

## Appendix F – Bailey Descriptions

### Geomorphic characteristics and potential natural vegetation for Bailey Ecoprovince Sections in the United States

Adapted and condensed from information at: <http://www.fs.fed.us/land/pubs/ecoregions/toc.html> (accessed 110919)

This site also includes information for each section on geology, soils, climate, hydrology, fauna, land use, and cultural ecology, as well as appendices with information on species nomenclature, compilers, a glossary, etc.

Additional information, including data, maps, and areas of different vegetation in each section and subsection available at: [http://svinetfc4.fs.fed.us/clearinghouse/other\\_resources/ecosubregions.html](http://svinetfc4.fs.fed.us/clearinghouse/other_resources/ecosubregions.html)

**A more general description of sections and how they were delineated is in: GTR\_WO-76B (2007) *Description of “Ecological Subregions: Sections of the Conterminous United States”: First Approximation*, Compiled by W. H. McNab, et al., which is available for download at the website above.**

### Arctic Tundra

The area of this Section, located in northern Alaska, is about 19,100 mi<sup>2</sup> (49,500 km<sup>2</sup>).

#### Section 124A--Coastal Plain

**Geomorphology.** A relatively smooth plain that gradually ascends from the Arctic Ocean to the adjacent Brooks Range foothills. The area is mantled with Quaternary deposits of alluvial, glacial, and aeolian origin. Permafrost-related terrain features mark local surfaces (e.g., pingos, ice-wedge polygons, frost boils). Small sand dunes irregularly occur along the coast. Essentially, the area is a gently rolling to level, treeless plain with many lakes and rivers. Elevation is less than 660 ft (200 m).

**Potential Natural Vegetation.** Wet tundra communities dominated by sedges, rushes, mosses, lichens, and willows.

**Disturbance Regimes.** Disturbance from wildfire is low.

### Bering Tundra (Northern)

These Sections, located in western Alaska bordering the Bering Sea, include the islands of St. Lawrence, St. Matthew, and Nuviak. The area of these Sections is about 46,900 mi<sup>2</sup> (121,500 km<sup>2</sup>).

#### Section 125A--Kotzebue Sound Lowlands

**Geomorphology.** Flat, poorly drained coastal plains dominated by terraces, low hills, stabilized and active dune fields. The many thaw lakes and sinks are connected by a maze of waterways. Pingos are abundant in the lowland around the Selawik River. Elevation is less than 330 ft (100 m).

**Potential Natural Vegetation.** Since standing water is almost always present, wet tundra communities consisting of sedge mats predominate. Peat ridges, drainage ways, and polygonal features provide better drainage upon which woody plants like white spruce, willows, alder, and paper birch occur. Black spruce forests are abundant along the Kobuk River, whereas grasses grow on the dunes along the coast.

### **Section 125B--Yukon-Kuskokwim Delta**

**Geomorphology.** The area is a lake-dotted marshy plain with many low hills of basalt and volcanic cinder cones and craters. Elevation is less than 400 ft (120 m).

**Potential Natural Vegetation.** Wet tundra communities consisting primarily of sedge mats, moss, and low growing shrubs predominate. Alder, willows, and scattered, stunted spruce and birch grow along the major streams.

### **Section 126A--Bristol Bay Lowlands**

**Geomorphology.** This Section is a flat-to-rolling moraine and outwash-mantled lowland. The source of the material is from surrounding glaciated mountains. Elevation is generally less than 500 ft (150 m).

**Potential Natural Vegetation.** Moist and wet tundra meadows are the dominant vegetation. Mosses, sedges, and low-growing shrubs cover most of the area. Alder and willows and, in scattered places, stunted spruce and birch grow along the major rivers and streams.

### **Brooks Range Tundra - Polar Desert**

These sections are in northern Alaska, north of the Arctic Circle. The area of these Sections is about 101,600 mi<sup>2</sup> (263,100 km<sup>2</sup>).

### **Section M121A--Foothills**

**Geomorphology.** In the northern portion, rock folding and unequal erosion have produced a linear-ridge topography. The sedimentary rocks of the southern portion are tightly folded and form irregular buttes, mesas, and long linear ridges. Hummocky morainal ridges border most north-south valleys. Ice-related features are common (e.g., pingos, solifluction lobes, ice-wedge polygons, stone stripes). The area consists of maturely dissected low hills and ridges that have never been glaciated. Elevation is mainly less than 1,970 ft (600 m).

**Potential Natural Vegetation.** Moist tundra-cottongrass tussocks are interspersed with willow-dominated communities along river corridors. **Fauna.** Moist tundra communities provide nesting

habitat for several species of sandpiper (e.g., Baird's, stilt, and buff-breasted) and small mammals such as the insular vole. Willow ptarmigan and Alaskan hare inhabit the scattered patches of birch, alder, and willow. Predators include rough-legged hawks, peregrine falcons, gyrfalcons, snowy owls, and Arctic foxes. Wood frogs have been reported north of the Brooks Range. Arctic char and Arctic grayling are found in most rivers and some of the shallow tundra lakes.

## **Section M121B--Mountains**

**Geomorphology.** Rugged, deeply dissected, east-west trending mountains having rounded-to-sharp summits. Abrupt mountain fronts frequently face northward. Small cirque glaciers occur only on the highest peaks of the Brooks Range. Elevation ranges from 1,640 to 8,530 ft (500 to 2,600 m).

**Potential Natural Vegetation.** Many of the highest ridges are barren or ice-covered. Alpine tundra heath communities occur on upper and intermediate slopes, whereas moist tundra sedge-tussock meadows with occasional trees prevail on lower slopes. Shrub thickets occur along river corridors.

## **Seward Peninsula Tundra - Meadow**

Located in northwestern Alaska along the Bering Sea, it includes much of the Seward Peninsula and part of St. Lawrence Island. The area of this Section is about 20,600 mi<sup>2</sup> (53,400 km<sup>2</sup>).

## **Section M125A--Seward Mountains**

**Geomorphology.** The area consists mainly of extensive uplands of broad convex hills and flat divides indented by sharp V-shaped valleys. Isolated groups of glaciated mountains and peaks cover the higher elevation areas. Elevation ranges from sea level to 4,600 ft (1,400 m).

**Potential Natural Vegetation.** Vegetation patterns consist of moist tundra sedge-tussock meadows at lower elevations, interspersed with scattered willows, birch, and isolated spruce-hardwood forests, particularly along rivers. Alpine tundra heath meadows and barrens dominate the high mountains.

## **Ahklun Mountains Tundra - Meadow**

It is located in southwestern Alaska, bordering the Bering Sea. The area of this Section is about 16,700 mi<sup>2</sup> (43,300 km<sup>2</sup>).

## **Section M126A---Ahklun Mountains**

**Geomorphology.** A group of rugged steep-walled mountains having sharp summits separated by broad, flat valleys and lowlands. This Section includes the Pribilof Islands. Elevation ranges from sea level to greater than 4,920 ft (1,500 m).

**Potential Natural Vegetation.** Alpine tundra heath meadows and barrens predominate in the mountains, whereas moist tundra sedge-tussock meadows occur in valley bottoms. Black spruce forest vegetation dominates some hills and ridges. Forests of white spruce, paper birch, and alder cover the low hills along the major rivers.

## **Aleutian Oceanic Meadow - Heath**

These Sections are located in southwestern Alaska, and, as their names describe, include the Alaska Peninsula, Aleutian Islands, and part of Kodiak Island. The area of these Sections is about 22,200 mi<sup>2</sup> (57,500 km<sup>2</sup>).

### **Section M127A--Alaska Peninsula**

**Geomorphology.** The Aleutian Range consists of rounded east-trending ridges surmounted at intervals by rugged volcanoes. The mountains were heavily glaciated during the Pleistocene epoch. This Section is bordered to the north by the Bristol Bay Lowlands where the Aleutian Mountains become increasingly submerged southwestwardly, forming the Aleutian Islands. Elevation ranges from sea level to 8,530 ft (2,600 m).

**Potential Natural Vegetation.** The vegetation is primarily alpine tundra heath meadows and barrens, with willow and alder occurring at lower elevations and along drainages.

### **Section M127B--Aleutian Islands**

**Geomorphology.** The Aleutian Islands are made up of a chain of volcanic islands perched atop the crest of a submarine ridge. Topography varies from wave-beaten level platforms near sea level, to intensely glaciated mountains indented with fjords and bordered by cliffs. The islands gradually emerge above sea level to the northeast forming the Alaska Peninsula. Elevation rises from sea level to greater than 6,230 ft (1,900 m).

**Potential Natural Vegetation.** Vegetation consists of alpine tundra heath meadows. Lichen communities prevail on windswept ridges. Moist tundra meadows occur at lower elevations and are dominated by grass, sedge, and scattered willows and birch.

### **Section M127C--West Kodiak Island**

**Geomorphology.** The Kodiak Mountains are mostly glaciated, with broad, smooth ridges that extend northwestward. The coastline is extremely irregular, having many fjords and islands. The western part of the island has many broad U-shaped valleys. Elevation ranges from sea level to 4,270 ft (1,300 m).

**Potential Natural Vegetation.** The vegetation is primarily alpine tundra heath meadows and barrens with moist and wet sedge meadows occurring at lower elevations. Shrub thickets occur along some drainages.

## **Province 131--Yukon Intermontane Plateaus Tayga**

These Sections are located in central Alaska; their area is about 56,100 mi<sup>2</sup> (145,300 km<sup>2</sup>)

## **Section 131A--Upper Kobuk Valley**

**Geomorphology.** Diverse topography which includes scattered groups of hills and low mountains surrounded by irregular lowlands and broad flat divides. Elevation ranges from 1,300 to 3,940 ft (400 to 1,200 m).

**Potential Natural Vegetation.** Closed forests of spruce, birch, and aspen occur on moderately drained to well drained sites. In wetlands, open black spruce forests are often interspersed with willow thickets and treeless bogs.

## **Section 131B--Yukon-Kuskokwim Bottomlands**

**Geomorphology.** This Section represents a collection of flat bottomlands along the larger rivers of interior Alaska. Although nearly level, broad valleys and basins are typical, some low rolling hills and piedmont slopes do occur. Riparian features, such as meandering streams and side sloughs, are prevalent. Oxbow, thaw, and morainal lakes are abundant. Elevation generally ranges from 400 ft (120 m) in the west to 1,640 ft (500 m) in the east.

**Potential Natural Vegetation.** Dominant vegetation communities span a moisture gradient from mesic to hydric and include spruce-poplar forests, open black spruce forests, floodplain thickets of willow and alder, and graminoid marsh.

## **Coastal Trough Humid Tayga**

The area of these Sections, which are located in south-central Alaska, is about 15,700 mi<sup>2</sup> (40,700 km<sup>2</sup>).

## **Section 135A--Cook Inlet Lowlands**

**Geomorphology.** A level-to-rolling surface derived mainly through glacial events (ground moraine, drumlin fields, eskers, and outwash plains). Elevation ranges from sea level to 500 ft (150 m).

**Potential Natural Vegetation.** Lowland black spruce forests are abundant. Bottomland spruce-poplar forests are adjacent to larger river drainages, along with thickets of alder and willow. Some wet tundra communities exist along the Cook Inlet coastline.

## **Section 135B--Copper River Basin**

**Geomorphology.** The area is a broad basin of rolling-to-hilly moraines and nearly level alluvial plains that occupy the site of a Pleistocene glacial lake. Most rivers originate from glaciers located in the surrounding mountains. Elevation ranges from 1,380 to 2,950 ft (420 to 900 m).

**Potential Natural Vegetation.** Open black spruce forests interspersed with large areas of brushy tundra characterize this Section. White spruce forests occur on south-facing, gravelly moraines, whereas cottonwood-tall bush communities are found on large floodplains.

## Upper Yukon Tayga

Located in east-central Alaska, the area of this Section is about 13,000 mi<sup>2</sup> (33,700 km<sup>2</sup>).

### Section 139A--Upper Yukon Flats

**Geomorphology.** The Yukon Flats encompass gently sloping outwash fans and floodplains of the Chandalar, Christian, Sheenjek, and Upper Yukon Rivers. This Section is a relatively flat, marshy basin patterned by braided and meandering streams, numerous thaw and oxbow lakes, and meander scars. Elevation ranges from 300 to 820 ft (90 to 250 m).

**Potential Natural Vegetation.** Bottomland spruce-aspen-birch grow on the better drained alluvial sites. Alder and willow form thickets on newly exposed alluvial sites, which are subject to periodic flooding. The wettest sites have black spruce, willow, or graminoid marsh cover.

## Yukon Intermontane Plateaus Tayga - Meadow

The area of these Sections, located in central Alaska, is about 55,000 mi<sup>2</sup> (142,400 km<sup>2</sup>).

### Section M131A--Nulato Hills

**Geomorphology.** The Nulato Hills generally consist of northeast-trending, even-crested ridges having rounded summits and gentle slopes. Valleys are narrow and flat-bottomed. Elevation ranges from sea level to 4,040 ft (1,230 m).

**Potential Natural Vegetation.** Most of the area supports alpine tundra vegetation of sedges and prostrate shrubs (e.g., willows). Barren areas are frequent at high elevations. Spruce-aspen-birch forests occur at lower elevations.

### Section M131B--Kuskokwim Mountains

**Geomorphology.** The Kuskokwim Mountains are northeast-trending ridges having rounded-to-flat summits and broad, gentle slopes. Deep narrow valleys are prevalent. Elevation ranges from 1,310 to 4,430 (400 to 1,350 m).

**Potential Natural Vegetation.** Open black spruce forests are abundant. Alpine tundra vegetation of sedges and shrubs (willow and alder) cover most hills and ridges. White spruce-paper birch communities occur on hills bordering the Yukon and Kuskokwim Rivers.

### Section M131C--Nushagak-Lime Hills

**Geomorphology.** This Section comprises largely rounded, flat-topped ridges having broad, gentle slopes and broad, flat, or gently sloping valleys. Elevation ranges from 1,310 to 4,270 ft (400 to 1,300 m).

**Potential Natural Vegetation.** Spruce-aspen-birch forests prevail at low elevations, whereas alpine tundra heath meadows and barrens dominate at high elevations.

## **Alaska Range Humid Tayga - Tundra - Meadow**

These Sections are located in southern Alaska, partly bordering Canada. The area of these Sections is about 61,000 mi<sup>2</sup> (158,000 km<sup>2</sup>).

### **Section M135A--Alaska Mountains**

**Geomorphology.** This Section consists of steep, rugged mountain ridges separated by broad valleys. Elevation ranges from 1,640 ft (500 m) in valleys to greater than 13,125 ft (4,000 m) on mountain peaks. Mount McKinley is about 20,320 ft (6,200 m).

**Potential Natural Vegetation.** A substantial portion of the area is barren of vegetation. Where vegetation exists, alpine and moist tundra communities of prostrate plants predominate. Riparian spruce-hardwood forests occur infrequently at low elevations.

### **Section M135B--Wrangell Mountains**

**Geomorphology.** This Section, comprised of steep, rugged mountains of volcanic origin, is extensively covered by ice fields and glaciers. Elevation ranges from 1,970 to about 16,400 ft (600 to 5,000 m).

**Potential Natural Vegetation.** Most areas are barren of vegetation. Where vegetation occurs, alpine tundra communities of prostrate shrubs, forbs, grasses, and lichens predominate.

## **Upper Yukon Tayga - Meadow**

This Section is located in east-central Alaska, bordering Canada. Its area is about 68,400 mi<sup>2</sup> (177,200 km<sup>2</sup>).

### **Section M139A--Upper Yukon Highlands**

**Geomorphology.** The area mainly consists of rounded, low mountains and hills, interspersed frequently by valleys. Elevation ranges from 985 to 5,900 ft (300 to 1,800 m).

**Potential Natural Vegetation.** Forests of white spruce, birch, and aspen dominate most lower slopes in the south and south-facing slopes in the north. Black spruce forests typically grow at higher elevations, on all north-facing slopes in the south, and on all but steep south-facing slopes in the north. Black spruce forests also occur at lower elevations where drainage is impeded. Highest elevations are either barren or have tundra vegetation, with sedge and mosses dominating poorly drained sites and low-growing shrubs on drier sites (e.g., scrub birch and willow).

## **Laurentian Mixed Forest**

These Sections are located in the north-central and northeastern conterminous States, including parts of Minnesota, Wisconsin, Michigan, Pennsylvania, New York, Vermont, and Maine. The area of these Sections is about 147,300 mi<sup>2</sup> (381,500 km<sup>2</sup>).

### **Section 212A--Aroostook Hills and Lowlands**

**Geomorphology.** The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain characterized by gently rolling terrain and pitted outwash plains, with scattered, low, rounded mountains (monadnocks). Mass wasting and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 600 to 1,000 ft (180 to 300 m). Local relief ranges from 300 to 500 ft (90 to 150 m). Gentle slopes cover 50 to 80 percent of the landscape, 50 to 75 percent in the lowlands. Subenvelop elevation range is 325 to 650 ft (100 to 200 m).

**Potential Natural Vegetation.** Kuchler vegetation types are northern hardwood and northern hardwood-spruce. Regional characterizations of important vegetation types include lowland red spruce-balsam fir and northern hardwood-conifer. The western boundary of this region coincides with a vegetation transition zone where species characteristic of more temperate regions are replaced by species of more boreal affinity.

**Disturbance Regimes.** Disturbance from fire and large scale windthrow is rare. Historical documentation of fire occurrence in this region shows considerable variability through time. Wind disturbance to individual trees and groups of trees may be common. Ice and wet, heavy snow can cause extensive crown damage, particularly in conifer types. Insect and disease disturbances occur, commonly from defoliating insects and particularly from the spruce budworm. Although the distribution of modern and pre-settlement forest types match well regionally, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

### **Section 212B--Maine and New Brunswick Foothills and Eastern Lowlands**

**Geomorphology.** The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain dominated by a broad, central, marine plain. The rest of the Section is characterized by gently sloping hills and low, rounded mountains (monadnocks). The Section exhibits some glacial features, primarily kames, eskers, and terraces. Mass wasting and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 400 to 1,000 ft (120 to 300 m); local relief ranges from 100 to 500 ft. (30

to 150 m). Gentle slopes cover 50 to 80 percent of the landscape, 50 to 70 percent in the lowlands. Subenvelop elevation ranges from 330 to 980 ft (100 to 300 m).

**Potential Natural Vegetation.** Kuchler vegetation types are northern hardwood and northern hardwood-spruce. Regional characterizations of important vegetation types include montane red spruce-balsam fir, lowland spruce-fir, northern hardwood-conifer.

**Disturbance Regimes.** Disturbance from fire and large scale windthrow are rare. Historical documentation of fire occurrence in this region shows considerable variability through time. Individual to few tree group level wind caused disturbance may be common. Ice and heavy snow can cause extensive crown damage, particularly in conifer types. Insect and disease disturbance have resulted from defoliating insects, particularly spruce budworm and hemlock looper; impact from beech bark disease and white pine blister rust have been severe. Significant brown ash dieback has also occurred. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Forest land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest.

## **Section 212C--Fundy Coastal and Interior**

**Geomorphology.** The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain with a few low, rounded mountains (monadnocks). The Section exhibits some glacial features, primarily kames, eskers, and terraces. Topography is gently rolling, sloping toward the coastal zone, which is characterized by low ridges surrounded by poorly drained and relatively flat terrain. Coastal and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 100 to 400 ft (30 to 120 m), with local relief from 1,000 to 1,400 ft (300 to 425 m). Gentle slopes cover 50 to 80 percent of the area; 50 to 75 percent are found in the lowlands. Subenvelop elevation range is 0 to 160 ft (0 to 50 m).

**Potential Natural Vegetation.** Kuchler vegetation types are northeastern spruce-fir, northern hardwood, and northern hardwood-spruce forests. Regionally described important vegetation types include lowland red spruce-balsam fir, coastal spruce-fir, coastal raised peatlands, and coastal plateau peat lands.

**Disturbance Regimes.** Disturbance from fire is rare, although historical documentation of fire occurrence in this region shows considerable variability through time. Severe wind events can cause considerable blowdown in forested communities near coastal areas. Tidal flooding associated with storms occurs along the coast. Insect and disease disturbances have resulted from hemlock looper, spruce budworm, and European larch canker. Severe impacts have resulted from beech bark disease. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this

century and the last. Land has been cleared and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

## **Section 212D--Central Maine Coastal and Interior**

**Geomorphology.** The Section is part of the New England geomorphic province. It is a glacially scoured and dissected peneplain, sloping toward the coast. It exhibits some glacial features, mainly kames, eskers, and terraces. Flat to gently rolling terrain is characteristic except around Penobscot Bay, where the terrain is dominated by knobby bedrock ridges and high hills that have a linear, southwest to northeast trend. Coastal and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from sealevel to 400 ft (120 m); Local relief ranges from 100 to 1,000 ft (30 to 305 m). Gentle slopes occupy 50 to 80 percent of the area; 50 to 75 percent are in the lowlands. Subenvelop elevation ranges from 0 to 50 ft (0 to 15 m).

**Potential Natural Vegetation.** Kuchler vegetation types are northeastern spruce-fir, northern hardwood-spruce, and northern hardwood forests. Regionally this area is described as a transitional zone. From west to east the forest transition ranges from northern Appalachian oak, pine, and mixed hardwoods typical of the southern New England coastal plain to northern coastal spruce-fir and spruce-fir-northern hardwood communities. From south to north, coastal communities grade to more montane spruce-fir and northern hardwood communities. Coastal pitch pine communities are represented on sand dunes and outcrops in the coastal zone.

**Disturbance Regimes.** Disturbance from fire is uncommon, but historical documentation of fire occurrence in this region indicates this has varied. Severe winds can cause considerable blowdown in forested communities near coastal regions. Tidal flooding associated with storms occurs along the coast. Insect and disease disturbances from beech bark disease and white pine blister rust have been severe. Impacts from European larch canker on coastal larch and dwarf mistletoe on coastal white spruce are ongoing. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Land has been cleared and farmed since early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and much was allowed to revert to forest land.

## **Section 212E--St. Lawrence and Champlain Valley**

**Geomorphology.** The Section is part of the St. Lawrence Valley geomorphic province. The eastern half is dominated by Lake Champlain, which is bracketed by wave-cut terraces and low hills. The western prong is characterized by marine plains and rolling, low parallel ridges. Lake shore and fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 80 to 1,000 ft (25 to 300 m), increasing gradually from the St. Lawrence River southward and from Lake Champlain to the east and west. Local relief ranges

from 500 to 1,000 ft. Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent in the lowlands. Subenvelop elevation range is 0 to 650 ft (0 to 200 m).

**Potential Natural Vegetation.** Kuchler vegetation types are northern hardwood and beech-maple forest. Regional characterizations of important vegetation types include transition hardwood-white pine-hemlock, northern hardwood-elm-red maple, northern hardwoods, aspen-gray birch-paper birch, and pitch pine-heath barrens.

**Disturbance Regimes.** Fire is an important, small scale disturbance on areas characterized by xeric edaphic extremes. Drought can be an important climatic influence. About 75 percent of this area is in agriculture; the remaining area is in forest. As in other areas dominated by agriculture in this region, extensive forest land occurs, generally on very dry or wet sites and is second or even third growth. Insect and disease disturbances have resulted from Dutch elm disease, beech bark disease, gypsy moth, false pine budworm, and butternut canker.

## **Section 212F--Northern Glaciated Allegheny Plateau**

**Geomorphology.** The Section is part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau of moderate relief, over-printed with notable moraine, drumlin, kettle, scour, and other glacial features. The Section is characterized by irregular topography-- broadly rolling with high hills, and steep valleys typified by the north-south trending Finger Lakes. It is demarcated by north-facing escarpments south of and paralleling Lake Ontario, and east-facing escarpments west of and paralleling the Hudson River, the most prominent of which stands up to 2,000 ft (610 m) above the valley. Mass wasting, karst solution, fluvial erosion, and transport and deposition are the primary operating geomorphic processes. Elevation ranges from 650 to 1,970 ft (200 to 600 m); local relief ranges from 400 to 1,000 ft (120 to 300 m). Gentle slopes cover 20 to 50 percent of the landscape; more than 75 percent are in the upland. Subenvelop elevation range is 650 to 1,000 ft (200 to 300 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwoods and Appalachian oak forest. Regionally defined important vegetation types include Appalachian oak-hickory forest, Appalachian oak-pine forest, beech-maple mesic forest, and hemlock-northern hardwood forest.

**Disturbance Regimes.** Fire was historically of some importance in maintaining oak dominated communities in the central part of the plateau and elsewhere on southern and western slopes of this region. Insect and disease disturbances have resulted from chestnut blight, beech bark disease, sugar maple defoliators, and ongoing ash dieback. Climatic influences include occasional droughts, particularly in the central part of the region.

## **Section 212G--Northern Unglaciated Allegheny Plateau**

**Geomorphology.** This Section is part of the Appalachian Plateaus Geomorphic Province. It is a maturely dissected plateau characterized by sharper ridge tops and narrower valleys than the glaciated portions of the plateau to the north and west. Drainage is dendritic. Mass wasting,

fluvial erosion, transport and deposition are the primary geomorphic processes currently operating. Broad, low amplitude, northeast-southwest trending folds imperceptibly tilt the horizontal sedimentary layers and lend a subtle grain to the topography. Elevation ranges from 1,000 to 2,000 ft (305 to 610 m). Local relief ranges from 100 to 670 ft (30 to 205). Local relief ranges from 100 to 670 ft (30 to 205 m).

**Potential Natural Vegetation.** Kuchler vegetation types are Northern hardwoods forest and Appalachian oak forest. Eastern hemlock, and American beech-hemlock forests are abundant on moist sites; American beech-sugar maple forests are common on the better drained sites. Common associates include red maple, sweet birch, black cherry, white ash, yellow birch, eastern white pine, yellow-poplar, and cucumbertree.

