytophthora lateralis* Root Rot

According to Roth et al. (1972), Port-Orford-cedar is highly susceptible to *Phytophthora lateralis* root rot. The greatest incidence of spread is believed to occur through road construction, logging, or other earth movement operations.

There is no known control of this disease. But, if management decisions require logging or other mechanical disturbance in Port-Orford-cedar stands, two precautions should be followed: (a) Because the disease is readily transmitted by soil clinging to equipment, all such equipment being moved from a contaminated area to a noncontaminated area should be thoroughly cleaned with water under high pressure/ (Batini and Cameron 1971); (b) infected residue must not be moved to an uninfected stand (Roth et al. 1972).

FI--FIRE MANAGEMENT GUIDELINES SUPPORTING INFORMATION

FI-1 Value-at-Risk

Research and development leading to an expression of value-at-risk truly comparable between different areas and different regions are incomplete. Most land managers have fire plans which incorporate some measure of fire risk, even if totally subjective. Many have fire plans which also reflect resource values. Commonly, these plans are used for assigning priorities and allocating fire management resources.

Because of the absence of a universally accepted method of rankin value-at-risk, or even of arriving at common measures of the separate elements,/ the Fire

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3/ James Hadfield, USDA Forest Service, Portland, Oregon, personal communication, 1974.

4/ For example, "risk" in some fire planning is based merely on the number of fires occurring for a given period in the planning area. In other fire planning, risk is based on fire occurrence in a composite of similar fuels, land uses, climates, and other factors to avoid a "history of luck" and/or a "history of too limited experience." (The latter composite method is similar to an insurance actuarial base over a large but fairly homogeneous population. A simple adaptation of this composite approach has been suggested for determining the risk of a wildfire smoke episode in the rule-of-thumb presented in Step 3 of AI-10, p. 175.) Similarly, "value" in some fire plans may be only the potential loss of unsalvageable timber and growing stock. In other fire plans, value may include the potential loss of downstream water improvements, lost opportunity for recreation enjoyment, and the cost of suppressing fires. Ways to handle value discounting, fuel rate of spread, ignition capability, and many other variables, all add to the present complexity and divergence of methods for estimating value-at-risk.

Management Panel agreed on the use of three broad classes. Panel members believed these classes could be well understood among land managers of the Pacific Northwest, despite differences in fire planning. This grouping results in a distorted weight being placed on value but does at least in part reflect man-caused fire risk./ The risk of lightning-caused fires is not incorporated.

Although admittedly imperfect, the Panel's list, presented below can serve to suggest appropriate classes for areas where no other method exists for rating value-at-risk.

List of Primary Land Use Categories Grouped by Value-at-Risk Classes/

High value-at-risk	Medium value-at-risk	Low value-at-risk
Commercial development	Scenic area	Noncommercial forest
Recreational areas, heavy and diversified	Winter game range (nonsprouting forage species)	Winter sports areas
Seed orchard	Irrigation (water) areas	Wilderness
Historical area	Industry (water)	Primitive. Area
Domestic water	Timber (old growth)	Seed production area
Camp and picnic area	Land suitable for recreational development	Perennial forb range
Endangered species	Barometer watershed	Seed collection area
Rare species habitat	Peripheral species (fauna)	Range meadow
Anadromous fish (a strip shading stream)	Geologic areas	Range conifer, pinion pine, juniper, broad-leaf tree
Water influence zone	Timber (poles)	Sagebrush
Experimental Forest	Timber (second growth)	Natural Area
Brushfield (erodible soil)	Timber (reproduction)	Brushfield (nonpalatable) stable soil
Power (water)	Timber (saplings)	Range grassland
National Recreation Area	Game and nongame (sprouting forage species)	Site class V and VI lands
Congressional classified area	Site class III and IV lands	
Summer home area		
Brushfield (thin soil)		
Fisheries		
Travel influence zone		
Archeological area		
Botanical area		
Site class I and II lands		

5/ See, for example, heavy use by recreation groups under "High value-at-risk" and high use of wilderness by groups under "Low value-at-risk" in the list adopted by the Fire Management Panel. A special reservation is necessary, however, for areas routinely closed to use during periods of high fire danger, which may thus fall in lower classes than indicated. (See also FI-13, p. 196.)

6/ Adapted by Fire Management Panel from "National Fire Planning Instructions," 1972 (unpublished copy on file, USDA Forest Service, Division of Fire Management, Washington, D.C.).

FI-2 Fuel Type Classifications

By Panel consensus, the fuels classification system in use by the Pacific Northwest Region of the Forest Service (USDA Forest Service, Pacific Northwest Region 1968) was selected as a reference from which other agencies and owners with other classification systems could most easily define equivalencies.[7/] The selected system defines each fuel type by four classes, both for rate of spread and for resistance to control:

E - Extreme
H - High
M - Moderate
L - Low

In use, the rate-of-spread rating is expressed first. For example, a fuel type rated as "EM" would be expected to have an extreme rate of spread and moderate resistance to control.

Rate of spread in the selected system is an expression of the perimeter increase for a small fire burning on an "average worst day" in the locality of the rating. Each spread class is five times greater than the next lower class. (An "E" rating would thus be 125 times greater than an "L" rating, 25 times greater than an "M" rating, and 5 times greater than an "H" rating.) From this, it can be seen that weaknesses are to be found in: the absence of any direct allowance for spread due to spot fires (except as snags are illustrated in higher spread rate examples); the absence of any definite allowance for crowning (except as ladder fuels are illustrated in higher spread rate examples); the need for a method of uniformly determining "average worst" as well as the theoretical chance (in using such an average) of an overrating 50 percent of the time and an underrating 50 percent of the time;[8/] the need to subjectively integrate such sensitive variables for the locality of the rating as:

Slope
Exposure to wind
Exposure to insolation
Fuel particle size, texture, and arrangement
Extent of live and dead fuel and seasonal changes therein.

Resistance to control in the selected system is an expression of the amount of work needed to control a unit of fire perimeter. Each resistance to control class is twice as great as the next lower class. (An "E" rating would thus be eight times greater than an "L" rating, four times greater than an "M" rating, and two times greater than an "H" rating.) Weaknesses are to be found in:

7/ Though not referenced as such, the selected fuel classification system has apparently been adapted from the work of Hornby (1936) which is discussed in detail in "Forest Fire Control and Use" (Brown and Davis 1973).

8/ Although difficult to prove and beyond the scope of the present discussions, it must be noted that at least for planning strategic locations for use in controlling conflagrations, fuels must be evaluated in terms of "worst probable" burning conditions.

the subjective determinations of the relative amount of work required, the need to make an additional allowance for travel time and availability of control resources, and the absence of an adjustment for fire intensity as it affects the directness of control action.

Selection of this system by the Fire Management Panel, despite such weaknesses, was due to the existence of a set- of photographs for differently rated fuel types in the published system guide (USDA Forest Service, Pacific Northwest Region 1968), and due to the absence'of a universally accepted, improved system. The Fire Management' Panel felt that in practice, these photographs would serve Northwest land managers better than any other interim method.

FI-3 Consequence of Fuels Under 3 Inches in Diameter

Needles and branches one-fourth inch and less in diameter are the fuels that propagate the main forward spread of fire (Anderson et al. 1966, cited in Martin and Brackebusch **1974,** p. **G-8).** Additionally, studies of slash fires show that **95** percent of fuel particles under 3 inches in diameter are consumed, which influences the energy release rate/ (Martin and Brackebusch **1974,** p. G-12), a factor which may be important in containing the fire (Martin and Brackebusch **1974,** p. **G-9).** Dry coniferous foliage, in addition to being fine in texture and often arranged to favor flame propagation, may provide more head per unit of measure than other fuels because of a high content of resin (Martin and Brackebusch **1974,** p. G-8).

FI-4 Consequence of Larger Fuel Particles

Fuel particles larger than 3 inches in diameter are consumed in part by the passing fire head and have been estimated to be about **30** percent consumed in overall slash fires (Martin and Brackebusch **1974, p. G-12).** Although not of "flash" burning character, these fuels still contribute to the total heat and the convective activity of the fire. This can be an advantage in prescription burning when smoke management requires maximum rise for dispersion aloft, but it can be a disadvantage in wildfire suppression because increased radiation and transport of burning embers cause long-distance spotting.

Fire whirls, which cause considerable spotting, are also related to rapid energy release. The larger fuels also smolder long after the fire is past, threaten to cause breakouts, and require extensive mopup. With time, they become punky and ignite easily (support glowing combustion) when dry (Martin and Brackebusch **1974, p. G-7).** These are also the fuels which result in extreme ratings for the work (resistance to control) of controlling the fire. Because they produce intense fire and are difficult to cut and move, these large fuels where sufficient are a hindrance to initial attack so that small fires can rapidly escape to become potential conflagrations. For these reasons, reduction of overall fuel loading is advocated (Martin and Brackebusch **1974,** p. G-9).

9/ Energy release rate, assuming a relatively constant combustion efficiency, is dependent upon the rate of.spread (in area) of the fire head times the amount of fuel consumed in the head.

FI-5 Use of "MM" Fuel Rating as a Benchmark

The medium rate of spread and medium resistance to control fuel rating (see FI-2, p. 183) was selected as a benchmark fuel rating by Fire Management Panel consensus. This benchmark is the rating value the Fire Management Panel believed should not be exceeded in several specified circumstances; it was chosen for the following characteristics of the MM[10] fuel type:

Rate of spread (see FI-3, p. 184)

- Available very fine fuels such as needles and flammable grass are low in quantity and are generally discontinuous.
- Available fuels larger than very fine, but under 3 inches in diameter, are relatively low in quantity and usually scattered.
- Ladder fuels and fuels with spotting potential are generally absent.

Resistance to control (see FI-4, p. 184)

- Control lines can usually be located to avoid larger logs.
- Work required to install control lines is commonly within the capability of most initial attack suppression resources.

FI-6 Land Stewardship

Most land managers strive to bring about improvement in resource conditions or at least to avoid degradation. The Public Land Management Decisions Panel applied this philosophy of land stewardship in their judgment that a desirable and attainable guideline statement should, as a minimum requirement, permit no activity to increase the hazard over the preactivity fuel hazard ratings. Past experience has shown that disputes develop over fuel quantity and arrangement necessary to meet a particular rating and over whether a particular residue component existed before, or as a result of, the activity. Critical differences in microclimatic factors, such as exposure to wind and sunlight,[11] also need to

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[10] The MM fuel rating should not be regarded as an optimum for all fire management situations. For example, an MM fuel will not always be satisfactory where preattack installations require fuel modification (see FI-9, p. 187, and FI-10, p. 189). Further, a higher percentage of crown fires has been reported to develop in medium rate of spread fuels than in any other class (Barrows 1951a). We noted an apparent discrepancy in the photograph depicting an MM type on page 23 in "Guide for Fuel Type Identification" (USDA Forest Service, Pacific Northwest Region, 1968). Unless the influence of "average worst" for the locality of this photograph permitted more fuel as an atypical situation, we would rate this as "HM." See also FI-12 (p. 195) regarding need for areawide treatment and reference to fuel loadings in the Sundance Fire.

[11] The effects of insolation upon fire behavior are not yet sufficiently well known to express as results of research. Some limited experiments and observations indicate an effect on fuel moisture and on the energy needed to propagate fire spread.

be recognized in the comparative fire hazard rating. Residue components need not be considered in terms of prior or subsequent existence, but rather in terms of their contribution to a desired fuel hazard rating.

FI-7 Reduction of Fuel Hazard, Prescribed Use of Fire, and Fire Under Surveillance in Areas Formally Designated Under the Wilderness Act

Both the Fire Management Panel and the Public Lands Management Decisions Panel considered the need for fuel hazard reduction and the potentials for the use of prescribed fire, or of permitting fires to burn under surveillance, in areas formally designated under the Wilderness Act. Only guideline statements 2.306 and 2.308 through 2.310 are directed toward Wilderness (along with other land classes) as a result of the Fire Management Panel process. Although none of these deal with permitting fire to burn under surveillance, a near-consensus of the Public Land Management Decisions Panel gave support to case-by-case application. Despite legal and policy implications, as well as the apparent need for further analyses, this support warrants being reported as a reflection of current administrative deliberations and of related research in progress.12/

For Wilderness, methods of residues management other than those identified above were not undertaken by the Fire Management Panel due to current interpretations of the Wilderness Act. Discussions among panelists did, however, indicate a possible need to liberalize authority for limited use of prescribed fire, both for fuel hazard reduction and for maintenance of certain species. Legal authority may also be needed for use of prescribed fire on limited fuel breaks, at least along Wilderness boundaries in strategic locations where the objective would be to halt conflagrations originating either in or outside Wilderness.

FI-8 Snags

Fire Management panelists agreed on the definition of "snag" (see "Glossary"), as well as on the need to treat snags for fire management purposes. But present differences in laws relating to snags prevented further agreement on minimum size of snags for treatment or on the exemption from treatment of certain snags for wildlife habitat. For this reason, the Fire Management Panel elected to call for treatment of only the snags associated with activity-produced residues, leaving further specification to law and to individual owners and agencies. The following discussion supporting snag treatment is for readers who may wish to pursue an acceptable further specification. Support for the associated wildlife exemption will be found under TE-15, p. 221, and TE-16, p. 222.

12/ The reader is referred to these additional references on current knowledge, policy, and research on prescribed fire and fire under surveillance in formally designated Wilderness Areas and related areas: USDA Forest Service Manual 2324.24, "Use of Fire," Amendment No. 35, May 1969; USDA Forest Service Manual 5130.3.5, "Policy--deviation," Manual Amendment No. 38, May 1972; USDA Forest Service, "Fire Policy Meeting Report Recommendation No. 1," May 12-14, 1971; Intermountain Fire Research Council (1970); Slaughter et al. (1971); Heinselmann and Wright (1973).

. Snags are regarded as one of the most important fuels influencing fire starts and fire control. Their relatively low moisture content and the ease with which glowing combustion can be initiated after deterioration make them a ready fuel for ignition. Radiant heat and firebrands falling on punky snags have accounted for many new starts of fires outside intended control perimeters. Lightning strikes in snags and in snag-topped green timber frequently become sources of wildfires even if precipitation accompanies the thunderstorm because of the snag's ability to ignite and then to hold the fire in hollow portions while the surrounding forest area dries out (Barrows 1951b; Brown and Davis 1973; Martin and Brackebusch 1974, p. G-8). Fire management personnel believe that numbers of lightning fires are reduced in areas where sanitation salvage has removed snags and snag-topped trees in the southwestern National Forests,[13] and studies of 12,000 fires in the northern Rocky Mountains are reported to have shown that over 34 percent of such fires started in snags (Barrows 1951a, 1951b).

Fire behavior is also importantly influenced by snags since they tend to serve as aerial platforms from which burning embers are launched on trajectories including long distance transport during strong winds or convective activity. Shaggy barked snags are particularly notorious for propagation of burning embers (Barrows 1951a).

Short snags and stubs in a renewing forest will usually be overtopped by the crown canopy more quickly than tall snags. Under the canopy they will be in a damper microclimate and thus contain more moisture, decay more rapidly, and be less likely to ignite and scatter firebrands than tall snags (Brown and Davis 1973). This is, no doubt, part of the basis for the 20-foot height used in the generally accepted snag definition. Height can also be part of the basis for further specification, where crown closure and regrowth characteristics of different forest types should be reflected. The proximity of snags to strategic fire control locations--for control lines, fuel breaks, etc.--might be the basis of an additional guideline for snag removal. Likely trajectory of firebrands, susceptibility of fuels to ignition, and kind of strategic use would be considered.

FI-9 Preattack Planning

The term "preattack" and the concept it represents were adopted for these guidelines by Fire Management Panel consensus. Also known among some foresters as "prefire planning," preattack planning covered in this discussion is only a part of the whole concept, which includes installation and maintenance phases as well.[14] It is a system of planning in advance of fire suppression and is done to accomplish two primary objectives: eliminate time lost in scouting and planning at the time of attack and provide a systematic basis for determining the what and where of installed fire control facilities.[15]

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[13] Hugh R. McLean, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, personal conversation, 1974.

[14] For discussion of installation and maintenance phases, see FI-10 (p. 189).

[15] For preattack priorities, see "Fuel Treatment Priorities," p. 192, under FI-10.

Preattack planning has grown from similar work done in many areas of the Nation since forest fire protection first began. The most recent developmental work was done on the southern California National Forests (Grace 1951). These procedures have been incorporated in Forest Service regional guides (USDA Forest Service 1959; USDA Forest Service, Southwest Region [n.d.]; USDA Forest Service 1972) as well as in a Forest Service national handbook (USDA Forest Service 1970). Although the regional guides are localized, they still conform to a standardized system which closely resembles the planning pioneered in southern California. Most notable in the extension of the preatt'ack concept from chaparral to timbered areas and to shaded fuel breaks is work done in the 1960's on the Duckwall Unit of the Stanislaus National Forest in California's central Sierras (Green and Schimke 1971).

Preattack planning in the Pacific Northwest is a major advance in forest residue management, but the Fire Management Panel recognizes that some of the procedural details[16/] and intensive application may not be appropriate for all public and private lands. The basic thrust is at least to plan to break up large continuous problem areas so as to accommodate preattack installations or objectives (Martin and Brackebusch 1974, p. G-22) (see FI-10, p. 189).

The following outline for preattack planning, adapted from Forest Service directives and guides, is offered as a standardized approach.[17/]

PREATTACK PLANNING PROCEDURE

Step 1: Identify preattack blocks (20,000-50,000 acres within well-defined terrain features).

Step 2: From topographic maps and aerial photos, identify strategic locations for firelines, fuel breaks, and other fire control facilities.

Step 3: Consider coordination with other land uses. Will proposed installations, either on a going fire or preinstalled, be acceptable?

Step 4: Complete field inventory and identify all final choices for strategic location of fire control installations; assemble as block plans.

Step 5: Obtain any needed approvals for preattack plan, including final coordination with other land uses.

Step 6: Provide for updating plans and sending copies to dispatchers and fire suppression personnel; and give information to personnel in activities such as timber management and engineering who may install priority preattack facilities.

16/ See, for example, inclusion of the "TRI System" (Robertson 1969) in the Pacific Northwest Region preattack guide (USDA Forest Service 1972).

17/ A guidebook presenting an adapted but uniform system of preattack planning for private lands and some public lands has been identified as a high-priority developmental need.

FI-10 Installation and Maintenance of Fuel Breaks and Related Preattack Facilities

The concept of preattack adopted by Fire Management Panel consensus embodies installation and maintenance phases discussed here, as well as the planning phase discussed in FI-9, p. 187. Fuel breaks have been emphasized because they break up continuous problem fuel areas by modifying the fuels in strategic locations (Martin and Brackebusch 1974, p. G-23).

Other facilities (such as helispots used in manning fuel breaks, and water sources in support of forces on fuel breaks) are no less important. Unmanned, or manned but poorly supported, fuel breaks are only occasionally effective in stopping fires. Fuel breaks are not fire barriers! The fuel break is intended only to provide safe access and a place from which to make either direct or indirect attack.

Like preattack planning, fuel break installation and maintenance have evolved from work done in many areas of the Nation; most recently fuel breaks have been installed in the southern California National Forests as part of their preattack system. Firebreaks and fire lanes installed there during the CCC (Civilian Conservation Corps) era have been an accepted part of the southern California scene. But firebreaks are not the same thing as fuel breaks. Firebreaks are devoid of vegetation, but only partial removal and modification of fuel arrangement are the rule in fuel breaks. Fuel breaks in timber often go unnoticed.

The following subsections are further support for fuel break-related guidelines originated by the Fire Management Panel.

