Landscape Dynamics Component: Terrestrial (Upland) Vegetation

Key Terms Used in This Section

Cover type — A vegetation classification depicting a genus, species, group of species, or life form of tree, shrub, grass, or sedge.

Disturbance — Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Downed wood — A tree, large shrub, or part of a tree or shrub that is dead and laying on the ground.

Ecological significance — In the *Scientific Assessment* and this EIS, refers to a specific method of judging the significance of changes (from historical) of cover types and terrestrial community types, based on class changes, regional changes, and departure indices. See Hann, Jones, Karl, et al. (1997, page 409) for details.

Excessive livestock grazing pressure — Grazing pressure that results in a decline in physiological vigor of plants (such as decline in seeds or other reproductive parts or decline in root growth or other growth), resulting in decreased ability of the plant to compete for resources and also resulting in alteration of plant species composition in plant communities.

Exotic Species — A plant or animal species introduced from a distant place; not native to the area.

Grazing pressure — The ratio of forage demand to forage available, for any specified forage, at any point in time. Thus, as forage demand increases relative to forage available, grazing pressure increases, and vice-versa.

Herbivore — An animal that subsists principally or entirely on plants or plant materials.

Invasion (plant) — The movement of a plant species into a new area outside its former range.

Landscape composition — The types of stands or patches of vegetation present across a given area of land.

Landscape structure — The mix and distribution of stand or patch sizes across a given area of land. Patch sizes, shapes, and distributions are a reflection of the major disturbance regimes operating on the landscape.

Noxious Weed — A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has other adverse effects on humans or their environment and therefore is detrimental to the agriculture and commerce of the United States and to public health.

Old Forest — (a) **Old single story** forest refers to mature forest characterized by a single canopy layer consisting of large or old trees. Understory trees are often absent, or present in randomly spaced patches. It generally consists of widely spaced, shade-intolerant species, such as ponderosa pine and western larch, adapted to a nonlethal, high frequency fire regime. (b) **Old multi-story** forest refers to mature forest characterized by two or more canopy layers with generally large or old trees in the upper canopy. Understory trees are also usually present, as a result of a lack of frequent disturbance to the understory. It can include both shade-tolerant and shade-intolerant species, and is generally adapted to a mixed fire regime of both lethal and nonlethal fires.

Other characteristics of old forests include: variability in tree size; increasing numbers of snags and coarse woody debris; increasing appearance of decadence, such as broken tops, sparse crowns, and decay in roots and stems; canopy gaps and understory patchiness; and old trees relative to the site and species.

Patch (stand) — An area of uniform vegetation that is different from surrounding vegetation in its structure or composition. Examples might include a patch of forest surrounded by a cut-over area or a patch of dense young forest surrounded by a patch of open old forest.

Regeneration —The process of establishment of new plant seedlings whether by natural means or artificial measures (planting).

Seral — Refers to the stages that plant communities go through during succession. Developmental stages have characteristic structure and plant species composition. In a forest, for example, early seral forest refers to seedling or sapling growth stages; mid seral forest refers to pole or medium saw timber growth stages; and mature or late seral forest refers to mature and old-growth stages.

Shade-intolerant — Species of plants that need full sunlight to establish and grow. Generally these are fire-adapted species.

Shade-tolerant — Species of plants that can establish and grow in the shade. Generally these are more fire-sensitive species.

Source habitat —The composite of vegetation characteristics that contribute to terrestrial species population maintenance or growth in a specified time and space. See Glossary for more detail.

Species composition —The mix of different species that make up a plant or animal communit. For example, the minx of different species of trees that are growing in a forest. Can include both shade-intolerant and shade-tolerant species.

Stand (patch) density —The number of trees growing in a given area, usually expressed in terms of trees per acre.

Stand (patch) structure —The mix and distribution of tree sizes, layers, and ages in a forest. Some stands are all one size (single story), some are two story, and some are a mix of trees of different ages and sizes (multi-story). (See Table 2-6 a for structural stages used in this EIS to describe forest stand structure.)

Structural stage —A stage of development of a vegetation community that is classified on the dominant processes of growth, development, competition, and mortality.

Succession —A predictable progression in structure and composition of plant and animal communities over time. Conditions of one plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as seral stages.

Terrestrial Communities — Groups of cover types with similar moisture and temperature regimes, elevational gradients, structures, and use by vertebrate wildlife species.

Terrestrial Family —An aggregate of groups of broad-based terrestrial vertebrate species of focus for the ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families are discussed in this EIS.

Summary of Conditions and Trends

The following trends have been noted on the landscape of the project area because of departures from natural disturbance and successional processes since historical times. These broad-scale changes in the landscape have influenced the susceptibility of ecosystems to uncharacteristic wildfires, noxious weed invasion, and large-scale insect and disease events, and have reduced the extent of habitat for many wildlife species.

- Interior ponderosa pine has decreased across its range, with a significant decrease in the amount of old single story structure. The primary transitions were to interior Douglas-fir and grand fir / white fir.
- There has been a loss of the large tree component (live and dead) within roaded and harvested areas. This loss affects terrestrial wildlife species closely associated with these old forest structures.
- Western larch has decreased across its range. The primary transitions were to interior Douglas-fir, lodgepole pine, or grand fir / white fir.
- Western white pine has decreased by 95 percent across its range. The primary transitions were to grand fir / white fir, western larch, and shrub / herb / tree regeneration.
- The whitebark pine / alpine larch cover type has decreased by 95 percent across its range, primarily through a transition into the whitebark pine cover type. Overall, however, the whitebark pine cover type has also decreased, with compensating increases in Engelmann spruce / subalpine fir.
- Generally, mid seral forest structures have increased in dry and moist forest potential vegetation groups, with a loss of large, scattered, residual, shade-intolerant tree components and an increase in density of smaller diameter shade-tolerant trees.
- Increased fragmentation and loss of connectivity within and between blocks of habitat, especially in the shrub steppe and riparian areas, have isolated some habitats and populations and reduced the ability of wildlife populations to move across the landscape, resulting in long-term loss of genetic interchange.
- Increasing human population in the project area has resulted in an increase in access and human activity for all types of uses. These uses can increase wildlife displacement and vulnerability to mortality, can fragment habitat, and can allow for access of exotic plants into new locations. In some places road density has increased to the point where many wildlife species will leave the area to avoid human activity.
- Rangeland noxious weeds are spreading rapidly and in some cases exponentially throughout the project area.
- Woody species encroachment by and / or increasing density of woody species (sagebrush, juniper, ponderosa pine, lodgepole pine, Douglas-fir), especially on the dry grassland and cool shrublands, have reduced herbaceous understory and biodiversity.
- Cheatgrass has taken over many dry shrublands, increasing soil erosion and fire frequency and reducing biodiversity and wildlife habitat. Cheatgrass and other exotic plant infestations have simplified species composition, reduced biodiversity, changed species interactions and forage availability, and reduced the system's ability to buffer against change or act as wildlife strongholds in the face of long-term environmental variation.
- Degradation of riparian areas and subsequent loss of riparian vegetation cover has reduced riparian ecosystem function, water quality, and habitat for many aquatic and terrestrial species. (See Aquatics section for riparian area details.)
- Expansion of agricultural and urban areas on non-federal lands has reduced the amount of some rangeland potential vegetation groups, most notably dry grassland, dry shrubland, and riparian potential vegetation groups (PVGs). Changes in some of the remaining habitat patches due to fragmentation, exotic species, disruption of natural fire cycles; overuse by livestock and wildlife; and loss of native species diversity have contributed to a number of wildlife species declines, some to the point of needing special attention (such as sage grouse, Columbian sharp-tailed grouse, California bighorn sheep, pygmy rabbit, kit fox, and Washington and Idaho ground squirrels).

Introduction to Terrestrial (Upland) Vegetation

Terrestrial vegetation in the ICBEMP project area is highly diverse, ranging from moist areas near the crest of the Cascades, to the Continental Divide in the Rocky Mountains, and to dry areas in the northern Great Basin.

The varying soils and climates support a diversity of plant species, from those that require moist sites—such as western hemlock, western redcedar, and huckleberries—to dry-land species such as sagebrush and blue bunch wheatgrass. More than 12,000 plant species are known in the project area. In the mountains, tree species range from mountain hemlock and subalpine fir at the higher elevations, to ponderosa pine in the valley bottoms. Mixed conifer forests dominated by white fir, grand fir, or Douglas-fir occupy many of the mid elevation forests. Lodgepole pine forests are also found throughout much of the project area. Huckleberries, buck brush, alder, and sagebrush are some of the shrubs found in project area forests. Juniper, sagebrush, bitterbrush, and associated bunchgrasses occupy many low-elevation drier sites. These mosaics of vegetation include productive riparian areas that support willows, sedges, and other similar species. In the absence of cultivation, sagebrush and grasses dominated the prairies and plains. Native Palouse prairie vegetation today is scarce in northern Idaho and eastern Washington, where exotic plants now dominate large areas. See Jensen et al. (1997) for descriptions of the physical environment and Hann, Jones, Karl, et al. (1997) for descriptions of historical and current patterns of vegetation and landscape change. In addition, plant species important to American Indians for food or spiritual uses are found in many locations. Plants used as food include camas, bitterroot, chokecherry, onion, cattail, and elderberry.

Because of the wide variety of plant species and landscape forms distributed throughout the project area, habitats for a wide variety of wildlife are found in the mountains, valleys, and rangelands of the basin. Approximately 13,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment (Marcot et al. 1997). Wisdom et al. (in press) conducted an in-depth analysis of habitat requirements of 91 species that represented those 13,000 species. Grizzly bears, black bears, and mountain lions are some of the more notable wildlife species in the project area. Highly prized game species include Rocky Mountain elk, mule deer, and white tail deer. The bald eagle and northern goshawk are important rapters that prey on squirrels, chipmunks, woodpeckers, and a host of other species. Prominent rangeland wildlife species are pronghorn antelope, bighorn sheep, jack rabbits, sage grouse, and numerous reptiles.

How Vegetation Was Classified

There are many different ways to classify vegetation, based on various factors such as: conditions, vegetation structure, site moisture conditions, site fertility, heat, climax vegetation, overstory, understory, current vegetation, and other criteria or combinations. Hann, Jones, Karl, et al. (1997) used several broad-scale variables to assess regional levels of change: potential vegetation types, potential vegetation groups, cover types, structural stages, physiognomic types, physiognomic type groups, terrestrial communities, disturbance types, roads, and land ownership. The broad-scale vegetation attributes of the current period were derived from 1991 satellite imagery. The historical or "native" regime was simulated.

In this EIS, individual cover type-structural stage combinations were nested within appropriate terrestrial communities, which were nested within potential vegetation groups in order to provide a logical context for understanding of current trends, the management direction, and projected effects of alternatives. These are described more fully on the following pages.

Historical conditions —The vegetation types, structural stages, and dynamics, and other conditions and processes that are likely to have occurred around the time of pre-European settlement, approximately the mid 1800s. This time period is used only as a reference point to understand ecological processes and functions. In many cases it is neither desired nor feasible to return to actual historical ecological conditions.

Potential Vegetation Types and Groups

The term *potential vegetation type* (PVT) is used in this EIS to represent the entire combination of species that might grow on a specific site. In the absence of disturbance and given enough time, climax vegetation will occupy any given site. The potential vegetation type is often named for this climax vegetation, but may also be named for an "indicator" species. The vegetative cover present at any one time can vary based on past disturbances; species other than those listed for the PVT may occur on the site through time. Thus, the name given to the PVT (such as "dry Douglas-fir with ponderosa pine") is simply an indicator and name for the kind of physical and biological environment that would support these representative species. In other words, the PVT name could stand for the vegetation that would grow on a site at the first successional stage, the climax, or any stage in between.

Potential vegetation types were grouped into 15 *potential vegetation groups* (PVGs), based on similar general moisture or temperature environments. The 15 PVGs, along with the potential vegetation types that make up each group, are listed in Table 2-2.

PVGs provide a basis for discussion about vegetation change at the broad scale. They will be discussed in order from the highest elevation to the lowest elevation. Riparian potential vegetation groups are addressed in the Aquatic/ Riparian/Hydrologic section.

Agricultural, urban, water, and rock potential vegetation groups are not discussed in detail in this EIS because they are less related to or form extremely small components of BLM- or Forest Service-administered lands in the project area, or because they are not used as major vegetation divisions for discussions in Chapters 2 through 4.

Maps 2-5 and 2-6 present the historical and current distribution of PVGs in the project area. Table 2-3 displays the current distribution and amount of major potential vegetation groups in the project area.

Terrestrial Communities

The *Scientific Assessment* also classified vegetation by terrestrial community types and terrestrial community groups. Twenty-four terrestrial community types were developed by grouping the cover types by their broad-scale structural stages and common temperature, moisture, and elevation characteristics (Table 2-4). See definitions of cover type and structural stage in Key Terms and in further discussion below. The change in composition of these cover types, over time, also was evaluated in Hann, Jones, Karl, et al. (1997).

Some communities (riparian shrubland, riparian woodland, and riparian herbland) in the basin could not be accurately quantified at the broad scale, so they were not reported. Riparian terrestrial community types, for example, tend to occur in small- to medium-sized patches and are therefore better described and quantified at a mid or fine scale.

In forest settings, change was dominated by transition of early and late seral communities into mid seral communities. Changes in rangelands were dominated by transitions from upland herbland and shrubland communities into the agriculture type.

The analysis of terrestrial communities quantified changes from one terrestrial community to another, compositional changes for the basin and within ERUs (or RAC/PACs), and change in comparison to the historical range of the community. Terrestrial community type departures were determined by comparing current extent of each type to their modeled historical ranges. Most terrestrial communities show current areas that are outside of their median 75 percent historical range. In forest settings, only the early seral montane forest community occurs within its median historical range. Forest community change is dominated by the transitions of early and late seral communities into mid seral communities. Forest changes have been greatest in lower montane forest communities and least in subalpine forest communities (Hann, Jones, Karl, et al. 1997).

Three of the terrestrial community types described by Hann, Jones, Karl, et al. (1997)—agricultural, exotic herbland, and urban—are the result of recent human activity and were not described historically. The transitions of upland herbland and upland shrubland communities into the agricultural type dominates the changes in rangelands that have occurred in the basin from the historical to current periods. Agriculture is the third most dominant community type in the basin.

Ecologically significant trends are evident in seven terrestrial communities: upland herbland, upland shrubland, early seral lower montane forest, late seral lower montane single story forest, late seral lower montane single story forest, and late seral subalpine multi-story forest.

Both the early seral lower montane and late seral lower montane single story forest communities have declined by more than 75 percent. Early seral subalpine forests, mid seral lower montane forest, mid seral montane forest, late seral subalpine single story forest, and upland woodland have increased significantly. Trends in each of these communities across the basin are shown in Table 2-5.

The 24 terrestrial community types were later combined into 12 terrestrial community groups which, for some analyses, increased the comparability between the historical and current periods (Hann, Jones, Karl, et al. 1997).

Cover Type–Structural Stages

Wisdom et al. (in press) identified 91 species of birds, mammals, and reptiles of concern for analysis, based on broad-scale criteria. This information was drawn from the current status of habitats and / or populations of each species. The 91 species were clustered into 40 groups and further combined into 12 "families" on the basis of similar habitat requirements. See the Terrestrial Species section of this chapter for detailed discussion of Terrestrial Families.

Within each of the 12 Terrestrial Families, the species use a variety of types of vegetation called *source habitat*. The vegetation that makes up source habitats can be classified according to the dominant species or cover type, and the structural stage of that vegetation. An example of a cover type and structural stage would be a *ponderosa pine old forest single story structure*. The source habitats for the 12 Terrestrial Families contain many cover types and structural stages, with a different number of cover type–structural stage combinations for each Family. In total, the 91 terrestrial species in these 12 Families use 155 cover type–structural stage combinations.

The number of combinations for each family are:

Terrestrial Family	Number of Cover Type–Structural Stage Combinations
Family 1 (low elevation old forest)	15
Family 2 (broad elevation old forest)	86
Family 3 (forest mosaic)	123
Family 4 (early seral montane and lower montane)	11
Family 5 (forest and range mosaic)	143
Family 6 (forest, woodland, and montane shrubs)	85
Family 7 (forests, woodlands, and sagebrush)	133
Family 8 (rangeland and early and late seral forest)	27
Family 9 (woodlands)	7
Family 10 (range mosaic)	27
Family 11 (sagebrush)	20
Family 12 (grassland and open canopy sagebrush)	18

Cover type-structural stage combinations have either declined, remained fairly stable, or increased in geographic extent between the historical and current period in the project area. Those that have increased have often done so at the expense of those that have declined (Hann, Jones, Karl, et al. 1997). Individual cover type-structural stage combinations that have declined substantially from historical to current for the project area were identified by the EIS Team if the following three conditions were met:

1. A decline in geographic extent of 20 percent or greater between the historical and current periods in the project area (adapted from the cover type analyses in Hann, Jones, Karl, et al. 1997);
2. A decline in geographic extent from historical to current periods had to occur in at least 50 percent of the ERUs that were deemed by the EIS Team to have "management significance" (see criterion 3 for definition).
3. ERUs that were deemed of "management significance" had to have a change in geographic extent of the cover type-structural stage combination of at least 20 percent from the historical to current periods, unless the absolute change between historical and current was less than or equal to 0.05 percent of the ERU (adapted from the cover type analyses in Hann, Jones, Karl, et al. 1997).