**Disturbance Regimes.** Tornadoes and other windstorms commonly cause catastrophic disturbances on sites tens to thousands of acres in size. Periodic outbreaks of insects (e.g., gypsy moth, elm spanworm, cherry scallop shell moth) and diseases (e.g., chestnut blight, beech bark disease) may cause significant tree defoliation and mortality. Lightning may be an important cause of individual tree mortality. Ice storms have periodically caused large-scale tree crown dieback. Intensive human uses of the land, including logging and oil and gas development, have disturbed this landscape for more than the past one hundred years. Moderate to high deer populations have existed nearly continuously for the past 70 years, causing significant changes in plant composition and structure of the forests.

## **Section 212H--Northern Great Lakes**

**Geomorphology.** This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling lowland (glacial ground moraine) and flat outwash or lacustrine plain, with dune fields near the Great Lakes. Cropping out of the lowlands and plains are partially-buried end moraines and mounded ice-contact hills that trend roughly parallel to the Great Lakes shorelines. Drainage is dendritic with pronounced terracing. Geomorphic processes operating in the Section are fluvial erosion, transport, and deposition; lake-shore erosion and deposition; and minor dune construction. Elevation ranges from 580 to 1,725 ft (176 to 523 m). In Upper Michigan, the elevation range is mostly between 580 to 850 ft (176 to 259 m). Local relief is generally less than ten feet except in moraines, where it may range up to 325 feet.

**Potential Natural Vegetation.** Kuchler vegetation types are northern hardwoods dominating on moraines and stratified ice-contact hills, and northern hardwood-fir forests on similar landforms in the coldest climatic regimes of Upper Michigan. Great Lakes pine forests occurred on outwash and lacustrine sands, with jack pine forests occupying outwash and lacustrine sand plains, and white and red pine forests on more mesic areas and grading into the ice-contact hills. Conifer bogs occupied low-lying areas in Upper Michigan and near the Straits of Mackinac. The elm-ash forest dominated a part of the Saginaw Bay lowlands in the southeastern part of the Section.

**Disturbance Regimes.** Fire is the dominant natural disturbance in pine forests, with catastrophic fires during pre-European settlement times, occurring in 80 to 250 year intervals. Ground fires occurred more frequently. Gap-phase windthrow is the primary disturbance regime in northern

hardwood forests, with about one percent of the canopy affected annually in patches mostly less than a half acre. Larger blowdowns due to windshear and tornadoes occur infrequently, but can cause extensive localized disturbance.

### **Section 212J--Southern Superior Uplands**

**Geomorphology.** This Section comprises the eastern two-thirds of the Superior Upland geomorphic province. About half the Section is level to gently rolling lowlands (glacial ground moraines) and flat laustrine plain; the rest is hillier uplands with escarpments. The lowlands and plains are intermittently overlain by low, undulating ridges (glacial end moraines) and by other mounded or hummocky glacial features (e.g., kames and eskers). Kettled glacial outwash plains are common. Most prominent of the uplands are linear "ranges" trending southwest-northeast along the Superior shore. Drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section are lake-shore and fluvial erosion, transport and deposition. Elevation ranges from 600 to 1,980 ft (183 to 603 m). Local relief is generally 100 to 600 ft (30 to 183 m).

**Potential Natural Vegetation.** Kuchler vegetation types are maple-beech-birch, aspen-birch, spruce-fir forests. More recent vegetation classification is more specific. Acer-Tsuga Series and Acer-Series occur on mesic landforms; Tsuga Series occur on dry-mesic landforms; Pinus Series occur on xeric landforms; and Tsuga-Thuja Series occur on wetland landforms.

**Disturbance Regimes.** Light to medium (10 to 40 percent canopy removal) windfall disturbance dominates in northern hardwoods on mesic landforms. In pine and mixed-pine cover types on xeric and dry mesic landforms, fire is the dominant disturbance, occurring at about 50 to 250 year intervals. Widespread thunderstorm downbursts occur at only about 1,200 to 2,000 year intervals.

### **Section 212K--Western Superior**

**Geomorphology.** The Section comprises part of the Superior Uplands geomorphic province. It is mostly poorly drained, flat to slightly rolling ground moraine and plain-pitted outwash with kettles intermittantly overlain by low, undulating ridges (glacial end moraines) and drumlins. Poor to unintegrated (chaotic) drainage dominates, except along the St. Croix River where dendritic drainage is established in and adjacent to a glacial channel. Geomorphic processes operating in the Section are fluvial erosion, transport, and deposition. Elevation ranges from 650 to 1,650 ft (200 to 500 m). Local relief is generally less than 100 ft (30 m), but ranges up to 200 ft (60 m) in pitted outwash areas.

**Potential Natural Vegetation.** Primarily coniferous and deciduous forests dominate. Some jack pine and oak barrens are on the Bayfield peninsula. Kuchler types are mapped as Great Lakes pine forest, Great Lakes spruce-fir forest, and maple-basswood forest.

**Disturbance Regimes.** Fires were very intensive, frequent, and quite severe on the landscape. This helped to keep a conifer dominated uplands Forest. The Jack pine and oak barrens were also maintained by intensive fires. Logging, grazing, and farming also caused large dramatic disturbances.

## **Section 212L--Northern Superior Uplands**

**Geomorphology.** The Section is part of the Superior Uplands geomorphic province. It is a glacially scoured peneplain characterized by level-to-rolling uplands and hills. Most prominent of the hills are linear ranges trending southwest to northeast along Lake Superior and parallel ranges farther north (Mesabi, Vermillion). There is a prominent escarpment along Superior's shore. Innumerable small lakes and potholes dominate the northern part of the Section. An east to west trending series of small lakes occurs in the northeasternmost portion of the Section; and an east to west trending series of larger lakes follows a fault zone in the most western part of the Section. Elevation ranges from 600 to 2,280 ft (183 to 695 m). Local relief ranges from 600 (180 m). General relief is 10 to 60 ft (3 to 20 m). Upland areas rise 300 to 600 ft (90 to 180 m) above lowlands, interspersed between lakes or bogs.

**Potential Natural Vegetation.** Dominant vegetation includes mixed pine with aspen-birch, white pine, red pine, jack pine, black spruce, balsam fir, and white cedar, with less common occurrences of northern hardwoods along the shore of Lake Superior. Kuchler types are Great Lakes spruce-fir forest and Great Lakes pine forest.

**Disturbance Regimes.** Fire, windstorm, insect infestation, animal browsing, and logging are major disturbances. Fires have burned 80 to 90 percent of the area one to several times during the last three hundred to four hundred years. High intensity crown fires tend to occur once every one hundred fifty to two hundred years. Low intensity fires tend to occur about every twenty to forty years. Atmospheric pollutants of greatest concern are mercury, ozone, and acidifying substances. Of these, only mercury has resulted in a demonstrated effect on resource uses through health-based limits on fish consumption by humans. Ozone impacts on vegetation and mercury impacts on wildlife (other than fish) are suspected, but have not been adequately studied to assess severity.

## **Section 212M--Northern Minnesota and Ontario**

**Geomorphology.** The Section is part of the Central Lowlands geomorphic province. It is dominated by a flat glacial lake plain. Some low moraines and beach ridges occur, especially in the northwest and east. The Section is poorly drained, with mostly boggy ground. Anoxic accumulation of plant material is the dominant geomorphic process operating; fluvial erosion, transport and deposition occur in the northwest. Elevation ranges from 1,100 to 1,500 ft (330 to 450 m). Local relief is less than 50 ft (15 m).

**Potential Natural Vegetation.** Kuchler types are (primarily) conifer bog, with lesser extent of Great Lakes spruce-fir and Great Lakes pine. Sedge fen, black spruce-sphagnum bog, and white

cedar-black ash swamp dominates the Section. Some low moraines and beach ridges are dominated by jack pine or trembling aspen-paper birch forests.

**Disturbance Regime.** Fire occurred on the peat lands. Insect infestations, such as spruce budworm probably lead to fires. Water level fluctuation, caused both by short-term climatic changes and by beaver dams, probably contributed to tree mortality.

## **Section 212N--Northern Minnesota Drift and Lake Plains**

**Geomorphology.** This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling lowland characterized by its glacial features. outwash plains, kettles, bogs, lake plains, till plains, narrow outwash channels, morainal ridges, and drumlin fields. Drainage is poorly to moderately integrated and includes the headwaters of the Mississippi River. Fluvial erosion, transport and deposition are the primary operating geomorphic processes. Elevation ranges from 1,100 to 1,850 ft (330 to 560 m). Local relief ranges from 50 to 165 ft (15 to 50 m).

**Potential Natural Vegetation.** Vegetation includes a mix of conifer and hardwood forest communities. Northern hardwoods grow in the south and around larger lakes. Conifers (Great Lakes pine and Great Lakes spruce-fir) are associated with outwash plains and coarsely textured end moraines. Large areas of lowlands are dominated by potential natural communities of black spruce, tamarack, and sedge meadows. Kuchler types are Great Lakes pine forest, Great Lakes spruce-fir forest, and conifer bog.

**Disturbance Regimes.** Fire occurred historically on about a 10 to 40 year rotation within much of the Section, accounting for a dominance of upland conifers and trembling aspen-birch forests.

## **Coniferous Forest - Alpine Meadow**

These Sections are located in the northeastern conterminous States, including parts of New York, Vermont, New Hampshire, Massachusetts, and Maine. The area of these Sections is about 43,600 mi<sup>2</sup> (112,900 km<sup>2</sup>).

## **Section M212A--White Mountains**

**Geomorphology.** The Section is part of the New England geomorphic Province. It is a glacially scoured, maturely dissected, irregular highland characterized by clusters of low, rounded mountains and scattered monadnocks. Highest elevations occur in a wide belt trending southwest to northeast through the Section, ending in central Maine. Glacial features are most evident in the Section's southern half and include cirques carved into the high peaks and U-shaped valleys, as well as kames, eskers, and drumlins. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes. General elevation ranges from 1,000 to 4,000 ft (300 to 1,200 m); isolated peaks are greater than 5,000 ft (1,500 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gentle slopes cover 20 to 50 percent of the area; 75 percent of gentle slopes occur in the lowland. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include northern hardwood-conifer, montane spruce-fir, lowland spruce-fir, alpine krummholz, and alpine meadow. Robbin's cinquefoil is a Federally listed plant, unique to alpine communities of the Presidential Range in New Hampshire.

**Disturbance Regimes.** Montane forests in this region lack significant fire regimes and are characterized by large blowdown disturbances resulting from hurricanes or other severe wind events and smaller area, single tree phenomena. Higher elevation forests are often characterized by an even-aged windthrow disturbance phenomenon known as fir-waves. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, spruce beetle, severe beech bark disease, and butternut canker. At higher elevations, spruce decline is related to severe winter injury and soil cation depletion. Forest composition at lower elevations has been influenced by agriculture dating from the colonial period and subsequent farm abandonment since about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally the distribution of modern and pre-settlement forest types matches well, 250 years of land use activity has affected forest structure and composition across the landscape. The land has been both selectively and intensively logged throughout this century and the last. Forest land has been cleared of trees and farmed since the time of early settlement. Beginning around 1870, land unprofitable for agriculture was abandoned and often allowed to revert to forest land.

## **M212B--New England Piedmont**

**Geomorphology.** The Section is part of the New England geomorphic Province. It is a glacially scoured, maturely dissected peneplain with open, low mountains and monadnocks. Glacial features include kames, eskers, drumlins, and lacustrine plains. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 600 to 3,000 ft (180 to 900 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gently sloping land covers 20 to 50 percent of the area; more than 50 percent is found in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood and northern hardwood-spruce forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

**Disturbance Regimes.** This area occupies the lower end of a regional disturbance gradient, ranging from relatively frequent occurrence of fire and hurricane winds in southern New England and New England coastal areas to a very low incidence of disturbance in more northern inland sites. Percent of land in forest continues to increase over time. However, composition of present day forest on a landscape scale is heavily influenced by agriculture dating from the colonial period and subsequent farm abandonment from about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally the distribution of modern and pre-settlement forest types match well, 250 years of land use activity have affected forest structure and composition across the landscape. Insect and disease disturbances have resulted

from chestnut blight, gypsy moth, spruce budworm, severe beech bark disease, butternut canker, and periodic birch and sugar maple defoliators. At higher elevations, spruce decline is related to severe winter damage and soil cation depletion.

## **Section M212C--Green, Taconic, Berkshire Mountains**

**Geomorphology.** The Section is part of the New England geomorphic Province. North of central Vermont, the Green Mountains are north to south trending, linear ranges. To the south, they and the Berkshires are highlands characterized by dissected, flat-topped plateaus (up-warped peneplains) with scattered monadnocks. The Taconic Mountains are west of and separated from the southern Green and Berkshire Mountains by a broad, nearly continuous valley (the Marble Valley) about 1,500 ft (460 m) lower than the highlands on either side. The Taconic Mountains contrast with the plateaus to the east by being more deeply cut into peaks, sharper ridges and canyons with a linear, north to south topographic trend. Scattered glacial features include kames and eskers; the mountains have been smoothed and rounded by glacial scour. Mass wasting, minor karst solution, fluvial erosion, transport and depositions are the primary geomorphic processes operating. Elevation ranges from 600 to 4,000 ft (180 to 1,200 m) with isolated peaks greater than 4,300 ft (1,300 m). Local relief ranges from 1,000 to 3,000 ft (400 to 900 m). Gentle slopes cover less than 20 to 50 percent of the Section; 75 percent occurs in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood, northern hardwood-spruce, and northeastern spruce-fir forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, and transition hardwood-conifer.

**Disturbance Regimes.** This area of New England occupies the lower end on a regional disturbance gradient ranging from relatively frequent occurrence of fire and hurricane winds in southern New England and New England coastal areas to a very low incidence of disturbance in more northern inland sites. Percentage of land in forest continues to increase over time. Composition of present day forest on a landscape scale is heavily influenced by agriculture dating from the colonial period and subsequent farm abandonment from about 1870, as well as by selective logging of certain species, particularly conifers. Although regionally, the distributions of modern and pre-settlement forest types match well, 250 years of land use activity has affected forest structure and composition across the landscape. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, periodic birch and sugar maple defoliators, periodic hemlock looper, ash dieback, and butternut canker. At higher elevations, spruce decline is related to severe winter damage and soil cation depletion.

## **Section M212D--Adirondack Highlands**

**Geomorphology.** The Section is also known as the Adirondack geomorphic Province, but includes a small part of the Appalachian Plateau (Tug Hill Plateau) at the southwest corner. It is a dissected, asymmetrical dome in overall configuration. It is most mountainous, highest, and

steepest in the north and east, with lower, rolling hills farther south and west. Local relief exceeds 3,000 ft (915 m). Glaciers covered the dome, producing cirques and other scour features, moraines, lake plains, and a prominent esker system in the north-central area. Tug Hill is a southwest-tilting plateau separated from the Adirondacks by the Black River Valley 1,200 ft (365 m) below the plateau. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation extends from 500 to 5,344 ft (150 to 1,630 m); local relief ranges from 1,000 to 3,000 ft (300 to 900 m). Gentle slopes cover 20 to 50 percent of the area; more than 75 percent occurs in lowlands. Subenvelop elevation ranges from 200 to 1,800 (60 to 550 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood-spruce and northeastern spruce-fir forest. Regionally-defined important vegetation types include montane spruce-fir, lowland spruce-fir, northern hardwood-conifer, alpine krummholz, and alpine meadow.

**Disturbance Regimes.** Montane spruce-fir and spruce-northern hardwood forests lack significant fire regimes and are characterized by blowdown disturbances from severe wind events and smaller area, single tree phenomenon. Higher elevation forests are often characterized by even-aged windthrow disturbance phenomenon known as fir-waves. Insect and disease disturbances have resulted from gypsy moth, spruce budworm, periodic severe spruce beetle, beech bark disease, and sugar maple defoliators; scleroderis canker on red pine is ongoing. At higher elevations, spruce decline is related to severe winter injury and soil cation depletion. Hardwood-dominated communities are more extensive now than in pre-settlement times due to intensive and selective logging of conifers up to about 1900, followed by fire.

## **Section M212E--Catskill Mountains**

**Geomorphology.** The Section is an inclusion in the northeast corner of the Appalachian Plateau geomorphic Province. Topographically, it is a maturely dissected plateau with a steep, 2,000 to 3,000 foot (610 to 915 m) scarp on its eastern margin (the Catskill Mural Front). It slopes gently westward, where it merges into the hilly landscape that typifies the rest of the Allegheny Plateau. The Catskills have the highest elevations on the plateau. They are characterized by steeply rolling uplands and ridges interlaced with deep ravines. Glaciation is expressed mostly by rounded hilltops and by cirques and other scour features. Mass wasting, fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 900 to 4,200 ft (275 to 1,260 m), peak elevations range from 3,000 to 4,200 ft (900 to 1,260 m); subenvelop elevation ranges from 900 to 2,500 ft (270 to 910 m). Local relief is from 1,000 to 3,000 ft (300 to 910 m). Less than 20 percent of area is covered by gentle slopes.

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood and northern hardwood-spruce forest. Regionally-defined important vegetation types include central hardwoods, transition hardwoods, northern hardwood-conifer, and montane spruce-fir.

**Disturbance Regimes.** Significant fire regime is absent. Higher elevation spruce-fir forests are characterized by blowdown disturbances from severe wind events and smaller area, single tree mortality. Insect and disease disturbances have resulted from beech bark disease, Dutch elm disease, hemlock woolly adelgid, and chestnut blight, which have resulted in the reduction of some species. Selective logging through about 1880 impacted forest composition. Hemlock, once an abundant species, was selectively logged and has not come back readily.

## **Eastern Broadleaf Forest (Oceanic)**

These Sections are located in the eastern conterminous States, including parts of Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, New York, New Jersey, Rhode Island, Massachusetts, New Hampshire, and Maine. The area of these Sections is about 104,500 mi<sup>2</sup> (270,650 km<sup>2</sup>).

### **Section 221A--Lower New England**

**Geomorphology.** The Section comprises parts of the New England, Piedmont, and Coastal Plain geomorphic provinces. Cape Cod and Long Island are large terminal moraine complexes modified by coastal processes. Glacial features such as small to large delata plains, lacustrine basins, eskers, and extensive drumlin fields are widespread. The Section gradually descends in a series of broad, hilly plateaus to the coastal zone. Central Connecticut and western Massachusetts are characterized by a north to south trending basin, a lowland plain, punctuated with a central linear ridge. Primary geomorphic processes are coastal and fluvial erosion, transport and deposition, and mass wasting. Elevation ranges from sea level to 1,500 ft (450 m). Some high hills (monadnocks) are 2,000 ft (600 m). Local relief ranges from 100 to 1,000 ft (30 to 300 m). Gentle slopes cover less than 20 to 80 percent of the area; 50 to 75 percent are in lowlands. Subenvelop elevation ranges from 0 to 650 ft (0 to 200 m).

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood, Appalachian oak, and northeastern oak-pine forest. Regionally-defined important vegetation types include northern hardwood-hemlock-white pine, central hardwoods, coastal pitch pine, maritime oak, and maritime red cedar.

**Disturbance Regimes.** Central and coastal New England have intermediate to high occurrences of fire and hurricane winds (thirty to fifty years) relative to inland New England sites. Tidal flooding associated with storms occurs along the coast. Regionally, the distribution of modern and pre-settlement forest types match well. At a landscape scale, modern forest characteristics are strongly controlled by land use, particularly agriculture dating from colonial time and subsequent farm abandonment from about 1850. Insect and disease disturbances result from gypsy moth, beech bark disease, chestnut blight, Dutch elm disease, hemlock woolly adelgid, periodic pitch pine and hemlock looper, oak leaf tier damage, and red pine scale and adelgid.

## Section 221B--Hudson Valley

**Geomorphology.** The Section is the northernmost extension of the Ridge and Valley geomorphic province. It is characterized by a linear lowland, a glacial lake plain in part, bounded on either side by high escarpments. The lowland was created by graben-faulting, easily eroded bedrock, and glacial scour. Fluvial erosion, transport and deposition, and mass wasting are the primary geomorphic processes operating. Minimum elevations range from about 200 ft (61 m) in the north to near sea level south of Long Island Sound. Maximum local elevations are generally under 500 ft (152 m) but range to 1,000 ft (305 m). Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent occurs in uplands.

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood and Appalachian oak forest. Regionally-defined important vegetation types include central hardwoods, transition hardwoods, and northern hardwoods grading from south to north. Albany sand plains support pitch pine-scrub oak communities.

**Disturbance Regimes.** This region generally lacks large-scale natural disturbance regimes; however, fire is an important small-scale disturbance in the maintenance of pitch pine-scrub oak communities on sand plains and ridges along the middle to lower Hudson River Valley. In general, forest land occurs on edaphic extremes, i.e., steep, shallow, or otherwise unsuitable land for farming or settlement. All forest land is in second or third growth. Insect and disease disturbances have resulted from chestnut blight, dutch elm disease, beech bark disease, butternut canker, and ongoing woolly adelgid infestation.

## Section 221C--Upper Atlantic Coastal Plain

**Geomorphology.** The Section is part of the Coastal Plain geomorphic province. It is characterized by a series of moderately dissected, northeast to southwest trending terraces that get progressively lower toward the coastline. It has a prominent lowland that forms its northwest border. The coastline is characterized by dune fields, beaches, lagoons, embayments, and barrier islands. Drainage is dendritic; coastal and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 0 to 300 ft (0 to 100 m). Most of the area is less than 150 ft (50 m).

**Potential Natural Vegetation.** Kuchler's map shows mostly northeastern oak-pine forest, with some oak-hickory-pine forest adjacent to Delaware Bay, and some fringes of northern cordgrass prairie along the Atlantic coast. Braun's discussions tell of cedar bogs with transition pine forests and deciduous swamps. There are also pine plains and grassy savannas, especially in the pine barrens area.

**Disturbance Regimes.** Historically, fire was a significant natural disturbance. Most of the vegetative types owe their existence to repeated fires. Other disturbances include bog-iron mining; construction of ore furnaces; utilization of clay deposits and glass sands; and logging. Early sawmills were driven by water power. Cedar bogs were exclusively logged which resulted

in an increase in deciduous swamps. The cranberry industry caused the construction of small dams, sluice gates, and ditches to facilitate drainage. Although peat was low grade, some harvesting did take place.

### **Section 221D--Northern Appalachian Piedmont**

**Geomorphology.** The Section comprises part of the Piedmont geomorphic province. Most of the Section is a maturely dissected peneplain, sloping gently toward the coast. It is hilly to rolling terrain with a few high ridges, where local relief can be up to 1,200 ft (365 m). The Section is crossed southwest to northeast by a broad, structural basin forming a lowland plain, an extension of the one noted in Section 221A. Drainage is dendritic; fluvial erosion, transport and deposition, and mass wasting are the primary geomorphic processes operating. Elevation ranges from 80 to 1,650 ft (25 to 500 m). The predominant elevation ranges from 300 to 1,000 ft (100 to 300 m).

**Potential Natural Vegetation.** Prior to Euro-American settlement in the early 17th century, the native vegetation consisted mainly of oak and hickory. Chestnut, yellow-poplar, ash, walnut, and elm were associated species. Maple was dominant on the wet bottomlands of the Piedmont area. Currently Appalachian oak forest (Kuchler) and sugar maple-mixed hardwoods, hemlock-mixed hardwoods, oak-chestnut (Braun) dominate.

**Disturbance Regimes.** Historically, fire was a significant natural disturbance. Gypsy moth and chestnut blight have had effects on the vegetation.

### **Section 221E--Southern Unglaciaded Allegheny Plateau**

**Geomorphology.** This Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high hills, sharp ridges, and narrow valleys. An exception is the broad Teays Valley, created by a major, preglacial river. The valley was dammed by an ice sheet during the Pleistocene and abandoned by the river after the melt. Local relief in the Section exceeds 2000 ft (610 m) along the New River Gorge, but is generally much less. Drainage is dendritic; mass wasting, karst solution, and fluvial erosion, and transport and deposition are the primary geomorphic processes operating. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit hummocky or gouged topography. Elevation ranges from 650 to 1,300 ft (200 to 400 m). Local relief is generally about 160 to 325 ft (50 to 100 m).

**Potential Natural Vegetation.** Kuchler types are mapped as mixed mesophytic forest and Appalachian oak forest. Other recognized communities include mixed oak forest, oak-hickory-chestnut forest, oak-pine forest, hemlock forest, beech forest, floodplain forest and swamp forest.

**Disturbance Regimes.** Historically, low-intensity fires probably occurred at a given site at five to 10 year intervals. Fires of higher intensity occurred at intervals of up to 50 years. Dry ridges and slopes facing south to west burned more frequently than moist creek bottoms and slopes facing north to east. Annual spring flooding occurred annually to some degree along major rivers. The forests were probably affected locally by insect and tree diseases. Climatic-influenced disturbances included winter ice storms, occasional tornadoes, and periodic flooding along major river floodplains. Natural disturbances to the streams and rivers include floods and droughts. Man-made disturbances to streams include channelization, construction of locks and dams, and input of industrial waste, sewage, mining wastes, and soil.

### **Section 221F--Western Glaciated Allegheny Plateau**

**Geomorphology.** The Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected upland modified by glaciation. It is characterized by rounded hills, ridges, and broad valleys. Glacial features include valley scour, ground moraines, kames, eskers, and kettled outwash plains. Drainage is dendritic; mass wasting and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief ranges from 6 to 50 ft (2 to 15 m).

**Potential Natural Vegetation.** Kuchler types are mapped as beech-maple forest, Appalachian oak forest, northern hardwood forest, mixed mesophytic forest, and a small extent of oak-hickory forest. Other recognized types include maple-ash-oak swamp forest, wet beech forest, beech-sugar maple forest, oak-maple forest, and mixed oak forest.

