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# (Excerpts from)
# CHAPTER 3
# Landscape Dynamics of the Basin

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## OVERVIEW OF METHODS

### Characterization of Multi-scale Landscape Relationships

These methods are an overview of the key analyses that were conducted to assess landscape dynamics. For more detail we refer the readers to Hann and others (1997), Hessburg and others (1996a), Ottmar and others (1996), and Keane and others (1996b).

The broad-scale data for this assessment were coarse grained (low resolution), but continuous across the Basin. Conversely, the mid- and fine-scale data were finer grained (higher resolution), but were sampled from the Basin and therefore not continuous. Using a multi-scale approach improved our understanding of the relationships among fine-, mid-, and broad-scale vegetation attributes.

Plot data (fine-scale) obtained from various agencies were inconsistent in type, methods, and data quality control. Data were relatively consistent within, but not among administrative units. The most consistent statistical correlation of the plot data was found within the administrative unit that collected the data. Very few attributes demonstrated adequate consistency of values and interrelated logical relationships to provide confidence in the use of plot data as a whole. Consequently, we only used a very reduced data set that had consistent and standard methodology, and that had been corrected for errors in logical relationships.

Although mid-scale vegetation inventory map data were available from various sources, such as satellite remote sensing and forest, rangeland, and wildlife habitat inventories, they were as variable and inconsistent as the plot data. Legends were difficult to correlate among different maps; even though map legend attributes were labeled identically among maps, the attributes themselves were often different. Furthermore, most of the vegetation maps did not have corresponding potential vegetation maps of the same scale, and major problems with logical relationships existed for those that were of the same scale. Consequently, we were unable to use existing mid-scale vegetation-inventory maps and were forced to develop a new set of mid-scale data that was consistent and rectified with a potential vegetation layer (see Hessburg and others 1996a). The mid-scale data set was derived from a two-stage, stratified random sample of paired “current” and “recent historical” aerial photography covering 337 subwatersheds from 43 subbasins. The areal coverage of the subsample was equivalent to approximately 5 percent of the Basin. Many of the recent historical data (1930-1960s), particularly on rangelands, were derived from relatively recent aerial photography. Conversely, some of the current aerial photography (also primarily on rangeland-dominated subwatersheds) was relatively old (1980-1990s). Consequently, the recent historical and current photographic pairs spanned various temporal periods [see Hessburg and others (1996a) for further details of the mid-scale sampling design].

The mid- and fine-scale data that were strongly correlated with broad-scale data could be extrapolated across the entire extent of the Basin. We observed several attributes that were correlated among the three scales when stratified by geographic area: land ownership, management strategy, and groups of potential vegetation groups (PVGs). We divided the Basin into two geographic areas or management regions: the Eastside (EEIS) and the Upper Columbia River Basin (UCRB). Land ownership and management strategies were stratified into eight management classes (table 3.4). Because our analysis focused on BLM- and FS-administered lands, we further aggregated the non-BLM- and FS-administered lands into a single “Other” lands category (map 3.7).

Often, the relationships among the three different scales were complex and not immediately obvious. In order to correctly interpret the differences among scales, we often had to qualitatively or quantitatively develop a broad-scale correlate to assess trends of mid- and fine-scale conditions.

For example, although we could assess the broad-scale areal extent of fires, the mid- and fine-scale patterns of fuel types and fire behavior differed substantially. These differences were apparently due to the management history of an area — which was correlated with the management objectives of that area [for instance, managed as wilderness or roadless areas (wilderness-like), or managed primarily by human-influenced processes (non-wilderness or roaded areas)]. Consequently, mid- and fine-scale fire behavior attributes (that is, crown fire, fire severity, fire interval, and smoke) would not necessarily be the same for two areas having similar types of broad-scale fire and/or physiognomic vegetation conditions.

## Biophysical Template

The PVGs (appendix 3-A) were used as indicators of broad-scale biophysical templates. We assessed the historical and current areal extent of each of the PVGs in relation to its general environment, land ownership pattern, composition of physiognomic types, and predominant disturbance regimes. Each of the PVGs was stratified at 1,200 meters mean sea level (MSL) to assess trends above and below that elevational breakpoint. In addition, we used a composite assessment to index the departure of the current PVG from its historical succession and disturbance regimes into three classes: low, moderate, and high.

Data for the assessment of PVGs were then derived from simulations of the historical and current periods using the Vegetation Dynamics Development Tool model (VDDT) (Beukema and Kurz 1995), the Columbia River Basin Succession Model (CRBSUM) (Keane and others 1996b), ecological vegetation and site plot data (Hann and others 1997), and historical vegetation mapping with comparison to current photo points (Losensky 1994, Losensky 1995). The dynamics of the historical physiognomic types were simulated using a single 100-year run of the

CRBSUM (Keane and others 1996b). We believed that a 100-year simulation of the historical dynamics captured the majority of the shifts in cover types and structural stages, and the associated succession and disturbance processes that would have occurred prior to Euro-American settlement and industrialization of the Basin. However, through sensitivity testing with the VDDT models we found that a 300-year period was generally required to produce consistent pattern repetitions (Hann and others 1997). Consequently, we conducted an additional CRBSUM historical simulation for 400 years.

## Succession and Disturbance Processes

Vegetation structure and composition changed as a result of the interaction between disturbances and the subsequent successional responses that occurred. These processes changed the live and dead attributes of vegetation composition and structure, and the associated site conditions such as soil cover and soil organic matter.

We used the PVTs and the PVGs (appendix 3-A) to stratify the succession/disturbance regimes by biophysical environment. The PVTs were named for the dominant vegetation that could potentially grow on a site in the absence of disturbance, and were grouped into PVGs based on similar moisture and temperature gradients (Menakis and others 1996). Succession and disturbance processes were described and modeled for each PVT within the Basin (Beukema and Kurz 1995, Byler and others 1996, Hann and others 1997, Keane and others 1996b, Long and others 1996). A VDDT model (Beukema and Kurz 1995) was developed for each PVT to simulate cover type and structural stage changes that were attributable to the predominant disturbances of the historical, current, and future scenarios through time (Byler and others 1996, Keane and others 1996b, Long and others 1996). The VDDT models and Losensky's (1994) historical vegetation information suggested that year 0 of the historical simulation represented a generalized historical condition of cover type and structural stage dynamics. Modeling suggested that the PVTs in the Basin generally required 250 to 400 years to cycle and stabilize at a relatively constant composition of vegetation cover types and structural stages. These models were also used to assess trends of regional and landscape composition and structure.