Therefore, criterion 1 attaches a project-area-wide context, and criteria 2 and 3 attach an additional regional context to the identification of cover type-structural stage combinations that have declined substantially from historical to current. To be identified, the geographic extent of a cover type-structural stage combination had to show a substantial decline both in the project area as a whole, and within at least one-half of the regions (ERUs) where it is present.

Succession and Disturbance Processes

Some of the more important concepts of landscape dynamics to understand when reading this EIS are vegetation succession and disturbance processes, the events that cause disturbance, and the resulting vegetation patterns. Unless otherwise noted, the following information was derived from the Landscape Dynamics (Hann, Jones, Karl, et al. 1997) and Terrestrial Ecology (Marcot et al. 1997) chapters of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997).

Table 2-2. Potential Vegetation Groups and Potential Vegetation Types in the Basin.

Potential Vegetation Group	Potential Vegetation Types
Alpine	Alpine shrub-herbaceous
Cold Forest	Mountain hemlock-Inland Spruce-fir, dry with aspen Spruce-fir, dry without aspen Spruce-fir, (whitebark pine greater than lodgepole pine) Spruce-fir, (lodgepole pine greater than whitebark pine) Whitebark pine/alpine larch-north Whitebark pine/alpine larch-south Mountain hemlock - East Cascades Mountain hemlock/Shasta red fir
Moist Forest	Cedar/hemlock-Inland Moist Douglas-fir Grand fir/white fir-Inland Spruce-fir, wet Cedar/hemlock - East Cascades Grand fir/white fir - East Cascades Pacific silver fir
Dry Forest	Dry Douglas-fir without ponderosa pine Dry Douglas-fir with ponderosa pine Dry grand fir/white fir Interior ponderosa pine Lodgepole pine - Oregon Lodgepole pine - Yellowstone Pacific ponderosa pine/Sierra mixed conifer
Woodland	Juniper Limber pine White oak Mountain mahogany Mountain mahogany with mountain big sage
Cool Shrub	Mountain big sage-mesic east Mountain big sage-mesic east with conifer Mountain big sage-mesic west Mountain big sage-mesic west with juniper Mountain shrub
Dry Grass	Agropyron steppe Fescue grassland Fescue grassland with conifer
Dry Shrub	Antelope bitterbrush Basin big sage steppe Low sage-mesic Low sage-mesic with juniper Low sage-xeric Low sage-xeric with juniper Big sage-warm Big sage-cool Salt desert shrub Threetip sage
Agriculture	Irrigated crop land Dry crop/pastureland
Riparian Herb	Riparian graminoid Riparian sedge
Riparian Shrub	Salix/carex Saltbrush riparian Mountain riparian low shrub
Riparian/Woodland	Cottonwood riverine Aspen
Urban	Urban
Rock	Barren of vegetation
Water	Water

The information in this table is for all lands in the entire basin, including the areas that were excluded from the decision space for the Supplemental Draft EIS (portions of Nevada, Utah, and Wyoming; and the area that overlaps with the Northwest Forest Plan area).

Source: Hann, Jones, Karl, et al. (1997).

Map 2-5. Potential Vegetation Groups: Historical.

Map 2-6. Potential Vegetation Groups: Current.

Table 2-3. Total Forest Service- and BLM-administered Acres by PVG Within Each RAC/PAC.

RAC/PAC Name	Cold Forest	Moist Forest	Dry Forest	Cool Shrub	Dry Grass	Dry Shrub
			Thousands of Acres			
Butte RAC	2,136	5,266	958	15	45	0.5
Deschutes PAC	64	262	750	786	43	540
Eastern Washington Cascades PAC	228	105	50	2	6	18
Eastern Washington RAC	119	1,158	212	10	19	71
John Day-Snake RAC	404	452	3,241	256	452	226
Klamath PAC	33	66	1,034	48	31	41
Lower Snake River RAC	296	266	536	1,675	291	2,885
Southeastern Oregon RAC	77	207	1,570	1,124	73	9,804
Upper Columbia-Salmon-Clearwater RAC-R1	848	4,822	1,042	1	75	2
Upper Columbia-Salmon-Clearwater RAC-R4	3,649	1,192	2,779	569	670	473
Upper Snake River RAC	578	32	598	1,367	434	4,306
Yakima PAC	0	4	0.2	5	2	30

Abbreviations used in this table:
BLM - Bureau of Land Management
PVG - potential vegetation group
RAC/PAC - Resource Advisory Council/Provincial Advisory Committee

Source: ICBEMP GIS data (converted to 1 km^2 raster data).

Succession

Plants respond to influences and disturbances from animals, people, and even other plant species by growing in patterns of succession. “Succession” refers to a predictable process of changes in structure and composition of plant and animal communities over time. Successional (or seral) stages often are described in terms of “early,” “mid,” or “late” to reflect the species and / or condition of vegetation and animal communities generally characteristic at different times during succession. Early seral communities, which occur early in the successional path, generally have less complex structural development than later successional communities. Late seral communities generally have mature, larger individuals (Hann, Jones, Karl, et al. 1997). Forest successional stages are presented in Table 2-6a. Rangeland successional stages are presented in Table 2-6b.

Disturbance

“Disturbance” refers to events that alter the structure, composition, and / or function of terrestrial or aquatic habitats. Disturbances in the native interior Columbia River Basin system generally follow cycles of infrequent, high intensity events (such as drought, floods, or crown fires) interspersed with frequent, low intensity events such as nonlethal underburns, annual wildlife grazing cycles, or scattered mortality from bark beetles (Hann, Jones, Karl, et al. 1997).

Succession and disturbance processes have changed considerably since settlement of the project area by immigrants from Europe and other places. The development of agriculture, mining, urban areas, transportation networks, and hydrologic projects, and other activities such as wildfire suppression, forest management, livestock management, and the introduction of exotic (non-native) plants and pathogens created a new set of disturbance regimes with which the native vegetation has not evolved. The result is altered succession and disturbance regimes which in turn affected the vegetative composition, structure, and patterns that appear on the landscape. These changes in the make-up of the vegetation then influence the survival and reproduction of aquatic and terrestrial species.

General forest and rangeland successional and disturbance processes are illustrated in Figures 2-9 and 2-10. Changes in fire disturbance severity and frequency from historical to current are shown on Maps 2-7 through 2-10.

Table 2-4. Terrestrial Community Types and Groups.

Terrestrial Community Group	Terrestrial Community Type
Agriculture	Agricultural
Alpine	Alpine
Exotic Herbland	Exotic Herbland
Lower Montane Forest[1]	Early Seral Lower Montane[1] Forest Mid Seral Lower Montane[1] Forest Late Seral Lower Montane[1] Multi-story Forest Late Seral Lower Montane[1] Single Story Forest
Montane Forest	Early Seral Montane Forest Mid Seral Montane Forest Late Seral Montane Multi-story Forest Late Seral Montane Single Story Forest
Rock	Rock/Barren
Subalpine Forest	Early Seral Subalpine Forest Mid Seral Subalpine Forest Late Seral Subalpine Multi-story Forest Late Seral Subalpine Single Story Forest
Upland Herbland	Upland Herbland
Upland Shrubland	Upland Shrubland
Upland Woodland	Upland Woodland
Urban	Urban
Water	Water
Not Used[2]	Riparian Herbland
Not Used[2]	Riparian Shrubland
Not Used[2]	Riparian Woodland

[1] Originally referred to as ponderosa pine forest.
[2] Patterns were not assessed for the riparian terrestrial community types because these types generally occurred in scattered, relatively small- to medium-sized patches, and tended to be underestimated as mapping resolution increased. Consequently, because the historical vegetation layer was developed at a coarser resolution than the current period vegetation layer, it was likely that the two mapping efforts contained different biases. Therefore, changes of riparian vegetation types between historical and current periods could not accurately be assessed.

Source: Adapted from Hann, Jones, Karl, et al. 1997, Table 3.9.

The most substantial change in vegetation in the basin was the ***conversion*** of 37 percent of non-BLM- or Forest Service-administered land to agricultural use, much of which is dominated by exotic plants. Only one percent of the basin was converted to urban areas, but the impact of the huge increase in human population that lives there and their impact on the natural resources of the basin go far beyond the urban boundaries.

The introduction of ***exotic plants*** resulted in the replacement of native cover types and structures especially in the dry grass, dry shrub, cool shrub, and riparian potential vegetation groups (PVGs). (See the Landscape: Terrestrial Upland Environment section of this chapter for a complete discussion of vegetation classifications, including PVGs.) Although these shade-intolerant exotic plants invaded the forested PVGs, they typically did not displace the dominant species. The agricultural PVG showed the greatest susceptibility to invasion by exotic plants, while the alpine PVG was least susceptible.

White pine blister rust, an introduced pathogen that attacks western white pine and whitebark pine, has modified cover types, structures, and successional pathways within moist and cold PVGs. Approximately 19 percent of Forest Service- and BLM-administered lands in the basin have been changed by white pine blister rust (Hann, Jones, Karl, et al. 1997).

Table 2-5. Changes in Extent of Terrestrial Communities, Within the Basin, Historical to Current Periods.

Cover Type	Historical Area[1]	Current Area[2]	Class Change[3]	Basin Change[4]
		Percent		
Agricultural	0.00	16.06	NA[5]	16.06[6]
Alpine	0.16	0.16	-0.18	0.00
Early Seral Lower Montane Forest	1.10	0.26	-76.75[6]	-0.85
Early Seral Montane Forest	8.67	7.94	-8.40	-0.73
Early Seral Subalpine Forest	1.21	1.80	48.20[6]	0.58
Exotic Herbland	0.00	2.06	NA[5]	2.06[6]
Late Seral Lower Montane Multi-story Forest	2.16	1.42	-34.55[6]	-0.75
Late Seral Lower Montane Single Story Forest	5.56	1.08	-80.61[6]	-4.48[6]
Late Seral Montane Multi-story Forest	3.80	3.38	-11.18	-0.43
Late Seral Montane Single Story Forest	0.78	0.85	8.38	0.07
Late Seral Subalpine Multi-story Forest	1.23	0.45	-63.83[6]	-0.79
Late Seral Subalpine Single Story Forest	0.57	0.78	36.32[6]	0.21
Mid Seral Lower Montane Forest	4.91	7.52	53.03[6]	2.60[6]
Mid Seral Montane Forest	10.48	16.62	58.58[6]	6.14[6]
Mid Seral Subalpine Forest	2.72	2.70	-1.02	-0.03
Rock/Barren	0.24	0.24	0.00	0.00
Upland Herbland	14.88	4.94	-66.82[6]	-9.94[6]
Upland Shrubland	36.71	25.50	-30.53[6]	-11.21[6]
Upland Woodland	1.91	2.85	49.49[6]	0.94
Urban	0.00	0.16	NA[5]	0.16
Water	0.94	0.94	0.00	0.00

The information in this table is for all lands in the entire basin, including the areas that were excluded from the decision space for the Supplemental Draft EIS (portions of Nevada, Utah, and Wyoming; and the area that overlaps with the Northwest Forest Plan area).

[1] Historical area - circa 1850 to 1900 (initiated model simulation).
[2] Current Area - circa 1991.
[3] Class change - percent change relative to the terrestrial community.
[4] Basin change - percent change of the basin attributable to the terrestrial community change.
[5] NA - Not applicable; the terrestrial community did not exist during the historical period.
[6] Ecologically significant changes.

Source: Adapted from Hann, Jones, Karl, et al. 1997, Table 3.139.

Excessive livestock grazing pressure on rangelands in the late 1800s and early 1900s caused excessive soil losses from upland habitats. In combination with the agriculture and loss of beavers, livestock grazing lowered the water table in valley bottom habitats and greatly reduced the extent of riparian shrubland and riparian woodland PVGs.

Dams across rivers and streams were built to generate power, irrigate agricultural land, and provide flood control. The impacts on the landscape carried far beyond the stream banks where migrating fish found the dams to be impediments. The reduction in some populations and extinction of others eliminated a food source that many aquatic and terrestrial species depended on for survival in the nutrient-poor mountains of the interior Columbia Basin. The reduction in the annual pulse of nutrients anadromous fish bring from the coastal estuaries into the streams, lakes, and uplands of the basin has affected both aquatic and terrestrial habitats.

Traditional timber harvest methods often changed the species composition and / or the stand structure in forested PVGs. By harvesting the large dominant shade-intolerant trees and leaving the shade-tolerant trees, forests have been quickly converted from late seral shade-intolerant forests to mid seral shade-tolerant forests. Clearcut logging changed mid or late seral forests to early seral forests.

For additional discussion of how these and other change factors have influenced forests, rangelands, aquatic systems, terrestrial and aquatic species, and human elements of the ecosystem, see the Factors of Influence section at the end of this chapter.

General Succession and Disturbance Regime Patterns

Forestlands

Historically, ***foothill and mountainous terrain*** dominated by forest potential vegetation groups had consistent patterns of succession / disturbance regimes which resulted in characteristic vegetation patterns on the landscape (see Figure 2-11). This is referred to as the native system. Over the past century, there have been two general strategies of land management: (1) traditional commodity production; and (2) traditional reserve management. As a general rule in traditional forest commodity production, roads have been built, timber has been harvested, and fires have been suppressed. This has taken place in many of the accessible areas, especially those that supported large trees. Traditional reserve management such as wilderness, generally involved more of a passive approach to management, although wildfires were still suppressed. Traditional reserves often have been associated with more remote and less productive areas. Traditional commodity production and traditional reserve management coupled with wildfire suppression have substantially changed the patterns of succession, disturbance, and vegetation. Like the native system, these patterns are generally predictable. (See Figures 3.11b and 3.11c, in Hann, Jones, Karl, et al. [1997]).

The dominant disturbances affecting succession in the native system were wildfire, insects, disease, weather (wind), and floods. Typically, ***ridges, plains, and terraces*** supported late seral single story forests (for example, open, park-like stands of ponderosa pine) sustained by frequent fires and other nonlethal disturbances (5- to 25-year disturbance interval) that killed understory trees. The composition and structure of

Table 2-6a. Forest Structural Stages.

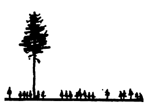
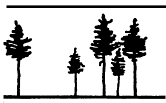
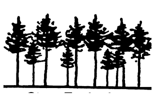
	Structural Stage	Definition	In this EIS, Also Called Seral Stage
	**Stand-initiation**	When land is reoccupied following a stand-replacing disturbance.	Early Successional Regenerational Early Seral
	**Stem exclusion - open canopy**	Forested areas where the occurrence of new tree stems is limited by moisture.	Mid Successional Young Forest (managed and unmanaged) Mid Seral
	**Stem exclusion - closed canopy**	Forested areas where the occurrence of new tree stems is predominantly limited by light.	
	**Understory reinitiation**	When a second generation is established under an older, typically early seral, overstory.	
	**Young forest multi-story**	Stand development resulting from frequent harvest or lethal disturbance to the overstory.	
	**Old multi-story**	Forested areas lacking frequent disturbance to understory vegetation.	Late Successional Mature and Old Forest Multi-story Late Seral
	**Old single story**	Forested areas resulting from frequent nonlethal natural or prescribed underburning or other management.	Late Successional Mature and Old Forest Single Story Late Seral

Table 2-6b. Rangeland Structural Stages.