**Disturbance Regimes.** Forests in the more rugged ravines and on dissected slopes were locally affected by insect and tree diseases and windstorms. The terraces and flood plains were also affected to some extent by large animals, insect and tree diseases, windstorms, droughts, and fires, but these impacts were less severe. Beaver also affected the flood plains along streams by building dams that sometimes killed relatively large stands of trees and created temporary ponds. Natural disturbances to the streams and rivers are floods and droughts. Man-made disturbances to streams in this Section include channelization, construction of dams, and input of industrial waste, sewage, and soil.

### **Section 221H--Northern Cumberland Plateau**

**Geomorphology.** This Section is in the Appalachian Plateaus geomorphic province. Broad uplift of strata gently-dipping strata to a level-bedded plateau, followed by fluvial erosion and mass wasting, has resulted in a moderately dissected region of dendritic drainages. Landforms on about 80 percent of the Section consist of high hills. Other landforms in the southern part of the Section are about equal areas of tablelands and open low mountains. Elevation ranges from 1,270 to 2,000 ft (380 to 600 m). Local relief ranges from 50 to 100 ft (15 to 30 m).

**Potential Natural Vegetation.** Kuchler classifies vegetation as mixed mesophytic forest and Appalachian oak forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The shortleaf pine-oak forest cover type dominates much of this Section in Kentucky. The oaks on drier sites include post, southern red, scarlet, and blackjack; on moister sites, white and black oaks predominate. In Tennessee, the same oaks are present, but pines are not a dominant overstory component. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

**Disturbance Regimes.** Fire has probably been the principal historical source of disturbance, previously burning over moderately sized areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional summer droughts, winter ice storms, and tornadoes.

## **Section 221I--Southern Cumberland Mountains**

**Geomorphology.** This Section is in the Appalachian Plateaus geomorphic province and originated when the Cumberland overthrust block was pushed westward as a result of thin-skinned tectonics. Prominent strike ridges are apparent along the thrust plate. Differential rates of erosion have contributed to the strongly dissected landscape. Landforms consist of low mountains and open hills. Elevation ranges from 1,200 to 3,000 ft (360 to 900 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler classifies vegetation as Appalachian oak forest and mixed mesophytic forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut, and blackjack; on moister sites, white, southern red, and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

**Disturbance Regimes.** Fire has probably been the principal historical source of disturbance, previously burning over moderate-size areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional summer droughts and ice storms.

## **Section 221J--Central Ridge and Valley**

**Geomorphology.** This Section is in the Ridge and Valley geomorphic province. The Section consists of a folded, faulted, and uplifted belt of parallel valleys and ridges, strongly dissected by differential erosion, mass wasting, fluvial transport, and deposition. Landforms on most of the Section consists of open hills. Elevation ranges from 650 to 2,000 ft (200 to 600 m). Local relief ranges from 300 to 700 ft (90 to 210 m).

**Potential Natural Vegetation.** Kuchler classifies vegetation as Appalachian oak forest. The predominant vegetation form is cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-pine forest cover type dominates. The oaks on drier sites include post, southern

red, scarlet, chestnut, and blackjack; on moister sites, white, southern red, and black oaks predominate. Shortleaf pine usually forms a major part of the canopy. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component throughout. The loblolly pine-shortleaf pine cover type is prevalent in the southern part of the Section. In these stands canopy hardwoods on well-drained soils include sweetgum, blackgum, southern red oak, post oak, white oak, mockernut hickory, and pignut hickory.

**Disturbance Regimes.** Fire has probably been the principal historical source of disturbance, previously burning over small areas between natural barriers with moderate frequency and low intensity. Climatic influences include occasional droughts and ice storms. During the early 1900's, all American chestnut trees were killed by an introduced pathogen; sprouting still occurs from root systems.

## **Eastern Broadleaf Forest (Continental)**

These Sections are located in the central conterminous States, including parts of Arkansas, Missouri, Tennessee, Kentucky, Illinois, Indiana, Ohio, New York, Michigan, Wisconsin, Iowa, and Minnesota. The area of these Sections is about 270,000 mi<sup>2</sup> (699,300 km<sup>2</sup>).

### **Section 222A--Ozark Highlands**

**Geomorphology.** This Section is part of the Ozark Plateaus geomorphic province. It is a maturely dissected high plateau with dendritic and radial drainage patterns. Most of the Section is equally divided between steep hills with local relief up to 1,000 ft (300 m) and rolling hills with local relief between 200 and 500 ft (60 to 150 m). There are also gently rolling plains with local relief of less than 200 ft; also present is the flat, 6-mile (10-km) wide Mississippi River flood plain, composed of broad bottomlands with associated terraces, ox-bows, and meander scars. Current geomorphic processes are fluvial erosion, transport and deposition, and mass wasting. Widespread karst features include caves, sinkholes, and springs. Elevation ranges from 300 to 1,800 ft (100 to 600 m).

**Potential Natural Vegetation.** Kuchler vegetation types are mapped as oak-hickory forest, oak-hickory-pine forest, mosaic of bluestem prairie and oak-hickory forest, and cedar glades. Dry upland sites include post oak-blackjack oak-black hickory with lichen-moss ground cover, and shortleaf pine-oak in areas of sandstone bedrock. Mesic slopes sites have white oak-northern red oak-bitternut hickory-flowering dogwood. Riparian sites have river birch-silver maple. Glades have little bluestem-baldgrass; eastern redcedar has invaded these prairie sites as a result of fire suppression. The current trend is to characterize Ozark's landscapes as "woodland" or "savanna" rather than "forest," in recognition of the role of frequent, low-intensity fire.

**Disturbance Regimes.** Frequent, low intensity, widespread fire occurred prior to European settlement. Fire suppression led to changes in community type and species composition. Closed-canopy forests replaced many woodlands; pastures replaced prairies, glades, and bottomland forests. Climatic influences include occasional summer droughts, winter ice storms, and tornadoes.

## 222C--Upper Gulf Coastal Plain

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landforms are irregular, shallow to moderately dissected plains of alluvial origin formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Geomorphic processes currently active include gentle-gradient valley stream erosion, transport and deposition. Elevation ranges from 80 to 330 ft (25 to 100 m). Local relief seldom exceeds 100 ft (30 m).

**Potential Natural Vegetation.** Kuchler classifies vegetation as oak-hickory forest, blackbelt, and a mosaic of bluestem prairie and oak-hickory forest. The predominant vegetation form is temperate lowland and submontane broad-leaved cold-deciduous forest and cold-deciduous alluvial forest. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut and blackjack; on moister, sites white, southern red, and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common, but minor component. Bottom land hardwoods occupy recent alluvium along major rivers. Many young stands are dominated by eastern cottonwood and black willow. Older stands include a mixture of species, including hackberry, sugarberry, American elm, boxelder, overcup oak, water hickory, and green ash.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include winter ice storms and periodic flooding along major rivers.

## 222D--Interior Low Plateau, Shawnee Hills

**Geomorphology.** This Section is part of the Interior Low Plateaus geomorphic province. Extensive sandstone bluffs, cuestas, rise up to 100 ft (30 m) above the terrain in front of them and dip gently down the back slope. Other landforms include steep-sided ridges and hills, gentler hills and broader valleys, karst terrain, gently rolling lowland plains, and bottom lands along major rivers, with associated terraces and meander scars. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit humocky or ridge-swale topography. Current geomorphic processes are fluvial erosion, transport and deposition; mass-wasting; and karst solution. Elevation ranges from 325 to 1,060 ft (100 to 325 m). Lowest elevations occur along the Ohio Rive, the highest at Williams Hill in Illinois.

**Potential Natural Vegetation.** Kuchler vegetational types include oak-hickory forest in the uplands of Illinois and Kentucky, and joined by maple-beech-birch in Indiana; oak-gum-cypress forest occupies the bottom lands throughout the Section. Uplands are dominated by the white oak, black oak, shagbark hickory community; the black jack oak, scarlet oak, pignut hickory community occupies drier sites; the beech, tuliptree, bitternut hickory, sugar maple, white ash community occupies deep, mesic ravines. The southern flood plains along the Ohio and Wabash rivers are dominated by the sycamore, Kentucky cofftree, sugarberry, and honey locust community, with local tupelo and cypress swamp communities.

**Disturbance Regimes.** The natural communities in this Section were influenced by large herbivores such as elk, by insects and tree diseases, by windstorms, and by drought and fire. Drastic environmental influences on the generally forested hills discouraged trees and maintained openings, glades, on slopes; extensive, bushy grasslands, called barrens, occur on some of the drier sites. Large herbivores, drought, windstorms, insects, and tree diseases kept the forest canopy open and similar to a savanna on ridges. Occasional wildfires helped to maintain the hill-prairies, glades, and barrens. Most communities were affected by mass wasting, due to shale bedrock outcrops, thin soils, and frequent freeze-thaw conditions. Beaver affected timber in narrow flood plains. Anthropogenic disturbances dominate today (see below).

## **Section 222E--Interior Low Plateau, Highland Rim**

**Geomorphology.** This Section is in the Interior Low Plateau geomorphic province. Landforms were formed by platform deposition of continental sediments into a shallow inland sea, followed by uplifting to form a level-bedded plateau, which has been shaped by differential erosion to form a moderate to deeply dissected surface. Landforms on about 70 percent of the Section consist of about equal areas of open hills and irregular plains. About 20 percent consists of tablelands. Elevation ranges from 650 to 990 ft (200 to 300 m). Local relief ranges from 100 to 300 ft (30 to 100 m) on irregular plains and from 300 to 600 ft (100 to 200 m) on tablelands.

**Potential Natural Vegetation.** Kuchler classifies vegetation as oak-hickory forest, cedar glades, and a mosaic of bluestem prairie and oak-hickory forest. The predominant vegetation form is temperate low land and submontane broad-leaved cold-deciduous forest. The oak-hickory forest cover type dominates this Section. The oaks on drier sites include post, southern red, scarlet, chestnut, and blackjack; on moister sites, white and black oaks predominate. Shortleaf pine is usually present. Hickories, including pignut, mockernut, shagbark, and bitternut, form a common but minor component.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance, previously burning over moderate-size areas between natural barriers with low frequency and low intensity.

## **Section 222F--Interior Low Plateau, Bluegrass**

**Geomorphology.** This Section is in the Interior Low Plateaus geomorphic province. Platform deposition of continental sediments into a shallow inland sea was followed by uplifting to form a level-bedded plateau, which has been shaped by differential erosion to form a moderately to deeply dissected surface. Landforms on about 90 percent of the Section consist of about equal amounts of irregular plains and open hills. A small area consists of smooth plains. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief ranges from 100 to 500 ft (30 to 150 m) in the open hills. In the smooth plains, relief is 100 to 300 ft (30 to 100 m).

**Potential Natural Vegetation.** The predominant vegetation form is temperate lowland and submontane broad-leaved, cold-deciduous forest, while cold-deciduous alluvial forest occurs along the major rivers. Major species in the oak-hickory cover type includes white, black, and northern red oaks. Other important species include sugar maple, beech, black walnut, and

yellow-poplar. Bitternut, pignut, or shagbark hickories may also be present. Sycamore, silver maple, boxelder, willow, and American elm are common species along major river bottom lands.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance, previously burning over moderate-size areas between natural barriers with low frequency and low intensity. Climatic influences include occasional summer droughts and tornadoes.

## **Section 222G--Central Till Plains, Oak-Hickory**

**Geomorphology.** This Section forms part of the Central low lands geomorphic province. The northern half is characterized by relative flatness and shallow entrenchment of drainages due to thick till deposits (50 to 100 ft, 15 to 30 m) that mask the topographic expression of the bedrock. Till is thinner (6 to 50 ft, 2 to 15 m) in the southern half, allowing the topography to be controlled by the relief on the deeply eroded bedrock. The dominant geomorphic process operating in the Section are fluvial erosion, transport and deposition. A notable but very minor landform is anthropogenic. lands that have been strip-mined exhibit humocky or ridge-swale topography. Elevation ranges from 330 to 985 ft (100 to 300 m).

**Potential Natural Vegetation.** Kuchler indicates that the uplands support oak-hickory forest. bottom lands along the Ohio and lower Wabash support oak-gum-cypress; elm-ash-cottonwood forest grows along the upper Wabash and its major Indiana tributaries. Historically, 40 percent of uplands in the Section were tall-grass prairie, not forest. The dominant forest community is post oak, black oak, shingle oak, mockernut hickory, and shagbark hickory. Forests on the drier southern and western slopes are of the white oak, shingle oak, and black oak community; the white oak, white ash, basswood, sugar maple, and slippery elm community dominates more mesic sites. The flat woods community is post oak, swamp white oak, blackjack oak, and pin oak. Forests in the broad flood plains are dominantly silver maple, willow, sycamore, and American elm nearest the rivers, with pin oak, white oak, hickory, ash, hackberry, and honeylocust on heavier soils farther from the river banks. Pin oak occasionally grows in pure stands.

**Disturbance Regimes.** Fire, both natural and human-caused, has probably been the principal historical source of disturbance, burning over moderate-size areas between natural barriers with moderate frequency and low intensity. Besides fire, grazing ungulates, insects and tree diseases, windstorms, drought, and ice were the major disturbances during presettlement times. They generally discouraged woody vegetation and encouraged grasslands on the flatter upland divides between forested drainages, and opened the canopy in the ravines and on slopes. Beaver dams occasionally created temporary ponds large enough to kill large stands of timber in the ravines and bottom lands. Over a period of years these ponds became filled with silt and became shallow wooded swamps or, on some sites, wet sedge meadows. Land use since settlement has caused conversion from forest, prairie, and wetland to agriculture on at least 80 percent of the area.

## **Section 222H--Central Till Plains, Beech-Maple**

**Geomorphology.** This Section is part of the Central Lowlands geomorphic province. It is characterized by its flatness and by shallow entrenchment of its drainages. This is a level to

gently rolling till-plain (glacial ground moraine), with broad bottom lands along the few major river valleys. The plain is overlain by a series of low ridges (glacial end moraines) generally trending west to east in an undulating pattern. Drainage is dendritic with only minor entrenchment. The dominant geomorphic process operating in the Section is fluvial erosion, transport and deposition. Elevation ranges from 650 to 1,000 ft (200 to 300 m). Local relief is mainly a few meters, but in places, hills rise as much as 80 ft (25 m).

**Potential Natural Vegetation.** Kuchler type is beech-maple forest over most of the Section, with a significant amount of oak-hickory forest mapped in the southeast portion, and a few patches mapped as mosaic of bluestem prairie and oak-hickory forest.

**Disturbance Regimes.** Disturbance from fire is uncommon, scattered, and small. By far the largest disturbance effect is from land use. Climatic-influenced disturbances include winter ice storms, occasional tornadoes, and periodic flooding along major river flood plains.

## **Section 222I--Erie and Ontario Lake Plain**

**Geomorphology.** This Section is part of the Central low lands geomorphic province. It is characterized by its flatness and by shallow entrenchment of its drainages. This is a combination of level to gently rolling till-plain (glacial ground moraine), and flat lake plain. There are a few areas with broad, low ridges (glacial end moraines) generally trending parallel to the lakes' shorelines. The eastern end of the Section, in New York State, includes either or both moderately dissected till and drumlin plains on three low but notable "stairstep" escarpments, parallel to and below the northern margin of the Allegheny Plateau. Geomorphic processes operating in the Section include: fluvial erosion, transport and deposition; lakeshore erosion and deposition; and minor dune construction. Elevations range from 245 ft (75 m), which is the mean elevation of the surface of Lake Ontario, and extend up to 1,000 ft (300 m) along the Appalachian Plateau border. Most of the land is under 800 ft (240 m) in elevation. Local relief ranges between 0 to 300 ft (0 to 90 m). Gentle slopes cover 50 to 80 percent of the area, 50 to 75 percent occur on low lands.

**Potential Natural Vegetation.** Kuchler vegetation types include northern hardwood forest, beech-maple forest, and elm-ash forest. Other, regionally-defined important vegetation types include beech-maple mesic forest in the east, maple-basswood forest, hemlock-northern hardwood forest, oak openings, and pitch pine-heath barrens.

**Disturbance Regimes.** Climatic-induced disturbances include winter ice storms and occasional tornadoes. Presettlement swamp forests, wet prairies, and marshes, were flooded during several months of the year. Natural disturbance regimes now affecting the streams and rivers are floods and droughts. Anthropogenic disturbance to aquatic systems includes channelization, ditching, and input of industrial waste, sewage, and soil. Insect and disease disturbances have resulted from Dutch elm disease, chestnut blight, and ash dieback among others. Occasional fire disturbances are small and scattered.

## **Section 222J--South Central Great Lakes**

**Geomorphology.** This Section is part of the Central low lands geomorphic province. It is a combination of a level to gently rolling low land (glacial ground moraine) and flat outwash or lacustrine plains. Dune fields are present along Lake Michigan. Cropping out of the plains are partially buried end moraine ridges and mounded ice-contact hills. Three glacial lobes converged in southern Michigan, and morainal ridges are arranged in roughly parallel arcs along the paths of glacial retreat. Glacial outwash plains and deltas are found along major drainages. Drainage is dendritic with pronounced terracing. Geomorphic processes operating in the Section include: fluvial erosion, transport, and deposition; lakeshore erosion and deposition; and minor dune construction. Elevation ranges from 580 to 1,280 ft (175 to 396 m), mostly below 1,000 ft (300 m). Local relief is primarily 6 to 200 ft (2 to 60 m).

**Potential Natural Vegetation.** Kuchler vegetation types are oak-hickory forest, dominating sandy sites and beech-maple forest on loamy soils.

**Disturbance Regimes.** Fire was the dominant natural disturbance in the oak-hickory forest. Tornadoes and windshear events, together with gaps in the overstory, were responsible for regenerating the beech-sugar maple forests.

## **Section 222K--Southwestern Great Lakes Morainal**

**Geomorphology.** This Section is part of the Central Lowland geomorphic province. It is characterized by flat to undulating topography resulting from glaciation: plains composed of till, outwash, and lacustrine; drumlin fields and morainal ridges; and local occurrences of other features (kames, eskers, kettles, etc.). Drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section include: are fluvial erosion, transport and deposition; lakeshore erosion and deposition; and minor dune construction. Elevation ranges from about 570 to 1,650 ft (175 to 500 m). Local relief ranges from a few feet on plains to about 300 ft (90 m) in some places, such as interlobate moraines and a few bedrock escarpments.

**Potential Natural Vegetation.** Kuchler vegetation types are primarily oak savanna, with a lesser extent of maple-basswood forest, and some small areas of bluestem prairie.

**Disturbance Regimes.** Fire was apparently important in maintaining the oak Savannas and prairies. Windthrow occurred in some localized areas.

## **Section 222L--North-Central U.S. Driftless and Escarpment**

**Geomorphology.** This Section is part of the Central low lands Geomorphic Province. It is bisected by the Mississippi River flood plain. The Section is a maturely dissected, upland plateau where broad, steep-sided bedrock ridges and "mounds" up to 500 ft (150 m) high are separated by wide, flat-bottomed drainages in the southern portion of the Section, and by narrow, V-shaped

valleys farther north. Current geomorphic processes include: fluvial erosion, transport and deposition; masswasting; and karst solution. Elevation ranges from 650 to 1,300 ft (200 to 400 m). Local relief ranges from 100 to 600 ft (30 to 180 m).

**Potential Natural Vegetation.** Kuchler types are oak savanna and maple-basswood forest, with some northern flood plain forest along some of the major rivers.

**Disturbance Regimes.** Fire was historically important on the upland prairie and oak dominated ecosystems. Recent records of tornadoes and ice storms indicate that they locally impacted forest vegetation.

## **Section 222M--Minnesota and Northeastern Iowa Morainal**

**Geomorphology.** This Section is part of the Central Lowland geomorphic province. It is characterized by level plains and low, irregular hills resulting from glaciation: till and outwash plains; drumlin fields and morainal ridges; and local occurrences of other features (e.g., kames, eskers, and kettles). Poor to unintegrated (chaotic) drainage is common in the northern portion of the Section; to the south, drainage is dendritic with only minor entrenchment. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 1,000 to 1,600 ft (300 to 485 m). Local relief is generally less than 100 ft (30 m).

**Potential Natural Vegetation.** Kuchler's map shows mostly bluestem prairie with significant maple-basswood forest and lesser amounts of oak savannah, oak-hickory forest, and northern flood plain forest. Other investigators indicate bluestem prairie may be a more minor component, with greater dominance of oak savannah and oak wood lands.

**Disturbance Regimes.** Fire was historically important in oak savanna development. Windthrow was common in the sugar maple-basswood forests. tornadoes and other high wind events and floods also created natural disturbances. Major anthropogenic disturbances during the past 100 to 150 years have included logging and clearing for agriculture.

## **Section 222N--Lake Agassiz, Aspen Parklands**

**Geomorphology.** This Section is part of the Central Lowlands geomorphic province. It forms the southeastern margin of a large, level lake plain (created by glacial Lake Agassiz) that extends far to the north and west into Manitoba, Saskatchewan, and Alberta. Low dunes and wet swales mark the Section's western edge; prominent beach and morainal ridges cross the Section in several places. Drainage is dendritic, with only minor entrenchment. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 900 to 1,250 ft (270 to 380 m). Local relief is low; most areas are nearly level. The western edge has up to 50 to 150 ft (15 to 45 m) of local relief along beach ridges.

**Potential Natural Community.** Kuchler mapped this area as bluestem prairie and oak savann, with a minor component of maple-basswood forest. Local investigators indicate the pre-

European settlement vegetation was primarily aspen savanna, with significant components of tallgrass prairie, wet prairie, and dry gravel prairie (on gravelly beach ridges.)

**Disturbance Regimes.** Fire was the most common natural disturbance, followed by floods and tornadoes. Fire frequency and intensity were reduced by the natural barrier of low dunes, beach ridges, and wet swales that mark the western edge of the Section.

## **Central Appalachian Broadleaf Forest - Coniferous Forest - Meadow**

These Sections are located in the eastern conterminous States, including parts of Georgia, North and South Carolina, Virginia, West Virginia, Maryland, and Pennsylvania. The area of these Sections is about 68,100 mi<sup>2</sup> (176,400 km<sup>2</sup>).

### **Section M221A--Northern Ridge and Valley**

**Geomorphology.** This Section forms part of the Ridge and Valley geomorphic province. It is characterized by a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by differential erosion of tightly folded, intensely faulted bedrock. The eastern boundary is the Great Valley low land; the western boundary is a steep, high ridge, the Allegheny Front. Drainage is structurally controlled, dominantly trellis with some dendritic patterns. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the dominant geomorphic processes currently active. A notable but very minor landform is anthropogenic: lands that have been strip-mined exhibit hummocky or gouged topography. Elevation ranges from 300 to 4,000 ft (100 to 1,200 m). Local relief is 500 to 1,500 ft (150 to 450 m).

**Potential Natural Vegetation.** Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation reflects drier conditions. Kuchler types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Braun classified much of the area as oak-chestnut. Before arrival of the blight that decimated the chestnut, this Section was a stronghold of the species. Oaks now dominate. As a broad generalization, red and white oaks occur on more productive, mesic sites. Eastern white pine can occur, with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table mountain, or Virginia pines. The latter can also occur as pure stands.

**Disturbance Regimes.** Fire was undoubtedly used extensively by Native Americans. Major historical disturbances include grazing from about 1780 onward and extensive logging from 1880 to 1920. Many logging operations were followed by fire. Since the 1930's, many fires have been suppressed through Federal and State agency efforts. Gypsy moth has affected forests in this Section, notably in Virginia.

## **Section M221B--Allegheny Mountains**

**Geomorphology.** This Section comprises part of the Appalachian Plateaus geomorphic province. It is a maturely dissected plateau characterized by high, sharp ridges, low mountains, and narrow valleys. It has a prominent structural and topographic grain created by broad, northeast to southwest trending folds in the bedrock. Drainage is dendritic to trellis, but primarily the former. Mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 1,000 to 4,500 ft (300 to 1,400 m), with a few peaks higher, notably Spruce Knob (4,861 ft, 1,620 m), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 ft (300 to 600 m).

**Potential Natural Vegetation.** Kuchler mapped this Section as northeastern spruce-fir, northern hardwoods, mixed mesophytic, and oak-hickory-pine. Strongly influenced by elevation and aspect, the vegetation of the Allegheny Mountains can be placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is characteristic above 3,500 ft (1,060 m) and includes stands of American beech and yellow birch. Beech is more common on northerly aspects, and yellow birch on southerly. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic represents a transition to drier types and presents a wide variety of successional pathways. Characteristic species are red oak, basswood, white ash, and tulip poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

**Disturbance Regimes.** Erosional processes over eons have been the primary disturbance agents. In the pre-European settlement era, fire was not a significant element of change because of the relatively high precipitation. The current forest was largely shaped by logging and associated fires from about 1880 to 1920. In some areas, notably those in the red spruce zone above 3,500 ft (1,200 m) elevation, some areas burned so severely that soil was removed to the bedrock. These areas are now stunted forests with blueberry understories. Gypsy moth is now entering this Section. Its effect on this Section may be less than on the Northern Ridge and Valley Section, because oak, preferred by the moth, is less extensive here.

## **Section M221C--Northern Cumberland Mountains**

**Geomorphology.** This section is in the Appalachian Plateaus geomorphic province. Synclinal structure resulting from folding, faulting, and uplift, followed by differential erosion, has resulted in long monoclinal mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Drainage is dendritic to trellis; mass wasting, karst solution, and fluvial erosion, transport and deposition are the primary geomorphic processes operating. Elevation ranges from 2,000 to 2,600 ft (600 to 800 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation form is cold-deciduous broad-leaved forest with a mixture of evergreen needle-leaved trees. Existing forest types consist of oak-hickory. The component consists of white, black, scarlet, and blackjack oaks; common hickories include mockernut and pignut.

**Disturbance Regimes.** Fire has probably been the principal historical source of disturbance. Climatic influences include occasional summer droughts and ice storms.

