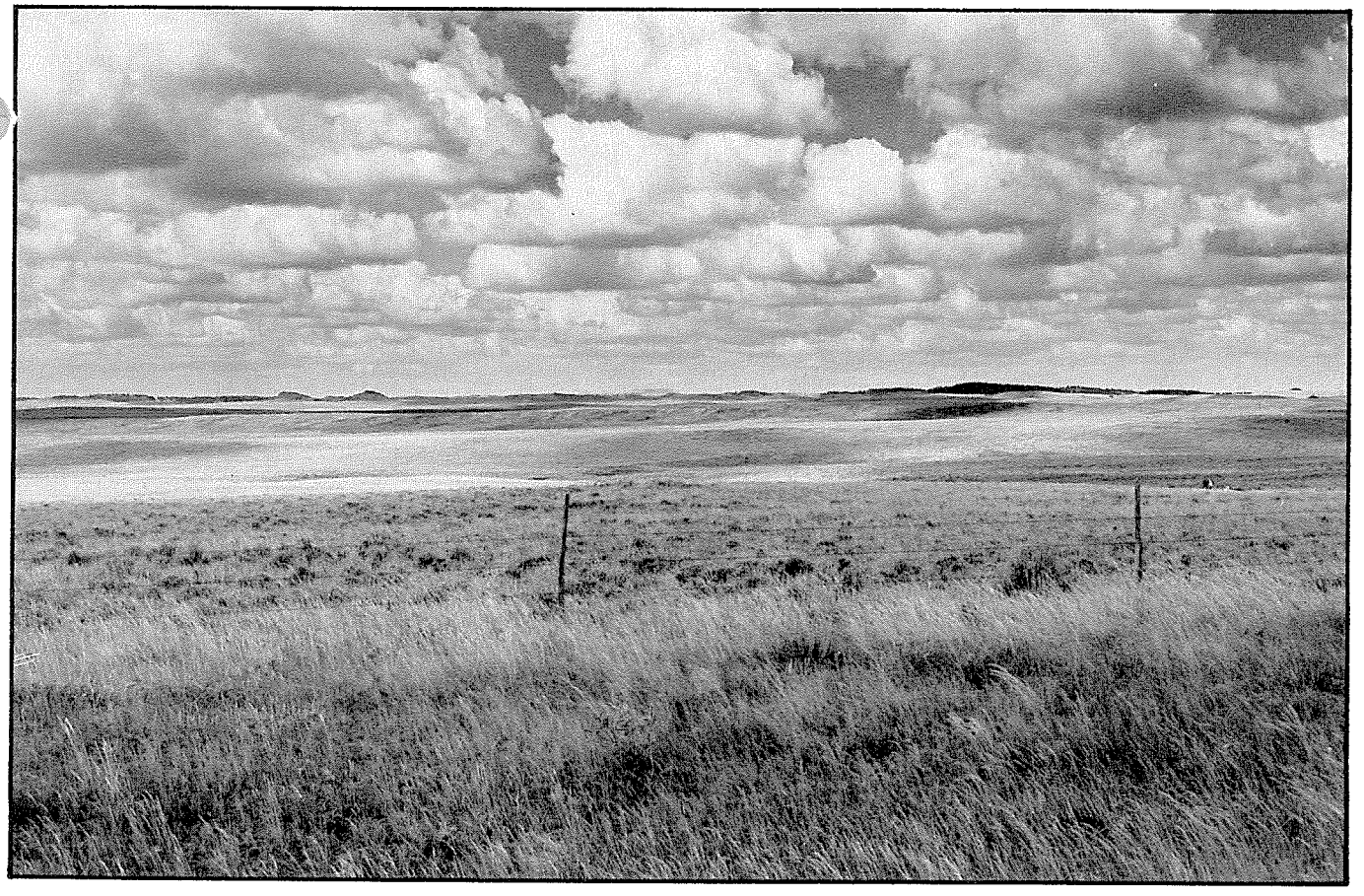
SURFACE ENVIRONMENT & MINING
SEAM
USDA FOREST SERVICE PROGRAM

PACIFIC SOUTHWEST
Forest and Range
Experiment Station

A LANDSCAPE INVENTORY FRAMEWORK: scenic analyses of the Northern Great Plains

R. Burton Litton, Jr. **Robert J. Tetlow**



FOREST SERVICE
U.S.DEPARTMENT OF AGRICULTURE

RESEARCH PAPER PSW-135

Litton, R. Burton, Jr., and Robert J. Tetlow

1978. **A landscape inventory framework: scenic analyses of the Northern Great Plains.** Res. Paper PSW-135, 83 p., illus. Pacific Southwest Forest and Range Exp. Stn., Forest Serv., U.S. Dep. Agric., Berkeley, Calif.

A set of four visual inventories are proposed. They are designed to document scenic resources for varied scales of application, from regional and general to local and specific. The Northern Great Plains is used as a case study. Scenic analysis and identification of criteria extend earlier work. The inventory is based on (1) study of previously developed landscape analysis methods and their terminology; (2) examination of high altitude imagery and topographic maps as sources of visual information; and (3) field observations in the Northern Great Plains. Criteria include visual characteristics and patterns of land forms, vegetation cover, water, and land use.

Retrieval Terms: scenic analysis; landscape inventories; Northern Great Plains.

Litton, R. Burton, Jr., and Robert J. Tetlow

1978. **A landscape inventory framework: scenic analyses of the Northern Great Plains.** Res. Paper PSW-135, 83 p., illus. Pacific Southwest Forest and Range Exp. Stn., Forest Serv., U.S. Dep. Agric., Berkeley, Calif.

A set of four visual inventories are proposed. They are designed to document scenic resources for varied scales of application, from regional and general to local and specific. The Northern Great Plains is used as a case study. Scenic analysis and identification of criteria extend earlier work. The inventory is based on (1) study of previously developed landscape analysis methods and their terminology; (2) examination of high altitude imagery and topographic maps as sources of visual information; and (3) field observations in the Northern Great Plains. Criteria include visual characteristics and patterns of land forms, vegetation cover, water, and land use.

Retrieval Terms: scenic analysis; landscape inventories; Northern Great Plains.

Litton, R. Burton, Jr., and Robert J. Tetlow

1978. **A landscape inventory framework: scenic analyses of the Northern Great Plains.** Res. Paper PSW-135, 83 p., illus. Pacific Southwest Forest and Range Exp. Stn., Forest Serv., U.S. Dep. Agric., Berkeley, Calif.

A set of four visual inventories are proposed. They are designed to document scenic resources for varied scales of application, from regional and general to local and specific. The Northern Great Plains is used as a case study. Scenic analysis and identification of criteria extend earlier work. The inventory is based on (1) study of previously developed landscape analysis methods and their terminology; (2) examination of high altitude imagery and topographic maps as sources of visual information; and (3) field observations in the Northern Great Plains. Criteria include visual characteristics and patterns of land forms, vegetation cover, water, and land use.

Retrieval Terms: scenic analysis; landscape inventories; Northern Great Plains.

The Authors

R. BURTON LITTON, JR., holds appointments with both the Forest Service and the University of California, Berkeley. He is a landscape architect with the Station's research work unit in land use and landscape planning, and professor in the University's department of landscape architecture. He earned a bachelor of science degree in landscape architecture (1941) at the University of California, Berkeley, and a master of landscape architecture degree (1948) at Iowa State University. He joined the University faculty in 1948 and the Forest Service in 1969. **ROBERT J. TETLOW** is professor of landscape architecture at the University of California, Berkeley. He earned a bachelor of landscape architecture degree (1949) at the University of Oregon, and a master of science degree (1951) at the University of California, Berkeley. He joined the University's Berkeley faculty in 1954.

ACKNOWLEDGMENTS

This summary report on landscape resources inventory methods is based on three individual but related cooperative agreements (21-298, 21-309, and 21-318) among the Pacific Southwest Forest and Range Experiment Station, Berkeley, California; the Forest Service's SEAM Project (Surface Environment and Mining), Billings, Montana; and the Department of Landscape Architecture, University of California, Berkeley.

We are grateful for the assistance of colleagues at the University of California, Berkeley, who were responsible for much of the basic work of the study. William Garnett, professor of design, flew the low-level air photo transect and provided color photography. Graduate students in landscape architecture participating were Susan Boyle, Jean Imai, and Nancy Owens, who did a majority of the field work and ground photography, and Lawrence Diamond, who, with Jean Imai, was a research assistant during 1974-75. Nancy Owens did the field sketches.

A LANDSCAPE INVENTORY FRAMEWORK: scenic analyses of the Northern Great Plains

R. Burton Litton, Jr.

Robert J. Tetlow

CONTENTS

Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, California 94701

December 1978

IN BRIEF . . .

Litton, R. Burton, Jr., and Robert J. Tetlow
1978. **A landscape inventory framework: scenic analyses of the Northern Great Plains.** Res. Paper PSW-135, 83 p., illus. Pacific Southwest Forest and Range Exp. Stn., Forest Serv., U.S. Dep. Agric., Berkeley, Calif.

Retrieval Terms: scenic analysis; landscape inventories; Northern Great Plains.

Landscape inventories are a means of recording the scenic resource; they provide information needed for judging landscape values and predicting visual impacts. The main goal of this study has been to develop a set of related landscape inventories to fit a variety of scales, for application to uses ranging from broad area planning to small area design and management.

Research support came from SEAM (Surface Environment and Mining, Billings, Montana), and the Northern Great Plains was the case study area. Where coal is a major resource, there are concurrent problems of visual impact, landscape rehabilitation, and scenic conservation, all relating to mining activity. Adequate landscape inventory methods are thus a necessary start for conservation of landscape quality.

This study is based upon three elements:

1. A review of existing landscape inventory methods, concepts, and vocabulary—including relationships to physiographic classification systems.

2. An evaluation of high-altitude imagery, conventional air stereo photography, and topographic maps assembled for the study area.

3. Field sampling of typical landscape elements in the area, using ground and low-level air reconnaissance photography, along with sketches and field notes.

For each of the existing landscape inventory methods included, we examined scale of application, purpose served, and vocabulary used. As our inventory methods were evolved, we noted applicable vocabulary or concepts of existing methods, which are discussed in the text. Summary outlines of existing inventories are also given in the Appendix.

High-altitude imagery (ERTS, LANDSAT) samples of the Northern Great Plains were assembled for interpretation in scales from 1:1,000,000 to 1:125,000 in black-and-white, color, and infrared color. Topographic maps of similar scales (and down to 1:24,000 and smaller) matched the coverage, along with samples of NASA and conventional air stereo photography. The imagery and maps are judged as useful in landscape inventory work but need to be supported with the more tangible evidence that is familiar to us from ground and low-level air experience. Characteristics of the imagery and maps are interpreted in the Appendix.

Ground and low-level air reconnaissance, through some 8,000 miles of travel, sampled the landscape seen in the four-state area of Montana, Wyoming, North and South Dakota. Black-and-white and color photographs, along with sketches, represent the places and relationships observed—these images and the field notes are all keyed to topographic maps (1:250,000). The four basic elements contained in the field records document (1) land form characteristics, (2) vegetation cover and patterns, (3) water and its patterns, (4) land use patterns. The visual sampling accomplished in field reconnaissance became the tangible evidence upon which the landscape inventory method is based.

The landscape inventory method presented is a conceptual framework composed of four hierarchical parts: the Landscape Continuity, the Landscape Province, the Landscape Unit, and the

Landscape Setting. In descending order of scale, these designations apply to a range of characteristics, from the broad and general to the local and specific. In the presentation of the method, related terminology and concepts found in other landscape inventories studied are reviewed. Scale, boundaries and edges, land forms, patterns of vegetation and water, and prominent local features are identified at each level, with the help of photography, maps, and sketches.

The Landscape Continuity is the continuous and extensive landscape typical of a broad geographical region. As represented by the Northern Great Plains, it is placid, lacking in extreme visual contrasts. Its scale is large—about 235,000 square miles. Sheer mountains or level plains may form its boundaries, which typify the Continuity in being sometimes striking, sometimes imperceptible. Plant cover forms consistent patterns of grassland and riparian vegetation. Broad river drainages are the major water features. Prominent features are primarily objects on the horizon, such as contrasting land forms or groups of trees.

The Landscape Province, a regional-scale landscape, is a part of the Continuity, and yet in contrast to it. Its scale is variable; there are six examples within the Northern Great Plains Continuity. Boundaries may be sharply defined or gradual; land forms may reflect geologic formations or erosional development. Plant cover responds to the characteristics of the Province, as do water expressions and local features. Provinces in the Northern Great Plains include segments of one or more rivers or major streams, and local features such as the Missouri Buttes in the Black Hills Landscape Province.

The Landscape Unit is unified by enclosure. Though smaller in scale than the Province, its actual size varies. Unit boundaries are often spectacular, a primary source of scenic interest. Land forms notable in Units within the Northern Great Plains are the badlands associated with certain rivers. Plant cover and water within the Unit are more significant in their small-scale values—such as the quality of aspens framing a lake view. Focal areas within a Unit are of special importance because the visual impact of degradation is most obvious there.

The Landscape Setting is the indefinite area of landscape associated with a scenic feature of particular visual importance. It is frequently a designated area for management—a park, monument, or other protected unit. Devils Tower National Monument is an example. It includes an area of about 15 square miles; its boundaries are determined by the visual sphere of influence radiating from the land form—a conspicuous volcanic neck—which is its main feature. Plant cover may in itself form a Landscape setting, as when a small forest is ecologically related to a particular soil formation. Water features may enhance a Setting or be a main feature of it.

The landscape exists in several conceptual and interacting forms. It is an image in the viewer's eye. It is an idea in the mind, a memory, a feeling in the gut. It is a physical set of elements visible in space. This study concentrates upon the physical and visual elements and their compositional arrangements.

Visual landscape inventories are an expression of the currently widespread attempt to document the scenic resource. The way the landscape looks at a given time represents base line information to be used in judging landscape quality, in predicting the visual impact of proposed changes, and in determining the need for modification of proposals. There is only limited agreement, however, as to the physical elements and relationships that make up the visual resource. Inventory criteria, forms, and methods of recording vary accordingly. It is a time of empiricism.

The central and major goal of this study has been to develop an integrated set of visual landscape inventories, each representing a different hierarchical level. Existing inventories, products of individuals or agencies, generally relate to specific problems and scales of land planning or design. One example is the North Atlantic regional water resources study of the visual and cultural environment (Res., Plan., and Design Assoc. 1967), which is based on regional landscapes of contiguous eastern states, a long time span, and broad land use planning problems. Another, the U.S. Forest Service's "visual management system" (1974b), addresses wildlands at the intermediate scale of a National Forest (or units thereof), emphasizing forest and resource management within an indefinite but apparently short time span. Litton's *Forest Landscape Description and Inventories* (1968), which the present study extends, suggests intensive landscape management, with application to localized landscapes at particular times. Except in limited and specialized applications (such as Litton and others 1974), there has been no integration of different scales of visual inventories within the single conceptual framework proposed here.

Through the sponsorship of SEAM (Surface Environment and Mining) we chose the Northern Great Plains, within the states of North and South Dakota, Montana, and Wyoming, as a case study area. Here there is a high potential for environmental impact relating to surface mining, especially of coal—a resource of vast proportions in the area. Planning for resource use, predicting visual impacts, developing methods for landscape rehabilitation where mining disturbances have occurred, and general maintenance of landscape quality—are all vital to conservation of the regional scenic resource. The development of

adequate visual landscape inventories for an area such as the Northern Great Plains must be the beginning of the conservation effort.

In the course of developing the integrated landscape inventories, we also attempted to review and develop landscape terminology for use at different scales, and to suggest relationships of our inventories to other scales of land inventory systems, such as those proposed by Fenneman (1931) and Wertz and Arnold (1972).

Our study is based on three elements:

1. A review of existing landscape inventory methods, concepts, and vocabulary
2. An evaluation of high-altitude imagery, including conventional air stereo photography, assembled for the study area
3. Field sampling of typical landscape elements in the area, using both ground and low-level air reconnaissance and photography

Eleven different landscape inventory studies have been examined. These either represent methods of analysis based on actual observation of the visual resource, or accept the concept of a visual landscape resource. The studies overlap to some degree. We did not examine landscape analyses based on physiography, soils, and vegetation; although these studies have important links to scenic analyses, they are essentially ecological rather than esthetic (see Hirvonen 1976).

For each inventory method, we determined (1) scale of application (breadth of land area embraced); (2) purpose served; and (3) vocabulary used. Some of the studies examined include assessment or evaluative procedures meant to serve application. Though useful, none go far to resolve the classic problem of weighing landscape quality. We have not attempted, either in appraising other studies or in pursuing our own, to consider techniques of quantitative assessment of landscape quality. Landscape evaluation must be considered a subject of continuing, long-term research. Review of existing inventory methods has provided guidance for the selection of landscape elements to be adapted for our use in proposed procedures. Additionally, the various scales of existing individual inventories have been helpful in development of our hierarchical inventory system.

For the evaluation of high-altitude imagery, we assembled imagery for photo interpretation in scales from 1:1,000,000 to 1:125,000, in black and white, color and infrared color. We assembled topographic maps (1:1,000,000 to 1:24,000 and smaller) to match the coverage, as well as samples of conventional air stereo photography (1:52,000 and 1:30,000). We compared the merits of different kinds and scales of available imagery and maps, and identified elements possibly related to different inventory scales and their appropriate content. We concluded that high-altitude imagery alone does not provide the tangibility of elements needed for inventory of the landscape resource. Topographic maps, though also inadequate in this way, are a source of landscape information we seem to have previously ignored.

Field reconnaissance was conducted in the four-state area—Montana and Wyoming east of the Rocky Mountains and North and South Dakota west of the Missouri River. In the course of approximately 6,000 miles of road travel, we documented landscape elements with many color and black-and-white photos, and with field sketches and notes, all coordinated to 1:250,000 topographic maps. Additionally, we took low-level air photos in color and black and white—in 2,000 miles of air travel in eastern Montana, northern Wyoming, and western North Dakota. We believe that ground or low-level air reconnaissance and photography are an essential part of landscape inventories; for these there can be no substitute. Here they represent a direct sampling technique to assure that the case study area has been comprehensively examined as landscape. Maps and high-altitude imagery alone cannot provide this.

In this report of our study, the field work is first reviewed, as represented by selected sketches and photography. This is the primary source of our tangible, visual evidence of the Northern Great Plains landscape resource. Second, our conceptual framework for landscape inventories is presented in four parts: (1) the Landscape Continuity, (2) the Landscape Province, (3) the Landscape Unit, and (4) the Landscape Setting. The order of the parts corresponds to their scale, from the broad and general to the local and specific. Within each part, relations to terminology and land classification in other studies are mentioned. Selected photography and sketches for each part illustrate typical features as seen at the appropriate scale. In Appendix A, samples of high-altitude imagery and topographic maps are given, with comments on their usefulness in the development of landscape inventories. In Appendix B, terms presently in use in visual landscape analyses and inventories are given as abstracts from selected references. These serve to suggest current differences in research directions and opinions.

FIELD OBSERVATIONS

This study rests upon the premise that the visual characteristics of the landscape and their relationships are the raw material from which landscape resource inventories may be developed. Therefore field observations and records of the landscape of the study area, both from the air and from the ground, were essential. Field work was also needed to identify relationships—both similarities and differences—between the divisions of the region established by physiographers (Fenneman 1931, Hunt 1967, Thornbury 1965) and the divisions to be established for our study, which concentrates on the scenic resource. Our analysis of collected data—photography, field sketches, and notes—has been a primary means of developing the inventory procedures described in this paper. No visual analysis can be realistic without field work.

The study area, the Northern Great Plains, is defined by Fenneman (1931) as the Northern sections of the Great Plains province (*fig. 1*). It includes the eastern parts of Wyoming, and Montana, extending into Canada, and the western halves of North and South Dakota. It is bounded on the west by the Middle and Northern sections of the Rocky Mountains province, and on the east by the Western Lake section of the Central Lowlands province. To the south, there is a gradual transition to the High Plains section.

The air observations made in this study included both high-level and low-level imagery. High-level imagery for the satellite ERTS (now LANDSAT) and the space platform SKYLAB were secured from the EROS (Earth Resources Observation System) Data Center of the U.S. Geological Survey. (This imagery is illustrated and discussed in Appendix A.) Low-level air reconnaissance with 35-mm photography was made across southeast Montana and into west central North Dakota on June 9 and 10, 1974. Flight elevation was maintained between 500 and 2000 feet relative to ground level, so that most photographs could be taken at 1200 to 1500 feet above ground surface. Approximately, the center line of the air route (*fig. 2*) was 450 miles long, bearing North 70° East, beginning from Silver Gate, Montana, passing through Custer National Monument and Medora, North Dakota, and ending at Stanton on the Missouri River. Because the coverage was made in two 1-day loops out of Billings, Montana, actual travel was about 2000 air miles.

In principle, the air observation represents a transect across the Northern Great Plains. It begins on the west with the steep mountain margin of the Middle Rocky Mountains and touches the north opening of the Big Horn Basin. It ends on the east, at the Missouri River, where the Great Plains meet the Western Lake section of the Central Lowlands (*fig. 1*). Sampling from the air served as a preview for later ground-level observations.

Ground reconnaissance was made from July 17 to August 15, 1974, by automobile in the four States of the study area. A series of loops (*fig. 2*), covering about 6,000 miles of travel on both major and minor roads, allowed visual sampling of the broad characteristics of the Northern Great Plains physiographic sections and their boundaries. In addition, because visual landscape inventories need to make tangible the specific resource manipulations that have occurred in specific places, through showing the diversity of the landscape, we made ground observations of subordinate elements (physiographic units) within the Northern Great Plains.

To sample the landscape diversity of the region, the routing was planned to cover (1) land form characteristics, (2) vegetation cover and patterns, (3) water presence and patterns—such as river landscapes with their floodplain woodlands and badlands, and lake areas, and (4) land use patterns—that is, manmade changes. Visual scenic analyses are developed by documentation of these four areas of concern, which are fundamental to both air and ground observations, and may be linked to other studies in various disciplines—studies valuable in land use planning and resource management. Thus the detailed discussion which follows is organized around these topics, and they are also emphasized in the description of the various levels of the landscape inventory itself.

The ground reconnaissance was recorded through field sketches as well as photographs. (Detailed criteria for such records are given in Appendix C.) Together, field sketching and photography provide landscape information unavailable through either medium alone. The field sketch can abstract from the complexity of the landscape, simplifying the impression that a photo usually gives. A sketch is most apt to portray relationships of strong contrast—characteristic silhou-

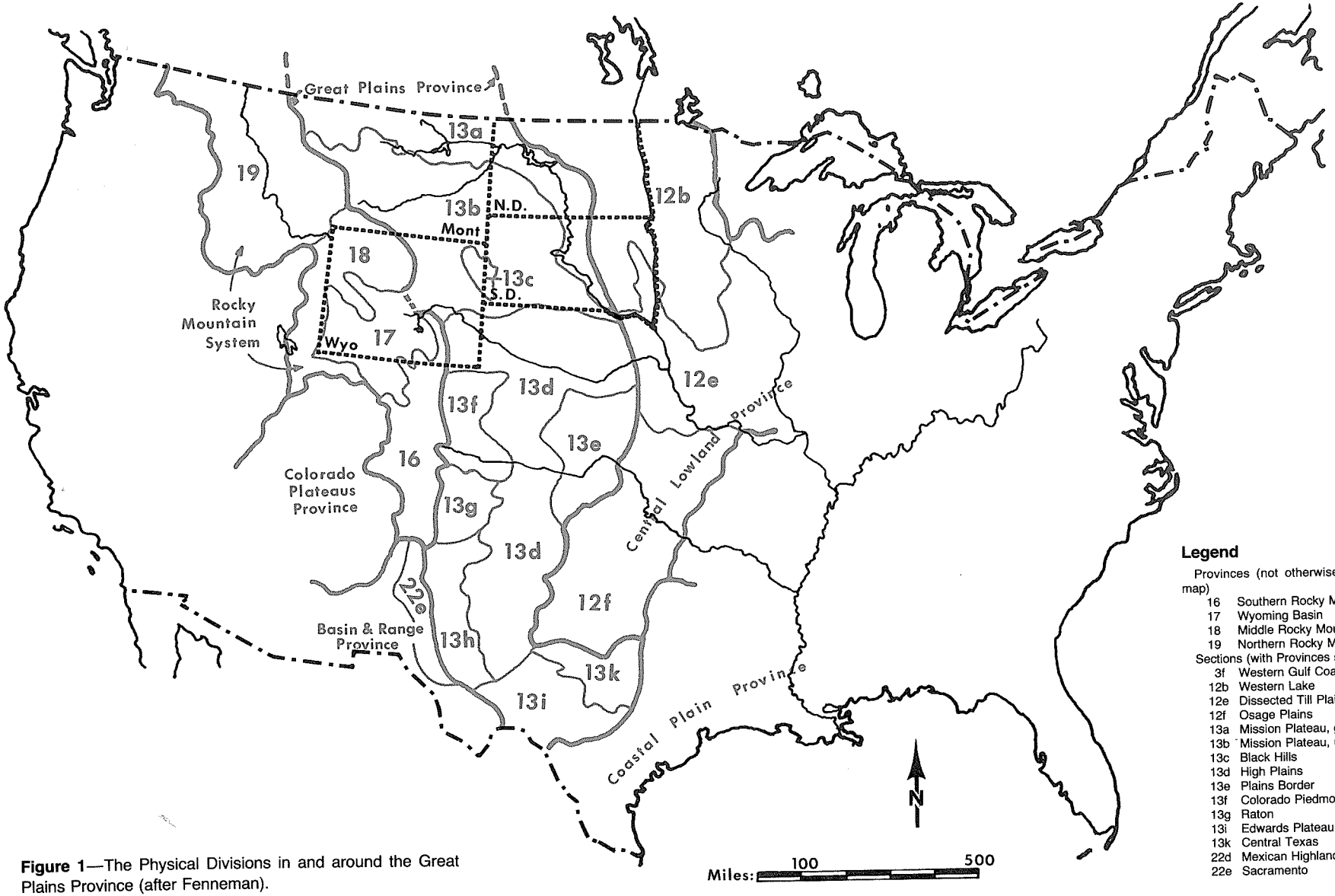


Figure 1—The Physical Divisions in and around the Great Plains Province (after Fenneman).

ettes and slopes of land forms, edges between land surfaces and vegetation or water. A sketch can also express the essence of a place under conditions that are adverse to good photography; problems of flat or dim light, haze, rainy weather, or midday sun are minimized. The possibility of distortion exists in sketches as well as in photographs, but the complete concentration upon the landscape that is required in field sketching tends to improve both observation and documentation.

In the discussion which follows, both low-level air views and ground observations are presented, and some differences between them as to value for particular purposes are pointed out. In general, the conditions responsible for these differences are (a) the distances and areas seen, as determined by the relative height of the eye; (b) the relative size or scale of viewed elements; (c) relative contrasts among landscape elements, such as forms and spaces and color values; (d) air clarity; and (e) illumination and sun angle.