Our evaluation included what we believed were the primary disturbance regimes. The evaluation took into account fire severity and fire interval (Morgan and others 1996), recent fire occurrence (Menakis and others 1996), roads (Menakis and others 1996), grazing (Burkhardt 1996), climate (Ferguson 1996a, 1996b, 1996c, 1996d), and human activities (Woods and Horstman 1996). In addition, we considered the paleoecological influences reported by Mehringer (1996). The simulations incorporated succession rates and disturbance effects in the modeling of regional and landscape composition and structure changes. Results of historical, current, and future modeling of different types of management were summarized by Keane and others (1996b) and Long and others (1996). Keane (1996) reported the results of modeling ecosystem processes. Response coefficients for modeling fire behavior and effects were adopted from Hardy and others (1996). Results of modeling the different effects of smoke from wildfire and prescribed fire were summarized by Holsapple and Snell (1996). Schoettle and others (1996) summarized the dynamics of air quality.

We developed a classification that separated succession/disturbance regimes into (1) regimes that generally maintained communities and (2) regimes that cycled communities through successional stages (table 3.6). Within these two classes, we provided for subdivisions based on the interval between disturbance, types of structures created by the disturbance, and the associated disturbance severity. Because the classification system was based upon succession and disturbance processes, it allowed us to readily predict succession and disturbance patterns without having detailed information on the causal disturbance agents (for example fire, drought, insect and disease infestation, stress, or wind). These regimes were developed from interpretations of plot data and historical photo points (Hann and others 1997; Losensky 1995) along with reference to the current succession and disturbance literature discussed in the introduction to this chapter.

Morgan and others (1996) mapped fire regimes that were based primarily upon frequency (the interval between successive fires) and severity (the fires' effects on the dominant overstory vegetation). They used two sets of decision rules (one set for historical regimes and another set for the current period regimes) to assign fire regime classes to cover types. Assignments were based upon published literature, a fire history database (Barret 1995), and expert opinion.

The decision rules for the current regimes reflected the influence of fire suppression, invasion of exotic plants, and other human-caused factors. Neither of the rule sets used vegetation structure nor fuels for modeling potential fire behavior. Consequently, we had less confidence in the current fire-regime map and associated regime change maps, than in the historical fire regime map. However, we believe that the indices of historical and current fire regime classes could be confidently used to assess broad-scale trends. In addition, if used in conjunction with other proxy variables, we believe that the fire regime classes could also be used to estimate potential fire risk and fire behavior.

We used five indices to estimate regional risks of severe fire behavior and severe fire effects. The five indices were based on the proportion of an ERU that had: (1) mixed or lethal historical fire severity; (2) an increase of fire severity or decrease of fire frequency (that is, an increase of infrequent and very infrequent classes) between historical and current periods; (3) a high probability of fire occurrence; (4) a high probability of severe fire behavior; and (5) the presence of rural/wildland interface. Fire-occurrence probabilities were based on seven years (1986-1992) of subwatershed fire-occurrence records. The fire behavior index incorporated elevation, precipitation, and temperature gradients. The overall index of severe fire risk was calculated as the average value of the five indices described above (see Hann and others 1997, Long and others 1996, and Menakis and others 1996 for a more detailed description of methodologies).

We also developed indexes for precipitation, seasonal climate gradients, and topoedaphic conditions to use in assessing succession and disturbance processes (Hann and others 1997). Coefficients were calculated for rule sets to estimate amounts of net wildfire, wildfire suppression cost, forest crown wildfire, forest surface/mixed wildfire, forest insect/disease, smoke, and soil disturbance. Subbasin landforms were developed by identifying the dominant subsection landforms for each subbasin.

Road density classes were mapped from a rule set using categories of land ownership, land use, life form, elevation, slope, and a GIS road data set obtained from United Parcel Service (Menakis and others 1996). The density classes and relationships to the categories were extrapolated from mid-scale subwatershed road data. Although we were not able to test the extrapolation rule set, or conduct a comparison analysis between the final broad-scale road density map and the sampled subwatersheds, we were able to evaluate the logic of the road density classes and refine the rule sets. Although we do not have a high degree of confidence in the absolute values of the broad-scale road density classes, we do believe that they can be appropriately used to assess broad-scale trends of relatively large geographic areas (for example, clusters of subbasins, basins, and ERUs).

The mid-scale subwatershed road data, photo points, and reconnaissance notes were used to develop interpretations of fine-scale effects of roads (Hann and others 1997).

## Broad-scale Changes in Cover Types

Forty-one broad-scale cover types were mapped at 1-square-kilometer resolution to describe the current and historical period vegetation of the Basin (appendix 3-E). Cover types were named for the vascular plant species having the dominant canopy cover for rangeland types (Shiflet 1994) and the dominant basal area for forest types (Eyre 1980). The current cover type map was created by Hardy and others (1996) by refining a land cover characterization map that was constructed from a 1991 classification of Advanced Very High Resolution Radiometer (AVHRR) satellite imagery (Loveland and Ohlen 1993, Loveland and others 1991). This map was revised using rule sets developed from knowledge of the PVT, a rectification procedure using CRBSUM, and information gained from workshops attended by ecologists familiar with the Basin (Keane and others 1996b, Hann and others 1997; Menakis and others 1996). The historical cover type map was produced by Losensky (1994) using archived maps and government records published near the turn of the century and revised using a rectification process similar to that for the current. Because the base historical map was compiled from many maps of varying scales and quality, it was difficult to cross-reference historical and current cover types. This was especially true for urban and agricultural areas. The derivation of current and historical vegetation layers and rectification with current and historical PVT layers was fully described by Menakis and others (1996) and Hann and others (1997).

Two spatial scales and three indices of change were used in this assessment to quantify areal changes of cover types between historical and current periods. Compositional changes were assessed across the Basin as a whole, as well as within the 13 ERUs (map 3.3) within the Basin. These changes were evaluated with respect to the cover type (that is, class change), to a region (that is, Basin or ERU change), and to the historical range of each cover type (that is, departure index).

Class changes quantified the proportional change of a cover type's area between the historical and current periods. Class change was estimated by:

$CC = [(CTA_C - CTA_H)/ CTA_H] * 100$

where

CC = percentage of class changed,

$CTA_C$ = current area of cover type, and

$CTA_H$ = historical area of cover type.

Regional changes quantified the areal proportion of the region (Basin or ERU) that was altered as a result of the change in areal extent of a cover type. Regional change was estimated by:

$RC = [(CTA_C - CTA_H) / RA] * 100$

where

RC = percentage of region changed,

$CTA_C$ = current area of cover type,

$CTA_H$ = historical area of cover type, and

RA = regional area (Basin or ERU).