## **Section M221D--Blue Ridge Mountains**

**Geomorphology.** This Section is in the Blue Ridge geomorphic province. The Section was formed by tectonic faulting and uplift of resistant, crystalline bedrock into a relatively narrow band of highly metamorphosed, somewhat parallel mountain ranges. The northern part of this Section (north of Roanoke Gap in Virginia) is characterized by a single, broad (5 to 10 mi, 8 to 16 km) ridge that extends into southern Pennsylvania. The southern half of the Section is broader, higher, more mountainous, and displays little or no structural grain. Though high (46 peaks are over 6,000 ft (1,820 m) in elevation), the mountains are rounded and generally lack prominent angularity. Drainage is structurally controlled, dominantly trellis in the north; dendritic patterns dominate the southern half. Landforms on about 80 percent of the Section are low mountains. The remainder of the Section is open, low mountains. Elevation ranges from 1,000 to over 6,000 ft (300 to 1,800 m). Local relief ranges from 500 to 1,000 ft (150 to 300 m). Mt. Mitchell, the highest point in eastern North America (6,684 ft, 2,025 m), occurs here.

**Potential Natural Vegetation.** Kuchler classified vegetation in this Section as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. The predominant vegetation form is montane cold-deciduous broad-leaved forest dominated by the genus *Quercus*. The oak forest type consists of black, white, and chestnut oaks that dominate dry mountain slopes; pitch pine is often a component along ridge tops. Mesophytic species such as yellow-poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller areas of cold-deciduous broad-leaved forest with evergreen needle-leaved trees are present in the intermontane basins, with the hardwood-pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia pines. Table Mountain pine, a fire-dependent species with serotinous cones, occurs on xeric ridge tops where fire was historically more common. Eastern white pine dominates small areas of coarse-textured soils and parts of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 ft, 1,360 m) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. The broad-leaved forest changes to evergreen needle-leaved forest with conical crowns (e.g., red spruce, Fraser fir) above altitudes of about 5,000 to 6,000 ft (1,800 m).

**Disturbance Regimes.** Fire, wind, ice, and precipitation are the principal causes of natural disturbance. It is believed that native Americans used fire for many purposes, especially at low elevations in intermountain basins, where drier conditions prevail. Fire caused by lightning is more prevalent in some areas, especially in the vicinity of Grandfather Mountain. Tornadoes are

uncommon, but more prevalent are localized "micro-bursts" of intense winds, which cause small patches of trees to be up-rooted, especially on mountain slopes. Winter ice storms are not uncommon at mid-to-high elevations and cause extensive damage to tree crowns. Occasional events of prolonged, intense precipitation cause localized scouring and erosion of drainage channels, followed by siltation, sedimentation, and flooding downstream. An introduced pathogen, the chestnut blight, caused considerable disturbance to composition of most forest stands from 1920 to 1940 by top-killing all American chestnut trees. Gypsy moth has not affected forests in the central and southern subsections, but has the potential to cause a major impact on forest vegetation because of the dominance by oaks.

## **Ozark Broadleaf Forest - Meadow**

Located in parts of Arkansas and Oklahoma, the area of this Section is about 6,400 mi<sup>2</sup> (16,600 km<sup>2</sup>).

### **Section M222A--Boston Mountains**

**Geomorphology.** This Section is in the Ozark Plateau geomorphic province. Geomorphic characteristics include broad uplift of generally flat-lying marine sediments to a plateau, followed by fluvial erosion, resulting in a strongly dissected region with dendritic drainages. About 80 percent of the Section has landforms of low mountains; 20 percent consists of open hills and plains with hills. Elevation ranges from 650 to 2,600 ft (20 to 80 m). Local relief ranges from 100 to 800 ft (30 to 240 m).

**Potential Natural Vegetation.** Kuchler mapped this area as oak-hickory forest and oak-hickory-pine forest. Predominant vegetation form is temperate low land and submontane broad-leaved, cold-deciduous forest, with smaller areas of cold-deciduous, broad-leaved forest with evergreen needle-leaved trees. Common oak species in the oak-hickory forest type include white oak, black oak, and northern red oak. Hickories include pignut and mockernut. The shortleaf pine-oak cover type occurs on drier sites where post, scarlet, and blackjack oaks dominate with shortleaf pine.

## **Southeastern Mixed Forest**

These Sections are located in the southeastern conterminous States, including parts of Virginia, North and South Carolina, Georgia, Alabama, Mississippi, Arkansas, Louisiana, and Texas. The area of these Sections is about 193,000 mi<sup>2</sup> (499,900 km<sup>2</sup>).

### **Section 231A--Southern Appalachian Piedmont**

**Geomorphology.** This Section is in the Appalachian Piedmont geomorphic province. It consists of an intensely metamorphosed, moderately dissected plain consisting of thick saprolite, continental sediments, and accreted terranes. Differential erosion has produced some isolated mountains (monadnocks) which rise above the general land surface. Landforms on about 70 percent of the Section are irregular plains. Landforms on the remaining area are about equally

divided; plains with high hills; open low hills; and tablelands of moderate relief. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler mapped this area as oak-hickory-pine forest and southern mixed forest. Predominant vegetation form is evergreen forest with rounded crowns, and about equal areas of cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-hickory forest cover type consists of white, post, and southern red oaks, and hickories of pignut and mockernut. The loblolly-shortleaf pine cover type is common on disturbed areas and usually has an understory component of dogwood and sourwood.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance, previously burning over small to moderate-size areas between natural barriers with low frequency and low intensity. Climatic influences include occasional summer droughts and winter ice storms, and infrequent tornadoes. Insect-related disturbances are often caused by southern pine beetles.

### **Section 231B--Coastal Plains, Middle**

**Geomorphology.** This Section is in the Coastal plains geomorphic province. The predominant landform on about 80 percent of the area consists of moderately dissected, irregular plains of marine origin formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 650 ft (25 to 200 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as oak-hickory-pine forest, blackbelt, and oak-hickory forest. The predominate vegetation form is evergreen, needle-leaved forest with cold-deciduous, broad-leaved trees. The principal forest cover type consists of loblolly and shortleaf pine with hardwoods, including sweetgum, flowering dogwood, elm, red cedar, southern red oak, and hickories. In central Mississippi and Alabama the hardwood component may be dominant, depending on soil moisture regime and past disturbance. A narrow band of oak-hickory forest type occurs along the extreme western edge of the Section, adjacent to flood plains of the Mississippi River and along major river bottoms.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms, and infrequent tornadoes. Insect disturbances are often caused by southern pine beetles.

### **Section 231C--Southern Cumberland Plateau**

**Geomorphology.** This Section is in the Appalachian Plateaus geomorphic province. It was formed by the broad uplift of gently-dipping strata to a level-bedded plateau, followed by fluvial erosion and mass wasting. The result of these geomorphic processes is a strongly dissected region of dendritic drainages. About 60 percent of this Section consists of open hills. Other landforms consist of tablelands of considerable relief and open high hills. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 300 to 500 ft (90 to 150 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as oak-hickory-pine forest and southern mixed forest. The predominant vegetation form consists of needle-leaved, evergreen

trees with cold-deciduous, broad-leaved forest. Principal species include loblolly pine, sweetgum, water oak, red maple, southern red oak, and white oak.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts, winter ice storms, and occasional tornadoes.

### **Section 231D--Southern Ridge and Valley**

**Geomorphology.** This Section is in the Ridge and Valley geomorphic province. The area is a folded, faulted, and uplifted belt of parallel valleys and ridges, strongly dissected by differential erosion, mass wasting, fluvial erosion, and transport and deposition. About 60 percent of this Section consists of plains with hills and 40 percent consists of open high hills. Elevation ranges from 650 to 2,000 ft (200 to 600 m). Local relief ranges from 300 to 500 ft (90 to 150 m) in areas of plains, with elevation ranging from 500 to 1,000 ft (150 to 300 m) in areas of high hills.

**Potential Natural Vegetation.** Kuchler mapped vegetation as oak-hickory-pine forest and southern mixed forest. The predominant vegetation form is needle-leaved, evergreen trees with cold deciduous, broad-leaved forest. The principal cover type is oak-hickory, which includes southern red oak, white oak, post oak, red maple, winged elm, flowering dogwood, pignut hickory, and loblolly pine. In some areas, loblolly and shortleaf pines are dominant.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance, previously burning over small areas between natural barriers with moderate frequency and low intensity. Insect related disturbances have resulted from southern pine beetles. Climatic related influences include occasional droughts and ice storms.

### **Section 231E--Mid Coastal Plains, Western**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform occupying about 80 percent of the Section consists of moderately dissected irregular plains of marine origin. The plains were formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Other landforms consist of plains with hills and smooth plains. Elevations range from 80 to 650 ft (25 to 200 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler mapped this area as oak-hickory-pine forest, southern mixed forest, and southern floodplain forest. The predominant vegetation form consists of needle-leaved evergreen trees. Belts of cold deciduous, broad-leaved hardwoods are prevalent along rivers. The principal forest cover type is loblolly and longleaf pines. Where hardwoods are prevalent, species consist of post, white, blackjack, and southern red oaks. Species of bottom lands are red maple, green ash, Nuttall oak, sweetgum, and swamp hickory.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms, and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles.

## Section 231F--Eastern Gulf Prairies and Marshes

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 10 to 330 ft (3 to 100 m). Local relief ranges from 0 to 100 ft (0 to 30 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. Predominant vegetation is mid to tall grass grasslands. Species consist of little bluestem, indiagrass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

**Disturbance Regimes.** Fire and ocean tides have likely been the principal historical disturbance. Climatic influences include occasional hurricanes.

## Section 231G--Arkansas Valley

**Geomorphology.** This Section is in the Ouachita geomorphic province. The area consists of a folded, faulted, and uplifted belt of parallel valleys and ridges, moderately dissected by differential erosion, mass wasting, fluvial erosion and transport and deposition. About 80 percent of this land consists of plains with hills and 20 percent includes open low mountains. Elevation ranges from 330 to 3,000 ft (100 to 900 m). Local relief ranges from 300 to 500 ft (90 to 150 m) in areas with hills. Relief is 500 to 1,000 ft (150 to 300 m) in areas with low mountains.

**Potential Natural Vegetation.** Kuchler mapped vegetation as oak-hickory forest, oak-hickory-pine forest, cross timbers (*Quercus-Andropogon*), and southern floodplains forest. The predominant vegetation form is about equal areas of cold-deciduous, broad-leaved forest and needle-leaved evergreen trees. Principal forest cover types are oak-hickory and loblolly-shortleaf pine. Species include white, black, bur, post, and blackjack oaks; pignut and mockernut hickories; and loblolly and shortleaf pines. Oak-gum-cypress forest type is dominant along major river bottoms and includes cottonwood, sugarberry, river birch, and green ash.

## Outer Coastal Plain Mixed Forest

These Sections are located in the southeastern conterminous States, including parts of Delaware, Maryland, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. The area of these Sections is about 173,800 mi<sup>2</sup> (450,100 km<sup>2</sup>).

## Section 232A--Middle Atlantic Coastal Plain

**Geomorphology.** This Section is in the Coastal Plains geomorphic Province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental

sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Landforms on about 50 percent of this Section consist of flat plains. Much of the other landforms are irregular plains. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 10 to 20 ft (3 to 6 m) on flat plains and from 20 to 40 ft (6 to 12 m) on the irregular plains.

**Potential Natural Vegetation.** Kuchler classified vegetation as oak-hickory-pine forest and southern flood plain forest. The predominant vegetation form is needle-leaved evergreen forest and smaller areas of cold-deciduous broad-leaved forests. The main forest cover type is loblolly pine-hardwood, where hardwood species consist of sweetgum, water oak, white ash, yellow-poplar, red maple, and swamp hickory. On bottomland areas along major rivers, species include green ash, sugarberry, water oak, American sycamore, sweetgum, and American elm.

### **232B--Coastal Plains and Flatwoods, Lower**

**Geomorphology.** This Section is in the Coastal Plain geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain was formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. About 90 percent of this Section consists of irregular or smooth plains. Other landforms include open hills. Elevation ranges from 80 to 660 ft (25 to 200 m). Local relief ranges from 10 to 30 ft (3 to 9 m) on smooth plains, and from 30 to 50 ft (9 to 15 m) in areas of hills.

**Potential Natural Vegetation.** Kuchler mapped this area as southern mixed forest and oak-hickory-pine forest, with smaller areas of southern flood plain forest and pocosin (*Pinus-Ilex*). The predominant vegetation form is evergreen needle-leaved trees with scattered areas of cold-deciduous and evergreen broad-leaved forest. Slash and longleaf pines are prevalent throughout the Section, but loblolly pine is common in the northern areas. Sand pine is prevalent in xeric, deep-sand areas of Florida. The oak-gum-cypress forest cover type is common along flood plains of major rivers and includes Nuttall oak, laurel oak, water tupelo, sweetbay, bald cypress, and pond cypress. Localized areas of mostly hardwoods occur, especially in central Florida; types include laurel oak, water oak, sweetbay, sweetgum, live oak, red maple, and spruce pine. An extensive area of grassland vegetation is present in central Florida, north of Lake Okeechobee.

**Disturbance Regimes.** Fire has been the principal historical disturbance, previously burning over medium to large size areas between natural barriers, generally with moderate frequency and low intensity. Fire occurrence is common in areas dominated by sand pine and is frequent in areas of longleaf pine. Fire intensity can range from moderate to high. Climatic influences include frequent hurricanes. Insect disturbances are often caused by southern pine beetles.

## Section 232C--Atlantic Coastal Flatlands

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 0 to 25 ft (0 to 8m).

**Potential Natural Vegetation.** Kuchler classified vegetation as mainly southern mixed forest and oak-hickory-pine forest, with smaller areas of southern flood plain forest and pocosin (Pinus-Ilex). The predominant vegetation form is needle-leaved evergreen forest with smaller areas of evergreen broad-leaved forest. Forest cover type is mainly longleaf pine and slash pine in the northern areas. In the southern areas, slash pine replaces loblolly. Pond pine, a fire-maintained species with serotinous cones, is prevalent in coastal North Carolina, where poorly drained organic soils are present and wildfire is common. The oak-gum-cypress forest type is common along flood plains and major rivers; it includes water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress. Localized areas of mostly hardwoods occur and include laurel oak, water oak, sweetbay, sweetgum, live oak, red maple, and spruce pine.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance, although high intensity fires are relatively common in the pocosin area of eastern North Carolina. Climatic influences include frequent hurricanes. Insect disturbances are often caused by southern pine beetles.

## Section 232D--Florida Coastal Lowlands (Western)

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 80 ft (0 to 25 m). Local relief ranges from 0 to 100 ft (0 to 30 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as oak-hickory-pine forest, southern flood plain forest, and live oak-sea oats. The predominant vegetation form is evergreen needle-leaved forest and evergreen broad-leaved forest. The main forest cover type is longleaf pine and slash pine. Large areas of oak-gum-cypress cover type are present in the central part of the Section along major river bottoms, with species of water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress.

## Section 232E--Louisiana Coast Prairies and Marshes

**Geomorphology.** This Section is in the Coastal Plains geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from 0 to 160 ft (0 to 50 m). Local relief ranges from 0 to 50 ft (0 to 15 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. Much of the existing vegetation is nonforested grasslands. Prairie grasslands dominate areas inland from the coast and consist of little bluestem, indiagrass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

**Disturbance Regimes.** Fire and ocean tides have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

## **Section 232F--Coastal Plains and Flatwoods, Western Gulf**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform consists of weakly to moderately dissected irregular plains of alluvial origin formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. About 80 percent of this Section consists of irregular plains. Other landforms include flat plains and plains with hills. Elevation ranges from 80 to 660 ft (25 to 200 m). Local relief mostly ranges from 100 to 300 ft (30 to 90 m) on irregular plains; however, relief ranges from 0 to 100 ft (0 to 30 m) on flat plains and 300 to 500 ft (90 to 150 m) where plains with hills are present.

**Potential Natural Vegetation.** Kuchler mapped vegetation as southern mixed forest, oak-hickory-pine forest, and southern flood plain forest. The predominant vegetation form is evergreen needle-leaved forest with a small area of cold-deciduous alluvial forest. The slash pine and longleaf pine cover type dominates most of the Section. The loblolly pine-shortleaf pine cover type is common in the northern parts of the Section. A bottomland type is prevalent along most major rivers and consists of cottonwood, sycamore, sugarberry, hackberry, silver maple, and red maple.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts and winter ice storms and infrequent hurricanes. Insect disturbances are often caused by southern pine beetles.

## **Section 232G--Florida Coastal Lowlands (Eastern)**

**Geomorphology.** This Section is in the Coastal Plains geomorphic Province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation averages 52 to 64 in (1,300 to 1,600 mm). There is little local relief.

**Potential Natural Vegetation.** Kuchler classified vegetation as oak-hickory-pine forest, southern flood plain forest, and live oak-sea oats. The predominant vegetation form is evergreen needle-leaved forest and evergreen broad-leaved forest. The main forest cover type is longleaf pine and slash pine. Large areas of oak-gum-cypress cover type are present in the central part of the Section along major river flood plains, with species of water oak, laurel oak, swamp tupelo, sweetbay, bald cypress, and pond cypress.

## **Lower Mississippi Riverine Forest**

This Section is located in the south-central conterminous States, including parts of Missouri, Arkansas, Tennessee, Mississippi, and Louisiana. The area of this Section is about 44,300 mi<sup>2</sup> (114,700 km<sup>2</sup>).

### **Section 234A--Mississippi Alluvial Basin**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform consists of flat, weakly to moderately dissected alluvial plains. The plains were formed by deposition of continental sediments into a submerged, synclinal trough, which was later exposed by sea level subsidence. Elevation ranges from 0 to 660 ft (0 to 200 m). Local relief in most of the Section ranges from 0 to 100 ft (0 to 30 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as southern floodplain forest and oak-hickory forest. The predominant vegetation form is cold-deciduous, alluvial broadleaf forest, with small areas of cold-deciduous, broad-leaved forest on upland sites. The main cover type is oak-gum-cypress, where main species are Nuttall oak, water oak, laurel oak, cherrybark oak, cottonwood, sycamore, hackberry, red and silver maple, and baldcypress. The oak-hickory cover type consists of post oak, bur oak, northern red oak, black oak, and white oak.

**Disturbance Regimes.** Periodic flooding has been the principal historical disturbance, but has been reduced by a series of levees and dams built for flood control.

## **Ouachita Mixed Forest - Meadow**

This Section is located in Arkansas and Oklahoma. The area is about 8,800 mi<sup>2</sup> (22,800 km<sup>2</sup>).

### **Section M231A--Ouachita Mountains**

**Geomorphology.** This section is in the Ouachita geomorphic province. It was formed by tectonic faulting and uplift of resistant bedrock into a narrow band of metamorphosed, parallel (east-west trending) mountain ranges. This was followed by mass wasting and steep and gentle stream valley erosion with fluvial transport. About 75 percent of the area consists of open high hills. Also included are open low mountains. Elevation ranges from 330 to 2,600 ft (100 to 800 m). Local relief in much of the section ranges from 500 to 800 ft, but it can range from 1,000 to 2,000 ft in areas with low mountains.

**Potential Natural Vegetation.** Kuchler classified vegetation as oak-hickory-pine forest. Existing forest types are mainly loblolly-shortleaf pine. The predominant vegetation form is evergreen needle-leaved forest and a small area of cold deciduous, broad-leaved forest. Loblolly pine and shortleaf pine cover types occur widely. Lesser areas of a shortleaf-oak type (southern red, scarlet, black, post, and blackjack oaks) and oak-hickory (black, scarlet, post, and white oaks and pignut and mockernut hickories) occur in Oklahoma.

**Disturbance Regimes.** Fire has probably been the principal historical disturbance. Climatic influences include occasional summer droughts, winter ice storms, and infrequent tornados. Insect disturbances are often caused by southern pine beetles.

## **Pacific Lowland Mixed Forest**

The area of this Section, which is located in Washington and Oregon, is about 14,900 mi<sup>2</sup> (38,600 km<sup>2</sup>).

### **Section 242A--Willamette Valley and Puget Trough**

**Geomorphology.** To the south, there are primarily cyclic flood deposits. To the north, Pleistocene glaciers have deposited and eroded morainal debris. South of the glacial limit, a zone of branching drainages and low divides is sculpted in soft rocks. Throughout the Section, isolated basalt-capped mesas and islands of bedrock occur. Elevation ranges from sea level to 2,000 ft (700 m).

**Potential Natural Vegetation.** The Willamette Valley portion is a mixture of Douglas-fir and White Oak series with local areas of Western Hemlock and Western Red Cedar series on more moist sites. A similar pattern occurs in the Puget Trough portion, but with a greater abundance of Western Hemlock and Western Red Cedar series and less amount of White Oak and Douglas-fir series. Riparian areas include Cottonwood, Willow, Ash, and Alder series. Bigleaf maple occupies mixed sites. Prairies of Idaho fescue are on droughty, gravelly soils in the Puget Trough; in the Willamette Valley, grasslands of danthonia, bentgrass, orchard grass, needle

grass, fescue, and prairie June grass are on the drier sites. Tufted hairgrass and shrub thickets are dominant in wetlands.

## **Section M242A--Oregon and Washington Coast Ranges**

**Geomorphology.** These primarily highly dissected low mountains were shaped by debris slide and avalanche erosion processes on slopes of 40 to 120 percent. Incised valleys are distributed throughout the Section. The Olympic Mountains in the north are an anomalously high range, with very deeply incised, fault-controlled drainages which experienced episodes of glaciation. Coastal lowlands formed from active mountain erosion have slopes less than 30 percent and are formed into marine and riverine terraces. Dunes and bogs occur along the coast, with numerous headlands formed of more resistant rock. Elevation range from sea level to 1,800 ft (545 m) is dominant. Most mountain tops are below 4,000 ft (1,212 m). Olympic Mountains peaks extend to 8,000 ft (2,424 m). Local relief is 200 to 800 ft (60 to 242 m).

**Potential Natural Vegetation.** Lower mountain slopes are dominated by Western Hemlock series. Coastal fog belt areas are dominated by Sitka Spruce and Western Hemlock series. Western Red Cedar series is abundant in the drainages and lower elevations where soil moisture is abundant. Pacific Silver Fir series is dominant on the cryic soils. Shore Pine series occurs on dunes.

## **Section M242B--Western Cascades**

**Geomorphology.** This is an uplifted sequence of extrusive volcanics and volcanoclastic rocks, interspersed with intrusives, that have been dissected by large order riverine systems. Alpine glaciation has left till and outwash deposits at the higher elevations. The high Cascades to the east of the Section are active volcanoes with evidence of recent, and in some cases, remnant glaciation. The northern part of the Section contains more metasediments than the southerly portion and abounds with classical U-shaped valleys and cirques. Elevation ranges from near sea level at the Columbia River to greater than 14,000 feet (4,516 m) in the peaks of the Cascade Mountains. Most of the Section is between 2,000 and 7,000 feet (645 and 2,258 m). Local relief is more than 1,000 feet (322 m) in most of the Section.

**Potential Natural Vegetation.** According to Kuchler, the dominant vegetation is silver fir--Douglas--fir forest. The next most abundant is fir-hemlock forest. At the highest elevations, there are dispersed areas of alpine meadow and barrens. In the northernmost portion, there is western spruce-fir forest. Western Hemlock series dominates the frigid and udic regimes. Western red cedar is common in drainages. Cryic regimes are dominated by Pacific Silver Fir, Mountain Hemlock and Subalpine Fir series. Parkland of forbs, grasses, shrubs, lichens, mosses, and krummholz are interspersed at the high elevations above timberline.

## **Section M242C--Eastern Cascades**

**Geomorphology.** Glaciation of high volcanic peaks has resulted in a relatively steep eastern slope for the Section. High energy streams and flows of debris and mud are common. Glacial forms have not stabilized. Classical U-shaped valleys and cirques abound in the northern part of

the Section. To the south, glaciation was less severe and gradually diminishes towards the southern limit of the Section. Individual volcanic peaks rise above the surrounding incised topography. Many are still active, primarily south of the Olympic-Wallowa lineament. Statistically, an eruption occurs about every 25 years. Small recent volcanic vents are common on the flanks of larger volcanoes. Large areas of fresh lava flows abound in the east of this Section. Volcanic ash from earlier eruptions originally blanketed the east slope. This ash has been concentrated in a southern pumice plateau, blanketing all but the higher hills and ridges. Elevation ranges from near sea level at the Columbia River to more than 10,000 ft (3,300 m) in the high mountain peaks. Most of the Section is between 3,000 and 7,000 ft (968 and 2,258 m). Local relief varies from about 200 ft in the plateau regions to more than 2,000 ft in the deeply dissected mountains.

**Potential Natural Vegetation.** According to Kuchler, the dominant vegetation is silver fir--Douglas--fir forest. The next most abundant is fir-hemlock forest. At the highest elevations, there are dispersed areas of alpine meadow and barrens. In the northernmost portion, there is western spruce-fir forest. Vegetation series is highly variable and diverse in the Eastern Cascades Section. Ponderosa Pine and Lodgepole Pine series dominate the lower elevations. In the pumice plateau of Oregon they are largely on cryic and xeric soils. Ponderosa Pine series also is in the mesic and frigid and xeric regimes. In the northern part of the Section, Lodgepole Pine series is mostly in cryic regimes. Douglas-fir series occupies frigid and xeric regimes. The higher elevations are dominated by White Fir, Grand Fir, Pacific Silver Fir, and Subalpine Fir series. Local areas of White Bark Pine, and Engelmann Spruce series occur. Quaking aspen occurs adjacent to and in some wet areas. Grass and sedge meadows (dry to wet) are scattered.

### **Section M244A--Chugach-St. Elias Mountains**

**Geomorphology.** The Kenai, Chugach, and St. Elias Mountains form a rugged, crescent-shaped barrier along the coast of the Gulf of Alaska. High segments of the mountains are dominated by extremely rugged east-trending ridges. The entire range is heavily glaciated, and the topography is characterized by horns, aretes, cirques, and U-shaped valleys. The south coast is deeply indented by fjords and sounds, and the ridges extend southward as chains of islands. Elevation ranges from 330 to greater than 14,750 ft (100 to more than 4,500 m).