Successes and failures of fuel breaks.--Only a few success stories have been published for fuel breaks (for example, Murphy and Murphy 1965). Reports of individual successes and failures, mostly communicated by word of mouth, have resulted in mixed opinions as to their worth. In an attempt to clear away confusion, we have drawn on two summaries of known encounters between fuel breaks and fires.[18/] [19/] These summaries were supplemented with individual documents supplied by the National Forests in California. See appendix 3 for this information.[20/] From our analysis, we conclude that success is most likely when fuel breaks are properly installed and maintained and adequately manned, and manning is adequately supported.

18/ James W. Jay. A look at fuel breaks. 60 p., illus. Unpublished report on file, Division of Fire Management, USDA Forest Service, Washington, D.C. [n.d.].

19/ Lisle R. Green, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Forest Fire Laboratory, Riverside, Calif., personal conversation, 1973.

20/ We recognize a need for more detailed study than could be afforded for this analysis and offer their results only as the currently best available information.

Prudent suppression tactics are also **important:**

a. **A** control line is established.

b. Spot fires are detected and contained rapidly.

c. Backfiring or firing out operations are initiated at the right time.

d. Control of the flanks of fires is accomplished (some very successful encounters became failures due to subsequent outflanking).

The likelihood of failures increases when the above elements are not met and/or when very high winds and erratic fire behavior or fire storms are experienced. Obviously, if a fire starts immediately adjacent to a fuel break, time is critical in meeting the above elements. Good access is thus a key consideration.

Occasional successes have been reported even for unmanned fuel breaks. We consider these the exception rather than the rule. In those cases, fire behavior was moderate and/or the encounter was along a flank, and either the ground fuel along the fuel break had not yet become established or a maintained firebreak or other barrier (such as green grass or a road) existed within the fuel break.

Some concern has been expressed that dry grass on lateral fuel breaks will serve as a "fuse" to spread fire more rapidly upslope. Although this is a real possibility, some fires would likely spread up these slopes regardless, even if at slower rates. Because dry grass ignites readily and access is provided, there is also a related possibility for an increase in man-caused fires which could make rapid initial runs along fuel breaks. For example, if trail bikes are used on fuel breaks, risk of ignitions from faulty exhaust systems is a definite possibility. However, fire prevention measures can be taken which will make the fire risk low enough to offset the advantages of an installed fuel break network.

Impact of installations.--The two potential impacts of most concern among land managers have been on esthetics and on timber production. Land managers have feared that fuel breaks would be the same as the firebreaks they have seen in chaparral. This would not only make an unwanted vegetative contrast, it would take land out of production. But in chaparral, feathered irregular edges and clumps of brush left in fuel breaks produced an appearance more like naturally grassy open ridges when carefully done. In timber, a shaded fuel break can be made inconspicuous by careful thinning, and by feathering edges and leaving clumps of understory. 21/

Timber production on fuel breaks is affected by the extent to which trees are thinned, by the care with which equipment is used, and the intensity of prescription burning practiced. In a case study of three representative fuel breaks in California, investigators concluded that rather than a subtractive effect, the present net worth of benefits to timber production (through increased growth on the fuel break) ranged from $1 to $10 per acre of fuel break (Grah and Long 1971).

21/ See guideline statement 1.520 in chapter III for a specified application of landscape management to fuel breaks.

Economic Analysis

Two studies--one by Davis,[22] the other by Murphy[23]--in 1965 seemed to be in conflict over the economics of fuel break construction. Davis used decision games and simulation to estimate fuel break effectiveness in a California Division of Forestry District. These estimates were then used to determine reductions in acres burned annually, to indicate effectiveness of both fuel breaks and additional suppression forces. Costs for reducing average annual acreage burned were believed to exceed all market and nonmarket losses due to wildfire, and the conclusion was reached:

> ...within the limits of assumptions used in this analysis, development of extensive fuelbreak systems or making substantial physical additions of conventional fire suppression forces to the current level. for protecting Zones I and II wildlands in District III of the California Division of Forestry does not appear economically justified.

This conclusion, taken by itself, leads to the confusion. This is unfortunate because, in further discussion of the implications of his analysis, the author concluded:

> Increases in funds for wildfire protection by the California Division of Forestry in District III...would probably be more effective in reducing the acreage burned by major fires if directed toward *selective* (italics ours[24]) fuelbreak construction and to fire prevention effort rather than to direct suppression forces.

Murphy[23] used costs collected during the Duckwall Conflagration Control Project on the Stanislaus National Forest. These costs were synthesized with the value of fire damage averted, and the marginal rate of substitution of fuel breaks for fire suppression was found. This finding was integrated with the least-cost-plus-damage method of analysis. Although the author concluded costs would be high, he stated: "Conflagration control through fuel breaks combined with a complementary fire suppression organization is economically justified on the Duckwall Unit."

When we recognize that the two studies are for two different situations, with different values-at-risk and different existing fire suppression resources, they actually may be viewed as complementary. Both conclude that fuel breaks to a certain level are economically justified. Both recognize that a certain level of suppression resources is necessary to use the fuel breaks, even though one study implies a need for increased suppression force expenditure and the other a reduction.

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[22] Lawrence S. Davis. The economics of wildfire protection with emphasis on fuel break systems. Doctoral dissertation, University of California, Berkeley, 166 p., illus., 1965.

[23] James L. Murphy. An analysis of the economic efficiency of an experiment in conflagration control on the Stanislaus National Forest, California. Ph.D. thesis, University of Michigan, Ann Arbor, 258 p., illus., 1965.

[24] See further discussions of economics of selecting highest priority locations under "Fuel Treatment Priorities," p. 192.

Fuel Treatment Priorities

Work has been done to refine the process for assigning priorities of fuel treatment and allocating budgets for fire management. The more sophisticated work in decision modeling was done for chaparral fuels under grant from the Forest Service to the Stanford Research Institute. The principal conclusion reported from this study[25] is that a program of fuel modification seems economically justified for the pilot area studied.[26] Less conclusive results have been obtained for the choice between an extensive system of fuel breaks and one of expanded fuel breaks ranging up to a mile wide.

Two methods for aiding the assignment of priorities of fuel treatment or determining the optimum density of fuel breaks in the Pacific Northwest are under development.[27] [28] Such decision-aiding methods will be most helpful, but in this document we accept the expert opinion of the Fire Management Panel's judgment that work on fuel breaks should be undertaken now. To begin with, highest priority locations for primary fuel breaks can be selected from local preattack planning and fire planning information based on fire risk and values. A preliminary list of priority locations for ultimate widening of fuel breaks to become areawide treatments can be developed from this same knowledge. Although decision-aiding models are likely to be completed before more difficult priority decisions need be made, this skeleton list of suggested priorities may be used as a start:

Priority 1. Standard fuel breaks around and through high value, high hazard, intensive use areas (e.g., resorts, camps, communities).

Priority 2. Standard fuel break segments on ridges above high risk areas.

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[25] J. Michael Harrison, D. Warner North, and Carl-Axel S. Staël von Holstein. Decision analysis of wildland fire protection: a pilot study. 196 p. Unpublished manuscript on file, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif., 1973.

[26] Matilija Creek and San Antonio Creek Drainages, Los Padres National Forest.

[27] Stewart G. Pickford. Work plan--analysis of fuel treatment alternatives. Unpublished manuscript on file, Pacific Northwest Forest and Range Experiment Station, Portland, Oreg., 5 p., 1974.

[28] Gary W. Lyon. Economic analysis of fuelbreaks. Unpublished manuscript on file, Pacific Northwest Forest and Range Experiment Station, Portland, Oreg., 29 p., 1974. Lyon, though concluding that fire damage is a parameter with weak input data, indicates that fuel breaks would be economically justified for the Snoqualmie National Forest. In this study, "net savings" are calculated for each proposed fuel break, making priority decisions possible. Weaknesses relative to fire damage inputs would be overcome in part if methods proposed by Pickford (see footnote 27) are successful. Pickford's work is directed toward an adaptation to the Pacific Northwest of an economic analysis method being used for fuel break decisions in the California Region of the Forest Service.

Priority 3. Standard primary fuel breaks along major ridges or other breaks in topography (e.g., block boundaries).

Priority 4. Standard fuel breaks on lateral ridges where outflanking of primary breaks is most likely.

Priority 5. Concurrent expansion of lateral and standard fuel break network, and areawide prescription burning (in forest types where suited).[29/]

Construction and Maintenance Standards

The following statements and quoted excerpts (from Green and Schimke 1971)[30/] represent the best known standards for fuel break construction and maintenance in the Pacific Northwest, as visualized by the Fire Management Panel.

Width.--Widths of fuel breaks are to be based on an estimate of "the distance from the flame front necessary to prevent serious burns from radiated heat and direct ignition from radiation" from intense fires in extreme fire danger. To this estimated distance must be added a margin for safety as well as the distance needed for varying widths in meeting landscape management requirements.[31/] Widths will vary with the sharpness of ridgetops, the nearness to critical saddles, the incorporation of safety islands, and with the steepness of slopes below slope-crossing roads (when roads are selected as the best available intermediate strategic location). The following widths have been suggested for the Sierra-Nevada mixed conifer type and are being followed in the Pacific Northwest:

...Knife-edge *ridges*--On slopes of of 50 percent or steeper, width should be at least 3 chains, slope distance.

Ridges where one slope is steep (50 percent) and *one* moderate (20 percent>-These will normally be marked to a fuel-break width of 4 chains, slope distance.

Loaf-shaped ridges--Two slopes of less than 20 percent will be marked for fuel-break treatment to a width of 3 to 5 chains, slope distance.

Valleys or flat areas--Where the ground is level or nearly level and the stand is dense (150 or more trees per acre), the fuel-break should be 5 chains wide. On areas with a less dense stand or when the stand does not extend too great a distance, the thinning should be done to a width of 3 to 4 chains. Outer edges of timber fuel-breaks should be thinned more severely than the center.

[29/] See also FI-12 (p. 195) on need for areawide treatments.

[30/] Readers are urged to use Green and Schimke's (1971) guides and/or the preattack guide (USDA Forest Service 1972) for actual applications.

[31/] See guideline statement 1.520 in chapter III on landscape management required for fuel breaks.

Canyons or ravines--If canyon walls are steep, spotting and radiation across the narrow canyon bottom are hazards. Canyons are not the most desirable sites for fuel-breaks. Consequently, they require more clearing and thinning than do ridgetop sites....

Treatment.--

...General--Remove all merchantable high risk, spike-top, damaged, bug infested, and catfaced trees.

Overstory--Remove enough of the remaining merchantable trees to achieve a spacing that will result in a shaded fuel-break of sound, thrifty trees. This will normally entail removing only those overstory trees which have interlacing crowns.

Understory--Thin merchantable understory trees to a minimum spacing of 20 feet or to a spacing of not less than 6 feet between crowns.

Unmerchantable trees--Unmerchantable material (poles, saplings, other material) in the fuel-break should be thinned after logging to a spacing of 6 feet between crowns.

Pruning--Prune crop trees according to..."established..." guidelines. All other "leave" trees must be pruned to a height of at least 10 feet, but not to exceed 50 percent of length of green crown.

Hazard reduction--All slash, brush, and other debris must be disposed of by burning, burying, or chipping. Machine piling, because of lower over-all costs, is recommended where damage to the residual stand can be avoided.

Maintenance.--

...If fuel-breaks are to serve their purpose they must be maintained. The ground cover must be kept to low volume. A ground cover is necessary to stabilize the soil and restrict growth of unwanted woody vegetation.

The aim in maintaining a low-volume ground cover is so that when it is ignited, it will burn with a low total heat output near the control line within a fuel-break. This aim assumes that the cover on a fuel-break will be flammable and that it will burn readily during critical fire periods.

A dry weight of 2 tons per acre has been arbitrarily set as a maximum volume of ground cover desired on a fuel-break. A cover of grass...or pine needles will be less than this volume on most sites in most years....

...Low intensity prescribed burning in tests on the Stanislaus National Forest, central California, has proved its value for maintaining a low level of fuels at low cost (Schimke and Green 1970). The use of this technique should be seriously considered for fuel-break maintenance....

FI-11 Prescribed Fire as a Preferred Treatment for Specified Areas

There is evidence that in the past fire has periodically been a natural element in the ecosystems of such timber species as Douglas-fir, lodgepole pine, ponderosa pine, and western larch (Intermountain Fire Research Council 1970, Franklin and Dyrness 1973). Certain types of fire are believed to be beneficial to these ecosystems (Intermountain Fire Research Council 1970). This led the Fire Management Panel to recommend prescribed fire as the preferred treatment for specified Forest Residue Type Areas.[32/] In calling for use of burning prescriptions, the Fire Management Panel recognized dependence on an improving art in a subject area where further research and development are greatly needed. While research and development[33/] are being conducted in both the Douglas-fir and ponderosa pine forest types of the Pacific Northwest, prescriptions may be drawn from two sources developed outside this geographic area (Pierovich et al. 1968, Schimke and Green 1970).

FI-12 The Need for Areawide Treatment

The need to treat fuels on an areawide basis is apparent to the initial attack fireman trying to hold a fire to small size in fuels which defy rapid handwork and/or are burning with intensities which are not readily quenched by ground or airtanker attack and continue to produce burning embers. Numerous individual fire reports attest to the importance of fuel at or near the point of fire origin. Brown and Davis (1973) point out that one or two highly trained men with handtools can control most fires of one-fourth acre or less but that, in some fuels and under some burning conditions, even a fire this size can overwhelm hand methods.

Preference for areawide treatment is more dramatically demonstrated by conflagrations in which long distance spotting and erratic behavior make it necessary to take flanking action and to depend upon indirect attack. The 1967 Sundance Fire in Idaho is one such fire which has been documented and studied. Anderson (1968) concludes that the spectacular run of this fire appears to have been a result of a combination of dry fuels from a sustained drought, low humidities for over 72 hours, increasing winds sustained over a period of 9 hours, and a 4-mile active front. He reports an advance of 16 miles in 9 hours, spot fires 10 to 12 miles northeast of the point of origin, a rate of spread of 6 miles per hour during the peak run, with a maximum energy release of 474 x 10^6 Btu/s and a maximum fire intensity of 22,500 Btu/s-ft of fire edge. Average fuel loading calculated for the fire area as a whole was divided into three levels: ground litter, brush, and crown material, and was reported by Anderson (1968) as 2.04, 2.7, and 20 tons per acre, respectively.

[32/] See chapter II for discussion of forest residue types and key to guideline statements. See SI-6, p. 213, for the further recommendation of the Silviculture Panel on use of prescribed fire.

[33/] A priority research and development job is formulation of prescription criteria for protecting specified depths of the duff layer (see SO-11, p. 216).

FI-13 Fire Closures

Federal, State, and local laws and regulations provide for "limited" and "full" closures of forest land to entry during periods of high fire danger. Limited closures may be for certain classes of fire risk or may simply close the area to entry unless certain fire prevention measures (such as the required "shovel, axe, and bucket" for forest visitors or the "hoot owl" schedule for loggers) are taken. Full closures usually close areas away from main traveled routes and away from places of habitation to all entry except by permit (such as for residents). Fire danger used for closures is usually weather dependent but may be declared automatically by dates with the approach of a fire season, and may last for the entire fire season regardless of changes in weather when fuel hazard [as a part of fire danger rating) is high.

Costs and difficulty of enforcing closures sometimes combine with a desire to leave the area open for use, especially on public lands, to the extent that decisions to effect closures are put off in the hope that the weather will change. On the other hand, some private lands remain closed to public entry for extended periods as a prerogative of private ownership in keeping with State and local laws or regulations.

Although literature on studies of fire closure effectiveness is scant, it seems reasonable to include the following in local evaluations of closures as an alternative, or as a supplement, to fuel hazard reduction:

a. Will other management goals be met (e.g., silviculture, providing open space)?

b. Can the closure be effectively enforced without undue costs and without adverse public reaction?

c. Are man-caused fires a problem and will lightning fires negate the results of preventing man-caused fires?

FI-14 Fire Management Through Cooperation

Concern about damage to forests from fire has been linked to the evolution of a forest policy in this country since colonial times. Kinney (1917) began his text on the development of forest law in America with reference *to* the first ordinance regarding the firing of woods in Plymouth Colony in Massachusetts He also cited the Massachusetts Act of January 1743, which recognized the damage caused by fire to young tree growth and to the soil, as well as a North Carolina Act of 1777 which carried penalties for unlawful firing of the woods. The first nonstructural fire regulation in Alta California is credited (Clar 1959) to Spanish Governor Jose Joaquin de Arrillaga, whose proclamation of Flay 31, 1793, addressed itself to the Indian practice of setting fire to pastureland. Use of fire, control of fire, and abatement of fire hazards continue to be controversial in forestry circles throughout the country. Controversy is woven into the history of forestry cooperation as it grew from such Federal regulatory legislation as the Snell Bill introduced in Congress in 1920. Dana (1956) calls the Clarke-McNary Act of 1924 the lineal descendant of the original Snell Bill; he points out its notable omission of any reference to public regulation of timber cutting, a matter of great controversy at the time. Among other provisions of the Clarke-McNary Act was an authorization for the Secretary of Agriculture to cooperate in forest fire control with States. This provision along with others has done much to quiet the pressure for Federal regulation.

It has enabled the States to work with local forestry associations in writing forest practice acts that have been received favorably in the West where there is a strong belief in the doctrine of natural rights. This doctrine has been codified by the U.S. Constitution. It has been used in our highest courts to protect private ownership against public regulation regardless of new constitutional interpretations. The Private Lands Management Decisions Panel recognizes a pride among these owners in their self-regulating forest practice rules and related State legislation (Oregon State Legislature 1971, Washington State Legislature 1974). The consensus of the Fire Management Panel is that individual owners and appropriate local protection organizations should work together to determine treatment criteria for each area instead of attempting to set forth specifications in law which may not be applicable or desirable in all instances.

As an example of the working practice acts, the following quotation is excerpted from the general rules developed by the Oregon State Department of Forestry (1974) through its forest practices committees of private owners:

> 24-301 MAINTENANCE OF PRODUCTIVITY AND RELATED VALUES. Operations on forest land shall be planned and conducted in a manner which will provide adequate consideration to treatment of slashing to protect residual stands of timber and reproduction, to optimize conditions for regeneration of forest tree species, to maintain productivity of forest land, and to maintain air and water quality and fish and wildlife habitat.
>
> (1) Reduce the volume of debris as much as practicable by such methods as:
>
> (a) Well planned and supervised felling and bucking practices to minimize breakage.
> (b) Increased utilization of wood fibre including but not limited to salvaging, pre-logging and re-logging when a market exists.
> (c) Stage cutting where applicable, with successive cuts delayed until slashing created by previous operations is reduced.
>
> (2) In those areas where slash treatment is necessary for protection or regeneration, the following methods may be used:
>
> (a) Scattering of slash accumulations;
> (b) Piling or windrowing of slash;
> (c) Mechanized chopping or compaction of slashing;
> (d) Controlled burning;
> (e) Provisions for additional protection from fire during the period of increased hazard. Protect fish habitat when establishing water sources....

IN--INSECTS GUIDELINES SUPPORTING INFORMATION

IN-1 Preventing Expansions of Douglas-fir Beetle Epidemics

Douglas-fir residue will attract and concentrate the Douglas-fir beetle in the vicinity of green trees (Johnson and Pettinger 1961) and may cause population increases of epidemic proportions (Furniss and Orr 1970). Greeley et al. (1953) reported that in 1951-52 about 8.9 billion board feet of timber was lost to windthrow, plus about 1 billion more due to beetle attack in 1951. An additional 3 billion board feet of green timber was killed by beetle emergence from the windthrown and beetle-killed timber (Johnson 1960a).

Shaded residue poses a greater insect hazard than does residue exposed to direct sunlight (Johnson et al. 1961, Johnson 1960b). Johnson (1960a) reported that high and low temperatures have an adverse effect on beetle broods, causing high mortality rates. In fact, Johnson et al. (1961) found that shaded residue is about twice as attractive to attacking beetles and six times as productive of new beetles as exposed material. Therefore, higher priority should be given to treating shaded and partially shaded residue than to residue found in direct sunlight.