Transition matrices of cover types were constructed to further our understanding of class and regional changes (Jones 1996). The transition matrices tracked the flux of individual 1-square-kilometer pixels from one cover type to another between the historical and current periods. For example, did a pixel that was classified as a ponderosa pine cover type during the historical period remain ponderosa pine, or did it change to another cover type in the current period? The dominant transitions within a region (that is, those affecting at least 1% of the Basin or an ERU) were summarized.

Cover type departure indices were determined by comparing the current period areal extent of each type to their modeled median 75-percent and 100- percent historical ranges. The median 75-percent range is 75 percent of the difference between minimum and maximum, which excludes 12.5 percent of the range from each end. We computed the median 75-percent range to exclude some of the more extreme variation. Historical ranges of cover types were simulated for the Basin and individual ERUs using the CRBSUM (Keane and others 1996b). The minimum and maximum values from a single 100-year or 400-year run of the CRBSUM, and appropriate outputs for simulation years 0, 50, 100, 200, 300, or 400 were used to define historical ranges. The initial conditions for the historical simulations and the simulation process were described by Menakis and others (1996) and Long and others (1996), respectively. We then calculated the median 75-percent historical range by adding or subtracting 12.5 percent of the historical range to the historical minimum and historical maximum, respectively. Five departure classes were defined based on the relationship between the current area of each cover type and its simulated median 75-percent and 100-percent historical ranges (table 3.7; fig. 3.10).

We used class changes, regional changes, and departure indices to determine ecologically significant changes of cover types. We judged the absolute value of class changes greater than or equal to 20 percent and regional changes greater than or equal to 1 percent as ecologically significant, but only if the departure indices indicated that the current area of the cover type occurred outside its median 75-percent historical range (that is, departure classes 1, 2, 4, and 5). In turn, areal changes resulting in departures classes 1, 2, 4, and 5, were ecologically significant if either the historical or current period areas of a cover type exceeded 1 percent of the region, and the class change exceeded 5 percent.

The herbaceous wetlands, shrub wetlands, and aspen cover types appeared to be under-represented in the historical vegetation layer and over-represented in the current layer. These types, which generally occur in scattered, relatively small- to medium-sized patches, tend to be underestimated as mapping resolution increases (Turner and others 1989). Because the historical vegetation layer was developed at a coarser resolution than the current period vegetation layer (Menakis and others 1996), it was likely that the two mapping efforts contained different biases. In fact, rectification with the PVTs indicated that the herbaceous wetlands, shrub wetlands, and aspen cover types were likely more abundant on the historical landscape than the data indicated [see appendix 3-F for a description of PVTs, and Menakis and others (1996) for the derivation of the historical vegetation layer]. Changes in these three types were not reported because they could not be accurately quantified.

## Broad-scale Changes in Terrestrial Community Types

Twenty-four broad-scale terrestrial community types were derived by aggregating 41 cover types and 25 structural stages (appendices 3-B and 3-G). Structural stages represented the developmental changes in a plant community's structure (Oliver and Larson 1990). Oliver's (1981) original forest structural stages were modified by O'Hara and others (1996) to account for the influence of natural and anthropogenic disturbances on successional development in forest and woodland types. Willard and Villnow (1996) developed a set of structural stages for rangelands that were later revised for use in a coarse-scale application. The current period structural stage map was created from a discriminant analysis of mid-scale data layers extrapolated to the broad scale (Keane and others 1996b). Data of historical structural stages were generated from historical information compiled by Losensky (1994), in which the areal extent of structural stages was summarized by cover type and county, and then extrapolated to Bailey's (1995) ecological section. Historical structural stages were then randomly assigned to pixels based upon the historical cover type and proportional area of structural stage within an ecological section (Keane and others 1996b). Cover types and structural stages were aggregated into terrestrial community types based upon moisture, temperature, elevational gradients, and similar broad-scale structures. Terrestrial community types were mapped at 1-square-kilometer resolution.

As with the analysis of cover types, two spatial scales and three indices of change were used to quantify areal changes of terrestrial communities between historical and current periods. Compositional changes were assessed across the Basin as a whole, and for ERUs within the Basin (map 3.3). These changes were evaluated with respect to the terrestrial community (that is, class change), the region (that is, Basin or ERU), and the historical range of a community's area (that is, departure index).

Class changes quantified the proportion of a terrestrial community's area that varied between historical and current periods, whereas regional changes quantified the areal proportion of the region (Basin or ERU) that was altered as a result of a change in areal extent of a terrestrial community type. The class and regional changes of terrestrial communities were estimated in the same manner as they were for cover types. Transition matrices of terrestrial communities were constructed to further our understanding of class and regional changes (Jones 1996). The dominant transitions within a region (that is, those affecting at least 1% of the Basin or an ERU) were summarized.

As with the cover type departures, terrestrial community type departures were determined by comparing the current period areal extent of each type to their modeled median 75-percent and 100- percent historical ranges. Ecologically significant changes between historical and current period terrestrial communities were determined in the same manner used for cover types.

The same problem was experienced with riparian terrestrial community types as was experienced with riparian cover types. Consequently, the changes of riparian terrestrial communities were not reported because they could not be accurately quantified.

## Broad-scale Changes of Physiognomic Types

Cover types and structural stages were aggregated into 20 physiognomic types to assess successional and disturbance processes (appendix 3-C). The physiognomic types corresponded to the terrestrial community types in non-forest (that is, rangeland) settings. However, in forest settings the physiognomic types incorporated shade tolerance/shade intolerance, in addition to structural and seral status. The aggregation of cover types to infer shade-tolerant and shade-intolerant groups should be used cautiously, particularly with model projections of HRVs. Although we believe the data for mid- and late-seral stages to be fairly reliable, the values for early-seral stages are questionable. Broad-scale physiognomic types cannot be directly associated with forest age, such as regeneration, young, mature, or old. However, we believe physiognomic types can be associated with forest age classes if they are stratified by PVG and disturbance history.

Regional trends of physiognomic types were stratified by PVG and land ownership, and assessed for the Basin and each of the 13 ERUs. In addition, the current areal extent of physiognomic types was compared to the HRV for each strata. The HRV was based upon the historical extent, and a single 100-year run of CRBSUM (using historical disturbance regimes) with outputs at 50 and 100 years. Consequently, three values (historical year 0, historical year 50, and historical year 100) were used to estimate historical minimum and maximum values.