As an overview of a large area or region, low-level air observation and photography seem superior to ground observation. Visibility at sea, which extends to the horizon, resembles that of flat terrain conforming to the curvature of the

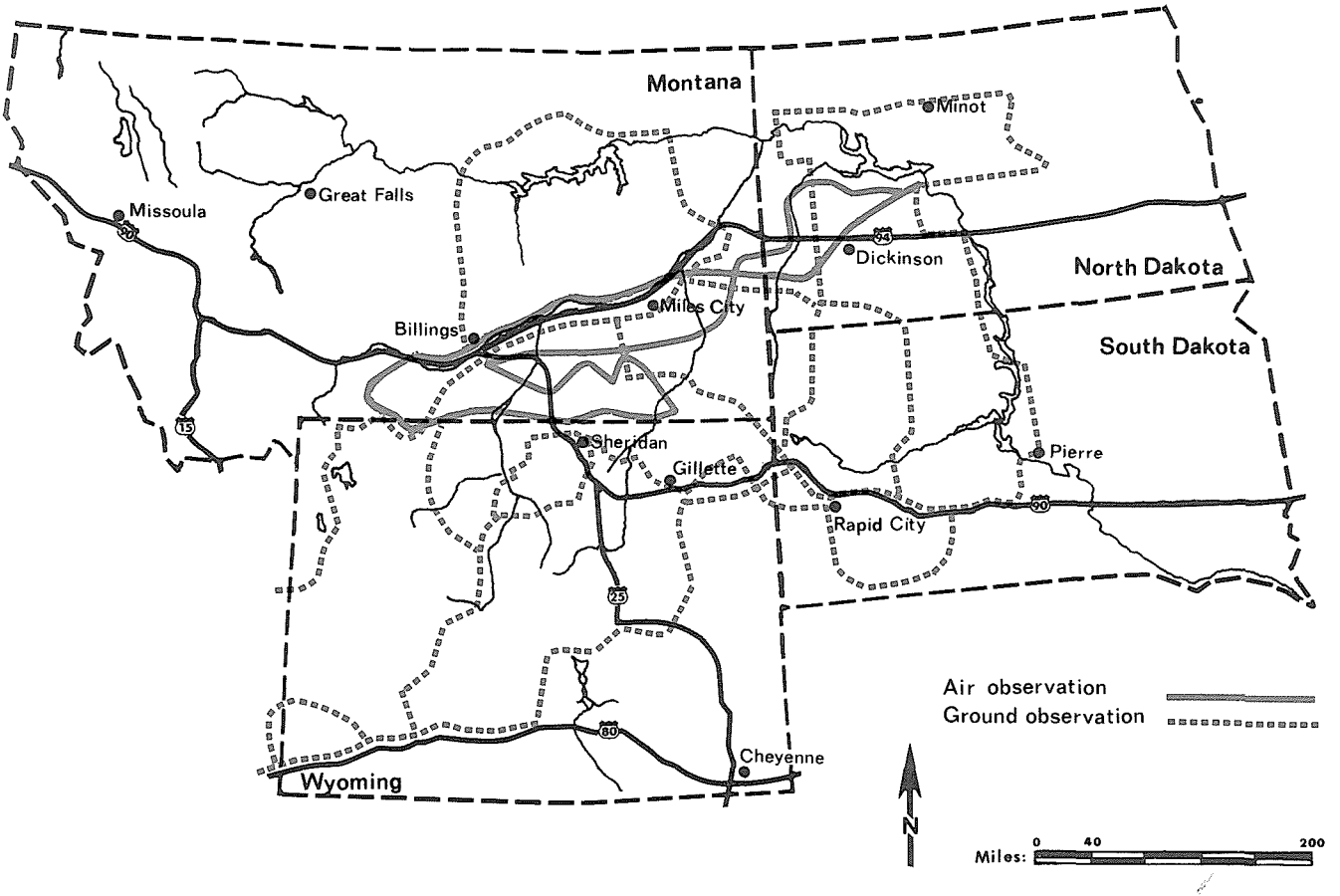
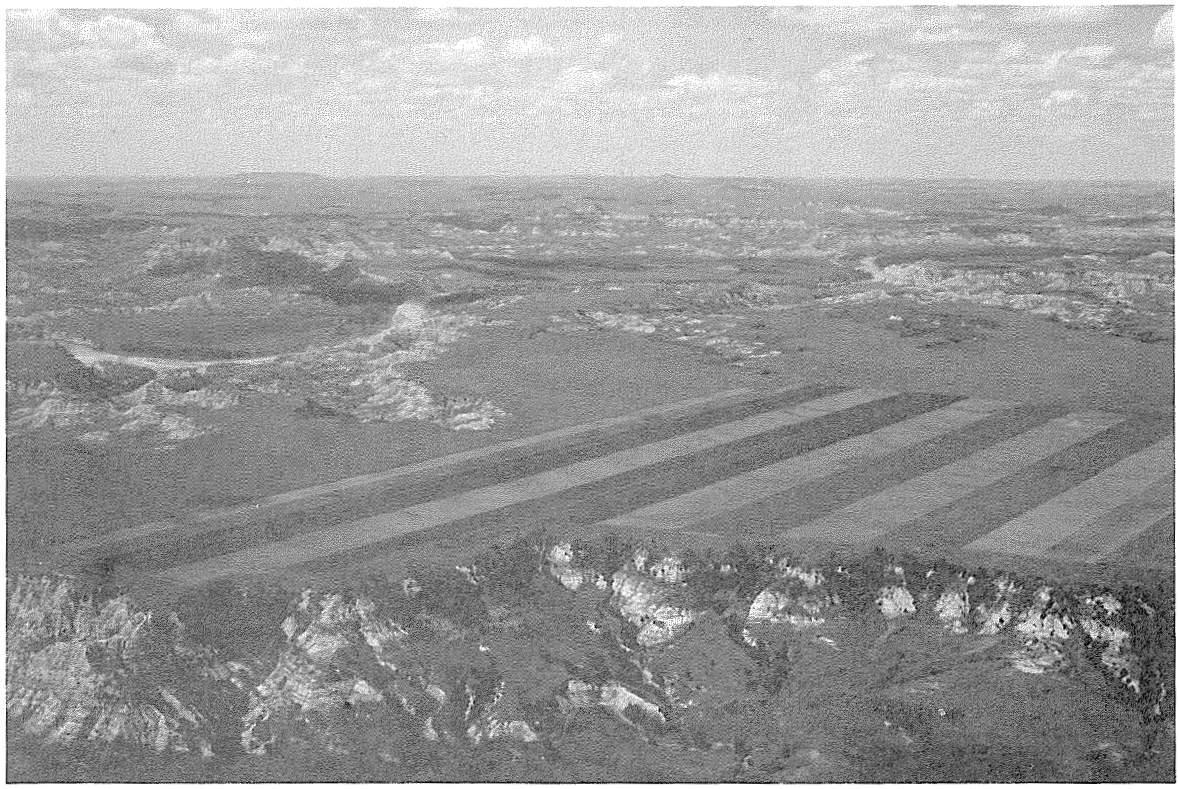


Figure 2—Air and ground observation routes are indicated on a base showing major numbered highways and major rivers.

earth. From a 5½-foot normal eye height, the horizon is 3 miles distant; it is 51 miles distant from a height of 1500 feet. A significant effect of higher elevation observation is the approach to full planimetric view, as opposed to perspective foreshortening at ground level. The plan view tends to be two-dimensional, however, losing the three-dimensional form associated with the ground view. Skylines seen from the air, because they are more distant than those from the ground, are diminished in image size and also possibly degraded if air clarity is poor. Most land form silhouettes are seen from the air against a terrain background, so that visual contrast is reduced.

In this flat country, comparing what may be seen at ground level with a map indicates that a surprisingly small area is actually visible. Detail and the close-in landscape tend to dominate unless higher terrain offers elevated observer positions which give us more extended scenes. A real advantage of air viewing is its comprehensiveness. From the air, detection of homogeneous landscape areas and the margins between areas of contrasting landscape is easier; so also is determination of the extent and junctions of different vegetation types or land use patterns. Freedom of movement in the air is another advantage, allowing changes in orientation for superior observation or photography. The speed of air coverage is not only efficient—it also aids in making comparisons over a brief time span. Ground viewing tends to be discontinuous because it depends on road patterns. Roads also limit choices of observation points and orientations. Nonetheless, ground observation does represent our normal perception, providing reality and detail not to be expected from any other viewpoint. A combination of air and ground observation provides different kinds of landscape inventory information, not available from either means alone.



Air and ground views of similar subjects reveal marked differences. The air view is extensive, shows surroundings and junction between agricultural pattern and badlands, and suggests the whole planimetric layout of strip crop agriculture (near Amidon, Little Missouri River, North Dakota). The ground view is limited and detailed; surroundings are not apparent and the geometric pattern is distorted in perspective relationship to surface undulations (north of Glendive, Yellowstone River, Montana).

Land Form Characteristics

Land form characteristics are a primary means of differentiating one landscape area from another. In particular, the freedom of movement provided by air observation makes it easy to see the extent of homogeneous landscapes—those which show a visual unity because of repeated similar forms. Edges, or the margins between areas with dissimilarities, are equally discernible, as are boundary zones of transition which show gradual change. Viewing from the air confirms that the physiographic provinces of the Middle Rocky Mountains and the Northern Great Plains abut one another sharply (*fig. 3*). The junction constitutes a distinctive edge, an area of concentrated visual interest: the steep mountain slopes of high relative relief (thousands of feet), capped by angular skylines, meet a transitional strip of hills and hogbacks with modest relative relief (hundreds of feet), moderate slopes, and predominantly rounded skylines. Then the essential flatness of the Northern Great Plains begins.

In general, land form characteristics provide in visual inventories the primary means of describing generalized form characteristics according to slope, scale, and silhouette; they identify individual or grouped forms which dominate an area or have a sphere of visual influence; they define areas according to the repetition of visually similar forms (homogeneous landscapes); and they identify boundaries and transition zones which mark the junctions between visually contrasting areas.

In this section, certain conspicuous aspects of land forms seen from air and ground are illustrated. Silhouette views of individual land form features can be significant from the roadway but can be quite lost in air views. We are apt to see only a segment of a larger land form—or a small part of repeated land forms—in ground views. From the air, it is easier to see that repeated similar forms can define areas of homogeneous landscape character. Also, from above, junctions between dissimilar landscapes become clear, the appreciation of scale is heightened, and there is more complete visibility of large, dominating land forms.

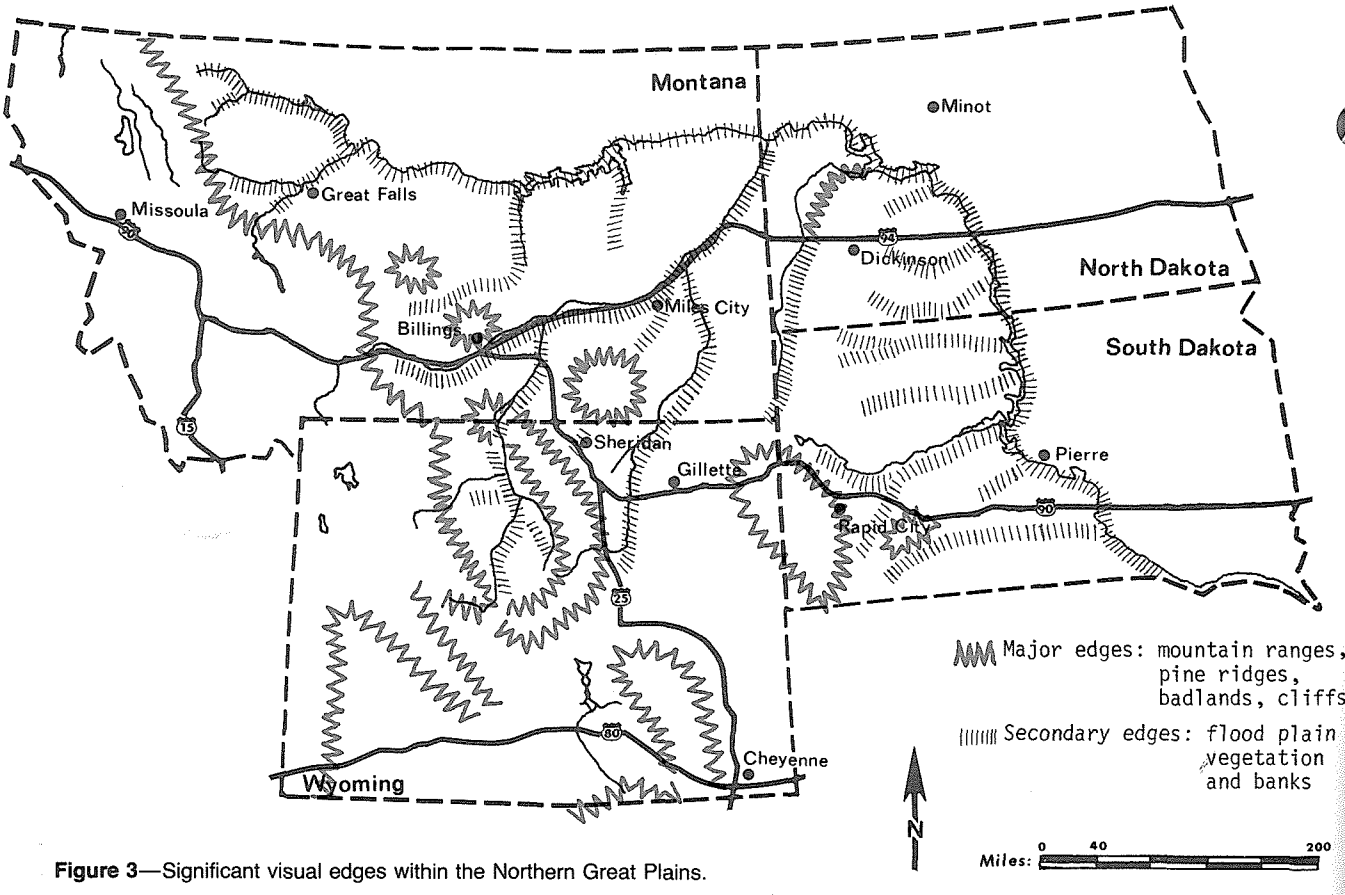
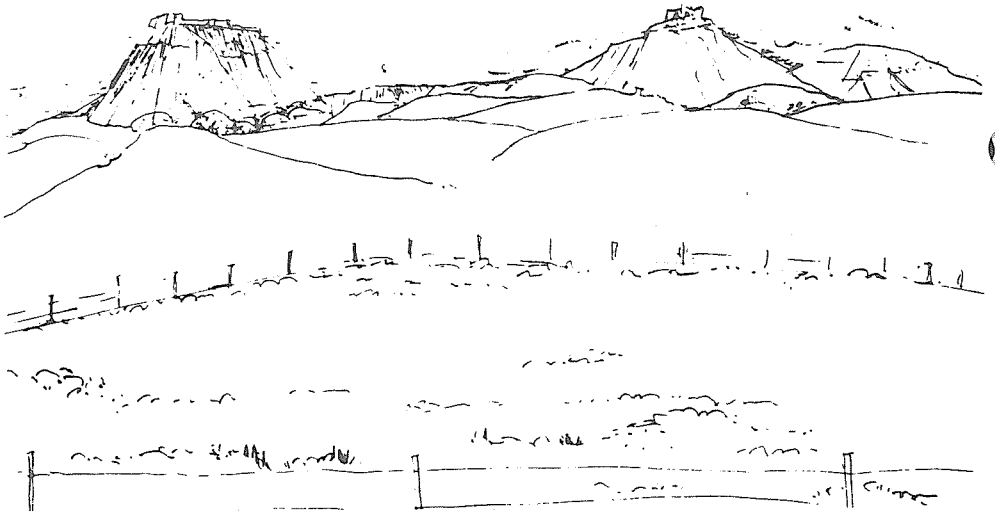
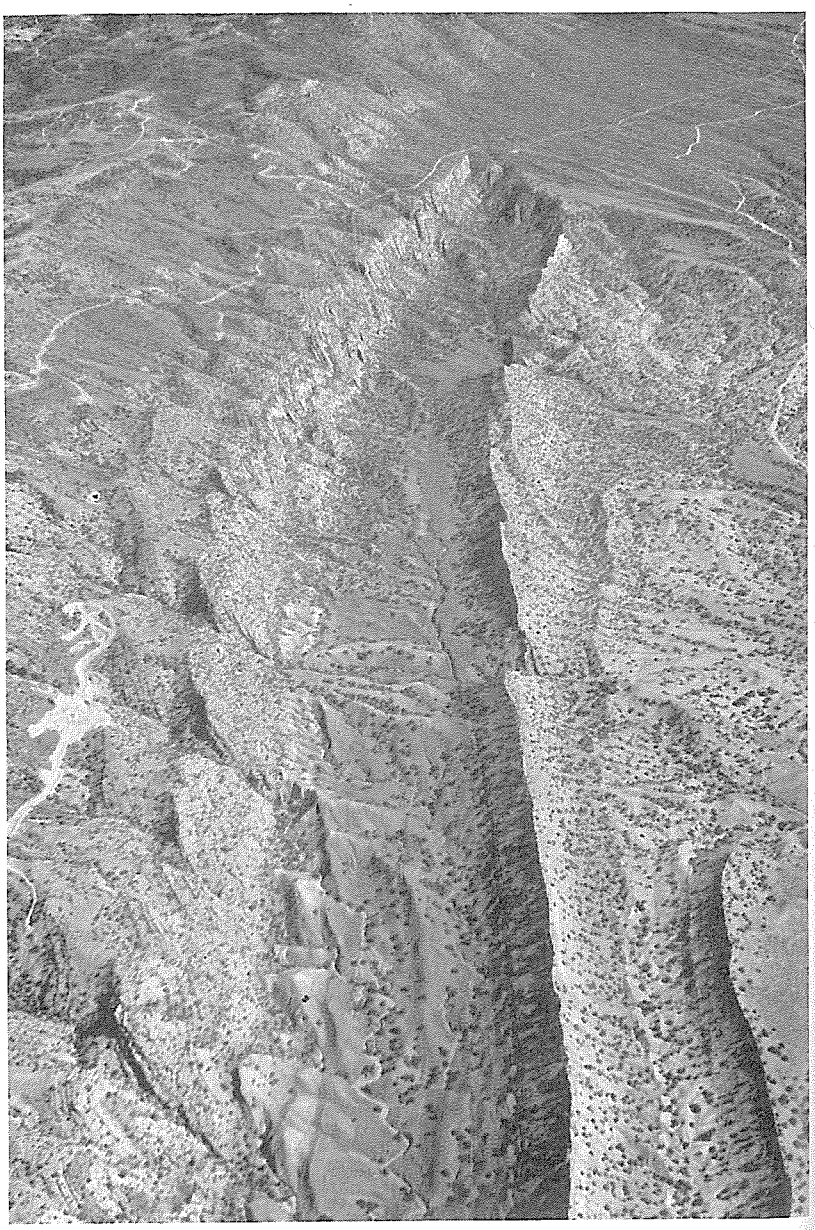


Figure 3—Significant visual edges within the Northern Great Plains.

Top: Angular mountain landforms with their conspicuous silhouettes are typical of the Middle Rockies, forming one distinctive boundary for the Northern Great Plains. (Pilot and Index Peaks, N. Absaroka Range, Wyo.)

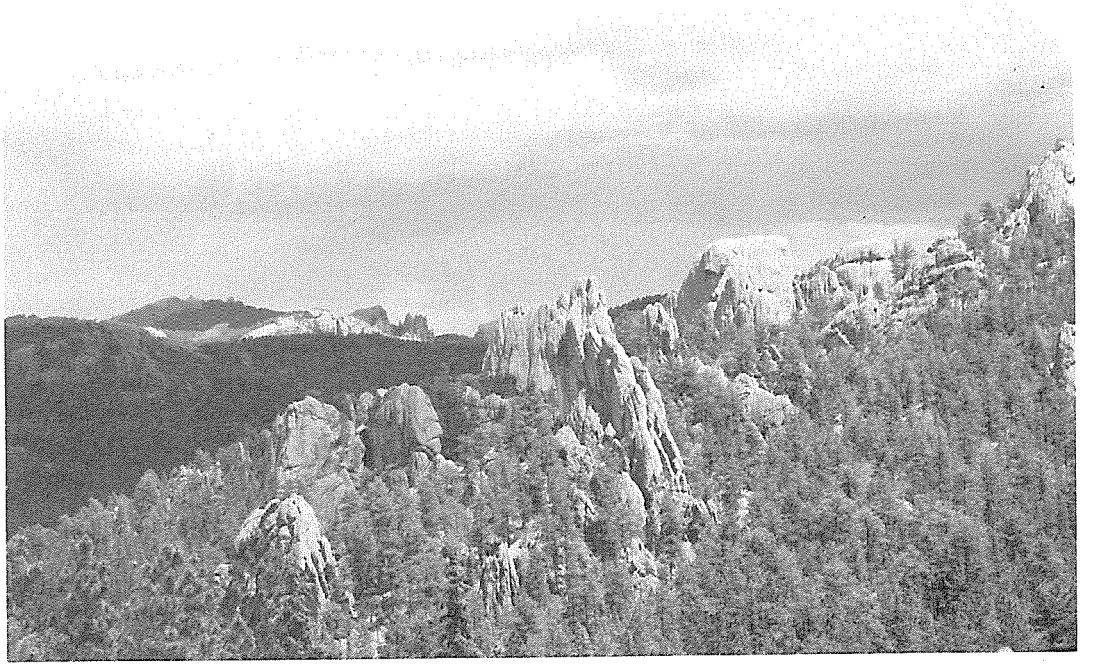
Bottom: Transitional landforms with relatively low relief and rounded ridges against the Middle Rocky Mountains are another visual edge of the Northern Great Plains. (Beehive, Mont., Beartooth Mountains in background.)

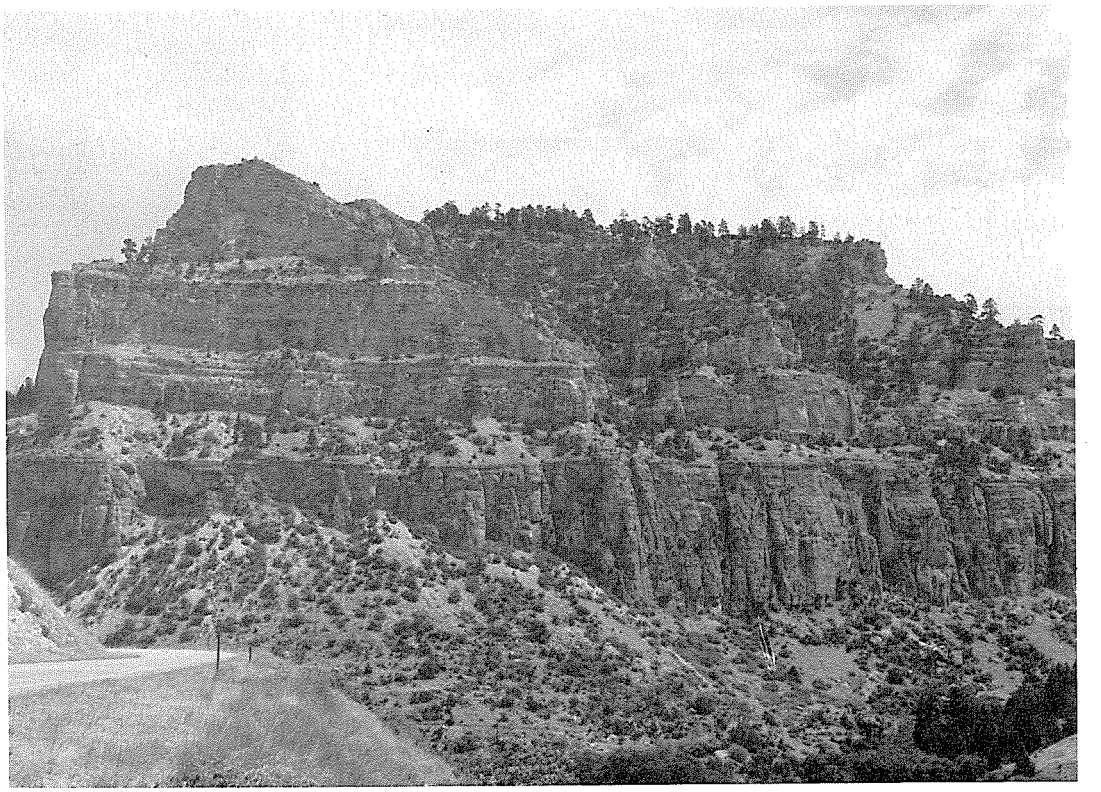




Top: Landform silhouettes are obvious expressions of the Northern Great Plains, but are also locally dominant in the landscape. (West side, Pryor Mountains, Mont.)

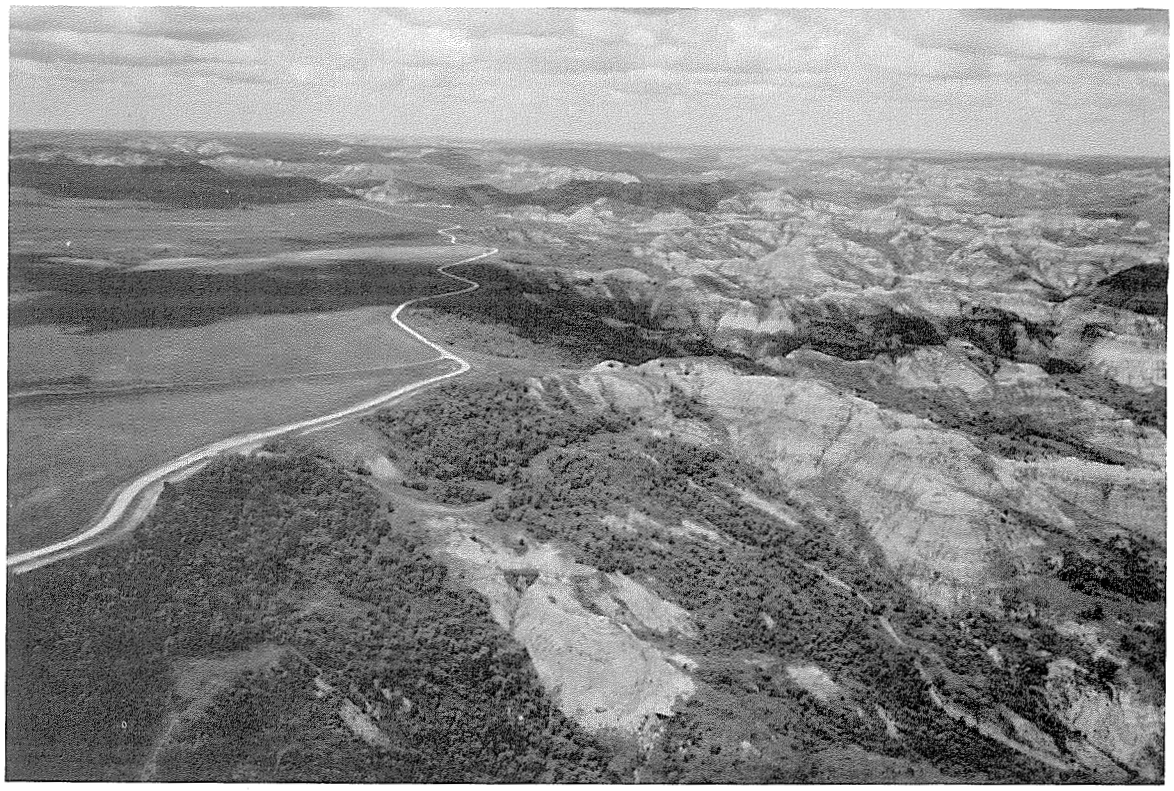
Bottom: Hogbacks are usual in the transition edge of visually perceived form in the landscape. These truncated cones, buttes of modest size, are associated with Northern Great Plains badlands. (Little Powder River, Mont.)





Top: Grouped granite needles become a landscape feature by their ridge skyline position and contrasts of form and color against pine forest. (Custer State Park, Black Hills, S. Dak.)

Bottom: An individual land form of distinctive silhouette and massive scale, with patterned surface of varied strata and pine-scrub cover, is a landscape feature of a different kind. (Tensleep Canyon entry, Big Horn Mountains, Wyo.)



Top: The visual edge between dissimilar landforms—flat agricultural fields and badlands—is clearly seen in this comprehensive air view. (Near Lake Sakakawea, Little Missouri River Badlands, N. Dak.)

Bottom: Repeated landforms with similar yet varied form make a homogeneous landscape. The air view reveals the extent and limits of this homogeneity. (Near Tongue River, south of Miles City, Mont.)

The predominant expression of the Northern Great Plains landscape is flatness, gentle undulations of surface with great extent. Its scale is grand, seen in both a vast sky and boundless horizontal land plane. (Near Badlands National Monument, S. Dak.)

Vegetation Cover and Patterns

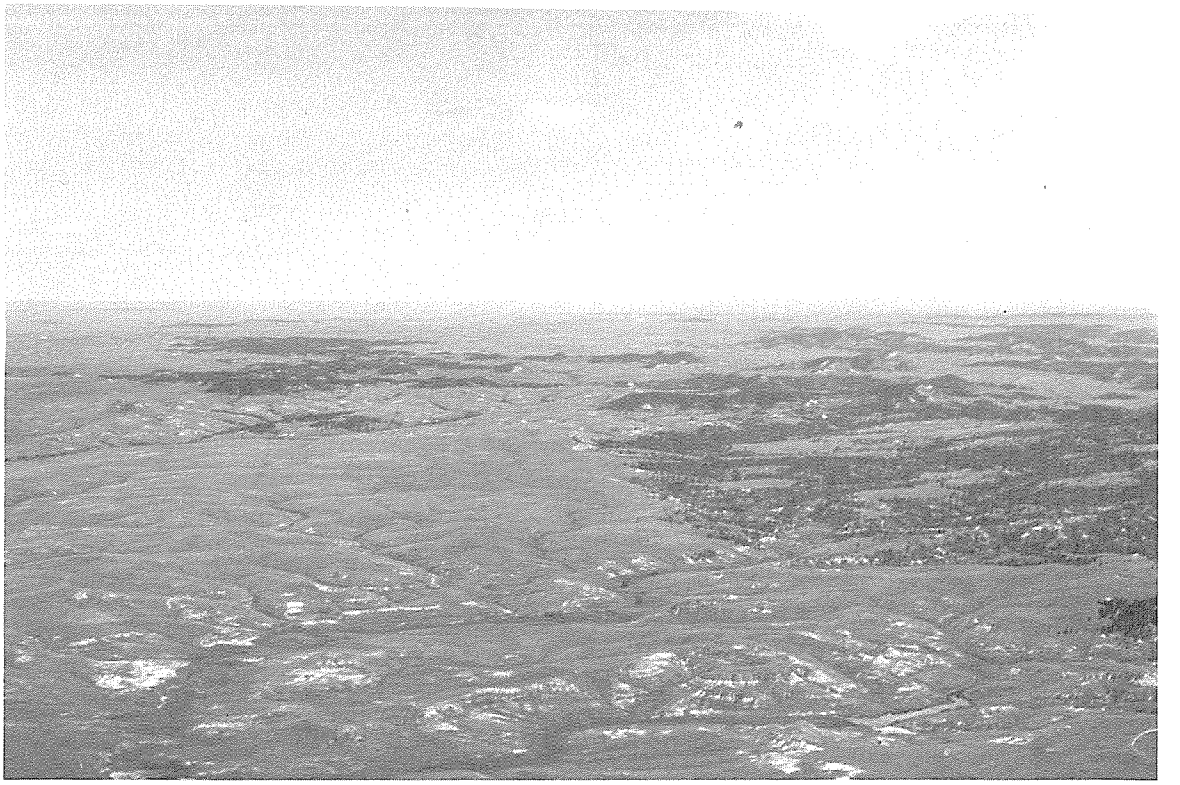
Vegetation cover and patterns are of considerably greater consequence to analysis of the visual landscape than they are to physiographic analysis: physiographic divisions depend fundamentally on the effects of geological structure and process. There may be overlapping, however. The Black Hills, which form a physiographic section by virtue of their structure (*fig. 1*), derive their name from the apparent blackness of ponderosa pine. The darkness of color is obvious because the hills are thrust up through a surrounding plain of light grass. In many parts of the country, both ground and air views reveal visual contrasts between forest cover and terrain. On a smaller scale, plant cover is an intimate overlay of land form, usually reflecting patterns traceable to microclimate, exposures, drainages, and compatible soils.

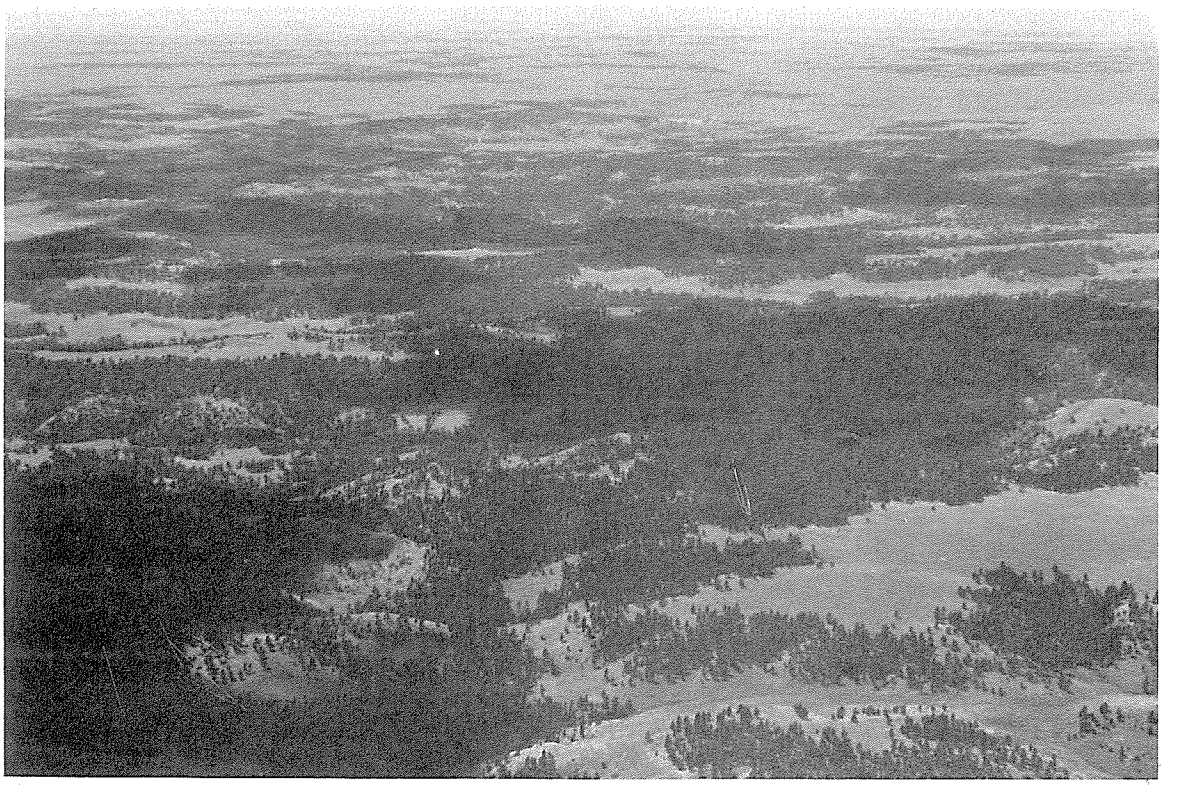
Low-level air views provide a superior means of identifying the extent of a dominating cover—especially grassland or forest; of investigating the margins between areas with contrasting plant covers—these junctions being special sources of visual interest; of identifying upland vegetation patterns that are based on land form relationships; and of identifying the extent of riparian vegetation and patterns, including their relations to streams, to basic channel spaces, and to upland vegetation.