**Potential Natural Vegetation.** Most of the Section is either barren, ice-covered, or mantled with alpine tundra heath meadows. Some spruce-hardwood forests occur along the largest rivers.

### **Section M244B--Lynn Canal**

**Geomorphology.** The area is dominated by rugged glaciated mountains with deep V-shaped and U-shaped valleys. Many of the bays have narrow borders of hilly moraines, with short flat-bottomed valleys at the head. Most slopes throughout the Section are steep. Elevation ranges from sea level to over 14,750 ft (4,500 m).

**Potential Natural Vegetation.** Since the Section is partially modified by polar air masses, the prevailing vegetation is quite diverse. Forest vegetation dominated by western hemlock and Sitka

spruce predominate in the low-lying areas up to 300 m in elevation. Mixed conifer, black cottonwood, and lodgepole pine forest types occur on drier inland sites. Low-growing alpine tundra vegetation of sedges and mosses prevails on sites above tree line.

### **Section M244C--Boundary Range**

**Geomorphology.** The area is dominated by rugged glacier-covered mountains or glaciated mountains with deep V-shaped and U-shaped valleys that straddle the international boundary with Canada. Most slopes throughout the Section are steep. Elevation ranges from sea level to over 9,840 ft (3,000 m).

**Potential Natural Vegetation.** Most of the area is either barren, ice-covered, or covered by alpine heath meadows. Forest vegetation of hemlock and spruce occurs along river corridors within mountain passes.

### **Section M245A--Northern Gulf**

**Geomorphology.** This area includes Afognak Island, Prince William Sound, coastal lowlands of Copper River Delta, and Yakutat Forelands. The foreland areas consist of alluvial fans, uplifted estuaries, morainal deposits, dunes, river deltas, and terraces. Crustal uplifting has created terraces or dunes that run parallel to the coastline. Erosion by glacial outburst floods dissect the forelands and dominate landscape patterns. The headlands within Prince William Sound and Afognak Island are erosional bedrock features that end as sea cliffs at the water's edge where little to no deposition occurs except in bays and shallow estuaries. Elevation ranges from sea level to 500 ft (150 m).

**Potential Natural Vegetation.** Coastal subpolar rainforests of western hemlock and Sitka spruce are characteristic in areas with better soil drainage. Along the coastline, areas with high water tables support sphagnum mosses, sedges, and willows, which foster peatland development.

**Disturbance Regimes.** Wildfire occurrence is rare.

### **Section M245B--Northern Alexander Archipelago**

**Geomorphology.** This Section includes Baranof, Chichagof, and Admiralty Islands, and the portion of the mainland below the permanent snowfields in southeast Alaska. These areas have rugged topography with many long and broad U-shaped glaciated valleys, many of which terminate at tidewater. Side slopes are very steep and exposed bedrock is common along the glacially scoured valley walls. The rolling moraine landforms dominate the low hills and valley bottoms. Elevation ranges from sea level to over 3,280 ft (1,000 m).

**Potential Natural Vegetation.** Perhumid rainforests of Sitka spruce and western hemlock predominate. Water-tolerant plants, such as sphagnum moss, sedges, bog kalmia, and shore pine, occur in peatlands. Alpine tundra heath meadows and barrens occur at higher elevations.

**Disturbance Regimes.** Wildfire is rare,

## **Section M245C--Southern Alexander Archipelago**

**Geomorphology.** This Section includes all the islands below Fredrick Sound, as well as the mainland south of the Stikine River corridor below the permanent snowfields in southeast Alaska. Most of the area is rugged mountains with many broad, U-shaped, glaciated valleys which terminate as fjords at tidewater. Tidewater glaciers are infrequent in this Section. Elevation ranges from sea level to over 3,280 ft (1,000 m).

**Potential Natural Vegetation.** Coastal perhumid rainforests of Sitka spruce and western hemlock predominate. The northern limits of western red cedar and salal correspond to the northern boundary of this Section. Hydric vegetation of sphagnum moss, sedges, and willows predominate on peatlands. Some alpine heath meadows occur on the highest mountains.

**Disturbance Regimes.** Wildfire occurs only during drought periods.

## **Prairie Parkland (Temperate)**

These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Nebraska, Missouri, Illinois, Indiana, Iowa, Minnesota, and North and South Dakota. The area of these Section is about 218,200 mi<sup>2</sup> (565,100 km<sup>2</sup>).

## **Section 251A--Red River Valley**

**Geomorphology.** This Section is part of the Central Lowland geomorphic province. It forms the southern extension of a large, level lacustrine plain (Glacial Lake Agassiz) that extends far to the north and west into Manitoba, Saskatchewan, and Alberta. The plain is bisected by the Red River valley. Prominent alluvial fans formed where the Pembina and Sheyenne Rivers entered the glacial lake from the west. Beach and morainal ridges border the Section on the east. Other features include kettles, wetlands, and dunes adjacent to the fans. Drainage is a modified trellis pattern; tributaries enter the Red River from uplands to the east and west. Geomorphic processes operating in the Section are fluvial erosion, transport and deposition. Elevation ranges from 825 to 1,150 ft (250 to 350 m). Local relief is 3 to 25 ft (1 to 8 m).

**Potential Natural Vegetation.** Kuchler types are bluestem prairie and northern flood plain forest, with the latter mapped in a narrow strip along the Red River and its major tributaries.

**Disturbance Regimes.** Fire, drought, and annual flooding are significant. High wind events are also common. Historically, bison grazing and ant activity caused important faunal modifications of vegetation and soils.

## **Section 251B--North-Central Glaciated Plains**

**Geomorphology.** This Section is part of the Central Lowland geomorphic province. It is mostly level to rolling till plain. A series of low, sub-parallel, south to north and southeast to northwest trending morainal ridges is featured in the northwestern third of the Section. The Coteau des

Prairies, a moderately dissected, relatively high plateau with a much thinner till cover, is prominent in the northwestern portion. The Minnesota River's broad valley was created by the Pleistocene draining of Glacial Lake Agassiz. There are scattered lacustrine lowlands and outwash channels as well. Elevation ranges from 750 to 2,000 ft (225 to 600 m). Local relief is generally 20 to 100 ft (6 to 30 m); it is higher in a few localized areas, notably the edge of the Coteau des Prairies.

**Potential Natural Vegetation.** Kuchler type is mapped as almost entirely bluestem prairie, with a narrow corridor of northern flood plain forest along the Minnesota River, and a few fingers of oak-hickory forest along other drainages in the southern part.

**Disturbance Regimes.** Historically, fire was the most common natural disturbance. Floods and tornadoes also occurred. Fire suppression has allowed woodlands to develop from what was originally oak openings or brush prairies.

### **Section 251C--Central Dissected Till Plains**

**Geomorphology.** This is part of the Central Lowland geomorphic province. It is characterized by moderately dissected, glaciated, flat to rolling plains that slope gently toward the Missouri and Mississippi River valleys, which bracket the Section on the west-south and east, respectively. Local relief is 20 to 165 ft (6 to 50 m). A minor anthropogenic landform, strip-mined areas, exhibit hummocky or ridge-swale topography. Drainage is dendritic; current geomorphic processes are fluvial erosion, transport and deposition, and minor mass wasting. Elevation ranges from 600 to 1,500 ft (185 to 450 m).

**Potential Natural Vegetation.** Kuchler vegetation types are mapped as dominantly mosaic of bluestem prairie and oak-hickory forest, with oak-hickory forest along drainageways. An estimated 60 percent of the land surface was bluestem (tall-grass) prairie, with bur oak and white oak savannas interspersed and in transitional areas. Upland forest (white oak-shagbark hickory) occurred on more dissected land, grading into bottomland forests and wet bottomland prairies along rivers.

**Disturbance Regimes.** Fire and grazing by herds of bison and elk were most important in creation and maintenance of this landscape.

### **Section 251D--Central Till Plains**

**Geomorphology.** This Section is part of the Central Lowlands geomorphic province. It is a level to gently rolling till-plain (glacial ground moraine), with broad bottomlands and associated terraces and meander scars along major river valleys. The plain is overlain by a series of low, undulating ridges (glacial end moraines). Relief along flood plain margins of major rivers and their larger tributaries can exceed 150 ft (45 m). A notable but minor landform is anthropogenic. lands that have been strip-mined exhibit hummocky or ridge-swale topography. The dominant geomorphic processes operating in the Section are fluvial erosion, transport and deposition, with

minor mass wasting. Elevation ranges from 600 to 1,000 ft (180 to 300 m). Local relief is dominantly 3 to 100 ft (1 to 30 m), but ranges up to 165 ft (50 m) along bedrock bluffs along some major streams.

**Potential Natural Community.** This area is principally tall grass prairie. variations on the big bluestem-indiangrass-prairie dropseed-switchgrass community; cord grass-sedge-blue jointgrass communities on wet sites; and little bluestem-side oats-grama on drier sites. Forest communities occur along stream valleys. white oak-black oak-shagbark hickory community on slopes, with basswood-sugar maple-elm-ash community on wetter, shaded sites. Kuchler mapped the area as oak savanna and oak-hickory forest.

**Disturbance Regimes.** Historically, major natural disturbances were prairie fires and grazing ungulates. Since settlement, most of the wetlands, marshes, and "prairie potholes" have been drained for agriculture, and virtually all prairie habitats have been replaced with row crops or pasture.

## **Section 251E--Osage Plains**

**Geomorphology.** This is part of the Central Lowlands geomorphic province. It is characterized by a series of sub parallel, southwestern to northeastern trending, maturely dissected, low cuestas or escarpments separating level to gently rolling plains. Local relief on the cuestas is generally between 100 and 300 ft (30-90 m); on the plains it is less than 100 ft. Elevation ranges from 300 to 1,300 ft (100 to 400 m).

**Potential Natural Vegetation.** Kuchler vegetation types are mapped as dominantly mosaic of bluestem prairie and oak-hickory forest, with corridors of oak-hickory forest along drainageways. This section was once 70 percent tall-grass prairie, little bluestem and associates, with groves of post and blackjack oaks. Upland prairie graded into wet bottomland prairie, with sloughs, marshes, and mixed bottomland forest. This forest included silver maple, green ash, cottonwood, pecan, pin oak, and bur oak.

**Disturbance Regimes.** Fire, grazing, drought (occasionally very severe), and tornadoes were the principal prehistoric sources of disturbance. Coal is strip-mined in many places.

## **Section 251F--Flint Hills**

**Geomorphology.** Relatively old episodes of Paleozoic platform sedimentation were followed by uplift and dissection, characteristic of geomorphic processes historically active in this Section. Present geomorphic processes include gentle and moderate gradient valley stream erosion, transport and deposition. Gentle sloping hills with relief of 300 to 500 ft, found among lowlands, make up most of the area. This Section is within the Central Lowlands geomorphic physical province. Elevation ranges from 985 to 1,970 ft (300 to 600 m).

**Potential Natural Vegetation.** There is bluestem prairie with northern flood plain forest along major drainages.

**Disturbance Regimes.** Fire and drought have probably been the principal historical sources of disturbance.

## **Section 251G--Central Loess Plains**

**Geomorphology.** Dissected loess plains comprise this Section. It has gently rolling smooth, and irregular plains mantled by loess. Drainage pattern cuts into upper loess mantle and exposes older Loveland loess. Stream valleys are narrow, not deeply incised. Local relief ranges from tens to hundreds of ft. This Section is in the Central Lowlands and Great Plains geomorphic provinces. Elevation ranges from 600 to 1,970 ft (183 to 600 m).

**Potential Natural Vegetation.** There is bluestem prairie with northern flood plain forest along major drainages.

**Disturbance Regimes.** Drought and fire are probably the principal sources of disturbance.

## **Prairie Parkland (Subtropical)**

These Sections are located in Oklahoma and Texas. The area of these Sections is about 80,100 mi<sup>2</sup> (207,500 km<sup>2</sup>).

## **Section 255A--Cross Timbers and Prairies**

**Geomorphology.** This Section is in the Central Lowlands geomorphic province. The predominant landform on about 70 percent of the Section consists of irregular plains that originated from uplift of level bedded continental sediments, that had been deposited into a shallow inland sea, followed by a long period of erosion. Other landforms include plains with hills and open high hills. Elevation ranges from 330 to 1,300 ft (100 to 400 m). Local relief ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as cross timbers (Quercus-Andropogon), oak-hickory forest, and oak-hickory-pine forest. The predominant vegetation form is cold-deciduous broad-leaved forest and extensive areas of tall grassland with a tree layer. Forest cover consists of post, live, and blackjack oaks, and pignut and mockernut hickories. Grasses consist of big and little bluestems, indiagrass, and sunflower.

**Disturbance Regimes.** Fire and drought have probably been the principal historical sources of disturbance.

## **Section 255B--Blackland Prairies**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform is irregular plains. This Section is an elevated sea bottom that has been shaped by marine and shore-zone processes resulting from repeated episodes of submergence and emergence of the land from the ocean. Some geomorphic processes currently active throughout

the area are gentle gradient valley stream erosion, transport and deposition. Elevation ranges from 330 to 660 ft (100 to 200m). Local relief ranges from 100 to 300 ft.

**Potential Natural Vegetation.** Kuchler mapped vegetation as blackland prairie (*Andropogon-Stipa*) and juniper-oak savanna. The predominant vegetation form is tall grassland consisting mainly of bunch grasses, such as indiagrass, big bluestem, switchgrass, and eastern gamagrass. A savanna community occurs along many major rivers, consisting of elm, pecan, cottonwood, and hackberry, with grasses between the trees.

**Disturbance Regimes.** Fire and drought have probably been the principal historical sources of disturbance.

### **Section 255C--Oak Woods and Prairies**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform on about 80 percent of the Section consists of irregular plains. Other landforms include plains with hills and smooth plains. This Section is an elevated sea bottom that has been shaped by marine and shore-zone processes resulting from repeated episodes of submergence and emergence of the land from the ocean. Some geomorphic processes currently active throughout the area are gentle gradient valley stream erosion, transport and deposition. Elevation ranges from 650 to 1,310 ft (200 to 400 m). Local relief ranges from 100 to 300 ft.

**Potential Natural Vegetation.** Kuchler classified vegetation as oak-hickory forest, cross timbers (*Quercus-Andropogon*), and juniper-oak savanna. The predominant vegetation type is cold-deciduous, broad-leaved forest. The oak-hickory cover type consists of scarlet, post, and blackjack oaks, and pignut and mockernut hickories. Forests of elm, pecan, and walnut are in bottomlands. Little bluestem is the dominant grass.

**Disturbance Regimes.** Fire and drought have probably been the principal historical disturbances.

### **Section 255D--Central Gulf Prairies and Marshes**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 160 ft (0 to 50 m). Local relief ranges from 0 to 100 ft.

**Potential Natural Vegetation.** Kuchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. The predominant vegetation form is tall grassland consisting mainly of bunch grasses. Prairie grasslands dominate areas inland from the coast and consist of little bluestem, indiagrass, switchgrass, and big bluestem. Occasional areas of live oak are present.

Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

**Disturbance Regimes.** Ocean tides have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

## **California Coastal Chaparral Forest and Shrub**

These Sections are located along coastal California. The area of these Sections is about 10,300 mi<sup>2</sup> (26,700 km<sup>2</sup>)

### **Section 261A--Central California Coast**

**Geomorphology.** This area includes parallel ranges and valleys on folded, faulted and metamorphosed strata; there are rounded crests of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from sea level to 2,400 ft (0 to 730 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as mixed hardwood forest, coastal prairie-scrub, coastal sagebrush, mixed hardwood and redwood forest, redwood forest, and southern oak forest. Predominant potential natural communities are Coastal Sage (Lucian), Coast Live Oak, Coastal Perennial Grassland and Redwood (northern part) series. Fires are of variable frequency, season, and intensity.

### **Section 261B--Southern California Coast**

**Geomorphology.** This Section comprises narrow ranges and broad fault blocks, as well as alluviated lowlands and coastal terraces. It is in the Transverse and Peninsular Ranges geomorphic province. Elevation ranges from sea level to 3,000 ft (0 to 912 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as chaparral, coastal sagebrush, southern oak forest and valley oak savanna. Predominant potential natural communities are Coastal Sage (Venturan) and Coastal Perennial Grassland series. Historic occurrence of fire has changed from variable frequency, season, and intensity to more frequent, larger, and more intense fires.

## **California Dry Steppe**

The area of this Section, which is located in California, is about 19,200 mi<sup>2</sup> (49,700 km<sup>2</sup>).

### **Section 262A--Great Valley**

**Geomorphology.** This low fluvial plain is in the Great Valley geomorphic province. Elevation ranges from sea level to 800 ft (0 to 243 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as California prairie, riparian forest, tule marsh, San Joaquin saltbush and valley oak savanna. Predominant potential natural communities are Valley Oak, Valley Needlegrass, and Saltbush series. Historic occurrence of

fire has changed from frequent, fast moving, large fires to infrequent small fires, or fire has been mostly excluded because of conversion to irrigated agriculture and urban uses.

## **California Coastal Steppe, Mixed Forest, and Redwood Forest**

This Section is located along coastal California. The area of this Section is about 4,600 mi<sup>2</sup> (11,900 km<sup>2</sup>).

### **Section 263A--Northern California Coast**

**Geomorphology.** This area has parallel ranges, and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from sea level to 3,000 ft (0 to 912 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as redwood forest, mixed evergreen forest, coastal prairie-scrub, coastal cypress and pine forest, and mixed hardwood forest. Predominant potential natural communities include Redwood, Douglas-Fir, Tanoak, Coast Live Oak, Coastal Sage (Franciscan) and North Coastal Shrub series. Historic occurrence of fire is changing from frequent, low to high intensity surface fires to infrequent, moderate to high intensity stand-replacing fires.

## **Sierran Steppe - Mixed Forest - Coniferous Forest**

The area of these Sections is about 68,300 mi<sup>2</sup> (176,900 km<sup>2</sup>).

### **Section M261A--Klamath Mountains**

**Geomorphology.** This is an uplifted and dissected peneplain on strong rocks; there are extensive monadnock ranges. Elevation ranges from 1,500 to 8,000 ft (456 to 2,432 m). This Section is in the Klamath Mountains geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Klamath montane forest, mixed evergreen forest, Oregon oak forest and northern yellow pine forest. Predominant potential natural communities are Douglas-Fir, Ponderosa Pine, Mixed Conifer, Jeffrey Pine, White Fir and Red Fir series. At lower and mid elevations, historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate and high intensity surface or stand-replacing fires.

### **Section M261B--Northern California Coast Ranges**

**Geomorphology.** This area has parallel ranges, and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. Elevation ranges from 1,000 to 7,500 ft (304 to 2,280 m). This Section is in the Coast Ranges geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Coast Ranges montane forest, mixed evergreen forest, chaparral, blue oak-foothill pine forest, and mixed hardwood forest. Predominant potential natural communities are Douglas-Fir, White Fir, Ponderosa Pine, Tanoak, Interior Live Oak, Coast Live Oak and Mixed Chaparral series. Historic occurrence of fire has changed from frequent, low, moderate, and high intensity surface fires to infrequent, high intensity ground or stand-replacing fires.

### **Section M261C--Northern California Interior Coast Ranges**

**Geomorphology.** This area has parallel ranges and folded, faulted, and metamorphosed strata; there are rounded crests of subequal height. Elevation ranges from 200 to 2,500 ft (61 to 760 m). This Section is in the Coast Ranges geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as blue oak-foothill pine forest, chaparral and California prairie. Predominant potential natural communities are Blue Oak, Mixed Chaparral and Valley Needlegrass series. Fires are low, moderate, and high intensity surface or stand-replacing fires.

### **Section M261D--Southern Cascades**

**Geomorphology.** These volcanic mountains are variously eroded; there is no distinct range. Elevation ranges from 1,500 to 14,000 ft (456 to 5,256 m). This Section is in the Cascade Range geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Sierran montane forest, sagebrush steppe, yellow pine-shrub forest and northern yellow pine forest. Predominant potential natural communities are White Fir, Ponderosa Pine, Mixed Conifer, Red Fir, Lodgepole Pine and Oregon Oak series. At lower and mid-elevations, historic occurrence of fire has changed from frequent, low intensity, surface fires to infrequent, high intensity, stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity surface fires to infrequent, low, moderate, and high intensity surface or stand-replacing fires. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

### **Section M261E--Sierra Nevada**

**Geomorphology.** This block mountain range tilts west and has accordant crests. Elevation ranges from 1,000 to 14,495 ft (300 to 4,407 m). Local relief ranges from 500 to 2,000 ft (150 to 600 m). It is in the Sierra Nevada Range geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Sierran montane forest, upper montane-subalpine forest, alpine communities and barren, and northern Jeffrey pine forest. Predominant potential natural communities are Ponderosa Pine, Ponderosa Pine-Mixed Conifer, Douglas Fir-Mixed Conifer, White Fir-Mixed Conifer, Red Fir, Lodgepole Pine, Jeffrey Pine, Big Sagebrush, Canyon Live Oak, White Alder, Mountain Alder, Huckleberry Oak, Carex and Aspen series. At lower and mid-elevations, historic occurrence of fire has changed from

frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires. At higher elevations, historic occurrence has changed from infrequent, low and moderate intensity ground fires to infrequent, low, moderate, and high intensity surface or stand-replacing fires. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

### **Section M261F--Sierra Nevada Foothills**

**Geomorphology.** This block mountain range tilts west and has accordant crests. Elevation ranges from 500 to 3,500 ft (152 to 1,064 m). It is in the Sierra Nevada Range geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as blue oak-foothill pine forest, and chaparral. Predominant potential natural communities are Blue Oak, Interior Live Oak, Valley Needlegrass and Mixed Chaparral series. Fires are low, moderate, and high intensity surface or stand-replacing fires.

### **Section M261G--Modoc Plateau**

**Geomorphology.** This area comprises northwesterly trending fault-block mountains and ridges, with intervening basin-like grabens commonly interspersed with lake bed deposits, shield volcanoes, cinder cones, or lava flows. Elevation ranges from 3,000 to 9,900 ft (912 to 3,010 m). This is in the Modoc Plateau geomorphic province (part of the Basin and Range Province flooded with volcanics related to those of the Cascade Range Province).

**Potential Natural Vegetation.** Kuchler mapped vegetation as yellow pine-shrub forest, juniper-shrub savannah, Sierran montane forest, sagebrush steppe, upper montane-alpine forests, and northern Jeffrey pine forest. Predominant potential natural communities are Ponderosa Pine, Mixed Conifer, Western Juniper, White Fir, Big Sagebrush, Low Sagebrush and Carex series. Historic occurrence of fire has changed from frequent, low intensity ground fires to infrequent, high intensity stand-replacing fires.

## **California Coastal Range Open Woodland - Shrub - Coniferous Forest - Meadow**

These Sections are located in California. The area of these Sections is about 24,900 mi<sup>2</sup> (64,500 km<sup>2</sup>).

### **Section M262A--Central California Coast Ranges**

**Geomorphology.** This area has parallel ranges, and folded, faulted, and metamorphosed strata; the rounded crests are of subequal height. This Section is in the Coast Ranges geomorphic province. Elevation ranges from 500 to 3,500 ft (152 to 1,064 m).

**Lithology and Stratigraphy.** There are Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits; late Mesozoic shelf, slope, and eugeosynclinal sedimentary rocks; and Mesozoic ultramafic rocks.

**Soil Taxa.** Soils include Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols, in combination with thermic soil temperature regime and xeric and aridic soil moisture regimes.

**Potential Natural Vegetation.** Kuchler mapped vegetation as blue oak-foothill pine forest, California prairie, and chaparral. Predominant potential natural communities are Blue Oak, Interior Live Oak, Valley Oak, Mixed Chaparral, Western Juniper-Pinyon Pine (southern part), Bluegrass, and Valley Needlegrass series. Fires are low, moderate, or high intensity ground or stand-replacing fires. Wide fluctuations in precipitation and temperature for periods of years result in significant or catastrophic changes in biological communities.

## **Section M262B--Southern California Mountains and Valleys**

**Geomorphology.** There are narrow ranges and broad fault blocks, alluviated lowlands, and dissected westward sloping granitic uplands. This Section is in both the Transverse and Peninsular Ranges geomorphic provinces. Elevation ranges from 500 to 11,500 ft (153 to 3,496 m).

**Lithology and Stratigraphy.** There are Cenozoic marine and nonmarine sedimentary rocks and alluvial deposits, and Mesozoic granitic rocks.

**Soil Taxa.** Soils include Alfisols, Entisols, Inceptisols, and Mollisols, in combination with thermic, mesic, and frigid soil temperature regimes and xeric and aridic soil moisture regimes.

**Potential Natural Vegetation.** Kuchler mapped vegetation as southern oak forest, coastal sagebrush, chaparral and southern yellow pine forest. Predominant potential natural communities include Chamise, Ceanothus, Mixed Chaparral, Scruboak, Coast Live Oak, Englemann Oak, Needlegrass, Jeffrey Pine, Canyon Oak and Big Cone Douglas-Fir series. There are stand-replacing fires of variable frequency, season, and intensity. Some plant and animal species show effects of air pollution.

## **Great Plains Steppe and Shrub**

Most of this section is located in Oklahoma. The area of this Section is about 17,600 mi<sup>2</sup> (45,600 km<sup>2</sup>).

## **Section 311A--Redbed Plains**

**Geomorphology.** This Section is in the Central Lowlands geomorphic province, and is mostly in Oklahoma. Platform uplift of continental sediments deposited previously into a shallow inland sea, followed by a long period of erosion; these processes resulted in a moderately to strongly dissected region. About 70 percent of this Section consists of irregular plains. Other landforms include about equal areas of plains with low mountains, smooth plains, and tablelands. Elevation ranges from 1,600 to 3,000 ft (500 to 900 m). Local relief in much of the Section ranges from

100 to 300 ft (30 to 90 m). Smaller areas are present where relief ranges from 30 to 60 ft (10 to 20 m) in tablelands and up to 1,000 ft (300 m) in low mountains.