## Broad-scale Subbasin Vegetation Departures

Terrestrial community type departures were developed to estimate the magnitude of broad-scale habitat changes in forest and rangeland habitats within subbasins. One-square-kilometer resolution, continuous, broad-scale data summarized by subbasin (map 3.6) was used to assess habitat departures of forest and rangeland ecosystems. After aggregating 41 cover types and 21 structural stages into 24 terrestrial community types, the forest terrestrial community types having late-seral single-layered and late-seral multi-layered structures were further collapsed into a “late” class. Departure classes (table 3.7) were then estimated by subbasin for nine forest terrestrial community types and three non-forest (that is, rangeland) community types. We estimated current period departures for those terrestrial community types that composed at least 1 percent of the area of a subbasin for any output period of the historical CRBSUM run, or for the current period condition. Departure values were not determined for anthropogenic community types (that is, cropland, exotic, and urban), nor community types that remained relatively stable between historical and current periods (that is, alpine, rock/barren, and water community types). Departures were also not estimated for riparian community types because historical occurrence of riparian cover types was typically underestimated and current period occurrence was typically overestimated (Jones and Hann 1996b).

Subbasin departure classes were estimated in a similar manner as were the Basin and ERU departures of cover types and terrestrial communities. However, in the subbasin, the departures were determined on an individual subbasin level. Consequently, the current areal extent of each type within individual subbasins was compared to the modeled median 75-percent and 100-percent historical ranges of each type within a subbasin. Subbasin historical ranges of terrestrial communities were determined for the Basin and ERUs in the same manner as the historical ranges of cover types and terrestrial communities. The persistence of species within a subbasin was presumed not to be at risk if the current period area of the species’ primary habitat fell within or above the median range of historical data. Consequently, we believed it would be informative to assess the fragmentation of areas in which the risks to persistence would be relatively low. We computed four fragmentation indices for subbasins in which a community type occurred within or above its historical range: (1) percent area (percentage of those subbasins in which a community composed a substantial proportion); (2) number of patches; (3) median patch size (count of subbasins within a patch); and (4) maximum patch size.

## Broad-scale Changes of Vegetation Patterns

We evaluated the patterns of physiognomic groups and terrestrial communities to assess landscape and regional patterns of vegetation, respectively, within the Basin.

### Physiognomic Group Patterns

Physiognomic groups were derived from an aggregation of 41 cover types and 25 structural stages having similar gross compositional and structural characteristics (table 3.8). Physiognomic group patterns were in turn created by classifying subwatersheds (6th field HUCs) (map 3.5) according to their pattern and composition of dominant physiognomic groups. In the coarsest sense, patterns were simplified as “uniform”, “mosaic”, or “mixed”. Uniform patterns existed where the dominant physiognomic group constituted a minimum of 80 percent of the subwatershed. The pattern was classified as mosaic where the dominant physiognomic group composed 60 to 80 percent of the subwatershed. In a mixed pattern, the dominant physiognomic group composed less than 60 percent of the subwatershed. A more descriptive pattern classification was also developed that used a hierarchy of pattern and dominant/codominant physiognomic groups. Changes of physiognomic group patterns were summarized by ERUs (map 3.3).

Transition matrices were prepared for each ERU to summarize the changes of physiognomic group patterns between the historical and current periods. Changes were quantified in relation to the physiognomic group (that is, class change or proportional change) and in relation to the ERU (that is, the proportional change of an ERU due to a change in a particular physiognomic group). The most dominant transitions within an ERU were evaluated to develop an understanding of the major pattern changes that had occurred between historical and current periods. In general, to be considered major, fluxes had to occur across a minimum of 1 percent of an ERU.

A coarse assessment of fragmentation trends was conducted by analyzing the net change in areal extent of ERUs that had fluxed between more uniform or more fragmented landscapes (that is, uniform to mosaic or mixed, and mosaic to mixed). The percentage of the ERU that remained in the same pattern class between historical and current periods was used to estimate a stability index. Conversely, a departure index for ERUs was calculated to quantify the magnitude of change between historical and current broad-scale physiognomic group patterns. The departure index was calculated by:

$$PD = 100 - \left[ \frac{200 \Sigma_k \text{minimum}(h_k, c_k)}{\Sigma_k h_k + \Sigma_k c_k} \right]$$

where
PD = departure index,
k = number of classes,
$h_k$ = the historical value for class k, and
$c_k$ = the current value for class k.

ERU departure indices were classified on a relative scale as low, moderate, and high for values less than 33.3, 33.3 to 66.6, and exceeding 66.6, respectively.

## Terrestrial Community Group Patterns

Historical and current period patterns of broad-scale terrestrial community groups were assessed for the LCA, an area that extended slightly beyond the boundaries of the Basin (maps 3.1 and 3.2). The historical and current period vegetation maps were derived using different methods and resolutions (Menakis and others 1996). Consequently, comparisons of landscape patterns between historical and current periods were difficult. To ameliorate the problems associated with resolution, the 1-square-kilometer current and historical vegetation layers were resampled to 4-square-kilometer resolution, and the 24 terrestrial community types were further aggregated into 12 terrestrial community groups (table 3.9). We believe that using a coarser 4-

square-kilometer resolution and a coarser classification of vegetation types improved the comparability of historical and current period vegetation patterns. As previously discussed, changes of riparian vegetation types between historical and current periods could not accurately be assessed. Consequently, pattern changes of any riparian community groups were not reported in this chapter.

FRAGSTATS (McGarigal and Marks 1994) was used to estimate class (that is, terrestrial community groups) and landscape metrics to assess pattern changes of the LCA as a whole, as well as pattern changes of each of the 12 community groups occurring within the LCA (table 3.10). Multiple metrics (that is, areal extent, largest patch index, patch number, and mean patch size) were evaluated to assess fragmentation. Indicators of an increase in fragmentation included decline in areal extent, a declining largest patch index, and a declining mean patch size, whereas the number of patches would generally be expected to increase. Conversely, indicators of a landscape becoming more homogeneous and contiguous included increasing areal extents, increasing largest patch index, increasing mean patch size, and declining numbers of patches. Because of the coarse resolution of this analysis and the different mapping methods involved, we assumed ecologically significant changes occurred when current period metrics deviated by 20 percent or more from historical metrics.