In this section, visual relationships of vegetation cover and patterns are illustrated. The presence of two distinctly different vegetation types—especially grassland and forest—is visually significant in any view of the landscape. From the ground we are apt to see bits and pieces of margins between forest and grassland, but from the air we can appreciate that whole areas of similar character may be dominated by one kind of plant cover. Riparian vegetation, seen from ground level, suggests the presence of water, but the connections between water bodies and adjacent vegetation become entirely visible from the air. Also, from the air we have a more complete sense of how vegetation patterns tie to the patterns of topographic form.

Top: Grassland is the dominating vegetation of the Northern Great Plains, extensive from horizon to horizon, seldom interrupted. (Keyhole Reservoir, Wyo.)

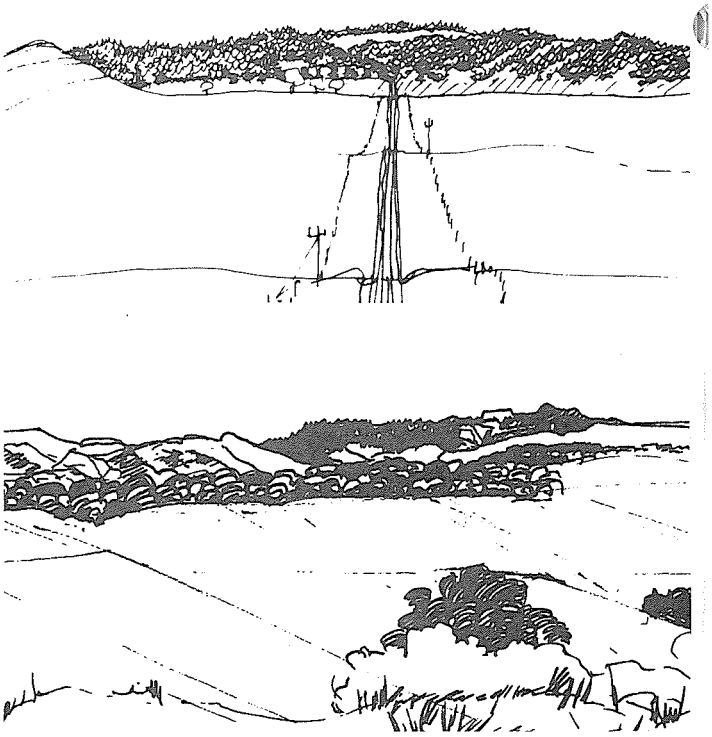
Bottom: Ponderosa pine is locally dominant and makes upland enclaves in contrasting seas of grass. (Black Hills National Forest, S. Dak.)





Top: The margin between forest and grass cover is a conspicuous line between two dissimilar landscapes. (East of Miles City near Powder River, Mont.)

Bottom: Light grassland is subordinate in proportion here to dark pine forest. (Otter Creek area and Tongue River, Mont.)



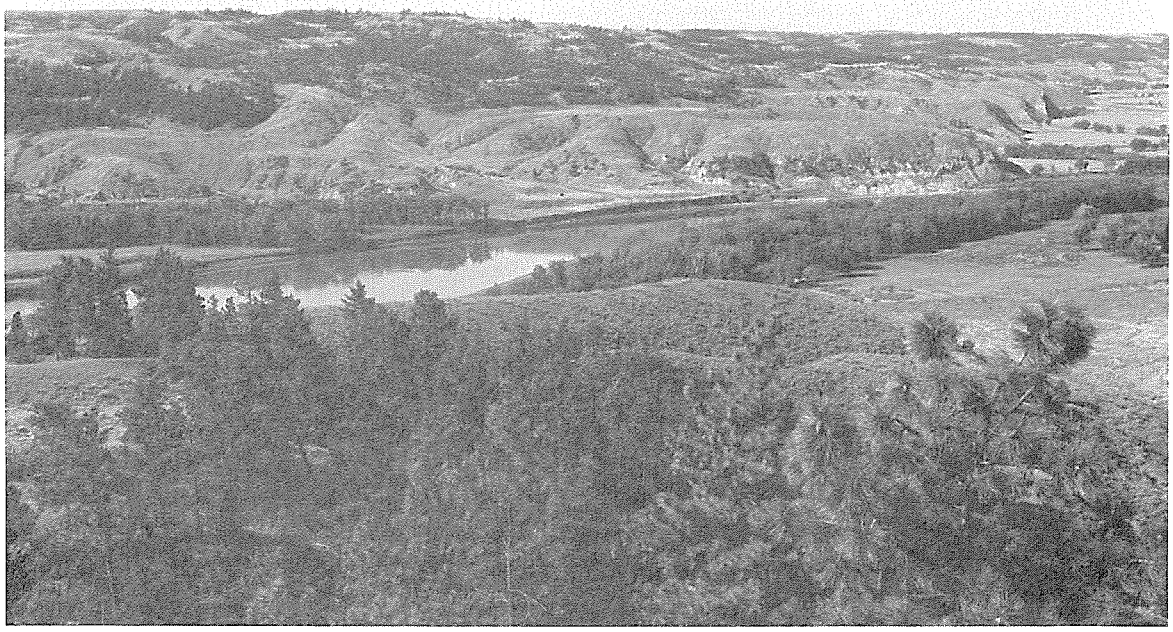
Top: The road sustains focal attention on the grassland-conifer edge at middle distance and the upland forest beyond. (Pine Ridge, Black Hills, Wyo.)

Middle: Masses of contrasting plant covers, with their sharply defined edges, create a landscape mosaic. (Deer Creek, Glendive, Mont.)

Bottom: Contrasting plant covers mark a flatland edge and provide a subtle introduction to uplands. (Belle Fourche River, near Devils Tower, Wyo.)

Top: Fingers of upland vegetation follow minor drainages and are seen against riparian woodland below. (Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River, N. Dak.)

Bottom: Cottonwoods occupy the interior flats of river loops, forming a recurrent pattern. (Near Medora, Little Missouri River, N. Dak.)



Top: Three other vegetation types seen from a moderate distance—light grass-scrub and dark conifers on higher land, brighter riparian woods below. (Charles M. Russell National Wildlife Range, Missouri River, Mont.)

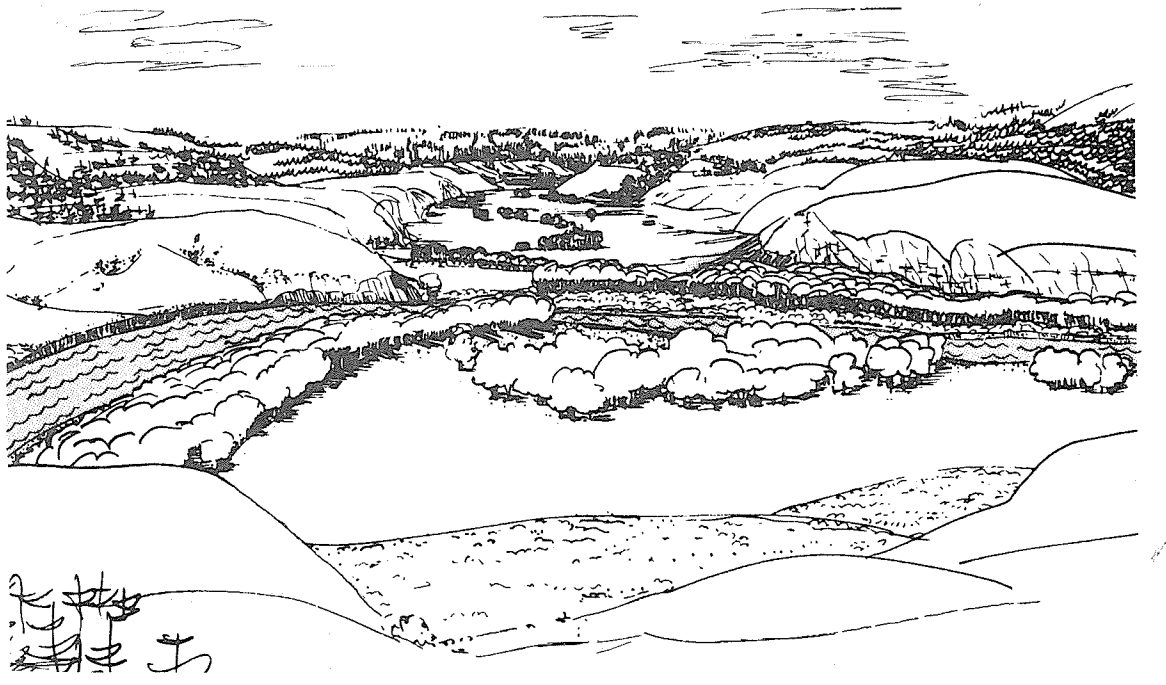
Bottom: Contrasts seen at close range: three life forms and colors—gray scrub, bright aspen, dark pine. (Black Hills, S. Dak.)

Water Presence and Patterns

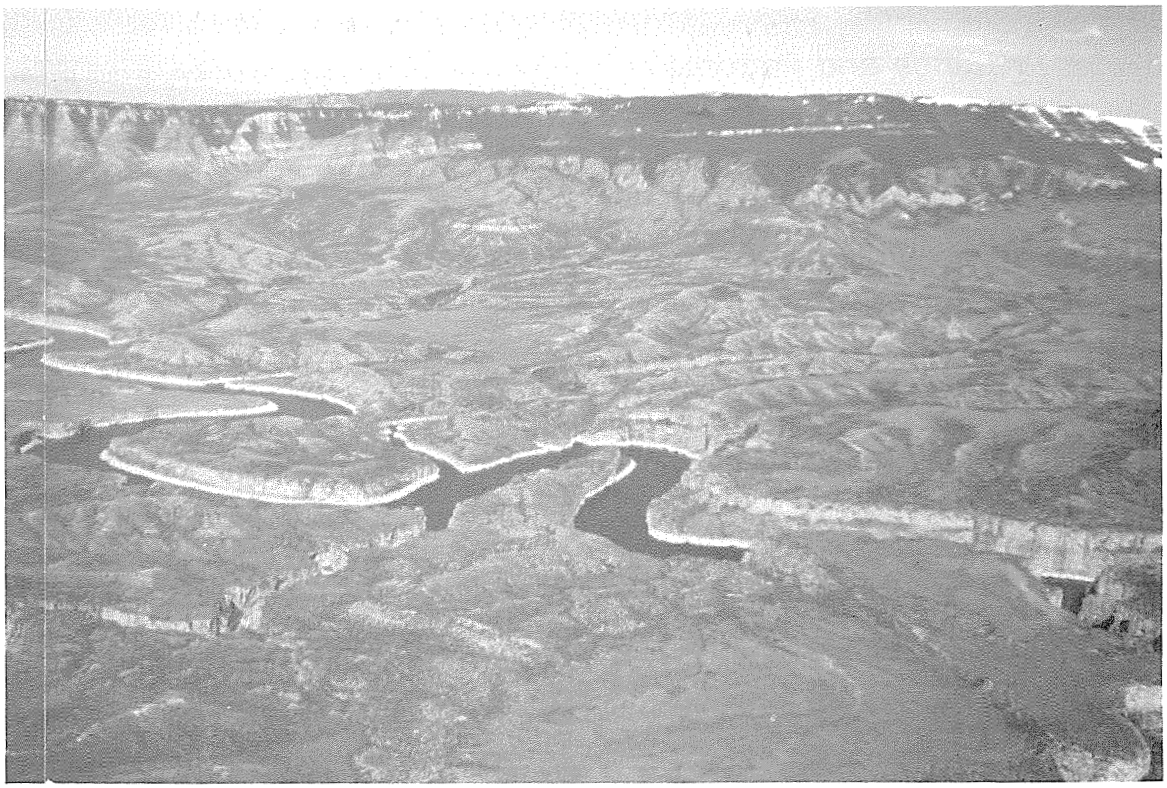
Water presence and patterns become special sources of visual amenity within the Northern Great Plains because it is a relatively dry country. In more moist regions, the presence of water is not associated with particularly marked visual changes. In dry areas, however, visual contrasts exist throughout the year between riparian vegetation and the vegetation of higher, drier land. Color differences are always a major factor in visual contrasts and especially so within the Northern Great Plains. During much of the year the lighter, bright greens of the riparian zone are seen against surfaces that are gray or buff. Typically the Northern Great Plains water expression is the meandering stream with concentric bands of associated vegetation—characteristics more readily seen from the air than from the ground. Clear water is unusual; coloration by silt is usual. Apart from impounded segments of streams, lakes are essentially nonexistent—this is the major difference between the Great Plains and the lake-dominated landscape of the Central Lowlands east of the Missouri River (*fig. 1*). Badlands of the Northern Great Plains combine with streams so as to form areas of special visual interest—these are the typical areas of this region which are designated as one kind of Landscape Unit in our system. Other relationships provide significant visual contrasts between land form and stream patterns; rivers may be deeply entrenched—as the Big Horn River is through the Big Horn Mountains—or steep bluffs may flank a river—as the Yellowstone River bluffs do near Pompeys Pillar. Stream paths in these flat plains are usually meander or braid patterns.

Low-level air observation is superior to ground observation for detecting entrenched river pattern and extent; identifying extent of bluff or areas of topographic breaks associated with streams; identifying badlands areas and their limits in association with rivers; identifying flatland stream patterns, associated riparian vegetation, and relationships to upland vegetation; and identifying the presence and abundance of lakes and stream impoundments.

From the ground, as from the air, the presence of water and its patterns are prime sources of scenic potential in most landscapes, and particularly in the Northern Great Plains. In flat country viewed from the ground, the presence of water is more likely to be implied by contrasts of riparian vegetation than to be actually visible. Ground viewing also seeks to document incised river patterns, for example, but has limited potential from the lower level; other water features (such as white water) observable from the air can be recorded from the ground as well, though with less comprehensiveness.

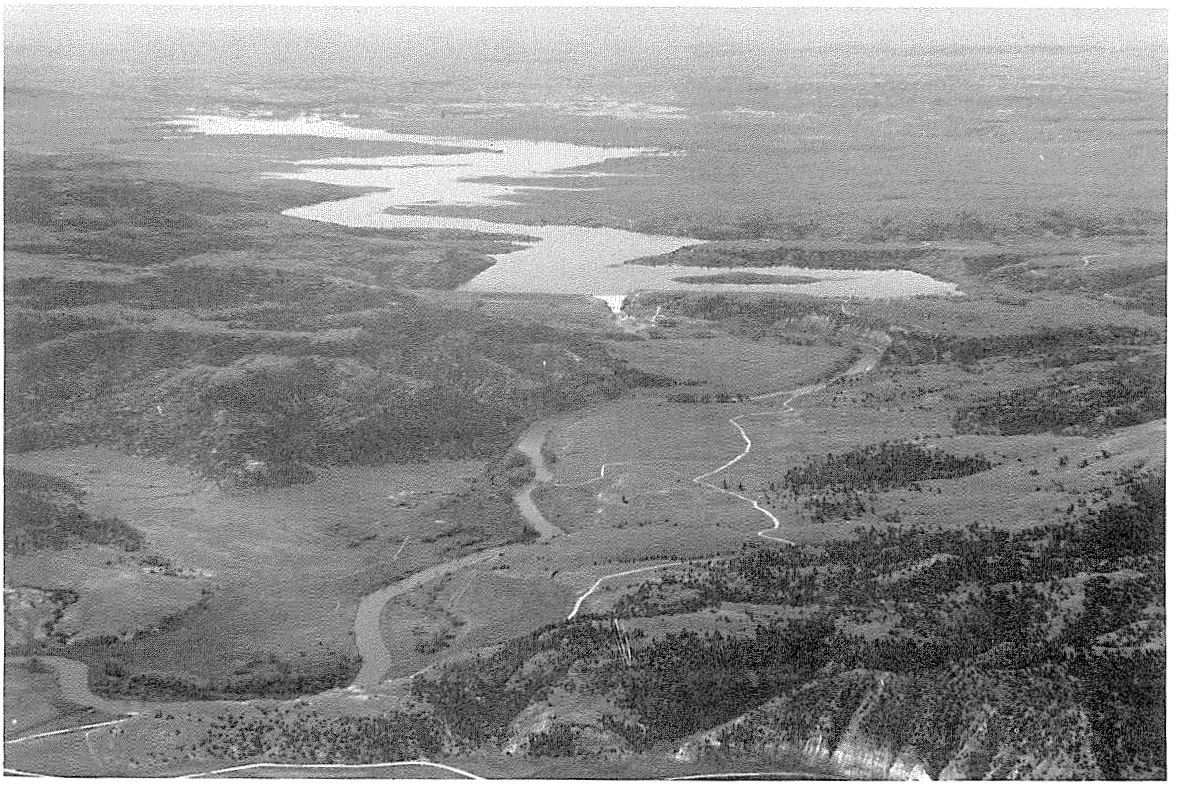


The alcove flat of a meandering side stream, with riparian vegetation, enters the larger flood plain space of the Missouri River. (Armells Creek at the Missouri River, Mont.).



Top: Deeply incised river meanders with continuous bluffs make a distinctive visual unit, conspicuous from the air. (Big Horn River, Yellowtail Reservoir, Wyo.)

Bottom: Bluff, stream, and vegetation relationships form a distinctive landscape with the river as the central feature. (Theodore Rooseveit National Memorial Park, North Unit, Little Missouri River, N. Dak.)



Top: A meandering stream typical of the Northern Great Plains is joined by a riparian woodland strip and badlands edge. (Powder River, Mont.)

Bottom: A water impoundment occupies the breadth of a former flood plain, and contrasts with the narrow outfall stream. (East end, Tongue River Reservoir, Mont.)

Top: Stream defiles are the major breaks seen in these repetitive undulate plains and ridges; water is absent or invisible. (Missouri River slope, near Mobridge, S. Dak.)

Bottom: A sinuous stream pattern is seen in relation to a riparian flat and adjacent bluff enclosure. (Near Killdeer, Little Missouri River, N. Dak.)

Top: A pond rests within the enclosure of small rounded hills and reflects them. (East side of Little Rocky Mountains, Mont.)

Bottom: Live streams and related wetland cottonwoods are two relatively rare landscape elements of the Northern Great Plains. (Cannonball River, N. Dak.)

Land Use Patterns

Land use patterns within the Northern Great Plains are relatively limited in both extent and visual impact. Urbanization is apparent primarily in small compact towns, which seem further diminished because of the large scale of the surrounding landscape. Agricultural use patterns are very extensive, but the typical grain crop strips alternating with fallow strips are dominant from the air rather than the ground. Because agricultural patterns occur on flatter or leveled parts of an already flat landscape, ground perspective tends to hide them. Roads which cling close to the general surface in this flat or undulate country similarly are inconspicuous on the ground except for their characteristically long tangents. Road grid patterns become obvious from the air.

Strip mining does appear conspicuous from the air; the scale of digging areas is massive even in the expansiveness of their surroundings. The area disrupted by mining is relatively concentrated, so that it is a focus of attention. The light color of spoil piles normally contrasts with darker undisturbed surfaces. Spoil piles are seen as geometric three-dimensional patterns from the air, whereas their ground views, especially in the Dakotas, are of steeply angular and pointed manmade forms. Reclamation regrading subdues visual contrast through slope flattening and ridge rounding, but does not affect surface color significantly. Undoubtedly the most conspicuous visual indication of coal mining is the coal-burning power or gasification plant, with tall stack and great smoke plume—somber domination of a flat landscape and vast skyscape.

Low-level air observation in relation to land use effects provides an excellent means of identifying organization of land use patterns, edges between different land uses, junctions between land use areas (and their patterns) and the natural landscape, and areal extent or scale of land use.

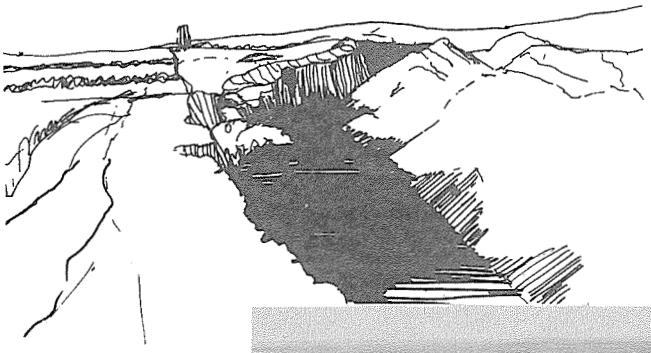
Illustrated here are samples of the more conspicuous land use patterns encountered in the Northern Great Plains. The ground view of a village is apt to be dominated by a few taller elements—trees and grain elevator typically; from the air it is the geometric pattern and overall block of streets, buildings, and trees. Agricultural patterns are those of the farmstead combined with tree plantations and parallel grain strips. The massive geometric forms of coal strip mines are apparent from the air but less so from the ground. Obvious ground signs of mining are those of peaked, sometimes light-colored, spoil piles, smoke stacks, and the visual impact of smoke in the atmosphere.

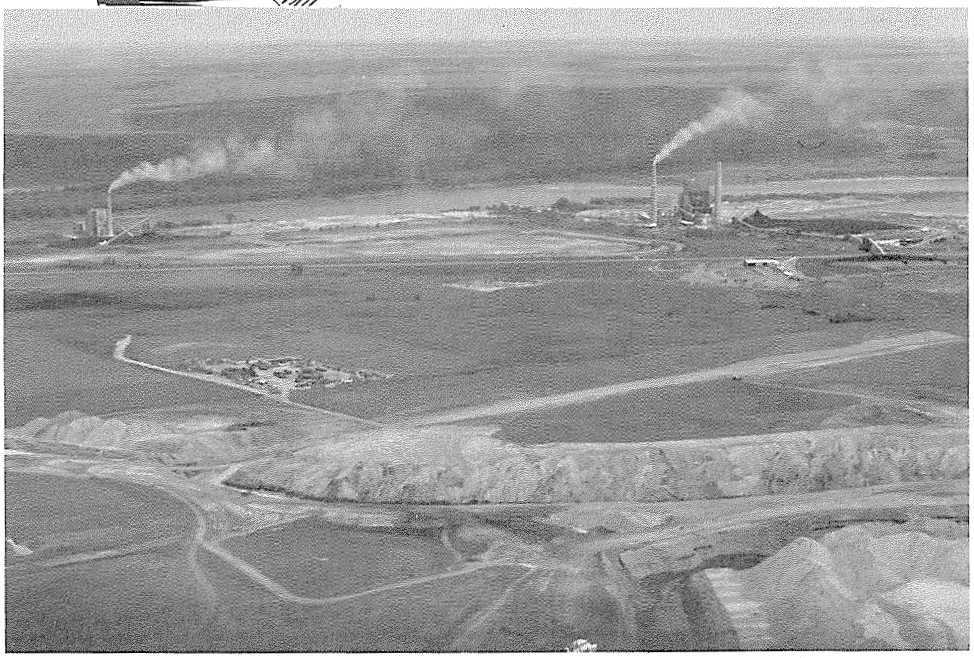
A typical entry impression of a Great Plains village is made by vertical forms of trees and grain elevators. (Clearmont, Mont.)

Top left: The urban land use pattern seen from the air is the geometry shared by buildings, roads and trees. (Hazen, N. Dak.)

Top right: Farmstead groups, abandoned or occupied, form another pattern element of agricultural land use—vertical exclamation points widely spaced on a flat landscape. (Highland Flat, Bill, Wyo.)

Bottom: The predominant expression of the Northern Great Plains landscape is flatness, reinforced by horizontal strips of agricultural land use. The village makes a contrasting vertical block. (Amidon, N. Dak.)





Top: A close-in sketch of strip mining in flatlands shows the linear cavity with coal bed exposed and adjacent spoil pile prior to reclamation. (Near Beulah, N. Dak.)

Middle: Visual impacts are combined here in a flat landscape: the horizontal coal stripping pit and overburden piles, and the vertical power plants with their smoke plumes. (Stanton, N. Dak.)

Bottom: Coal stripping with geometric linear impacts, and water impoundment conforming to topographic contours are two kinds of large-scale land use patterns. (Tongue River Reservoir, Decker, Mont.)

Top: Strip mine spoil piles, before reclamation grading, make strong pyramidal silhouettes upon a horizontal landscape. (Stanton, N. Dak.)

Bottom: Low rounded profile of land form reconstruction matches surroundings in this spoil pile reclamation. (Stanton, N. Dak.)

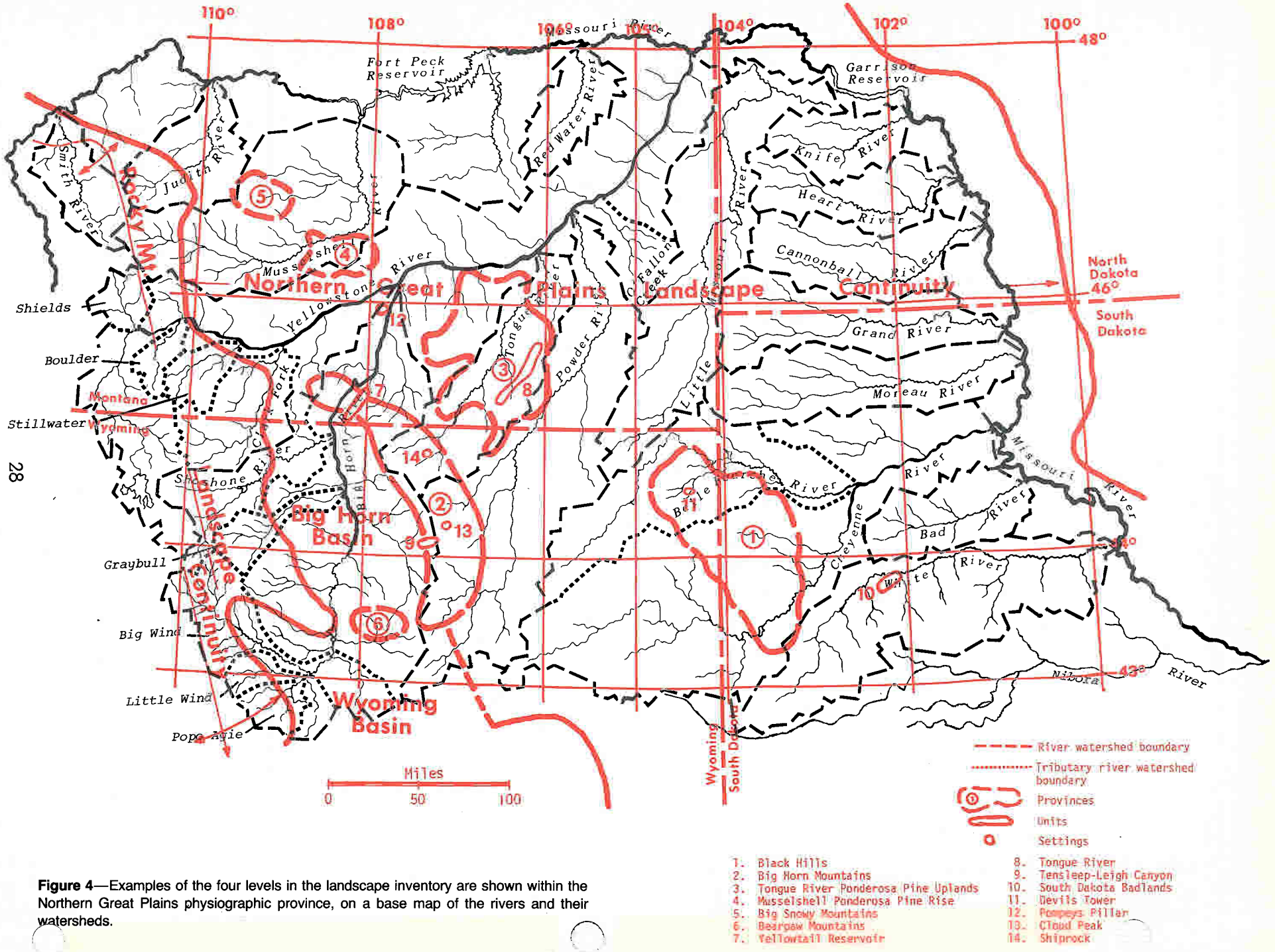


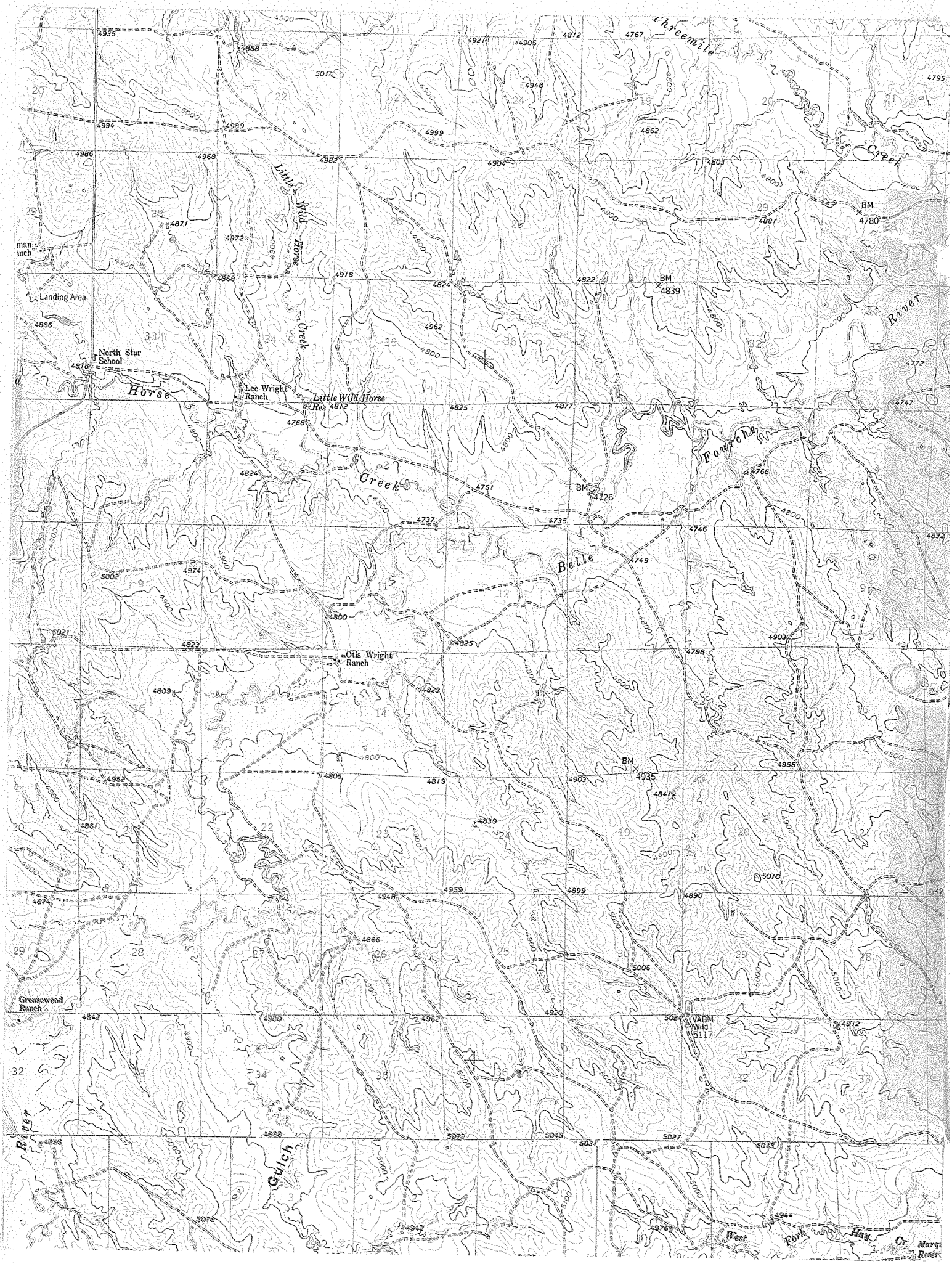
Figure 4—Examples of the four levels in the landscape inventory are shown within the Northern Great Plains physiographic province, on a base map of the rivers and their watersheds.