Work by Johnson and Pettinger (1961) showed that intensity of attack decreased with distance from infested trees or logs. The consensus of the Insects Panel is that moving the residue at least 35 feet from living trees will give adequate protection to the stand.

Removal of residue and infested trees is the best means of reducing beetle populations. Ideally, removal or treatment should take place promptly after the residue is created or trees are attacked. If this is not possible, the work should be completed before the beetles emerge, usually within 12 months.

IN-2 Preventing Expansions of Engelmann Spruce Bark Beetle Epidemics

Buildup of spruce beetle populations in Engelmann spruce residues is a major factor contributing to severe tree destruction (Schmid and Beckwith 1972; Mitchell and Sartwell 1974, p. R-5). Broods of this insect may take 1 or 2 years for a complete cycle (Massey and Wygant 1954). The consensus of the Insects Panel is that, for best control of this beetle, infested stemwood residues should be removed from the area within 1 year of infestation to prevent further buildup and outbreak.

IN-3 Providing Future Protection from the Balsam Woolly Aphid

The balsam woolly aphid has caused extensive damage and mortality in true fir stands in the Western United States (Doerksen and Mitchell 1965, Johnson and Wright 1957). Pacific silver fir found below 3,000-foot elevation (Mitchell and Sartwell 1974, p. R-9) and subalpine fir growing above 3,000-foot elevation (Flitchell 1966) infested by the aphid seldom develop to merchantable size. The infested trees are also a source of infestation for subsequent reproduction.

The only effective treatment known is to remove infested Pacific silver fir and return the site to an earlier successional stage (Mitchell and Sartwell 1974, p. R-10). The consensus of the Insects Panel is that removal or destruction of infested Pacific silver and subalpine fir trees would adequately protect remaining stands.

IN-4 Preventing Epidemics of Mountain Pine Beetle in Sugar Pine

Population buildup of mountain pine beetle in recently windthrown sugar pine is a major factor contributing to tree killing (Miller 1928). Normally, losses are very light and most of the damage has been endemic with outbreaks usually short-lived. However, a sudden beetle buildup and increased mortality of mature and overmature sugar pine trees in 1964 were attributed to the 1962 October windstorm. The damaged trees evidently acted as the breeding ground for buildup of the beetle epidemic (Dolph 1970).

The consensus of the Insects Panel is that the best line of defense is removal of accessible windthrown trees within 1 year of blowdown.

IN-5 Preventing Mountain Pine Beetle Epidemics in Lodgepole Pine

The mountain pine beetle is the most serious insect enemy of lodgepole pine and can cause severe damage over extensive areas (Fowells 1965). Lodgepole pine becomes most susceptible to mountain pine beetle attacks at about age 80. Keeping beetle outbreaks to a minimum is best accomplished by maintaining a young, healthy, and vigorous stand (Dolph 1970).

The consensus of the Insects Panel is that the best method for maintaining a young and vigorous stand is removal of all infested trees as well as all noninfested merchantable trees in the area of infestations.

IN-6 Preventing Mountain Pine Beetle Epidemics in Ponderosa Pine

Old-growth ponderosa pine stands rarely experience outbreaks of mountain pine beetles. However, beetle populations have greatly increased and become widespread with conversion of old-growth stands to second-growth management (Sartwell 1971).

Sartwell (1971) stated that beetle outbreaks occurred on about 100,000 acres annually during the 10 years prior to 1971. He also said that this problem will become more extensive as more timbered land is harvested.

The attacked young, second-growth stands were usually even aged, densely stocked, and stagnated. This combination reduced tree vigor making these stands susceptible to beetle outbreaks when the trees grew into pole-size classes (Dolph 1970, Sartwell 1971).

The best direct method for controlling mountain pine beetle outbreaks is by increasing stand vigor through precommercial and commercial thinnings. This produces healthy and fast-growing trees which are more resistant to beetle outbreaks (Dolph 1970).

IN-7 Preventing Damage From Pine Engraver Beetle to Uncut Timber

Removal of fresh residue will reduce pine engraver beetle aggregation, thus decreasing risk to standing trees. Where complete disposal is not practical or economical, the residue should be scattered or piled in openings away from the standing trees (Sartwell et al. 1971; Mitchell and Sartwell 1974, p. R-8).

IN-8 Preventing Loss from Pine Engraver Beetle in Ponderosa Pine Thinning Areas

The pine engraver beetle is mainly a pest of ponderosa pine. Although in most years it is not important as a tree killer, young trees and the tops of older ones are the main targets of this beetle (Metcalf and Flint 1962).

Mortality of leave trees after precommercial thinning occurs predominantly in stands thinned during spring and summer (Sartwell et al. 1971, Sartwell 1970). Therefore, the best approach for pine engraver control in young stands is thinning during the fall or winter months (Mitchell and Sartwell 1974, p. R-7).

Large populations of engraver beetles can also exist in fresh green logging residue from overstory removal. Thinning the stand before beetle emergence adds food to further increase beetle populations. This in turn causes epidemic outbreaks on residual trees. Since emergence normally occurs throughout the summer, thinning should be postponed until beetle flights have ceased, usually sometime in the fall.[34/]

IN-9 Protecting Uncut Timber from Attack by Western Pine Beetle

Extensive tree killing by the western pine beetle in logged ponderosa pine stands occurs primarily while nearby green residues are under attack (Craighead et al. 1927, Miller and Keen 1960). Disposal of the residue before it is attacked is the best method of keeping western pine beetle populations to endemic levels (Mitchell and Sartwell 1974, p. R-6).

The consensus of the Insects Panel is that a practical minimum requirement is to arrange the residue so it is at least 35 feet from standing trees.

IN-10 Preventing Buildup of Western Pine Beetle Broods

Tree killing by western pine beetle in association with blowdown and wildfire occurs primarily after population buildup in these residues (Miller and Keen 1960; Mitchell and Sartwell 1974, p. R-6). Salvage of windthrown or fire-injured or killed trees is an effective means of reducing beetle populations and subsequent damage (Mitchell and Sartwell 1974, p. R-6).

The consensus of the Insects Panel is that removal of the infested material should take place before developing broods emerge.

IN-11 Controlling Insects with Public Funds

The consensus of the Private Lands Management Decisions Panel is that insect infestations threatening several forest properties are the concern of more than the individual owners. The Insects Panel believes that when such populations are found and declared by the appropriate State Forester to be a zone of epidemic insect infestation, public funds should be made available for insect control.

34/ Robert' E. Dolph, Jr., USDA Forest Service Regional Office, Region 6, Portland, Oregon, personal conversation, 1974.

RE--RECREATION GUIDELINES SUPPORTING INFORMATION

Forest residues guideline statements for protection of esthetic quality were developed from a focus on forest recreation use. This focus brought differing views of what constitutes acceptable esthetic quality into a common field--the way recreationists perceive and enjoy forest surroundings.

Differences in perception, including disagreement among observers as to the nature and content of a given scene, have been attributed to differences in training and experience as well as to other factors such as perceptual capacity (Vernon 1962; Wagar 1974, p. H-2). These differences in perception can reach extremes among the many individuals who make various uses of the forest and who may express strong opinions about "an optimum forest management" for differing combinations of uses. Despite great diversities in background, recreationists are all seeking forest areas pleasing and appropriate to enjoyment of particular activities, but what is sought may change when an individual's role changes, as for example, from "seeker of scenery" to "hunter" (Wagar 1974, p. H-8).

Knowledge about the choices and the reactions of recreation users can lead to description of different forest environments satisfying their quests. But the quantity of these different forest environments to be provided is a matter of land use planning, not residues management. Missions and goals of various ownerships, cost and profitability of alternative uses, demand, and many related elements must be considered in land use planning, but these were beyond the scope of the Recreation Panel.

Recreation Panel members directed their efforts to defining a set of premises about forest environments that satisfy recreationists. The Recreation Panel next chose a system of visual resource classes for classifying forest scenes, or "visual resources," for recreation use. The premises were then translated into guideline statements appropriate to protecting the esthetic quality requisite to recreation enjoyment in each visual resource class.

The basic premises regarding forest recreational environments are covered in RE-1--the basis for each related statement presented in the Public Lands Guidelines (chapter 111). Because of the differences in goals between public and private ownerships, statements 1.503 through 1.527 are limited to areas classified under the visual classification system chosen by the Panel. For areas which are not so classified, a more general approach has been taken in statements 1.501 (see RE-1, p. 202) and 1.551 (see RE-2, p. 207). RE-3 (p. 208) and RE-4 (p. 208) cover circumstances where benefits to recreation use must be balanced against trade offs necessary to the overall protection of the forest environment; these trade offs call for special treatments within areas classified for protection of esthetic quality.

Input Block 4 of the User's Work Form (chapter 11) for sorting guideline statements shows the system for classifying visual resources described in RE-1 (p. 202). The relationships diagrammatically presented there will help land managers who have no formal system for visual resource classification but who may elect to define equivalent classifications to use the sorting form in chapter II as access to appropriate guideline statements.

Relating Premise Statements to a Visual Resource Classification System

The Recreation Panel agreed on certain premises about the visual resources requisite to forest recreation. They also agreed on a system for classifying the visual resources.. Both the premises and the classification system were adapted for residue management by the Recreation Panel from a publication on landscape management developed for use in the National Forests of Oregon and Washington (USDA Forest Service 1974). These premises, as adapted to all forests, are quoted along with other agreed on premises in the following discussion.

Development of General Premises

Expected Images Exist

> The majority of recreation-oriented people who visit...[forests]... have an image of what they expect to see. Such an image or mental picture is generated by available information concerning a particular area and the person's experience with that or similar areas. The image produced represents the knowledgeability, expectedness, romanticism, and emotionalism associated with features within the area. Obviously, several images may exist simultaneously, even within a single individual, and yet a particular geographic region tends to have an identifiable image.35/

The following are also quotations (USDA Forest Service 1974):

> Although studies of people's images of forest areas result in varied responses from one geographic region to another, one factor generally remains constant. People expect to see a naturally appearing character within each general Region.

Aesthetic Concern Varies and Types of Viewers Are Critical

> It is assumed that esthetic concern varies among National Forest users. Those people most concerned about aesthetics are those who are in an area because of, or have a major interest in, the scenic qualities, e.g., recreation area residents and travelers.

View Duration Is Critical

> The visual impacts of management activities increase as the duration of view increases beyond a quick glance. Examples are those areas seen from vista points, visitor centers, end of road tangents, etc.

35/ Floyd L. Newby. Environmental impact appraisal of proposed developments in Harney Peak area of the Black Hills. Unpublished manuscript on file, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. [n.d.].

Number of Viewers Is Critical

The visual'impacts of a management activity become more important as the actual or potential number of viewers increases.

All Lands Are Viewed

Because all National Forest lands can be seen from aircraft or high vista points, a minimum [acceptable] visual quality objective should be determined.

Diverse Landscape Character Is Important

All landscapes have a definable character and those with the greatest variety or diversity have the greatest potential for high scenic value.

Retention of Character Is Desirable

Landscapes with distinctive variety in form, line, color, and/or texture should be retained and perpetuated.

The Capacity of Each Landscape to Absorb Alteration Without Losing Its Visual Character Is Critical

Each landscape unit has its individual capacity to accept alteration [modification] without losing its inherent visual character. This may be expressed in the screening ability of the vegetation and landforms, the variety of vegetative cover and rock outcrops and water, and its ability to recover vegetatively after disturbances.

The Visual Impact and Character of Management Activities Is Critical

The visual impact of management activities increases as the amount of landscape alteration increases. The visual impact of management activities generally increases as the visual elements in the management activity deviate from the same elements [expected] in the natural landscape.[36/]

Focus of Viewer Attention Is Critical

The dominance and arrangement of elements will focus viewer's attention and subject certain areas to critical scrutiny. Major peaks, water forms, rock outcrops, meadows, edges, enframed views, axial patterns and convergent patterns are typical areas of focalization. The visual impact of management activities increases as the focus of viewer attention increases in such managed areas.

36/ This premise is supported by the findings of studies which have been further interpreted to suggest that many visitors will overlook or wish to encounter debris from natural, or natural-appearing, causes. Natural debris from some causes may, nevertheless, be damaging to recreation and scenery (Wagar 1974, H-2).

Alteration of Character [Landscape] May Be Desired

Landscapes with little or no variety may be enhanced by alteration.

Viewing Distance Is Critical

Visibility and clarity of detail is often a function of viewing distance. The visual impact of management activities usually increases as viewing distance decreases.

Viewing Angle Is Critical

Visual impact of management, activities increases as the viewer's line of sight tends to become perpendicular to the slope upon which the management activity is to take place.

Management Is Necessary

Landscapes are dynamic and even those areas of high aesthetic value may require some management activity to retain the valued character.

Additional Premises

Other variables which affect the system [esthetics] indirectly are motion of activity, lighting, weather conditions, and season of the year.. ..

A System of Visual Resource Classification Drawn From Certain General Premises

The *first order* classification is based on *viewing distance*. The first order classes,[37] in descending order of need for protection of esthetic quality, are:

FOREGROUND--variable distance, up to one-half mile from viewer
MIDDLE GROUND--variable distance, between one-half mile and 5 miles
BACKGROUND--beyond 5 miles

Second order classification is based on amount of *landscape alteration*. Further subdivision of each first order class depends on the extent to which visual elements in management activities deviate from the same elements expected in the natural landscape. The second order classes[38] (visual quality objectives) in descending order of need for protection of esthetic quality, are:

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[37] In the developed system (USDA Forest Service 1974).

[38] In the developed system (USDA Forest Service 1974).

PRESERVATION--allows natural changes only

RETENTION--permits management activities that are not visually evident

PARTIAL RETENTION--permits management activities visually subordinate to the characteristic natural landscape

MODIFICATION--permits management activities to dominate original characteristic landscape

MAXIMUM MODIFICATION--permits vegetative and landform alterations to dominate the characteristic landscape

Third order classification is based on *duration* of *view*. The following terms were developed by the Panel for subdivision of second order classes. These third order classes, in descending order of need for protection of esthetic quality, are:

OCCUPANCY AND WANDER THROUGH

LOW SPEED TRAVEL PAST--30 MPH OR LESS

HIGH SPEED TRAVEL PAST

Fourth order classification is based on *density* of *screening* (capacity of landscape to absorb modification). The following terms were developed by the Panel for subdivision of third order classes. These classes, in descending order of need for protection of esthetic quality, are:

LITTLE OR NO DENSITY OF SCREENING

MODERATE DENSITY OF SCREENING

HEAVY DENSITY OF SCREENING

Interpretations and Additional Premises Applied to the Adapted Classification System

Levels of protection of esthetic quality can be developed for the classes and subclasses defined above. Each class and subclass in the adapted visual resource classification system has a descending order of need for protection of esthetic quality, making it possible to scale what is expected.

In addition to interpretation of the general premises on a scale running from most to least stringent, the following list should further scale the end result of management actions called for in the guideline statements. These adjectives are taken from a "Landscape Adjective Checklist" (LACL) (Craik 1972, cited in Wagar 1974, p. H-3). The lists, drawn from a limited though statistically significant study, are repeated here for possible use by land managers.

LACL for Esthetically Unappealing Scenes

arid	destroyed	scraggly.
bare	dirty	ugly
barren	drab	unfriendly
bleak	dry	uninspiring
brown	dull	uninviting
burned	eroded	weedy
bushy	golden	windswept
colorless	hot	withered
depressing	lifeless	worn
deserted	monotonous	yellow
desolate	plain	

LACL for Esthetically Appealing Scenes

alive	fresh	pure	wild
clean	green	secluded	wooded
clear	living	timbered	
cool	moist	unspoiled	
forested	natural	vegetated	

Specific details were discussed by the Recreation Panel for each class of viewing distance (first order classes):

FOREGROUND--up to one-half-mile:

- Specifications should aim at natural appearance (Wagar 1974, p. H-2), with any management activity being least evident or subordinate (USDA Forest Service 1974).
- For sites likely to be entered, passability (ease of traversing or degree of obstruction) must be considered[39/] (Wagar 1974, p. H-7).
- Residue cleanup will avoid the appearance of waste, an objectionable condition to many viewers[39/] (Wagar 1974, p. H-7).
- Size and arrangement of residue pieces are more important close to the viewer than in the distance, especially for partial retention and modification conditions.
- Higher stumps and more and larger residue pieces may be left with screening.
- Areas normally viewed from cars passing at high speed may have more and larger residue pieces and higher stumps than areas normally viewed at low speeds.

39/ Randel F. Washburne, Roger F. Clark, Frederick Campbell, and others. Panel report on aesthetic objections to forest residues. Unpublished manuscript on file, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon [n.d.].

- Under maximum modification conditions, passability, appearance of waste, and disposal of manufactured waste materials (oil drums, cable, and trash) are the only important esthetic considerations.

- More stringent esthetic conditions require low-cut stumps and may call for camouflaging of cut faces with dirt or moss.

- Bare soil is displeasing[39/] especially where piled or dug up, or where it contrasts with humus or duff in undisturbed areas.

- In more stringent conditions, the density and character of vegetation in areas where timber is harvested should approximate that in surrounding areas.

- Burned areas resulting from piling and burning of residues are undesirable in increasingly stringent esthetic situations.

MIDDLE GROUND--between 1/2 mile and 5 miles:

- Skidding patterns are obvious and undesirable in the most stringent specifications.[39/]

- Controlling texture (pattern) produced by residue pieces[39/] (Wagar 1974, p. H-6) by limiting size and density is more important with increased esthetic stringency.

- Patterns of disturbed soil and burning are undesirable as discussed under "Foreground."

BACKGROUND--beyond 5 miles:

- Most features of forest residues and residue treatments are not evident at background distances. Areas classified as background are, however, subject to some public use. Although background should thus meet minimum standards for passability, appearance of residue, and disposal of manufactured waste materials (oil drums, cable, etc.), the consensus of the Recreation Panel was to not develop statements for areas so classified.

RE-2 Protection of Esthetic Quality on Lands Used for Recreation But Not Under a Formal Visual Resource Classification System

Some public and private lands are little used for recreation because the nonrecreation goals of the owners, or the goals established in law for some public lands, limit opportunities for such use. Access may be restricted or may be undeveloped. Formal classification of the visual resource on such lands either may be unnecessary, or equivalent classifications for those shown in Input Block 4 of the User's Work Form or a simplified system may be used.

If visual resource classification is unnecessary but some recreation use is encouraged, goals of keeping man-caused residues subordinate to the characteristic landscape are desirable in areas where use is encouraged (Wagar 1974, p. H-5 and H-7).

In areas of lesser use, decomposition should be hastened and the appearance of waste and disorder minimized (Wagar 1974, p. H-7, H-11, and H-12).

RE-3 Recreational Benefits from Exceptions to Recreation Guidelines

Certain guidelines for esthetics and forest protection (List 1.000 statements) may be modified for silvicultural and terrestrial habitat purposes (List 3.000 statements). Such modifications also provide benefits to recreation. These may include improving the forest appearance by treatment to enhance the establishment of new trees and improving chances for sighting of wildlife by removal of residue.

Wherever exceptions are made to the List 1.000 statements, manipulation must be done in a manner that avoids public misunderstanding, deviates as little as possible from List 1.000 statements, and gives the impression of having been done carefully as part of a coherent pattern of land stewardship (Wagar 1974, p. H-5).

RE-4 Compensatory Benefits to Overall Forest Protection from Exceptions to Recreation Guidelines

Although natural debris may be acceptable to visitors, it may nevertheless be damaging to recreation and scenery (Wagar 1974, p. H-2). The massive amounts of debris resulting from events such as wildfire, epidemics, and violent storms are considered in this category.