Table 3.4—Total percentages by management region, land ownership group, and management class.

| Management Region | Land Ownership Group, Management Class[1] | Percent of Management Region | Percent of Total Basin |
|---|---|---|---|
| EEIS[2] | BLM/FS[3] Natural Processes | 9.9 | 4.8 |
| | BLM/FS Roadless Human-Influenced Processes | 1.7 | 0.8 |
| | BLM/FS Roaded Human-Influenced Processes | 25.2 | 12.3 |
| | BLM/FS Roadless Natural/Human-Influenced Processes | 1.2 | 0.6 |
| | BLM/FS Roaded Natural/Human-Influenced Processes | 3.4 | 1.6 |
| | National Park and Other Wilderness | 0.4 | 0.2 |
| | Private or Other Lands | 47.7 | 23.1 |
| | Tribal, State, or Other Public Land | 10.6 | 5.2 |
| Total | | 100.0 | 48.6 |
| UCRB[4] | BLM/FS Natural Processes | 14.4 | 7.4 |
| | BLM/FS Roadless Human-Influenced Processes | 5.5 | 2.8 |
| | BLM/FS Roaded Human-Influenced Processes | 30.0 | 15.4 |
| | BLM/FS Roadless Natural/Human-Influenced Processes | 8.7 | 4.5 |
| | BLM/FS Roaded Natural/Human-Influenced Processes | 2.9 | 1.5 |
| | National Park and Other Wilderness | 1.9 | 1.0 |
| | Private or Other Lands | 28.2 | 14.5 |
| | Tribal, State, or Other Public Land | 8.4 | 4.3 |
| Total | | 100.0 | 51.4 |

| | |
|---|---|
| EEIS and UCRB Total | 100.0 |

[1] Information from EIS data files.
[2] Eastside EIS assessment area.
[3] Bureau of Land Management- and Forest Service-administered lands.
[4] Upper Columbia River Basin EIS assessment area.

Table 3.6—Succession and disturbance regimes developed for broad-scale assessment.

| | Average Disturbance Interval (years) | | | | |
|---|---|---|---|---|---|
| Regime (Code) | Intermediate Mixed[1] / Non-lethal[2] | Lethal | Severity | Description | Examples |
| Cycling | NA[3] | 1+ | Moderate-High | Succession is reinitiated by disturbances that are lethal[4] to most or all of the upper-layer and some or all of the lower-layer vegetation. | |
| Accelerated Cycle (AC) | 5-50 | 30-300 | Moderate | Intermediate disturbances that accelerate growth of disturbance-adapted species, often creating an irregular fine-scale mosaic of patches of different vegetation structures. Eventually cycled by a lethal disturbance. | Conifer potential vegetation types (PVTs) with non-lethal or mixed fires, insect, or disease effects that thin the stands of susceptible species, allowing the resistant species to accelerate growth; shrub PVTs with non-lethal or mixed fires, insects, disease, grazing, or beaver cutting effects that open-up stands. |
| Long Cycle (LC) | NA | 101 - 300 | High | Successional cycle is long, with reinitiation from seedlings and some resprouting. Intermediate disturbances may happen but they have minimal effects on composition,structure, and density. | Conifer PVTs with longer-lived, fast-growing, shade-intolerant, conifer species that dominate after crown fires, insect attacks, windthrow, or other lethal effects that cycle the community. |

| | | | | | |
|---|---|---|---|---|---|
| Moderate Cycle (MC) | NA | 5 - 100 | Moderate | Successional cycle is moderately long, with reinitiation from a mixture of resprouting plants and seedlings. Intermediate disturbances may happen but they have minimal effects on composition, structure, and density. | Shrub PVTs where succession after lethal burning, herbicide application, chaining, or insect topkill takes from 10 to 25 years to reestablish the dominant shrub layer; conifer or broadleaf PVTs with short-lived, fast-growing, shade-intolerant, conifer or broadleaf species that dominate after crown fires, insect attacks, windthrow, or other lethal effects that cycle the community; floods in floodplain areas that cycle broadleaf, conifer, or shrub vegetation; cutting or flooding by beaver in riparian areas; avalanche paths; conifer PVTs where lethal disturbance cycles the vegetation prior to dominance by conifers, keeping the system in an herb or shrub dominated stage. |
| Retrogressive Cycle (RC) | NA | 10 - 50 | Low | Disturbances that reverse successional direction to an earlier seral stage, typically an annual or biannual cycle of grazing stress insect/pathogen mortality, drought mortality,or pollutant mortality. | Conifer PVTs with fire exclusion resulting in a dense upper layer that undergoes relatively little annual mortality from insects, disease, and stress that cumulatively are a lethal effect to the dominant vegetation a long period (10-50 yrs); grazing that selectively causes mortality in relatively small annual increments such that over a long period there is a complete change in dominant vegetation composition or structure; invasion by exotic plants that can compete more effectively than native plants due to environment or disturbance (grazing, fire, tillage, or roads). |
| Short Cycle (SC) | NA | 1 - 4 | High | Successional cycle is very short with a composition of new seedlings, annuals, biennials, or weedy perennial species. | Annual high water in channel zone/draw area adjacent to the channel; annual tillage in agriculture; soil or gravel surfaced roads with annual grading and runoff; annual grass and weed dominated vegetation with high amounts of bare soil; annual avalanche path areas. |
| Very Long Cycle (VC) | NA | 301+ | High | Successional cycle is very long, with reinitiation primarily from seedlings. Intermediate disturbances may happen but they have minimal effects on composition, structure, and density. | Conifer PVTs with a sequence of dominance by shade-intolerant tree species that succeed to shade-tolerant tree species and then are cycled by crown fires, insect attacks, windthrow, or other lethal effects on the dominant upper layer vegetation. |

| | | | | | |
|---|---|---|---|---|---|
| Maintenance | 5 - 50 | NA | Low | Succession is maintained in one structural stage by periodic disturbances that do not cycle the upper-layer vegetation but are lethal to species in the lower layer that would grow up into and change the upper layer. | |
| Frequent Maintenance (FM) | 5 - 25 | NA | Low | Intermediate effects produce relatively uniform upper and lower layers of vegetation with relatively short intervals between maintenance disturbances. | Warm conifer PVTs with non-lethal fires, insects, disease, or grazing effects that selectively remove the susceptible understory species allowing for recruitment of resistant species into the overstory; warm grassland, shrubland, and conifer PVTs with non-lethal and mixed fires, insects, disease, or grazing effects that maintain the dominant grass or forb vegetation. |
| Less FrequentMaintenance (GM) | 26 - 50 | NA | Low | Intermediate effects produce relatively uniform upper and lower layers of vegetation with moderate intervals between disturbances. | Cooler conifer PVTs with non-lethal fires, insects, disease, or grazing effects that selectively remove the susceptible understory species allowing for recruitment of resistant species into the overstory; cooler grassland, shrubland, and conifer PVTs with non-lethal and mixed fires, insects, disease, or grazing effects that maintain the dominant grass or forb vegetation. |
| Irregular Maintenance (IM) | 26 - 50 | NA | Low | Intermediate effects produce relatively irregular upper layers of vegetation and multiple lower layers. | Wet conifer, broadleaf, or shrub PVTs with mixed fires, insects, disease, or grazing effects that selectively remove small patches of susceptible species in any vegetative layer allowing for recruitment of resistant species into the structure. |