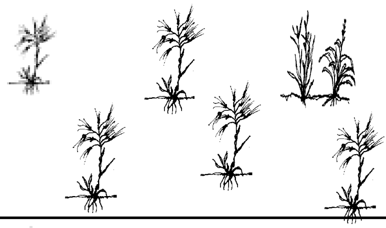
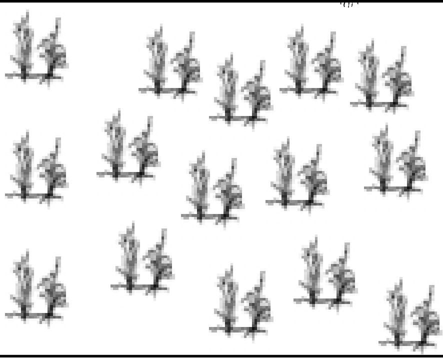
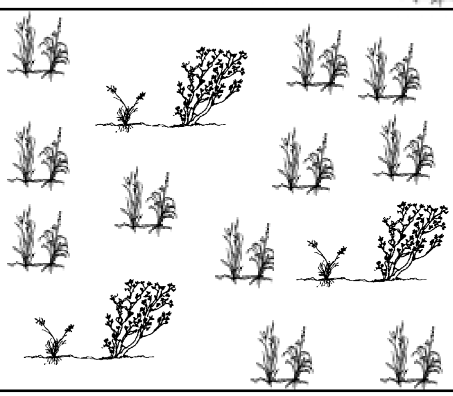
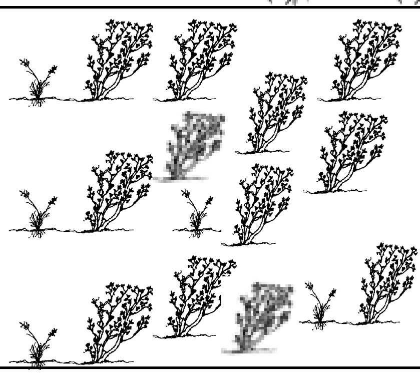
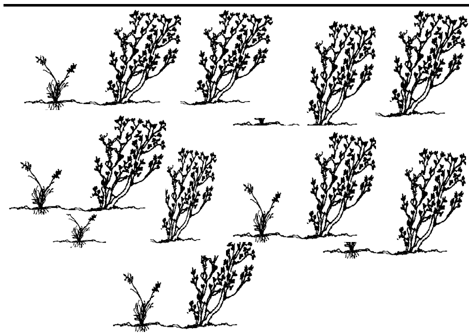
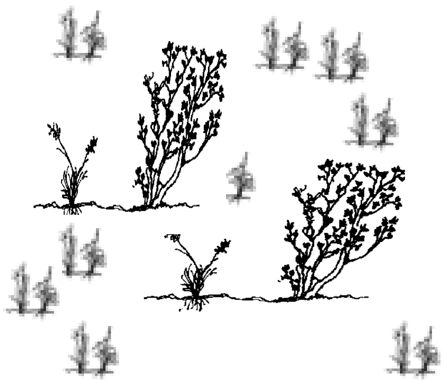
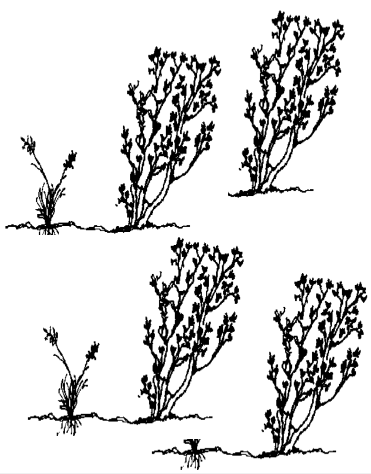
	Structural Stage	Definition
	Open Herbland	Area has less than 15% canopy cover[1] of herbaceous species[2] and less than 5% canopy cover of trees and shrubs. (Typical setting is less than 12" precipitation or rocky environment.)
	Closed Herbland	Area has 15% or greater herbaceous species and less than 5% canopy cover of trees and shrubs. (Typical setting is greater than 12" precipitation and good soil; may occur after fire in a shrub type.)
	Open Low Shrub	Area has less than 15% canopy cover of low (<20") shrubs (for example, black sagebrush) and less than 5% canopy cover of trees. (Typical setting is less than 12" precipitation and lithic or rocky environment.)
	Closed Low Shrub	Areas has 15% or greater canopy cover of low (<20") shrubs (for example, black sage-brush) and less than 5% canopy cover of trees. (Typical setting is less than 12" precipitation and lithic or rocky environment; usually a result of fire exclusion.)
	Open Mid Shrub	Area has less than 15% canopy cover of mid (>20" to <6.5') shrubs (for example, Wyoming sagebrush) and less than 5% canopy cover of trees. (Typical setting is upland bench or foothill environment.)

Table 2-6b. Rangeland Structural Stages. (continued)

	Structural Stage	Definition
	Closed Mid Shrub	Area has 15% or greater canopy cover of mid (>20” to <6.5’) shrubs (for example, Wyoming sagebrush) and less than 5% canopy cover of trees. (Typical setting is upland bench or foothill environment; usually a result of fire exclusion.)
	Open Tall Shrub	Area has less than 15% canopy cover of tall (>6.5’) shrubs (for example, chokecherry) and less than 5% canopy cover of trees. (Typical setting is draw or swale upland environment.)
	Closed Tall Shrub	Area has 15% or greater canopy cover of tall (>6.5’) shrubs (for example, chokecherry) and less than 5% canopy cover of trees. (Typical setting is valley broad riparian zone or wetland environment.)

[1] Canopy cover for this definition is on-the-ground cover at a 1:1 scale. This typically is measured by a line-intercept technique for shrubs, or by a quadrad microplot for herbaceous plants. Canopy cover can also be estimated if these techniques are used for calibration. This is the technique and scale normally used by Forest Service and BLM field staff at the fine scale, but it differs from the definition and measurement technique reported in Hann, Jones, Karl et al. (1997; Appendix 3-G, p. 1007) and in Hessburg et al. (in press). That technique used photo interpretation methods at a scale of approximately 1:12,000, which is not applicable for the fine-scale techniques used by the agencies on the ground.

A comparison of the two techniques and scales (1:1 versus 1:12,0000) reveals a ratio of approximately 1:4; that is, canopy cover thresholds using the photo interpretation/1:12,000 scale will be about 4 times higher than canopy cover thresholds using the line intercept/1:1 scale (S. Bunting, University of Idaho Range Science Department, pers. comm. with W. Hann 1997). For example, a 15 percent canopy cover of shrubs using line intercept at a 1:1 on-the-ground scale will be comparable to a 60 to 70 percent canopy cover using photo interpretation dot-grid techniques at a 1:12,000 scale.

This table uses the definition for canopy cover that is consistent with the technique and scale used by the Forest Service and BLM at the fine scale.

[2] Herbaceous species are vascular plants with non-woody stems, such as grasses and forbs.

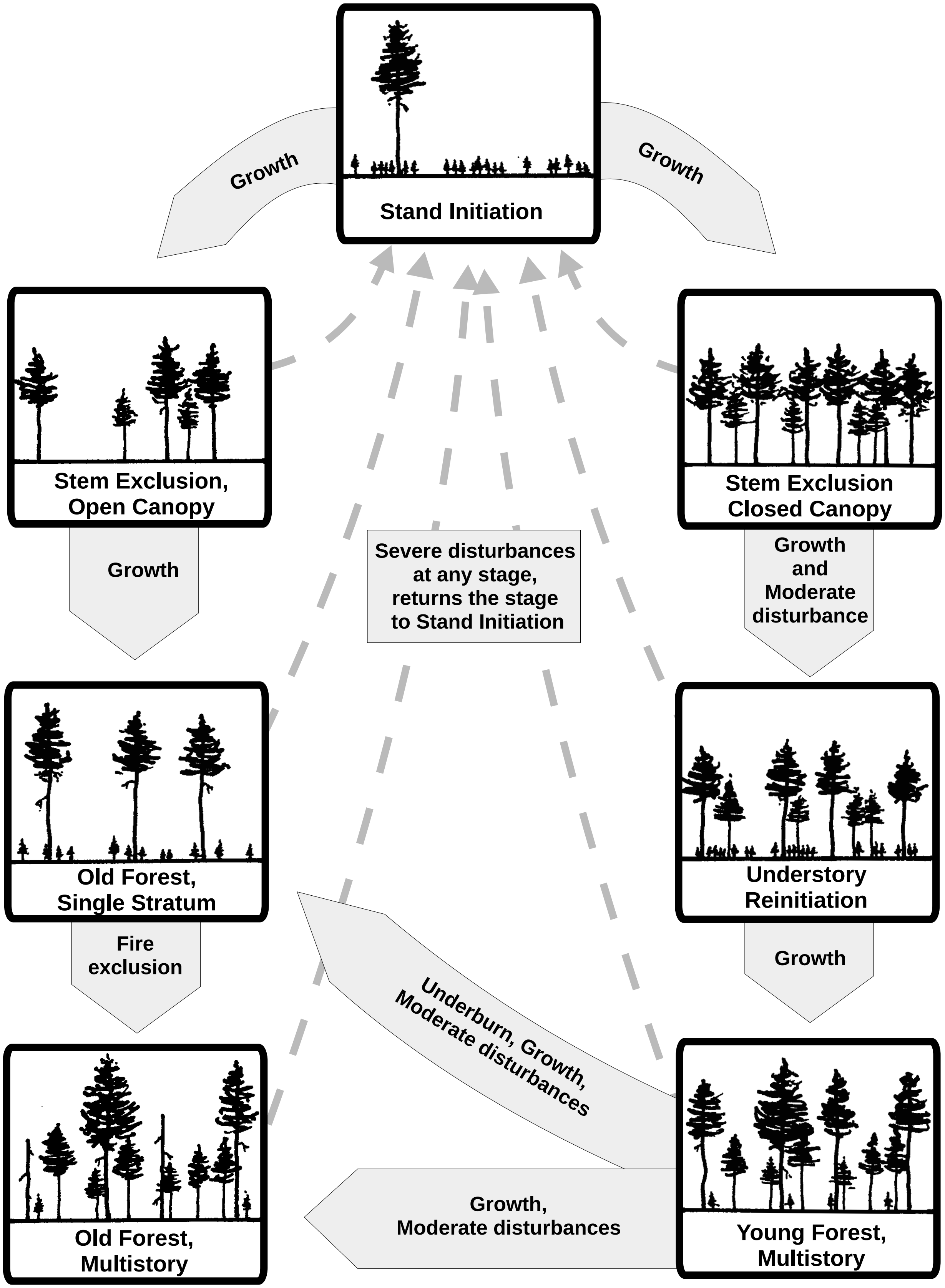


Figure 2-9. General Forest Successional and Disturbance Processes.

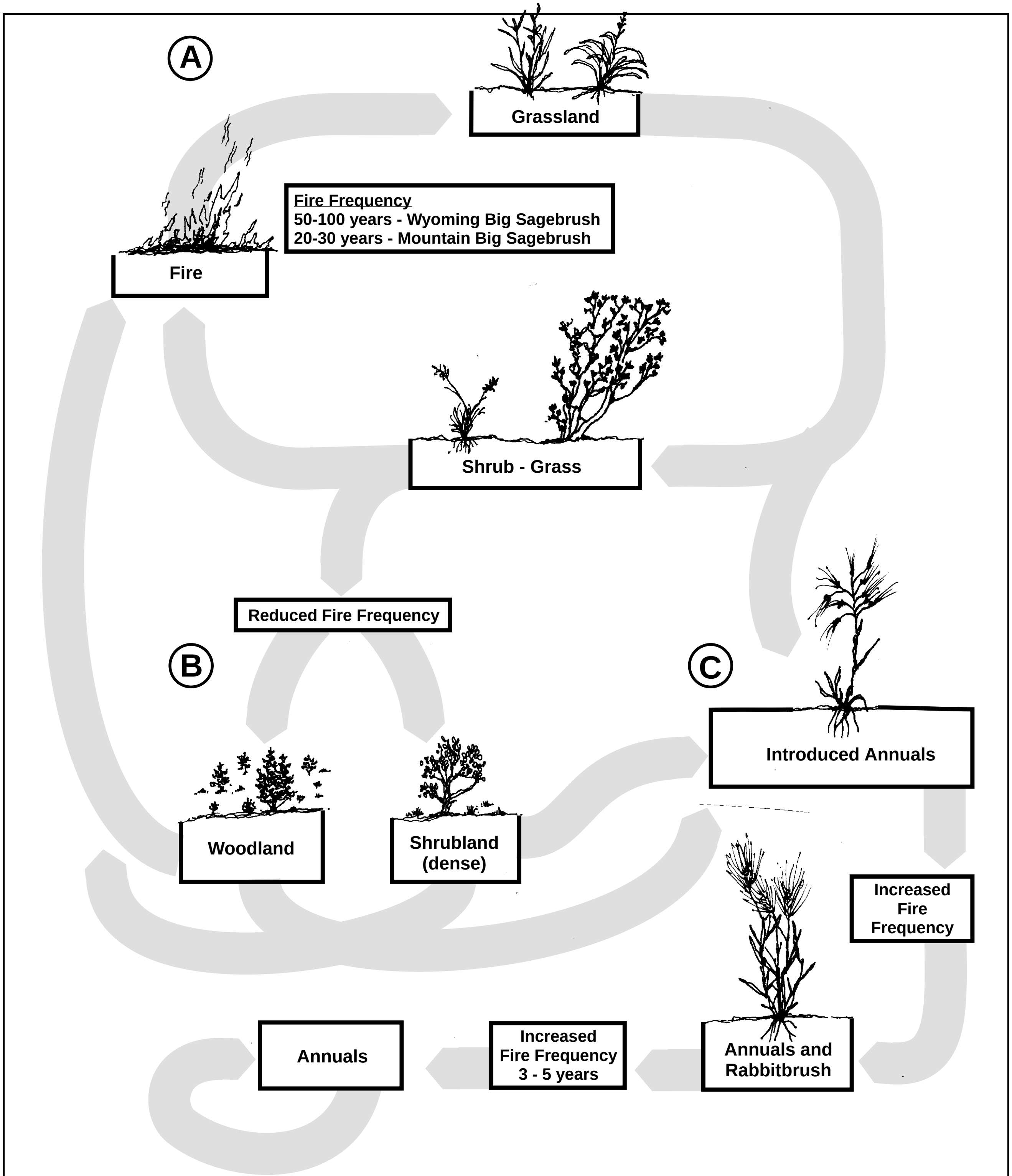


Figure 2-10. General Rangeland Successional and Disturbance Processes (includes altered sagebrush steppe). Three common pathways of succession in the sagebrush steppe. Pathway A represents a succession from a grassland to a shrub-grass dominated plant community, with fire acting to move the shrub-grass community back to a grassland. This type of succession follows the "Climax Model" of plant succession. Pathway B represents succession of a shrub-grass dominated plant community to either a woodland (dominated mostly by juniper) or a shrubland, caused by a reduction in fire occurrence. The dense shrub or woodland plant community can re-enter Pathway A if native perennial understory plants are sufficient to establish themselves following a wildfire or it could move into Pathway C if the understory plants are mostly introduced annuals such as cheatgrass following a wildfire. Pathway C represents succession of a shrub-grass or woodland-shrub-grass dominated plant community to a community dominated by introduced annual grasses, characterized by an increase in fire occurrence. Once dominated by introduced annual grasses, the community tends to remain this way because of frequent fire and competition from the introduced annual grasses which prevents shrubs and native perennial grasses from establishing. This type of succession follows the "State and Transition Model" of plant succession. (Adapted from Vavra et al. (editors) 1994.)

Map 2-7. Fire Regime Severity: Historical.

Map 2-8. Fire Regime Severity: Current.

Map 2-9. Changes in Fire Regime Severity: Historical to Current.

Map 2-10. Changes in Fire Regime Frequency: Historical to Current.

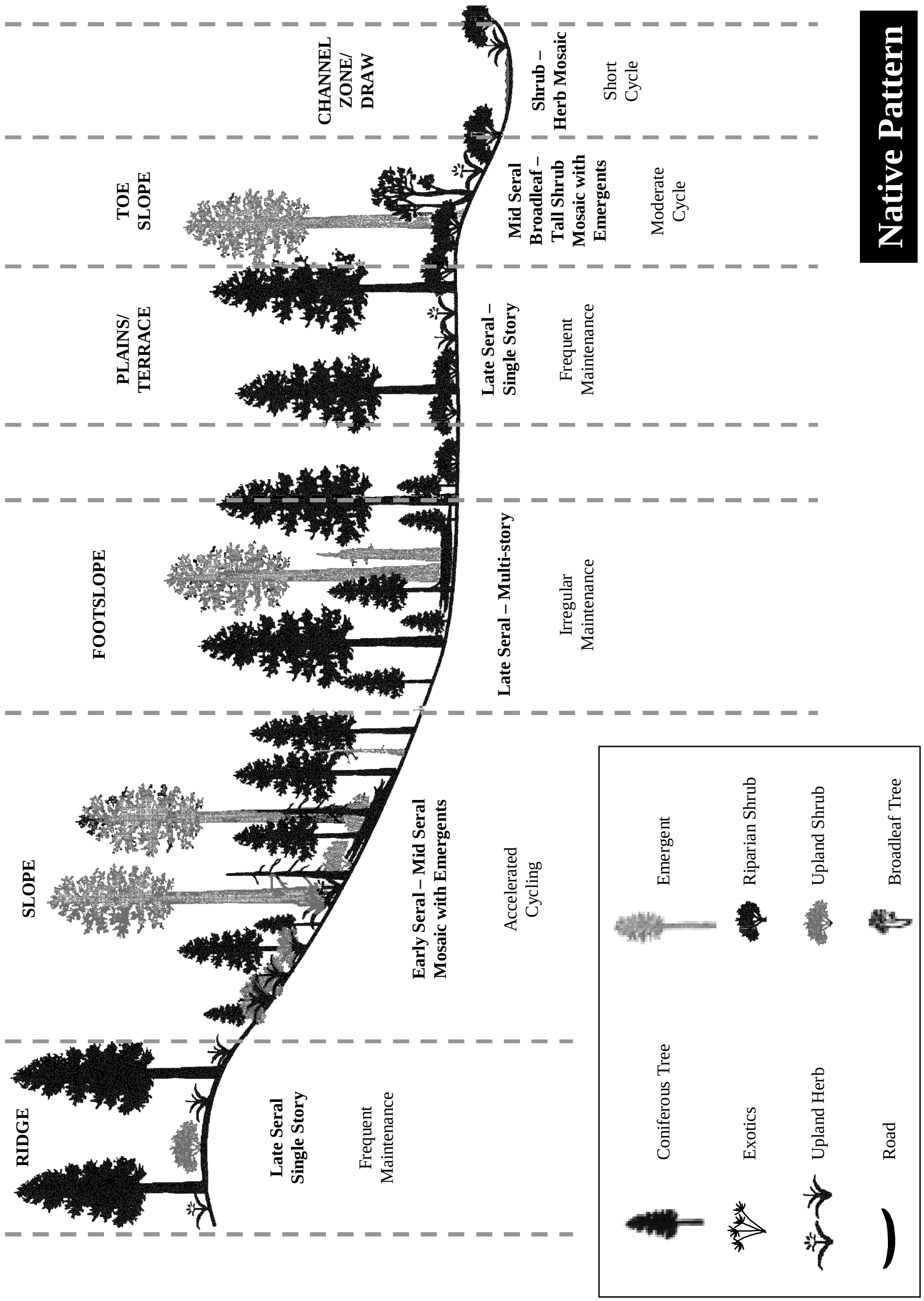


Figure 2-II. Forest Landscape Patterns—Succession/Disturbance Regime Patterns on the Landscape. Source: Hann, Jones, Karl, et al. 1997.