Removal of much of this debris may benefit many aspects of environmental quality, including avoidance of losses of vegetative cover from fire, insect attack, and disease. Where overall forest protection will benefit from debris removal, certain guidelines drawn from List 2.000 apply. These guidelines prescribe treatments necessary to provide adequate fuel management and to prevent spread of insects and disease. Wherever these supplementary conditions are attached to List 1.000 statements, attention should be given to achieving what people associate as natural in the area of treatment (Wagar 1974, p. H-5). Natural appearance is aided by softening the edges of any openings through gradual transition from cleared areas to forest; i.e., by "feathering" (Wagar 1974, p. H-6).

SI--SILVICULTURE GUIDELINES SUPPORTING INFORMATION

SI-1 The Need for Eliminating Residues Which Are Obstacles to Management

Timber harvesting and silvicultural operations in the Pacific Northwest can produce unacceptable accumulations of residues, These residues may obstruct regeneration and impede planting, future harvesting, silvicultural activities, recreation, and efficient forest management (Dell and Ward 1971; Edgren and Stein 1974, p. M-1 and M-4 to M-6; Ruth 1974, p. K-9).

The consensus of the Silviculture Panel is that forest residues created by silvicultural activities should be treated to eliminate obstacles for future silvicultural activities or timber harvesting.[40/]

SI-2 The Need for Space for Prompt Reestablishment of Timber Species

To meet an objective of utilizing the full growing capacity of forest lands, prompt reestablishment of preferred timber species is needed after any harvesting that more than thins the stand. Some species in some situations may become established on rotten residues, e.g., in coastal hemlock-spruce forests (Ruth 1974, p. K-8). Also, conditions most favoring germination of seed may be at variance with conditions most favoring seedling survival, e.g., white fir in mixed conifer stands on the west slope of the. Sierra Nevada (Stark 1964, cited in Seidel 1974, p. L-7). Nevertheless, some generalizations regarding space for prompt reestablishment can be made:

For areas to be planted in the Olympic and Coast Range Provinces, the consensus of the Silviculture Panel, was that any time the number of crop trees was reduced below 70 trees per acre, ll-inch d.b.h. or larger, there should be at least 350 planting spots and/or established seedlings or saplings uniformly distributed on each acre. In these geographic areas, an acceptable planting spot conforms to the concept presented in the paragraph on planting spot acceptability and is free of established salmonberry (Miller et al. 1974, p. J-10).

For areas to be planted in all other specified forest residue type areas, the consensus of the Silviculture Panel was that any time the number of crop trees was reduced below 40 trees per acre, ll-inch d.b.h. or larger, there should be at least 190 planting spots and/or established seedlings and saplings uniformly distributed on each acre.

For all specified areas where planting is to be done, the following additional statement of planting spot acceptability applies: Every acceptable planting spot must be accessible to planters and protected from soil ravel; for example, downslope from stumps or logs which are preferably bark free (Edgren and Stein 1974, p. M-6 and M-11). For sites where sunshine may be expected to cause mortality, planting spots will have partial shade (Edgren and Stein 1974, p. M-12 to M-14; Seidel 1974, p. L-7; Miller et al. 1974, p. J-10) from the south and west sides in the form of rocks, stumps, and logs (Ruth 1974, p. K-7), which are preferably bark free (Edgren and Stein 1974, p. M-6). Rotten wood is acceptable as a planting medium in the coastal hemlock-spruce type (Berntsen 1960, cited in Ruth 1974, p. K-9) but is to be avoided for planting spots in the remaining mixed-conifer types (Ruth 1974, p. K-9) and is not desirable on sites with extreme conditions (for example, steep south slopes with shallow soil (Miller et al. 1974, p. J-4)). Skid roads and other compacted areas should be avoided, as should those with partially buried residues, or where chips may become mixed with the soil surrounding the planted tree (Edgren and Stein 1974,

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[40/] Edgren and Stein (1974, p. M-6) make the point that, although the obstruction effect is recognized by most people, very little data have been published; but they suggest the resistance to control rating used in fire management may correlate with obstruction to planting (see FI-2, p. 183, on rating resistance to control).

p. M-7 and M-10). Generally, residual vegetation may provide beneficial shade and protection from frost (Youngberg 1966) and is thought to be of little consequence in successfully regenerating Douglas-fir, with certain notable exceptions. Salmonberry has been previously mentioned on page 209. Swordfern and oxalis communities become increasingly vigorous after clearcutting on moist sites of the western Cascade Range. On such sites, planted trees either should be shade tolerant or should be expected to maintain dominance over the residual vegetation (Miller et al. 1974, p. J-5 and J-10). If not, vegetation should be avoided in selecting planting spots.

In certain areas where seeding is to be practiced or where natural regeneration is to be the means of achieving stocking, a uniform distribution of spots similar to those described above will be needed as well as an exposed mineral soil seed bed. There is general agreement on the desirability of a mineral soil seed bed for favoring survival and growth of Douglas-fir (Miller et al. 1974, p. 5-25), as well as all species in the pine and mixed-conifer types east of the Cascade Range (Seidel 1974, p. L-8). Mineral soil seed bed is also necessary in the mixed-conifer stands west of the Cascade Range, with the exception of hemlock-spruce in partial cut stands (Ruth 1974, p. K-8 and K-9).[41/]

SI-3 The Need for Protection of Seedlings by Leaving a Portion of Forest Residues Untreated

Miller et al. (1974, p. J-10) cite Silen,[42/] Hallin (1968), and Fowler (1974) in stating that a major benefit from slash is that it provides numerous patches of shade throughout cutover areas, thus moderating high and low surface temperatures. They also credit slash with reducing mortality of Douglas-fir reproduction from freezing, frost heaving, heat lesion, and drought. General agreement is reported on similar benefits to both tolerant and intolerant pine species east of the Cascade Range, including a study in lodgepole pine in which light to moderate slash on scarified areas yielded improved first-year survival over scarified plots with no slash protection (Cochran 1973, cited in Seidel 1974, p. L-7). Regarding lodgepole pine, Seidel (1974, p. L-8) further states that where it occurs as a seral species in mixed conifer forests, it regenerates satisfactorily with no overhead shade. However, in the pumice plateau area of central Oregon where this species forms climax stands, a light amount of logging residue seems to have a favorable effect. For the mixed conifers of western Oregon, Ruth (1974, p. K-7) cites Hallin (1968), Minore (1971), and Isaac (1938) in documenting the need for shade. He also points out that the net effect of residues is variable, but their presence does reduce frost damage on numerous microsites.

41/ Additional references in the cited literature and in Edgren and Stein (1974) form the basis for statements interpreted and cited in this discussion on seed bed preparation: Alexander (1966), Berntsen (1955), Boyd (1969), Boyd and Deitschman (1969), Fowells (1965), Fowells and Stark (1964), Hall (1971), Hermann and Chilcote (1965), Isaac (1943), Lotan (1964), Roy (1953), Trappe (1959).

42/ Roy Ragnar Silen. Lethal surface temperatures and their interpretation for Douglas-fir. Ph.D. thesis, Oregon State College, Corvallis, 1960.

The importance of shade is further emphasized by Berntsen (1955), Hermann (1963), Ronco (1970), Ryker and Potter (1970), Stoeckeler (1945), and Strothmann (1972). In addition to moderating temperature, dead residues such as slash slow moisture loss. Edgren and Stein (1974, p. 14-14) cite Cochran (1973) regarding protection of seedlings from low temperatures by slash which reflects the outgoing radiation back to the ground. Fowler (1974, p. N-11 and N-14) presents a case for using the aerodynamic roughness of slash on a slope for stirring the dense, cold air which tends to move downslope and settle in depressions, causing frost damage. Residues also reduce damage to timber species by limiting access of browsing animals (Ruth 1974, p. K-8; Dimock 1974, p. 0-5; Edgren and Stein 1974, p. M-6) and may help hide some seed of commercial species from birds (Dimock 1974).

In addition to serious detrimental effects of residues discussed in SI-1 (p. 208), SI-2 (p. 209), and SI-4 (p. 212), and documented for several guideline statements (such as for esthetics, fire, insects, and disease), other detrimental effects must be evaluated. The effect on microenvironments can be either beneficial or detrimental, depending on the depth of the residues. For example, Fowler (1974, p. N-14) points out that with increasing depth, air exchange within the zone near the soil surface can become restricted. He states that plants in such environments can be effectively "buried" with excessive residue accumulation if the minimum air exchange is not met for removal of toxic gaseous products. Even deformation of seedlings and small saplings by bending and twisting, though not regarded as a normally serious problem, should be recognized as an effect of slash (Seidel 1974, p. L-9).

Besides shade, seedlings also need sunlight. Douglas-fir tolerates light-to-moderate shading of seedlings by residues or by trees left on the site (Miller et al. 1974, p. 5-4). Edgren and Stein (1974, p. M-12) cite Berntsen (1955) relative to a preference for light slash in a spruce-hemlock clearcut. Day (1964) found that one-third of the spruce and fir seedlings in a study in Alberta, Canada, occurred where there was heavy shade 50 to 100 percent of the day.[43/] Damping-off fungi are reported to increase seedling mortality under moderate to heavy shading (Miller et'al. 1974, p. 5-4).

From the above discussion, it is apparent that there is limited knowledge of the beneficial effects of residues on timber regeneration; but many interactions are not accounted for. Fowler (1974, p. N-2), for example, points to the limited availability of literature directly related to effects of residue on microclimate. This accounts for the absence of more precise statements than "light," "moderate," and "heavy" slash when speaking of silvicultural benefits and detriments. In the face of this deficiency, the consensus of the Silviculture

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43/ Other references have been cited by Edgren and Stein (1974, p. M-12 to M-14) on light intensity and are specific to species. These include reports of studies which should be useful in arriving at more quantitative expressions of desired shade levels but which may not adequately include such additional variables as reflectance, heat advection, humidity, and soil moisture on the welfare of the trees studied: Adams et al. (1966), Franklin (1963), Garman (1955), Gordon (1970a, 1970b), Hatch and Lotan (1969), Isaac (1943, 1956, 1963), Krauch (1956), Maguire (1955), McCulloch (1942), Minore (1971, 1972a), Pearson (1950), Ronco (1970), Roy (1953), Ryker and Potter (1970), Shearer (1967), Strothmann (1972), Wahlenberg (1930).

Panel was to leave a per-acre maximum of no more than five 80-cuhic-foot pieces (representing wood pieces 24-inch diameter, small end, by 25 feet long, and 40-inch diameter, small end, by 10 feet long, etc.). The Silviculture Panel further agreed that leaving smaller material, as permitted by other guidelines, would satisfy requirements for clearcut areas for which leaving certain amounts of logging slash was recommended.

SI-4 The Need for Control of Competition from Living Residues

Crop trees of intolerant species such as Douglas-fir need to maintain dominance over their competitors (Miller et al. 1974, p. J-5). The effect of competitors upon available light and soil moisture is of prime importance (Edgren and Stein 1974, p. M-2, M-3, M-12 to M-14, and M-16) in deciding when and if to control competition from living forest residues.

The Silviculture Panel has established a requirement for control of brush species during the first 5 years before dominance of crop trees is lost or growth of crop trees is limited by competition for sunlight or soil moisture. .The Silviculture Panel has assumed that detailed judgments will be made by land managers for each case. For soil moisture determination, it will be necessary to do more than judge height or. quantity of competing vegetation. For this purpose, available soil moisture during critical seasons should be compared with the known effects of different stress levels. Soil water potentials of -2 to -4 bars may reduce seedling growth. A reduction of 0.5 bar may affect stem elongation and dry weight production. Water will become less available as soil moisture decreases. However, there is no definite point at which water becomes unavailable to plants (Kramer 1969 as cited in Edgren and Stein 1974, p. M-3).

The Silviculture Panel agreed that the need for treating live residues was less critical after the first 5 years. After that time, living residues less than two-thirds the height of crop trees could be tolerated.

SI-5 Damage from Birds and Animals

Numbers and kinds of vertebrates using a forest site are significantly affected by the character, density, and distribution of residues (Dimock 1974, p. 0-3). As developed in SI-3 (p. 210), residues can protect tree seedlings from bird and animal predation. Unfortunately, they can also provide habitat for birds and animals which feed on tree seeds and seedlings. For example, logging slash can help to hide some tree seed (see SI-3) but, at the same time, it provides nesting habitat for small seed-eating birds (Dimock 1974, p. 0-5). Slash improves the habitat for species such as deer mice, which can devastate Douglas-fir natural regeneration, and which normally do not require dense cover (Dimock 1974, p. 0-5; Miller et al. 1974, p. J-4). Dimock (1974, p. 0-13) cites Mitchell's (1950) observation that it was necessary to plant trees 5 to 20 feet from brush piles to lessen damage by brush rabbits on western sites and suggests that damage by snowshoe hare may be expected in habitats with prominent slash piles.

Although admitting the weaknesses of experimental data, Dimock (1974, p. 0-17) risks some generalizations which include the statement:

> Treatment methods that alter residues the least--although still meeting objectives of reducing fire hazard, lessening waste, and alleviating brush competition--seem to have most practical possibilities for minimizing animal problems.

The Silviculture Panel, while acknowledging the potential benefits of leaving certain residues (see SI-3, p. 210), recognized that the potential of an animal problem associated with residues could best be determined on the basis of local experience and conditions. For this reason, the Silviculture Panel recommended treatment of residues that may provide habitat for development of animal populations that would prevent establishment and growth of adequate numbers of crop trees. Their recommendation implies a need for local observation, preferably by experts in both silviculture and animal habitat.

SI-6 Use of Prescribed Fire Recommended

Prescribed fire may be used to reduce both logging slash and potentially competitive vegetation in clearcut areas. It may also be used in forest stands to reduce the natural litter from stand atrophy and understory vegetation in either uncut stands or in partially cut stands along with the slash from partial cutting. When used in clearcut areas or for type conversion, the fire prescribed is usually more intense than fire used in uncut or partially cut stands. The former is known as broadcast burning and the latter as underburning.

Fire prescriptions, their relationship to a natural role of fire in certain northwestern ecosystems, and the Fire Management Panel recommendation that fire be used in certain Forest Residue Type Areas, are covered in FI-11 (p. 195). Silvicultural use of prescribed fire requires preparation. For minimum difficulty in control of fire and threat of damage to adjacent timber, slash from logging and timber culture operations should be arranged so as to avoid piles or concentrations against uncut timber. Judicious rearrangement of fuel can measurably improve the reintroduction of fire to forest areas where its long-time exclusion has resulted in excessive fuel accumulations that now make fire restoration a difficult task.

Seidel (1974, p. L-10) cites Weaver (1967) who stresses the importance of fire in maintaining ponderosa pine and who also discusses the effects of excluding fire. Gratkowski (1974, p. I-9), in pointing to both the advantages and disadvantages of using prescribed fire, introduces the use of chemical desiccants along with controlled burning for certain situations. He also points out that chemicals are not as effective against some species as is fire for initial treatment and as a subsequent control for reinvasion or resprouting.

In recommending fire for control of invading species and for seed bed preparation, the Silviculture Panel consensus was that 20 percent is the maximum reduction in timber growth rate which can be tolerated. It was the view of this Panel that the use of prescribed fire should be among the alternatives considered whenever the growth rate is threatened to this extent by invading vegetation.

SO--SOILS GUIDELINES SUPPORTING INFORMATION

SO-1 Soils of Medium and Fine Texture

Soils of this group have a tendency to be compacted readily by equipment (Rothacher and Lopushinsky 1974, p. D-7 and p. D-8; Ruth 1974, p. K-14; Gratkowski 1974, p. I-12). Moisture content in these soils becomes especially critical when soil moisture exceeds about 10 percent. Soil compaction is most frequently a factor in evaluating which equipment to use for piling and burning, crushing,

and YUM (yarding unutilized material) operations. The consensus of the Private Lands Management Decisions Panel is that equipment exerting less than 3½ pounds per square inch will have little effect on compaction.

SO-2 Soils of Coarse Texture

Soils of this group contain 50 percent gravel or larger size fragments. Texture governs the treatments which would increase the erosion rate of coarse-textured soils or increase the rate of gravel-or stone raveling on the soil surface (Rothacher and Lopushinsky 1974, p. D-7). Soil textures include sandy loam, loamy sand, and sand. These soils also are most susceptible to nonwettability resulting from fire (Miller et al. 1974, p. 5-16).

SO-3 Soil Organic Matter of Less Than 2-3 Percent

Soil organic matter content of 2-3 percent is recognized as a critical minimum by consensus of Soils Panel. Organic matter plays important roles in both physical and chemical properties of the soil that control water movement and available plant water storage, soil stability, and general life of the soil (Rothacher and Lopushinsky 1974, p. D-7 and D-8). As broadcast burning of residues usually results in destruction of organic matter, soils in which the reserve is already very low should not be subjected to this treatment. Low intensity spring burns which do not destroy the duff generally do not materially affect soil organic matter functions. The Private Lands Management Decisions Panel agreed that leaving materials less than 3 inches in diameter would help offset soil damage resulting from machine piling on soils of low organic content. The Public Lands Management Decisions Panel agreed to limit the mineral soil exposed during broadcast burning on low organic matter soils to 20 percent of the area being treated. (See SI-3, p. 210.)

SO-4 Soil Depth of Less Than 24 Inches

Reduction in soil depth is considered important, particularly in combination with residue disposal by burning, because both reduce nutrient and water storage. With deep soils, the reserve is large and reductions are of little consequence; but when the reserve is low as in shallow soils, reduction of depth may be crucial (Ruth 1974, p. K-7; Seidel 1974, p. L-6; Gratkowski 1974, p. 1-10). The Soils Panel has arbitarily designated 24 inches as a critical minimum soil depth. The Private Lands Management Decisions Panel agreed that leaving materials less than 3 inches in diameter would help offset soil damage resulting from machine piling on shallow soils. (See SI-3, p. 210.)

SO-5 Low Soil Fertility

Low soil fertility contributes to slow growth of timber and associated understory plants. Soils with low fertility require conservation or improvement of existing plant nutrients. Practices such as burning or complete YUM yarding which tend to deplete nutrients are detrimental to site productivity. Crushing and incorporation of residue into the soil are also detrimental since this results in an immediate, though temporary, reduction of nitrogen, an essential plant nutrient. These effects on plant nutrients have been documented (Ruth 1974, p. K-7, p. K-14, and p. K-15; Seidel 1974, p. L-6; Gratkowski 1974, p. 1-20; Miller et al. 1974, p. J-11 and J-12). A 3-inch maximum diameter for materials to be left in place is intended to leave most of the foliage since this residue component yields most of the essential elements.

Fertilization to offset effects of residue treatments on nutrients should be specified on the basis of factors such as: intensity of burn, though effects on nutrients have been controversial (Miller et al. 1974, p. 5-13; Moore and Norris 1974, p. C-13); the presence of nitrogen-fixing species such as alder (Moore and Norris 1974, p. C-4); the rate of return to normalcy after treatment (Moore and Norris 1974, p. C-10) in relation to management goals; and the extent to which residues are mixed with the soil.

SO-6 Available Soil Moisture Holding Capacity of Less Than 2 Inches Per Foot of Soil

Soils with less than 2 inches available water per foot of depth are considered by the Soils Panel to be droughty soils. Infiltration rates should be protected and a surface organic mulch preserved to reduce soil moisture loss. This situation is commonly associated with shallow, coarse-textured soils. Practices negatively affecting this situation are broadcast burning and piling and burning (Gratkowski 1974, p. 1-20). The consensus of the Public Lands Management Decisions Panel is that a 25-percent shade cover in certain cases should offset the loss of moisture holding capacity associated with machine piling of residues. Similarly, the Private Lands Management Decisions Panel agreed that sufficient shade for seedling establishment should offset the removal of residues. (See **SI-3, p.** 210.)