[1] Mixed disturbances maintain a salt and pepper, fine-scale mosaic within a patch by cycling clumps and gaps; mixed disturbances leave patches intact, but maintain a rough textural pattern of clumps and gaps; mixed disturbances can be lethal (maintaining scattered gaps or creating gaps); or non-lethal (creating gaps that are intermingled with clumps).
[2] Non-lethal disturbances do not cycle the upper layer of vegetation; non-lethal disturbances selectively thin susceptible plants in all layers of the patch.
[3] NA = Not Applicable.
[4] Lethal disturbances cycle the upper layer of vegetation in the patch, and may cycle the lower layers.

Table 3.7—Cover type and terrestrial community departure classes.

| Departure Class | Relationship of Current Period Area to Historical Ranges |
|---|---|

| | |
|---|---|
| 1 | $A_C$[1] < Historical Minimum |
| 2 | Historical Minimum ≤ $A_C$ < Median 75% Historical Range |
| 3 | $A_C$ is within Median 75% Historical Range |
| 4 | Median 75% Historical Range < $A_C$ ≤ Historical Maximum |
| 5 | $A_C$ > Historical Maximum |

[1] $A_C$ = Current area.

Table 3.8—Physiognomic groups used to assess coarse landscape patterns of subwatersheds within the Basin.

| Physiognomic Group | Description |
|---|---|
| Agriculture | Agricultural types including irrigated and non-irrigated crop land, hayland, and seeded pasture. |
| Forest / Woodland Early-seral | Forest and woodland early-seral structures (that is, stand initiation[1]). |
| Forest / Woodland Mid-seral | Forest and woodland mid-seral structures including stem exclusion open and closed, understory reinitiation, and young multi-storied stands. |
| Forest / Woodland Late-seralMulti-layer | Forest and woodland late-seral multi-layered stand structures. |
| Forest / Woodland Late-seral Single-layer | Forest and woodland late-seral single-layered stand structures. |

| | |
|---|---|
| Herbland | Herbland structures including both native and exotic grasses and forbs, and sedge-dominated open and closed stands. |
| Low Shrub | Low shrub structures including open and closed shrub stands less than 0.76 meters in height. |
| Mid Shrub | Mid shrub structures including open and closed shrub stands 0.76 to 2.00 meters in height. |
| Rock | Rock and barren structures. |
| Tall Shrub | Tall shrub structures including both open and closed shrub stands exceeding 2 meters in height. |
| Urban | Urban and industrial areas. |
| Water | Large bodies of water. |

[1] See appendix 3-G for structural stages descriptions.

Table 3.9—Aggregation of 24 terrestrial community types into 12 terrestrial community groups for analysis of broad-scale changes in vegetation patterns.

| 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-layer Forest |
| | Late-seral Lower Montane[1] Single-layer Forest |
| Montane Forest | Early-seral Montane Forest |
| | Mid-seral Montane Forest |

| | |
|---|---|
| | Late-seral Montane Multi-layer Forest |
| | Late-seral Montane Single-layer Forest |
| Rock | Rock / Barren |
| Subalpine Forest | Early-seral Subalpine Forest |
| | Mid-seral Subalpine Forest |
| | Late-seral Subalpine Multi-layer Forest |
| | Late-seral Subalpine Single-layer Forest |
| Upland Herbland | Upland Herbland |
| Upland | Shrubland |
| Upland Woodland | Upland Woodland |
| Urban | Urban |
| Water | Water |
| NU[2] | Riparian Herbland |
| NU | Riparian Shrubland |
| NU | Riparian Woodland |

[1] Originally referred to as Ponderosa pine Forest.

[2] NU = Not Used. 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.

Table 3.10—Landscape metrics used to assess broad-scale vegetation patterns.

| Metric[1] | Scale[2] | Description (units) |
|---|---|---|
| %LAND | Class | Percent of the landscape (%) |

| | | |
|---|---|---|
| CONTAG | Landscape | Contagion Index |
| PR | Landscape | Patch Richness (#) |
| SHDI | Landscape | Shannon's Diversity Index |
| SHEI | Landscape | Shannon's Evenness Index |
| SIDI | Landscape | Simpson's Diversity Index |
| SIEI | Landscape | Simpson's Evenness Index |
| ED | Class / Landscape | Edge Density (m/ha) |
| LPI | Class / Landscape | Largest Patch Index (%) |
| MPS | Class / Landscape | Mean Patch Size (ha) |
| NP | Class / Landscape | Number of patches (#) |

Adapted from McGarigal and Marks (1994).

[1] Metric: a means of measuring or specifying values of variability.

[2] Scale: Class indicates that metric is calculated for individual habitat types (that is, terrestrial community group); landscape indicates that metric is calculated for the landscape as a whole, regardless of habitat type; class/landscape indicates that metric is used for both class and landscape.

# APPENDIX 3-A

## Aggregation of Native (HRV[1]) and Current Potential Vegetation Types (PVTs) Into Potential Vegetation Groups (PVGs).

| Potential Vegetation Group | Native and Current Potential Vegetation Type |
|---|---|
| Agricultural | Dry Crop / Pasture Land[2] |
| | Irrigated Crop Land[2] |
| Alpine | Alpine Shrub-Herbaceous |
| Cold Forest | Mountain Hemlock East Cascades[5] |
| | Mountain Hemlock Inland[5] |
| | Mountain Hemlock / Red Fir[5] |
| | Spruce-Fir Dry with Aspen |
| | Spruce-Fir Dry without Aspen |
| | Spruce-Fir (LPP > WBP[3]) |
| | Spruce-Fir (WBP > LPP[4]) |
| | Whitebark Pine / Subalpine Larch North |
| | Whitebark Pine / Subalpine Larch South |
| Cool Shrub | Mountain Big Sagebrush-Mesic-East |
| | Mountain Big Sagebrush-Mesic-East with Conifer |
| | Mountain Big Sagebrush-Mesic-West |
| | Mountain Big Sagebrush Mesic West with Juniper |
| | Mountain Shrub |
| Dry Forest | Dry Douglas-fir with Ponderosa Pine |
| | Dry Douglas-fir without Ponderosa Pine |
| | Dry Grand Fir / White Fir |
| | Interior Ponderosa Pine |
| | Lodgepole Pine-Oregon |
| | Lodgepole Pine-Yellowstone |
| | Pacific Ponderosa Pine / Sierra Nevada Mixed-Conifer |
| Dry Grass | Fescue Grassland |
| | Fescue Grassland with Conifer |
| | Wheatgrass Grassland |