LANDSCAPE INVENTORIES

The conceptual framework of this landscape inventory, developed in the context of the Northern Great Plains, is described in four parts: the Landscape Continuity, the Landscape Province, the Landscape Unit, and the Landscape Setting. The discussion in each part begins with a definition, including references to related terminology and land classification in other studies. Then, the particular level is described as to scale, boundaries and edges, land form and topography, plant cover, water (as appropriate to the scale), and focal attractions or local features.

The sketches and photographs accompanying the discussion of each inventory level serve to illustrate the points made in the text, in a broad and general way. They are arranged sequentially, but a particular photograph or sketch may clarify features or principles discussed under various headings. Illustrations in the preceding section, Field Observations, will also help to provide the tangibility necessary to better understanding of the inventory method.

The map (*fig. 4*) provides a good general view of the whole inventory framework. It shows how the different elements of the inventory relate to one another in scale and location. The base map shows river watersheds to suggest a sense of scale and place that is based upon natural subdivisions of the landscape.


Landing Area
North Star School
Lee Wright Ranch
Little Wild Horse Res
Little Wild Horse Creek
Horse Creek
Otis Wright Ranch
Greasewood Ranch
Belle Fourche River
Belle Fourche
Creek
River
Gulch
West Fork
BM 4780
BM 4839
BM 4726
BM 4935
VABM Wild 5117

LANDSCAPE CONTINUITY

An extensive landscape with repetitious, undulating land forms and flat horizon typifies the Northern Great Plains Continuity. (Gillette, Wyo.)

USGS 15-minute Quadrangle Segment: North Star School, Wyoming.

The Landscape Continuity is the continuous and extensive landscape typical of a broad geographical region. The term "Continuity" suggests a visual flow of repeated relationships in similar land forms, vegetation cover and patterns, and water elements. The basic homogeneity of a region is implied, rather than mere repeated similarities of a smaller area, and the term applies to any kind of extensive landscape. Accordingly, some Continuities are placid, perhaps monotonous, in that they lack marked contrasts; examples are the undulate grasslands of the Northern Great Plains or the sagebrush steppe of Oregon and Idaho. Other Continuities are vivid in their display of differences; an example is the angular mountain landscape of the Middle Rocky Mountains, with its strong variations. Whatever the attributes, they create, by their visual impact, a regional identity. Of course, even within a broad landscape that shows an apparent consistency or homogeneity, there are variations, Yet the continuum—the Continuity—is extensive enough and apparent enough so that breaks in character are relatively small in area. The Continuity is a visual matrix that is not obliterated by such pockets of internal change.

The Northern Great Plains Continuity is a placid one. Extreme visual contrasts typical of scenic landmarks are largely absent. Simple and similar land forms, recurrent over broad grassland expanses, produce an impression of monotony. Yet small islands and other areas of modest change may be encountered within the continuum.

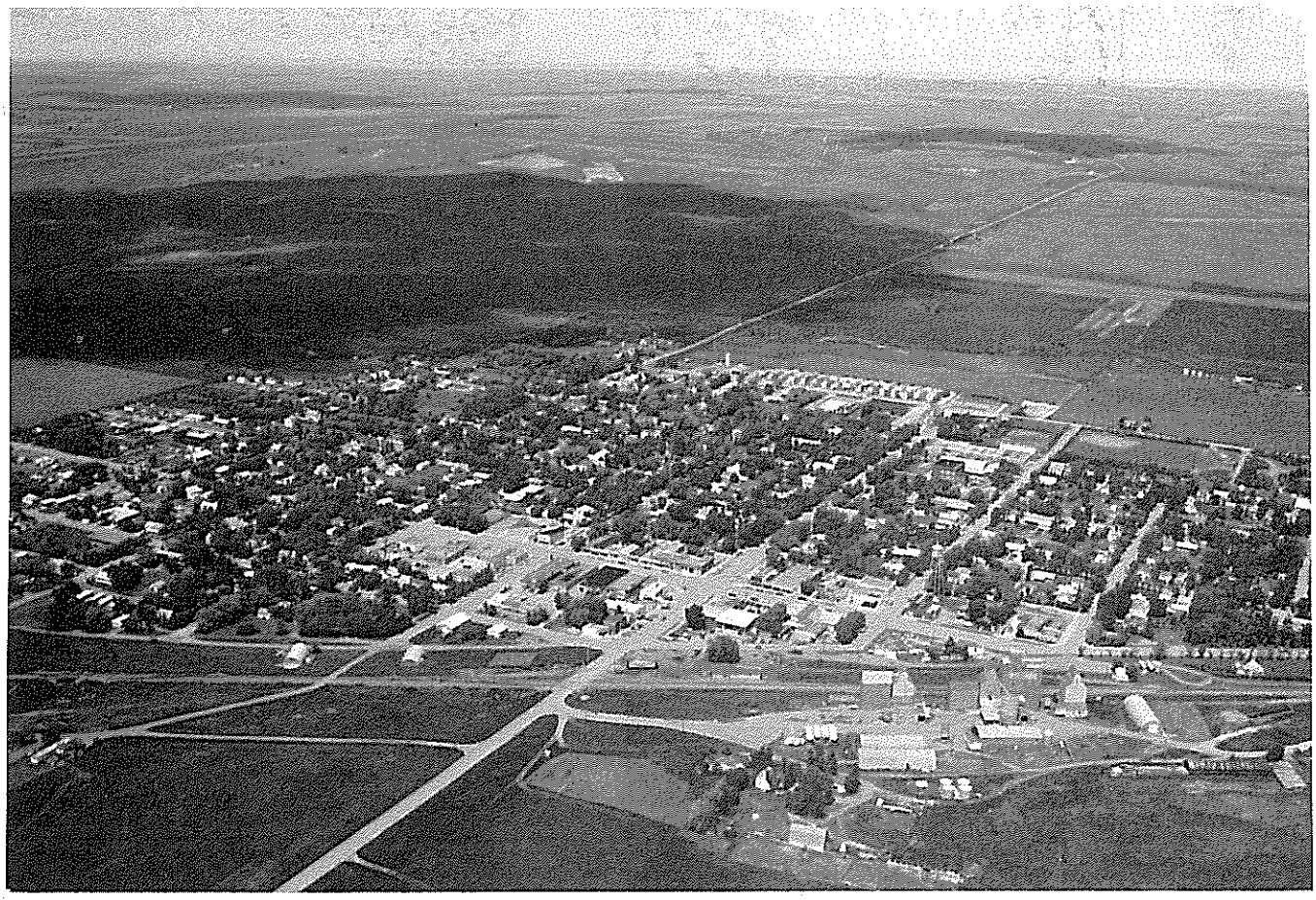
According to its elements and their relationships, landscapes may be called scenic, ordinary, or perhaps degraded. Seasonal changes, among various influences, can bring greater or less distinction to any landscape, however. The landscape of the Continuity—when a norm is represented—provides a reference level for comparisons. From the generalized visual characteristics of a regionally consistent landscape, it should be possible to determine changes in quality that represent either greater scenic contrast or deterioration and degradation.

The Landscape Continuity, represented by the Northern Great Plains as an example, is intermediate in scale between the physiographic province and the section or subprovince (Wertz and Arnold 1972, p. 4–5). Thousands of square miles are included in this example, and delineation may be made on maps of 1:1,000,000 scale and considerably smaller. Other Continuities may be of much less extent.

We identify the following physiographic sections of Fenneman (1931) as making up the Northern Great Plains Landscape Continuity: Missouri Plateau (glaciated), Missouri Plateau (unglaciated), and the Big Horn and Wyoming Basins (parts of the Middle Rocky Mountains). (See *figures 1 and 4.*) Although the Black Hills Section is included, we give it a separate identity. This Continuity can also be identified with the Upper Missouri Basin Broken Lands and the Big Horn and Wyoming Basins of Hammond (1964).

The term "Landscape Continuity" has been chosen because it suggests repeated visual characteristics that are common and typical for a broad and continuous area. It is not a static image so much as a dynamic impression obtained in traveling for days at a time. Burke and others (1968) have used the term "characteristic landscape" to mean the typical landscape which "... occurs most of the time—the average condition ..." as seen along a roadway. No particular scale is implied, but the examples emphasize the roadside of the High Plains and adjacent Rocky Mountains. Burke's emphasis is upon evaluation—making comparisons with the average condition. The Forest Service landscape management procedures (U.S. Forest Serv. 1974b) define "character type" as the landscape typical of any single physiographic section according to Fenneman's (1931) classification. These same procedures define "characteristic landscape" as a directly viewed sample of a character type. Thornbury (1965, p. 8) makes use of Malott's definition of a physiographic (geomorphic) unit as one with "characteristic topographic elements" throughout, and as contrasting with other units displaying other land form characteristics. This usage restricts the meaning to topographic elements—one part only of the visible landscape. So a number of different meanings are carried by landscapes designated as "characteristic," but all such meanings help to define the idea of the Landscape Continuity.

In *Study of the Visual and Cultural Environment* (Res. Plan and Design Assoc. 1967) a set of "Landscape Series" are defined, classifying divisions of the landscape according to "... repetition of a dominant land form over a large area." Two series, "undulating land" and "flat land" (or a combination "Compound Series") would apparently apply to the Northern Great Plains.



Familiar geometry and structures of a small town provide a scale comparison to the extensive surrounding landscape. (Hazen, N. Dak.)

Scale

Landscape Continuities are the broader regional expanse—they are not the immediate, personal and local landscapes of scenic "places," such as Kevin Lynch (1960, p. 119) describes. Their scale, in consequence, is large. In the Northern Great Plains, actual land forms and vegetation patterns are small, but their repetition produces largeness in scale. Breaks are infrequent. Continuities are usually so expanisve that their dimensions are not easily visualized in the abstract. The Minnesota Lakes region, the Texas rangelands, or the Northern Great Plains are collectively expansive enough to lack tangible scale. Most travelers never touch all the borders of these areas, never reach its extremities. The landscape is thus measured by travel time rather than by surface dimensions.

The Northern Great Plains Continuity covers an area of approximately 235,000 square miles—about 350 by 550 miles—within the following nominal boundaries: (1) the Missouri River to the north and east, (2) the Nibora and White Rivers to the south, and (3) the Rocky Mountains edge in the west (*fig. 4*). An even larger area is logically included within this particular Continuity. It consists of the Big Horn and Wyoming Basins and the glaciated and unglaciated physiographic sections of the Missouri Plateau. The northern limits apparently lie in Canada at about the latitude of Great Slave Lake (Thornbury 1965, p. 287).

In an aircraft, Continuities are rapidly traversed. One grasps the relative proportions of regional areas, their beginnings and endings. But detachment from landmarks, internal elements, and edges creates an abstract experience entirely different from that of the surface traveler. The greater the altitude and speed, the greater the detachment.

The western boundary of the Continuity is abrupt against the Central Rocky Mountains edge, but there is a transition zone of lower hills and hogbacks. (Aerial view, Beehive, Mont.; Beartooth Mountains in background)

Boundaries and Edges

Appreciation of extent depends on seeing the edges of an area. A Continuity is a consistent landscape through which one travels, and the traveler is in an area where edges are beyond visual limits. One may circle a lake, for example, to appreciate its boundaries at first hand, but large areas may appear endless because their extent and the difficulty of access prevent circumnavigation.

Edges experienced at the point of entry into a Continuity may erroneously be thought typical. The size of the Continuity often precludes uniformity of boundaries, however. Sheer mountains may lie along one edge and nearly imperceptible land form differences mark another—this is true of the Northern Great Plains. In such great expanses, edges, when encountered, may seem remarkably dramatic because of contrast. The flank of the Middle Rocky Mountain west of Billings, Montana, makes a vivid blockage in the Great Plains landscape. By comparison, the margins between the Northern Great Plains and the adjacent High Plains or the Central Lowlands are soft transition zones—inconspicuous to the eye. When the Continuity has edges or boundaries that are particularly vivid, relative to the characteristic features on its surface, those landscape areas adjacent to the edge assume a special character. Distinct edges suggest sources of higher scenic interest. This can happen without changing the nature or the quality of the visual characteristics of the greater part of the Continuity.

Land Form and Topography

Surface form is ordinarily consistent throughout the Continuity. Over so great an extent, minor or local interruptions in this surface character are likely. They are attributable to erosion of stream systems, variations in soil and the geologic base, or geologic disturbances—upheavals, faulting, or folds. Because these are logical variants explained by underlying natural forces, their visual or scenic presence has meaning; they do not seem disruptive or detractive. They are local centers of interest within the Continuity. If they stand out sufficiently because of variation in visual form and size, they may be recognized as discrete subunits. Landscape Provinces and Landscape Units, in this inventory procedure, are so recognized within the Continuity.

Typical land forms of the Northern Great Plains Continuity are long, gentle slopes with flattened, rounded, or peaked tops, which emerge from an undulate surface. Low relative relief is the common denominator. Examination of randomly chosen square-mile sample areas on 7½-minute topographic maps indicate relative relief of less than 100 feet to about 200 feet; in cross-section, some are symmetrical, others asymmetrical. River troughs are another definite form: flat-bottomed defiles with moderately sloping sides—or bluff banks on cutting sides—are depressed below the horizon plane. Spaced 25 to 50 miles or more apart, the flood troughs seem less common than they actually are because roads do not often intersect them. Badlands topography, though common enough within this Continuity, is sufficiently contrasting in visual form to be classified into subareas, the Landscape Units. Mountain peak forms—such as the Black Hills or Big Snowy Mountains, outliers of the Rocky Mountains—or forested upland areas are also separated from the Continuity because of obvious differences; these are Landscape Provinces.

Repeated similar and undulating grass-clad land forms provide the impression of a homogeneous landscape. (Near South Fork of Moreau River, S. Dak.)

Plant Cover

In the Continuity, plant cover is more important for the consistency of the patterns developed than for the continuous presence of a particular plant species. The pattern of repetition provides the characteristic identity, but variations in pattern occur, reflecting favorable or marginal cultural conditions. In the Continuity, it is normal to expect such differences; their frequency depends on latitude, soil, exposure, available water, and other conditions which limit plant location and diversity of type.

In the Northern Great Plains Continuity, grasslands constitute a major visual characteristic—a fine-textured, light-colored blanket which echoes the gentle terrain below it. Within the grassland, however, are at least three different grassland types, as well as grassland-sage combinations. All are similar in appearance. In visual terms, the grassland predominates, but to those with the requisite knowledge and a discerning eye, the subtle differences are revealed, and underlying cultural variations can be inferred.

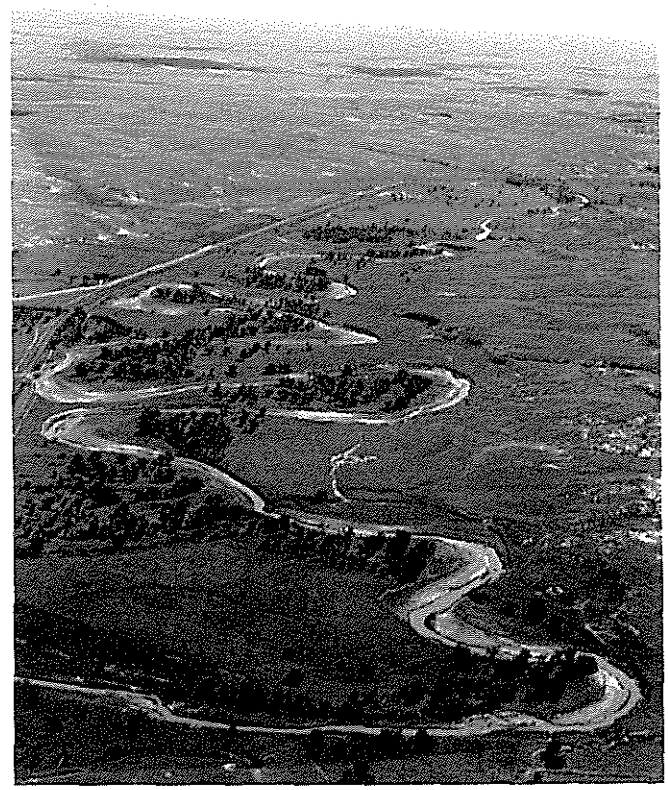
Top: Grain crops, suggestive of original grasslands, are a light-colored blanket echoing the gentle terrain. (Near Pierre, S. Dak.).

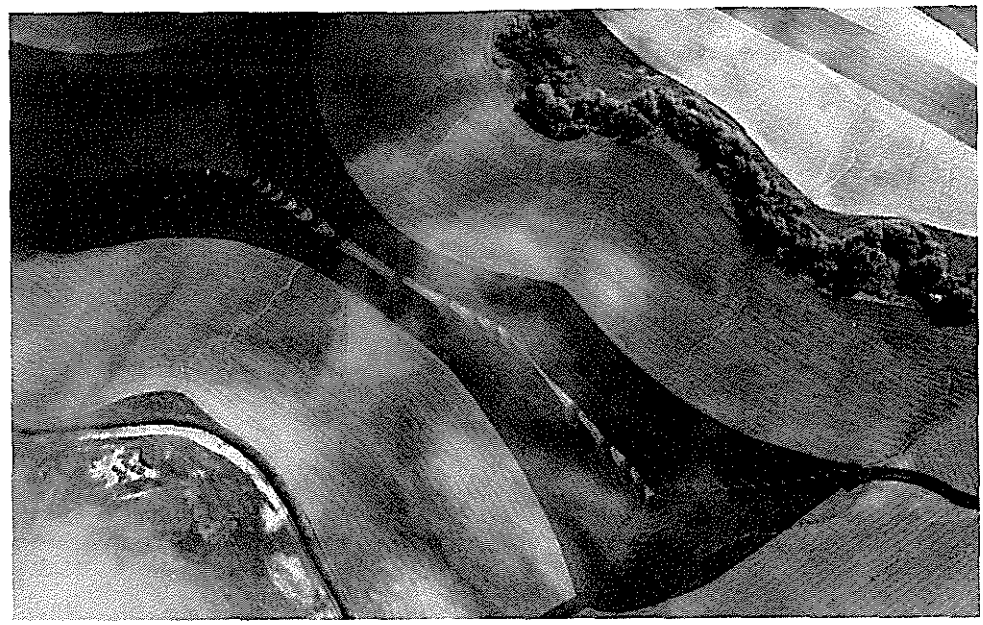
Bottom: Grassland and grain crops are the dominant vegetation of the Continuity, accompanied by typical contrasts of riparian tree lines and groves. (Near Medora, N. Dak.)

A major theme variant of the plant pattern is found in the characteristic riparian linearities. Pockets, lines, concentrations, and scatters of trees and low plants follow meandering watercourses and drainages through much of the area. Visual contrast—hence distinction—comes from the darker trees and associated plants that stand out against the lighter grassland. Tree lines trace out invisible streams. The amount of tree cover is small compared to grass, and frequently the tree patterns of lines and patches lie low below the crests of terrain.

Water—River Drainages

The presence of water is a conspicuous visual element in any landscape. It is, additionally, a major force contributing to the formation of identifiable visual elements, whether at the broad scale of the Landscape Continuity or at the much smaller scale of the Landscape Province. Terrain gradient, precipitation, and water volume, rock and soil types, and riparian vegetation all contribute to the landscape seen as directly related to water and its action.





Top: Streams typical of the Northern Great Plains meander across the flats, accompanied by cottonwoods in the flood zone. (Aerial view, O'Fallon Creek, Mont.)

Bottom: Visual mosaics result from the meeting of farm crop patterns and sinuous lines of creek vegetation, but are conspicuous only from the air. (Near Sentinel Butte, Medora, N. Dak.)

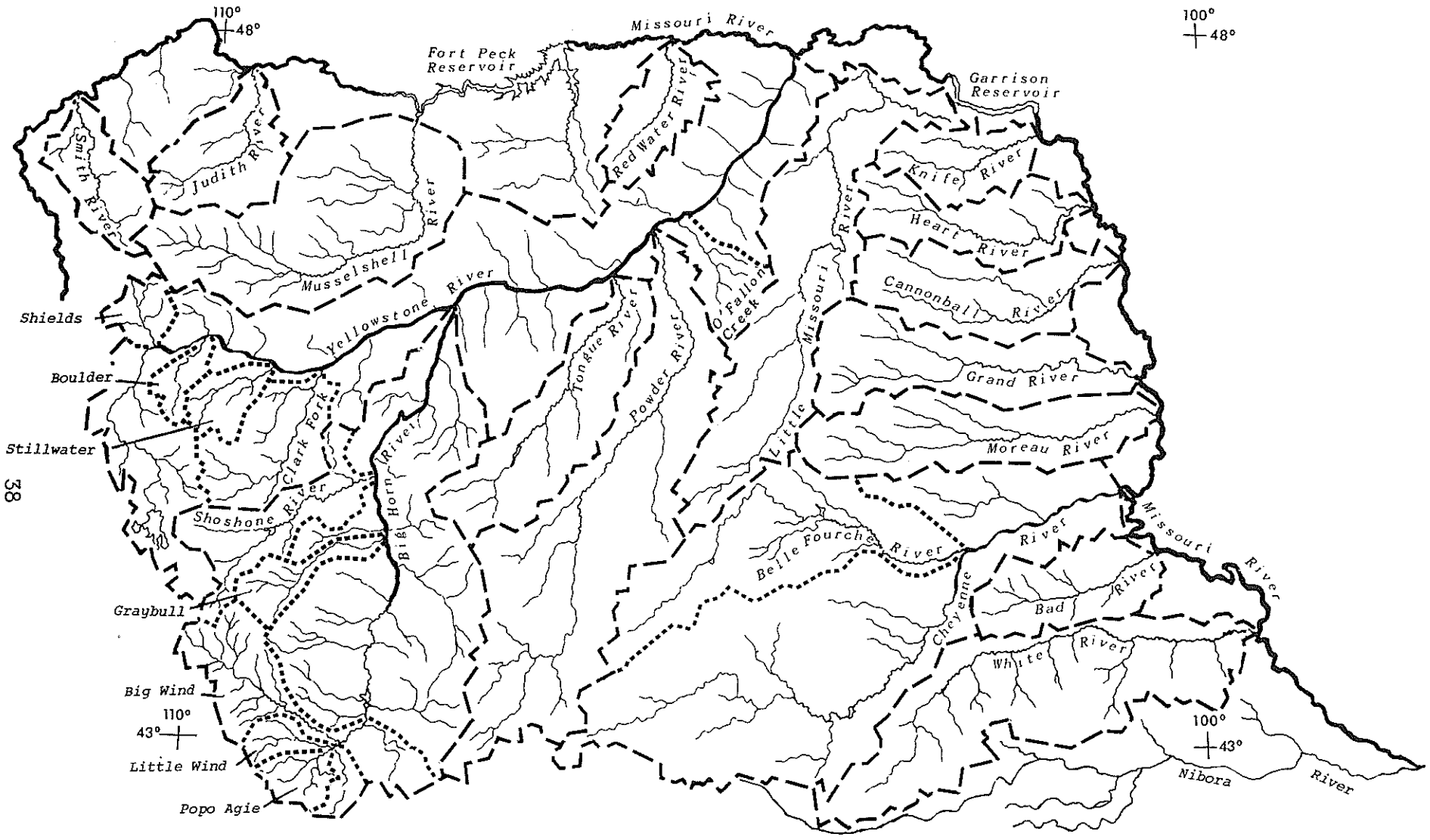


Figure 5—River watersheds of the Northern Great Plains and adjacent Rocky Mountains.

River watershed boundary

Tributary river watershed boundary

Table 1–*Rivers of the Northern Great Plains and Middle Rocky Mountains, draining north and east into the Missouri River, between 48° N. 110° W. and 44° N. 99° W.*

River[1]	Watershed area	Watershed orientation	Alignment length[2]
	Sq. miles	*Azimuth*	*Miles*
Smith	2,100	330°	85
Judith	2,900	030°	95
Musselshell	9,275	060°	205
Red Water	2,050	030°	80
Yellowstone	21,775	350°-060°	540
Shields	850	160°	35
Boulder	650	020°	45
Stillwater	1,025	050°	55
Clark Fork	2,975	030°	95
Big Horn	16,850	020°	220
Shoshone	2,975	070°	120
Graybull	1,125	060°	85
Big Wind	2,350	120°	120
Little Wind	1,200	090°	45
Popo Agie	825	050°	40
Tongue	5,425	030°	160
Powder	13,550	025°	320
O'Fallon Cr.	1,475	320°	70
Little Missouri	6,100	020°	295
Knife	2,375	070°	85
Heart	3,325	090°	135
Cannonball	4,325	070°	145
Grand	5,350	090°	170
Moreau	5,575	080°	185
Cheyenne	17,725	070°	350
Belle Fourche	6,950	030°-070°	230
Bad	3,150	070°	100
White	9,775	080°	260

[1] Rivers in the Middle Rocky Mountains are shown in italic.
[2] Alignment length is generalized, omitting meanders; measurements made on 1:1,000,000-scale map for comparison only.

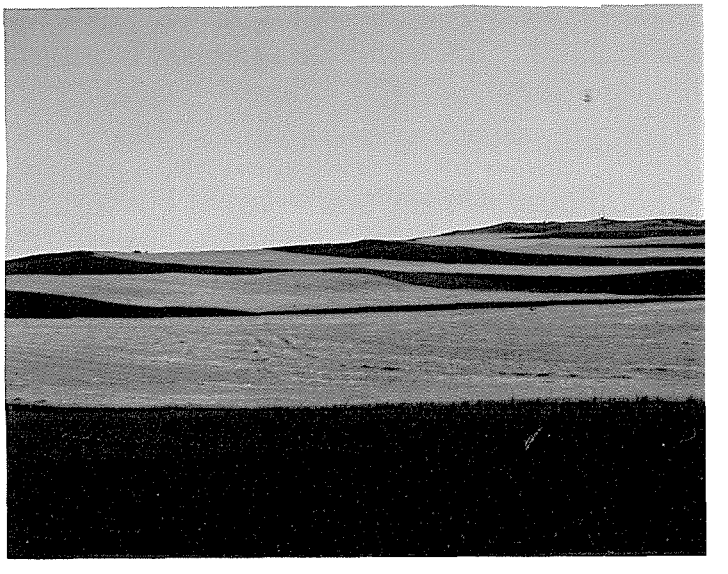
Rivers and their drainages are numerous within the Landscape Continuity. They tend to repeat similar visual relationships, although each river is an individual. The traveler, crossing or moving parallel to the rivers of the Northern Great Plains can expect repetitive elements, such as

1. Definite flood plain troughs depressed below general terrain level, usually deep enough to screen riparian woodlands from outside view
2. Trough edges, variable but predominantly of three types: gentle to moderate slopes, steep to nearly vertical bluffs, and badlands strips—riparian woods within the trough creating subordinate edges
3. Sinuous or meandering stream patterns with slow water—frequently silty.

The repetition of watershed orientations and streamflow from west to east of the eight rivers draining into the Missouri (from the Knife in the north and down to the White in the south) suggests similar visual characteristics (*fig. 5*). This particular set of similar orientations also indicates repeated and marked contrasts between north-face and south-face vegetation.

The scale of the Landscape Continuity is indicated clearly by its many rivers and river systems, which are best seen on a small-scale map (*fig. 5*). Within the Northern Great Plains Continuity, between latitudes 43° and 48°N, there are 15 rivers. These range from the Red Water, the smallest, to the Yellowstone; the largest (*table 1*), all draining into some 700 miles of the Missouri. The Yellowstone alone carries one third of the watershed runoff of this portion of the Landscape Continuity; 13 streams are tributary to it—8 within the Middle Rocky Mountains. At the scale of this Landscape Continuity, the number of creeks is legion—some, such as O'Fallon Creek, could be considered rivers.

Crop pattern of alternating fallow and planted strips gives visual emphasis of subtle land forms. (Dawson Co., 20 mi. north of Glendive, Mont.)