SO-7 Litter Less Than 1 Inch Deep

Litter on the soil surface serves several important roles including shading, reducing raindrop impact, and slowing overland flow. Sites on whi'ch this restriction of litter removal applies are generally hot, southerly exposures frequently with low amounts of plant-available moisture. The consensus of the Soils Panel is that litter of at least 1-inch depth should be present over at least 70 percent of the land area. This should provide minimum satisfactory soil protection where raindrop impact, overland waterflow, and wind erosion are likely to occur (Bollen 1974, p. B-27; Ruth 1974, p. K-7; Gratkowski 1974, p. 1-10).

Pure ponderosa pine and juniper stands are excluded because site potential and climate preclude development of 1 inch of litter. Bunchgrasses commonly form ground cover under these open (savanna) stands. Bunchgrass litter tends to blow away, and tree cover is not sufficient to produce 1 inch of litter. Fire scars on trees testify to a history of repeated natural underburnings.

Depth and distribution of litter are most strongly affected by broadcast burning, piling and burning, and ground contact YUM yarding.

SO-8 Slopes of 30 to 60 Percent

Slopes greater than 30 percent without roads pose severe limitations to track and wheeled equipment. The 60-percent slope is approximately the natural angle of repose. Experience has shown that erosion increases severely on slopes greater than 60 percent after burning (Rothacher and Lopushinsky 1974, p. D-10). The consensus of the Private Lands Management Decisions Panel is that slope-related limitations on residue treatment should begin at 35 percent for all provinces except the Siskiyou where limitations should begin at 30 percent.

SO-9 Slopes Greater Than 60 Percent

Steep slopes near or above the natural angle of repose (approximately 60 percent) are a hazard to several forms of fuels management. These slopes are susceptible to sliding and are very likely to be subject to overland flow and soil erosion (Rothacher and Lopushinsky 1974, p. D-10; Ruth 1974, p. K-7).

Broadcast burning on such slopes may reduce the amount of root binding and hence increase soil sliding. Such steep slopes generally burn very hot, hence lose any protective cover of vegetative material. This accentuates the problem of overland flow by increasing erosion rates. Use of equipment on such steep slopes, as for crushing or piling, leads to very serious soil displacement and erosion. Ground contact YLJMyarding on these slopes also tends to reduce the protective ground cover.

SO-10 Treatment Less Than 100 Feet From Live Stream

This restriction is meant to protect the stream from sediment from adjacent sources. It is generally applied where overland flow could be expected after fuels treatment (Rothacher and Lopushinsky 1974, p. D-10, D-12, and D-13). Distances mentioned in the guidelines are the arbitrary judgment of the Soils Panel.

SO-11 Extension of Reliance on Fire Prescriptions That Will Avoid Destruction of the Duff Layer

The consensus of the Private Lands Management Decisions Panel is that, in certain areas where the Soils Panel holds the view there are not now adequate fire prescription criteria for soil protection: (a) experienced prescribed burners have demonstrated that reasonable precautions to protect the duff layer are possible; (b) the art of prescribed use of fire is making rapid advances; (c) current research and development toward reliable duff-protecting prescription criteria are progressing at a pace that should make these criteria available soon. (See FI-11, p. 195.)

SO-12 Southerly Exposures

Certain residue treatments such as broadcast burning, piling and burning, and YUM increase south slope temperatures and dryness, thereby increasing survival problems of regeneration and vegetation cover (Aho 1974, p. Q-7). In the consensus of the Public Lands Management Decisions Panel, a 25-percent shade cover in certain cases should offset problems associated with machine piling of residues. Similarly, the Private Lands Management Decisions Panel agreed that sufficient shade for seedling establishment should be encouraged to offset the removal of residues. (See SI-3, p. 210.)

SO-13 Frost Heaving

Limitations are suggested for soils which tend to frost heave planted and natural seedlings. These limitations are most often applied to practices which leave no insulative layer of organic litter following treatment (Ruth 1974, p. K-7). Mulching (Fowler 1974, p. N-13) and shading (Miller et al. 1974, p. J-10) with residues may help to reduce frost heaving and seedling dislodgment. The consensus of the Public Lands Management Decisions Panel is that a 25-percent soil shade cover in certain cases should offset frost heaving problems associated

with machine piling of residues. Similarly, the Private Lands Management Decisions Panel agreed that sufficient shade for seedling establishment should be encouraged to offset the removal of residues. (See SI-3, p. 210.)

SO-14 Subalpine Forests (Timber Species Association 5)

Management of harvesting residue and subsequent regeneration on subalpine forests frequently presents different problems because of the nature of the organic matter accumulated during the development of the forest. This forest area is characterized by low average temperature and summer moisture deficiency so that decomposition is slow, resulting in large surface accumulations of organic matter. These can build up to depths of 14-18 inches with a total weight of 6-12 tons of dry matter per acre.

After removal of overstory, this material dries out rapidly and not only constitutes a large amount of combustible material but is frequently a barrier to forest regeneration.

There is generally little incorporation of this organic matter into the upper soil layers, and mineralized nitrogen is frequently low. The material itself displays distinct hydrophobic properties when dry, and initial rains tend to run off the surface and may contribute to rapid streamflow peaks.

Residues from forest harvesting need special consideration because residue treatment here may contribute additional problems or may be used to ameliorate existing conditions. For instance, complete destruction by fire would remove much of the stored nitrogen, with very slow rates of recovery. Advance regeneration, frequently found under the harvested stand, is also destroyed, and large amounts of ash material and soluble chemicals may be released to nearby streams.

A system that brings about a mixing of logging residues with the forest floor and with the underlying mineral soil is to be preferred. From the point of view of overall forest management, the more complete the mixing, the better for future development of the ecosystem.

SO-15 Dunal Subprovince

These soils are dominantly coarse and highly erodible by wind and water. Small gouged areas can readily grow to depressional "blowouts." Even small areas of surface exposure can erode. Any operation in this soil province must be governed by strict attention to preventing any disturbance that may lead to "blow" conditions.

Also, these soils are highly displaceable. Any use of machinery or log gouging can remove the weakly developed soil, leaving behind an infertile soil material.

The consensus of the Soils Panel is that there should be no disturbance, or displacement, of soil in this area.

SO-16 Combinations of Above

In certain forest type areas, combinations of many of the above critical soils factors are so frequent and of such importance that any disturbance is undesirable. Lopping and scattering of forest residues is specified as the preferred treatment for such areas since it is least disturbing.

TE--TERRESTRIAL HABITAT GUIDELINES SUPPORTING INFORMATION

TE-1 Broadcast Seeding

When forest vegetation is killed or destroyed and soil is exposed, watershed protective value and forage for wildlife and domestic livestock are lost. In most cases nitrogen-fixing vegetation is reduced, and nutrient cycling is interrupted. Often poisonous or noxious plants invade the area to compete with desired species.

Soil exposed by disturbance or fire offers the land manager an opportunity to seed with plants which are suitable to the site, climate, and use of the land. Seeding promptly after soil disturbance or burning is better land management than waiting 2 or 3 years. Dyrness (1970) pointed out that best success with broadcast seeding occurs while the soil is still loose and friable. The consensus of the Terrestrial Habitat Panel is that seeding should be done within 10 days of disturbance or burning. As time passes, the soil tends to settle and the surface crusts from raindrop impact. This results in erosion and provides a poor seed bed for establishment of ground cover species.

TE-2 Topsoil Replacement

Replacement of topsoil on debris burial pits, or mounds, enhances establishment of ground cover vegetation. The Terrestrial Habitat Panel specifically did not mention animals because many burial sites are located along main roads. In situations where traffic speed is high, use of palatable plants to provide forage for animals is discouraged because grazing animals, particularly big game, pose a serious traffic safety hazard. In these cases, plants of low palatability should be selected to discourage animal use.

TE-3 Use of Prescribed Fire

Broadcast burning of logging slash in Douglas-fir forest types enhances establishment and growth of forage communities desired by big game animals. The quality and quantity of preferred forage can be increased as can the period of optimum habitability (Garrison and Smith 1974, p. P-3 to P-5; Dimock 1974, p. 0-7 to 0-9). The SO-percent minimum level in Statement 3.804 is the consensus of the Terrestrial Habitat Panel.

TE-4 Soil Disturbance

Avoiding soil in piles of debris permits complete combustion of the residue pile (see **AI-4,** p. 174) and prevents undue displacement of the soil A horizon. Desired vegetation establishes easier and grows better in relatively undisturbed soil or A horizon than in severely disturbed soil in which'the poorly weathered C horizon is exposed. The consensus of the Terrestrial Habitat Panel is that severe soil disturbance and reduction in plant growth should be avoided.

TE-5 Retention of Some Slash Cover in Certain Clearcuts

Retention of undisturbed slash in clearcut areas aids cover and concealment of big game, as well as nongame animals. Literature cited by Garrison and Smith (1974, p. P-2) and Dimock (1974, p. 0-5) suggests that some slash should be left untreated but other areas should be treated to improve animal movement and access. The Public Lands Management Decisions Panel agreed that 10 percent of certain clearcut areas be left untreated as a reasonable compromise between fire management, accessibility for intensive stand management, and animal habitat needs. Smaller diameter patches of untreated slash were recommended for small clearcuts where cover around the edge of the clearcut would be adequate for big game animals. Larger slash piles were recommended in larger clearcuts as cover for big game animals as well as small game.

TE-6 Movement of Animals and Wildlife Cover

Reduction of slash to a depth of 8 inches or less on at least 75 percent of an area primarily facilitates livestock movement. The Terrestrial Habitat Panel agreed that 25 percent of an area should be left in untreated slash to provide cover and habitat for wildlife. Slopes greater than 30 percent are exempted because cattle graze with increasing difficulty on steeper slopes.

TE-7 Critical Big Game Habitat

The Terrestrial Habitat Panel believed maintenance of critical-weather big game range to be essential.

In these areas, any significant reduction in bitterbrush will be detrimental to big game. Therefore, primary land management objectives should be to enhance game winter range rather than optimize timber, livestock, or recreational opportunities. Of game winter ranges in the greater Pacific Northwest area, those with bitterbrush are most sensitive to forest residue treatment because bitterbrush seldom sprouts after burning nor can it reproduce from rootstalks following destruction of the aboveground shrub. The Public Land Management Decisions Panel concurred that there should be a program to prevent destruction of bitterbrush in these limited but crucial areas. To survive, bitterbrush plants must be able to sprout and produce new growth the next year.

TE-8 Retention of Bitterbrush

The consensus of the Terrestrial Habitat Panel is that at least 50 percent of the original number of bitterbrush plants should be retained alive after timber harvest and slash disposal in the lodgepole-bitterbrush community of south central Oregon. This community is an important big game spring, fall, and summer range. A key point in this statement is that plants must "survive" logging. This means that bitterbrush plants may sustain damage from logging or slash disposal, such as crushing or breaking, but only to the extent that the plants are able to sprout and produce new growth the next year.

TE-9 Movement of Animals

Any continuous concentration of residues, especially across frequently used livestock and game trails, will greatly restrict movement. This in turn restricts use of forage and movement from forage to water. Such obstruction is very disruptive and detrimental to the habits and needs of both domestic and wild grazing animals (Garrison and Smith 1974, p. P-3; Dimock 1974, p. 0-5). By consensus of the Terrestrial Habitat Panel, any material larger than 3 inches in diameter or higher than 6 inches above the soil is considered disruptive.

TE-10 Huckleberry Areas

One of the major factors in reducing huckleberry production is the encroachment on huckleberry fields by pioneer tree species, such as lodgepole pine and mountain ash (Minore 1972b). The Terrestrial Habitat Panel members and several professionals on the Gifford Pinchot National Forest intimately familiar with the Twin Buttes huckleberry field believe that pine species should be removed first. The Terrestrial Habitat Panel concluded that three to five fir or hemlock trees per acre tend to modify the microclimate favorably for huckleberries. These three to five trees per acre tend to produce no more than 10 to 20 percent of ground cover and therefore, apparently, do not significantly reduce berry production.

TE-11 Movement of People in Berry Areas

The consensus of Terrestrial Habitat Panel members is that removal of logs would reduce barriers to people moving through clearcuts to pick huckleberries and would improve berry production. Although little is known about managing northwestern huckleberries (Minore 1972b), broadcast burning, according to observations of personnel of the Gifford Pinchot and Mount Hood National Forests, tends to stimulate huckleberry bushes to grow faster and produce more berries.

TE-12 Retention of Brush in Clearcut Areas

Control of shrubs in clearcut areas can have adverse effects on wildlife, particularly if several adjacent clearcuts are treated simultaneously. It is the Terrestrial Habitat Panel's view that any treatment program should be designed to maintain some habitat for wildlife in brushfields.

TE-13 Limit on Chip Depth

An area uniformly covered by a 1-inch thickness of wood chips had an adverse effect on establishment of grass seeds (Rothacher and Lopushinsky 1974, p. D-7). This effect has also prevented establishment and survival of tree seedlings, shrubs, and herbaceous plants. If the chips are mulched into the soil, the carbon-nitrogen ratio causes reduced growth or death (Garrison and Smith 1974, p. P-5). Fowler (1974, p. N-12) has shown that there is a negative exponential relationship between pine and spruce seedlings and litter depth. Therefore, the Terrestrial Habitat Panel concludes that chip depth should be limited to 1 inch.

TE-14 Movement of Animals in Windrowed Residues

Terrestrial Habitat Panel members have observed forced trailing of both livestock and big game animals due to windrowed materials. Their consensus is that 200 feet between breaks in windrows is a reasonable travel distance for animals and a reasonable criterion to administer. An important consideration in windrowing material, particularly on west-side clearcuts is to avoid blocking access to streams or other water. When windrows are placed on the contour, a long, nearly impenetrable barrier between forage areas and water can result if such breaks are not provided.

TE-15 Snags

Forestry practices involving removal of dead and cull trees create changes in the forest environment which reduce both numbers and diversity of birds and mammals. The most important single effect of snag removal is the severe reduction or elimination of the opportunity for cavity nesting species to breed and successfully rear young (Cowley 1971; Haapanen 1965, 1966; Hilden 1965; Goodrum 1971).

Bertrand and Scott (1971) list 44 species of birds as preferring conifer habitat. Thirteen, or 30 percent of these species, require cavities for nesting. Elimination or reduction of species and bird numbers of this magnitude can create significant changes in the insect balance of the conifer ecosystem. Most of the species that would be eliminated or reduced are heavy insect consumers. They include chickadees, woodpeckers, bluebirds, creepers, nuthatches, titmouse, and purple martin. Insect-feeding birds are one of several natural controls which restrict the population of forest insects. Workers studying the effects of avian predation on injurious insects generally conclude that birds are normally not able to control an insect epidemic, and that birds play an important role in preventing or extending the period between epidemic insect outbreaks by continuous and effective predation on endemic populations (Bruns 1960; Otvos 1965; MacLellan 1958, 1959).

Bruns (1960) points to a number of studies which substantiate that bird densities can be increased 5 to 20 times with the addition of nest boxes; and that insect populations and forest damage are much lower where bird populations have been increased. Much of the need for nest boxes in Europe has developed from intensive silvicultural practices which require removal of dead and cull trees. Forestry practices in the Pacific Northwest are also rapidly depleting snags for the stated purposes of decreasing fire hazard and improving safety conditions for woods workers. Both purposes are legitimate; however, the forest manager often has the responsibility for maintaining habitat for all forms of wildlife and should encourage birds as a major insect predator.

Consensus of the Terrestrial Habitat Panel was that a minimum of four snags per acre be left within a cutting area; this is based on findings by Gale.[44/] He studied the use of snags for feeding and nesting in several forest types, and found that bird use varied from 0.8 to 4.3 snags per acre.

44/ Robert M. Gale. Snags-chainsaws and wildlife. Paper presented to 4th Annual Joint Conference, American Fisheries Society, The Wildlife Society, North Lake Tahoe, Calif., 1973.

The fact that a snag does not exhibit evidence of bird use at the time of inspection should not be used as sole criterion in judging its value. The age of the snag and its potential for future use should also be considered. Gale[44/] measured several snag parameters in relation to bird use and established criteria for determining snags that provide optimum nesting or feeding habitat. He found that the value of a snag for bird nesting and feeding increases in relation to a combination of its size (both height and diameter) and softness. The ideal nesting snag should "be soft or rotten, be 20-49 feet tall, be greater than 15 inches in diameter, have the bark absent, and limbs absent or reduced to stubs." For feeding, the snag should "be soft or rotten, have a diameter greater than 15 inches, and be absent of bark."

The exceptions to the guideline statements calling for leaving snags are a result of deliberations between the Chairmen of the Terrestrial Habitat and Fire Management Panels and reflect agreement of the Public Land Management Decisions Panel. These exceptions are founded in a need to protect the forest from wildfire for overall environmental protection (see FI-8, p. 186; FI-9, p. 187; and FI-10, p. 189).

TE-16 Cull Trees

Cull trees may or may not be currently good wildlife habitat. However, the Terrestrial Habitat Panel's viewpoint is that retention of one cull tree per acre is essential if a future supply of snags and stubs is to be assured. Dominant crown position of cull trees was specified for enhancement of eagle, osprey, and other raptor habitat. The exception related to cull trees has the same basis as discussed under TE-15 above.

WA--WATER QUALITY AND AQUATIC HABITAT GUIDELINES SUPPORTING INFORMATION

WA-1 Protection of Stream Channels

Removing natural residue may seriously damage the stream channel. In many cases, natural residue provides excellent habitat for fish and should be left in place if possible (Brown 1974, p. E-8). A few logs buried in the bottom of the streambed frequently result in small waterfalls or plunge pools which increase living space and reaerate the water. Greater accumulations of large residues may act as a barrier to fish and may cause streambank erosion (Brown 1974, p. E-7).

WA-2 Removal of Unstable Residues

Residues which move and accumulate behind large obstructions cause temporary damming. Under extreme high flows, these dams break and flush out the stream channel with damage to streambanks and to fish habitat, particularly downstream from the original occurrence (Brown 1974, p. E-7).

WA-3 Prevention of Residues in Streams

Under Federal and State pollution control laws, streams may not be used for the disposal of solid wastes. Buffer strips, directional felling, cable-assisted felling, and yarding away from streams will normally keep man-caused debris out of streams (Brown 1974, p. E-4 and E-5).

WA-4 Removal of Residues with Minimum Disturbance

Optimums exist for remedial work to remove residues from streams. For example, optimum timing would be during the low water period; the optimum method of removal would be to lift residues out of the stream channel and place them well above high water. The least desirable removal method would be use of vehicular equipment in the stream channel.[45/]

WA-5 Streambank Erosion From Residues

Residues such as logs or limbs over 3 inches in diameter and 5 feet long may divert water, causing erosion of streambanks (Brown 1974, p. E-7).

WA-6 Effect on Dissolved Oxygen

Fine residues (needles and twigs) in combination with low flows in small streams and with elevated water temperatures can reduce dissolved oxygen to levels unacceptable for fish habitat (Brown 1974, p. E-6). Additionally, free-flowing streams will be reaerated naturally, thus eliminating most dissolved oxygen problems (Lantz 1971).

WA-7 Mortality of Salmon Embryos

Natural conditions for salmon embryos developing in gravel are often suboptimal at best. The clogging of gravels with small amounts of fine residues can increase embryo mortality (Brown 1974, p. E-7).

WA-8 Acceptance of Federal and State Standards

The Water Quality and Aquatic Habitat Panel accepts the Federal and State standards cited in guidelines 1.905, 1.906, 1.953, and 1.954 as the best available.

WA-9 Role of Riparian Vegetation Shade

Direct sunlight provides the major source of energy for heating streams. Streamside vegetation provides shade essential to keeping water temperatures at acceptable levels for fish habitat on most small streams (Brown 1974, p. E-10).

45/ Melvin H. Burke, "M-Watersheds," general memorandum to R. W. Lindstedt, on file, Pacific Northwest Region, USDA Forest Service, Portland, Oregon, 1965.