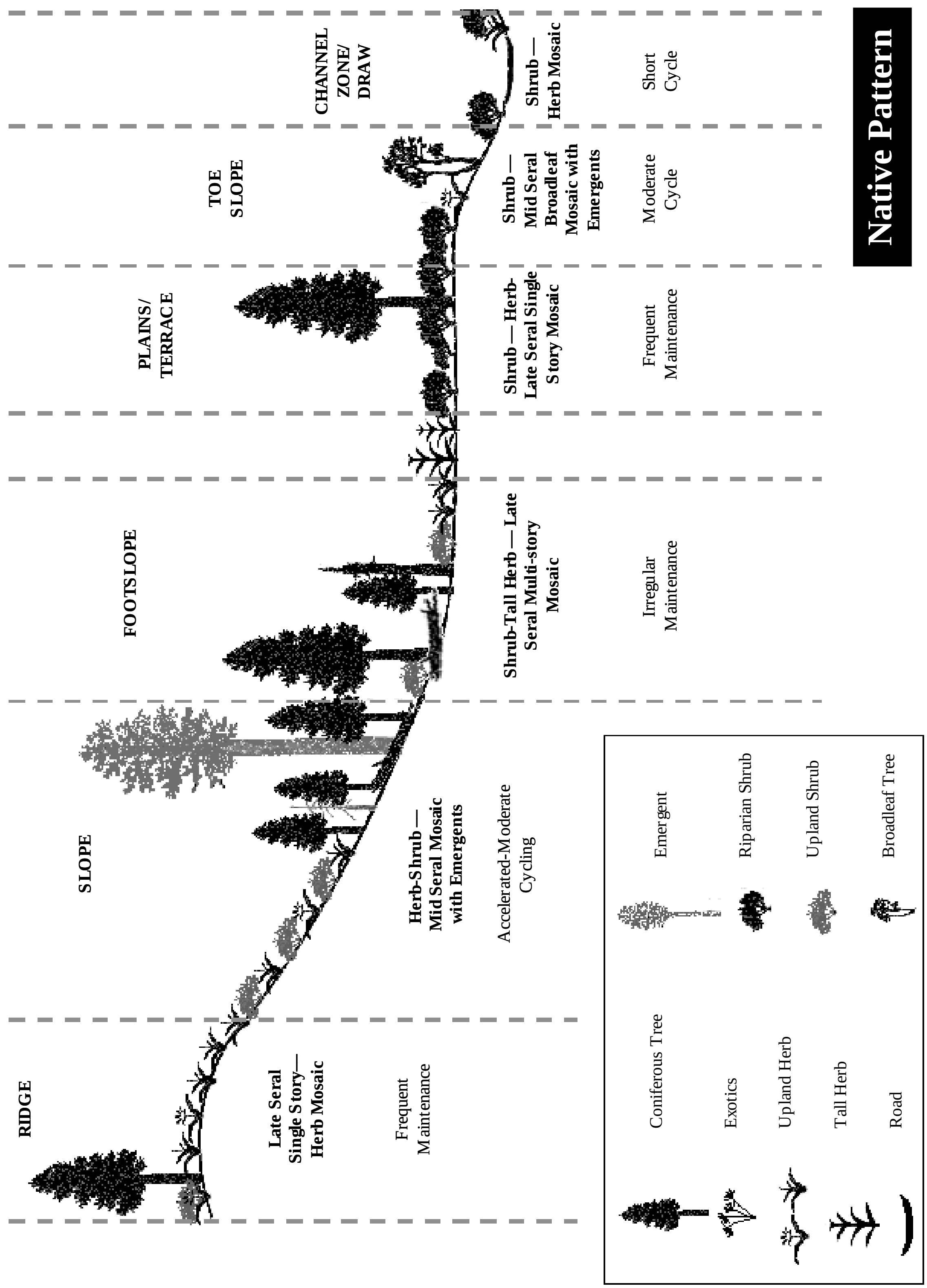


Figure 2-12. Rangeland Landscape Patterns—Succession/Disturbance Regime Patterns on the Landscape.

Forest Health - A Definition

'Forest health' is defined as the condition in which forest ecosystems sustain sufficient complexity, diversity, resiliency, and productivity to provide for specified human needs and values. It is a useful way to communicate about the current condition of the forest, especially with regard to resiliency, a part of forest health which describes the ability of the ecosystem to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages. Forest health and resiliency can be described, in part, by species composition, density, and structure.

Forests are constantly changing through a combination of disturbances, such as fire, climate, insects, disease, timber harvest, and grazing. Change determines the plant and animal species that will exist in forested areas, and governs future products, recreational opportunities, habitats, and other resources provided by forests.

these forests were generally maintained over the long term. The most drastic changes have occurred in these areas.

Traditional commodity management typically removed large trees from ridges and terraces and moved the forest from late seral to mid or early seral stages of development. The disturbance regime also took a major shift from nonlethal with a return interval of 100 to 300 years or more to lethal with a return interval of 10 to 50 years. In areas with traditional reserve management landscape patterns, the open late seral single story forests changed to relatively dense late seral multi-story forests with or without large trees, depending on the intensity of insects, disease, or drought stress.

Historically on slopes, especially ***steep slopes***, could be found mid seral forest mosaics that included some late seral and some early seral patches. A common stand characteristic was emergent trees, or remnants from previous stands. The predominant disturbance regime included a mixture of nonlethal and lethal fires and other disturbances. The nonlethal fire return interval ranged from 5 to 50 years. On these slopes, wildfire could carry into the crowns and become a lethal fire every 30 to 300 years. The wildfire scenario varied by location on the landscape, aspect, and potential vegetation group.

On the slopes, traditional forestry and fire management has resulted in the loss of large shade-intolerant emergent trees and fostered the development of dense mid seral forests. Traditional reserve management has resulted in very similar species composition and structure to that of traditional forestry and fire management. The main difference is that reserve areas may maintain emergent trees until the first cycle of disturbance. The lethal disturbance regime that has evolved interjects wildfire, insects, or disease into the forest every 10 to 50 years, causing a high risk for lethal crown fires. Without human intervention, periods of regeneration tend to be very long because of a lack of seed source.

Historically, late seral multi-story forests lived on the ***footslopes***, maintained by nonlethal fires at intervals of 25 to 50 years. This fire return interval was longer than on the ridges and terraces and allowed more layers in the canopy and more shade-tolerant species to survive. Before Euroamerican settlement, footslopes often supported large trees and large timber volumes.

In traditional commodity management, the footslopes gave good accessibility to large volumes of timber and lent themselves to road building. The traditional commodity regime removed the overstory, exposing trees to frost, high water tables, and sunlight, and changing the disturbance regime to a lethal one with return intervals generally greater than 300 years with high severity. Traditional reserve management also changed the disturbance regime to a lethal one, but the return interval is 10 to 50 years and the severity is low.

Toeslopes refers to areas where upland vegetation meets riparian vegetation. Typically, on the toeslopes would be found some combination of mid seral broadleaf trees (cottonwood, aspen) and tall shrub mosaics with some scattered emergent conifers. This condition was probably recycled by a lethal fire every 5 to 100 years. The ***channel zone/draw*** supports a shrub–herb mosaic that includes the stream channel. The annual high water was the major disturbance on these parts of the landscape.

Both traditional commodity and reserve management scenarios have led the toeslopes and the channel zone / draw to more mid seral and late seral stages with multi-story structure and a heavier build-up of fuel. The traditional commodity scenario has in many cases also caused a lowering of the water table. Under both commodity and reserve management, the toeslope and channel zone / draw disturbance regime has changed to lethal, and highly severe in nature. The return interval for traditional commodity is in the range of 100 to 300 years, while under the traditional reserve the disturbance return rate is a shorter 10 to 50 years. In the channel zone / draw under both scenarios, the disturbance regime is lethal and the return interval is a highly variable 5 to 100 years with moderate severity.

Rangelands

As in forestland potential vegetation groups, areas in native ***basin and foothill terrain*** that were dominated by rangeland potential vegetation groups had consistent patterns of succession and disturbance which resulted in vegetation patterns on the landscape. This is referred to as the native system (see Figure 2-12). Over the past century, there have been two general strategies of land management: (1) traditional commodity production; and (2) traditional reserve management. As a general rule in rangeland commodity production, livestock has been grazed, fires have been suppressed, and exotic plants have been introduced. Even in areas of traditional reserve management, such as wilderness areas, there has been wildfire suppression and introduction of exotic plants. Both traditional commodity production and traditional reserve management have substantially changed the patterns of succession, disturbance, and vegetation. Like the native system, these patterns are generally predictable. (See Figures 3.12b and 3.12c in Hann, Jones, Karl, et al. [1997]).

The ***ridges, terraces and plains*** historically had a succession and disturbance regime that supported herb-dominated grassland, with a diversity of upland grasses, sedges, forbs, and scattered shrubs. Scattered large conifers such as ponderosa pine, Douglas-fir, or juniper were found on ridges or rocky outcrops. Intervals of disturbances vary between infrequent and lethal events (5 to 100 years) in colder or drier environments to more frequent (5 to 50 years) nonlethal regimes in warmer and moister environments. Traditional commodity management on ridges, terraces, and plains changed disturbance regime to mostly lethal with a 100- to 300-year interval and a high intensity. Consequently, the herb-dominated communities were replaced by conifer communities or dense decadent shrubs. Because of a lack of fine grass fuels, these sites burn only during very dry conditions. High livestock use during the growing season coupled with fire suppression has changed the disturbance from nonlethal to lethal, with a return interval of 10 to 50 years and a low severity. In turn, the overall density of large grasses has decreased and the dominance of smaller grasses has increased.

High livestock use during the growing season coupled with fire suppression has changed the disturbance from nonlethal to lethal, with a return interval of 10 to 50 years and a low severity.

Slope landforms usually support a lethal disturbance regime ranging from 5 to 100 years. The vegetation that resulted was a shifting mosaic of shrub and herb communities. Shrub-dominated communities were typically open and relatively young and vigorous, with a diversity of understory grasses. Herb-dominated patches contained grasses, sedges, and scattered shrubs as well. Shrub patches were commonly associated with rises or rocky areas that likely had nonlethal disturbances, while herb patches were associated with concave areas that had a higher probability of lethal fire.

The response of slope landforms to traditional commodity management followed one of several pathways depending on the presence of exotic plants:

1. If exotic species did not dominate a substantial portion of the site, the disturbance regime changed to 100- to 300-year, lethal, high severity regime.
2. If exotic herbs dominate the site, the disturbance regime likely has changed to a low severity lethal regime on a 10- to 50-year cycle. These sites are susceptible to soil erosion.
3. If the slope is dominated by exotic grasses, the disturbance regime has probably changed to a frequent (1- to 4-year) lethal regime with high severity.
4. On sloped sites lacking exotic species, the disturbance regime did not change much but became less severe because of a reduction in fine fuels. The dominance of shrubs has increased on these sites and conifers have encroached into areas with higher precipitation.

Footslope landforms had a nonlethal disturbance regime with a return interval of 5 to 50 years. Footslopes were typically dominated by herb communities with large grasses and forbs. Small patches of broadleaf trees were grouped around springs and seeps. High grazing pressure during the growing season has converted predominant disturbance regime on rangeland footslopes to a lethal one with a cycle of 10 to 50 years. The large grasses and forbs have been replaced by smaller species more characteristic of the rangeland slopes.

In the ***toeslopes***, flood or fire at 5- to 100-year cycles occurred with lethal intensity. In general, shrub–herb communities dominated sites with coarse textured soils, and shrub or mid seral broadleaf trees dominated sites with heavier soils. ***Channel zone/draw*** landforms have a 1- to 4-year lethal disturbance regime and support scattered shrubs and herbs. Great changes have taken place in the toeslopes and channel zone / draw landforms. The disturbance regime has been shortened to 10- to 50-year return intervals. The multiple layers of broadleaf trees or shrubs have been reduced to a single layer of broadleaf trees or shrubs with an herbaceous understory.

Forestlands/Rangelands

Areas in foothill and mountainous terrain with both forest and rangeland vegetation have inherently diverse community structure and vegetation patterns (see Figure 3.13a, in Hann, Jones, Karl, et al. 1997). In addition, this unique terrain is home to many complex relationships at the ecotones, or boundaries between adjacent communities. The traditional commodity management scenario—with its timber harvest, livestock management, introduction of exotic plants, wildfire suppression, and consequent introduction of white pine blister rust—substantially changed the succession / disturbance regimes as well as the associated vegetation patterns, composition, and structures (see Figure 3.12b, in Hann, Jones, Karl, et al. 1997). In general, the disturbances became less frequent and more intense, and the effects became more severe. Changes were more substantial in the forest / rangeland transition zone than either the forest or rangeland because their energy gradients were much steeper, their disturbance regimes were more dynamic, and species diversity was higher. The traditional reserve or semi-primitive management scenario in conjunction with fire exclusion, introduction of white pine blister rust, and introduction of exotic plants, also substantially changed the succession / disturbance regimes and the vegetation patterns, composition, and structures (see Figure 3.12c, in Hann, Jones, Karl, et al. 1997).

Typically, changes due to traditional commodity management result in longer intervals between disturbances and an increase in the area affected by those disturbances. Traditional reserve management similarly caused longer disturbance return intervals and more severe disturbances than the native pattern.

Project area mountains, forests, and streams support diverse plant and animal populations offer unparalleled recreational, cultural, and economic opportunities to people.

Alpine Potential Vegetation Group

Alpine Potential Vegetation Types (PVTs):
Alpine shrub-herbaceous

Background

Most (83 percent) of the alpine potential vegetation group is located on BLM- or Forest Service-administered lands. For the project area as a whole, the alpine PVG covered a very small portion (less than 0.5 percent) historically, and did not change substantially in geographic extent between historical and current.

Table 2-7 lists the composition and structure of vegetation within the alpine potential vegetation group.

Current Conditions and Trends

At the broad scale, fire frequency and severity in alpine vegetation did not change from historical to current. Thus, broad-scale vegetation and disturbance patterns did not provide much evidence for changes in condition of alpine vegetation between historical and current. However, based on finer-scale information, changes in alpine soils and plants (for example, excessive erosion and removal of alpine vegetation) have been attributed to excessive grazing pressure by domestic sheep (Hann, Jones, Karl, et al. 1997).

Cold Forest Potential Vegetation Group

Cold Forest Potential Vegetation Types (PVTs):
Mountain hemlock-Inland
Spruce-fir, dry with aspen
Spruce-fir, dry without aspen
Spruce-fir, (whitebark pine greater than lodgepole pine)
Spruce-fir, (lodgepole pine greater than whitebark pine)
Whitebark pine/subalpine larch-North
Whitebark pine/subalpine larch-South
Mountain hemlock - East Cascades
Mountain hemlock/Shasta red fir
Alpine Shrub - Herbaceous

Background

The cold forest potential vegetation group is a major vegetation component at higher elevations, but it occurs on only about 10 percent of the ICBEMP project area. The Forest Service or BLM administers 87 percent of the cold forest PVG. The cold forest PVG is primarily distributed in the Upper Clark and Central Idaho Mountains ERUs in central Idaho and southwest Montana, and in the Northern Cascades in Washington.

Subalpine sites that support cold forests are more difficult for tree establishment and growth, and they define the upper limits of tree survival on mountains.