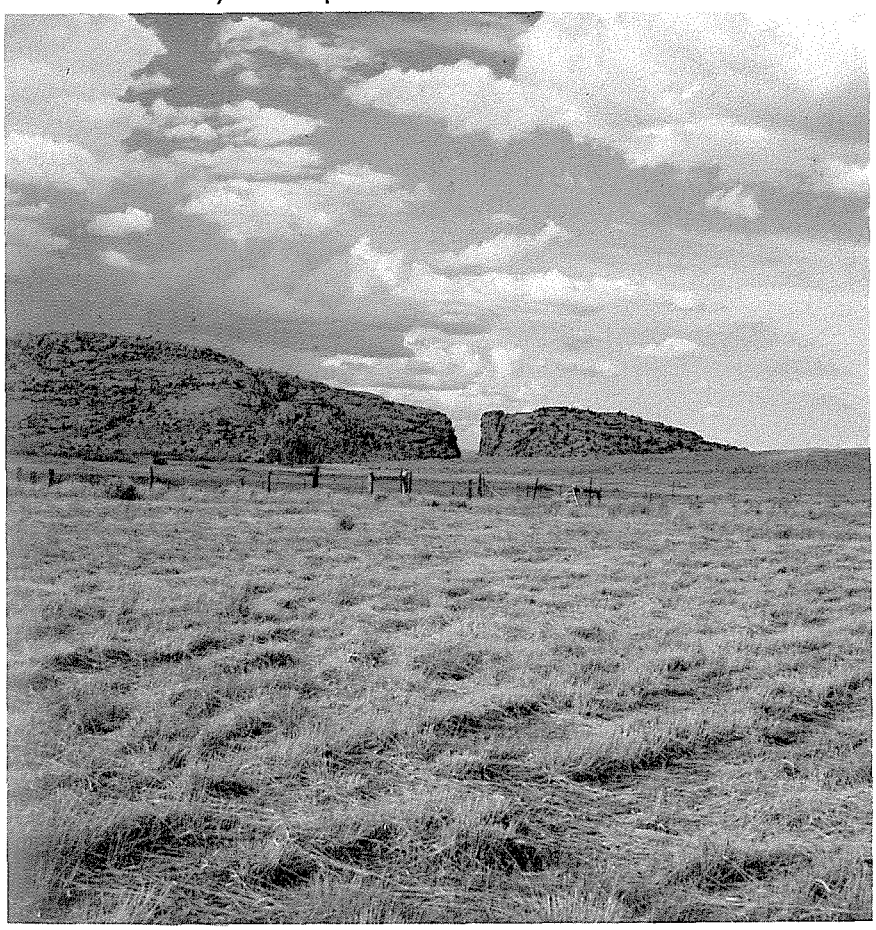


An isolated butte, distinguished by a dark skyline cap, is a local feature within the Continuity. (Harding Co., North Fork of the Moreau River, S. Dak.)

Focal Attractions—Local Features

Focal attractions are the landscape configurations commanding our attention and acting momentarily as visual anchors as we move through space. Gibson (1966, p. 197) indicates that for the observer in motion, objects appear to stream by in our visual field. In rapid forward motion, only the point of aim of sight remains sharp and relatively stable. Contrasting elements seen at greater distance also appear fixed. It is natural for us to fix upon some distinctive element rather than gaze at blank or neutral areas. The number of such focal attractions to be seen in the landscape could provide an index of visual quality, either according to degrees of contrast encountered or frequency at which contrasting attractions occur within a broad landscape. Focal elements are conspicuous because of the way they are displayed; they may be more easily remembered for their contrast with their surroundings.

A focal landscape (Litton 1968, p. 32–35) is one which by form, or by the disposition of its ele-



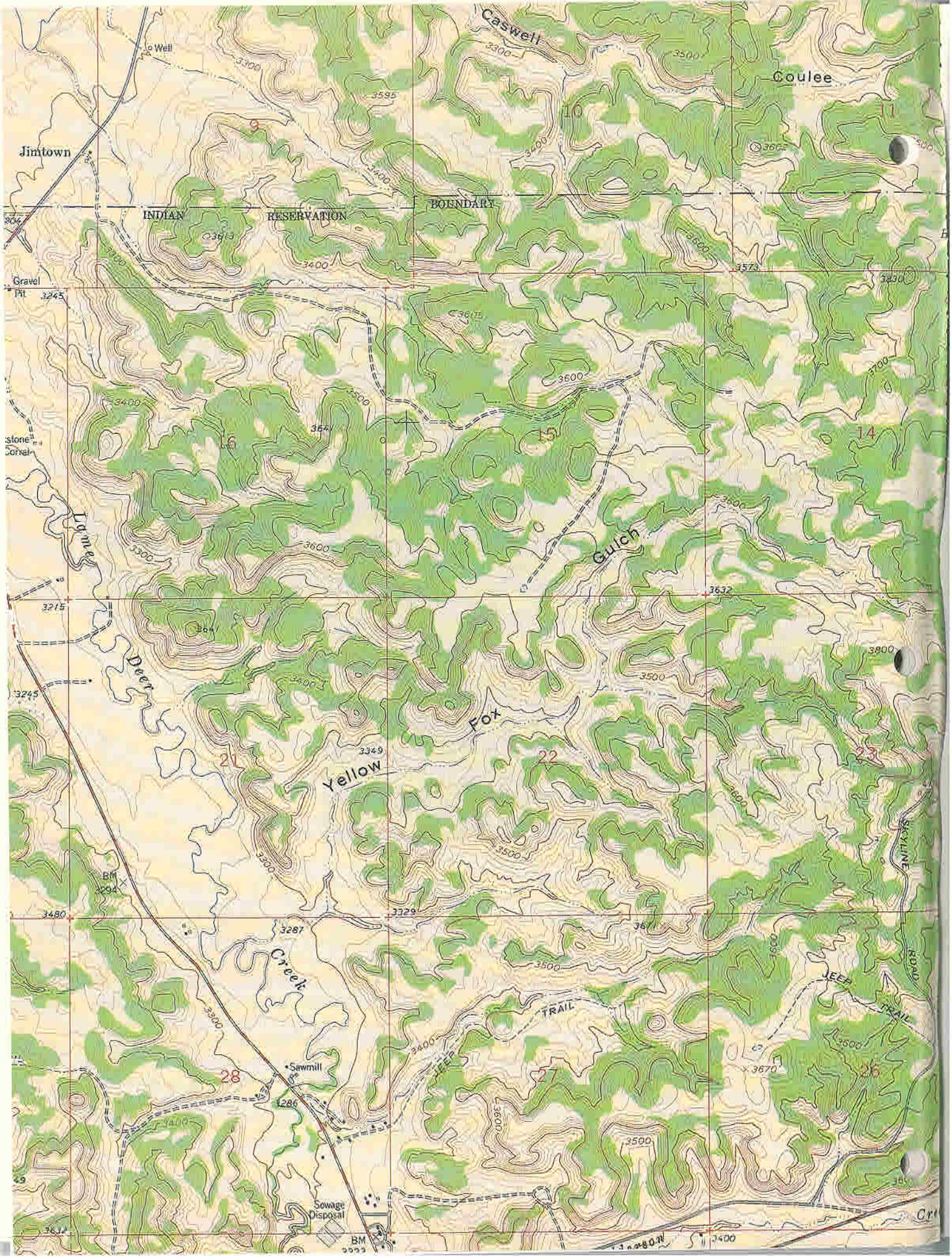
Top: The road focuses attention ahead, singling out this combination of land form folds with tree patches as attractions within a broad, placid landscape. (Approaching Badlands National Monument, S. Dak.)

Bottom: Abrupt rock formation with "keyhole" at the skyline is a local feature. (Devils Gate, Sweetwater River, Wyo.).

ments, tends to force the observer's gaze along a given line or direction. In nature, the disposition of elements within streams and drainage defiles, together with the location of the observer, produces focal landscapes. Straight segments of roads leading toward the horizon also direct the observer's attention. The design of roads and overlooks can capitalize upon these particular characteristics.

Local features of the Continuity are primarily objects on the horizon, dominant, isolated, or contrasting land forms, or groups of trees (Litton 1968, p. 26–27). Some may be named, such as Hell's Half Acre, Wyoming, or Bear Butte, South Dakota. The size of Continuities prevents dependence on any one of these; but the presence and repetition of contrasting small features provide interest and local identity. For open landscapes such as those typical of the Northern Great Plains, the focal aspects of roads or objects on the visible horizon predominate. A driver's attention is directed forward.

Landscape elements seen on an extension of forward view lines enjoy major advantage. Planning and design for scenic roads can take this into account. By this one means, at least, local landscape features of the Continuity can be significantly displayed.


Caswell
Coulee
Jimtown
Well
INDIAN
RESERVATION
BOUNDARY
Gravel Pit
Lamee
Deer
Fox
Yellow
Gulch
Creek
Sawmill
Sewage Disposal
BM
SKYLINE
ROAD
JEEP
TRAIL
9
10
11
14
15
16
21
22
23
26
27
28

LANDSCAPE PROVINCE

An area of repeated small, steep land forms with dominant pine cover stands out within the Continuity as a Landscape Province. (Colstrip, Mont.)

USGS 7.5-minute Quadrangle Segment: Jimtown, Montana.

The Landscape Province is a regional-scale landscape area with a combination of distinctive visual features which set it apart in its broad geographical setting. It is a part of the Continuity and yet in contrast to it. The visible differences that mark a Province may begin along a sharp line of demarcation or at least may occur within a narrow zone. Again, gradual blending of contrasting parts may create an almost imperceptible edge. The elements of a Province must be seen as contrasting with the broader landscape. The Province is identified by new surface groupings and land form configurations; they may be larger or smaller in scale, or markedly different in color impression. Another significant characteristic is a distinct change in vegetation type.

Uniqueness, frequently a characteristic of the Province, results from scenic variety in the generalized landscape; it offers relief or diversion to the traveler crossing large geographical areas. Yet, in the strict sense, a Province is not necessarily unique—its features may exist elsewhere in the Continuity. Thus, several Provinces may be similar in having steeper topography with higher relative relief than their surroundings. The Province has sufficient extent and visual unity to stand out clearly as an island within the Continuity (*fig. 4*). It is large enough to have within its boundaries a variety of its own in scenic landscape.

The Province characteristically has a name closely related to the landscape and its qualities. As well as serving for general reference and location, the name conveys something of the actual quality of a place. On the contrary, names of some broader divisions, such as the Rocky Mountains or the Mississippi Basin, evoke only generalized geographic images. The Province should be sufficiently vivid in character to warrant a name that suggests a fairly precise image of reality. The Black Hills and the Big Horn Mountains are Province names that evoke clear visual images.

We identify six Landscape Provinces as examples in the Northern Great Plains Continuity (*fig. 4*): The Black Hills, Big Horn Mountains, Tongue River Ponderosa Pine Uplands, Musselshell Ponderosa Pine Rise, Big Snowy Mountains, and Bearpaw Mountains.

In our visual inventory classification, the Landscape Province is a second-rank division, following after the Continuity. Similarly, in Fenneman's physiographic classification, the Province is a second order designation, following after "major division." The Province is also defined as a biogeographic division of less rank than a region. Study of the Visual and Cultural Environment (Res. Plan. Design Assoc. 1967) does not designate hierarchical units, but it does classify divisions called "landscape series" based upon "repetition of a dominant land form over a large area." Such series as "mountain" or steep hill," for example, could be used as a means of identifying a Province. The Landscape Province is considered the most distinctive large subdivision within the broad, regional Continuity.

The Landscape Province is an area of high imageability. Lynch defines the term as "that quality in physical objects with high probability of evoking a strong image in any given observer. . . ."

The Surface Resources Work Group study (1973) does not develop any special terminology but rather depends upon generalized description or places recognized by name. "Scattered Ponderosa Pine Country" or "The Black Hills" indicates special areas which happen to coincide with the concept of the Landscape Province. In *Water and Landscape* (Litton and others 1974), certain concepts, and the criteria presented in defining the "landscape unit," can be used in identifying and analyzing the Landscape Province. The underlying theme in both applications is a repetitive consistency of visual landscape elements within discrete, distinctive subareas of a broader region.

The Landscape Province is related to the physiographic section or subprovince in scale (Wertz and Arnold 1972, p. 5). From hundreds to a few thousands of square miles may be included; delineation may be made on maps of 1:500,000 or 1:250,000 in scale. We show Fenneman's Black Hills physiographic section as a Landscape Province, but also identify several other Landscape Provinces (such as the Tongue River Ponderosa Pine Uplands and the Big Snowy Mountains) which, because of their character or size, are not differentiated as physiographic sections within the Northern Great Plains. Fenneman has referred to isolated mountains such as the Big Snowy Mountains as "exceptional features" seen as islands within the physiographic province or section. We also distinguish the Big Horn Mountains Landscape Province as a visual subdivision of the Middle Rocky Mountains physiographic province.

Scale

The Province has been defined as having a regional scale. The definition of "regional" must be reasonably flexible. The Province is seen as a recognizable island, seeming small in area when compared to the extensive Continuity in which it lies. It cannot be identified by any arbitrary measure of size, such as number of square miles, and representative Provinces may vary rather widely in area. Of the six Landscape Provinces of the Northern Great Plains shown in figure 4, the Black Hills covers slightly more than 5000 square miles and the Tongue River Ponderosa Pine Uplands about 4500; the Big Horn Mountains extends over some 4200 square miles; the Bearpaw Mountains covers about 1200 miles; and the Big Snowy Mountains and the Musselshell Ponderosa Rise cover about 900 square miles each.

A possibly useful unit of measure is the distance traversable within the scope of a day's journey in a particular area. In large and open landscapes with scattered scenic elements, good roads, and gentle gradients, this measure would designate an extensive area. In hilly or mountainous country, rich in spatial details, water features, and terrain quality, much less ground could be covered in a day's journey, and the unit would designate a shorter distance.

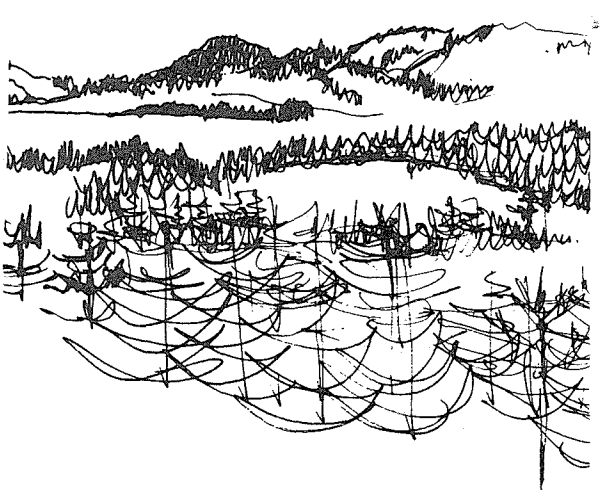
Boundaries and Edges

In visual terms, the edges or boundaries of the Province may be sharply defined or somewhat gradual. Topographic breaks, streams, and forest borders are typical edges, usually in combination. Vividly perceived Provinces, such as the Black Hills, tend to have abrupt edges as boundaries over a good portion of their perimeters. Too gentle a gradation weakens perception of area beginnings, with consequent diffusion of visual impact. When Province boundaries are vivid—perhaps topographically abrupt—rail, road, or trail entrances to interior areas are likely to occur through passes, gaps, or canyons. These are all landscape spaces that provide a sense of enclosure and lead to an interior landscape. Descent into the interior of a Province through such constrictions is likely to be a more visually revealing scenic experience than an ascent to a plateau, but either encounter is interesting for its contrast to a preceding journey.

Land Form and Topography

One of the simplest sources of the visual distinction of the Province is terrain—land forms markedly at variance with those of the surrounding Continuity. Normally, land forms are derived from basic geologic action in nature—vulcanism, uplift, folding or faulting. Erosional dynamics of water also create diverse local landscapes. The Province as situated within a Continuity of more ordinary landscape is usually distinguished by terrain forms that are of a differing geological formation that covers a limited area, or alternatively, is made or modified by erosion. The Black Hills Landscape Province is such an area—one of original uplift, now modified by erosion. It rises from the Great Plains plateau as a unified central mass, surrounded by sharp ridges and narrow circumferential valleys. Although water has softened much of this perimeter, a distinct elevational difference is visible from the surrounding area, and the traveler has a vivid sense of penetration through its boundaries to an interior of mountain peaks, deep valleys, and plateaus. These topographic distinctions are important to its character.

Steep hills of the Province and heavy pine cover are both different from characteristics of the Continuity. (Black Hills, S. Dak.)



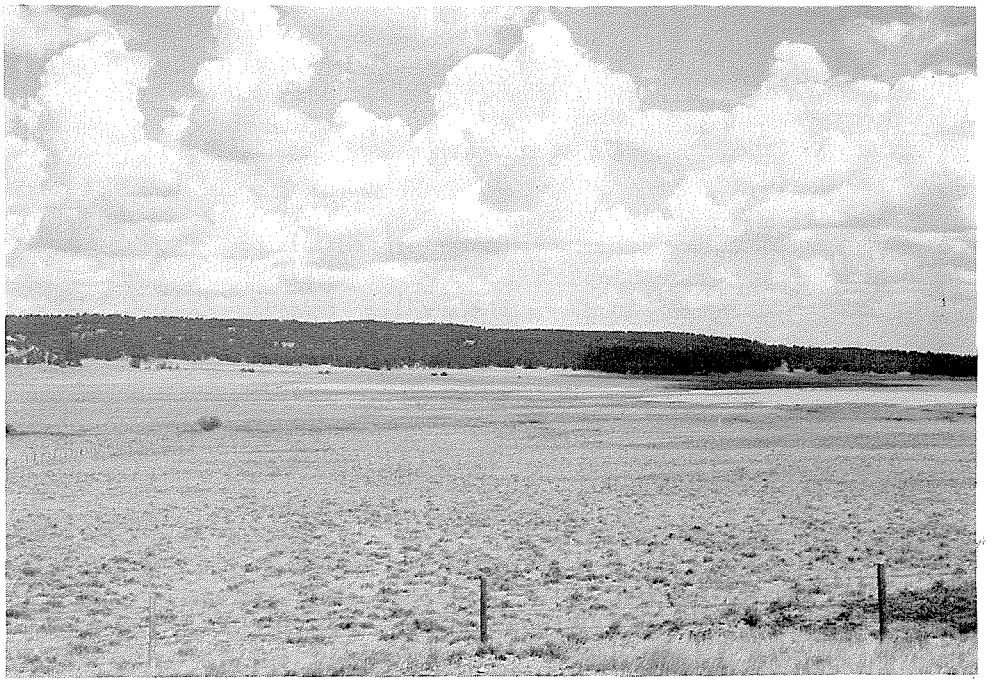
By virtue of their scale, Provinces may include a considerable variety of terrain. Linear to peaked escarpments of sheer rock, steep interior peaks and glaciated valleys, plateaus, or ancient lake beds and glacial debris may all form part of a single Landscape Province.

The visual distinctions of steep slopes and land forms with high relative relief, in part typical of mountain scenery (Linton 1968), are found consistently within most of the Landscape Provinces identified. That is, steep landscape elements with relatively high relief are not absent from the surrounding Continuity; but there the concentration of such forms is less evident, and the elevational difference is smaller. Some examples may be cited, as evident in the 1:250,000-scale U.S. Army Topographic Maps:

- In the Black Hills, St. Elmo Peak is high (el. 7241) rising 2200 ft in 2½ miles, and 12 miles east the general level drops 3800 ft (el. 3400 ft).
- In the Big Horn Mountains, east and west edge scarps rise 2000 feet in 2 to 2½ miles, Cloud Peak (el. 13,175 ft) rises 3000 feet in 4 to 5 miles, and 24 miles east the general level drops 8000 feet (el. 4900 ft).
- In the Big Snowy Mountains, the relative relief of Great House Peak is 3700 feet in 7 miles.
- The Musselshell and Tongue River Landscape Provinces, though not mountainous and having less local relative difference in elevation (Musselshell: 1000 ft in 5 miles, Tongue River: 1500 feet in 2 miles), are nonetheless in marked contrast to the flatter surrounding Continuity.

Plant Cover

Plant cover in the Landscape Province is responsive to the special characteristics which set that terrain apart from the generalized landscape of the Continuity. Uplift for example, in creating the land mass of a Province, elevates ground level to an altitude which favors certain plants. Differences of substrata and rock types have an eventual impact on soil types, with corresponding plant response. The presence of high peaks and ridges brings climatic changes, with winter snow and other precipitation sufficient to make significant differences in the available supply of water. The net effect is that the Landscape Provinces of the Northern Great Plains are covered by dark forest growth, seen in distinct contrast to the light-colored grasslands of the Continuity. The "blackness" of the Black Hills' ponderosa pine forest



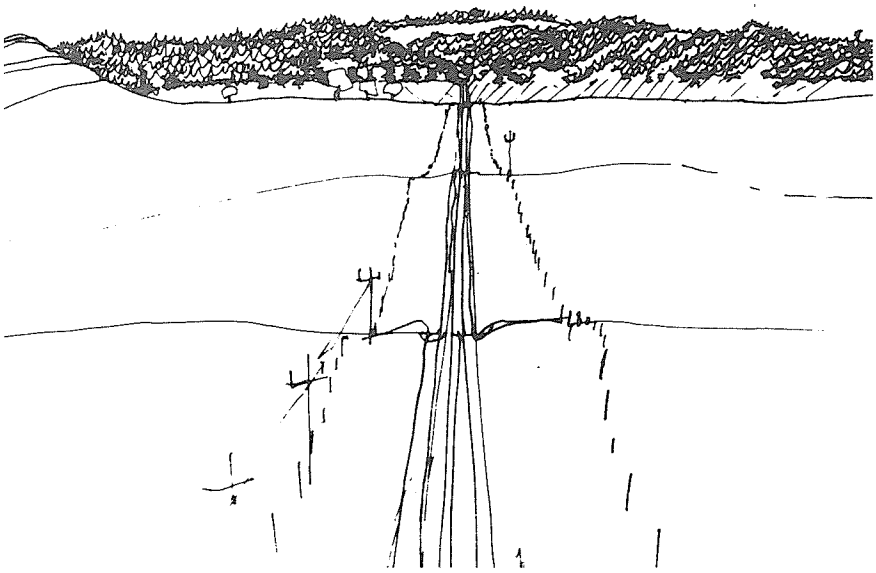
This introductory view of a Landscape Province is enhanced by the sharp edge between flatland with grass, and hills with pine forest. (Pine Ridge, Black Hills, Wyo.)

Top: Nearly equal proportions of grass and trees establish a small scale pattern of contrasting vegetative covers. (Bear Lodge Mountains, Sundance, Wyo.)

Bottom: Ponderosa pine forest creates an enclosure and gives focal emphasis to the roadway. (Vicinity of Badger Peak, North Cheyenne Indian Reservation, Mont.)

cover clearly illustrates such contrast. (In defining Landscape Provinces by areas of distinctive plant cover, the map and accompanying manual, *Potential Natural Vegetation* ..., Kuchler 1964, is a helpful reference.)

Vegetation patterns are varied within the Northern Great Plains Provinces, requiring description in visual terms rather than mere reference to plant cover. In the outer perimeter of the Black Hills, there is a pattern of ponderosa pine ridges enclosing "prairies"—grassland areas of relatively large size, from a few to tens of square miles in extent. Deeper into the interior, smaller grassland pockets replace the prairies, and pine forests are more continuous; some forest areas are dominated by granite spires thrust up through them and are distinctive enough to be inventoried as Settings. In the Big Horn Mountain Province, there is a somewhat similar pattern of large prairies and forest, but the tree types are lodgepole pine and spruce-fir. In the Tongue River Ponderosa Pine Uplands Province, a two-part pattern is based on opposing exposures. A seemingly continuous ponderosa pine forest occupies gentle northerly slopes but is actually interrupted by steep, light-colored scarp formations facing south. Views north thus contrast sharply with those to the south. Plant cover patterns typical of the other Provinces can presumably be identified.



A straight road segment focuses upon the grassland-pine margin with dark forested hills above. (Black Hills, S. Dak.)

Water–River Segments and Subdrainages

The Province is large enough to include sizeable segments of one or more rivers or major streams, together with systems of creek tributaries, and usually lakes. The form of the Province may vary from a range of mountain peaks, whose drainage is multidirectional and characterized by lakes and small headwaters, to more low-lying terrain where parts of well-developed rivers make edges or are central, scenic attractions. Within the limits of the Province, water, with its commanding visual characteristics and relationships, is normally significant among the scenic resources.

The scale of the Province, like that of the Continuity, may best be judged through reference to a map (*fig. 4*) showing the parts of rivers and other streams that are included. Additional detail is needed, however. The U.S. Army Topographic Maps, 1:250,000 scale, show the following water elements within the sample Landscape Provinces of the Northern Great Plains:

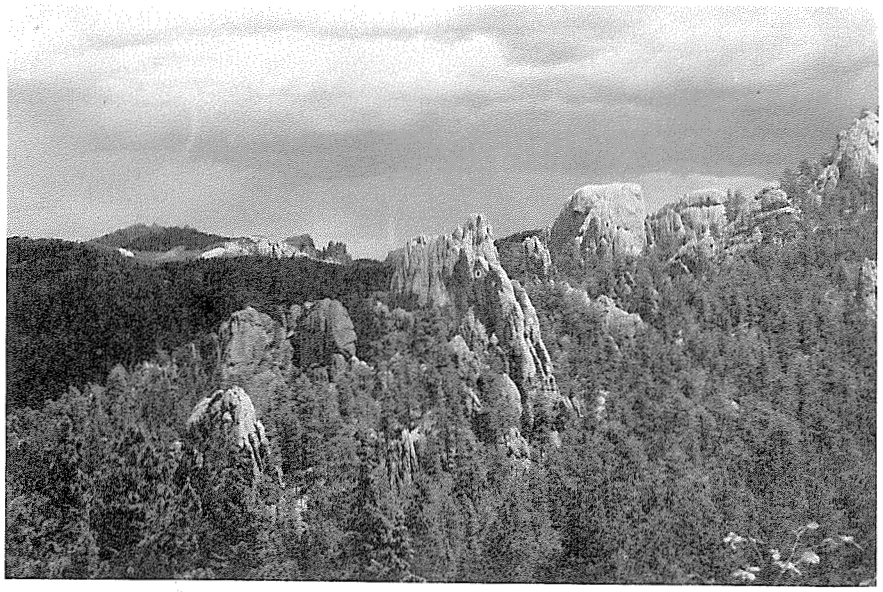
1. In the Black Hills, the Belle Fourche and Cheyenne Rivers define a large part of the Province's north, south, and west edges. Only about a third of the total length of the Belle Fourche and a seventh of the Cheyenne are included, along with a few of their tributary creeks. Within the Province are a very large number of creeks and some 60 small lakes—mostly manmade impoundments.

2. In the Big Snowy Mountains there are about 35 named creeks; Flatwillow Creek is the largest stream originating in this area.

3. Almost all of the north boundary of the Musselshell Province is defined by a quarter of the length of that river. About 15 named creeks either lie within this Province or originate within it, and there is one lake.

4. The Tongue River Ponderosa Pine Uplands is named for the river, about a third of which is contained within the Province. A small number of major creeks (Otter, Rosebud, Sarpy, Hanging Woman) are included, as well as about 95 other named minor creeks. The Tongue River reservoir is on the west edge of this Province.

5. In the Big Horn Mountains Province, there are headwaters of the Tongue and Powder Rivers and part of the Big Horn River, which slices through the Prior and Big Horn ranges. Within a 5-mile radius of Cloud Peak, there are more than 90 alpine lakes. More than 400 named creeks are estimated to be in the Province.



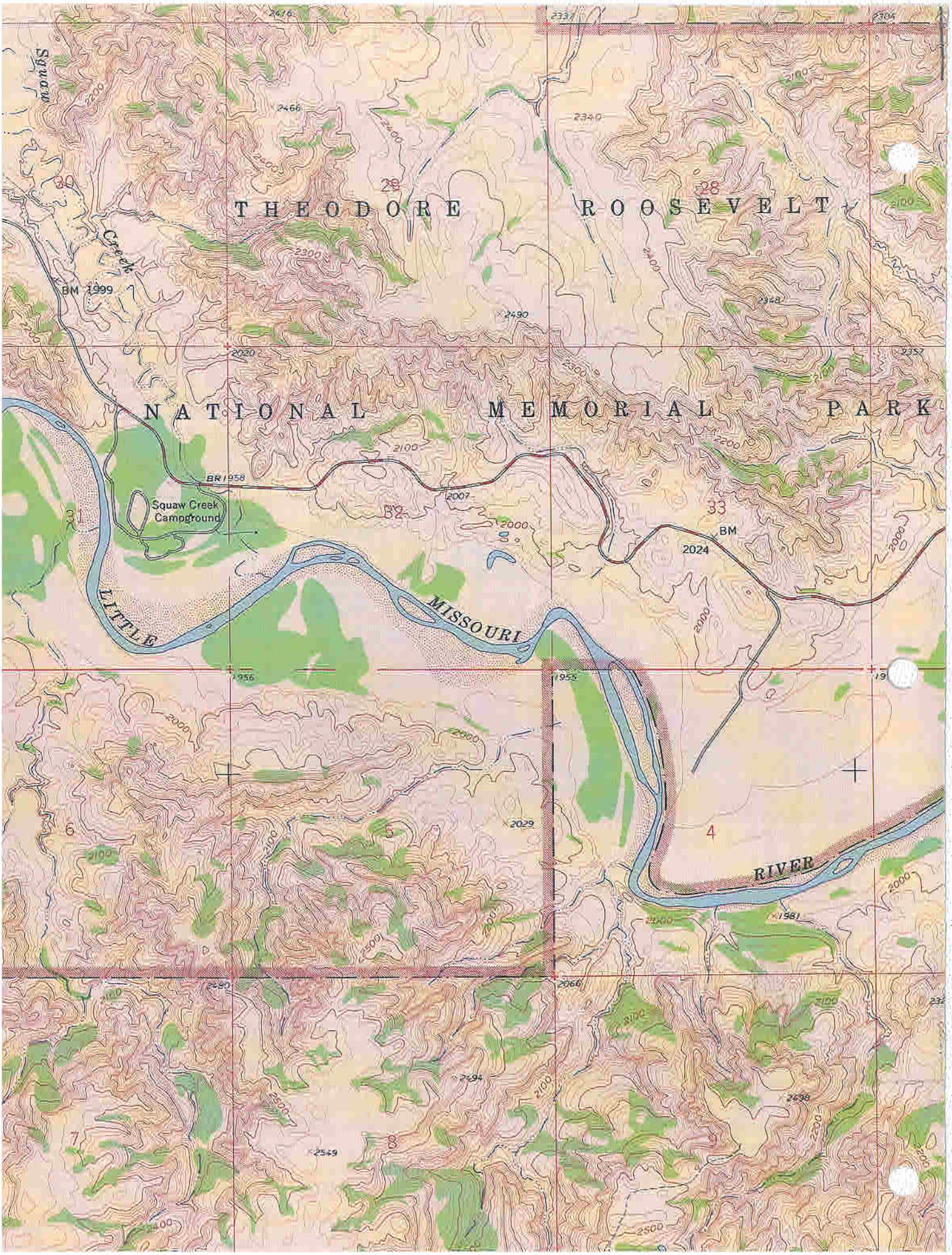
Top: Granite needles are another kind of local feature, grouped together and conspicuous on the ridge above a dark forest. (Custer State Park, Black Hills, S. Dak.)