Widths of Zeave *strips for* shade.--On very small streams, brush is often sufficient to provide necessary shade (Brown 1974, p. E-10). Measurements along streams in western Oregon indicate that greater than 30-foot widths of uncut strips of timber along streams are not important to water temperature (Brown and Brazier 1972).

WA-10 Introduced Chemicals

Introduced chemicals used in treating forest residues and the introduced chemicals which may interact with forest residues are fertilizers and fire retardants, and pesticides (Moore and Norris 1974, p. C-15). In the fertilizer and fire retardant category, though there is an absence of direct data (Moore and Norris 1974, p. C-17), the primary water quality-related interactions with residues are presumed to be increased nutrient availability and more rapid decomposition of forest residues. In the pesticide category, the charcoal from burned forest residues may tightly adsorb applied pesticides, and any treatment drastically changing the native soil organic matter will influence pesticide retention and transport behavior (Moore and Norris 1974, p. C-19).

Guideline statements, other than 1.906, 1.954, and 1.955, do not address themselves directly to maintenance of water quality by limiting amounts of nonintroduced chemicals; other statements were directed at preventing chemical introduction from such sources as accelerated chemical leaching from stored nutrients, which may be expected with any removal of the forest floor and accompanying reduction of nutrient retention capability (Moore and Norris 1974, p. C-11), and the increase in quantity of chemicals in streams when rate of decomposition of residues exceeds the uptake by vegetation and the exchange capacity of the soil (Rothacher and Lopushinsky 1974, p. D-17). Members of the two Land Management Decisions Panels believe, however, that the behavior of nonintroduced chemicals will be adequately recognized by individuals applying these statements so that the details of "class of stream," "order of stream," "treatment method and intensity," etc., need not be spelled out in statements presented here. The following example illustrates the type of recognitions expected to be applied: In some streams draining immediately from areas of broadcast burning, temporary increases in concentrations of combustion product chemicals (sometimes above water quality standards) may be expected in proportion to the portion of the watershed that has been burned (Rothacher and Lopushinsky 1974, p. D-16). From this, it follows that downstream water quality can be maintained by limiting the extent of area burned to an equivalency of the dilution expected from conjoining waters of burned and unburned portions of the watershed.

Of greatest importance in application of chemicals is the prevention of drift or the avoidance of direct application to water surfaces. Buffer strips of untreated area along watercourses, as well as proper selections of formulations and equipment to minimize vapor loss, make this prevention possible (Norris and Moore 1971).

WA-11 Role of Riparian Vegetation and Litter in Reducing Erosion

Vegetation and litter along stream margins can be expected to reduce erosion by cushioning the impact and reducing the overland flow from precipitation as well as by providing holding material along streambanks (Burns 1970, Young and Wiersma 1973).

WA-12 Insects as Food for Fish Dependent on Riparian Vegetation

Removal of streamside vegetation may reduce the numbers and variety of insects. Insects dropping from overhanging vegetation are an important food source for fish (Brown 1974, p. E-10).

WA-13 Sediment

Sediment in streambed gravels reduces movement of water, impairs development of salmonid embryos, and restricts movement of young fish out of the gravel (Brown 1974, p. E-9).

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Glossary

available fuel - the portion of the total fuel that would actually burn under various specified conditions.

blow-out - a hollow excavated by the wind in loose soil; e.g., in sand dunes.

broadcast burning - intentional burning in which fire is set to spread over all of a specified area, usually in nonpiled fuels. In the Pacific Northwest, usually confined to burning of logging slash after clearcutting of an area.

characteristic landscape - the naturally established landscape within a scene or scenes being viewed.

coarse-textured soil - includes sands, loamy sands, and sandy loams except the very fine sandy loam textured classes. Compare fine-textured soil, medium-textured soil.

contrast - diversity of adjacent parts, as in color, tone, or emotions. the closer the juxtaposition of two dissimilar perceptions, in time or space, the more powerful the appeal to the attention.

crop tree - any tree forming, or selected to form, a component of the final crop.

cull - a tree or log of merchantable size but classified as unmerchantable because of poor form, rot, or other defect.

damping off - the rotting of seedlings, before or soon after emergence, by soil fungi attacking at soil level.

duff - forest litter and other organic debris in various stages of decomposition, on top of the mineral soil, typical of coniferous forests in cool climates where rate of decomposition is slow and litter accumulation exceeds decay.

established sapling - a young tree typically 2- to 4-inch diameter at breast height, growing vigorously and without dead bark or more than an occasional dead branch.

established seedling - a healthy, vigorous seedling that has survived for at least 2 years on the site.

evident contrast - exceptions to form, line, color, or texture infrequently found in the surrounding characteristic landscapes; or changes in existing natural character apparent to the casual forest visitor.

fine-textured soil - predominating in fine fractions, as fine clay. Includes all clay loams and clays. Compare coarse-textured soil, medium-textured soil.

fire whirl - a spinning, vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range from a foot or two in diameter to small tornadoes in size and intensity. They may involve only a hot spot within the fire area or the entire fire.

forest residue - the unwanted accumulation in the forest of living or dead, mostly woody material that is added to and rearranged by man's activities such as forest harvest, cultural operations, and land clearing. Forest residue includes slash materials, excessive litter on the forest floor, unwanted living brush and weed trees, and standing dead trees and snags.

fuel break - a strategically located strip or block of land of varying width, depending on fuel and terrain, in which fuel density has been so reduced as to provide an accessible location from which fires burning into it may be more readily stopped. If forested, the stand is thinned and remaining trees are pruned to remove ladder fuels; most brush, heavy ground fuels, snags, and dead trees are removed, and an open parklike appearance established in contrast to a firebreak from which all vegetation is removed.

litter - the surface layer of the forest floor consisting of freshly fallen leaves, needles, twigs, stems, bark, and fruits. This layer may be very thin or absent during the growing season.

live stream - see perennial stream.

low-speed travel - travel on established trails or roads at speeds of less than 30 miles per hour.

medium-textured soil - intermediate between fine-textured and coarse-textured soils. Includes very fine sandy loams, loam, silt loam, and silt-textured classes.

modification - a visual quality objective meaning man's activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middle ground.

partial retention - a visual quality objective which, in general, means man's activities may be evident but must remain subordinate to the characteristic landscape.

perennial stream - a body of continuously flowing water in a natural channel.

planting spot - an area *3* feet in diameter cleared of all residue under *3* inches in diameter and *3* feet long, and cleared to mineral soil.

prescribed burning - controlled application of fire to wild land fuels in either their natural or modified state, under such conditions of weather, fuel moisture, soil moisture, etc., as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives of silviculture, wildlife management, grazing, fire-hazard reduction, etc.

preservation - a visual quality objective providing for ecological change only.

rate of spread - the relative activity of a fire in extending its horizontal dimensions. It may be expressed as rate of increase of the perimeter, as rate of forward spread of the fire front, or as rate of increase in area.

residue - see forest residue.

resistance to control - the relative difficulty of constructing and holding a control line, as affected by fire behavior and difficulty of line construction.

retention - a visual quality objective which, in general., means man's activities are not evident to the casual forest visitor.

sapling - see established sapling.

seedling - generally, a young tree, shrub, etc., grown from seed, from its germination up to the sapling stage (see established sapling).

shaded fuel break - see fuel break.

slash - a complex of woody forest debris left on the ground after logging, land clearing, thinning, pruning, brush removal, or natural processes such as ice or snow breakage, wind, and fire. Slash includes logs, chunks, bark, branches, tops, uprooted stumps and trees, intermixed understory vegetation, and other fuels.

smoke episode - a period when smoke is dense enough to be an unmistakable nuisance.

smoke management - a system whereby current and predicted weather information pertinent to fire behavior, smoke convection, and smoke plume movement and dispersal is used as a basis for scheduling the location, amount, and timing of burning operations. Objective is to minimize total smoke production and assure that smoke does not contribute significantly to air pollution.

snag - a standing dead tree or standing portion at least 20 feet tall from which at least the leaves and smaller branches have fallen. Often called a stub if less than 20 feet tall.

stub - a standing section of the stem of a tree, broken off at a height of less than 20 feet, from which the leaves and most of the branches have fallen. Note: For the purpose of bird habitat, the Terrestrial Habitat Panel specifies in statement 3.817 that the stub need only be less than 12 feet in height.

underburning - prescribed burning with a low intensity fire in activity-created or natural fuels under the timber canopy.

visually subordinate - less than or below another feature in visual contrast in size, color, intensity, or brightness.

wander through - areas subject to close observation via foot travel and, in some cases, horse travel.

wilderness - an area established by the Federal Government and administered either by the Forest Service of the U.S. Department of Agriculture; or the National Park Service, the Fish and Wildlife Service, or the Bureau of Land Management, all of the U.S. Department of the Interior. Objective is to conserve its primeval character and influence for public enjoyment, under primitive conditions, in perpetuity.

wildfire - an unplanned fire not being used as a tool in forest protection or management in accordance with an authorized permit or plan and which requires suppression.

Appendix 1. Acknowledgments

The compilers gratefully acknowledge the commitment and dedication of the following people in developing these forest residues management guidelines. Their participation, thoughts, experience, and research findings made this publication possible.

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The compilers wish to recognize and thank Donald F. Boyer and James W. Russell for delineating and describing the forest types and preparing the Forest Type map. Thanks are also due Brian Anholt who made available an automatic data processing program for the numerous source documents used by panelists and compilers. David Foley and James Russell gave substantial input by providing legwork and support to panel members while they were assembled.

A complete list of all who helped us is too long to present here, but we are grateful and acknowledge their valuable support.

Appendix 2. Model smoke management plan for prescribed burning of forest residue [1/]

INTRODUCTION

Land managers have moderate flexibility in determining when, where, and how much of their prescribed burning, with proper fuel preparation, can usually await conditions favorable for both burning and smoke dispersion. Since burning operations require elaborate planning and, at the time of execution, involve considerable deployment of equipment and personnel, the burn must be scheduled in advance on the basis of predicted conditions described in the appropriate fire-weather forecasts.

This plan provides guidelines for air resource management to be used in conjunction with fire-weather air quality forecasts during forestry prescribed burning operations. It includes a schedule of limitations for keeping excessive forest residue smoke out of sensitive areas and procedures for minimizing smoke production and impact. The plan is based on knowledge that smoke from prescribed burning of forest residue can be:

1. Regulated by scheduling and selecting a favorable smoke plume trajectory, and

2. Manipulated by fuel preparation, selection of burning conditions, and burning procedure.

OBJECTIVE

The objectives of this plan are to minimize smoke resulting from burning of forest residues and to prevent it from being carried to or accumulating in areas sensitive to smoke. Smoke Sensitive Areas (SSA) are defined as heavy

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[1/] Prepared by Air Quality Technical Panel members, Leo W. Wilson and Owen P. Cramer, Fire Prevention Director, Oregon State Forestry Department, and Meteorologist, Pacific Northwest Forest and Range Experiment Station, respectively.

population or high use areas that are susceptible to excessive accumulation of atmospheric emissions because of climatic and topographic restraints on ventilation, such as in natural basins (figs. 1 and 2). SSA boundaries may be defined in terms of the confining terrain, distance from heavy population, and with a ceiling 2,000 feet above mean terrain level. SSA's are agreed upon jointly by State forestry and State air quality control agencies.

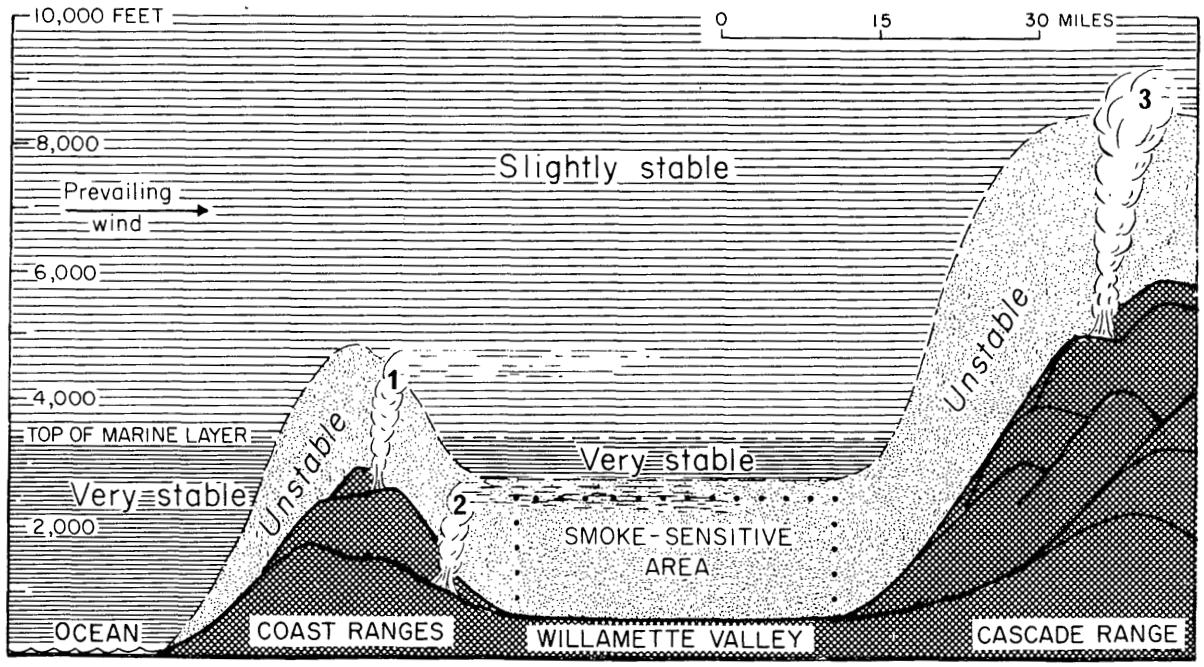

Figure 1.--Atmospheric stability conditions over western Oregon on a typical warm-season afternoon. Over the mountains the surface-heated unstable layer often extends up through the cool marine layer. A very stable layer often remains above the valley, particularly in fall, confining low-level emissions below it. (Reproduced with permission of Journal of Forestry and authors: Gwen P. Cramer and Howard E. Graham, Cooperative management of smoke from slash fires, Journal of Forestry 69(6): 327-331, 1971.)

ADMINISTRATION

Each field administrator issuing permission to burn under this plan will manage the prescribed burning operations in such a way as to maintain a satisfactory atmospheric environment. To do this, he will consider weather forecasts, acreages involved, amounts of material to be burned, smoke production characteristics of fuel complex being burned, evaluation of potential smoke column vent height, direction and speed of smoke drift, residual smoke, mixing characteristics of the atmosphere, and distance from any SSA for each burning operation. He will also need to consider special situations. These are termed smoke sensitive sites which are smaller, special activity areas, such as major recreation sites, in which smoke is particularly objectionable. Here sensitivity to smoke may vary seasonally, by days of the week, with weather conditions, or may exist only for a holiday or other special occasion.

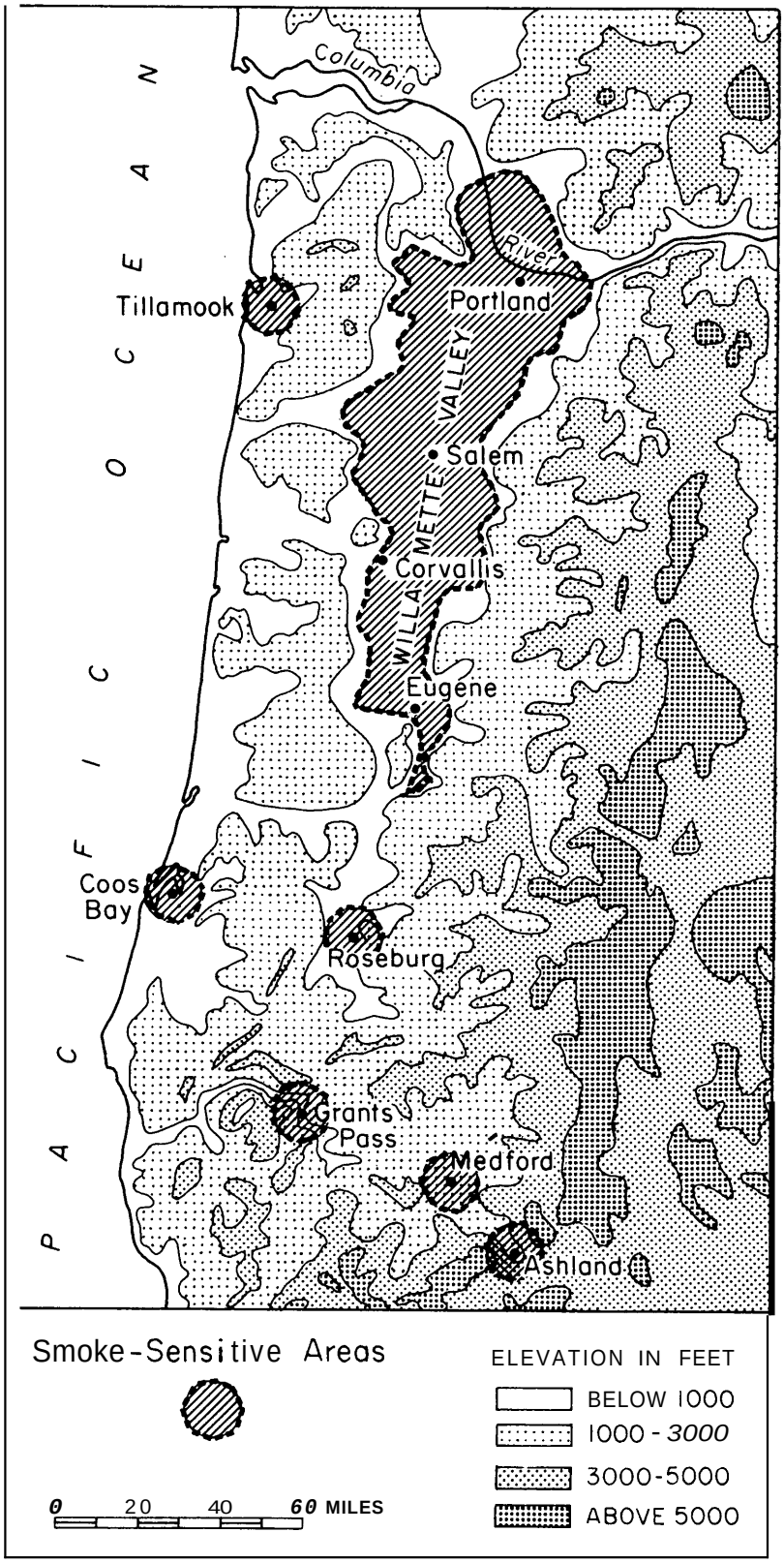

Figure 2.--Formally designated smoke-sensitive areas in Oregon included the Willamette Valley and certain urban centers. Area ceilings are generally 2,000 feet above the surface. (Reproduced with permission of Journal of Forestry and authors; Owen P. Cramer and Howard E. Graham, Cooperative management of smoke from slash fires, Journal of Forestry 69(6): 327-331, 1971.)

Each cognizant administrator will evaluate downwind conditions before starting a burn. When he determines that visibility in downwind SSA is already less than 11 miles or would likely become so with additional burning, or upon notice that air in the State, *or* adjacent State, or any portion thereof, is, or would likely become excessively affected by smoke, the administrator will require burning to be cancelled or terminated. Upon termination, any burning already underway will be completed as rapidly as possible and mopped up as soon as practical; and no additional burning will be attempted until favorable conditions again occur.

When residue to be burned is within 100 miles of a downwind SSA, the specific provisions of the Forest Residue Burning Restrictions for Smoke Management (p. 256) relating to quotas and smoke drift apply as well as the Procedures for Minimizing Smoke Production and Impact (p. 257). If the residue to be burned is beyond the 100-mile limit, only the more general Procedures for Minimizing Smoke Production and Impact apply.