**Potential Natural Vegetation.** Kuchler classified vegetation as bluestem-grama prairie, and cross timbers (*Quercus-Andropogon*); shinnery (*Quercus-Andropogon*); and sandsage-bluestem prairie. The predominant vegetation form is medium-tall grasslands with sparse tree cover. Grasses consist mainly of sand bluestem, little bluestem, and sand saltbrush. Fire and drought have probably been the principal historical disturbances.

## Colorado Plateau Semi-Desert

These Sections are located in the southwestern conterminous States, including parts of Arizona, New Mexico, Utah, and Colorado. The area of these Sections is about 75,300 mi<sup>2</sup> (195,000 km<sup>2</sup>

### Section 313A--Grand Canyon

**Geomorphology.** This Section is in the Colorado Plateau physiographic province. Grand Canyon lands are in the south-central part of Utah and the northern portion of Arizona. It extends into the southwestern corner of Colorado. This area is eroded by the Colorado River and its tributaries. Deep sheer-walled canyons, lines of cliffs, elevated plains, low plateaus, mesas, buttes, and badlands dominate landscape. Major landforms are the Grand Canyon and Colorado Plateau. Elevation ranges from 4,200 to 7,800 ft (1,300 to 2,400 m).

**Potential Natural Vegetation.** This area consists of pinyon-juniper woodland with a small area of Great Basin sagebrush, and blackbrush vegetation. The area has a cold desert shrub and steppe woodland vegetation, with some paleoendemic blackbrush. Fire is cyclical. Grazing for sheep and cattle is the major land use. Hay and pasture lands also occur to a very limited extent along drainage ways. Climate is very dry and hot in the summer and cold and moist in the winter, indicative of a cold, desertic condition.

### Section 313B--Navajo Canyonlands

**Geomorphology.** This Section is in the Colorado Plateaus physiographic province. Navajo Canyonlands are in the northeast part of Arizona and southeast Utah. Geomorphic processes active in this area are deep canyon formations as the result of plateau dissection. Volcanic mountains exist in this Section, but block-fault structural mountain ranges do not. Major landforms are canyonlands, plateaus, plains, and hills. Major landform features are the Painted Desert, Vermillion and Echo Cliffs, Glen Canyon Recreation Area, and Canyonlands National Park. Elevation ranges from 4,000 to 8,000 ft (1,210 to 2,425 m).

**Potential Natural Vegetation.** Vegetation consists of pinyon-juniper woodlands at higher elevations. Grama and galleta grasses are found at lower elevations; greasewood and saltbrush are found on calcareous and salt affected soils. Fires are variable in frequency and intensity. Flash floods and drought are common. Approximately 90 percent of this area is rangeland. It is grazed by both cattle and sheep.

## **Section 313C--Tonto Transition**

**Geomorphology.** The Tonto Transition Section lies between the Basin and Range and Colorado Plateaus physiographic provinces. The Tonto Transition Section is located in central and northwest central Arizona. Precambrian through Mesozoic volcanic activity and sedimentary deposition were major geomorphic processes. Lava flows, plugs, dikes, and relatively flat sedimentary deposits resulted. Major landforms are mountains, hills, scarps, and some plains. Major landform features include the Mazatzal Mountains, Black Hills, Aquarius Mountains, Bradshaw Mountains, and the Superstition Mountains. Elevation ranges from 3,000 to 7,400 ft (915 to 2,255 m).

**Potential Natural Vegetation.** Vegetation consists of interior chaparral of Turbinella oak on coarse igneous parent materials, steep slopes, and fire disturbed regimes. There are pinyon-juniper on elevations higher than about 4,200 ft (1,280 m); ponderosa pine occurs in frigid and limited mesic soil temperature regimes at higher elevations.

Fire climax occurs on steep slopes and many coarse igneous rocks in mesic and thermic soil temperature regime areas in the interior chaparral community. Frequency is variable, but may range from 25 to 100 years. Flash floods and droughts are common.

## **Section 313D--Painted Desert**

**Geomorphology.** This Section is in the Colorado Plateaus physiographic province. Geomorphic processes active in this area are Mesozoic sedimentary deposition followed by tilting and erosion into majestic plateaus. Major landforms are plains, hills, canyonlands, and valley plains. Elevation ranges from 4,000 to 7,000 ft (1,210 to 2,134 m).

**Potential Natural Vegetation.** Grama and galleta grasses occur at lower elevations and pinyon-juniper woodlands at higher elevations; saltbrush-greasewood type occur in dry, salt affected, and calcareous soils. Fires are variable in frequency and intensity. Flash floods and drought are common. Most of this area is rangeland. It is grazed by both sheep and cattle.

## **Section 313E--Central Rio Grande Intermontane**

**Geomorphology.** This Section, which is in the Basin and Range physiographic province, is located in central New Mexico. Active geomorphic processes in this Section are basins produced by erosional and depositional action of running water. Major landforms are valleys and lowland and outwash plains, and alluvial fans and terraces. The Rio Grande basin is the major landform feature.

**Potential Natural Vegetation.** Grama and galleta grasses and four-wing saltbrush occur along with sand sage at lower elevations; pinyon-juniper woodlands are at higher elevations. A few areas have riparian species such as cottonwood and willow. Fires are variable in frequency and intensity, depending on fuel and moisture. Most of this Section is grazed by sheep and cattle.

## Southwest Plateau and Plains Dry Steppe and Shrub

These Sections are located in the New Mexico and Texas. The area of these Sections is about 160,900 mi<sup>2</sup> (416,700 km<sup>2</sup>).

### Section 315A--Pecos Valley

**Geomorphology.** This section is in the Great Plains physiographic province. It is located in west-central New Mexico. Major landforms are plains, hills, basins, and fans. Major landform features include the Pecos Plains and the Canadian Valley. Elevation range from 4,000 to 6,900 ft (1,200 to 2,100 m)

**Potential Natural Vegetation.** Vegetation consists of grama and galleta grass, pinyon-juniper in mesic soil temperature regimes, and ustic soil moisture regimes, and mesquite bush in aridic soil moisture regimes.

**Disturbance Regimes.** Fires vary in frequency and intensity, depending on fuel load and moisture.

### Section 315B--Texas High Plains

**Geomorphology.** This Section is in the Great Plains geomorphic province. The predominant landform consists of a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport. These processes resulted in a region of moderate dissection. Elevation ranges from 2,600 to 6,500 ft (800 to 2,000 m). Local relief in most of the Section ranges from 100 to 300 ft, however, relief in the tablelands ranges from 300 to 500 ft.

**Potential Natural Vegetation.** Kuchler classified vegetation as grama-buffalo grass and shinnery (*Quercus-Andropogon*). The predominant vegetation form is short grass communities composed of bunch grasses with a sparse shrub layer. Species include short grasses (blue gramma, and buffalograss), sagebrush, mesquite, and yucca.

**Disturbance Regimes.** Fire and drought have probably been the principal historical disturbances.

### Section 315C--Rolling Plains

**Geomorphology.** This Section is in the Central Lowlands geomorphic province. Landforms originated from platform uplift of continental sediments deposited previously into a shallow inland sea, followed by a long period of erosion. These processes resulted in a moderately dissected landscape. About 80 percent of this Section is equally divided between irregular plains and tablelands. Smaller areas of smooth plains and plains with hills are also present. Elevation

ranges from 1,640 to 2,950 ft (500 to 900 m). Local relief in most of the Section ranges from 100 to 300 ft. Smaller areas are present where local relief ranges from 300 to 500 ft.

**Potential Natural Vegetation.** Kuchler classified vegetation as mesquite-buffalo grass. The predominant vegetation form is medium-tall grassland with a sparse shrub cover. The vegetative community consists of sand and little bluestems and sagebrush.

**Disturbance Regimes.** Fire and drought have probably been the principal historical disturbances.

### **Section 315D--Edwards Plateau**

**Geomorphology.** This Section is in the Great Plains geomorphic province. The predominant landform consists of a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport; these processes resulted in a region of moderate dissection. About 90 percent of this Section consists of landforms equally divided between smooth plains and tablelands having moderate relief. Also included are smaller areas of open high hills, high hills, and plains with hills. Elevation ranges from 650 to 4,000 ft (200 to 1,200 m). Local relief in most of the Section ranges from 100 to 300 ft (30 to 90 m). In a small area of hills, relief ranges from 300 to 500 ft (90 to 150 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as juniper-oak savanna and mesquite-acacia-savanna. The predominant vegetation form is mid to short grasslands and evergreen scale-leaved woodlands with a sparse cover of drought-deciduous shrubs. A mixture of species may occur, including blackjack oak, red cedar, mesquite, live oak, and species of mid and short grass grasslands.

**Disturbance Regimes.** Fire and drought have probably been the principal historical disturbances.

### **Section 315E--Rio Grande Plain**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform in this Section is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto submerged, shallow continental shelf, which was later exposed by sea level subsidence. Elevation ranges from 80 to 1,000 ft (25 to 300 m). Local relief in most of the Section ranges from 100 to 300 ft (30 to 90 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as mesquite-acacia-savanna and ceniza shrub. The predominant vegetation form is short grassland with a sparse cover of drought deciduous shrubs. Species include mesquite, cactus, and tall and mid grasses. Live oaks and cottonwoods may be present along stream banks.

**Disturbance Regimes.** Drought has probably been the principal historical disturbance.

## **Section 315F--Southern Gulf Prairies and Marshes**

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform consists of a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 160 ft (0 to 50 m). Local relief ranges from 0 to 50 ft (0 to 18 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as bluestem-sacahuista prairie and southern cordgrass prairie. The predominant vegetation form is tall grassland with little tree cover. Grasslands dominate areas inland from the coast and consist of little bluestem, indiangrass, switchgrass, and big bluestem. Occasional areas of live oak are present. Poorly drained areas along the coast support freshwater and saltwater marsh vegetation of sedges, rushes, saltgrass, and cordgrass.

**Disturbance Regimes.** Ocean tides and grazing have probably been the principal historical disturbance. Climatic influences include occasional hurricanes.

## **Arizona-New Mexico Mountains Semi-Desert - Open Woodland - Coniferous Forest - Alpine Meadow**

These Sections are located in Arizona and New Mexico. The area of these Sections is about 50,200 mi<sup>2</sup> (130,000 km<sup>2</sup>).

### **Section M313A--White Mountain-San Francisco Peaks-Mogollon Rim**

**Geomorphology.** Located in the Colorado Plateau physiographic province, this section is in central and eastern-central Arizona and west-central New Mexico. Geomorphic processes active in this Section include Cenozoic volcanism, including basaltic lava flows, cinder cone eruptions, and volcanic ash. Major landforms include mountains, plains, plateaus, and hills. Major landform features include the San Francisco Mountains, White Mountains, and Jemez and Mogollon Mountains. Elevation ranges from 6,000 to over 12,600 ft (1,820 to 3,860 m).

**Potential Natural Vegetation.** Predominant vegetation consists of ponderosa pine and gambel oak in frigid soil temperature and ustic soil moisture regimes, and white fir, Douglas-fir in frigid-udic regimes. Engelmann spruce and corkbark fir are in cryic-udic regimes and mountain avens are in pergelic-udic regimes. Natural fires occurred in ponderosa pine about every 3 to 10 years, but have been prevented recently. This has led to a higher canopy cover and increased fuel loads, resulting in a less resilient ecosystem and increased hazard of wildfire. Much of this area is covered with timber, with rangeland and recreation being secondary uses.

## **Section M313B--Sacramento-Manzano Mountain**

**Geomorphology.** This Section is in the Basin and Range physiographic province; it is located in central and south-central New Mexico. Major landforms are mountains, hills, plains, and scarps. Major landform features are the Sacramento, Manzano and Sandia Mountains and the Canadian Escarpment. Elevation ranges from 6,000 to 11,000 ft (2,130 to 3,690 m).

**Potential Natural Vegetation.** Vegetation consists of ponderosa pine in frigid soil temperature regimes and ustic and udic soil moisture regimes, Douglas-Fir in frigid-udic regimes, pinyon-juniper in mesic-ustic regimes, and Engelmann spruce, and subalpine fir in cryic-udic regimes. A few areas support grey oak at the lowest elevations. Natural fire regime averages 3 to 10 years of frequency in ponderosa pine forests. Much of this area is covered with timber, with some areas of commercial quality. Another use of land is as range.

## **Chihuahuan Semi-Desert**

These Sections are located in the southwestern conterminous States, including parts of Arizona, New Mexico, and Texas. The area of these Sections is about 85,200 mi<sup>2</sup> (220,700 km<sup>2</sup>).

### **Section 321A--Basin and Range**

**Geomorphology.** This area, which is in the Basin and Range physiographic province, is located in southeast Arizona and southwest and central New Mexico. Relatively recent episodes of continental rifting, volcanism, erosion, and sedimentation have dominated this Section. Various landforms comprise about equal areas: (1) plains with low mountains consisting of 50 to 80 percent of gently sloping area and local relief of 1,000 to 3,000 ft; (2) plains with high hills where relief is 1,000 to 3,000 ft; (3) open high hills with relief of 500 to 1,000 ft; and (4) tablelands with moderate relief averaging 100 to 300 ft. Elevation ranges from 2,600 to 5,500 ft (800 to 1676 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as trans-Pecos shrub savanna (with *Flourensia-Larrea*); grama-tobosa desert grasslands; oak-juniper woodland; and mesquite-tarbrush desert scrub. Drought has probably been the principal historical source of disturbance.

### **Section 321B--Stockton Plateau**

**Geomorphology.** This Section is in the Great Plains geomorphic province. The predominant landform consists of open high hills with smaller areas of tablelands. These landform were formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, which was followed by sheet erosion and transport. These processes resulted in a region of shallow dissection. Elevation ranges from 2,600 to 4,500 ft (800 to 1,300 m). Local relief in most of the Section ranges from 500 to 1,000 ft. Relief in a small area of tablelands ranges from 300 to 500 ft.

**Potential Natural Vegetation.** Kuchler classified vegetation as trans-Pecos shrub savanna (with *Flourensia-Larrea*); with juniper and redcedar woodlands. The predominant vegetation form is

short to mid height grasslands with sparse cover of drought-deciduous and scale-leaved shrubs and small trees. Species include desert shrubs in association with short to mid height grasses and oak savannas. This section is part of the Chihuahuan Desert and drought has been the principal disturbance.

## **American Semi-Desert and Desert**

These Sections are located in California and Arizona. The area of these Sections is about 87,700 mi<sup>2</sup> (227,100 km<sup>2</sup>).

### **Section 322A--Mohave Desert**

**Geomorphology.** This area comprises widely separated short ranges in desert plains. It contains isolated mountains, plateaus, alluvial fans, playas, basins, and dunes. Elevation ranges from 300 ft below sea level to 11,000 ft above sea level (-91 to 3,344 m). This Section is in the Basin and Range geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Mojave creosote bush, juniper-pinyon woodland, desert saltbush, and Joshua tree scrub. Predominant potential natural communities include creosote bush, blackbush, greasewood and saltbush series on basins, plains, and hills; Joshua Tree series on plains and hills; and basin sagebrush, western juniper and pinyon pine series on mountains. Areas with less than about 8 in (200 mm) of rainfall rarely support enough vegetation to carry a fire. Fire occurrence in areas receiving more than about 8 in (200 mm) has been influenced by introduced grasses. Fires are variable in frequency and intensity. Flash floods are commonly associated with the irregular occurrence of precipitation events.

### **Section 322B--Sonoran Desert**

**Geomorphology.** This Section is in the Basin and Range physiographic province. There are widely separated short ranges in desert plains. This Section, which is located in southwestern Arizona, has as its major landforms, plains, fans, and terraces. Elevation ranges from 300 to 3,500 ft (91 to 1,064 m).

**Potential Natural Vegetation.** Potential natural communities include palo verde, creosote bush, saguaro, mesquite series, and bursage. Composition and successional sequence of some communities have changed because of plant and animal species introduced between the late 1800's and early 1900's related to mining and grazing.

### **Section 322C--Colorado Desert**

**Geomorphology.** There are alluvial slopes, basin, dunes, and delta plain (Gulf of California). Elevation ranges from 230 feet below sea level to 1,000 ft (-70 to 304 m). This Section is in the Basin and Range geomorphic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Sonoran creosote bush, Salton Sea saltbush, and oasis scrub-woodland. Predominant potential natural communities include creosote

bush and mesquite series. Strong winds and drifting sand are common in parts of the area. Flash floods are commonly associated with the irregular occurrence of precipitation events. Precipitation does not occur every year.

## **Great Plains-Palouse Dry Steppe**

These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Colorado, Nebraska, Wyoming, South and North Dakota, and Montana. The area of these Sections is about 290,700 mi<sup>2</sup> (752,900 km<sup>2</sup>).

### **Section 331A--Palouse Prairie**

**Geomorphology.** This Section comprises moderately to strongly dissected loess-covered basalt plains, hills with large steptoes, undulating plateaus, and some river breaklands. Mountains occur in the southeast part of the Section. This Section is within the Columbia Plateau physiographic province. Elevation ranges from 1,200 to 6,000 ft (366 to 1,830 m).

**Potential Natural Vegetation.** Grasslands and meadow-steppe vegetation dominated by grasses are the prototypical vegetation of the Palouse. Woodlands and forests occur in the eastern portion of the Section on hills and low mountains. The relatively arid western portion of the Section is dominated by grassland, where bluebunch wheatgrass and Idaho fescue are the most prominent. Meadow-steppe vegetation characterized by Idaho fescue and common snowberry dominates areas with more precipitation, but still too dry to support forest vegetation on deep loamy soils. Most of this meadow-steppe as well as the grassland to the west, has been converted to crop lands. Ponderosa pine woodlands and forests form the lower timberline in the eastern portion of the Section on hills and low mountains. The transition zone between forest and meadow-steppe consists of a complex interfingering between these two vegetation types. Douglas-fir series forests dominate at higher elevations in the mountains. Isolated fragments of the Western Red Cedar series and Grand Fir series occur on sheltered north slopes in the mountains. Wind is the principal source of natural disturbance.

### **Section 331B--Southern High Plains**

**Geomorphology.** This Section is in the Great Plains geomorphic province. The predominant landform is a broad, extensive flat plain formed by fluvial sedimentation of continental erosional products from adjacent mountain ranges, followed by sheet erosion and transport. These processes resulted in a region of moderate dissection. Landforms consist mostly of smooth plains with smaller areas of tablelands. Elevation ranges from 2,600 to 4,000 ft (800 to 1,200 m). Local relief ranges mainly from 100 to 300 ft (90 m). A small area of tablelands is present where relief ranges from 300 to 500 ft (90 to 150 m).

**Potential Natural Vegetation.** Kuchler classified vegetation as sandsage-bluestem prairie and bluestem-grama prairie. The predominant vegetation form is short to mid-height grasslands. Species composition includes bluegrama, buffalograss, hairy grama, and little bluestem.

### **Section 331C--Central High Tablelands**

**Geomorphology.** This Section includes broad intervalley remnants of smooth fluvial plains. Smooth loess-mantled tablelands with gently rolling slopes and major valleys are bordered by steep slopes. Broad, level flood plains and terraces occur on major rivers and streams. This Section is in Fenneman and Johnson's Great Plains geomorphic physical division. Elevation ranges from 2,625 to 3,950 ft (800 to 1,200 m).

**Potential Natural Vegetation.** Kuchler mapped vegetation as grama-buffalo grass prairie, bluestem-grama prairie, sandsage-bluestem prairie, and wheatgrass-bluestem-needlegrass prairie. The predominant vegetation is short grass prairie. Fire, insects, and disease are predominant disturbance regimes.

### **Section 331D--Northwestern Glaciated Plains**

**Geomorphology.** This Section includes level to gently rolling continental glacial till plains and rolling hills on the Missouri Plateau. Steep slopes border some of the larger rivers. Elevation ranges from 2,500 to 5,000 ft (763 to 1,525 m). This Section is within the Great Plains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as grama-needlegrass-wheatgrass. Common species include blue grama, bluebunch wheatgrass, green needlegrass, needleandthread, western wheatgrass, and basin wildrye. Fire and drought are the principal sources of natural disturbance.

### **Section 331E--Northern Glaciated Plains**

**Geomorphology.** This area includes gently undulating to rolling continental glacial till plains with areas of kettle holes, kames, and moraines. Slopes adjacent to major stream valleys are steep. Elevation ranges from 2,000 to 6,000 ft (610 to 1,830 m). This Section is within the Great Plains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as wheatgrass-needlegrass. The natural prairie vegetation is characterized by western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem occurs on sloping and thin soils. Prairie cordgrass, northern reedgrass, and slim sedge occur on wet soils. Western snowberry and prairie rose are common shrubs. Fire and drought are the principal natural sources of disturbance.

### **Section 331F--Northwestern Great Plains**

**Geomorphology.** This area includes gently sloping to rolling, moderately dissected shale plains. There are some steep, flat-topped buttes, particularly in eastern Wyoming. Badlands with eroded escarpments are in North Dakota and western South Dakota. Elevation ranges from 1,500 to 3,900 ft (458 to 1,200 m). This Section occurs on the Missouri Plateau and High Plains within the Great Plains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as wheatgrass-needlegrass. Most of the Section has natural prairie vegetation, which includes western wheatgrass, green needlegrass, blue grama, needleandthread, and buffalograss. Bluebunch wheatgrass, little bluestem, and

sideoats grama occur on shallow soils. Common shrubs in draws and along streams include buffaloberry, chokecherry, snowberry, and sagebrush. Ponderosa pine, juniper, and some aspen occur in North Dakota and on the Pine Ridge in South Dakota. Fire and drought are the principal natural sources of disturbance.

### **Section 331G--Powder River Basin**

**Geomorphology.** This area includes gently rolling to steep dissected plains on the Missouri Plateau. Wide belts of steeply sloping badlands border a few of the larger river valleys. In places, flat-topped, steep-sided buttes rise sharply above the surrounding plains. Elevation ranges from 3,000 to 6,000 ft (915 to 1,830 m). This Section is within the Great Plains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as grama-needlegrass-wheatgrass. About 20 percent of the area supports eastern ponderosa forest. Dominant grassland species include western wheatgrass, blue grama, green needlegrass, bluebunch wheatgrass, and needleandthread. Little bluestem replaces bluebunch wheatgrass in the eastern part of the Section. Basin wild rye and sagebrush occur along streams and on bottomlands. Fire and drought are the principal natural sources of disturbance.

### **Section 331H--Central High Plains**

**Geomorphology.** This Section includes undulating to rolling plains, moderately dissected by streams. There are steep slopes, large streams, and isolated mesas, with rolling to hilly sand dunes that border some valleys. Local relief ranges up to tens of meters. Elevation ranges from 3,610 to 5,905 ft (1,100 to 1,800 m). This Section is in Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Predominant vegetation is short and mid grass prairie. Kuchler classified potential vegetation as grama-buffalo grass prairie and sandsage-bluestem prairie, with northern floodplain forest along major drainages. Fire, insects, and disease are predominant natural disturbances.

### **Section 331I--Arkansas Tablelands**

**Geomorphology.** This Section includes undulating to rolling plains composed of shale that are moderately dissected by streams. In many places the shale is mantled by loess, alluvium, and outwash. Large stream valleys and isolated mesas with steep slopes and rolling to hilly dunes border some of the valleys. Local relief ranges from 10 to 300 ft (3 to 90 m). Elevation ranges from 3,610 to 6,235 ft (1,100 to 1,900 m). This Section is in Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Predominant vegetation consists of short and mid grass prairie, and some woodlands. Kuchler classified vegetation as grama-buffalo grass prairie, sandsage-bluestem prairie, and juniper-pinyon woodland. Fire, drought, insects, and disease have been the principal historical source of disturbance.

## **Section 331J--Northern Rio Grande Basin**

**Geomorphology.** This area is in the Southern Rocky Mountain Province. This Section is located in north-central New Mexico and south-central Colorado. Landforms include valley, lowland, and elevated plains and hills. Elevation ranges from 6,875 to 8,800 ft (2,100 to 2,680 m). The major landform features are The San Luis Valley and the Rio Grande River.

**Potential Natural Vegetation.** Grama, galleta and sand dropseed grasses and Great Basin big sagebrush are found in ustic soil moisture regimes and cottonwood and willow along riparian corridors. Fescue-mountain muhly prairie also occurs. Kuchler mapped potential vegetation as saltbush-greasewood and wheatgrass-needlegrass.

## **Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow**

These Sections are located in the west-central conterminous States, including parts of New Mexico, Colorado, Utah, Wyoming, Idaho, and Montana. The area of these Sections is about 35,000 mi<sup>2</sup> (68,000 km<sup>2</sup>). Section M331C is not delineated.

## **Section M331A--Yellowstone Highlands**

**Geomorphology.** The Yellowstone Plateau was formed from two volcanic episodes. Other areas include high rugged mountains with ridges and cirques at higher elevations and narrow to broad valleys. Much of this area has been glaciated, and moraines are common. Elevation ranges from 6,000 to 13,000 ft (1,800 to 4,100 m) in the mountains, and 2,500 to 6,500 ft (763 to 1,983 m) in the basins and valleys. This Section is within the Middle Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped potential vegetation as wheatgrass--needlegrass--shrubsteppe on drier, lower elevation valleys (55 percent), and Douglas-fir forest and western spruce-fir forest (45 percent) between 5,500 and 9,500 ft (1,667 and 2,879 m). Lodgepole pine is the common cover type, with an understory of grouse whortleberry, pine grass, heartleaf arnica, or Oregon grape. Alpine vegetation, including whitebark pine and subalpine fir, occurs above 9,500 ft (2,878 m). Sheep fescue, alpine bluegrass, and American bistort are common grass and forb species. Historic fire occurrence has been low intensity, low severity, patchy fires and infrequent, high intensity, high severity, continuous fires. Fire suppression has largely reversed this situation. Insect infestations and outbreaks of disease are also an important natural source of disturbance.