Bottom: Lake impoundment with steep land and forest enclosure is a local feature of the Province. (Pactola Reservoir, Black Hills, S. Dak.)

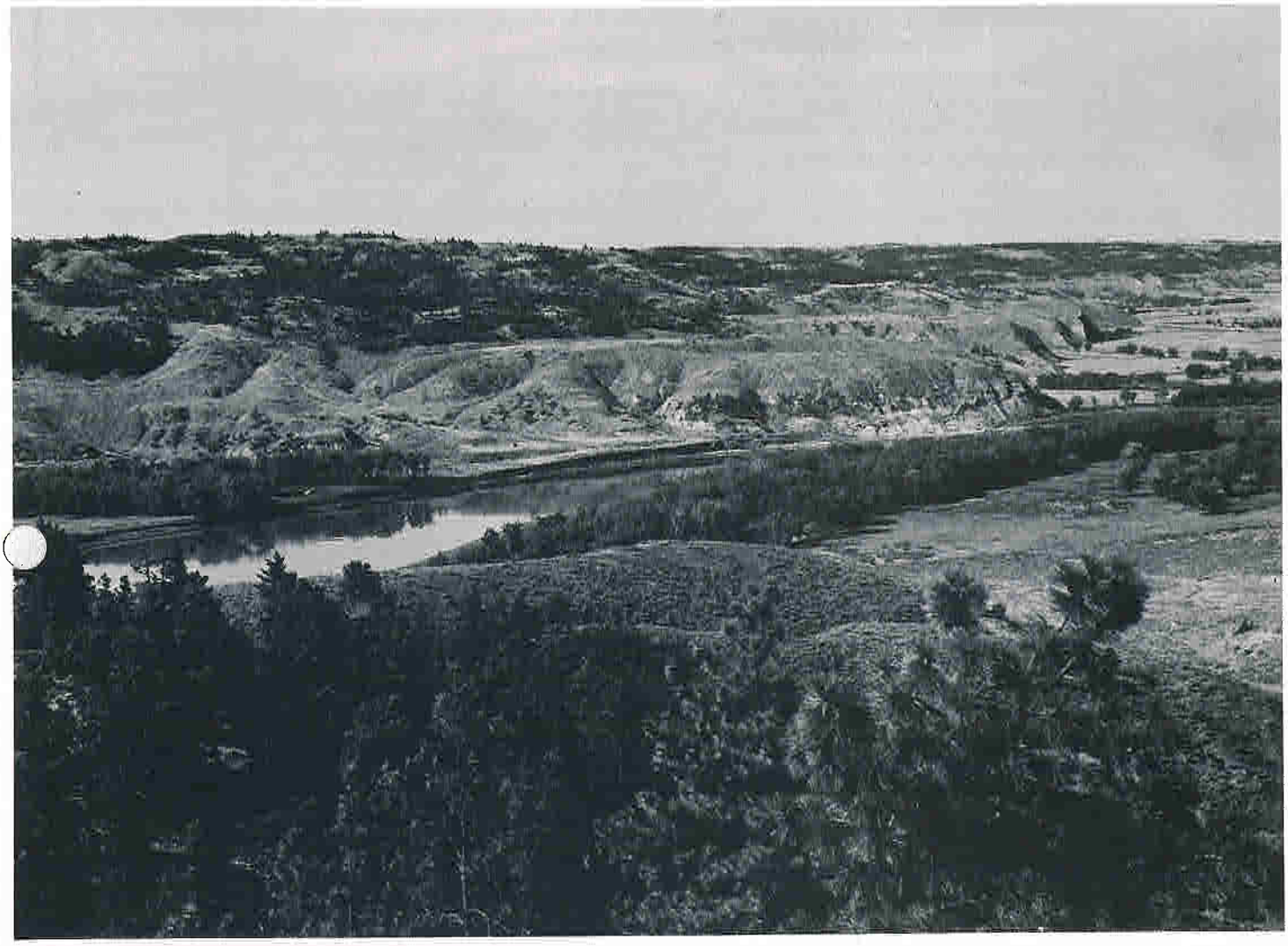
Focal Attractions—Local Features

Initial distant aspects of a Province, seen as contour edges or general silhouettes, are themselves focal attractions when viewed from the surrounding Continuity. Within the highly varied Province, there are many land forms to be seen as local visual features: mountain and hill peaks and ridges, scarps and exposed intrusions, mesas, and valleys and canyons of different proportions. Water bodies and water displays are included (Litton and others 1974).

Focal views of landscapes, structured by roads, stream reaches, or converging narrow valleys, particularly when directed to scenic features such as peaks, are especially apt to be vivid expressions. Individual and separate visual impressions of local features may be effectively drawn together within a Province through the linkage of a road. Within the Northern Great Plains Landscape Provinces, a few of the many local features to be identified are the Missouri Buttes and the Devils Tower in the Black Hills, and Bald Mountain or Leigh Creek in Tensleep Canyon inside the Big Horn Province. Note, however, that the Devils Tower is significant enough to be the central element of a Landscape Setting.


THEODORE ROOSEVELT
NATIONAL MEMORIAL PARK
Squaw Creek Campground
BM 1999
BM 2024
LITTLE MISSOURI RIVER
BR 1958
2416
2337
2304
2466
2340
2490
2348
2357
2020
2007
2029
1956
1955
1981
2066
2494
2549
2438
29
28
30
31
32
33
6
5
4
7
8

LANDSCAPE UNIT



A linear land form enclosing a straight reach of quiet water identifies this Landscape Unit. (Missouri River, Fergus Co., Mont.)

USGS 7.5-minute Quadrangle Segment: Long X Divide, North Dakota.

The Landscape Unit is an area of landscape unified by enclosure. That unified form is essentially spatial—space consisting of a valley, a lake basin, a distinct high plateau bounded by mountain ranges, or a coastal shelf bounded between land and sea. Litton (1968, p. 28–31) uses the term "enclosed landscape," a similar concept. Examples are an eroded canyon in an otherwise relatively uniform drainage defile, or a special reach of a stream and its trough. Indeed, a river presents a series of connected Units—some more stimulating visually, some less. Yet spatial distinction is the Unit's most striking visual quality.

The Unit is the landscape element most likely to generate a sense of place. Elements that enclose and surround it tend to make a Unit's boundaries comparatively clear when its extent is small enough to be observed through limited access or contact. Its enclosed limits and its internal qualities are often recalled in a name—Crater Lake, the Punch Bowl, and Jackson Hole, for example.

The Landscape Unit may be related to the physiographic subsection in scale (Wertz and Arnold 1972, p. 5–6). Tens to hundreds of square miles may be included. Maps of 1:250,000 to 1:1,000,000 scale and larger should prove useful in overall delineation. Topographic maps of 1:62,500 and 1:24,000 will be useful for interpreting characteristics. Scale differences between Landscape Units and Settings are not necessarily obvious.

The term Landscape Unit has been used in widely diverse ways, and unfortunately becomes explicit only within the bounds of specific definition. In our use, the principle of the Unit is its enclosing cohesiveness; additionally it carries the implication of esthetic unity.

In the *Study of the Visual and Cultural Environment* (Res., Plan., and Design Assoc. 1967), the "landscape unit" is identified with surficial patterns laid upon the "landform landscape," either native or manmade, such as forest on wildlands, or town on farm patterns. This is comparable to Linton's "land-use landscapes." Litton's "visual landscape units," developed for Lake Tahoe (1971), depend primarily upon spatial characteristics "... most generally ... bowl shape (units with) inward focus toward (lake) water surface.... " But six different criteria are used with variable dominance, reflecting marked differences in the visual units. As noted in the discussion of the Landscape Province, the landscape unit in *Water and Landscape* (Litton and others 1974) was defined as a larger-scale division than the Unit in the present landscape inventory. Additionally, to confound confusion, the landscape unit is a popular and apparently useful term in such studies as Hirvonen's physiographic-soil-vegetation analysis of Bowen's Island, British Columbia (1976).

Finally, there is a definite relationship between the Landscape Unit concepts in this report and the "natural corridor" of Lewis used in his study (1963) of the Wisconsin south shore area of Lake Superior.

Scale

The scale of the Unit—its size or area compared with other landscapes—is not wholly dependent upon the observer's perception of immediate enclosure with positive physical boundaries and the presence of clear internal views. Vividly perceived Units are apt to be relatively open, however, within very strongly enclosed landscapes, which offer few obstructions to sight and exploration. Yet they may be complex.

It is not possible, at any scale, to see all of a landscape or to arrive at useful conclusions about its characteristics and their quality all at once. Gibson (1966, p. 106, 264) shows us that an observer perceives a spatial world which is incomplete and indeterminate; movement is necessary in order to isolate elements from their background and to achieve a sense of form and spatial extent. Winding landscapes require much motion, whereas landscapes in open desert can be seen almost wholly from a single point—not vividly or completely, but usefully. Therefore some motion or access system is a necessary link to the appreciation of scale. Complex landscapes with partially restricted views must be traversed and seen from many angles before their size and limits may be appreciated. Clarence King (1872) conveys this convincingly in his writings—a complex and diversified landscape is worth looking at from many points, in many weathers and seasons.

Though relatively small, the Unit permits considerable exploration. For example, most scenic Landscape Units in which housing is available for visitors also provide a number of scenic trails or roads. In a succession of days, experience can add materially to appreciation of the quality of the total Unit.

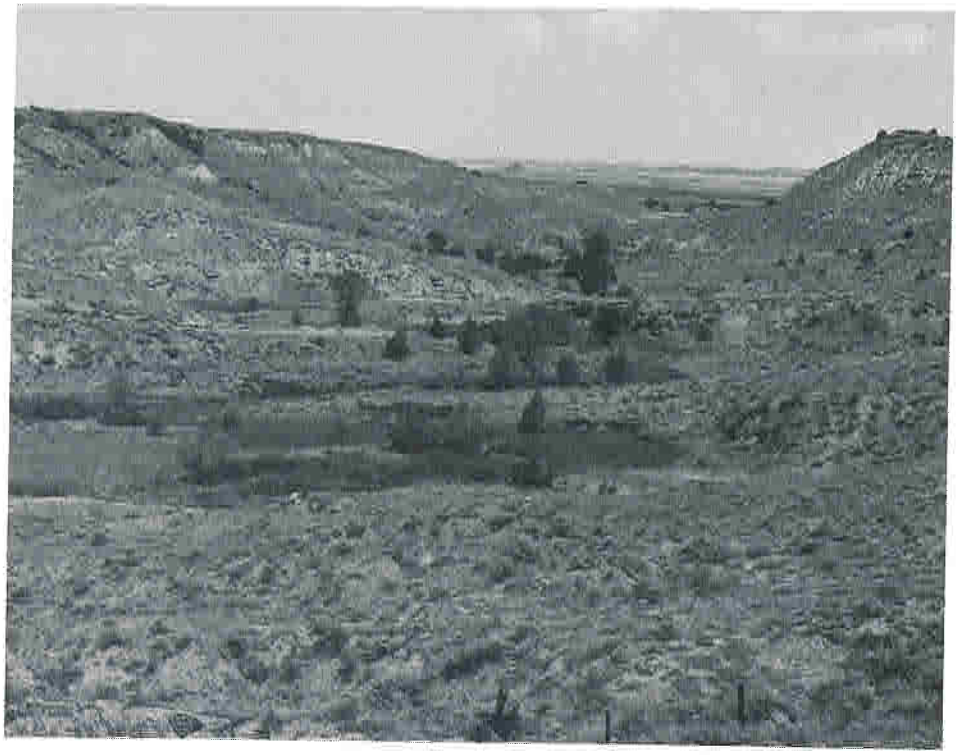
A Unit may be relatively large in scale, broad in extent as compared to low enclosure by distant slopes. (Keester Basin near Pathfinder Reservoir, Casper, Wyo.)

The Unit may occur within a Continuity or a Province. Tensleep and Leigh Canyons within the Big Horn Landscape Province constitute a rich and varied Unit with an aggregate length of about 20 miles. The Tongue River Landscape Unit has a length of about 50 miles and includes about 1050 square miles, if watershed lines are taken as approximate limits (*fig. 4*).

Boundaries and Edges

Because the Unit is spatially defined, its topographic boundary or enclosure can readily coincide with local watersheds—and perhaps with administrative boundaries. Considerable variation is to be expected in the elements which ring a particular Unit. Unit boundaries, if distinct and abrupt, can be spectacular. Parts of the enclosure may be cliffs or mountainsides which offer extreme contrasts to the Unit floor; elsewhere the enclosure may consist of gradual slopes, rolling hills, or forest edges or surfaces. In places, the enclosure may be very limited. For example, at the entrance to a broad valley with steep cliff walls, the floor will not be bounded. Nevertheless, in such an open-ended linear enclosure, the observer will have a strong spatial sense, normally completing the fragmented enclosure (Arnheim 1954, p. 44). The same general tendency permits us to consider some vague areas to be parts of Unit boundaries. In general, the more complete the encircling or enclosing elements and the more positively wall-like they may be, the more vivid the spatial quality.

The bounding enclosure, in all its parts, both vivid and bland, can be a primary source of scenic interest which is further enhanced by a water feature. In addition, slopes permit better display of forest cover where patterns of vegetation type changes, growth, and coloration provide interesting accents. Rock outcroppings and exposed scarps can also add to this visual pattern. Finally, enclosing skylines—the upper horizon—are of special interest because of the dark-light contrast. The sky is nearly always much lighter than even the most brightly illuminated terrain surface; it permits the skyline to be a sharp outline of its typical kind—peaked, rounded, irregular, or smooth.



Top: Bluffs enclose a broad river bend, the bottom enriched by riparian woods and a variety of farmland patterns. (Yellowstone River near Miles City, Mont.)

Bottom: Abrupt, nearby steep slopes are the edges of a small scale Unit; water is invisible but implied by central trees and associated woody plants. (Cracker Box Creek, near O'Fallon Creek and the Yellowstone River, Mont.)

Land Form and Topography

By the requirements for enclosure, vertical or steep topography is normally an important component of the Unit. Wide variations are possible, however, within the general condition that the overall land form be that of an enclosed landscape. As we have seen, the Unit boundaries are primarily land form edges.

The most obvious Units are those presenting the most simple and clear spatial image. This combines flat or concave interior ground surfaces with positive enclosing land form faces—often with a plant cover. These opposing parts may be compared to floors and walls; their proportions—width to height—very much affect the degree of enclosure. Also, as the complexity of the floor topography increases, it tends to interfere more and more with clarity of view. Variable floor topography, along with plants, can severely obstruct the distant enclosing elements and ground details, except from elevated viewpoints. Opportunity for such a viewpoint is offered by a canyon with a rim road, which is followed by descent into the space. The clarity and drama of the canyon form, seen from above, permits considerable complexity and detail to be present within the canyon without creating a sense of spatial confusion.

Within the Northern Great Plains, badlands are typical land forms associated with certain rivers. They form distinctive Landscape Units, a special attraction of the region, as confirmed by such reservations as the Theodore Roosevelt National Memorial Parks on the Little Missouri River, and the Badlands National Monument between the Cheyenne and White Rivers.

Two examples of Units, both including segments of rivers, may be compared (on 1:24,000 scale topographic maps) for their differences of

The sharp river bend, precipitous bluff, and concentric bands of cottonwoods are features that form a distinctive Unit. (Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River N. Dak.)

land form enclosure: a Tongue River Unit within the Tongue River Landscape Province and a Big Horn Unit as defined by the Yellowtail reservoir. On the Tongue River some 6 miles below the reservoir, the river bottom is ¼ to ½ mile wide; bluffs close by are 200 to 400 feet high, predominantly much incised, but occasionally eroded into elongated faces. Bottom and bluff vegetation is scant except for pine rimming; meanders make subspaces in the Unit, giving interior view lengths of ½ to 2 miles. Starting just below the reservoir, this Tongue River Unit runs downstream for about 50 miles. The Big Horn Yellowtail Unit is about 18 miles long. Comparatively, it is more visually striking in its proportions than the Tongue River Unit. The impoundment water surface is about half a mile wide with no riparian flat showing; bluffs are 1000 to 1500 feet high within ¼ to ½ mile of the water edge; sizeable patches of trees and of scrub are interspersed with barren exposures; meander view lengths are 1 to 2 miles or more.

Other examples of Units cited elsewhere help to suggest the great variation to be found at this level of the inventory.

Plant Cover

The scale of the Unit necessarily abbreviates, in amount and variety, the plant cover associated with it. However, the spatial envelope of the Unit brings included plants into close view and contact. Trees may be a significant part of a Unit's visual boundary, whether standing on flat land or on sloping terrain. The usefulness of a single oak in providing shade for a campsite, the quality of aspens framing a lake view, and the display of autumn color in cottonwoods are all the more apparent for their association with the Unit. Because many Units are closely related to streams or water, riparian vegetation frequently provides contrast to nearby mesophytic plants.

Patterns of vegetation may be found in the concentric stands of riparian trees generated periodically by favorable growing conditions. In the Northern Great Plains, with low rainfall, certain Unit orientations produce patterns of tree growth on northerly or protected exposures, with the visual contrasts of barren land, grass, or scrub on opposing exposures. The richness of a Unit is

Top: Badlands are small landscape features, both as individual land forms and as a pattern of bare knobs within a vegetative mosaic. (Strip Creek, near Amidon and Little Missouri River, N. Dak.)

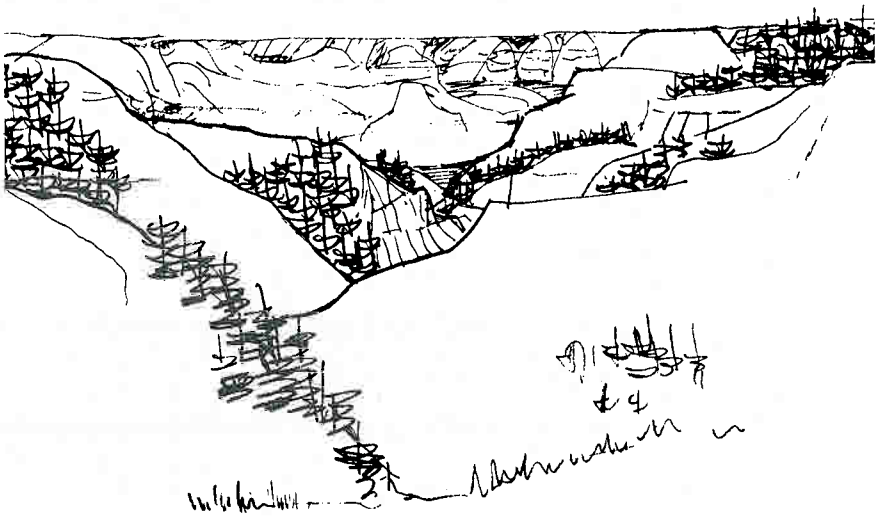
Bottom: A continuous but varied cover of riparian trees and plants forms the central core of a Unit, occupying most of the space within the Unit boundaries. (Near Yellowstone River, east of Miles City, Mont.)

considerably enhanced by different plant types and their seasonal responses.

Water Elements

We have seen that water elements are capable of generating powerful forms and linkages in the larger landscapes, but the innumerable qualities of water are perhaps best appreciated at the scale of the Unit, where they are associated with detail of land forms and plants. The concavity of the Unit is the natural receptacle for water bodies of any size. Conversely, water has been the active agency for the fundamental formation of the Unit's landscape. A single central stream or water body is dominant within the enclosure of the Unit, although subordinate side tributaries are present. Visual contrasts within the water body—white cascades or quiet dark pools—occur without disrupting the basic unity of the continuous surface (Litton and others 1974, p. 80–81).

Although the emphasis of this study is on the physical, visual elements of the landscape, water seems to trigger a multitude of human responses associated with sound, touch, smell, and memory. The tangible character of water seen at the scale of the Unit has particular potential to contribute positively or negatively to the landscape quality perceived there.



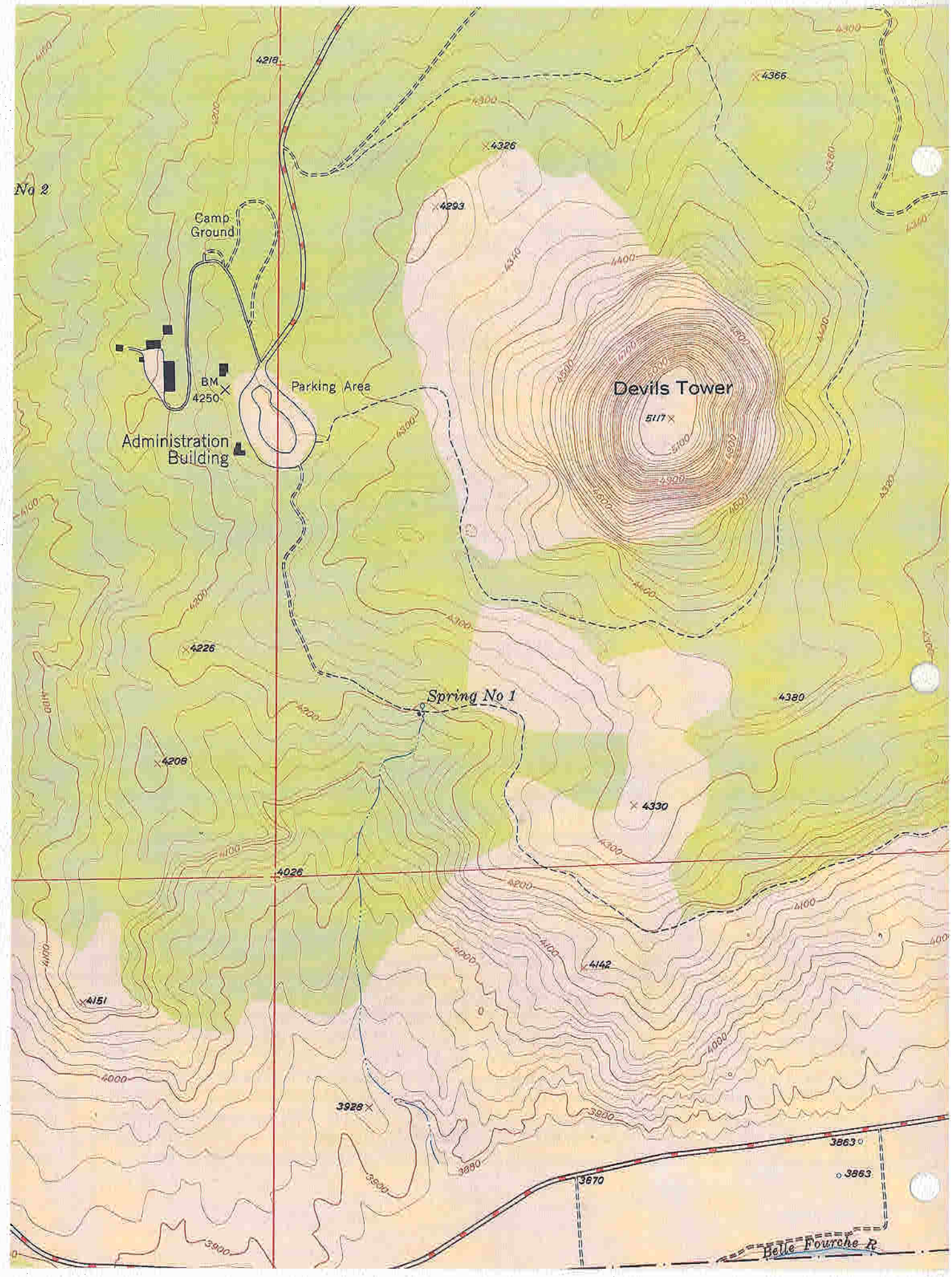
Badlands collectively form a Unit, outer ranks making an enclosure with interior alcoves along complex tributary paths. (Theodore Roosevelt National Memorial Park, North Unit, N. Dak.)

Focal Attractions—Local Features

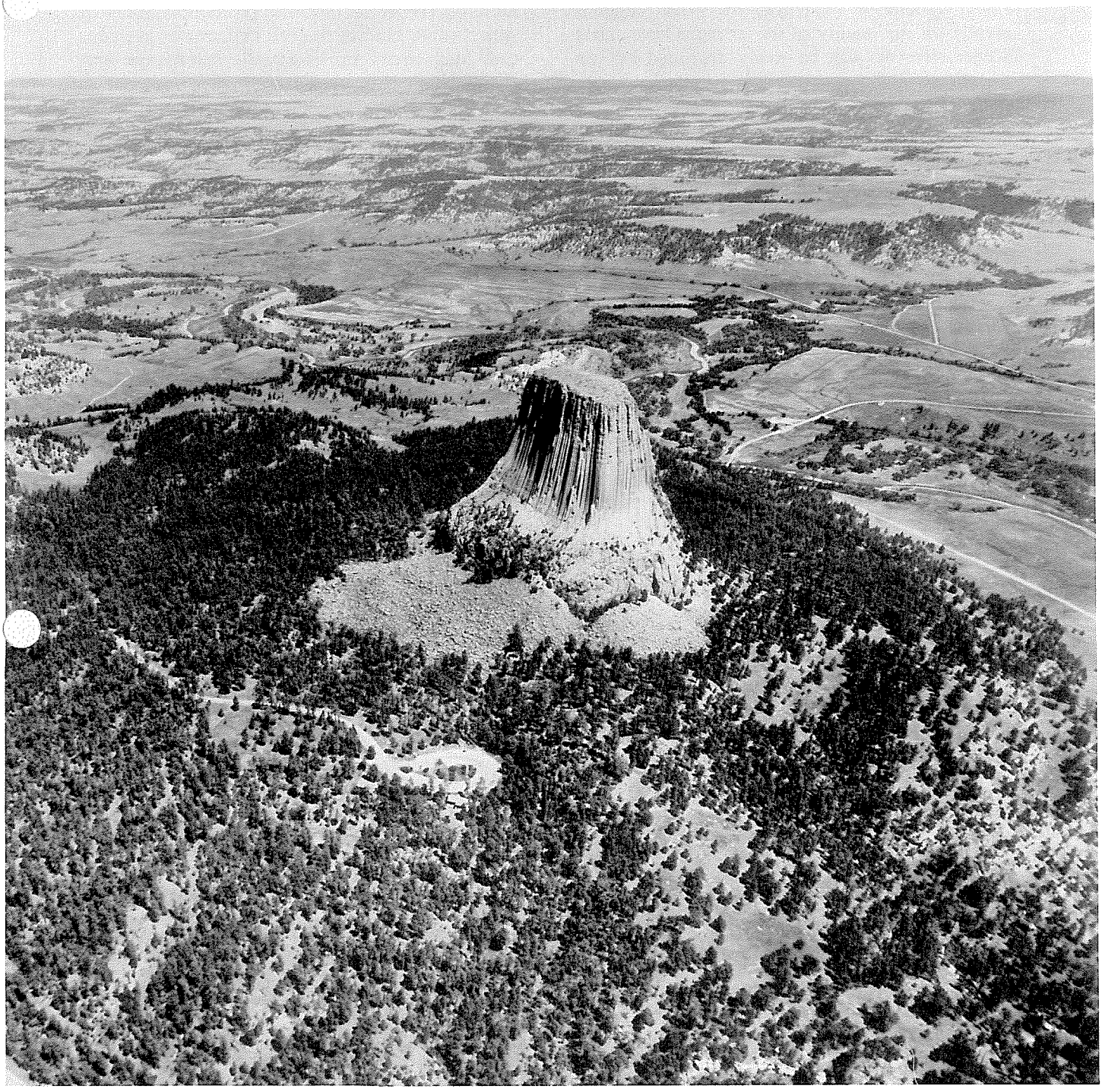
The quality of a scenic landscape depends upon many different visual impressions. High among these is the sense of unity—characteristic of the Landscape Unit—which is enlivened by focal attractions.

The observer has a tendency to see particular visual elements that are bigger, brighter, or more colorful than the rest, elements that are moving, or that are unique to the local landscape. Water features within the Unit, especially faster water against quiet, reflective water, are examples of such local features. The scale of the Unit may be such that a grove of trees may be a local feature, the more so in many parts of the Northern Great Plains where vegetation tends to be sparse. Individual bluffs, part of a Unit's enclosure, can become notable by reason of greater size, isolation, or different coloration. It is not likely that such individual elements will be seen or thought of as misfits; their natural form, no matter how novel or striking, prevents that. Badlands topography, as both individual and repeated land forms, also constitutes a special visual feature of the region.

The Unit's form—as a whole or in part—often has the linear configuration of a focal landscape. An example would be a straight reach of stream, its lines leading the eye toward terrain that blocks the view, as in the Unit in the Tongue River Province, described earlier. Visual terminals, such as the bluffs or slopes where a stream bends, are focal areas readily identified. Within a Unit, the character of such focal areas is of special importance; they contribute greatly to visual quality, for better or worse. They are especially prone to degradation through a loss of integrity or unity, because visual impacts here are so obvious.


No 2
Camp Ground
BM 4250
Parking Area
Administration Building
Devils Tower
5117
Spring No 1
4218
4366
4326
4293
4226
4208
4330
4380
4026
4142
4151
3928
3870
3863
3863
Belle Fourche R

LANDSCAPE SETTING



A conspicuous and dominating feature is the center of complementary surroundings—the Landscape Setting. (Devils Tower National Monument, Wyo.)

USGS 1:4800 Map Segment: Devils Tower National Monument, Wyoming.

The Landscape Setting is the indefinite area of landscape associated with a scenic feature of particular visual importance. Such a feature has a visual sphere of influence; its value depends greatly on the quality of its setting. Outstanding scenic elements can be easily degraded by surroundings that are detractive or not in proper scale. Large elements require enough space to permit retention of naturalness and to accommodate visitors unobtrusively. Vertical or isolated elements in open country are particularly susceptible to intrusive distractions. On the other hand, smaller lakes in hilly country may require far less protection for their setting, provided that access or distant views are not overly detractive.

Because the Setting is frequently an area designated for management by public agencies—a park, monument, or other protected unit—considerations important to such management are emphasized in this discussion.