CONCEPTS AND DEFINITIONS

The following definitions and concepts apply to this system (listed in order of decreasing importance):

air pollution - the National Air Pollution Control Administration of the U.S. Department of Health, Education, and Welfare (HEW) defined air pollution:

> Air pollution exists when contaminants are present in such quantities and of such duration as may be, or may tend to be, injurious to human, plant, or animal life, or property, or which unreasonably interferes with the comfortable enjoyment of life, or property, or the conduct of business.

smoke plume - smoke from a particular source but not in a well-defined convective column, usually with neutral buoyancy and subject to motions of the air in which it lies. Depending on the fire, it may form at the ground or at the top of a smoke convection column.

plume dispersal height or smoke venting height - the level in the vicinity of the fire at which the smoke ceases to rise and moves with the wind and turbulence acting at that level. The smoke configuration changes from a convection column to a plume at this height.

mixing height or mixed layer - height above ground to which air heated at the surface during the warm part of the day will normally rise, hence the layer through which emissions from small surface sources may be expected to mix. The mixing height is the minimum height to which a substantial smoke convection column from forest or range prescribed burning may be expected to rise.

unstable layer - characterized by turbulence and vertical motion, hence permitting convection through the layer and mixing of a plume throughout the layer. Indicated by decrease in temperature with elevation of at least 5° F per 1,000 feet. The mixed layer is an unstable layer in contact with the ground.

stable layer - turbulence and vertical motion absence; impedes ascent of convection column and prevents descent of a smoke plume aloft to lower elevation. Great range in degree of stability is possible and is most pronounced in the inversion layer--a layer through which temperature actually increases with height.

smoke plume moving away - projected plume will not intersect or pass over an SSA boundary within 100 miles downwind from the fire.

smoke plume moving toward - projected plume will intersect or pass over an SSA boundary within 100 miles downwind from the fire, or plume is within 100 miles of SSA boundary and wind direction is indeterminate due to windspeed of less than 5 mi/h at plume dispersal height.

residual smoke - smoke produced after the initial fire has passed through the fuel, usually from smoldering, incomplete combustion, and with insufficient heat or volume to produce appreciable rise.

daily quotas - actual amounts of forest residue authorized to be consumed by fire expressed as tonnage of available fuel which is expected to burn and is usually less than total fuel. Quota is also expressed in equivalent amount of particulate produced by normal burning of given amount of available fuel, assuming an emission factor of 14 lb of particulate per ton of forest residue burned. Actual emission factor varies with fuel and manner of burning.

150,000-acre administrative area - an average size fire management area here assumed as a unit area size for limiting emissions from burning operations. Burning quotas are set for unit size areas to assure some lateral spacing of resulting plumes. Indicated quotas (table 1) are for the entire 150,000-acre area. These need proportional adjustment for major differences in actual district size. For any burn situation, quotas are based on the proportion of the district within a distance class from SSA's. (For example, a 200,000-acre district would have quotas one-third greater than those in table 1. But for a given burning day, their quota for 30-60 miles from SSA would be reduced to one-tenth of the district quota if only one-tenth of the district lay within that distance class.)

no restriction - the only limit on the daily quota is the capacity of personnel and equipment to conduct a proper and safe burn and be prepared for mopup; 30,000 tons of available fuel burned per day per district is rarely exceeded.

available fuel - an estimate of the tons of fuel that will be actually consumed by fire at the given time and place. A clean broadcast burn may remove up to 75 percent of the total fuel; pile burning may remove 50 to 90 percent, depending on which fuels are piled and thoroughness of burn.

total fuel loading examples - amounts of fuel commonly found in clearcut old-growth slash west of the Cascades:

low loading--less than 75 tons per acre
medium loading--76 to 150 tons per acre
high loading--over 150 tons per acre.

test fire - small pile or small area in a broadcast burn that is ignited to confirm the burning prescription and smoke dispersal forecast before starting the burning project.

mopup - extinguishing fire, including search for and extinguishing of buried and smoldering fire remnants.

Atmospheric stability and instability and other meteorological concepts upon which this smoke management plan is based are explained in Fire Weather, 1970, by Mark J. Schroeder and Charles C. Buck, USDA Forest Service, Agriculture Handbook 360, 229 p., illus.

Table 1.--Summary of forest residue burning restrictions for smoke management

Dispersion conditions over Smoke Sensitive Area (SSA) and direction of drift of smoke plume	Daily quotas[1] of forest fuels that may be consumed in each 150,000-acre administrative area (or quotas of particulate from burning these amounts--in parentheses)[2]			
	Upwind distance from SSA boundary			
	More than 60 mi	30-60 mi	10-30 mi	Less than 10 mi
	Tons			
1. Smoke plume directly into precipitating cloud system[3]	No restriction	No restriction	No restriction	No restriction
2. Smoke plume moving away from SSA at 5 mi/h or more	No restriction	No restriction	No restriction	No restriction
3. Smoke plume moving toward SSA[4]				
a. Plume above stable layer and above SSA ceiling-- day and night	36,000 (252)	18,000 (126)	9,000 (63)	6,000 (42)
b. Plume mixed through deep layer over SSA. Mixing level more than 1,000 feet above SSA ceiling-- day only	18,000 (126)	9,000 (63)	4,500 (31.5)	3,000 (21)
c. Plume below SSA ceiling-- day only	9,000 (63)	3,000 (21)	1,500 (10.5) Complete the burning of any area already afire in excess of these restrictions as rapidly as possible and mop up smoldering residual fire.[5]	No new fires; chunk-in ongoing fires. Complete the burning of any area already afire in excess of these restrictions as rapidly as possible, and mop up smoldering residual fire.[5]

[1] Except as noted, half of quota may also be burned at night, in addition to daytime total, where conditions are otherwise favorable. Total quota for a 1-million-acre administrative area may not exceed 150,000 tons per day under condition 3 (smoke toward SSA).

[2] Based on emission factor of 14 lb of particulate from 1 ton of forest fuel. Burning quotas may be based on particulate emission for the given fuel complex and burning method.

[3] No burning when visibility (visual range) is less than 11 mi except under condition 1

[4] Amounts decrease for windspeeds slower than 16 mi/h at plume dispersal height: 10-15 mi/h, 75 percent of quota; 5-10 mi/h, 50 percent; under 5 mi/h, 25 percent. Plume dispersal winds of less than 5 mi/h are considered too light to be of dependable direction, hence are assumed to be toward SSA.

[5] When plume rise decreases due to deterioration of earlier, more favorable conditions

FOREST RESIDUE BURNING RESTRICTIONS FOR SMOKE MANAGEMENT

Most of the details of residue burning restrictions for smoke management are covered in table 1. Briefly, these restrictions provide for the following:

Only limited burning is permitted when smoke will disperse in air that is moving toward a Smoke Sensitive Area within 100 miles. No burning will be permitted if the smoke will be confined to elevations below the area's specified ceiling when the burn is less than 10 miles from a sensitive area. Limited burning is permitted if the smoke will be dispersed through a deep layer extending above the SSA ceiling. Only under special conditions will unlimited burning be permitted: (1) when the smoke will blow directly away from an SSA; (2) if smoke will blow toward an SSA, when the nearest such area is no closer than 100 miles downwind; and (3) when the smoke rises into the base of a precipitating cloud system.

Other details and explanation of smoke management provisions are:

Visibility.--No burning will be permitted (no new starts) when the downwind visual range at the surface is less than 11 miles, unless such obstruction is produced by fog, precipitation, or water droplet cloud. Ten miles is equivalent approximately to the effect of suspended particulate in the amount of 75 micrograms per cubic meter (Air Quality Criteria for Particulate, HEW 1969, p. 3-19), the National Ambient Air Quality Standard for Suspended Particulate which is given as the maximum allowable annual geometric mean. A 24-hour average concentration of 260 micrograms per cubic meter, or a visual range of approximately 3.5 miles, is not to be exceeded more than once a year. The intent of the Smoke Management Plan is to maintain the visual range at no less than 10 miles at any time in Smoke Sensitive Areas due to the prescribed burning of forest residues.

Changes after firing.--Should conditions deteriorate while burning is in progress, plans for burning should be revised to correspond to amounts permissible under the new conditions. Where no burning would be permitted under the revised classification, ongoing burns should be completed quickly and, where practical and safe, fuels chunked in to permit more rapid burning.

Liaison with air pollution control officials.--Regional and State air pollution control agencies must be kept informed of burn plans, operations, and current orders. They receive inquiries about visible smoke plumes and should be kept up to date.

Fire-weather forecasts.--Each Forest or State district will maintain contact with the fire-weather forecaster of the National Weather Service, to relay weather data to the agency in charge of the burning and to arrange for special weather observations as needed.

Precipitating cloud system.--Smoke that actually disperses within a precipitating cloud system is likely to become condensation nuclei and be subjected to washout mechanisms that may remove most of it in a short time. A layer of fog or stratus from which drizzle is falling does not qualify.

Optimum dispersal winds.--Windspeeds of more than 15 mi/h have been assumed to provide the standard dilution of the smoke plume at venting height. Daily burn quotas are decreased in slower winds, which provide less dilution and slower transport of the plume.

Smoke plumes aloft.--Smoke plumes aloft that are completely separated from surface air by a stable layer do not detract from air quality at the surface and may not be readily distinguishable from normal water droplet or ice crystal clouds. Nevertheless, some limitations are imposed when such clouds are expected to pass over an **SSA** (condition 3a in table 1).

PROCEDURES FOR MINIMIZING SMOKE PRODUCTION **AND** IMPACT

Some of the practices which will assist in minimizing the impact of smoke emissions are:

1. Weather. Prior to ignition of the test fire, both the latest fire-weather forecast and the observed conditions at the site must indicate that smoke dispersal as well as fire behavior conditions are favorable. The test fire will help to confirm this.

2. ***Time*** of ignition. Selection of the correct time to burn will help to minimize the amount, dispersal, and visibility of resulting smoke.

   a. *If burning can be completed* in *less* than *12 hours*, ignition in the morning will take advantage of the heated mixed layer above the surface. Smoke columns normally rise higher and turbulent dispersion of smoke is more rapid during the warm part of the day. However, morning ignition will not be permitted if fire-danger indexes are predicted to rise above safe levels at any time during the burnout period.

   b. *If* burning requires more than 12 *hours* and considerable smoldering remnants may be expected to produce residual smoke after the main burn, ignition at night may minimize drift smoke accumulation. This is effective for higher elevation, heavy fuel burns above the usual valley bottom inversions. The more stable night air is compensated for by the strong convective column phase of the burn. By the time the residual burning stage is reached, daytime heating may be only a short time away so that the low-energy stage of the burn is compensated for by the better daytime dispersion conditions.

3. Condition of *fuel*. Burning of cured or well-dried material is favored as consistent with safety and burning objectives, because it burns hotter, hence will produce less visible emission and will produce a stronger convective column reaching greater heights.

4. *Rapid firing*. The objective is to develop maximum heat energy per unit time to vent the smoke at the highest elevation possible. Prescribed burns should be fired as rapidly as safety and the objectives of the burn will permit.

5. *Preparation* of *fuel.* To achieve maximum flexibility in selection of time of burning and the optimum smoke dispersion conditions, it is often desirable to prepare residue for burning during the wet season. This may be done by piling or windrowing and covering with plastic to keep the fuel dry through the early fall rains. Fuel piled without soil will burn more efficiently under a much greater variety of weather conditions than fuel requiring broadcast burning. Properly cured, clean piles will also produce less holdover fire and smoldering smoke.

6. *Chunking-in.* Pushing together large pieces in a burning pile will help to maintain flaming combustion. This practice reduces the total volume of smoke, shortens mopup and patrol time, and prevents holdover fires. When conditions change after burning has been started, so that burning operations would be restricted or cancelled, fires that are chunked-in will normally produce less smoke for shorter periods than mopup work.

Appendix 3. Special analysis of known fuel break encounters

1. Name and date	2. Details on fuel break	3. Manning	4. Line construction on fuel break	5. Firing out	6. Control of spot fires beyond fuel break
ANGELES NATIONAL FOREST					
Akens Fire, 7/6/72		Yes, first attack with helitanker and 13-man crew	Existing line on fuel break	No	Some spotting, controlled due to ready access along fuel break
Bear Fire, 9/5/66					
Bouquet Fire, 9/10/64				Yes	
Devon Fire					
Dry Fire, 7/2/64	Fire lane	No			
Easley Fire, 7/12/68[2/]	Disked soil	Yes			
Loop Fire, 10/1/66[3/] Santa Clara Fuel Break					Manned quickly from fuel break
Lukens Fire, 8/26/65 Mount Lukens Fuel Break		Yes	Yes	Yes	
Morris Fire, 7/8/62 Glendora Ridge Fuel Break					3 across narrow portion were quickly extinguished
Pacoima Fire, 2/22/63					
Rabbit Fire, 7/13/67 Round Top Fuel Break					
Redrock Mountain Fuel Break, July 1968					
Tule Fire, 4/17/62					

See footnotes, p. 268.

Fuel Break Encounters

7. Success or failure	8. Reasons indicated for success or failure	9. Fuel type	10. Fire danger at encounter	11. Fire behavior at encounter
Success	Fuel break provided quick access and reduced resistance to control in grass established on the fuel break. Fuel break was final control along top of fire, approximately 2 mi.	Chaparral	Extreme temperature 93, humidity 30, fuel moisture 7	Fire spread up steep slope from bottom of canyon to top of main ridge in 1 hour (estimated distance, 60 chains)
Success	Fuel break held fire until manpower arrived at fire head	Chaparral		
Success				
Success				
Success	Unattended break held fire due to burning conditions	Chaparral		
Success	Fire stopped at fuel break except for two slopovers	Chaparral		
Success	Fuel break provided safe access	Chaparral		
Success	Personnel safety a big factor in success	Chaparral		
Success	Safe and rapid access made possible keeping fire out of town	Chaparral	Moderately severe	Rate of spread about average for conditions but intensity well above average
Success	Fuel break provided safe and rapid access to head of fire	Chaparral		
Success	Safe access	Chaparral		
Success		Chaparral		
Success	4-7 miles of a 12-mile perimeter were held by this installation	Chaparral		

1. Name and date	2. Details on fuel break	3. Manning	4. Line construction on fuel break	5. Firing out	6. Control of spot fires beyond fuel break
CLEVELAND NATIONAL FOREST					
Boulder Fire, 9/28/70					
Middle Fork Fuel Break	150 ft wide? little maintenance and in "messy" condition	Yes	Truck trail on fuel break as line	In part but not a factor of success	
Boulder Oaks Fire, 10/27/73	Natural fuel break (meadow)	Yes		Yes	
Laguna Fire, 9/26/70					
Corte Madera Fuel Break	Approximately 150 ft wide	Yes		Yes	1/2-mile spot fires could not be controlled
Japatul Fuel Break	Approximately 150 ft wide	Yes		No	Spot fires occurred and were not controlled
Morena Fuel Break	300 ft wide	No	No	No	
Pine Valley Fuel Break	Constructed 200-250 ft wide. Little maintenance, scattered brush and herbs	Yes	Dozer at time of use	Yes	
Meyers Fire, 10/1/70					
Foothill Fuel Break	150-200 ft wide	Initially only 3 men	Road used as line	Fired with assist from upslope wind opposing gradient wind during part of firing operation	
Tecate Fire, 8/25/70					
Barrett Fuel Break	200 ft wide	Yes	Used truck trail on fuel break as line	Fired into wind	Controlled by ground tanker crewmen from fuel break
International Fuel Break (5 of 40 mi total)	300 ft wide	Yes	None, but ground tanker used to provide water line in grass on fuel break	Yes	

See footnotes, p. 268.

Fuel Break Encounters (continued)

7. Success or failure	8. Reasons indicated for success or failure	9. Fuel type	10. Fire danger at encounter	11. Fire behavior at encounter
Success	Fire backed into fuel break and was easily held due to lighter fuels along break (if other than a backing fire, failure would have been possible)	Brush and coniferous timber	Santa Ana winds	Backing fire toward fuel break
Success	Light fuels permitted safe attack	Chaparral	Santa Ana winds	
Partial success	Fire not controlled due to spot fires, but it was possible to protect adjacent properties since fuel break made it safe for tankers	Chaparral	Santa Ana winds 40 mi/h	High intensity fire, main spread toward fuel break
Partial success	Fire not controlled due to spot fires, but it was possible to protect adjacent properties since fuel break made it safe for ground tankers	Chaparral	Santa Ana winds 40 mi/h	High intensity fire, main spread toward fuel break
Failure	Fire spread across fuel break in absence of manning	Chaparral	Santa Ana winds 40 mi/h	High intensity fire, main spread toward fuel break
Success (saved 30 homes)	Obvious change in fire behavior in fuels on fuel break	Chaparral	Santa Ana winds 40 mi/h	High intensity fire, main spread toward fuel break
Success	Firing out the lighter fuels (grass) made control possible, saving many expensive structures	Chaparral	Northerly winds 40-50 mi/h	Fire burning downslope with gradient wind
Success	Control of fire made possible from this fuel break	Chaparral	Santa Ana winds 40-50 mi/h	High intensity fire, main spread toward fuel break
Success	Grass fuel on fuel break permitted water lines and firing out ahead of fire	Chaparral	Santa Ana winds 40 mi/h	High intensity fire, main spread toward fuel break

1. Name and date	2. Details on fuel break	3. Manning	4. Line construction on fuel break	5. Firing out	6. Control of spot fires beyond fuel break
CLEVELAND NATIONAL FOREST (continued)					
International Fuel Break					
Julian-Sunrise Fuel Break					
Magee Fuel Break					
Pauba Fuel break					
KLAMATH NATIONAL FOREST Con Fire, 7/19/73[4]	100 ft wide, grass covered				
Louis Fire, 10/28/68[5] Fuel break in path of head		No		No	3 spot fires remained uncontrolled
Fuel break on east side of fire	2 years since constructed in thinned pine 12-18 ft high, with shaded grass cover which had been grazed to 4- to 6-in stubble	Little or none			
LOS PADRES NATIONAL FOREST Coyote Fire, 9/22/64					
Romero Fire, 10/6/71 Camino Cielo Fuel Break		Yes, with air tanker support	Yes		
Sisar Fire, 10/29/67[6]		Yes, with air tanker support			Yes, with air tankers
Tunnel 10 Fire, 11/1/66		No			

See footnotes, p. 268.

Fuel Break Encounters (continued)

7. Success or failure	8. Reasons indicated for success or failure	9. Fuel type	10. Fire danger at encounter	11. Fire behavior at encounter
Numerous		Chaparral	Normally severe	
6 successes		Chaparral	Normally severe	
Success		Chaparral	Normally severe	
3 failures		Chaparral	Normally severe	
Success	Changed behavior of fire along fuel break and access to head of fire	Timber and brush		
Failure	Not manned	Lodgepole logging slash, 3- to 6-yr ponderosa pine thinning slash, unthinned pine	Winds 25-30 mi/h	Crowning
Success	As a flanking line, the fuel break effectively changed fire behavior preventing further spread eastward with little or no manning	Lodgepole logging slash, 3- to 6-yr ponderosa pine thinning slash, unthinned pine	Winds 25-30 mi/h	Crowning
Partial success	20 miles of fuel break were fired out and held but subsequently lost by being outflanked next day	Chaparral		
Success	Change in fire behavior due to modified fuels, plus access, permitted holding fire from crossing the ridge along 12 miles of fuel break	Chaparral	Extreme	
Success	Fuel break provided easy and safe access, allowing rapid and safe movement of men and equipment to strategic points. Averted a major conflagration with likely heavy loss of property	Chaparral	Extreme	High intensity
Failure	Fire crossed fuel break before initial attack crew arrived			

1. Name and date	2. Details on fuel break	3. Manning	4. Line construction on fuel break	5. Firing out	6. Control of spot fires beyond fuel break
MENDOCINO NATIONAL FOREST					
Horse Fire, 8/6/66[7/]					
Horse Pasture Ridge Fuel Break					
SIERRA NATIONAL FOREST					
Backbone Fire, 8/21/62	Partially completed	Yes		Yes	
Backbone Fire, 1964		Yes		Yes	
Haslett Fire, 10/15/61	Incomplete fuel break	3 men only	Yes	Yes	
Sugarloaf Fire, 7/13/64		In part and support by air tanker			Yes
Thornberry Fire, 7/21/68		Yes		Yes	
Whitener Fire, 7/10/64		12 ground tankers plus 2-man crew			
STANISLAUS NATIONAL FOREST					
Tuolumne River Fire, 7/11/68[8/]	75-100 ft wide, grass covered	Aggressive holding action by first-in units. Air tanker support		Yes	One 1-acre spot fire
Miller Ridge Fuel Break					
Wet Meadow Fire, 7/5/62	Newly constructed, 150-300 ft wide--mostly bare	Initially 3 men	None needed	No	

See footnotes, p. 268.