## **Section M331B--Bighorn Mountains**

**Geomorphology.** There are high mountains with sharp crests, rolling uplands, and dissected hills, with alpine glaciation dominating the upper third of the area. The rugged hills and mountains are cut by many narrow valleys with steep gradients. Elevation ranges from 4,000 to 13,000 ft (1,220 to 3,962 m). This Section is within the Middle Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped potential vegetation as Douglas-fir forest and western spruce--fir forest (50 percent) and wheatgrass--needlegrass--shrubsteppe (50 percent). Common tree species include lodgepole pine, Douglas-fir, subalpine fir, and Engelmann spruce. Idaho fescue, bluebunch wheatgrass, and mountain big sagebrush are common grass and shrub species.

**Disturbance Regimes.** Fire, insects, and disease are the dominant natural sources of disturbance. Fire has historically been fairly frequent, low intensity, and patchy; however, fire suppression has caused this pattern to change to less frequent, more intense, larger fires.

## **Section M331D--Overthrust Mountain**

**Geomorphology.** This Section occurs within the Middle Rocky Mountain physiographic province. The Overthrust Mountains Section is part of western Wyoming, southeastern Idaho, and north-central Utah. Mountain ranges include the Teton and Salt River Ranges in Wyoming; Snake River, Caribou, Webster, Aspen, Portneuf, Bannock, and Bear River Ranges in Idaho; and the Wasatch Range in Utah. Anticlinal and synclinal structures and thrust fault zones control development of linear valleys and ridges in the northern part of this Section. Some ranges are bound by thrust faults that dip west. Snake River Mountains are distinct, separate, and subparallel. They are mostly steep, rugged mountains with narrow to broad valleys. The Teton Range is the highest in this Section. The Wasatch Range has very steep topography and an extensive and active fault. Higher portions of this Section have been glaciated, with few active glaciers and snow fields in the Teton Range. Many cirques, moraines, and other glacial features are present and extend into Utah. Alluvial fans and mud flow fans have developed at the mouths of many canyons in Utah. Mass movements are common and helped form the Wyoming Range. Elevation ranges from 5,000 to 13,000 ft (1,524 to 3,962 m). Local relief ranges from 3,000 to 7,000 ft (900 to 2,134 m).

**Potential Natural Vegetation.** Kuchler vegetation types include lodgepole pine-subalpine forest, and Douglas-fir forest with outer fringes of sagebrush steppe in the northern portion of the Section. Mountain mahogany-oak scrub surrounds a Douglas-fir forest in the Utah portion of the Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifers and sagebrush-grassland with Douglas-fir, lodgepole pine, and aspen occupying northern aspects. About 50 percent is Douglas-fir forest. Vegetation zones are controlled by a combination of altitude, latitude, slope exposure, and prevailing winds. Areas of alpine tundra exist on highest mountains, subalpine zone has spruce--fir forests, and montane zone has ponderosa pine and Douglas-fir forest. Sagebrush occurs at the lower elevations. After fire, aspen and lodgepole pine replace higher seral species.

**Disturbance Regimes.** Mass movements are common and water erosion is occurring.

## **Section M331E--Uinta Mountains**

**Geomorphology.** This Section occurs within the Middle Rocky Mountain province. The Uinta Mountains Section is located in northeastern Utah and the southwest corner of Wyoming. Mountains are an anticlinal uplift with an east-west orientation. Periglacial and glacial processes

have shaped higher elevation landforms with freezing and thawing, an active process. At lower elevations, erosion by water and wind are active landforming processes. Elevations range from approximately 6,000 to 13,000 ft (1,800 to 3,900 m). Slopes range from about 5 percent to vertical in gradient.

**Potential Natural Vegetation.** Kuchler vegetation types include alpine meadows, Douglas-fir forest, and western spruce-fir forest. It has been noted that some of Kuchler's vegetation types are incorrect for this Section. More accurate information, from higher to lower elevations, is alpine tundra, Engelmann spruce, spruce-fir, lodgepole pine, subalpine meadow, Douglas-fir, ponderosa pine, aspen, mountain big sagebrush, oak and mountain brush, pinyon-juniper, Wyoming big sagebrush, and cold desert shrub. Douglas-fir is limited to limestone and lower elevations in canyons on quartzite. Oak communities are generally limited to the western portion of the Section. The eastern portion is mostly juniper-pinyon woodland with sagebrush steppe.

**Disturbance Regimes.** From low to high elevation, alpine fire is probably insignificant. Engelmann spruce has low frequency and small fires (frequency of 300 to 400 years or more and mostly less than 100 acres. In mixed conifers there are more frequent and larger fires than in the Engelmann spruce belt. Lodgepole pine has an 80 to 200 year interval and large fires to 20,000 acres or more. Ponderosa pine has 20 to 50 year interval underburns. Mountain big sagebrush and mountain brush have 20 to 80 year intervals and 10 to 1,000 acres or more in size. Pinyon-juniper has a 20 to 200 year interval with small fires up to 100 acres being common and larger fires being rare. These estimates of fire frequency and size are applicable to presettlement times. In modern times, the national forest fire suppression policy has resulted in reduced fire frequency and size in all timber types.

## **Section M331F--Southern Parks and Rocky Mountain Ranges**

**Geomorphology.** Included in the Southern Rocky Mountain Province, this Section is located in northeast-central New Mexico and south-central Colorado. Landforms are mountains and a few valley plains. The Sangre de Cristo Mountains are this Section's major landform feature. Elevation ranges from 7,500 to 14,000 ft (2,300 to 4,300 m).

**Potential Natural Vegetation.** Predominant vegetation includes Douglas-fir and ponderosa pine in frigid soil temperature regimes; Engelmann spruce and subalpine fir in cryic soil temperature regimes; and *Kobresia*, *Geum* and *Arenaria* in alpine pergelic zones.

**Disturbance Regimes.** Fires vary in frequency and intensity in ponderosa pine stands, but may occur when fuel load is high and dry. Fire is rare in areas with cryic temperature regimes and udic soil moisture regimes. The upper mountain slopes are forested, but merchantable timber is scarce.

## **Section M331G--South-Central Highlands**

**Geomorphology.** Steeply sloping to precipitous mountains are dissected by many narrow stream valleys with steep gradients. Upper mountain slopes and crests may be covered by snowfields and glaciers. High plateaus and steep walled canyons are common, especially in the west. Elevation ranges from 7,545 to 14,110 ft (2,300 to 4,300 m). This Section is within Fenneman

and Johnson's Southern Rocky Mountains (eastern half of the Section) and Colorado Plateaus (western half of the Section) geomorphic physical divisions.

**Potential Natural Vegetation.** Vegetation ranges from shrub and grasslands, forests, and alpine tundra. Kuchler classified vegetation as southwestern spruce--fir forest; pine--Douglas-fir forest; mountain mahogany--oak scrub; Great Basin sagebrush; juniper-pinyon woodland; and alpine meadows and barren.

**Disturbance Regimes.** Fire, insects, and disease are principal sources of natural disturbance.

### **Section M331H--North-Central Highlands and Rocky Mountain**

**Geomorphology.** This area includes steeply sloping to precipitous flat-topped mountains dissected by narrow stream valleys with steep gradients. High plateaus have steep walled canyons. There are gently rolling mountain parks, mountain ridges, and foothills. Elevation ranges from 5,600 to 12,000 ft (1,706 to 3,657 m). This Section is within three geomorphic physical divisions: Fenneman and Johnson's Wyoming Basin (northern part of the Section), Southern Rocky Mountains (central part of the Section), and the Colorado Plateaus (southern part of the Section).

**Potential Natural Vegetation.** Kuchler mapped vegetation as western spruce--fir forest, pine--Douglas-fir forest, juniper--pinyon woodland, mountain mahogany--oak scrub, and sagebrush steppe. Above timberline, alpine tundra predominates. At higher elevations types include Engelmann spruce, subalpine fir, Douglas-fir, ponderosa pine--Douglas-fir, aspen, and meadows of grass and sedge. At lower elevations, there are pinyon pine, shrubs, grass, and shrub-grass vegetation. **Disturbance Regimes.** Fire, insects, and disease are the principal sources of natural disturbance.

### **Section M331I--Northern Parks and Ranges**

**Geomorphology.** Steeply sloping to precipitous mountains are dissected by many narrow stream valleys with steep gradients. This area has gently rolling mountain parks and valleys, with some mountain ridges. Rugged hills and low mountains are found in narrow bands along the eastern slopes of the Rocky Mountains. These hills are strongly dissected and in many places are crossed by large streams flowing eastward from the mountains. Elevation ranges from 5,575 to 14,410 ft (1,700 to 4,400 m). This Section is within Fenneman and Johnson's Southern Rocky Mountains geomorphic physical division.

**Potential Natural Vegetation.** Kuchler mapped vegetation as alpine meadows and barren, fescue--mountain muhly prairie, sagebrush steppe, juniper-pinyon woodland, and Great Basin sagebrush. **Disturbance Regimes.** Fire, insects, and disease are predominate sources of natural disturbance.

### **Section M331J--Wind River Mountains**

**Geomorphology.** This Section, which occurs within the Middle Rocky Mountain physiographic province, is located in western Wyoming. It has high alpine mountains that have been glaciated.

Glacial troughs, cirque headwalls, and floors are common. The highest areas have glaciers covering the mountain tops. Elevation ranges from 6,000 to 13,000 ft (1,800 to 4,100 m).

**Potential Natural Vegetation.** Kuchler vegetation types include lodgepole pine and alpine grasses and forbs. Areas of spruce-firs and Douglas-fir forest occur in this Section.

**Disturbance Regimes.** Mass movements are infrequent, and erosion is occurring from water.

## Great Plains Steppe

These Sections are located in the north-central conterminous States, including parts of Oklahoma, Kansas, Nebraska, and South and North Dakota. The area of these Sections is about 134,000 mi<sup>2</sup> (347,100 km<sup>2</sup>).

### Section 332A--Northeastern Glaciated Plains

**Geomorphology.** This is an area of nearly level to undulating continental glacial till and glacial lake plains, with areas of kettle holes, kames, and moraines. Some steep slopes occur adjacent to streams. Elevation ranges from 700 to 2,300 ft (214 to 704 m). This Section is within the Central Lowlands physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as wheatgrass-bluestem-needlegrass. The natural prairie vegetation is dominantly western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem is important on sloping and thin soils. Northern reedgrass, prairie cordgrass, big bluestem, and slim sedge are important species on wet soils.

**Disturbance Regimes.** Fire and drought are the principal natural sources of disturbance.

### Section 332B--Western Glaciated Plains

**Geomorphology.** Nearly level to undulating continental glacial till plains occur, with areas of kettle holes, kames, moraines, and glacial lake plains. Glacial lake plains and some steep slopes are adjacent to streams. Elevation ranges from 1,000 to 2,000 ft (305 to 610 m). This Section is within the Central Lowland physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as wheatgrass-bluestem-needlegrass. The natural prairie vegetation is mainly western wheatgrass, needleandthread, green needlegrass, and blue grama. Little bluestem is important on sloping and thin soils. Northern reedgrass, prairie cordgrass, big bluestem, and slim sedge are important species on wet soils. Northern flood plain forest occurs along major drainages.

**Disturbance Regimes.** Fire and drought are the principal natural sources of disturbance.

### Section 332C--Nebraska Sandhills

**Geomorphology.** This area has rolling to steep, irregular sand dunes stabilized by vegetation, with narrow, elongated, gently rolling sloping valleys between dunes. Elevation ranges from 1,970 to 3,950 ft (600 to 1,200 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Mid and tall grass plant communities are present including Nebraska sandhills prairie (bluestem, sandreed). Kuchler classified vegetation as sandhills prairie, wheatgrass-bluestem-needlegrass, and, along major drainages, northern flood plain forest.

**Disturbance Regimes.** Fire, insect and disease are predominant natural disturbances.

### **Section 332D--North-Central Great Plains**

**Geomorphology.** There are nearly level to gently rolling till plains with potholes and well defined dendritic drainage system. Moderate to steep slopes are adjacent to major valleys. River and creek valleys have smooth floors and steep walls. Higher parts of tablelands are moderately sloping, but steeper areas occur on ridges and drainage ways. Drainages are well defined except in some undulating areas where eolian materials cover the bedrock. Elevation ranges from 1,310 to 2,950 ft (400 to 900 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Kuchler mapped potential vegetation as wheatgrass-needlegrass prairie and wheatgrass-bluestem-needlegrass prairie and wheatgrass-bluestem-needlegrass prairie with northern flood plain forests along the Missouri River lowlands. Other communities consist of mixed and natural prairie.

**Disturbance Regimes.** Fire, insects, and disease are the primary natural disturbances.

### **Section 332E--South-Central Great Plains**

**Geomorphology.** Gently sloping loess-mantled narrow ridgetops are separated by steep slopes bordering drainage ways. Some stream valleys with nearly level flood plains and large stream terraces exist. Dissected plains with broad rolling ridgetops and moderately steep valley sides occur. Valleys are usually narrow with broad flood plains and terraces, and hilly dissected plains. There are rivers with wide flood plains and terraces, and small streams with narrow bottomlands. Rolling plains have a deep mantle of windblown sand and sandy outwash. Elevation ranges from 1,310 to 2,950 ft (400 to 900 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Predominant vegetation is grass and prairie communities. Kuchler mapped vegetation as bluestem-grama prairie, sandsage-bluestem prairie, northern flood plain forests, and buffalograss.

**Disturbance Regimes.** Fire, insects, and disease are primary natural disturbances.

## **Middle Rocky Mountain Steppe - Coniferous Forest - Alpine Meadow**

These Sections are located in the northwestern conterminous States, including parts of Oregon, Washington, Idaho, and Montana. The area of these Sections is about 81,800 mi<sup>2</sup> (211,900 km<sup>2</sup>).

### **Section M332A--Idaho Batholith**

**Geomorphology.** These are mountains with alpine ridges and cirques at higher elevations. Large U-shaped valleys with broad bottoms indicate that the area has been strongly glaciated. Mature surfaces are dissected with major drainages deeply incised, resulting in steep breaklands. Elevation ranges from 3,000 to 10,000 ft (900 to 3,000 m). Local relief ranges from 3,000 to 5,000 ft (900 to 1,500 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as grand fir--Douglas-fir forest, western spruce--fir forest, and western ponderosa forest.

**Disturbance Regimes.** Fire, insects, and disease are the dominant natural sources of disturbance. Fires have been frequent, low intensity, and patchy, and occasionally high intensity and continuous. Mass wasting is also an important source of disturbance in some areas.

### **Section M332B--Bitterroot Valley**

**Geomorphology.** This area includes high, glaciated mountains with alpine ridges and cirques at higher elevations and glacial and lacustrine basins at lower elevations. Steep slopes, sharp crests, and narrow valleys are characteristic. Elevation ranges from 2,500 to 6,000 ft (763 to 1,830 m) in basin areas; the range is 3,000 to 8,000 ft (915 to 2,440 m) in mountains, with some alpine areas up to 10,000 ft (3,050 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler classified vegetation as Douglas-fir forest and western ponderosa forest (80 percent) and foothills prairie (20 percent), mostly in the lower valleys. The upper timberline occurs at about 8,800 ft (2,667 m). Common tree species include western larch, Douglas-fir, subalpine fir, and ponderosa pine. Grassland species are mainly bluebunch wheatgrass, Idaho fescue, and rough fescue.

**Disturbance Regimes.** Fire, insects, and disease are the dominant natural sources of disturbance. Fires were generally low intensity, frequent ground fires prior to fire suppression efforts. Fuel accumulations have now set the stage for large, high-intensity fires.

## Section M332C--Rocky Mountain Front

**Geomorphology.** There are glaciated mountains with limestone scarps and ridges interspersed with glacial and lacustrine intermontane basins. Alpine ridges and cirques occur at higher elevations. Elevation ranges from 5,500 to 8,500 ft (1,678 to 2,593 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Douglas-fir forest and western spruce-fir forest (15 percent), occur mostly between 4,500 to 8,000 ft (1,360 to 2,425 m). Extensive aspen groves also occur. Limber pine is also present. Foothills prairie (85 percent) occurs on lower elevation foothills. Common grasses include wheatgrasses, fescues, and needlegrass.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance. Strong chinook winds that cause windthrow are also a source of disturbance.

## Section M332D--Belt Mountains

**Geomorphology.** This Section comprises high mountains, gravel-capped benches, and intermontane valleys bordered by terraces and fans. Plains and rolling hills surround the isolated mountain ranges. Elevation ranges from 4,000 to 8,500 ft (1,220 to 2,593 m) in the mountains; elevation ranges from 2,500 to 5,000 ft (763 to 1,525 m) on the plains. Most of this Section is within the Northern Rocky Mountains physiographic province, but the eastern part extends onto the Missouri Plateau within the Great Plains physiographic province.

**Potential Natural Vegetation.** Kuchler classified vegetation as foothills prairie (75 percent) and Douglas-fir forest--eastern ponderosa forest (25 percent). Forests are associated with prominent mountain ranges and the Missouri River breaks, and cover all but the highest peaks. Typical prairie species include wheatgrasses, fescues, grama, and needlegrass. Common tree species are Douglas-fir, ponderosa pine, limber pine, and subalpine fir.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance.

## Section M332E--Beaverhead Mountains

**Geomorphology.** This area encompasses complex and high, steep mountains with sharp alpine ridges and cirques at higher elevations, glacial and fluvial valleys, and alluvial terraces and flood plains. Elevation ranges from 2,500 to 6,500 ft (763 to 1,983 m) in valleys; elevation ranges from 4,000 to 10,000 ft (1,220 to 3,050 m) in the mountains. This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Vegetation consists of sagebrush steppe with small areas of alpine vegetation (75 percent) above 9,500 ft (2,880 m), and Douglas-fir forest (25 percent) the latter spans an elevation range of only about 1,000 to 1,500 ft (300 to 450). Typical steppe species include big sagebrush, fescues, wheatgrasses, and needlegrass. Douglas-fir, limber pine, and lodgepole pine are common tree species.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance.

## Section M332F--Challis Volcanic

**Geomorphology.** This Section occurs within the Middle Rocky Mountain physiographic province. The Challis Volcanics Section is in central Idaho. Mountain ranges include White Cloud Peaks, Pioneer Mountains, Smokey Mountains, Boulder Mountains, White Knob Mountains, and portions of the Salmon River Range. Areas of glaciation occur in this Section. Most of the mountain ranges have residual weathering. Elevation ranges from 4,000 to 11,800 ft (1,200 to 3,600 m).

**Potential Natural Vegetation.** Kuchler vegetation types include a mixture of western spruce-fir forest and sagebrush steppe. Douglas-fir forest occurs also in this Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifer forest. Also included are areas of Lodgepole Pine series. Whitebark Pine and Subalpine Fir series also occur at the highest elevations. Areas of Big Sagebrush series are on southerly exposure and at lower elevation.

**Disturbance Regimes.** Common high intensity forest fires occur during summer thunderstorms. Erosion by water is occurring.

## Section M332G--Blue Mountains

**Geomorphology.** This is a moderately dissected wide, uplifted plateau dominated by landslide and fluvial erosion processes in the western portion. Mesas and buttes are common. Moderately dissected mountains dominated by glacial and fluvial erosion processes are in the eastern half. From the low-lying Ochoco Mountains in the southwest, individual ranges, separated by north-south trending valleys, rise to ice-sculpted peaks and deep canyons in the Wallowa Range. Wide, low elevation valleys between ranges are alluvium-filled fault troughs. Elevation ranges from 1,000 to 10,000 ft (300 to 3,300 m). Most of the mountainous part of the Section is between 4,000 and 7,500 ft (1,212 and 2,273 m), and the valleys are less than 4,000 ft (3,030 m). Local relief is 2,000 ft (606 m) or more in the mountains and 100 to 500 ft (30 to 150 m) on the broad valley floors.

**Potential Natural Vegetation.** The Kuchler vegetation types are dominantly grand fir--Douglas-fir forests, followed by western ponderosa forests. High elevation forests are western spruce-fir. Great basin sagebrush and juniper steppe woodland are interspersed on relatively dry, mesic regime sites. Wheatgrass-bluegrass occurs on mesic-xeric soils in canyons and south slopes. Alpine meadows and barrens occupy the highest elevations. Grand fir and Lodgepole Pine are the dominant series and are at mid elevations on the moderately deep and deep volcanic ash soils with frigid temperature regimes and udic to xeric moisture regimes. Some lodgepole pine is on cryic soils. Ponderosa Pine series dominates at mid to low elevations on mesic and frigid xeric soils. Douglas-Fir series is intermediate between the Lodgepole Pine and Ponderosa Pine series. Subalpine Fir series dominates at the highest elevations on cryic soils. Western Juniper series occurs at low elevations on mesic and xeric soils. Shrub series of Snowberry, Mountain Mahogany, Bitterbrush, Common Snowberry, and Low Sage are interspersed. Grasslands are at the highest and lowest elevations. High elevation, cryic soils are dominated by green and Idaho

fescues, and sedges. At mid and low elevations, Idaho fescue and bluebunch wheatgrass, occur with lesser amounts of Sandbergs bluegrass and prairie junegrass. Wet meadows are dominated by sedges and tufted hairgrass.

**Disturbance Regimes.** Fire was a major factor in disturbance until the early the advent of fire control in the early 20th century. Periodicities ranged from as few as 10 to 15 years. to as infrequent as several decades on the cooler and wetter sites. A variety of insects, including beetles, tussock moth, spruce budworm, and others, are endemic; periodic epidemics appeared and declined until recently. Epidemic occurrences have had significant effects in the recent decade. A variety of diseases also have had some local effects. Periodic floods and ice jams are important in some watersheds.

## **Northern Rocky Mountain Forest-Steppe - Coniferous Forest - Alpine Meadow**

These Sections are located in the northwestern conterminous States, Including parts of Washington, Idaho, and Montana The area of these Sections is about 38,100 mi<sup>2</sup> (98,700 km<sup>2</sup>).

### **Section M333A--Okanogan Highlands**

**Geomorphology.** This Section's features range from accretion of continental shelf material forming the Okanogan Highlands, in response to the uplifting and movement of the oceanic shelf to the east, to the Rocky Mountain facies and volcanic influences from the rise of the Kettle Dome. Extreme metamorphism and deformation have occurred, as well as deposits of glacial till, outwash, and debris that cover most of the modern landscape. The area is inundated with glacial lakes, rivers, and streams, as well as mountains, and both narrow and broad valleys. Elevation ranges from 1,376 to 7,309 ft (444 to 2,358 m). Local relief ranges from 500 to 1,000 ft (161 to 322 m).

**Potential Natural Vegetation.** Vegetation pattern in this Section is strongly influenced by the strong east-west precipitation gradient. Vegetation in the western third of the Section found west of the Kettle Mountains crest differs significantly from that in the eastern two-thirds. The Big Sagebrush series dominates the lowest elevations on mostly xeric soils. The Ponderosa Pine series occurs at slightly higher elevations, also on xeric soils. This series is replaced by the Douglas-Fir series at higher elevations. Soils with this series have a xeric moisture regime and mesic or frigid temperature regimes. The Subalpine Fir series occupies higher elevations to upper forest line on cryic soils.

Vegetation east of the Columbia River is characterized by the Douglas-Fir series at lowest elevations followed by the Grand Fir series, Western Hemlock and Western Red Cedar series, and the Subalpine Fir series with increasing elevation. The Douglas-Fir and Grand Fir series occur on xeric soils, with the Grand Fir series occupying slightly cooler and more mesic habitats. The Western Hemlock and Western Redcedar series occur on soils with udic regimes. The Subalpine Fir series occurs on cryic soils. The Whitebark Pine series and the Green Fescue series occur at the highest elevations throughout the Section above continuous forest line.

**Disturbance Regime.** Historic fire events have changed a large portion of the forest. Changes are periodic and range from high intensity, high severity, continuous fires to low severity,

infrequent fires. Composition and successional sequences of some communities has changed because of harvesting practices and the introduction of animal species into the valleys. Wide fluctuations in precipitation and temperatures for periods of years result in significant changes in biological communities. Insects and diseases are frequent disturbance features.

### **Section M333B--Flathead Valley**

**Geomorphology.** There are glaciated mountains, glacial moraines, large glacial troughs, and glacial and lacustrine basins. Elevation ranges from 2,000 to 7,000 ft (610 to 2,135 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped vegetation as Douglas-fir forest and western ponderosa forest. Principal tree species include Douglas-fir, ponderosa pine, hemlock, cedar, and grand fir.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance.

### **Section M333C--Northern Rockies**

**Geomorphology.** There are steep glaciated overthrust mountains with sharp alpine ridges and cirques at higher elevations. Some areas of glacial deposition also occur. Elevation generally ranges from 3,000 to 9,500 ft (915 to 2,898 m). Some alpine areas range from 8,000 to 10,000 ft (2,440 to 3,050 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler mapped potential vegetation as Douglas-fir forest. The alpine treeline occurs at about 8,000 ft (2,420 m). Foothills prairie with wheatgrasses, fescues, and needlegrass occurs in the drier valleys. Principal tree species include Douglas-fir, hemlock, cedar, and grand fir.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance.

### **Section M333D--Bitterroot Mountains**

**Geomorphology.** This area comprises steep dissected mountains, some with sharp crests and narrow valleys. Elevation ranges from 1,200 to 7,000 ft (366 to 2,135 m). This Section is within the Northern Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler classified potential vegetation as cedar-hemlock-pine forest, Douglas-fir forest, and western ponderosa forest. Common species include western redcedar, western hemlock, western white pine, Douglas-fir, and ponderosa pine. Other important tree species include grand fir and mountain hemlock.

**Disturbance Regimes.** Fire, insects, and disease are the principal natural sources of disturbance. Mass wasting also occurs in some areas. Fires were mostly large, low frequency, high intensity, stand-replacing fires, except for the eastern quarter of the Section, which had mostly low

intensity, frequent ground fires. Fire suppression efforts have altered the fire regime to a large extent.