Table 2-7. Composition and Structure of Vegetation, with Associated Terrestrial Families, Alpine Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Families
Alpine	Alpine Tundra	Closed Low Shrub	3, 5
		Open Low Shrub	3, 5

Source: Appendices 3A, 3B, 3F; Hann, Jones, Karl, et al. 1997, Wisdom, et al. (in press).

Changes in cold forest vegetation composition and structure have resulted in a 95 percent loss of whitebark pine/alpine larch, and in changes in fire type and frequency.

Cold forests are generally limited by a short growing season and on some sites by low available moisture as well. Rates of tree growth are generally slow in comparison to moist forests. Nutrients are often limited, and loss of volcanic ash soil, litter, surface soil, or tree foliage from the site can greatly reduce productivity. Maintenance of dead and downed wood on these sites is important for nutrient cycling (Hann, Jones, Karl, et al. 1997).

Tree regeneration in the cold forest PVG is generally slow; mortality from stress, insects, and disease generally thins the stands and accelerates growth of the surviving trees. Whitebark pine may be codominant with subalpine fir in stands at the upper limits of tree growth. Whitebark pine forests exist in harsh areas with high winds; they can withstand severe ice and snow damage which create open or clumped stands (Johnson et al. 1994). Other vegetation of the cold forest PVG includes shrubs and grasses, many of which are perennial species that can survive years in which flowering and fruiting cycles are disrupted by the early arrival of killing frosts. Cold forests extend into moist forests along stream courses, cold air pockets, or other cold sites (Hann, Jones, Karl, et al. 1997). For a complete discussion on the composition, structure, and historical response of the cold forest PVG, please refer to Hann, Jones, Karl, et al. (1997).

Maps 2-5 and 2-6, earlier in this chapter, show the historical and current distributions of the cold forest potential vegetation group.

Current Conditions and Trends

Composition and Structure

Cold forests have longer fire intervals and fewer human-caused disturbances than dry or moist forests, so changes in forest structure and composition are not as noticeable in the cold forest as in the other forest PVGs. The cold climate and short growing season in cold forests also slow the natural rate of change in vegetation when compared to dry or moist forests. However, some changes from historical conditions have occurred. The cold forest PVG has generally shifted from a dominance by shade-intolerant species to a predominance of shade-tolerant species or a mixture of shade-tolerant and intolerant species. Changes in vegetation composition and structure have resulted in an approximately 95 percent loss of whitebark pine / alpine larch, and in changes in fire type and frequency (Table 2-8). Where whitebark pine and alpine larch have declined, they have been replaced by Engelmann spruce and subalpine fir. In particular, loss of whitebark pine and alpine larch and overstocking of forests have become forest health concerns in the past ten years. Future cold forests will not provide the diversity of habitats as they did in the past (Hann, Jones, Karl, et al. 1997).

The largest structural change in the cold forest PVG is the nearly 30 percent increase in the extent of early seral forests, most of which are now dominated by shade-tolerant species (Hann, Jones, Karl, et al. 1997). Some of this increase has come from a decline in the old forest multi-story structure and some has come from a decline in the extent of mid seral forests. Since the historical period, the amount of early seral shade-tolerant forests has nearly doubled.

Fire Regime

Cold forests have experienced higher amounts of lethal fires in the past ten years than they did under historical conditions, partly because of the spread of fires from other forest types during drought periods. Additionally, changes in landscape structure and composition have typically resulted in higher surface fuel loads and greater crowning potential over larger areas. The predominant fire regime is now lethal stand-replacing fires (about 59 percent in the Upper Basin portion of the project area and 44 percent in the Eastside portion), most of which burn at very infrequent intervals of 150 to 300 years. About 50 percent of fires are mixed severity, and nonlethal underburns have essentially been eliminated from the present fire regime. (See Maps 2-7 through 2-10 earlier in this chapter, and Table 2-8)

Insects and Disease

White pine blister rust is an introduced disease that has had a devastating impact on whitebark pine in the cold forest PVG, killing many trees and reducing the vigor in others. It has changed successional pathways, cover types, and / or structures of whitebark pine forests. This has seriously affected native successional potentials in at least 50 percent of the

Table 2-8. Changes in Fire Regimes, Cold Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service- and BLM-Administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, frequent (26–75 years)	8.8	0.0
Nonlethal underburns, infrequent (76–150 years)	1.3	0.0
Total nonlethal underburns	**10.1**	**0.0**
Mixed severity, very frequent (<25 years)	0.0	0.0
Mixed severity, frequent (26–75 years)	3.9	0.0
Mixed severity, infrequent (76–150 years)	67.0	43.2
Mixed severity, very infrequent (151–300 years)	5.1	0.0
Total mixed severity	**76.0**	**43.2**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	4.5	0.0
Lethal, stand-replacing, infrequent (76–150 years)	1.6	13.3
Lethal, stand-replacing, very infrequent (151-300 years)	7.9	43.6
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**14.0**	**56.9**

Source: ICBEMP GIS Data (1KM^2 raster data)

cold forest PVG, where whitebark pine was a dominant or common residual large tree structure (Hann, Jones, Karl, et al. 1997).

Mountain pine beetle is an important pest of lodgepole pine. Historically, when the density of lodgepole pine forests reached such a level that inner tree competition limited tree vigor, mountain pine beetles attacked and killed large numbers of trees which provided fuel for a stand-replacing fire. The fire prepared the mineral soil seedbed necessary for regeneration of the lodgepole pine forest and allowed the release of seed from serotinous cones stored on the tree. The cycle was repeated over and over.

Today outbreaks of mountain pine beetle infest larger areas, for longer periods, and often with greater intensity than occurred historically. Consequently, the patch sizes of the wildfires that sometimes follow are much larger than they typically were historically. Increasing size of susceptible stands of trees have also contributed to higher levels of other insects and diseases (Hann, Jones, Karl, et al. 1997).

Human Disturbance

Some of the old multi-story forest has been harvested in the cold forest potential vegetation group. Although the extent of old single story forest has not changed much, its composition has changed with the loss of whitebark pine due to blister rust. Young forests have increased, generally as a result of harvesting old multi-story forests. These harvested areas generally do not have the number of snags that occurred historically, which limits habitat for birds, mammals, and insects that need dead trees (Hann, Jones, Karl, et al. 1997).

Historically, shade-intolerant species dominated regeneration and young forest environments. This relationship has been altered, resulting in landscapes that now have mixed dominance or are dominated by shade-tolerant species, such as extensive areas where conifers have replaced or are replacing aspen. This is especially true where timber harvest and fire exclusion have favored the establishment of shade-tolerant species. As a result, much of the area where investments have been made (roads, harvest, planting, thinning, etc.) is highly susceptible to tree mortality from fire, insects, disease, and stress (Hann, Jones, Karl, et al. 1997).

Terrestrial Communities

Eight terrestrial communities can be found in the cold forest PVG. The communities and their status are shown in Table 2-9.

Table 2-9. Terrestrial Communities and Status, Cold Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral montane forest	Stayed constant
Early seral subalpine forest	Increased substantially
Late seral montane single story forest	Declined substantially
Late seral montane multi-story forest	Stayed constant
Late seral subalpine multi-story forest	Declined substantially
Late seral subalpine single story forest	Increased substantially
Mid seral montane forest	Decreased somewhat
Mid seral subalpine forest	Stayed constant

Definition of status:
Declined substantially - current is less than 80% of historical extent.
Decreased somewhat - current is 80-95% of historical extent.
Increased substantially - current is more than 120% of historical extent.
Stayed constant - current is 95-105% of historical extent.

Source: Hemstrom, et al. 1999

Source Habitats: Cover Type-Structural Stages

Seven of the eight Terrestrial Families that use forest habitats (Families 2, 3, 4, 5, 6, 7, and 8), use cover type / structural stage combinations that can be found in the cold forest PVG (Table 2-10). Most of the Families are generalists. They use a variety of habitats from early to late seral, and several different cover types.

The cold forest PVG contains 52 different cover type–structural stage combinations. The dominant species found in the cold forest PVG are: whitebark pine, Engelmann spruce / subalpine fir, interior Douglas-fir, lodgepole pine, and the shrub / herb regeneration. These cover types can be matched with some or all of eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand initiation (Table 2-10).

Some of the cover type–structural stage combinations have expanded in extent since historical times and others have shown a reduction in area. In general, the vegetation is not as different from that historically in the cold forest PVG as in the other forest PVGs. Only three cover type–structural stage combinations from the cold forest have declined substantially in geographic extent from the historical to current period throughout their range: *lodgepole pine* unmanaged young multi-story structure (especially in ERUs 1, 2, 3, 7, 9, and 12) has declined a moderate amount; the *lodgepole pine* stem exclusion closed canopy (especially in ERUs 2, 3, 6, 7, 12, and 13) and the *whitebark pine* unmanaged young multi-story (especially in ERUs 1, 12, and 13) have declined to a lesser extent. The cover type / structural stage combinations within the cold forest PVG that have *increased* the most are *interior Douglas-fir* managed young multi-story; *Engelmann spruce* stem exclusion closed canopy, and stand-initiation; *lodgepole pine* stand-initiation; and *shrub/herb regeneration* open low-medium shrub and closed low-medium shrub.

Since the two cover type–structural stage combinations used by Terrestrial Family 4 (early seral forest family) in the cold forest have increased substantially, it can be inferred that Terrestrial Family 4 should do very well in the cold forest. However, Family 4 uses more of the cover type–structural stage combinations in the dry and moist forest PVGs. For Terrestrial Family 8 (rangeland, early and late seral forest), since the only cover type–structural stage combination used by Family 8 in the cold forest PVG declined somewhat, it could be inferred that the species in Family 8 are not flourishing in the cold forest. For the other five Terrestrial Families that reside in the cold forest, it is more difficult to draw conclusions, because most of these families use many of the cold forest cover type–structural stage combinations, some of which have increased and some of which have decreased.

Table 2-10. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Cold Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Aspen	Stem exclusion closed	Riparian woodland	3, 5, 7
	Stand initiation	Riparian woodland	2, 3, 4, 5, 6, 7, 8
	Understory reinitiation[1]	Riparian woodland	2, 3, 5, 6, 7
Engelmann spruce/ subalpine fir	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 4, 5, 6, 7
Grand fir/White fir	Old forest multi-story	Late seral montane multi	2,3,5,6,7
	Stem exclusion closed	Mid seral montane	3, 5, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
Interior Douglas-fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi-story	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7, 8
Lodgepole pine	Old forest single story[1]	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi-story	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	2, 3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 7
Mountain Hemlock	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 5, 6, 7
Red fir	Old forest multi-story	Late seral montane multi	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation	Early seral montane	2, 3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
Shrub/herb/tree regeneration	Open tall shrub	Early seral montane	3, 5
	Closed low-med shrub	Early seral montane	2, 3, 5
Western larch	Old forest multi-story[1]	Late seral montane multi	1, 2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 6, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 6, 7, 8
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7

Table 2-10. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Cold Forest Potential Vegetation Group. (continued)

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Whitebark pine	Old forest single story	Late seral subalpine single	2, 3, 5, 7
	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation[1]	Mid seral subalpine	2, 3, 5, 7
	Stem exclusion closed[1]	Mid seral subalpine	3, 5, 7
	Stand initiation[1]	Early seral subalpine	3, 5, 7
Whitebark pine/alpine larch	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation[1]	Mid seral subalpine	2, 3, 5, 7
	Stem exclusion open[1]	Mid seral subalpine	5, 7
	Stand initiation[1]	Early seral subalpine	3, 5, 7
Western white pine	Old forest multi-story[1]	Late seral montane multi	2,3,5,6,7
	Stem exclusion closed[1]	Mid seral montane	3,5,7
	Stand initiation[1]	Early seral montane	2,3,5,6,7,8
	Understory reinitiation[1]	Mid seral montane	2,3,5,6,7
	Unmanaged young	Mid seral montane	2,3,5,6,7
	Managed young	Mid seral montane	3,5,7

[1] These cover type/structural stages have declined substantially from the historical to current period.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

Moist Forest PVG

Moist Forest Potential Vegetation Types (PVTs):

- Cedar/hemlock-Inland
- Moist Douglas-fir
- Grand fir/white fir-Inland
- Spruce-fir, wet
- Cedar/hemlock- East Cascades
- Grand fir/white fir - East Cascades
- Pacific silver fir

Background

The moist forest potential vegetation group includes transitional areas between drier, lower elevation forest or woodland types in dry forests, and higher elevation subalpine forest types in cold forests (Agee 1993). Approximately 40 percent of the moist forest potential vegetation group in the project area occurs at elevations less than 4,000 feet (1,220 meters) the other 60 percent occurs above 4,000 feet. Moist forests cover approximately 18 percent of the project area; 64 percent of that is administered by either the Forest Service or BLM (Hann, Jones, Karl, et al. 1997). The moist forest PVG is primarily distributed in the Northern Cascades, Southern Cascades, Northern Glaciated Mountains, Lower Clark Fork, and the northern part of the Central Idaho Mountains ERUs.

Moist forests typically have relatively high soil moisture in the spring and early summer, followed by drought stress in the late summer and early fall. Available nutrients in the soil can limit productivity, particularly on sites where decomposition of dead wood and litter is slow and where harvest practices have caused soil loss or have removed a large proportion of wood, litter, duff, and small branches that contain the bulk of site nutrients. However, tree growth rates are generally rapid and these sites tend to be the most productive in the project area. Young forests develop relatively quickly into mid seral structures. The moist forest PVG has a productive environment which rapidly produces biomass and accumulates fuels. Insects and pathogens that attack trees are potentially very active in the moist forest environment.

As in the cold forest and dry forest PVGs, quaking aspen can be found in the moist forest PVG. Other vegetation in moist forest is highly diverse. Many of the shrub and herbaceous understories have evolved under more limited light and longer fire frequencies than in dry forest. Shrub species include: Oregon boxwood, big huckleberry, oceanspray, baldhip rose, streambank gooseberry, prince's pine, and American twinflower. Herbaceous plants are characterized by shade-tolerant species including: queencup beadlily, mountain lady's slipper orchid, heart-leaved arnica, wild ginger, sword fern, white trillium, and pioneer violet. Grasses include: pinegrass, Columbia brome, and tufted hairgrass. One sedge species, Ross' sedge, appears to be widely distributed across the project area in the moist forest PVG. For a complete discussion on the composition, structure, and historical response of the moist forest PVG, refer to Hann, Jones, Karl, et al. (1997) and Everett et al. (1994).

Maps 2-5 and 2-6, earlier in this chapter, show the historical and current distributions of the moist forest potential vegetation group.

Current Conditions and Trends

Composition and Structure

Changes to the structure and composition of vegetation since historical times is prevalent within moist forests. In general, these forest structure and composition changes are not as obvious in moist forests as the dry forest but more substantial than in the cold forest. Major changes to the moist forest potential vegetation group include: the network of roads and timber harvest units across the landscape; increased stand density in forests; increased dominance of young stands of even-aged shade-tolerant species such as grand fir, Douglas-fir, or white fir species; rapid decline in western white pine; reductions in early seral and old stands; and increases in young mid seral stands. These changes have decreased productivity and landscape diversity, increased the probability of severe or uncharacteristic disturbance events such as flood or fire, decreased habitat diversity, and unbalanced many of the natural processes and cycles.

Mid seral shade-tolerant forest has almost tripled in extent in the moist forest potential vegetation group since the historical period.

The late seral single story stage of these shade-intolerant species has decreased 90 percent from historical amounts, while the shade-tolerant species in the late seral single story stage have doubled from historical amounts. The late seral multi-story stage of these shade-intolerant species has decreased 78 percent from historical amounts, while the shade-tolerant species in the late seral multi-story stage have not changed from historical amounts. The early seral forest stage of shade-intolerant species is about half as extensive as it once was, while the early seral forest stage of shade-tolerant species has increased slightly. The highest increase was in the mid seral shade-tolerant forest, which almost tripled in extent since the historical period.

Moist forest landscapes are now dominated by shade-tolerant species or a mixture of shade-tolerant and intolerant species, particularly in areas that have been harvested and where fire suppression has been successful. These harvests have not generally left the snag structure that existed historically. Fire suppression has been most successful in roaded areas, which has substantially changed seral stage composition and community composition and structure.

Fire Regime

The most important change in the fire regime in moist forest has been the shift to 74 percent lethal stand-replacing fires in the Upper Basin portion of the project area (Idaho and western Montana) and 55 percent in the Eastside portion (eastern Oregon and eastern Washington; see Maps 2-7 through 2-10, earlier in this chapter, and Table 2-11). The effective exclusion of almost all nonlethal underburns (currently 3 and 17 percent respectively) and a reduction of mixed severity fires (currently 23 and 26 percent, respectively) has resulted in the development of dense multi-storied stands with high potential for stand-replacing fires. These highly productive forests have increased amounts of carbon and nutrients stored in woody material, resulting in fires that are of higher intensity and severity. Even where fires do not crown, dominant trees can be killed by consumption of large diameter surface fuels and duff layers. Potential for high amounts of soil heating and death of tree roots and other understory plants is much higher than it was historically.