Fuel Break Encounters (continued)

7. Success or failure	8. Reasons indicated for success or failure	9. Fuel type	10. Fire danger at encounter	11. Fire behavior at encounter
Success	Fuel break helped to hold fire from crossing ridge	Mixed conifer	Very high	
Success	Firing out made control from the fuel break possible; fire was nearly lost due to outflanking slopover, but this was picked up by crews with access from the fuel break		Average burning conditions	
Success	Access and reduced fuel made firing out and use of water possible			
Success	Good access and availability to speed up firing out	Logging slash, timber, and brush	Ignition index 75 Burning index 24	Initial rate of spread 1.4 chains/hour
Partial success	Early failure when unmanned. Later, success due to manning			
Success	Controllable behavior of burnout fire in the reduced fuels on the fuel break	Timber and brush		
Success	Access and firing out in grass fuel on fuel break	Grass and chaparral	Wind 12 mi/h	
Success	Safe access and reduced fuels	Mixed brush	**High**	
Success	Permitted safe access and prevented fire from crossing ridge	Timber and brush	Moderate	No unusual fire behavior

Footnotes for appendix 3

1/ The information presented in this appendix was obtained from various sources, mainly by personal conversation with people directly involved with the fires. If further details are desired, write to Fire Management on the National Forest on which the fire occurred.

2/ The fuel break insured greater maneuverability of men since they could be placed directly in front of the fire and moved about without any great danger to themselves. This safety factor alone insures a greater effectiveness in placement and distribution of men to rapidly and efficiently suppress running fires.

3/ Without the presence of the Santa Clara fuel break, keeping the fire on the south side of the Los Pinetos ridge would have been impossible. The fuel break provided safe access along the ridge and even though spots occurred in the grass on the break and in the brush on the north side, the firefighters were able to jump on them fast and control them.

4/ The Con Fire burned 13 acres and would have been larger except that it ran into a fuel break that was constructed in 1966 and drilled with grass. This break was at the head of the fire which allowed crews to concentrate their efforts on both flanks.

5/ When the crown fire hit the fuel break, it came to the ground. This is still evident in the fire area as the fuel break still has green trees along its total length. Two tanker crews could have held this fire along the front, if they had been available. The three or four spot fires across the break would have been easily picked up by these crews.

6/ Key points in control of the Sisar Fire under extreme weather conditions were:

a. Access provided by the Ojai Front Country fuel break.
b. Relatively safe environment created by the fuel break which allowed rapid deployment of men and machines at all strategic points on the fire perimeter.
c. Relatively light fuel on the fuel break which increased effectiveness of the air tankers.
d. Strong, sustained air attack from time of first dispatch. (First dispatch--one B-17, one TBM, two F7F's, which were supported later by the addition of two more TBM's and one B-17, making a total of seven air tankers dropping on the fire.)
e. Strong initial dispatch of conventional fire forces (four districts in Los Padres, Ventura County Fire Department, and California Division of Forestry, and other mutual aid equipment).
f. Ready availability of dozers due to extreme fire weather alert.

7/ The existence of a fuel break on Horse Pasture ridge was effective in controlling the fire. It is estimated that without this improvement this fire had the potential to burn an additional 10,000 acres in Thatcher Creek. This fuel break is positive evidence that costs in constructing this type of improvement can be justified and that fuel breaks are effective in fire suppression even under adverse burning conditions.

8/ It was generally felt that had not the fuel break been in existence on Miller ridge, Forest Service protected area burned could have been materially greater. The combination of quick dispatch and utilization of ground pumpers on the fuel break access road held the fire at ridgeline and enabled full effort to be put on the flanks of the fire.

Appendix 4. Metric conversion table

1 inch	= 2.54 centimeters
0.3937 inch	= 1 centimeter
1 foot	= 0.3048 meter
3.281 feet	= 1 meter
1 cubic foot	= 0.02832 cubic meter
35.31 cubic feet	= 1 cubic meter
1 square foot	= 0.0929 square meter
10.76 square feet	= 1 square meter
1 acre	= 0.4047 'hectare
2.471 acres	= 1 hectare
1 mile	= 1.609 kilometers
0.622 mile	= 1 kilometer
1 ton (short)	= 0.907 ton [metric)
1.102 tons (short)	= 1 ton (metric)
1 ton (short) per acre	= 2.241 tons (metric) per hectare
0.446 ton (short) per acre	= 1 ton (metric) per hectare
1 inch per foot	= 8.333 centimeters per meter
0.120 inch per foot	= 1 centimeter per meter
1 pound per square inch	= 70.31 grams per square centimeter
0.014 pound per square inch	= 1 gram per square centimeter

Appendix 5. List of plant and animal species cited

The sources for the scientific names are Little (1953) for trees and plants except huckleberry, oxalis, salmonberry, and swordfern, which are taken from Peck (1961), Peterson (1961) for birds, Blickenstaff (1970) for insects, Ingles (1965) for mammals, and American Fisheries Society (1960) for fish. No common names are given for diseases except for mistletoe and dwarf mistletoe which are from Boyce (1961).

TREES AND PLANTS

bigleaf maple	*Acer macrophyllum* Pursh
bitterbrush	*Purshia* spp.
California black oak	*Quercus kelloggi* Newb.
canyon live oak	*Quercus chrysolepis* Liebm.
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Engelmann spruce	*Picea engelmannii* Parry
golden chinkapin	*Castanopsis chrysophylla* (Dougl.) A. DC.
grand fir	*Abies grandis* (Dougl.) Lindl.
huckleberry	*Vaccinium* spp.
incense-cedar	*Libocedrus decurrens* Torr.
juniper	*Juniperus* spp.
lodgepole pine	*Pinus contorta* Dougl.
mountain ash	*Sorbus* spp.
mountain hemlock	*Tsuga mertensiana* (Bong.) Carr.
noble fir	*Abies procera* Rehd.
Oregon white oak	*Quercus garryana* Dougl.
oxalis	*Oxalis oregana* Nutt.
Pacific dogwood	*Cornus nuttallii* Audubon
Pacific madrone	*Arbutus menziesii* Pursh
Pacific silver fir	*Abies amabilis* (Dougl.) Forbes
ponderosa pine	*Pinus ponderosa* Laws.
Port-Orford-cedar	*Chamaecyparis lawsoniana* (A. Murr.) Parl.
red alder	*Alnus rubra* Bong.
redwood	*Sequoia sempervirens* (D. Don) Endl.
salmonberry	*Rubus spectabilis* Pursh.
Shasta red fir	*Abies magnifica* var. *shastensis* Lemm.
Sitka spruce	*Picea sitchensis* (Bong.) Carr.
subalpine fir	*Abies lasiocarpa* (Hook.) Nutt.
sugar pine	*Pinus lambertiana* Dougl.
swordfern	*Polystichum munitum* (Kaulf.) Presl
tanoak	*Lithocarpus densiflorus* (Hook & Arn.) Rehd
vine maple	*Acer circinatum* Pursh.
western hemlock	*Tsuga heterophylla* (Raf.) Sarg.

western juniper	*Juniperus occidentalis* Hook.
western larch	*Larix occidentalis* Nutt.
western redcedar	*Thuja plicata* Donn
western white pine	*Pinus monticola* Dougl.
white fir	*Abies concolor* (Gord. & Glend.) Lindl.

INSECTS

balsam woolly aphid	*Adelges piceae* (Ratzeburg)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
mountain pine beetle	*Dendroctonus ponderosae* Hopkins
pine engraver beetle	*Ips pini* (Say)
spruce bark beetle	*Dendroctonus obesus* (Mannerheim)
western pine beetle	*Dendroctonus brevicomis* LeConte

DISEASES

	Armillaria mellea
	Fomes annosus
	Phytophthora ZateraZis
	Poria weirii
dwarf mistletoe	*Arceuthobium* spp.
mistletoe	*Phoradendron* spp.

BIRDS

bluebird	*Sialia* spp.
chickadee	*Parus* spp.
creeper	*Certhia* spp.
eagle	Buteoninae (family)
nuthatch	*Sitta* spp.
osprey	*Pandion haliaetus*
purple martin	*Progne subis*
titmouse	*Parus* spp.
woodpecker	Picidae (family)

FISH

salmon	*Oncorhynchus* spp.

MAMMALS

brush rabbit	*SyZvilagus bachmani*
deer mouse	*Peromyscus maniculatus* (Wagner)
snowshoe hare	*Lepus americanus*

LITERATURE CITED

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Little, Elbert L., Jr.
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1961. A field guide to western birds. 366 p., illus. Boston: Houghton Mifflin Co.

Appendix 6. User's work form

Project name or other identifiers:

USER'S WORK FORM

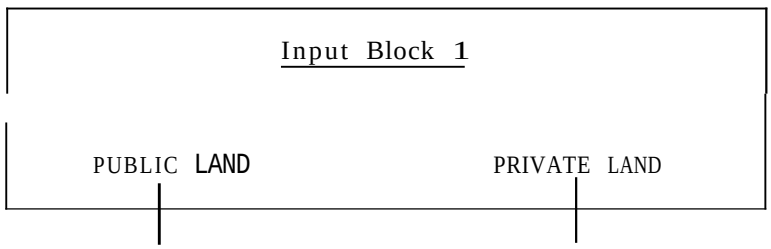
GUIDELINES FOR FOREST RESIDUES MANAGEMENT

This form has been developed to help users sort for guideline statements believed to apply to specified land management situations. It is intended for use with the publication:

> Pierovich, John M., Edward H. Clarke, Stewart G. Pickford, and Franklin R. Ward. 1975. Forest residues management guidelines for the Pacific Northwest. Pacific Northwest Forest and Range Experiment Station USDA Forest Service General Technical Report PNW-33.

STEP 1 Enter the information requested in Input Blocks 1 through 5 of this form.

Input Block 1



Administrative unit name or other identifiers:

Input Block 2

This work form applies to (check only one):

- ____ A. Road construction
- ____ B. Trail construction
- ____ C. Campground construction
- ____ D. Structure construction
- ____ E. Ski run construction
- ____ F. Utility right-of-way construction
- ____ G. Timber harvest by individual tree selection cutting
- ____ H. Timber harvest by shelterwood cutting
- ____ J. Timber harvest by group selection cutting
- ____ K. Timber harvest by clearcutting
- ____ L. Precommercial thinning
- ____ M. Commercial thinning
- ____ N. Type conversion, except rangeland
- ____ O. Treatment of natural residue
- ____ P. Treatment of dying and damaged vegetation
- ____ Q. Rangeland type conversion

USER'S WORK FORM (Cont.)

STEP 3 Within the Table Set (I or 11) chosen in Step 2, turn to the Sorting Set letter corresponding to the letter checked in Input Block 2. Note that there are either four or five tables within this Sorting Set. Refer to Table 1 now and list all statement numbers shown in, the box below:

Statement List 1 (from Table 1):

Input Block 3

STEP 4

burned, refer to Table 2 now and list the statement numbers shown in the box below:

burned, check here and proceed to step 5-----☐

Statement List 2 (from Table 2):

USER'S WORK FORM (cont.)

STEP 5 If Input Block **4** is for Private Land, check here and go to Step 6 - ☐

If Input Block 4 is for Public Land and the notation "Skip Table 3" is circled in Input Block **4,** check here and go to step *6* - - - - - - - ☐

If Input Block 4 is for Public Land and a column number is circled in Input Block 4, enter the column number in the space labeled "from Table *3,* column _____ in the box below. Find this column number in Table **3** and enter all the statement numbers found there in the box below.

Statement List **3** (from Table **3,** column ____).

Input Block 4

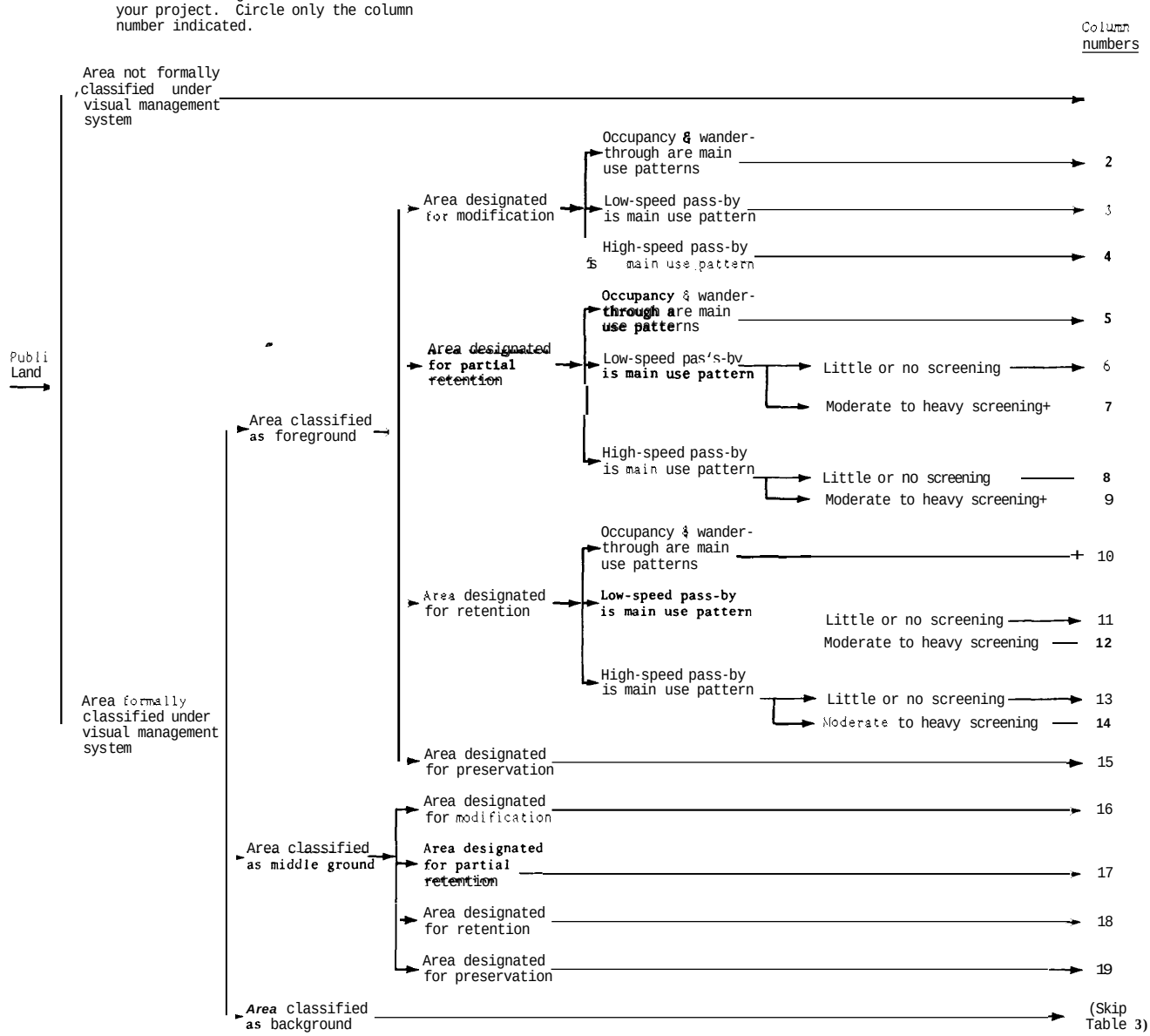
This work form will be for (circle only one):

Public Land

If for public land, proceed to trace from left to right along the path describing the visual management classification for your project. Circle only the column number indicated.

Private Land

If for private land, skip this block and check here: _____



Input Block 5

a. Refer to the Forest Residue Type Area maps in the Guidelines publication (chapter 11, Figure 1 or 2), and locate the type area for which this work form applies. Enter here the five-digit code for this area below:

:Timber Spp. Assoc.

:Province :	:Subprovince

b. Refer to the Forest Residue Type Area discussion (Guidelines publication, chapter II). Using your knowledge of the specific area for which this worksheet applies, review the descriptions of the Timber Species Associations and of those geomorphic subprovinces, within your province, for accuracy. Because the Forest Residue Type Area map must be somewhat generalized, you may find a description which better fits your situation.

After your review, enter below a final, confirmed (from part a, above), or revised identifying number.

(CAUTION - use only Subprovince numbers and Timber Species Associations numbers listed as "recognized" for your province):

:Timber Spp. Assoc.

:Province :	:Subprovince

USER'S WORK FORM (cont.)

STEP 6 Enter the Province number (first two digits in part b of Input Block 5, above) in the space labeled "from Table **4,** column ____" in the box below. Then list all statement numbers in this column of Table **4** in the box below.

Statement List 4 (from Table **4,** column ____):

STEP 7 For some management activities, there will be a Table 5. If there is no Table 5 in your sorting set, check here ☐ and go to step 8 -

If there is a Table 5, refer back to Input Block **3.**

If residues will not be burned, check here ☐ and go to step 8 -

If residues will be or may be burned, enter the Province number (first two digits from Input Block 5) in the space labeled, "Table 5, column ___," in the box below.

In the box below, list all statement numbers shown in that column.

Statement List 5 (from Table 5, column ____):

USER'S WORK FORM (cont.)

STEP 8 If you are using Table Set I, for public lands, turn to Table Set IA (blue paper). If you are using Table Set 11, for private lands, turn to Table Set IIA (green paper).

STEP 9 Use the Province number (first two digits from Input Block 5), to locate in your Table Set the appropriate tabulation of statement numbers for your Province.

STEP 10 Within this Province, find the Timber Species Association identifying number (third digit, part b, of Input Block 5). These rows of statement numbers apply to your Timber Species Association. Then use the Subprovince identifying number (last two digits from part b of Input Block 5), to locate the column for your Subprovince.

Use this column and these rows to verify the applicability of statement numbers in Statement Lists 4 and 5. ONLY THE STATEMENT NUMBERS LISTED PREVIOUSLY IN LISTS 4 AND 5 AND THEN FOUND AGAIN HERE ARE VERIFIED. CROSS OUT ALL STATEMENT NUMBERS IN LISTS 4 AND 5 WHICH ARE NOT VERIFIED.

STEP 11 You now have a complete set of Statement numbers (from Lists 1 through 5) which should be applicable to most situations like the one for which you have prepared this form. Use these numbers to locate the actual statements listed in chapter 111, p. 135-157, for Public Lands and in chapter 111, p. 160-172, for Private Lands. You will want to note carefully all EXCEPTIONS to any statement to determine if your situation may be one for which a certain guideline was not intended to apply.

You may wish to attach to this form a record of departures from recommended guidelines, as well as any other notes regarding modifications or limits you may develop. In this way, this work form and attachments will be available for future reviews of **the decisions you have made regarding forest residues** management.

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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

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