The Landscape Setting can be related to combinations of "subsection" or "landtype association" in scale (Wertz and Arnold 1972, p. 5, 6). Tens of square miles may be included. Maps of 1:100,000 to 1:20,000 scale (and larger) are appropriate for delineation and identification.

The scenic features which are frequently the focus of a Setting are commonly described and identified, and often distinctively named. The concept of a visually protective environment complementary to a feature receives little direct attention in the studies we reviewed.

The "High Site Scenic Areas" or HSSA's of Dooling (1974) are surface protection areas in which some kind of feature or features are central. Such areas are essentially Landscape Settings. Often they are given park or recreation unit status. Each HSSA is associated with one of the compositional types defined by Litton (1968): feature, panoramic, focal, or enclosed.

Certain elements of Lewis' (1963) water, topographic, or vegetation resources are inevitably specific features; hence a related Setting may be inferred. Similarly, several of Litton's landscape compositional types—especially feature, focal, or enclosed types—are relatable to Settings. The "setting unit" discussed in *Water and Landscape* (Litton and others 1974) is essentially a Setting—a surrounding context for the display of a water feature. In the *Scenery Subgroup Regional Profile,* certain specific key features of the Northern Great Plains are identified. These are dominant elements of Settings. Named examples include the Missouri River Breaks and Signal Butte in Montana; Devils Tower—Missouri Buttes and Cloud Peak in Wyoming; and the Little Missouri Badlands and Sentinel Butte locality in North Dakota. Finally, in the Zube and Dega study (1964), some shoreline types have sufficient visual vividness to be the center point of an established Setting.

A strong vertical element, dominant in the middle distance, is displayed against opposing horizontal ridgelines. (Devils Tower National Monument, Wyo.)

Detail aspects of vegetative pattern—contrasts of life form, edge, texture, and color—may be seen at the scale of the Setting. (Deer Creek, Glendive, Mont.)

Scale

The proper size for a Setting is determined by the scenic element itself, the quality and character of the surrounding landscape, the viewing distance needed, the need to protect drainages, and the need for maintenance or visitor facilities. The need to exclude degrading factors such as moving vehicles, industrial influences, urbanization, automobile or crowd concentrations, or timber harvests which significantly alter the surrounding landscape must also influence the size of the Setting. Topographic factors are likely to be highly significant. In a hilly surrounding, logic may demand the Setting include landscape which is naturally enclosed by those hills. River canyons are examples.

Frequently, topography does not provide adequate natural boundary or site limits. These must then be determined administratively.

A desirable scale for the Setting reflects to some extent the general scale of the surrounding countryside and the travel distances. Scenic elements in open country can become conspicuously restricted if circulation and necessary service crowd the scenic focus. Access corridors are important in the Setting, and should figure in the size of the area. In particular, where travel distances are great, skimpy close-in boundaries are conspicuously out of scale.

Where the surrounding landscape is presently under the control of an agency able to provide adequate protection of the scenic element, the administrative boundaries proposed for the Setting may be more restrictive without loss of control. Special consideration should then be given to approach roads, because these serve to set the scale for observers. Boundary indicators in the shadow of the main feature are likely to create a restrictive sense of administrative enclosure. Entrance signs, gates, or kiosks all set the stage; their position is important in affecting scale.

The relation of the Setting to the scenic element may be illustrated by Devils Tower National Monument, which in itself includes an area of about 2 square miles. Estimated size of a Devils Tower Setting would be 15 to 20 square miles—a star-shaped area reflecting access corridors.

Boundaries and Edges

The administrative boundary of the Setting, if coincident with topographic features, may be visible and thus noticeable; preferably, however, it should seem to flow into the surrounding landscape. The Setting is best considered a part of a larger landscape in which the scenic feature is experienced locally as dominant. But it is supported by the normal, subordinate natural elements in the area. The actual site may then exist principally as an administrative domain.

The Devils Tower Setting illustrates a study method for arriving at the Setting boundary. It is evident that there is a sphere of influence radiating from this conspicuous volcanic neck. All of the places from which this feature is visible may be plotted, using computer-assisted methods (Amidon and Elsner 1968), especially from access corridors, and these places are then given planning consideration, either for actual site reservation or administrative control. Similarly, at the Tower itself, a plan plot may be made of the directly visible

Setting features are seen here in a skyline silhouette; the Setting boundary is clear because of contrasts between land form and accompanying plant cover. (Missouri Buttes and Devils Tower, Wyo.)

surrounding landscape. These are mechanical steps, subject to interpretation and later consolidation, but they help to determine realistic boundaries, based on actual conditions.

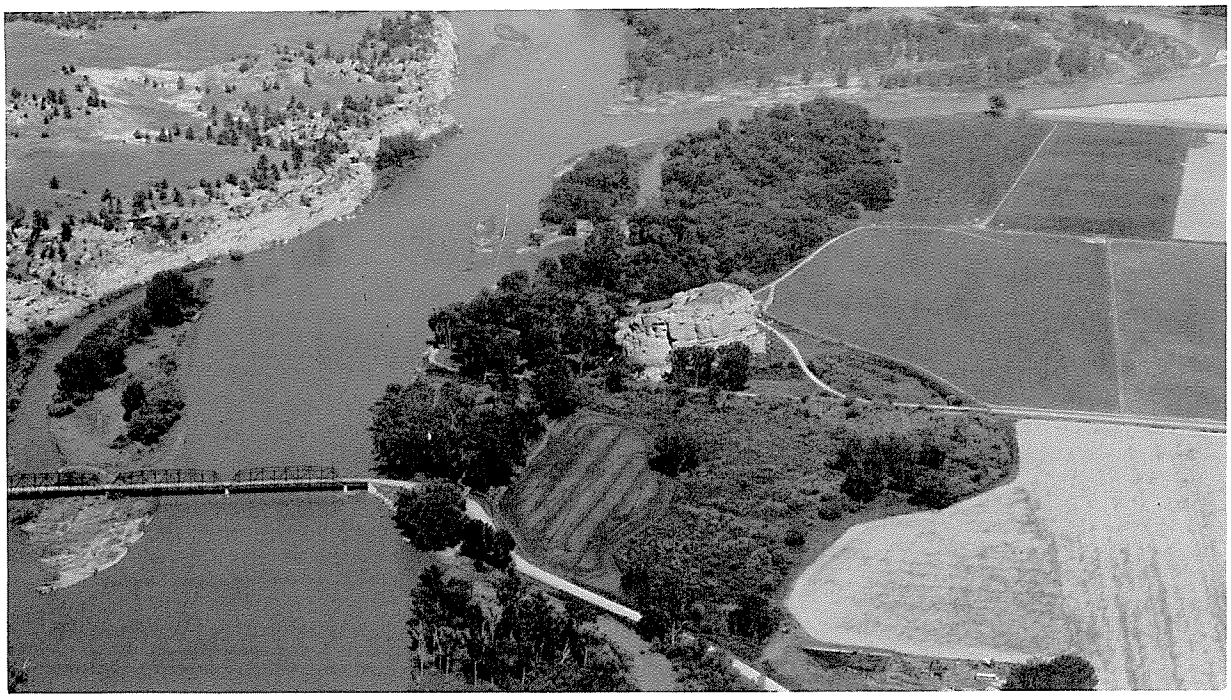
Other kinds of Setting features, especially water elements, may not lend themselves directly to visual plotting, but they also have a definable sphere of influence. Topographic eminences related to water features could be used in plotting visible surfaces; related drainages would then strongly affect the Setting limits. Stream corridors may serve concurrently as access corridors.

Land Form and Topography

In the Setting the principal scenic feature occupies center stage. The feature is often a distinctive land form—such as the Devils Tower, but its topographical surroundings—the Setting—determine the overall level of quality seen. The hill forms and mesa-like ridges about Devils Tower present a strong horizontal contrast to the vertical neck. In a lake feature, the lake basin determines overall scenic value as much as the water surface itself, and is often of even greater importance.

Topography can serve to screen roads, trails, service buildings, or other visitor facilities from direct view, when their visible presence may detract from the scenic quality. Even modest alterations to ground surface may be effectively used for this purpose. The topographical alterations that are necessary for the siting of buildings or roads should be carefully blended with natural surfaces to avoid conspicuous variations from typical surrounding slopes.

Nearby topography can often be employed to gain variety in possible views of the scenic element. Panoramic views may be possible from elevated positions, or variety in approach road elevations may be achieved. Within the Setting, trails can also provide the best viewing if their location takes maximum advantage of topographic change.



Top: A Setting feature, Pompeys Pillar, is here combined with a Landscape Unit. (Pompeys Pillar, Yellowstone River, Mont.)

Bottom: Detailed aspects of water and shore edge plant associations are small-scale impressions characteristic of both Settings and Units. (Near Underwood, N. Dak.)

Focal Attractions and Local Features

The scenic feature itself is visually dominant in the Setting, and the focus of most visitors' attention. Intelligent planning can provide enhancement, however, through approach roads and trails which give a full range of views for appreciation of the Setting's scenic quality. Visitor facilities need to be visually subordinate and should not occupy focal positions.

Local features may be small and relatively detailed within the Setting—especially related to the scale of pedestrian attention. Within the Devils Tower Setting, they include typical plant associations such as a cottonwood grove, small lava extrusions, a creek, and a segment of the Belle Fourche River.

Water Features and Elements

Water within the Setting may be either the central and main feature, or a part of the general landscape within the Setting. In the Devils Tower Setting, a mile or so of the Belle Fourche River is included, as are minor creeks. They have had a function in the creation of this landscape, and they provide secondary interest to the main feature.

The discussion of water in the section on Landscape Units is generally applicable to the Setting as well.

Plant cover contrasts—grass against woody plants, hardwoods against conifers — are apparent and appreciated close at hand. (Black Hills, S. Dak.)

Plant Cover

Plant cover, in the form of unusual or even unique plant associations, can be the central feature of a Setting. Examples are a relic plant island, a small forest ecologically related to a particular soil formation, or an old-growth grove. Usually established for scientific purposes, these special aggregations of plants do provide a subtle kind of local scenic landscape. The Setting adds to this central element a buffer area, both visual and actual—in part consisting of plant cover typical of the locale.

In establishment of the Setting, local protection of scenic values should be the primary consideration. Normally, the presence of a special scenic land form feature would not create an interruption in the characteristic plant cover. Plant cover within the Setting may be considered similar in scale and detail to that within the Landscape Unit. Normal objectives for planning would be to maintain typical local cover, avoid intrusions of inappropriate exotic plantings, and seek cooperative design control of such major landscape manipulations as nearby timber harvesting.

The integrity of the Setting's landscape and its plant cover may be easy enough to maintain, but there should also be no abrupt changes in management practices at the boundaries and visual surroundings of Settings. If a protected but highly visible Setting is established within a visibly fragmented surrounding landscape, there is general loss of scenic value. Isolation and protection of the best parts is not the answer. In general, management practices must be especially attuned to the varied scenic values of the Setting, including its plant cover.

Planting to provide shelter or screening should augment the native landscape character wherever possible. When this course is impractical, plants that meet the visual requirements for similarity are often available. Obvious contrasts should be avoided: regional characteristics of plant types in size and color should be respected, and close plant family associations sought wherever possible.

APPENDIX

A. Maps and High-Altitude Imagery

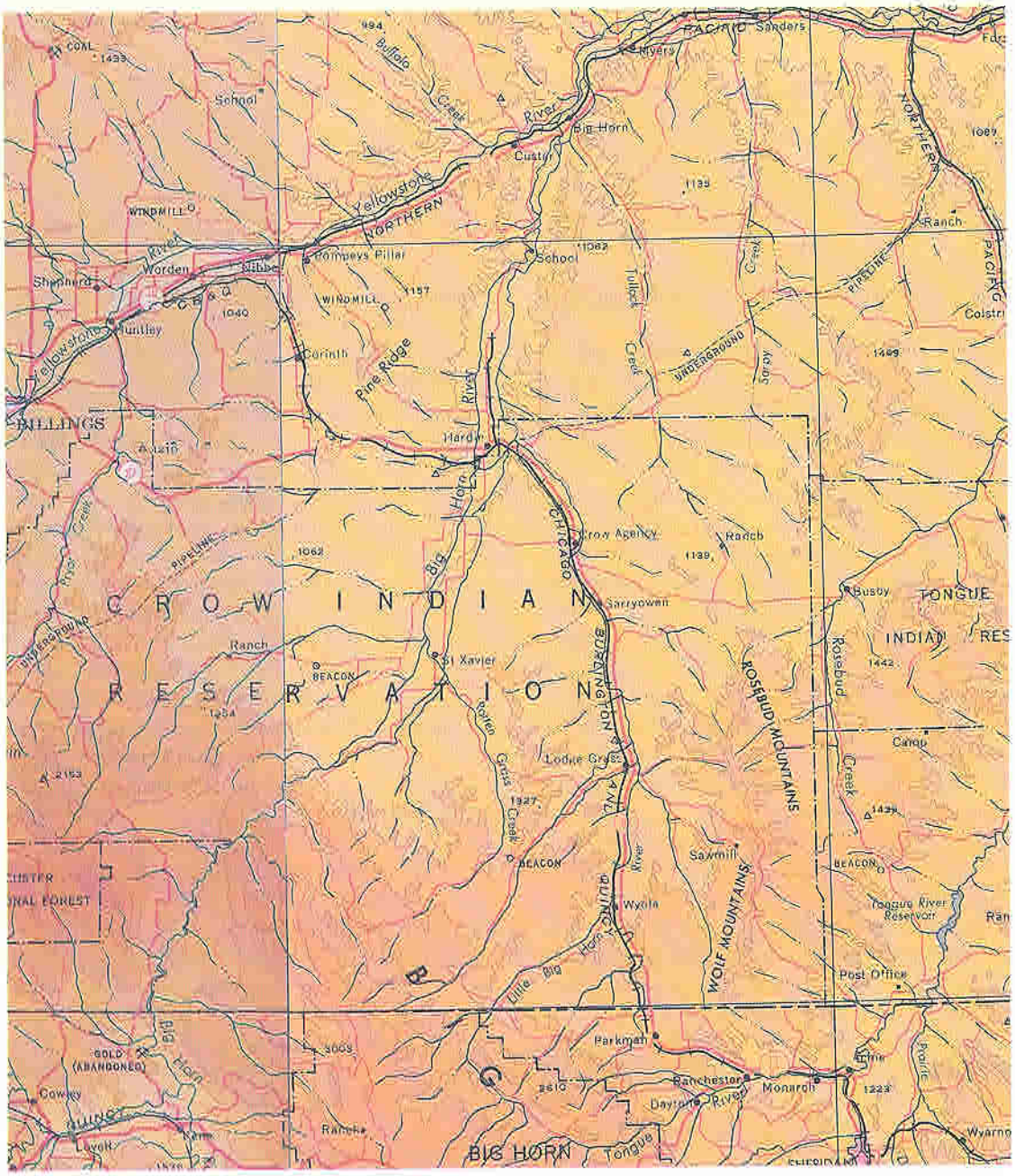
The usefulness of high-altitude imagery and topographic maps of the Northern Great Plains in making landscape inventories was evaluated. In particular, information was sought which might delineate the boundaries between different inventory elements, and help identify characteristics of landforms, vegetation, and land use patterns. Samples of high-altitude imagery were limited to standard photographic prints on paper. Interpretation was limited to direct examination with and without magnification and with simple stereoscopes. Although these methods do not take full advantage of the medium, we assumed that more sophisticated interpretation, using other photographic products and advanced equipment, would be unrealistic, because it would not ordinarily be available to land managers.

Our use of remote sensing material is limited to some samples of imagery from ERTS (Earth Resources Technology Satellite), and Skylab, or EREP (Earth Resources Experimental Package). These represent only an introduction to the possibilities, but further investigation was beyond the scope of the project. The material from ERTS and Skylab was obtained from the EROS (Earth Resource Observation System) Data Center, Sioux Falls, South Dakota.

The procedure for obtaining high altitude imagery from the EROS Data Center is simple but may take several months to complete. An inquiry form for geographic search (available from the Center) is helpful. For each point of interest, the form calls for geographic coordinates; for each area of interest, area corner coordinates are required. The Center makes a computer search and provides a printout sheet showing the coverage, types, and quality of imagery available. (About three weeks or more should be allowed for receipt of this printout.) From the printout, the choice of available imagery and photographic product can be made. (About six weeks should be allowed for delivery of the material ordered.) Note: Prices shown (1978) are subject to change.

With each image of a different scale, a corresponding topographic map is provided. The map is a material aid to interpretation, especially of black and white prints at smaller scales (1:1,000,000 to 1:250,000). Topographic maps at a variety of scales have potential use in landscape inventories that has not been exploited. The matched sets of sample segments of topographic maps and high-altitude imagery allow comparison of clarity in resolution and detail. Scales of coverage range from 1:1,000,000 to 1:31,400. Information on the original and complete maps, which are available from the U.S. Geological Survey (USGS) and the National Oceanographic and Aeronautical Administration (NOAA), is given for each sample. The following maps and photos are included:

1. Billings and Yellowstone River, Montana
   - Topographic Map (USGS, 1:1,000,000)
   - ERTS Black and White Composite
2. Colstrip, Lame Deer, Montana
   - Sectional Aeronautical Chart (NOAA, 1:500,000)
   - Skylab Color Photo
3. Billings and Yellowstone River, Montana
   - Sectional Aeronautical Chart (NOAA, 1:500,000)
   - Skylab Infrared Color Photo
4. Theodore Roosevelt National Memorial Park, North Dakota
   - Topographic Maps (USGS, 1:250,000)
   - ERTS Black and White Composite
   - ERTS False Color Composite
   - Skylab Color Photo
5. Theodore Roosevelt National Memorial Park, North Dakota
   - NASA Aircraft Infrared Color Photo
   - USGS Air Black and White Stereo Photo



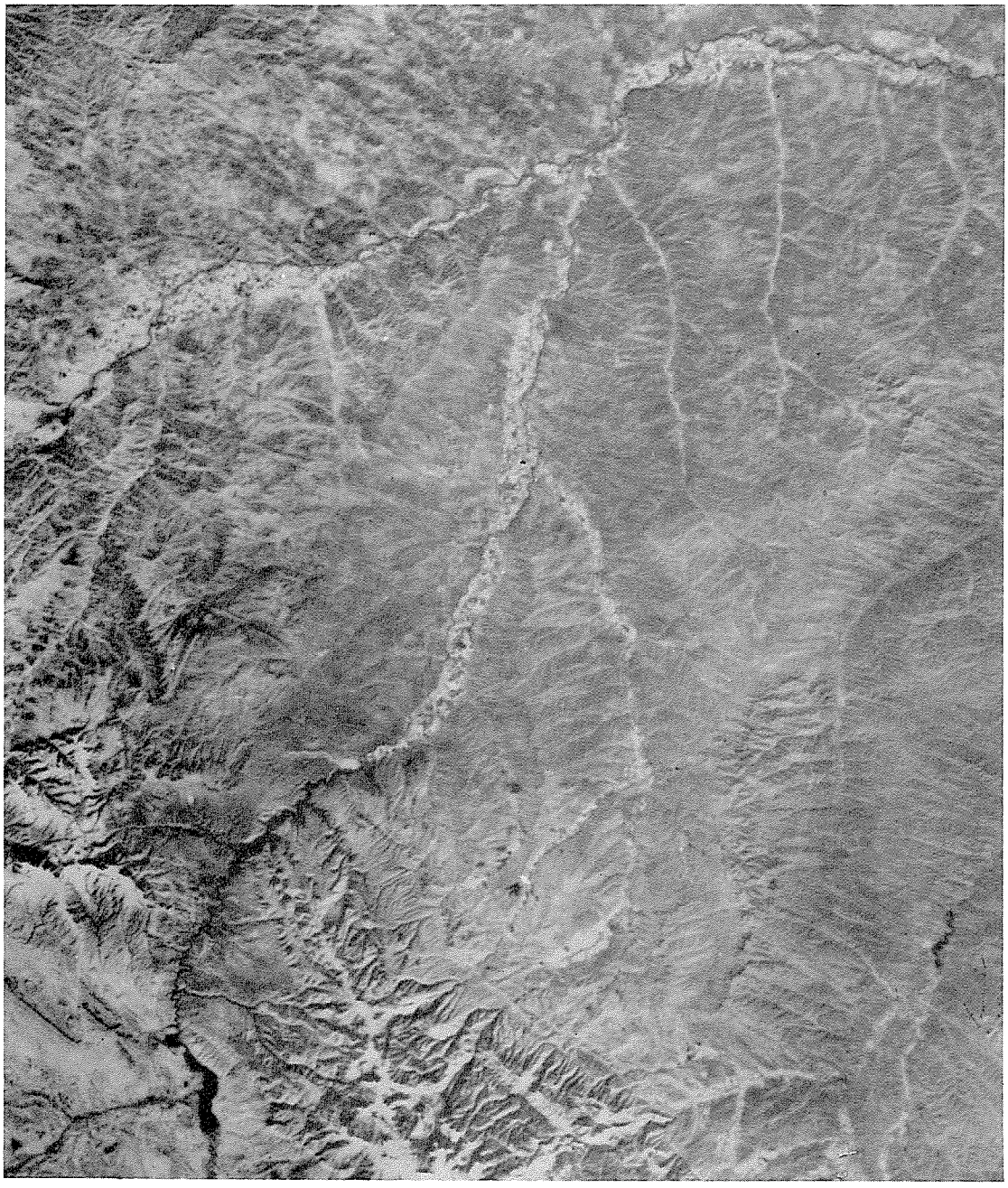
Billings and Yellowstone River, Montana

Map

USGS World (North America) Series, 1:1,000,000
Parts of two sheets: Bighorn Mountains NL13 and Yellowstone NL12. 1955. $1.00 per sheet
Limits: long. 102° to 108° W (NL13) and 108° to 114° W (NL12); lat. 44° to 48° N
Contour intervals: 150, 300, 500 meters, with tints
Scale: 1 in. = 15.78 (16) miles, 1 cm = 10 km; 1 in^2 = 249.1 $miles^2$, 1 cm^2 = 100 km^2

Image

ERTS black and white composite, bands 5 and 7.
Center coordinates: (Cooke City, Mont.) N 45°00 X W 109°55'
Special order.
Limits: long. 104° to 115¼° W, lat. 40½° to 49° N
Scale: 1:1,000,000 (1:1,065,600; 1 in. = 16.6 miles)



Application

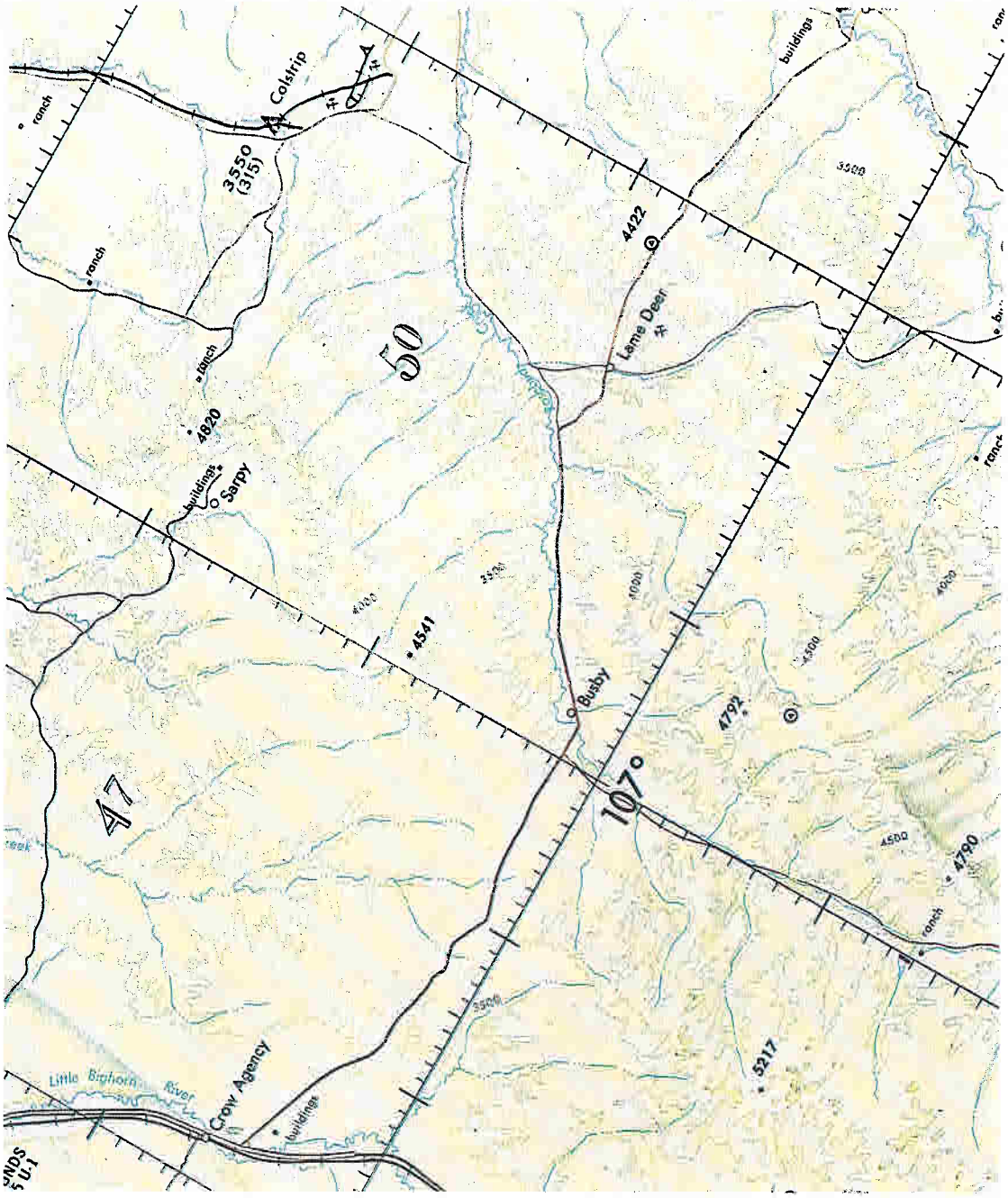
Landscape Continuity, Province

Landforms and Topography: Gross differences (and edges) apparent between Northern Great Plains Continuity and the Bighorn Mountains Landscape Province; not apparent for the Tongue River Ponderosa Pine Upland Province.

Plant Cover: Different vegetation types and their patterns not visible.

Water—River Drainages: Larger streams and reservoirs clear; density of streams and drainage patterns range from apparent to clear.

Land-use Patterns: Agricultural crop patterns faintly visible; urbanization, roads, and disturbances not visible.



Colstrip, Lame Deer, Montana

Map

NOAA sectional aeronautical chart, 1:500,000
Billings. October 1973-April 1974. $2.00
Limits: lat. 44½° to 49° N, long. 101° to 109° W
Center coordinates for Lame Deer: N 45°37' x W 106°40'
Contour interval: 500 ft
Scale: 1 in. = 7.89 (8) miles, 1 cm = 5 km; 1 in.² = 62.25 miles², 1 cm² = 25 km²

Image

Skylab color, S190B
Center coordinates: N 45°41'48" X W 106°56'15"
4.5 in. G 20B08115000000, June 9, 1973, 8.6- X 8.6-in. enlargement. $12.00
Quality 8, cloud cover 0%
Scale: Same as map.

Application

Landscape Continuity, Province

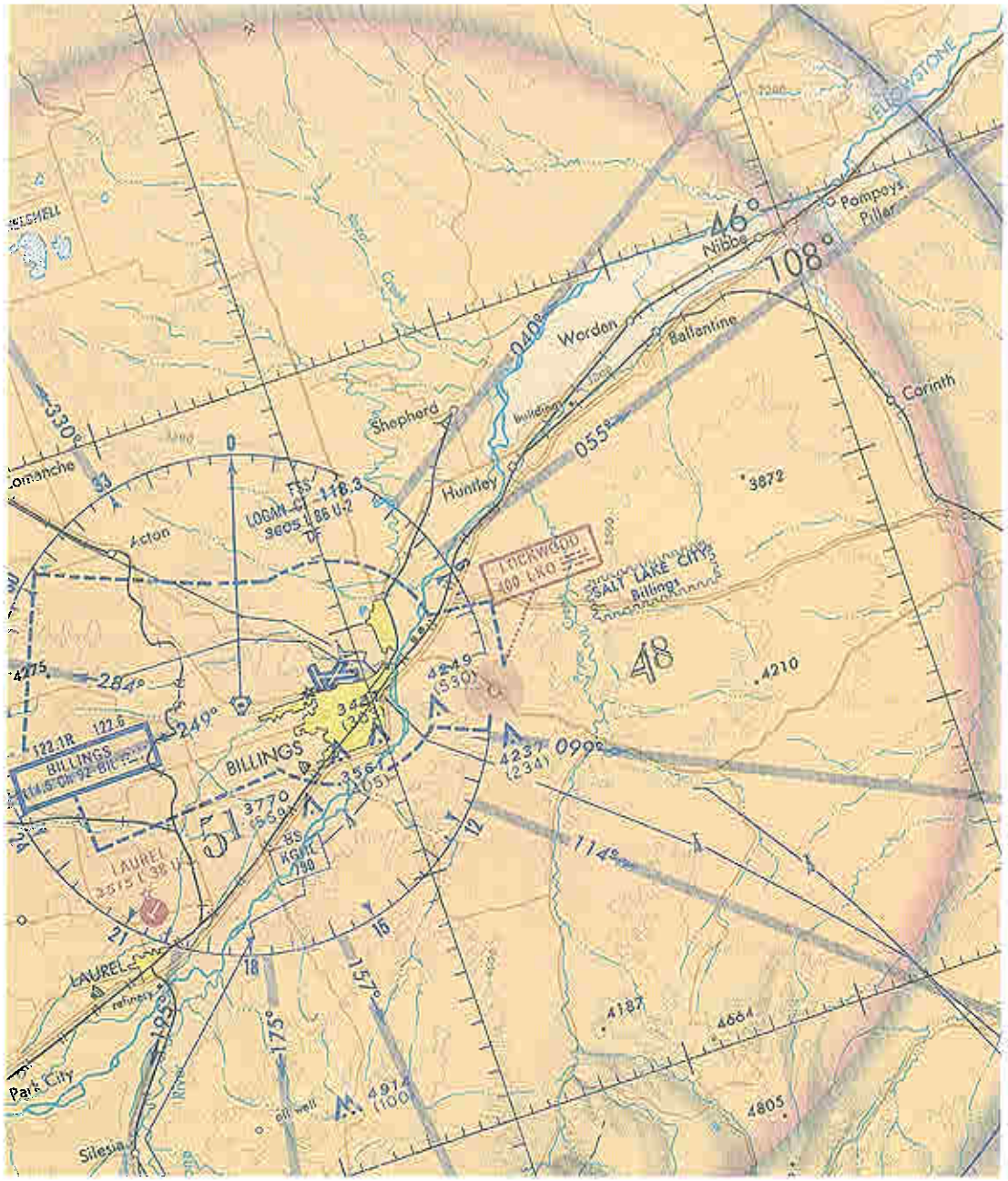
Landforms and Topography: Consistency of small elements apparent, all within the Tongue River Ponderosa Pine Uplands Landscape Province.