Insects and Disease

Susceptibility to large-scale damage by insect infestations and diseases has increased in many moist forests, contributing to forest health problems. Tree

Table 2-11. Changes in Fire Regimes, Moist Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service- and BLM-Administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, very frequent (<25 years)	10.9	0.0
Nonlethal underburns, frequent (26–75 years)	3.7	0.0
Nonlethal underburns, infrequent (76–150 years)	4.0	5.0
Total nonlethal underburns	**18.6**	**5.0**
Mixed severity, very frequent (<25 years)	3.5	0.0
Mixed severity, frequent (26–75 years)	24.0	1.9
Mixed severity, infrequent (76–150 years)	20.3	21.7
Mixed severity, very infrequent (151–300 years)	7.3	0.0
Total mixed severity	**55.1**	**23.6**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	2.3	5.4
Lethal, stand-replacing, infrequent (76–150 years)	10.1	37.3
Lethal, stand-replacing, very infrequent (151–300 years)	13.8	28.6
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**26.2**	**71.3**

Source: ICBEMP GIS Data (1KM^2 raster data)

density has increased and vigor has decreased in moist Douglas-fir and grand fir forests, making them more susceptible to insect and disease damage. Timber harvest and mortality from fir engraver beetles in productive grand and white fir patches, has contributed to the sharp decline of this type in the Blue Mountains. Areas susceptible to western larch dwarf mistletoe decreased because the western larch cover type in the Northern Glaciated Mountains also decreased (Hann, Jones, Karl, et al. 1997).

An additional forest health concern is that, with few exceptions, areas susceptible to Armillaria root disease, laminated root rot, and S-group annosum root disease increased across the project area. Areas susceptible to Armillaria root disease increased in the Central Idaho Mountains, Lower Clark Fork, Northern Glaciated Mountains, Columbia Plateau, and Southern Cascades ERUs. Areas susceptible to S-group annosum root disease increased in the Central Idaho Mountains, Northern Glaciated Mountains, Columbia Plateau, and Northern Cascades ERUs.

White pine blister rust is the primary introduced disease that has changed successional pathways, cover types, and / or structures of western white pine in the moist forest. This has seriously affected native successional potentials in at least 50 percent of the moist forest PVG where western white pine was a dominant or common residual large tree structure.

Human Disturbance

Clearcuts or partial cuts where western larch, western white pine, and ponderosa pine were harvested have changed stand structure and composition. The resulting stands have few of the large dead or live trees that historically could have remained on most sites, even after intense fire events. With the selective removal of shade-intolerant species, seeds to grow new trees mainly came from shade-tolerant trees, trees with poor form / growth, or off-site sources. Seed from poorly formed or undesired trees may pass on characteristics that will not provide the wood quality or other tree values desired in the future.

Tree harvest and fire exclusion have compounded forest health concerns through their roles in the extensive loss of western white pine to blister rust, and unsuccessful regeneration (Hann, Jones, Karl, et al. 1997). Western white pine has been replaced by grand fir and white fir (now representing 28 percent of the area in moist forest), western larch (24 percent), and shrub / herb / tree regeneration (17 percent). Aspen and Sierra mixed conifer forest types have also declined. Habitat diversity for wildlife provided by these forest types has also decreased, as have scenic qualities, recreation values, and wood products provided by species in decline.

Moist Forest, Aerial View: Loss of old forest structures in the moist forest is evident in the fairly uniform size class of the crown as seen from the air.

Photo #10

Not available in PDF.

Photo by USFS.

Photo #11

Not available in PDF.

Photo by USFS.

Moist Forest, Surface View: Predominantly young forest structures characterize the current condition of the moist forest in the project area.

Large trees, early seral stands, and old single storied stands have decreased because of the practice of harvesting and planting. Mid seral and multi-storied forests have increased.

Terrestrial Communities

Eight terrestrial communities can be found in the moist forest PVG. The communities and their status are shown in Table 2-12.

Source Habitats: Cover Type–Structural Stages

The moist forest PVG can include any of 64 different cover type–structural stage combinations in the project area. The dominant species that are found in the moist forest include: Pacific silver fir / mountain hemlock, western redcedar / mountain hemlock, interior Douglas-fir, western larch, grand fir / white fir, Sierra Nevada mixed conifer, western white pine, shrub or herb / tree regeneration, Pacific ponderosa pine, and interior ponderosa pine. The cover types can be matched with eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand initiation (Table 2-13).

All eight Terrestrial Families that use forested cover type–structural stage combinations (Families 1 through 8) can be found in moist forest habitats. Although Terrestrial Family 1 (low elevation old forest family) uses cover type–structural stage combinations that are found in both dry forest and moist forest PVGs (such as ponderosa pine old forest single story), most of them are predominantly in the dry forest PVG. Therefore any ties between trends in Family 1 source habitats and trends in the moist forest PVG are weak at best.

The trends in old forest of the moist forest PVG should be a good reflection of the trends for Terrestrial Family 2 (all elevation old forest family) source habitat; 46 of the 86 cover type–structural stage combinations that make up the source habitat for Terrestrial Family 2 can be found in the moist forest. Only 16 of these cover type–structural stage combinations are found exclusively in the moist forest PVG, but the moist forest PVG spans the middle of forest ecological conditions in the project area and includes most of the Terrestrial Family 2 source habitats that have declined substantially in geographic extent from the historical to current period: *interior ponderosa pine* old forest single story (in all ERUs except 10, 11, and 12), old forest multi-story structure (especially in ERUs 1, 2, 3, 7, 8, 9, and 13), and stand-initiation (in all ERUs except 10, 11, and 12); *western larch* old forest multi-story structure (especially in ERUs 7 and 8), young multi-story structure (especially in ERUs 1 and 2), and stand-initiation (especially in ERUs 7 and 8); *western white pine* multi-story structure (especially in ERUs 7 and 8), understory reinitiation (especially in ERUs 7 and 8), and stand-initiation (especially in ERUs 7 and 8); and *interior Douglas-fir* stand initiation (especially in ERUs 2, 3, 8, 9, and 13).

Terrestrial Family 4 source habitat contains 11 cover type–structural stage combinations. Seven of those occur in the moist forest. The two cover type–

Table 2-12. Terrestrial Communities and Status, Moist Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral lower montane forest	Declined substantially
Early seral montane forest	Declined substantially
Late seral lower montane multi-story forest	Declined substantially
Late seral lower montane single story forest	Declined substantially
Late seral montane multi-story forest	Declined substantially
Late seral montane single story forest	Increased substantially
Mid seral lower montane forest	Increased somewhat
Mid seral montane forest	Increased substantially

Definition of status:
Declined substantially - Current is less than 80% of historical extent
Increased somewhat - Current is 105-120% of historical extent
Increased substantially - Current is more than 120% of historical extent

Source: Hemstrom, et al. 1999

Table 2-13. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Moist Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Engelmann spruce/Subalpine fir	Old forest multi[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 4, 5, 6, 7
Grand fir/ white fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 5, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7
Interior Douglas-fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7, 8
Interior ponderosa pine	Old forest single story[1]	Late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	Late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral lower montane	1, 2, 3, 5, 6, 7
	Managed young	Mid seral lower montane	1, 3, 5, 6, 7
	Understory reinitiation	Mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral lower montane	6, 7
	Stand initiation[1]	Early seral lower montane	2, 3, 4, 5, 6, 7, 8, 10
Lodgepole pine	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation[1]	early seral montane	2, 3, 4, 5, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	2, 3, 5, 7
Mountain hemlock	Old forest single story	late seral subalpine single	2, 3, 5, 6, 7
	Old forest multi[1]	late seral subalpine multi	2, 3, 5, 6, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	early seral subalpine	2, 3, 5, 6, 7
Pacific silver fir/mountain hemlock	Old forest multi	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation	Early seral montane	2, 3, 5, 6, 7
Shrub/ herb/ tree regeneration	Closed low-med shrub	Early seral montane	2, 3, 5
	Open low-med shrub	early seral montane	2, 3, 5

Table 2-13. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Moist Forest Potential Vegetation Group. (continued)

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Western red cedar/Western hemlock	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 5, 6, 7
	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
Western larch	Old forest single story[1]	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi[1]	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 6, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 6, 7, 8
Western white pine	Old forest single story	Late seral montane single	2, 3, 5, 6, 7, 8
	Old forest multi[1]	Late seral montane multi	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation[1]	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 7
	Stand initiation[1]	Early seral montane	2, 3, 5, 6, 7, 8
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7

[1] These cover type-structural stages have declined substantially from the historical to current period.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

structural stage combinations from the Terrestrial Family 4 source habitat that have declined the most in geographic extent from the historical to current periodare the *interior ponderosa pine* (in all ERUs except 10, 11, and 12) and *western larch* (especially in ERUs 7 and 8) stand-initiation stages. The *interior Douglas-fir* stand-initiation stage has also declined substantially in geographic extent from the historical to current period.

Conclusions about source habitats for the forest generalists and the forest / rangeland generalists families (Terrestrial Families 3, 5, 6, 7, and 8) are more favorable than for Terrestrial Families 1, 2, and 4. Other cover type–structural stage combinations that have declined substantially in geographic extent from the historical to current period which are not included in the source habitats for Terrestrial Families 1, 2, and 4 are few: *interior ponderosa pine* (in all ERUs except 10, 11, and 12) and *western white pine* (especially in ERUs 7 and 8), in the stem exclusion closed canopy stage. In total, 14 of the 66 cover type–structural stage combinations found in the moist forest have declined substantially in geographic extent from the historical to current period.

In order for some of the cover type–structural stage combinations to have declined in extent in the moist forest, some of the cover type–structural stage combinations must have increased. The cover type / structural stage combinations that have expanded the most are: *interior Douglas-fir* managed young multi-story (all ERUs), old forest multi-story (especially in ERUs 1, 2, 3, and 6), old forest single story structure (especially in ERUs 2 and 3), and understory reinitiation (especially in ERUs 1, 7, 8, and 9); *grand fir/ white fir* stem exclusion closed canopy (especially in ERUs 7 and 8), old forest multi-story structure (especially in ERUs 1, 2, 3, 4, 6, and 13), managed young multi-story (especially in ERUs 2, 5, 6, 7, 8, and 13), and understory reinitiation (especially in ERUs 7, 8, and 13); *western larch* understory reinitiation (especially in ERUs 7 and 8); *interior ponderosa pine* managed young multi-story (especially in all ERUs except 10, 11, and 12), and unmanaged young multi-story (in ERU 6); *Pacific ponderosa pine* managed young multi-story (in ERUs 1, 2, and 3); and *shrub/ herb-regeneration* open low-medium shrub (in ERUs 7 and 8), and closed low-medium shrub (especially in ERUs 2, 3, 9, and 13).

Dry Forest PVG

Dry Forest Potential Vegetation Types (PVTs):

Dry Douglas-fir without ponderosa pine
Dry Douglas-fir with ponderosa pine
Dry grand fir/white fir
Interior ponderosa pine
Lodgepole pine - Oregon
Lodgepole pine -Yellowstone
Pacific ponderosa pine/Sierra mixed conifer

Background

The dry forest potential vegetation group (PVG) currently makes up 18 percent of the ICBEMP project area, with 69 percent of the PVG occurring above 4,000 feet (1,220 meters) in elevation. The Forest Service or BLM administer 56 percent of dry forests in the project area (Hann, Jones, Karl, et al. 1997). The dry forest PVG is primarily distributed in ERUs 2, 3, 6, 7, 9, and 13 in northeast Washington, northeast Oregon, south central Oregon, central Idaho and western Montana.

Shade-tolerant and Shade-intolerant Trees

Shade-intolerant trees—those that need full sunlight to regenerate, survive and grow— may dominate newly opened forested areas. They may continue to dominate if disturbance events remove enough of the existing trees to allow a new generation to reproduce and grow in the sunny, open areas. If such a disturbance does not open up the forest to sunlight, shade-intolerant trees mature, grow more dense, and create shade on the forest floor; the shade does not allow their own seedlings to become established but does allow other trees that don't need as much sunlight (shade-tolerant species), to germinate and grow. These new trees will continue to grow in the shade of the overstory. They will eventually dominate the forest unless they are removed by fire, wind, harvest, or another disturbance that maintains the shade-intolerant overstory or returns sunlight to the forest floor and allows shade-intolerant species to once again become established in open areas. In the project area, mid seral shade-tolerant forests have increased in area and become significantly more continuous in extent. This has affected disturbance processes such as fire, insects, and disease, and severely changed the availability of other habitats.

Common shade-tolerant trees include, but are not limited to:
- Douglas-fir (sometimes)
- Engelmann spruce
- Grand fir
- Subalpine fir
- Western hemlock
- Western redcedar
- White fir

Common shade intolerant species include, but are not limited to:
- Aspen
- Douglas-fir (sometimes)
- Interior ponderosa pine
- Lodgepole pine
- Pacific ponderosa pine (Eastside only)
- Western larch (sometimes on the Eastside)
- Western white pine
- Whitebark pine

Forest vegetation in dry forest PVGs generally is limited by low water availability and often is subject to drought. Dry forest areas can also be stressed by limited nutrients if surface soils are eroded or displaced, or if tree density is high. Quaking aspen is one of few non-coniferous trees associated with the dry forest PVG. Non-tree vegetation is diverse. On dry sites, shrubs are generally widely spaced in the understory beneath tree cover and are fire-adapted and medium to very shade-intolerant. Spaces between shrubs are generally occupied by fire-tolerant and shade-intolerant grasses and forbs. The dry forest PVG frequently borders on grasslands, which form alternating vegetative patterns interspersed with tree-dominated stands. Between grassland and tree-dominated patches, shrubs may be dense. For a complete discussion on the composition, structure, and historical response of the dry forest PVG, see Hann, Jones, Karl, et al. (1997).

The historical and current distributions of the dry forest potential vegetation group are shown on Maps 2-5 and 2-6, earlier in this chapter.

Current Conditions and Trends

Composition and Structure

Although the actual loss in extent of the dry forest potential vegetation group from historical amounts has been slight, the composition, structure, and disturbance patterns in dry forests have changed significantly. Human-caused disturbances have been more pronounced in the dry forest potential vegetation group than in the moist or cold forest groups.

In the Upper Basin portion of the project area there are currently 25 percent more young tree stands than there were historically. In the Eastside area, there are close to historical levels of young stands. Historically, these types of stands were created by wildfire and other kinds of disturbance. Often the forests were slow to regenerate (Wisdom et al. in press). Today these types of stands are most often created by harvesting and are missing the scattered large live and dead trees that would have been present if a fire had initiated the stand (Hann, Jones, Karl, et al. 1997). Averaged across the project area, ponderosa pine has been replaced by grand fir and white fir on 19 percent of its range, and by interior Douglas-fir on another 20 percent of its range. The old single story stage of ponderosa pine is at 25 percent or less than its historical amount. On the other hand, the old multi-story stage of Douglas-fir, grand fir, and white fir is approximately three times its historical amount, while the young forest structural stages of Douglas-fir, grand fir, and white fir are nearly double their historical amounts. Western larch stands have been replaced by Douglas-fir (16 percent), lodgepole pine (12 percent), and grand fir or white fir (10 percent).

Currently, 30 percent of stands within dry forests are dominated by shade-tolerant species, more than twice the amount that existed in the early 1800s (Hann, Jones, Karl, et al. 1997).

In some cases, dry forest conifers have encroached into rangeland types. For instance, there have been shifts of upland herbland to mid seral interior ponderosa pine and interior Douglas-fir, especially in the Upper Clark Fork and Upper Klamath ERUs. In other places in the dry forest PVG, upland shrubland has converted to mid seral forest—such as in the Snake Headwaters where the interior Douglas-fir type has increased at the expense of the mountain big sagebrush type.

The clumpy character of historical stands that was created by fire has changed. We now see larger stands with more uniformity within stands and more contrast between stands. Overall, stand structures have changed from open park-like stands of large trees with clumps of small trees, to dense overstocked young stands with several canopy layers (Caraher et al. 1992, Gast et al. 1991 in Lehmkuhl et al. 1994). Landscapes once dominated by shade-intolerant species are less than half their historical level.

Fire Regime

About 39 percent of acres in the Upper Basin portion of the project area and 45 percent of the Eastside portion currently have the potential to sustain nonlethal underburns, but they occur at frequencies greater than 76 years. Currently about 36 and 35 percent of the areas have a mixed severity regime, most ranging in occurrence between 76 to 150 years. Lethal stand-replacing fires in the dry forest occur on 25 and 17 percent of the areas, at rates three times greater than historical in the Upper Basin and 50 percent greater in the Eastside area. About 54 and 46 percent of the area that used to burn with nonlethal fires now has a mixed severity or lethal stand-replacing fire regime. (See Maps 2-7 through 2-10, earlier in this chapter, and Table 2-14.) The dense mid seral structures of the dry forest have high risks for crown fire and intense fire events. The current period fire interval doubled or tripled to approximately 40 to 80 years.