## **Black Hills Coniferous Forest**

The area of this Section, which is located in Wyoming and South Dakota, is about 3,700 mi<sup>2</sup> (9,600 km<sup>2</sup>).

### **Section M334A--Black Hills**

**Geomorphology.** Slopes range from moderate on some of the high plateaus to very steep along drainage ways and on peaks and ridges. Narrow valleys are mostly gently sloping to strongly sloping. Elevation ranges from 2,950 to 7,220 ft. (900 to 2,200 m). This Section is within Fenneman and Johnson's Great Plains geomorphic physical division.

**Potential Natural Vegetation.** Kuchler classified vegetation as dominates open to dense forest vegetation. Black Hills ponderosa pine forest.

**Disturbance Regimes.** Fire, insects, and disease are principal natural disturbances.

## **Intermountain Semi-Desert and Desert**

These Sections are located in the west-central conterminous States, including parts of Nevada, Utah, and Colorado. The area of these Sections is about 107,100 mi<sup>2</sup> (277,400 km<sup>2</sup>).

### **Section 341A--Bonneville Basin**

**Geomorphology.** This Section occurs within the Basin and Range physiographic province. Dominant landforms are north-south trending mountains separated by broad, sediment-filled valleys, many of which have internal drainages. Mountains were formed by faulting and were subsequently modified by erosion. Large alluvial fans have developed at the mouths of most canyons. Some fans are coalescing, nearly burying the eroded mountains. Playas are found in some closed basins, and salt flats are common. Elevation ranges from 4,000 to 8,000 ft (1,200 to 2,400 m).

**Potential Natural Vegetation.** Kuchler vegetation types are saltbush-greasewood and juniper-pinyon woodlands. Areas of sagebrush and wheatgrass-grama-buffalograss also were mapped. The Soil Conservation Service identifies the potential natural vegetation as desert shrub, shrub-grass, and woodland vegetation.

**Disturbance Regimes.** Common low intensity short duration burns of sagebrush and desert shrubs occur during summer thunderstorms. Often there is insufficient understory to carry fires, or they are suppressed.

### **Section 341B--Northern Canyon Lands**

**Geomorphology.** This area occurs within the Colorado Plateau physiographic province. Northern Canyon lands Section is located in the eastern portion of Utah. This area is eroded by

the Colorado River and its tributaries. Deep sheer-walled canyons, canyonlands, lines of cliffs, low plateaus, mesas, buttes, and badlands dominate the landscape. Major landforms are the San Rafael Swell, Henry Mountains, Abajo Mountains, La Sal Mountains, and Circle Cliffs. Elevation ranges from 4,200 to 12,700 ft (1,300 to 3,900 m).

**Potential Natural Vegetation.** Kuchler vegetation types are blackbrush, juniper-pinyon woodlands, saltbush-greasewood, and galleta-three awn shrub steppe. Areas of ponderosa pine series occur on the La Sal and Abajo Mountains. Areas of Arizona pine occur on the Henry Mountains. The Soil Conservation Service identifies the area as desert shrub and woodland vegetation with some big sagebrush. Spruce-fir forests with aspen occur on the higher elevations of the Henry, Abajo, and La Sal Mountains.

**Disturbance Regimes.** Common, low intensity, short duration burns occur due to thunderstorms. Water and wind erosion is also occurring.

### **Section 341C--Uinta Basin**

**Geomorphology.** This area occurs within the Colorado Plateau physiographic province. Uinta Basin Section lies south of the Uinta Mountain Range in northeastern Utah. It is a synclinal and topographical basin, with its east-west axis running near the south flank of the Uinta Mountains. The central portion is gently rolling with eroded slopes. Elevation ranges from 6,200 to 7,300 ft (1,900 to 2,200 m). Local relief ranges from 100 to 1,000 ft (30 to 300 m).

**Potential Natural Vegetation.** Kuchler vegetation types include juniper-pinyon woodlands and saltbush-greasewood. The Soil Conservation Service identifies some of the area as grasslands-shrub vegetation with some big sagebrush. Series include juniper-pinyon and saltbush-greasewood. Areas of big sagebrush also occur.

**Disturbance Regimes.** Few low intensity short duration burns of sagebrush occur due to summer thunderstorms. Most disturbance is from wind and water erosion.

### **Section 341D--Mono**

**Geomorphology.** Isolated ranges of largely dissected block mountains are separated by aggraded desert plains (alluvial fans and basins). Elevation ranges from 4,000 to 14,200 ft (1,216 to 4,315 m). This Section is in the Basin and Range geomorphic province.

**Potential Natural Vegetation.** Kuchler classified potential vegetation as sagebrush steppe, juniper-pinyon woodland, northern jeffrey pine forest, Great Basin subalpine forest, and alpine communities and barren. Potential natural communities include western juniper, pinyon pine, Jeffrey pine, basin sagebrush and bristlecone pine series.

**Disturbance Regimes.** Fires are infrequent, low, moderate, and high intensity surface or stand-replacing fires. This area contains locations with eruptive activity (lava flows and ash fall) within the past 200 years. This is a seismically active area with strong shaking and ground rupture.

## **Section 341E--Lahontan Basin**

**Geomorphology.** This area occurs within the Great Basin physiographic province. Lahontan Basin Section is located in the western portion of Nevada. Block-faulting created upthrust north-south trending mountains which are interspersed with interior playas; surface water occurs frequently. Little glaciation is evident. Elevation ranges from 4,000 to 9,800 ft (1,200 to 3,000 m). Star Peak in the Humboldt Range is south of Winnemucca.

**Potential Natural Vegetation.** Kuchler vegetation types include saltbush-greasewood, big sagebrush, juniper-pinyon, aspen, marshes, and intermittent lakebeds with greasewood or little vegetation. The Soil Conservation Service identifies the vegetation as desert shrub with widespread shadscale. Areas of big sagebrush also occur.

**Disturbance Regimes.** Fires are historically common due to thunderstorm activity. Large fires (1,000 acres or more) are common and moderately intense in the north end of this Section. Water and wind erosion also is occurring.

## **Section 341F--Southeastern Great Basin**

**Geomorphology.** This area is within the Basin and Range physiographic province. The Southeastern Great Basin Section is located in southern Nevada. North-south trending mountains are separated by broad sediment-filled valleys. Mountains are formed by faulting and modified by erosion. Large alluvial fans are at the mouths of most canyons. Elevation ranges from 4,700 to 9,400 ft (1,425 to 2,900 m). There are three or four peaks southwest of the Quinn-Canyon Range (in the Ely Ranger District of the Humboldt National Forest), which are at or close to 9,400 ft (2,900 m) elevation (e.g., Kawich Peak in the Kawich Range and Bald Peak in the Groom Range). These peaks are south and east of the southeastern-most end of the Toiyabe Range of the Toiyabe National Forest.

**Potential Natural Vegetation.** Kuchler vegetation types include Great Basin sagebrush with some Great Basin pine forest and saltbush-greasewood. The Soil Conservation Service has classified the area as being desert-shrub, shrub-grass, and woodland vegetation. This area is a transitional zone between the mountains of the Toiyabe--Grant--Quinn Ranges, and the true Mojave (represented by Joshua tree cactus). Site factors (precipitation, soils, and topography) influence distribution of cholla chactus, greasewood and saltbush species, ephedra, sagebrush species, galleta grass, banana yucca, Fremont barberry, little leaf mahogany, Utah juniper, and single leaf pinyon; small amounts of limber pine, ponderosa pine, bristlecone pine, and subalpine fir.

**Disturbance Regimes.** Infrequent, small to moderate, low intensity fires start due to thunderstorms. Fires remain small due to sparse fuels. Erosion by wind and water occur.

## **Section 341G--Northeastern Great Basin**

**Geomorphology.** This area occurs within the Basin and Range physiographic province. The Northeastern Great Basin Section is located in northeastern Nevada. There are north-south

trending mountains with broad sediment-filled valleys, formed by thrust-faulting (e.g., south Independence Range). Some glaciation is evident on the highest peaks. Elevation ranges from 4,800 to 10,704 ft (1,500 to 3,250 m).

**Potential Natural Vegetation.** Kuchler vegetation types include Great Basin sagebrush and juniper-pinyon woodlands. Juniper-mahogany woodlands and aspen are also found.

**Disturbance Regimes.** Infrequent, moderate to large sized fires occur due to summer thunderstorms. Periodic catastrophic snowmelt in high snow years leads to debris flows down steep mountain valleys.

## **Intermountain Semi-Desert**

These Sections are located in the northwestern conterminous States, including parts of Washington, Oregon, California, Nevada, Idaho, Utah, Wyoming, and Colorado. The area of these Sections is about 159,100 mi<sup>2</sup> (412,100 km<sup>2</sup>).

### **Section 342A--Bighorn Basin**

**Geomorphology.** There are piedmont plains and mountain footslopes with large stream terraces along the Wind-Bighorn River system. Plains are eroded to clay shale bedrock in some places, forming badlands. Elevation ranges from 3,600 to 5,900 ft (1,100 to 1,800 m). This Section is within the Middle Rocky Mountains physiographic province.

**Potential Natural Vegetation.** Kuchler classified potential vegetation as saltbush-greasewood, wheatgrass-needlegrass-shrubsteppe, and sagebrush steppe. Common species include big sagebrush, gardner saltbush, indian ricegrass, and needleandthread. Black sage and bluebunch wheatgrass are common on areas with shallow soils.

**Disturbance Regimes.** Fire and drought are the principal natural sources of disturbance.

### **Section 342B--Northwestern Basin and Range**

**Geomorphology.** This area occurs within the Basin and Range physiographic province. Northwestern Basin and Range Section is located in the northern portion of Nevada, southeastern Idaho, and south-central Oregon. It extends into northern Utah also. Nearly level basins and valleys are bordered by long, gently sloping alluvial fans. North-south trending mountain ranges and few volcanic plateaus rise sharply above the valleys. Large alluvial fans have developed at the mouths of most canyons. Elevation ranges from 4,000 to 7,200 ft (1,200 to 2,200 m).

**Potential Natural Vegetation.** Kuchler vegetation types include sagebrush steppe. The Soil Conservation Service identifies the potential natural vegetation as shrub-grass with saltbush-greasewood vegetation.

**Disturbance Regimes.** Short duration and low intensity brush fires occur due to summer thunderstorms. Water and wind erosion is also occurring.

## Section 342C--Owyhee Uplands

**Geomorphology.** This area occurs within the Columbia Plateau physiographic province, also known as the Columbia Intermontane province. The Owyhee Uplands Section is part of southwest Idaho, southeast Oregon, and northern Nevada. This area is an uplifted region with doming and block-faulting common. It is deeply dissected from erosional processes. Lavas are older than that of the Snake River Plains. The Owyhee Mountains are made of granite; however, most of the uplands are rhyolites and welded tuffs with silicic volcanic flows, ash deposits, and wind-blown loess. Elevation ranges from 4,000 to 8,000 ft (1,200 to 2,500 m).

**Potential Natural Vegetation.** Kuchler vegetation types are sagebrush steppe with *Artemisia* and *Agropyron* and small areas of wheatgrass-bluegrass. The Soil Conservation Service identifies the area as having a sagebrush-grass potential natural vegetation.

**Disturbance Regimes.** After fire, grasses and forbs replace higher seral species. Water and wind erosion is also occurring.

## Section 342D--Snake River Basalts

**Geomorphology.** This area occurs within the Columbia Plateau physiographic province, also known as the Columbia Intermontane province. The Snake River Basalts Section is part of southeast and south-central Idaho. Most of this Section is characterized by nearly horizontal sheets of basalt laid down in the Snake River drainage to form a plain. Lava flows range from less than 100 ft thick to several thousand ft thick. Block-faulted mountains are also included in this Section. The basalts are mainly two ages: the older flows are of the Miocene and Pliocene epoch; the younger lavas are Pliocene through Recent. The Section is about 60 mi wide and is essentially flat; however, the eastern portions of the Section are much higher in elevation. The surface is a youthful lava plateau with a thin wind-blown soil layer covering it. Shield volcanoes, cinder cones, and squeezed-up lava ridges are common. Craters of the Moon National Monument is an example of the recent volcanic features. Elevation ranges from 3,000 to 6,000 ft (900 to 2,000 m). Lava plain and hills are nearly level to steeply sloping.

**Potential Natural Vegetation.** Kuchler vegetation types include sagebrush steppe with *Artemisia* and *Agropyron*. The Soil Conservation Service identifies the area as having a sagebrush-grass potential natural vegetation.

**Disturbance Regimes.** After fire, grasses and forbs replace higher seral species. Water and wind erosion is also occurring.

## Section 342E--Bear Lake

**Geomorphology.** This area occurs within the Middle Rocky Mountain physiographic province. The Bear Lake Section is located in the southeast corner of Idaho, southwest corner of Wyoming, and northern corner of Utah. Steep north-south oriented mountain ranges with broad linear valleys are the major landforms. Few areas have been glaciated and were mostly formed from thrust and faults, landslides, and pluvial action.

**Potential Natural Vegetation.** Kuchler vegetation types include lodgepole pine and Douglas-fir forests, with outer fringes of sagebrush lands. Oak-pine forests occur in the Utah portion of this Section. The Soil Conservation Service identifies the potential natural vegetation as mixed conifers and sagebrush-grassland with Douglas-fir, lodgepole pine, and aspen occupying northern aspects.

**Disturbance Regimes.** A few high intensity, short duration burns of shrubs occur in the summer due to thunderstorms. Water and wind erosion occurs.

## **Section 342F--Central Basins and Hills**

**Geomorphology.** Plains eroded to clay shale bedrock, creating badlands. Mountain ranges include steep slopes that rise sharply from desert basins. There are alluvial fans, piedmont plains, and piedmonts that slope from the mountains to stream terraces of the Wind-Bighorn system, and to broad intermountain basins. Rugged hills and low mountains are cut by narrow valleys with steep gradients. Broad flood plains are associated with some of the major rivers. Elevation ranges from 3,610 to 10,170 ft (1,100 to 3,100 m). This Section is within Fenneman and Johnson's Wyoming Basin geomorphic physical division.

**Lithology and Stratigraphy.** The northern half of the Section is Tertiary sandstones, siltstones, and shales. The southern half of the Section is Cretaceous through Tertiary sandstones, siltstones, shales, conglomerates, and local coals. The middle part of the Section also includes local Precambrian granite and metamorphosed sedimentary and volcanic rocks and Precambrian granite and Paleozoic carbonates in the Seminole Mountains.

**Soil Taxa.** There are mesic and frigid temperature regimes. Soils include Mollisols, Inceptisols, Aridisols, and Entisols, including, Argids, Orthents, Borolls, and Fluvents.

**Potential Natural Vegetation.** Vegetative communities range from grass to grass-shrub to shrub-grass to forest. Kuchler mapped vegetation as sagebrush steppe (sagebrush-wheatgrass); wheatgrass-needlegrass shrub steppe; grama-needlegrass-wheatgrass prairie; and Douglas-fir forests.

**Disturbance Regimes.** Fire, insects, and disease are primary sources of disturbance.

## **Section 342G--Green River Basin**

**Geomorphology.** This Section includes rugged hills and low mountains, with narrow valleys having steep gradients. Broad flood plains and fans are present on major rivers. Alluvial fans, piedmont plains, and piedmont slopes from the surrounding mountains join to form broad intermountain basins. Elevation ranges from 3,610 to 7,875 ft (1,100 to 2,400 m). This Section is within Fenneman and Johnson's Wyoming Basin geomorphic physical division.

**Potential Natural Vegetation.** Vegetative communities include grasses to grass-shrub to forests. Kuchler classified potential vegetation as sagebrush steppe (sagebrush-wheatgrass), saltbush-greasewood, and wheatgrass-needlegrass shrubsteppe.

**Disturbance Regimes.** Primary sources of disturbance are fire, insects and disease.

## **Section 342H--High Lava Plains**

**Geomorphology.** This area includes moderately dissected mountains and broad flat uplands. This Section is dominated by debris slides, rock fall and slow creep erosion processes on slopes of 20 to 120 percent. Some ancient lake terraces occur along the valley sides on slopes less than 30 percent. A multitude of young eruptive events have left volcanic features. During glacial stages numerous large lakes formed, filling to the playas found today. Elevation ranges from 2,000 to 5,000 ft (700 to 1,700 m). Local relief is mostly 300 to 800 ft (90 to 242 m).

**Potential Natural Vegetation.** Kuchler vegetation is characterized by three principal groups. Sagebrush-steppe ( *Artemesia-Agropyron* }) is considered dominant; followed by the juniper-steppe woodland ( *Juniperus-Artemesia-Agropyron* }) type; least common is wheatgrass-bluegrass ( *Agropyron-Poa* }). More recent classifications reveal a somewhat different characterization. A savanna with ponderosa pine occurs along the extreme western edge of this Section. Proceeding east, western juniper forms a woodland mixed with native sagebrush, bitterbrush and bunchgrasses. This woodland dominates the landscape over much of the western one-third of the Section. The woodland character soon changes as one proceeds east, with sagebrush and bunchgrasses dominating the undulating land; western juniper becomes restricted to rocky outcrops and other areas that have not experienced a recent fire. The eastern portion of the Section maintains a vegetative dominance of sagebrush and bunchgrass, but elements of either the desert or salt desert shrub communities are noticeable. Locally, grasses, sedges, rushes, and forbs occupy wet sites in meadows and along streams.

**Disturbance Regimes.** Prior to fire protection, fire was a common disturbance factor. Periods were about 15 to 30 years.

## **Section 342I--Columbia Basin**

**Geomorphology.** The Section is characterized by generally flat-lying basalt flows. It is a large dissected plain high above sea level. Structurally the Plateau is a great basin between the Rockies and the Cascades. Also, it is the best known example of plateau flood basalts. Channeled scablands, the result of mega-floods, range from excavated low points to coulees miles wide and hundreds of ft deep. Deposits of glacial till, glacial moraine, or glacial outwash blanket the plain. Rolling hills of loess cover unglaciated areas to the south and east. Elevation ranges from less than 200 ft near the Columbia River to more than 4,500 ft on high ridges and low mountains (70 to 1,500 m).

**Potential Natural Vegetation.** According to Kuchler, the sagebrush-steppe is dominant, followed by fescue-wheatgrass and wheatgrass-bluegrass.

**Disturbance Regimes.** Wind is the principal disturbance feature. Composition and successional sequences of some communities have changed because of agricultural practices and the introduction of animal species into the valleys.

## **Nevada-Utah Mountains Semi-Desert - Coniferous Forest - Alpine Meadow**

These Sections are located in the west-central conterminous States, including parts of Nevada, Utah, and Colorado. The area of these Sections is about 43,600 mi<sup>2</sup> (112,900 km<sup>2</sup>).

### **Section M341A--Central Great Basin Mountains**

**Geomorphology.** This area occurs within the Central Nevada Basin and Range physiographic province. The Central Great Basin Mountains section is located in central Nevada and a small area of western Utah. The dominant landforms are north-south trending mountains separated by broad, sediment-filled valleys, many of which have internal drainages. Mountains were formed by faulting and were subsequently modified by erosion. Large alluvial fans have developed at the mouths of most canyons. Some fans are coalescing, nearly burying the eroded mountains. Elevation ranges from 5,000 to 13,000 ft (1,500 to 4,000 m).

**Potential Natural Vegetation.** Kuchler vegetation types include Great Basin sagebrush and areas of saltbush-greasewood and juniper-pinyon woodlands. The Soil Conservation Service identifies the potential natural vegetation as saltbush-greasewood, big sagebrush, and pinyon-juniper woodland vegetation.

**Disturbance Regimes.** Erosion by wind and water is occurring. Fires also occur.

### **Section M341B--Tavaputs Plateau**

**Geomorphology.** This area occurs within the Colorado Plateau physiographic province. The Tavaputs Plateau Section is located in eastern Utah and western Colorado. One of Utah's most rugged areas is between the relatively level interior of the Uinta Basin and the valleys cut in the Mancos Shale in Carbon, Emery, and Grand Counties. The structure is relatively simple. Strata of Cretaceous and Tertiary periods rise gradually southward and upward from the center of the Uinta Basin to reach elevations between 8,000 and 10,000 ft where they are abruptly cut off in great erosional cliffs that descend in giant steps to the valleys of the south; there elevations are between 4,000 and 5,500 ft. The great system of linear cliffs is evident. The lower one, most visible and best known, is the Book Cliffs. Elevation ranges from 7,300 to 10,000 ft (2,100 to 3,000 m). Local relief ranges from 5 percent on the broad plateau uplands, to steep vertical canyon sidewalls comprised predominantly of bedrock.

**Potential Natural Vegetation.** Kuchler vegetation types include juniper-pinyon and big sagebrush. The eastern part of this Section (Book Cliffs-Roan Plateau-East and West Tavaputs Plateau) as delineated by Stokes includes juniper-pinyon, black sagebrush, big sagebrush, mountain brush, Salina wildrye grasslands, ponderosa pine, aspen, Douglas-fir, and spruce-fir.

**Disturbance Regimes.** Occurrence of fire is common, with large grass and shrub areas burning rapidly. At higher elevations, small fires are common, generally caused by lightning. They are usually confined to aspect and vegetation type. These fires are generally not extensive.

## Section M341C--Utah High Plateaus and Mountains

**Geomorphology.** This area occurs within the Colorado Plateau physiographic province. It includes portions of south-central Utah. This Section is located in the northwest corner of the Colorado Plateau physiographic province. These plateaus are primarily fault-controlled, have relatively high elevations, are aligned in a north-south direction, and are underlain with rocks of Mesozoic and Cenozoic eras. The east flank of the high plateaus is bordered by the Canyonlands. The western boundary is faulted, separating it from the Basin and Range physiographic province. They are a series of high plateaus that are gently rolling on top, but rise steeply from the valley bottoms. They are separated by north-south trending valleys. Landslides have influenced many areas in this Section and several plateaus were sites of local icecaps during at least the Wisconsin age. The tops of the plateaus have been capped with volcanic flows and glacial deposits. Colorful badland topography exists near Bryce Canyon and Cedar Breaks, another fault-controlled depression, and by the Paunsaugunt Fault. The western boundary of the Utah High Plateaus and Mountains Section also follows the northern part of Hurricane Fault.

**Potential Natural Vegetation.** Kuchler vegetation types include western spruce-fir forest, Arizona pine forest, and spruce-fir--Douglas-fir forest. The Soil Conservation Service identifies potential natural vegetation as conifer, aspen, grasses, mountain shrub, and sagebrush-grass. Areas of big sagebrush also occur.

**Disturbance Regimes.** The primary disturbance forces are infrequent mass movements and erosion from water. Historically, fire was a major disturbance that modified the vegetation. Fire suppression practices during the past century has altered this process.

## Everglades Province

This Section is located in southern Florida and has an area of about 7,800 mi<sup>2</sup> (20,200 km<sup>2</sup>).

### Section 411A--Everglades

**Geomorphology.** This Section is in the Coastal Plains geomorphic province. The predominant landform is a flat, weakly dissected alluvial plain formed by deposition of marine sediments onto a submerged, shallow continental shelf, which was later exposed by sea level subsidence. Along the coast, fluvial deposition and shore-zone processes are active in developing and maintaining beaches, swamps, and mud flats. Elevation ranges from sea level to 80 ft (25 m). Local relief ranges from 0 to 10 ft (3 m).

**Potential Natural Vegetation.** Kuchler classified five potential communities: Everglades (*Spartina patens*, *Mariscus*, *Magnolia-Persea*); mangrove, cypress savanna, and sub-tropical pine forest. This Section is dominated by two principal potential natural communities adapted to hydric conditions: an extensive treeless savanna (the Everglades) on the eastern side of the Section, and forested woodlands (the Big Cypress Swamp) on the western side. The Everglades is a shallow, broad (60 mi, 95 km) river with freshwater flowing southward from Lake Okeechobee to the Gulf of Mexico. Physiognomy of vegetation varies by duration of inundation and amount of salt

content. Vegetation includes: grasses in permanently submerged freshwater habitats; trees in dry to intermittently flooded fresh water habitats; and shrubs to small trees in saltwater estuary habitats. Predominant vegetation of flooded freshwater habitats includes sawgrass (actually a sedge), swamp lily, and spatterdock; on islands of slightly higher elevation (hammocks), trees include slash pine, royal palm, gumbo limbo, and strangler fig. Epiphytes are common. Big Cypress Swamp, and other adjacent areas to the north, are characterized by intermittently flooded freshwater habitats with very poor drainage that are dominated by cypress; oaks and magnolias occupy better drained areas. Poorly drained soils along the east coast, and farther inland along the west coast, are dominated by south Florida slash pine. Sand pine, with scrub oak and saw palmetto understory, occupies excessively drained, deep sands. Both south Florida slash and sand pine are well adapted to an environment of frequent fire. Coastal areas influenced by saltwater tidal zones are occupied by successive zones of vegetation, from freshwater to saltwater environments, of button mangrove, black mangrove, and red mangrove, respectively. Other species common to this tropical environment include Florida fishpoison-tree, Bahama lysiloma, royal poinciana, tamarind, shortleaf fig, Florida royalpalm, Jamaica thatchpalm, and oxhorn bucida. Key West *Cephalocereus*, a tree-sized member of the cactus family, occurs in thin, dry soils of the Florida Keys. Exotic species are creating a threat to native species. For example, the cajuput, or bottle-brush tree, a native of Australia has been planted widely as an ornamental and is now invading the Everglades National Park. Also, the water hyacinth, a free-floating Brazilian herb, clogs waterways.

**Disturbance Regimes.** Hurricanes are probably the most widespread form of natural disturbance, followed by infrequent fires during the winter dry season. Fire consumes irregular areas of organic soils, which fill with water during the wet season to make shallow lakes.

**Land Use.** Much of the land along the east and west coasts has been cleared of natural vegetation, originally for agriculture, but more recently for urban development. This Section contains the Everglades National Park, the Seminole and Miccosukee Native American reservations, and several national wildlife refuges.