Plant Cover: Darkness of conifer cover clear to apparent; contrast between conifer cover and scrub and grass apparent; difference between grass and scrub not apparent.

Water-Stream Drainages: Streams and dense drainage patterns clear.

Land-use Patterns: Agricultural crop patterns clear; roads clear to faint; urbanization apparent as disturbance (Lame Deer, Crow Agency); disturbance clear (Colstrip mining).

General: Much more informative than ERTS image.



Billings and Yellowstone River, Montana

Map

NOAA sectional aeronautical chart, 1:500,000
Billings. October 1973—April 1974. $2.00
Limits: lat. 44½° to 49° N, long. 101° to 109° W. Center coordinates for Billings: N 45°45' x W 108°32'
Contour interval: 500 ft
Scale: 1 in. ≈ 7.89 (8) miles, 1 cm = 5 km; 1 in.^{2} = 62.25 miles^2, 1 cm^2 = 25 km^2

Image

Skylab color infrared photo, S190A CIR. 2.2 in.
20A00911300000,
Center coordinates: N 45°58'27" X W 107°54'35"
June 9, 1973,
Quality 8, cloud cover 10%
12.8- X 12.8-in. enlargement. $15.00
Scale: Same as map

Application

Landscape Continuity, Province

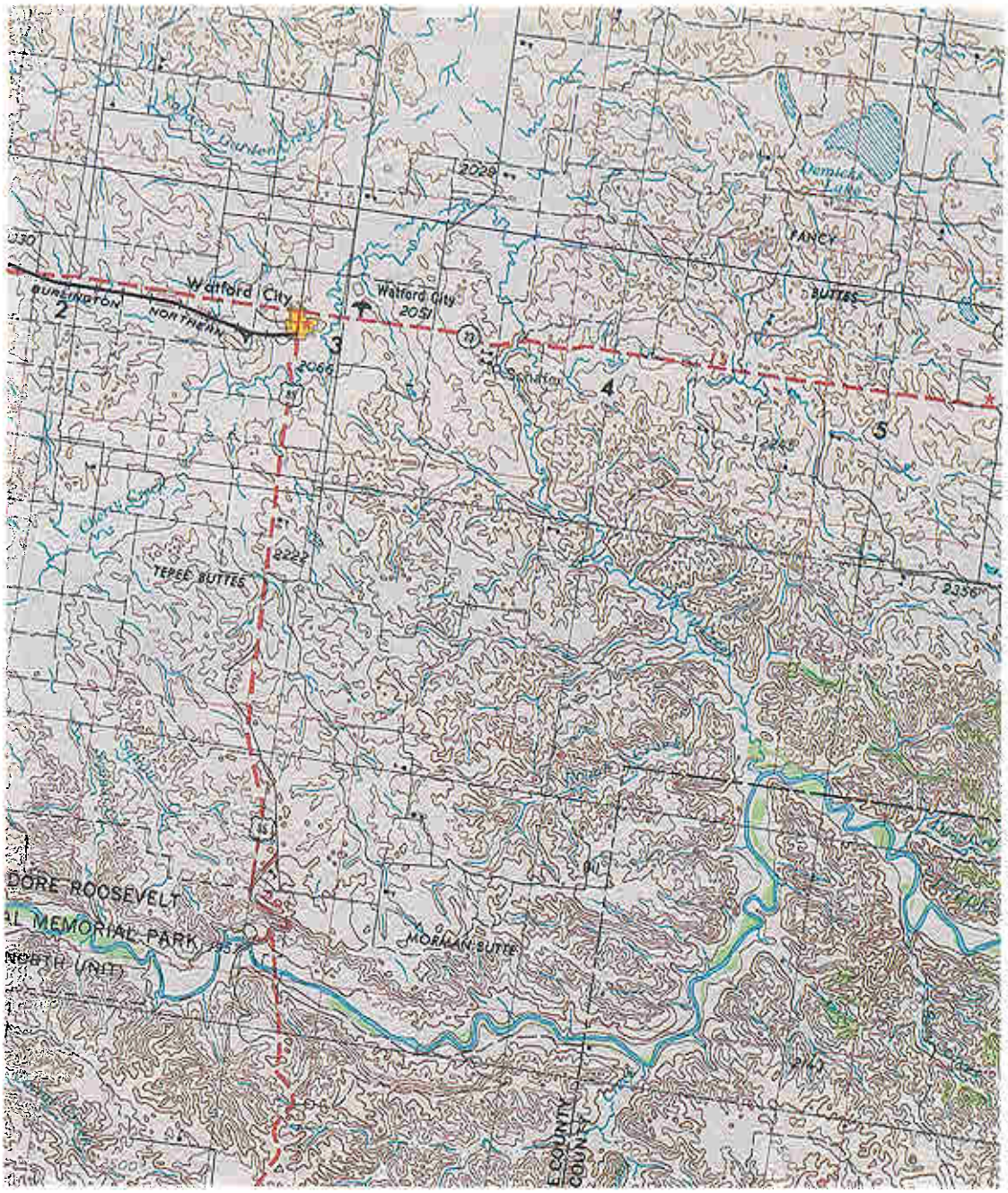
Landforms and Topography: Textural character and scale typical of the Landscape Continuity apparent, separable from texture and scale of adjacent Tongue River Ponderosa Pine Uplands Province.

Plant Cover: Conifer cover apparent to faint as darker tonal areas; contrast between conifer cover and scrub/grass faint; riparian cover clear but connective with blocks of lush growth crops.

Water-Stream Drainages: Streams and creek drainage patterns apparent to clear.

Land-use Patterns: Agricultural crop patterns clear, especially lush-growth fields; roads and railroads apparent to faint; urbanization faint, indefinite tonal texture (Billings).

General: Useful in combination with Skylab color at the same scale.



Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River and Watford City, North Dakota

Map

USGS Army Map Service, U.S. Series, 1:250,000 Watford City, North Dakota NL13-3, 1953, limited revision 1967. $1.00
Limits: lat. 47° to 48° N, long. 102° to 104° W
Center coordinates for Theodore Roosevelt National Memorial Park, North Unit: N 47°37' X W 103°22'
Contour interval: 100 ft (50 ft to 200 ft in series)
Scale: 1 in. = 3.95 (or 4) miles; 1 cm = 2.5 km; 1 in.^{2} = 15.57 miles^2, 1 cm = 6.25 km

Image

ERTS black and white
Center coordinates: N 47°24'59" X W 103°54'59" 2.2 in., 81157170445G000, November 27, 1974, 29.2-X 29.2-in. enlargement. $20.00
Quality 8, cloud cover 10%
Scale: Same as map

Application

Landscape Continuity, possibly Province

Landforms and Topography: Fine texture of badlands apparent, separable from adjacent smoother terrain.
Plant Cover: No reliable indication of vegetation type differences; darker tones associated with badlands forms possibly related to vegetation.
Water-Stream Drainages: River surface apparent (Little Missouri); lesser stream patterns faint.
Land-use Patterns: Agricultural crop patterns faint; roads and urbanization (Watford City) not visible.
General: Not significantly different from ERTS at 1:1,000,000 scale.

Image

ERTS false color composite
Center coordinates: N 47°26'06" X W 102°34'34"
81388171115N200, August 15, 1973, 29.2- X 29.2-in. enlargement.
$50.00
Quality 8, cloud cover 10%
Scale: Same as map—1:250,000.

Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River, North Dakota

Application

Landscape Continuity and (marginally) Province

Landforms and Topography: Fine texture of badlands apparent, separable from adjacent smoother terrain.

Plant Cover: Riparian cover and pattern clear; vegetation associated with badlands apparent; vegetation type separations suggested but indefinite.

Water-Stream Drainages: River and lake surfaces apparent (Little Missouri, Demicks Lake); stream patterns apparent as associated with riparian cover.

Land-use Patterns: Agricultural crop patterns apparent to clear; roads not visible; urbanization suggested but indefinite (Watford City).

General: Significantly more informative than ERTS black and white.

Image

Skylab color, S190B
Center coordinates: N 47°58'05" X W 102°53'01" 4.5 in., G30B08623400000
September 11, 1973, 17.1- X 17.1-in. enlargement. $25.00
Quality 8, cloud cover 10%
Scale: Same as map—1:250,000

Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River, North Dakota

Application

Landscape Province and Unit

Landforms and Topography: Fine texture of badlands clear, readily separable from less dissected forms of adjacent smoother terrain.

Plant Cover: Riparian vegetation apparent; darker tonal patterns associated with badlands apparently related to vegetation, medium tones apparent as grass/scrub cover and contrasting to darker (woody) vegetation within drainage defiles.

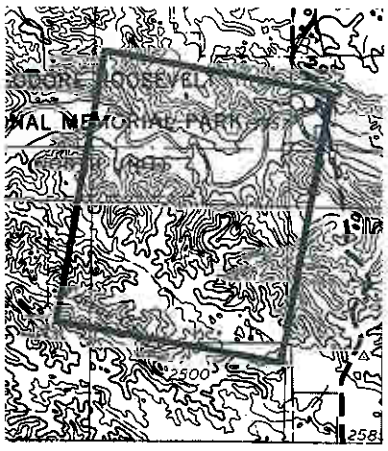
Water-Stream Patterns: River and lake surfaces clear (Little Missouri, Demicks Lake); meander creek patterns clear and separable from upland drainage patterns.

Land-use Patterns: Agricultural crop patterns very clear; road faint to clear, urbanization clear (Watford City); disturbance detectable to clear.

General: Infinitely superior to all other images at 1:250,000 scale.

Image

NASA aircraft color infrared (stereo available)
Center coordinates: N 47°35'29" X W 103°19'17"
6317001400023, frame 27, August 30, 1975. 9- X 9-in. print, $7.00 (EROS Data Center)
Quality 8, cloud cover 0%
Scale: 1:52,000; 1 in. = 0.82 (4/5) mile, 1 cm = 0.51 km; 1 in.^{2} = 0.67 mile^2 (429 acres), 1 cm^2 = 0.26 km^2
Index maps: Enlargements from 1:250,000 map (see page 72).



Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River, North Dakota

Application

Landscape Unit and Setting, Boundaries of Continuity and Provinces

Landforms and Topography: Pattern and form of badlands clear and detailed, readily separable from less dissected forms of adjacent smoother terrain.

Plant Cover: Riparian woodlands and stringers very clear; (woody) vegetation in upper outliers of drainage defiles very clear; grassland and scrub contrasts faint to apparent; barren (erosion) surfaces apparent to clear.

Water-Stream Patterns: River stream patterns and pond surfaces clear; meander creek patterns clear and readily separable from upland drainage patterns; associations with riparian vegetation clear and detailed.

Land-use Patterns: Agricultural crop patterns very clear—some with wetlands or lush growth; roads very clear to apparent; urbanization (buildings and associated patterns) clear; disturbances clear (cuts, fills, cleared areas)

General: Superior in contrast to comparable NASA color, but the combination is useful. Superior in resolution and detail.

Image

USGS air stereo, black and white (stereo pair)
Center coordinates: N 47°37' X W 103°22' 1F 44 GS CDO and 1F 45 GS CDO August 20, 1956. (set of 5) $10.00 (USGS National Cartographic Information Center, Reston, Va.)
Scale: 1:31,428, 1 in = 2619 ft, 0.50 mile; 1 cm = 0.31 km; 1 in.^{2} = 0.25 miles^2, 1 cm^2 = 0.096 km^2

Theodore Roosevelt National Memorial Park, North Unit, Little Missouri River, North Dakota

Application

Landscape Unit and Setting

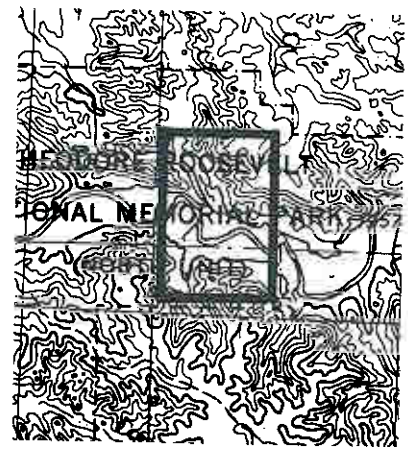
Landforms and Topography: Landform patterns, form, and slope differences very clear in detail; separation of types clear.

Plant Cover: Riparian woodlands and patterns very clear; (woody) vegetation in drainage defiles and on northerly surfaces clear; grassland and scrub contrasts faint to apparent; barren (erosion) surfaces very clear.

Water-Stream Patterns: River stream patterns and surfaces clear; meander creek patterns clear and readily separable from upland drainage patterns; riparian vegetation associations clear and detailed.

Land-use Patterns: Agricultural crop patterns and urbanization not present but very clear in adjacent frames of the sortie; roads very clear; disturbances very clear.

General: Superior resolution in detail although less informative than color; highly useful in determination of boundaries between the various visual inventory elements.



B. Visual Landscape Terminology

The following abstracts present terms and concepts that have been used in visual landscape analyses, inventories, and assessment procedures.

Each abstract has three parts: (1) Terminology, (2) Scale of application, and (3) Objectives. Only studies based upon the visual or scenic landscape resource are included. Studies are broadly grouped, and range from general to specific.

Terminology is presented without definition and without comment. Repeated occurrence of similar terms suggests that they are accepted to a certain degree, but meanings may well have shaded differences. Obviously there is no standardization at this time and no authority that might effect standardization can be identified.

Scale of application attempts to suggest the general scale of the study being reviewed and the map scales used. Publication graphics affect what may be shown, and can fundamentally alter the most desirable working scales. It is therefore important to be aware that proportional scales, when cited, are taken from the published maps or from the text.

Objectives briefly summarize the major goals of each study chosen for review.

Regional or Large-Scale Studies

Linton, David L.
1968. The assessment of scenery as a natural resource.
Terminology
Landform landscapes
Relative relief
Lowland
Hill Country
Bold hills
Mountains
Plateau uplands
Low uplands
Significant water elements
Land-use landscapes
Urbanized and industrialized landscapes
Continuous forests
Treeless farmland
Moorland
Varied forest and moorland landscapes
Richly varied farming landscapes
Wild landscapes
Scale of application
All of Scotland, 30,400 square miles, (78,736 km²), 145 miles (235 km) wide by 275 miles (445 km) long. Studies at 1:634,000 (1 inch = 10 miles, 1 cm = 6.3 km), published at 1:3,168,000 (1 inch = 50 miles, 1 cm = 31.68 km).
Objectives
Identify, compare, and discuss scenic resources, and finally summarize them with an (arbitary) numerical rating system.

Research, Planning and Design Associates
1967. Study of the visual and cultural environment; North Atlantic regional water resources study.
Terminology
Landscape series—natural element
Mountain subseries
Steep hill subseries
Rolling hill subseries
Undulating land subseries
Flat subseries
Coast line subseries
Compound subseries
Landscape unit—manmade element—pattern
Center City
Intermediate city
Fringe city
Town/farm
Farm
Farm/forest
Forest/farm
Forest/wildland
Scale of application
Northeastern tier of states, North Carolina to Canada, 167,000 square miles (435,000 km²).
Objectives
Define broad area landscape inventory and assessment procedure; ranking or weighing values are based upon (arbitrary) numbers. Visual landscape is represented also by typical topographic sample and excellent sketches.

Surface Resources Work Group, Northern Great Plains Resources Program
1973. Scenery subgroup regional profile.
Terminology
Level plains
Hilly country
Flat open country
Rolling open country

River breaks
Scattered Ponderosa Pine country
Gently rolling prairies with low hills
Badlands
Lake and pothole country
Buttes
Vast rolling grasslands
Mountains

Scale of application

Northern Great Plains, basis of the study: Hammond's *Physical Subdivisions* map in *National Atlas of the U.S.*; work plotted on 1:1,000,000 (1 inch = 16 miles, 1 cm = 10 km) map.

Objectives

Identify visual landscape resources of Northern Great Plains, based upon judgment of experienced landscape architects familiar with the area. Criteria not explicit but including "character of topography, vegetative variety, unique landform features, land use patterns and a brief description of the scenic qualities of the (landscape) subdivision or category."

County-Scale and National Forest Studies

Lewis, Philip H., Jr.
1963. Landscape analysis 1—Lake Superior south shore area.

Terminology

Natural corridors
Manmade corridors
Environmental corridors
Corridor fringe
Surface, slope rim
Water resources (list)
Wetland resources (list)
Topographic resources (list)
Vegetation resources (list)
Historical and cultural resources
Archeological resources (list)
Wildlife resources (list)
Tourist service facilities

Scale of application

County mapping, 1:125,000 (1 inch = 2 miles, 1 cm = 1.25 km).

Objective

Map county-scale areas, incorporating assessment of landscape resources, intrinsic and extrinsic values, through an (arbitrary) point system.

U.S. Forest Service
1974a. National Forest landscape management, vol. 1.

Terminology

Basic concepts
Characteristic landscape (includes Litton's types)
Variety
Deviations
Dominance elements
Form, color
Line, texture
Dominance principles
Contrast, convergence
Sequence, codominance
Axis, enframement
Variable factors
Motion, scale
Light, time
Atmospheric conditions, season
Distance, observer position
Landscape character analysis
Landscape management alternatives
Deterioration, destruction
Preservation, enhancement
Retention, modification
Rehabilitation

Scale of application

National Forest lands context, land use planning and landscape management scales.

Objectives

Present national forest servicewide approach to landscape management development; establish terminology and illustrate concepts. Includes a limited glossary of landscape management terms.

U.S. Forest Service
1974b. National Forest landscape management: the visual management system, vol. 2 chap. 1.

Terminology (as in vol. 1, with additions)

Character type and subtype
Variety classes
Distinctive
Common
Minimal
Sensitivity levels
Highest
Average
Lowest
Quality objectives
Preservation
Retention, partial retention
Modification, maximum modification
Unacceptable modification

Scale of application

National Forest land use and landscape management planning use, mapping shown at 1:42,240 (1 inch = 0.67 miles, 1 cm = 0.42 km) and 1:56,316 (1 inch = 0.89 miles, 1 cm = 0.56 km) probable application at 1:62,500 to 1:125,000.

Objective

Define and map physical landscape quality according to variety classes and distance zones, delineate landscape quality in relation to user's concern for landscape (sensitivity level), so as to identify a visual quality objective for management decision.

Route and Travel Corridor Studies

Burke, Hubert D., Glen H. Lewis and Howard R. Orr

1968. A method for classifying scenery from a roadway.

Terminology

Characteristic landscape
Roadside zone
Outer zone
Far zone

Scale of application

Road or stream corridors, inventories based on visible landscape.

Objective

Define a road-based landscape evaluation procedure with the characteristic landscape as normal or modified by either a positive or negative rating.

Dooling, J. Peter

1974. The golden circle: toward a park and outdoor recreation plan.

Terminology

Landscape image analysis
Landscape continuum, scenic nodes
Imageability, imageable (highly, less, least)
Image (strong, weaker)
Visual use, physical use
Spatial definition, visual order
Visual complexity
Kinesthesia
Ecological dynamics
Edge (degree, types)
Compositional types (Litton)
Form, light, color, texture
Observer position and distance
Landscape transparency
High site scenic areas (HSSA's)

Scale of application

Visual travel corridor of the Golden Circle highways, northern British Columbia, approximately 1200 miles long. One HSSA identified in each (arbitrary) 70-mile segment. Field maps: 1:50,000 (1 inch = 0.79 miles, 1 cm = 0.5 km) reproduced at 1:64,100 (1 inch = 1.1 miles, 1 cm = 0.64 km).

Objective

Protect basic values of the area, develop park-recreation systems appropriate to the region, develop a mapping framework and visual display of HSSA's to serve as coordinative for all resources, consider trade-offs and alternatives, prepare long range plans for landscape and historic preservation and outdoor recreation, provide a benchmark study.

Litton, R. Burton, Jr.

1968. Forest landscape description and inventories—a basis for land planning and design.

Terminology

Factors of scenic analysis and observation
Distance (foreground, middleground, background)
Observer position (inferior, normal, superior)
Form (isolation, size, silhouette, surface variation)
Spatial definition (proportions)
Light
Sequence

Compositional types
Panoramic landscape
Feature landscape
Enclosed landscape
Focal landscape
Canopied landscape
Detail landscape
Ephemeral landscape

Scale of application

Route inventories, road and stream corridors, 1:62,500 (1 inch = mile, 1 cm = 0.625 km) working studies at scale of 1:24,000 and 1:62,500.

Objective

Identify and define visual landscape resources: apply scenic analysis and field recording to various inventory methods, case studies.

Water Emphasis Studies

Litton, R. Burton, Jr.
1971. Visual landscape units of the Lake Tahoe region.
Terminology
Spatial characteristics
Enclosures, cohesive skyline
Headland and shoreline spurs
Floor or flattened lower and central slopes
Cove indentations, water edge
Conspicuous, dominant landforms, scarps or lakes
Visually distinct forest stands, and other plant associations
Visual subdivisions: landscape units and subunits
Scale of application
Lake Tahoe watershed, 500 square miles, (1290 km²) (including 190 square miles (495 km²) of water surface).
Field work on 1:62,500 (1 inch = 1 mile, 1 cm = 0.625 km) map, reproduced at 1:125,000 (1 inch = 2 miles, 1 cm = 1.25 km).
Objective
Identify and describe visual landscape units and their scenic content, indicate visual impacts present or potential, "—suggest developmental constraints that may respond to visual clues found in the landscape."

Litton, R. Burton, Jr., Robert J. Tetlow, Jens Sorensen, and Russell A. Beatty.
1974. Water and landscape—an aesthetic overview of the role of water in the landscape.
Terminology
Unity and visual units
Landscape unit
Boundary definition
General form—terrain pattern
Features
Vegetation patterns
Water presence
Characteristic weather
Cultural and land use patterns
Setting unit
Landscape expression
(subheads similar to those under Landscape unit)
Water expression
Prominence
Continuity
Transition
Evidence of human impact
Waterscape unit
Water element
Spatial expression and edge
Movement and features
Appearance
Aquatic environment
Evidence of human impact
Shore element
Edge definition, vertical and longshore
Spatial expression
Edge features
Riparian environment
Evidence of human impact
Manmade structures or alterations in units
Linear elements
Area elements
Mass elements
Point elements
Color and texture
Scale of application
Hierarchical in scale: (1) landscape unit is regional, including a series of visually similar rivers or streams, (2) setting unit is a stream segment and its terrain enclosures, (3) waterscape unit is detailed inventory of a stream segment.
Objective
Discuss esthetic character of water, develop a landscape inventory method emphasizing water presence, appraising manmade changes relative to water. Includes high-low landscape quality ranking lists using unity, variety, and vividness as esthetic criteria.

Zube, Ervin H. and Hugh A. Dega
1964. Wisconsin's Lake Superior shoreline—3
Terminology
Visible physical features
Shoretypes, A to N, 13 types
Wet beach, dry beach, bluff, upland, etc.
Scale of Application
County mapping—shoreline 1:500,000 (1 inch = 8 miles, 1 cm = 5 km). Shore type profiles (1 inch = 50 feet, 1 cm = 15.2m).
Objective
Specify characteristics, summarize climate, vegetation, topography, services, etc.; analyse visual landscape, shore, beach, clay bluffs, sandstone bluffs and caves, sloughs, etc.; compare quantitatively shore types, primarily by linear measurement, and determine their attributes.

C. Criteria for Recording Ground Reconnaissance

Our landscape field recording with photographs and sketches was carried out according to the following criteria:

1. Document the usual as well as the striking—the ordinary landscape, which has relative homogeneity because of repetitive land form, vegetation, and water elements, as well as the unusual landscape with its vivid expressions of these elements (sharply contrasting forms, colors, and proportions.)

2. Record visual boundaries, whether sharp edges or gradual transitions, which lie between homogeneous landscapes, and are typically related to changes of land form and vegetation.

3. Record lighting effects, giving emphasis or highlighting to particular relationships and patterns of landscape elements. (These tend to occur with low level sun of early morning or late afternoon and make for better photographs.)

4. Record ephemeral effects (Litton 1968), particularly those having to do with weather, the sky, regional climate, and wildlife.

5. Record water in the landscape and the different expressions found in zones dominated by water as well as areas suggesting water presence.

6. Record examples of geophysical structures or processes, such as stream terraces, hogbacks, and strata with related vegetation. These relate to the prime factors in visual landscape sampling, but are not prime factors in themselves.

7. Record settlements, habitations ranging from farmsteads to cities, looking especially at the outskirt junctions with the landscape and the collective town site in relation to the broad surrounding landscape.

8. Record examples of impacts which appear in conflict with the adjacent landscape—mining, roads, power transmission, and so on.

9. Record examples of man-made changes (impacts) which appear compatible (or at least tolerable) with the adjacent landscape—agriculture, mining, roads, and so on.

10. To reinforce criterion 1, make photographs and sketches which are representative of the range of visual experiences encountered. When in doubt, take another photograph—too many are better than too few. Sketches may be abstractions or distillations of regionally typical landscapes as well as specific representations.

11. Record and date each photo and sketch in a fieldbook, noting cogent characteristics and any special reasons for making the photo or sketch. Record location using speedometer readings set from an initial point, plot on U.S. Army Topographic maps (1:250,000).

Because ground reconnaissance for a large area is practically limited to viewing from the road, there are necessarily disruptions of observation. These make it difficult to sense the continuity of any landscape subdivision and to see the junctions between dissimilar visual areas. In principle, the objectives of both ground and air observation for landscape inventories are the same. It is appropriate to repeat (with minor modifications) the subject heads and subitems which accompanied the low level air photos so that a comparison may be made with similar ground level photos.

LITERATURE CITED

Amidon, Elliot L., and Gary H. Elsner
1968. **Delineating landscape view areas—a computer approach (VIEWIT).** USDA Forest Serv. Res. Note PSW-180, 5 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Arnheim, Rudolf
1954. **Art and visual perception.** Univ. of California Press, 485 p., illus.

Burke, Hubert D., Glenn H. Lewis, and Howard R. Orr
1968. **A method for classifying scenery from a roadway.** Park Practice Guide, Nat. Conference on State Parks, Washington, D.C., 22(1):125–141.

Dooling, J. Peter
1974. **The golden circle: toward a park and outdoor recreation plan.** Faculty of Forestry, Univ. of British Columbia, and Parks Branch, Dept. of Recreation and Conservation, Vancouver, B.C., Study Vol. I, 129 p.

Fenneman, Nevin M.
1931. **Physiography of the western U.S.** McGraw-Hill Book Co., New York, 534 p., illus.

Gibson, James J.
1966. **The senses considered as perceptual systems.** Houghton Mifflin Co., Boston, 335 p.

Hammond, Edwin H.
1964. **Analysis of properties in land form geography: an application to broad-scale land form mapping.** Ann. Assoc. of Amer. Geogr. 54:11–23.

Hammond, Edwin H.
1970. **Physical subdivisions (map, 1965).** *In* National Atlas of the United States of America. U.S. Geol. Surv., Dep. Inter., p. 61.

Hirvonen, H. E.
1976. **Bowen Island, a landscape analysis.** Pac. Forest Res. Cent., Information Rep., BC-X-122, Victoria, B.C., Canada. 29 p., illus.

Hunt, Charles B.
1967. **Physiography of the U.S.** W. H. Freeman, San Francisco. 480 p., illus.

King, Clarence
1872. **Mountaineering in the Sierra Nevada.** James R. Osgood and Co., Boston, 292 p. (Reprinted 1970, Bison Book, Univ. of Nebraska Press).

Kuchler, A. W.
1964. **Manual to accompany map. Potential natural vegetation of the coterminous U.S.** Spec. Publ. 36, Amer. Geogr. Soc., New York. 116 p., illus.

Lewis, Philip H., Jr.
1963. **Landscape analysis 1—Lake Superior south shore area.** Wisconsin Dep. Resour. Devel., Madison, 58 p.

Linton, David L.
1968. **The assessment of scenery as a natural resource.** Scot. Geogr. Mag., 84(3):219–238.

Litton, R. Burton, Jr.
1968. **Forest landscape description and inventories—a basis for land planning and design.** USDA Forest Serv. Res. Paper PSW-49, 64 p., illus. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

Litton, R. Burton, Jr.
1971. **Visual landscape units of the Lake Tahoe region: Scenic analyses of the Lake Tahoe region.** USDA Forest Serv. South Lake Tahoe, Calif., p. 6–14.

Litton, R. Burton, Jr., R. J. Tetlow, J. Sorenson, and R. A. Beatty
1974. **Water and landscape: An aesthetic overview of the role of water in the landscape.** Water Inf. Cent. Huntington, 314 p., illus.

Lynch, Kevin
1960. **The image of the city.** Harvard Univ. Press, Cambridge, 194 p.

Research, Planning and Design Associates
1967. **Study of the visual and cultural environment: North Atlantic regional water resources study.** No. Atl. Reg. Water Resourc. Study Coord. Comm., 71 p., illus.

Surface Resources Work Group, Northern Great Plains Resources Program
1973. **Scenery subgroup regional profile.** 53 p. Natl. Park Serv., Omaha, Nebr.

Thornbury, W. D.
1965. **Regional geomorphology of the U.S.** John Wiley, New York, 609 p., illus.

U. S. Forest Service
1974a. **National Forest landscape management, vol. 1.** USDA Agric. Handbook 434, Washington, D.C. 77 p.

U. S. Forest Service
1974b. **National Forest landscape management, vol. 2, chap. 1, The visual management system.** USDA Agric. Handb. 462, Washington, D.C.,47 p.

Wertz, W. A., and J. A. Arnold
1972. **Land systems inventory.** USDA Forest Serv., Intermountain Region, Ogden, Utah, 12 p.

Zube, Ervin H., and Dega, Hugh A.
1964. **Wisconsin's Lake Superior shoreline—3.** Wisconsin, Dep. Resour. Devel. Madison, 42 p.

The Forest Service of the U.S. Department of Agriculture

. . . Conducts forest and range research at more than 75 locations from Puerto Rico to Alaska and Hawaii.

. . . Participates with all State forestry agencies in cooperative programs to protect and improve the Nation's 395 million acres of State, local, and private forest lands.

. . . Manages and protects the 187-million-acre National Forest System for sustained yield of its many products and services.

The Pacific Southwest Forest and Range Experiment Station

represents the research branch of the Forest Service in California and Hawaii.