Table 2-14. Changes in Fire Regimes, Dry Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service-and BLM-administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, very frequent (<25 years)	60.1	0.1
Nonlethal underburns, frequent (26–75 years)	14.4	0.1
Nonlethal underburns, infrequent (76–150 years)	11.4	41.6
Total nonlethal underburns	**85.9**	**41.8**
Mixed severity, very frequent (<25 years)	0.0	0.0
Mixed severity, frequent (26–75 years)	1.0	5.5
Mixed severity, infrequent (76–150 years)	3.3	31.2
Mixed severity, very infrequent (151–300 years)	0.0	0.0
Total mixed severity	**4.3**	**36.7**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	7.8	0.1
Lethal, stand-replacing, infrequent (76–150 years)	2.0	21.3
Lethal, stand-replacing, very infrequent (151–300 years)	0.0	0.1
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**9.8**	**21.5**

Source: ICBEMP GIS Data (1 km^2 raster data)

Fuel moisture is greater in dense stands, particularly in small diameter fuels, because increased shading and reduced wind speed decrease the drying rate of forest fuels. Total available fuel has generally increased everywhere in dry forests. However, within dense stands, the rate of fuel increase is even greater because more dead woody material is available.

Fire exclusion effects have been highest in the most heavily roaded areas. Development of residential areas and other cultural facilities in project area forests has been most common in the dry forest PVG, which, coupled with the changed fire regime, has caused a greatly increased risk to life and property.

Insects and Disease

The insect and disease relationship as it relates to forest health in dry forests has changed as forest structure has changed. Insects and diseases always existed in forests, but the size and intensity of their attacks have increased in recent years (Caraher et al. 1992, Gast et al. 1991 in Lehmkuhl et al. 1994). With the exclusion of fire, stand densities are often much greater, and species composition has changed to dominance by trees such as Douglas-fir, grand fir, and white fir. Bark beetles currently often replace fire in eliminating trees growing in excess of site potential.

Susceptibility to the Douglas-fir beetle has increased in the Blue Mountains, Lower Clark Fork, and Snake Headwaters ERUs, and declined in the Southern Cascades compared to historical conditions. This was attributed to increased contagious spread of shade-tolerant Douglas-fir, increased abundance of host trees of adequate size for successful bark beetle breeding, increased patch densities and layering of canopies, and increased landscape contiguity of susceptible areas.

Susceptibility to fir engraver beetle increased in the Central Idaho Mountains and Upper Clark Fork ERUs and declined in the Blue Mountains. While grand fir and white fir have increased in area in the Blue Mountains, that increase is occurring in the understories of multi-storied patches. Timber harvest and fir engraver mortality of productive grand fir and white fir patches have contributed to the precipitous decline in that cover type in the Blue Mountains ERU.

Susceptibility to defoliators (needle-eating insects) such as western spruce budworm and Douglas-fir tussock moth has increased in several ERUs and declined in none. The increased susceptibility was attributed to increases in shade-tolerant Douglas-fir, grand fir, and white fir and the increased density and layering of canopies. These insects have been active in all ERUs in the project area, especially in the Southern Cascades and the Columbia Plateau ERUs.

In the Southern Cascades and the Snake Headwaters ERUs, lodgepole pine forests recently were hosts to mountain pine beetle attacks. Areas susceptible to spruce beetle declined significantly in the Blue Mountains. This is especially noteworthy because beetle outbreaks during the last decade reduced spruce stands in valley bottoms and on benches that were once common in the Blue Mountains.

The extent of forests infected with Douglas-fir dwarf mistletoe increased in the Blue Mountains and Snake Headwaters ERUs and declined in the Upper Clark Fork and Southern Cascades ERUs. Areas susceptible to ponderosa pine dwarf mistletoe decreased with the declining area in the ponderosa pine cover type in the Northern Cascades, Blue Mountains, and Northern Glaciated Mountains ERUs.

An additional forest health concern is that, with few exceptions, areas susceptible to Armillaria root disease, laminated root rot, and S-group annosum root disease increased across the project area. Areas susceptible to Armillaria root disease increased in the Central Idaho Mountains, Lower Clark Fork, Northern Glaciated Mountains, Columbia Plateau, and Southern Cascades ERUs. Areas susceptible to S-group annosum root disease increased in the Central Idaho Mountains, Northern Glaciated Mountains, Columbia Plateau, and Northern Cascades ERUs.

The increasing number of small dead trees in stands attacked by insects and diseases makes forests even more susceptible to large high-intensity fires.

The increasing number of small dead trees in stands attacked by insects and diseases makes forests even more susceptible to large high-intensity fires. The stands that are most susceptible to moisture stress, insects, and disease tend to be those at the lowest elevations, which typically border private, state, tribal, or other land ownerships. Homes, private, tribal, and state forest resources, wildlife winter ranges, and other important resources are increasingly at risk from fire and insect and disease attack from lands administered by the BLM and Forest Service (Everett et al. 1994).

Human Disturbance

In general, forests showing the most change are those that have been roaded and harvested. Large trees of high-value species, such as ponderosa pine, were selectively logged. True firs, Douglas-fir, and lodgepole pine were left in stands either because these species were not desirable on the timber market or because they were smaller trees and could not be processed efficiently. The remaining trees, which were not always the best genetic stock, provided seeds for the next generation of forest. These stands now exhibit changes in forest health including a loss of growth potential due to overstocking, greater risk of severe insect and disease problems, greater risk of high severity fires, and a loss of habitat diversity in the forested site when compared to historical conditions.

The dry forest PVG is particularly vulnerable to the introduction of exotic species (noxious weeds). Noxious weeds such as knapweed are rapidly displacing native species in some places. The results include changes in fire regimes, changes in succession pathways, loss of biodiversity, more exposed mineral soil and erosion potential, loss of habitat suitability for some terrestrial species, and lost productivity.

Terrestrial Communities

Eight terrestrial communities exist in the dry forest potential vegetation group. The terrestrial community groups and their status are shown in Table 2-15.

Source Habitats: Cover Type–Structural Stages

Of the eight Terrestrial Families that use forested cover type–structural stage combinations, all eight overlap with the dry forest potential vegetation group. However, Family 1 (the low elevation old forest species) is the one that can be identified most with the dry forest PVG, because 10 of the 15 cover type–structural stage combinations used by Family 1 come from the dry forest PVG. The remainder are from the riparian woodland PVG.

The dry forest PVG can include any of 50 different cover type–structural stage combinations in the project area. The dominant species that are found in the dry forest include: interior Douglas-fir, western larch, lodgepole pine, grand fir / white fir, shrub or herb / tree regeneration, Pacific ponderosa pine, interior ponderosa pine, and aspen. The cover types can be matched with eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand-initiation (Table 2-16).

Table 2-15. Terrestrial Communities and Status, Dry Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral lower montane forest	Declined substantially
Early seral montane forest	Increased substantially
Late seral lower montane single story forest	Declined substantially
Late seral lower montane multi-story forest	Stayed constant
Late seral montane single story forest	Stayed constant
Late seral montane multi-story forest	Increased substantially
Mid seral lower montane forest	Increased somewhat
Mid seral montane forest	Increased substantially

Definition of status: declined substantially = current is less than 80% of historical extent; stayed constant = current is 95-105% of historical extent; increased somewhat = current is 105-120% of historical extent; increased substantially = current is more than 120% of historical extent.

Source: Hemstrom, et al. 1999

Some of the 50 cover type–structural stage combinations have expanded in extent since historical times, while others have shown a reduction in area. For instance, the dry forest PVG has seen a substantial reduction in ponderosa pine old forest single story structure since historical times. In some places, these forests have changed to cover types and structural stages such as Douglas-fir stem exclusion closed canopy, which is a mid seral vegetation community. The amount and direction of vegetation change depend on its location and scale. For example, across the project area, ponderosa pine old forest multi-story has declined substantially, but within some subwatersheds, watersheds, subbasins, and even ERUs that is not the case; in the Upper Klamath ERU ponderosa pine old forest multi-story structure increased by 88 percent (Wisdom et al. in press).

The cover type–structural stage combinations that are found in the dry forest are presented in Table 2-16. Nine of these cover type-structural stage combinations have declined substantially in geographic extent throughout their range since the historical period. The declines have been led by the losses in *ponderosa pine* old forest single story, old forest multi-story, stem exclusion closed canopy, and stand initiation stages. This is followed by *western larch* old forest multi-story and unmanaged young multi-story structures, and *lodgepole pine* unmanaged young multi-story structure. To a lesser extent, the stand-initiation stages of *interior Douglas-fir* and *western larch* have also declined substantially in geographic extent from the historical to current period. The biggest declines have been in the ponderosa pine cover type and the old forest, especially single story structure.

The cover type–structural stage combinations that have **increased** the most are mid seral stages such as *grand fir/white fir* understory reinitiation, and *ponderosa pine* managed young multi-story; grand fir / white fir old forest multi-story; and young forest stages such as *lodgepole pine* stand-initiation and *shrub/herb regeneration* open low-medium shrub. Cover type–structural stage combinations that have shown somewhat lesser increases since historical times are *interior Douglas-fir* old forest single story and multi-story structure and understory reinitiation; *ponderosa pine* unmanaged young multi-story and understory reinitiation; *lodgepole pine* understory reinitiation; *grand fir/white fir* old forest single story structure; *western larch* understory reinitiation and young unmanaged multi-story; and *shrub/herb regeneration*. For the most part, shifts have been to more shade-tolerant species and to mid seral stages.

Since the geographic extent of several of the Terrestrial Family 1 (low elevation old forest species) cover type–structural stage combinations in the dry forest have declined, it can be expected that the species in Family 1 are not faring well in the dry forest. The decreases in the dry forest cover type–structural stage combinations for Terrestrial Families 4 and 8 would suggest that Families 4 and 8 might be struggling in the dry forest as well.

It is more difficult to draw conclusions about the trends for the other forestland Terrestrial Families, since some of their source habitats are larger and some are smaller, geographically. It may be that these terrestrial species have shifted their use from young and old forests to middle aged forests in the dry forest potential vegetation group.

Table 2-16. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Dry Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Exotic forbs/Annual grass	Closed herbland	exotic herbland	10
Fescue-bunchgrass	Open herbland[1]	upland herbland	5, 8, 10, 12
	Closed herbland[1]	upland herbland	5, 8, 10, 12
Grand fir/white fir	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 5, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	mid seral montane	3, 5, 7
	Stand initiation	early seral montane	2, 3, 4, 5, 6, 7
Interior Douglas-fir	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 5, 6, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	mid seral montane	3, 5, 6, 7
	Stand initiation	early seral montane	2, 3, 4, 5, 6, 7, 8
Interior ponderosa pine	Old forest single story[1]	late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral lower montane	1, 2, 3, 5, 6, 7
	Managed young	mid seral lower montane	1, 3, 5, 6, 7
	Understory reinitiation	mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion open	mid seral lower montane	2, 5, 6, 7
	Stem exclusion closed[1]	mid seral lower montane	6, 7
	Stand initiation[1]	early seral lower montane	2, 3, 4, 5, 6, 7, 8, 10
Lodgepole pine	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	2, 3, 5, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 7
	Stem exclusion closed	mid seral montane	3, 7
	Stand initiation[1]	early seral montane	2, 3, 4, 5, 7
Mountain big sagebrush	Closed low-med shrub	upland shrubland	5, 7, 10, 11
	Open low-med shrub[1]	upland shrubland	5, 7, 8, 10, 11, 12
Pacific ponderosa pine	Old forest single story	late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral lower montane	2, 3, 5, 6, 7
	Managed young	mid seral lower montane	3, 5, 7
	Understory reinitiation	mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	mid seral lower montane	7
	Stand initiation	early seral lower montane	2, 3, 5, 6, 7, 8
Shrub/herb/tree regeneration	Open low-medium shrub	early seral montane	2, 3, 5
	Closed low-med shrub	early seral montane	2, 3, 5
	Closed herbland	early seral montane	2, 3, 5
Sierra Nevada mixed-conifer	Old forest single story	late seral montane single	1, 2, 3, 5, 6, 7
	Old forest multi[1]	late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 7
	Understory reinitiation[1]	mid seral montane	2, 3, 5, 7
	Stem exclusion closed[1]	mid seral montane	7
	Stand initiation	early seral montane	2, 3, 5, 7, 8

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

Photo #12

Not available in PDF.

Photo by USFS.

Ponderosa pine forests historically were characterized as unbroken parklands of widely spaced tree clumps with a continuous understory of grasses and flowering plants.

Dry forests currently have ponderosa pine being replaced by Douglas-fir and grand fir/ white fir.

Photo #13

Not available in PDF.

Photo by Doug Basford.

Woodland PVG

Background

For the project area as a whole, the woodland PVG is relatively uncommon, making up about one percent of the area, both historically and currently. Roughly one-half of the woodland PVG is located on BLM- or Forest Service-administered lands (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the woodland PVG is most prevalent in the Columbia Plateau, Blue Mountains, Central Idaho Mountains, Owyhee Uplands, and Upper Snake ERUs (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6 earlier in this chapter).

The woodland PVG is typically located on edges of mesas, ridges, and knolls where fractured bedrock is near the surface and soil depths are shallow. These sites generally have low soil water availability due to the shallow soils. Consequently, herbaceous production is low. The restriction of woodlands to these sites has been attributed to fire exclusion (Burkhardt and Tisdale 1976, in Hann, Jones, Karl, et al. 1997). The woodland PVG is often located in the driest of the zones that would support conifer or broadleaved trees.

Table 2-17 shows the composition and structure of vegetation within the woodland potential vegetation group, and the associated Terrestrial Families.

Current Conditions and Trends

Currently the woodland PVG includes primarily upland woodlands and upland shrublands, with lesser amounts of early seral montane forest and exotic herblands. Representative tree species include western juniper, limber pine, mountain mahogany, and Oregon white oak, with representative shrub species including mountain big sagebrush and low sagebrush. Representative grass species include bluebunch wheatgrass, Sandberg bluegrass, and

Table 2-17. Cover Type–Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Woodland Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland woodland	Juniper woodlands	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
	Limber pine	Stand-initiation forest	2, 5, 6, 7
		Stem exclusion open canopy forest	2, 5, 6, 7
		Understory reinitiation forest	2, 5, 6, 7
		Old multi-story forest	2, 5, 6, 7
Upland shrubland	Mountain mahogany	Closed low shrub	5, 6, 7, 9, 10, 11
		Open mid shrub[1]	5, 6, 7, 8, 9, 10, 11
	Mountain big sagebrush	Closed low shrub	5, 7, 10, 11
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Early seral montane forest	Shrub or herb/Tree regeneration	Closed mid shrub	2, 3, 5
Exotic herbland	Exotic forbs/Annual grass	Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

bottlebrush squirreltail. Exotic herblands, commonly composed of such species as cheatgrass and medusahead, do not dominate the woodland PVG but could be found particularly on areas with disturbed soils and on areas subject to excessive livestock grazing pressure at some point in time.

Although there was no measurable change in geographic extent between historical and current for the woodland PVG, many of its constituent woodland cover types and structural stages encroached into other PVGs, such as the cool shrub and dry grass. In addition, within the woodland PVG itself, upland herblands transitioned into upland woodlands and / or upland shrublands (Table 3.30 in Hann, Jones, Karl, et al. 1997). The partial conversion of herbland to woodland and / or shrubland was the dominant change within the woodland PVG between historical and current. The decline in herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) in the woodland PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Fire-return intervals in the woodland PVG before Euroamerican settlement ranged from 5 to 150 years. Roughly 30 percent of fires then were lethal to the crowns of shrub and woodland species (that is, the upper vegetative layer). Between historical and current, fire regimes have shifted from roughly 30 percent to roughly 95 percent lethal. Fire-return intervals have lengthened to 75 to 150 years (see Maps 2-7 through 2-10 earlier in this chapter). The combination of lethal fires that occur less frequently means that fires in the woodland PVG have become more severe in their effects between historical and current.

Cool Shrub PVG

Background

Between historical and current, the geographic extent of the cool shrub PVG declined from nine percent to eight percent of the project area, representing an 11 percent decline. This decline in geographic extent of cool shrub PVG occurred primarily on non-BLM- or Forest Service-administered lands. Because of this, there was an increase in the proportion of the cool shrub PVG on BLM- and Forest Service-administered lands between historical and current, from slightly over one-half to two-thirds (57 to 66 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the cool shrub PVG is most prevalent in the Owyhee Uplands, Columbia Plateau, Blue Mountains, Central Idaho Mountains, and Upper Snake ERUs, (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6, earlier in this chapter).

The conversion of upland herbland and/or shrubland to upland woodland was the dominant change within the cool shrub potential vegetation group from historical to current periods.

Native plant communities of the cool shrub PVG tend to be diverse with many species of shrubs, grasses, forbs, and sedges. Representative shrub species include mountain big sagebrush, chokecherry, serviceberry, and rose species. Production of vegetation within the cool shrub PVG is limited by a short growing season and by low available water in the soil, attributable to either low rainfall or shallow, rocky, or clay soils. Soils of the cool shrub PVG generally indicate that they developed from a mixed shrub and grassland potential vegetation.

Table 2-18 shows the composition and structure of vegetation, and associated Terrestrial Families, within the cool shrub potential vegetation group.

Current Conditions and Trends

The conversion of upland herbland and / or upland shrubland to upland woodland was the dominant change within the cool shrub PVG between historical and current (Table 3.41 in Hann, Jones, Karl, et al. 1997). As mentioned in the woodland PVG section, many of the woodland cover types and structural stages within the woodland PVG encroached into the cool shrub PVG. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to woodlands in the cool shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and their constituent cover types (mountain big sagebrush and big sagebrush) to woodlands has contributed to the widespread decline observed in the project area for the mountain big sagebrush and big sagebrush cover types (Appendix 5). The greatest geographic extent of woodland encroachment into herblands and / or shrublands in the cool shrub PVG was attributable to

Table 2-18. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Cool Shrub Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland shrubland	Mountain big sagebrush	Closed mid shrub	5, 7, 10, 11
		Open mid shrub[1]	5, 7, 8, 10, 11, 12
	Big sagebrush	Closed mid shrub[1]	5, 7, 10, 11
		Open mid shrub[1]	5, 7, 8, 10, 11, 12
	Chokecherry/serviceberry/rose	Closed low shrub[1]	2, 3, 4, 5, 6, 11, 12
		Open low shrub	2, 3, 4, 5, 6, 8, 11, 12
		Open mid shrub	2, 3, 4, 5, 6, 8, 11, 12
		Open tall shrub	2, 3, 4, 5, 6, 11, 12
Upland woodland	Mixed-conifer woodlands	Stand-initiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
	Juniper/sagebrush	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
	Juniper woodlands	Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
		Closed herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Open herbland[1]	5, 8, 10, 12
		Closed herbland[1]	5, 8, 10, 12
Exotic herbland	Exotic forbs/Annual grass	Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

western juniper, a relatively small- to medium-statured native tree of the Pacific Northwest.

Since the late 1800s, and more specifically since the 1880s on Steens Mountain (Miller and Rose 1995) in the Northern Great Basin ERU (Southeast Oregon RAC), western juniper has increased in density and distribution. While western juniper at historical times was relegated to either relatively open, savannah-like woodlands, which were maintained by relatively frequent fires, or to rocky surfaces and ridges, western juniper from historical to current has expanded not only into mountain big sagebrush, but also into the dry shrub PVG (for example low sagebrush) and the riparian woodland PVG (for example, quaking aspen, and other riparian vegetative types).

As western juniper woodlands increase in density, understory vegetation production declines. Conversely, after reduction of western juniper density, site productivity of understory species typically increases. However, undesirable species, especially cheatgrass and noxious weeds such as medusahead, knapweed, and leafy spurge, increase after juniper removal if they were present before removal.

Healthy western juniper woodlands, with a full complement of understory non-vascular species (for example, species composing biological crusts), grasses, forbs, and shrubs, represent one of the most diverse plant communities in the project area. However, biodiversity is reduced on sites where western juniper has increased in density to the point that understory vegetation is excluded. Therefore, the expansion and increasing density of western juniper within native plant communities poses a threat to plant species in the understory and other species that depend on the habitat within those communities.

Western juniper expansion also has affected hydrologic processes. Western juniper intercepts rain and snow with its canopy, which results in less water reaching the soil surface, especially in low intensity storm events. On sites where western juniper has excluded understory vegetation, particularly in spaces between canopies, infiltration has probably declined and runoff and erosion have probably increased, especially under high intensity storm events. The hydrological effects of western juniper increase are difficult to separate from those resulting from excessive livestock grazing pressure, but where excessive livestock grazing pressure has contributed to the decline in understory vegetation it has probably contributed to increased runoff and erosion as well.

Fire frequency and severity in the cool shrub PVG has changed between historical and current (see Maps 2-7 through 2-10, earlier in this chapter), attributable greatly to the invasion and increasing density of woodlands, which itself has been caused at least partially by excessive livestock grazing pressure. The increasing density of woodland species can cause deep litter and duff layers beneath the tree canopies, which are flammable. However, particularly in woodlands with a high canopy cover, herbaceous fuel is lacking beneath and between canopies. The result is that these woodlands tend to burn less frequently, but when fire does occur, the effects are more severe.

Subdominant changes in the cool shrub PVG between historical and current, apparent regionally rather than project-area-wide, were the conversion of upland herbland to upland shrubland, and the conversion of upland herbland and upland shrubland to exotic herbland (that is, exotic undesirable plant species). Mountain big sagebrush was the primary contributor to the conversion of herbland to shrubland. Conversion of herbland to shrubland within the cool shrub PVG was most notable within the Central Idaho Mountains and Owyhee Uplands ERUs, corresponding to the Lower Snake RAC and Southeast Oregon RAC (Tables 3.59, 3.95 in Hann, Jones, Karl, et al. 1997; Map 2-1). Conversion of herbland and/or shrubland to exotic herbland was most notable within the Blue Mountains and Central Idaho Mountains ERUs, (Tables 3.51, 3.59 in Hann, Jones, Karl, et al. 1997; Map 2-1). Problematic exotic plants were cheatgrass, medusahead, whitetop, spotted knapweed, and leafy spurge. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to shrublands and exotic herblands in the cool shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and their constituent cover types (mountain big sagebrush and big sagebrush) to exotic herblands has contributed to the widespread decline observed in the project area for the mountain big sagebrush and big sagebrush cover types (Appendix 5).

Dry Grass PVG

Background

Between historical and current, the geographic extent of the dry grass PVG declined from 9 percent to 4 percent of the project area, representing a 56 percent decline. This decline in geographic extent of dry grass PVG occurred primarily on non-BLM- or Forest Service-administered lands. Because of this, there was an increase in the proportion of the dry grass PVG on BLM- and Forest Service-administered lands between historical and current, from only one-fifth to nearly one-half (20 to 44 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the dry grass PVG is most prevalent in the Blue Mountains, Central Idaho Mountains, Upper Clark Fork, Columbia Plateau, and Snake Headwaters ERUs (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6, earlier in this chapter).

The dry grass PVG includes primarily native grasslands, with lesser amounts of woodlands (dominated by conifers such as ponderosa pine and Douglas-fir), seeded grasslands (whether seeded with native grasses or desirable exotic grasses), and cropland-hay-pasture (whether grass such as wheat, or forb such as alfalfa). Native plant communities are diverse, with grasses being dominant, but numerous forbs and sedges are present. Representative grass species of the dry grass PVG include the native grasses bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, bottlebrush squirreltail, and Great Basin wildrye, as well as exotic grasses such as crested wheatgrass, intermediate wheatgrass, and Kentucky bluegrass. In the absence of fire, shrubs and trees eventually invade the dry grass PVG, particularly where the dry grass PVG is adjacent to the dry shrub, woodland, or dry forest PVGs.

Production of vegetation within the dry grass PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where the dry grass PVG is located. Summers are typically dry. Dry grass PVG vegetation has adapted to periodic drought. During a 100-year period from 1895 through 1994, the dry grass PVG has experienced more frequent drought periods (years in which less than 75 percent of fall–winter or winter–spring precipitation is received) than wet periods (two or more successive years of greater than 110 percent of fall–winter or winter–spring precipitation, believed to be critical for perennial plant recruitment).

Table 2-19 shows the composition and structure of vegetation within the dry grass potential vegetation group, and the associated Terrestrial Families.

Current Conditions and Trends

A dominant change within the dry grass potential vegetation group was the conversion of upland herbland to exotic herbland through the invasion and spread of exotic undesirable plants. Fires in the dry grass PVG have become more severe in their effects.

Regardless of whether the dry grass PVG was on BLM- or Forest Service-administered lands or not, a dominant change within the dry grass PVG between historical and current was the conversion of upland herbland to exotic herbland through the invasion and spread of exotic undesirable plants (including noxious weeds) (Table 3.39 in Hann, Jones, Karl, et al. 1997). Exotic undesirable plants were common within most cover types of the dry grass PVG. Although the most problematic exotic plants within the dry grass PVG varied regionally within the project area, some of the most notable include yellow starthistle, spotted knapweed, dalmatian toadflax, and cheatgrass. With the exception of the agricultural PVG, the dry grass PVG was the most susceptible to exotic plant invasion of all the PVGs in the project area. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to exotic herblands in the dry grass PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Another dominant change within the dry grass PVG between historical and current was a decline within the upland herblands in the dominance of native bunchgrasses, such as bluebunch wheatgrass and Idaho fescue. With the decline in dominance of these native bunchgrasses came an increase in dominance of smaller-statured bunchgrasses such as Sandberg bluegrass, an increase in exotic undesirable plants as already mentioned, and an increase in exotic seeded grasses (such as crested wheatgrass).

Fire-return intervals in the dry grass PVG before Euroamerican settlement ranged from 5 to 75 years. The majority of these fires were nonlethal, meaning that the herbaceous vegetation cycled back after the

Table 2-19. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Dry Grass Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
		Closed herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Open herbland[1]	5, 8, 10, 12
		Closed herbland[1]	5, 8, 10, 12
	Native forb	Open herbland	5, 8, 10, 12
		Closed herbland	5, 8, 10, 12
Upland woodland	Mixed-conifer woodlands	Stand-initiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Stem exclusion woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
Agricultural	Cropland/hay/pasture	Closed herbland	NA
Exotic herbland	Exotic forbs/annual grass	Open herbland	10
		Closed herbland	10

Abbreviations used in this table:
NA - none reported for this cover type-structural stage in Wisdom et al. (in press).

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

fire. Mixed-fire events, meaning fires that were a mixture of non-lethal and lethal (that is, burning the upper vegetative layer of shrubs and / or trees), occurred on roughly 10 percent of the dry grass PVG. Mixed-fire events typically occurred where shrub or woodland cover types existed within the dry grass PVG, or in herb-dominated areas that had high accumulations of litter and decadent plants. Fire-return intervals lengthened between historical and current, from 5 to 75 years to 25 to 75 years (see Maps 2-7 through 2-10, earlier in this chapter). In addition, more fires currently are of the mixed-regime compared with historical regimes, because of fire suppression. The combination of increased prevalence of lethal fires that occur less frequently means that fires in the dry grass PVG have become more severe in their effects between historical and current periods.

Dry Shrub PVG

Background

Between historical and current, the geographic extent of the dry shrub PVG declined from 30 percent to 21 percent of the project area, representing a 30 percent decline. This decline in geographic extent of dry shrub PVG occurred primarily on non-BLM- / Forest Service-administered lands. Because of this, there was an increase in the proportion of the dry shrub PVG on BLM- and Forest Service-administered lands between historical and current, from nearly one-half to two-thirds (46 to 65 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the dry shrub PVG is most prevalent in the Northern Great Basin, Owyhee Uplands, Upper Snake, Columbia Plateau, Blue Mountains, and Central Idaho Mountains ERUs (Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6 earlier in this chapter).

The dry shrub PVG includes primarily native shrublands, with lesser amounts of exotic herblands, seeded grasslands (whether seeded with native grasses or desirable exotic grasses), native grasslands, and woodlands. Native plant communities are diverse, with shrubs being dominant, but numerous grasses and forbs are present. Representative shrub species of the dry shrub PVG include Wyoming big sagebrush, Basin big sagebrush, low sagebrush, antelope bitterbrush, shadscale, winterfat, and greasewood. Representative grass species of the dry shrub PVG include the native grasses bluebunch wheatgrass, bottlebrush squirreltail, Thurber

Production of vegetation within the dry shrub PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where most of the dry shrub PVG is located.

needlegrass, and Sandberg bluegrass; and seeded exotic grasses such as crested wheatgrass and intermediate wheatgrass. The periodicity of fire maintained a shifting mosaic of herblands and shrublands within the dry shrub PVG. In the absence of fire, trees such as western juniper invaded the dry shrub PVG, particularly where the dry shrub PVG was adjacent to the woodland PVG or the dry forest PVG.

Production of vegetation within the dry shrub PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where most of the dry shrub PVG is located. Summers are typically dry. Dry shrub PVG vegetation has adapted to frequent drought. During a 100-year period from 1895 through 1994, dry shrub PVG areas have experienced more frequent drought periods (years in which less than 75 percent of fall-winter or winter-spring precipitation is received) than wet periods (two or more successive years of greater than 110 percent of fall–winter or winter–spring precipitation, believed to be critical for perennial plant recruitment). Compared with the dry grass PVG, the dry shrub PVG receives less annual rainfall, and experiences greater drought frequency and frequency of wet periods. Therefore, not only is the dry shrub PVG drier than the dry grass PVG, but the amount of rainfall it receives from year to year is more variable.

Table 2-20 shows the composition and structure of vegetation in the dry shrub potential vegetation group and the associated Terrestrial Families.

Current Conditions and Trends

Similar to the dry grass PVG, a dominant change within the dry shrub PVG between historical and current was the conversion of upland herbland and upland shrubland to exotic herbland through the invasion and spread of exotic undesirable plants (including noxious weeds) (table 3.40 in Hann, Jones, Karl, et al. 1997). This change was evident both on BLM- and Forest Service-administered lands and on

Table 2-20. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Dry Shrub Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland shrubland	Antelope bitterbrush/bluebunch wheatgrass	Closed low shrub[1]	3, 5, 7, 10, 11
	Big sagebrush	Closed low shrub[1]	5, 7, 10, 11
		Open low shrub[1]	5, 7, 8, 10, 11, 12
		Closed herbland[1]	5, 8, 10, 11, 12
	Salt desert shrub	Closed low shrub	5, 7, 10, 11
		Open low shrub	5, 7, 10, 11
	Low sagebrush	Open low shrub	5, 7, 8, 10, 11, 12
Upland woodland	Juniper woodlands	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
	Juniper/sagebrush	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
Upland herbland	Wheatgrass bunchgrass	Closed herbland[1]	3, 5, 8, 10, 12
		Open herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Exotic herbland	Exotic forbs/annual grass	Closed herbland	10
		Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

non-BLM-/Forest Service-administered lands. Exotic undesirable plants were common within most cover types of the dry shrub PVG, with the most common being cheatgrass. Other problematic exotic plants within the dry shrub PVG varied regionally within the project area, with some of the most notable being rush skeletonweed, medusahead, whitetop, and diffuse knapweed. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to exotic herblands in the dry shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and the following constituent cover types (antelope bitterbrush / bluebunch wheatgrass and big sagebrush) to exotic herblands has contributed to the widespread decline observed in the project area for the antelope bitterbrush / bluebunch wheatgrass and big sagebrush cover types (Appendix 5). The greatest geographic extent of shrubland conversion to exotic herbland was attributable to cheatgrass. See the Factors of Influence section of this chapter for more detailed information on cheatgrass.

Another dominant change within the dry shrub PVG between historical and current was the conversion of upland herbland to upland shrubland (table 3.40 in Hann, Jones, Karl, et al. 1997). This change, too, was evident both on BLM- and Forest Service-administered lands and on non-BLM- and Forest Service-administered lands. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to shrublands in the dry shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Conversion to agriculture was the greatest contributor to the decline in geographic extent of the dry shrub, dry grass, coolshrub, and riparian shrub PVGs.

A subdominant change within the dry shrub PVG, apparent regionally in the Upper Klamath ERU (corresponds best to the Klamath PAC), was a conversion of upland shrublands to upland woodlands. Western juniper (juniper-sagebrush cover type) encroached into the low sagebrush cover type.

Fire, interacting with livestock grazing, played a major role in these changes. Cheatgrass was the major contributor to the conversion of upland herbland and upland shrubland to exotic herbland. The flammability of cheatgrass caused a greater frequency of fire that led to decline of upland shrublands and herblands. Conversely, lack of fire was responsible for the conversion of upland herbland to upland shrubland. See the Factors of Influence section of this chapter for more detail on wildfire frequency and severity.

Agricultural PVG

Between historical and current, the geographic extent of the agricultural PVG increased from zero to 17 percent of the project area. This increase, as expected, occurred almost totally on non-BLM- or Forest Service-administered lands. The agricultural PVG is located primarily in areas that were dry shrub, dry grass, cool shrub, and riparian shrub PVGs historically. Hence, conversion to agriculture was the greatest contributor to the decline in geographic extent of the dry shrub, dry grass, cool shrub, and riparian shrub PVGs (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the agricultural PVG is most prevalent in the Columbia Plateau, Northern Glaciated Mountains, Blue Mountains, Owyhee Uplands, and Upper Snake ERUs (see Maps 2-1, 2-5, 2-6, earlier in this chapter).

Table 2-21 shows the composition and structure of vegetation in the agricultural potential vegetation group and the associated Terrestrial Families.

Table 2-21. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Agricultural Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Agricultural	Cropland/hay/pasture	Closed herbland	NA
		Agricultural	NA
Upland herbland	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Urban	Urban	Urban	NA

Abbreviations used in this table:
NA - none reported for this cover type-structural stage in Wisdom et al. (in press).

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

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