| Potential Vegetation Group | Native and Current Potential Vegetation Type |
|---|---|
| Dry Shrub | Antelope Bitterbrush |
| | Big Sagebrush |
| | Big Sagebrush-Cool |
| | Big Sagebrush-Warm |
| | Low Sagebrush-Mesic |
| | Low Sagebrush-Mesic with Juniper |
| | Low Sagebrush-Xeric |
| | Low Sagebrush-Xeric with Juniper |
| | Salt Desert Shrub |
| | Threetip Sagebrush |
| Moist Forest | Cedar / Hemlock East Cascades |
| | Cedar / Hemlock Inland |
| | Grand Fir / White Fir East Cascades |
| | Grand Fir / White Fir Inland |
| | Moist Douglas-fir |
| | Pacific Silver Fir |
| | Spruce-Fir Wet |
| Riparian Herb | Riparian Graminoid |
| | Riparian Sedge |
| Riparian Shrub | Mountain Riparian Low Shrub |
| | Saltbrush Riparian |
| | Willow / Sedge |
| Riparian Woodland | Aspen |
| | Cottonwood Riverine |
| Rock | Barren |
| Urban | Urban[2] |
| Water | Water |
| Woodland | Juniper |
| | Limber Pine |
| | Mountain Mahogany |
| | Mountain Mahogany with Big Sagebrush |
| | White Oak |

[1]Native and HRV are synonymous terms, defined in this chapter as the pre-Euro-American settlement regime.
[2]Indicates a PVT that did not exist in the native regime.
[3] Lodgepole pine more abundant than Whitebark pine.
[4] Whitebark pine more abundant than Lodgepole pine.
[5]Shifted from moist forest to cold forest in 2nd version of assessment PVGs.

# APPENDIX 3-B

## Aggregation of broad-scale terrestrial communities, cover types, and structural stages.

| Terrestrial Community | Cover Type | Structural Stage[1] |
|---|---|---|
| Agricultural | Cropland / Hay / Pasture | Closed Herbland[2] |
| | | Agricultural |
| Alpine | Alpine Tundra | Closed Low Shrub |
| | | Open Low Shrub |
| Early-seral Lower Montane Forest | Interior Ponderosa Pine | Stand Initiation Forest |
| | Pacific Ponderosa Pine | Stand Initiation Forest |
| Early-seral Montane Forest | Shrub or Herb / Tree Regen | Closed Herbland |
| | | Open Low Shrub |
| | | Closed Mid Shrub |
| | | Open Tall Shrub |
| | Pacific Silver Fir / Mountain Hemlock | Stand Initiation Forest |
| | Grand Fir / White Fir | Stand Initiation Forest |
| | Red Fir | Stand Initiation Forest |
| | Interior Douglas-fir | Stand Initiation Forest |
| | Western Larch | Stand Initiation Forest |
| | Western White Pine | Stand Initiation Forest |
| | Lodgepole Pine | Stand Initiation Forest |
| | Western Redcedar / Western Hemlock | Stand Initiation Forest |
| | Sierra Nevada Mixed-Conifer | Stand Initiation Forest |
| Early-seral Subalpine Forest | Whitebark Pine / Subalpine Larch | Stand Initiation Forest |
| | Mountain Hemlock | Stand Initiation Forest |
| | Engelmann Spruce / Subalpine Fir | Stand Initiation Forest |
| | Whitebark Pine | Stand Initiation Forest |
| Exotic Herbland | Exotic Forbs / Annual Grass | Open Herbland |
| | | Closed Herbland |
| Late-seral Lower Montane Multi-layer Forest | Interior Ponderosa Pine | Old Multi-strata Forest |
| | Pacific Ponderosa Pine | Old Multi-strata Forest |
| Late-seral Lower Montane Single-layer Forest | Interior Ponderosa Pine | Old Single-strata Forest |
| | Pacific Ponderosa Pine | Old Single-strata Forest |

| Terrestrial Community | Cover Type | Structural Stage[1] |
|---|---|---|
| Late-seral Montane Multi-layer Forest | Grand Fir / White Fir | Old Multi-strata Forest |
| | Interior Douglas-fir | Old Multi-strata Forest |
| | Western Larch | Old Multi-strata Forest |
| | Lodgepole Pine | Old Multi-strata Forest |
| | Western Redcedar / Western Hemlock | Old Multi-strata Forest |
| | Sierra Nevada Mixed-Conifer | Old Multi-strata Forest |
| | Pacific Silver Fir / Mountain Hemlock | Old Multi-strata Forest |
| | Red Fir | Old Multi-strata Forest |
| Late-seral Montane Single-layer Forest | Grand Fir / White Fir | Old Single-strata Forest |
| | Interior Douglas-fir | Old Single-strata Forest |
| | Western Larch | Old Single-strata Forest |
| | Western Larch | Old Single-strata Forest |
| | Lodgepole Pine | Old Single-strata Forest |
| | Western Redcedar / Western Hemlock | Old Single-strata Forest |
| | Sierra Nevada Mixed-Conifer | Old Single-strata Forest |
| Late-seral Subalpine Multi-layer Forest | Mountain Hemlock | Old Multi-strata Forest |
| | Whitebark Pine | Old Multi-strata Forest |
| | Whitebark Pine / Subalpine Larch | Old Multi-strata Forest |
| | Engelmann Spruce / Subalpine Fir | Old Multi-strata Forest |
| Late-seral Subalpine Single-layer Forest | Mountain Hemlock | Old Single-strata Forest |
| | Whitebark Pine | Old Single-strata Forest |
| Mid-seral Lower Montane Forest | Interior Ponderosa Pine | Stem Exclusion Open Canopy Forest |
| | | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Pacific Ponderosa Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| Mid-seral Montane Forest | Pacific Silver Fir / Mountain Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Grand Fir / White Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Red Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |

| Terrestrial Community | Cover Type | Structural Stage[1] |
|---|---|---|
| | Interior Douglas-fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Western Larch | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Western White Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Lodgepole Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Western Redcedar / Western Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Sierra Nevada Mixed-Conifer | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| Mid-seral Subalpine Forest | Whitebark Pine / Subalpine Larch | Stem Exclusion Open Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Mountain Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Engelmann Spruce / Subalpine Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| | Whitebark Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reintiation Forest |
| | | Young Multi-strata Forest |
| Riparian Herbland | Herbaceous Wetlands | Open Herbland |
| | | Closed Herbland |
| Riparian Shrubland | Shrub Wetlands | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | | Closed Mid Shrub |
| | | Closed Tall Shrub |
| Riparian Woodland | Aspen | Stand Initiation Forest |
| | | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |

| Terrestrial Community | Cover Type | Structural Stage[1] |
|---|---|---|
| | Cottonwood / Willow | Stand Initiation Forest |
| | | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | | Old Multi-strata Forest |
| Rock/Barren | Barren | Rock |
| Upland Herbland | Wheatgrass  Bunchgrass | Open Herbland |
| | | Closed Herbland |
| | Native Forb | Open Herbland |
| | | Closed Herbland |
| | Fescue Bunchgrass | Open Herbland |
| | | Closed Herbland |
| Upland Shrubland | Antelope Bitterbrush / Bluebunch Wheatgrass | Closed Low Shrub |
| | Mountain Mahogany | Closed Low Shrub |
| | | Open Mid Shrub |
| | Mountain Big Sagebrush | Closed Low Shrub |
| | | Open Mid Shrub |
| | | Closed Mid Shrub |
| | Low Sagebrush | Closed Low Shrub |
| | | Open Low Shrub |
| | Salt Desert Shrub | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | Chokecherry / Serviceberry / Rose | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | | Open Tall Shrub |
| | Big Sagebrush | Closed Herbland |
| | | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | | Closed Mid Shrub |
| Upland Woodland | Juniper Woodlands | Stand Initiation Woodland |
| | | Understory Reintiation Woodland |
| | | Young Multi-strata Woodland |
| | | Old Multi-strata Woodland |
| | | Old Single-strata Woodland |

| Terrestrial Community | Cover Type | Structural Stage[1] |
|---|---|---|
| | Mixed-Conifer Woodlands | Stand Initiation Woodland |
| | | Stem Exclusion Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | | Old Multi-strata Woodland |
| | Juniper / Sagebrush | Stand Initiation Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | | Old Single-strata Woodland |
| | Limber Pine | Stand Initiation Forest |
| | | Stem Exclusion Open Canopy Forest |
| | | Understory Reintiation Forest |
| | | Old Multi-strata Forest |
| | Oregon White Oak | Stand Initiation Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | | Old Multi-strata Woodland |
| | | Old Single-strata Woodland |
| Urban | Urban | Urban |
| Water | Water | Water |

[1]See appendix 3-G for description of structural stages.

[2]The crosswalk between structural stage, cover type, and terrestrial community is simplified in this appendix. For more detailed crosswalk see metadata, on file with: U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Bureau of Land Management; Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362.

# APPENDIX 3–C

## Cross tabulation of broad-scale physiognomic types, cover types, and structural stages.

| Physiognomic Type with Shade-Tolerance Modifer | Cover Type | Structural Stage[1] |
|---|---|---|
| Agricultural | Cropland / Hay / Pasture | Agricultural |
| | | Closed Herbland |
| Alpine | Alpine Tundra | Closed Low Shrub |
| | | Open Low Shrub |
| Early-seral Shade-intolerant Forest | Interior Ponderosa Pine | Stand Initiation Forest |
| | Lodgepole Pine | Stand Initiation Forest |
| | Pacific Ponderosa Pine | Stand Initiation Forest |
| | Shrub or Herb / Tree Regen | Closed Herbland |
| | | Closed Mid Shrub |
| | | Open Low Shrub |
| | | Open Tall Shrub |
| | Western Larch | Stand Initiation Forest |
| | Western White Pine | Stand Initiation Forest |
| | Whitebark Pine / Subalpine Larch | Stand Initiation Forest |
| | Whitebark Pine | Stand Initiation Forest |
| Early-seral Shade-tolerant Forest | Engelmann Spruce / Subalpine Fir | Stand Initiation Forest |
| | Grand Fir / White Fir | Stand Initiation Forest |
| | Interior Douglas-fir | Stand Initiation Forest |
| | Mountain Hemlock | Stand Initiation Forest |
| | Pacific Silver Fir / Mountain Hemlock | Stand Initiation Forest |
| | Red Fir | Stand Initiation Forest |
| | Sierra Nevada Mixed-Conifer | Stand Initiation Forest |
| | Western Redcedar / Western Hemlock | Stand Initiation Forest |
| Exotic Herbland | Exotic Forbs / Annual Grass | Closed Herbland |
| | | Open Herbland |
| Late-seral Shade-intolerant Multi-layer Forest | Interior Ponderosa Pine | Old Multi-strata Forest |
| | Lodgepole Pine | Old Multi-strata Forest |
| | Pacific Ponderosa Pine | Old Multi-strata Forest |
| | Western Larch | Old Multi-strata Forest |
| | Western White Pine | Old Multi-strata Forest |
| | Whitebark Pine / Subalpine Larch | Old Multi-strata Forest |
| | Whitebark Pine | Old Multi-strata Forest |

| Physiognomic Type with Shade-Tolerance Modifer | Cover Type | Structural Stage[1] |
|---|---|---|
| Late-seral Shade-intolerant Single-layer Forest | Interior Ponderosa Pine | Old Single-strata Forest |
| | Lodgepole Pine | Old Single-strata Forest |
| | Pacific Ponderosa Pine | Old Single-strata Forest |
| | Western Larch | Old Single-strata Forest |
| | Western White Pine | Old Single-strata Forest |
| | Whitebark Pine | Old Single-strata Forest |
| Late-seral Shade-tolerant Multi-layer Forest | Engelmann Spruce / Subalpine Fir | Old Multi-strata Forest |
| | Grand Fir / White Fir | Old Multi-strata Forest |
| | Interior Douglas-fir | Old Multi-strata Forest |
| | Mountain Hemlock | Old Multi-strata Forest |
| | Pacific Silver Fir / Mountain Hemlock | Old Multi-strata Forest |
| | Red Fir | Old Multi-strata Forest |
| | Sierra Nevada Mixed-Conifer | Old Multi-strata Forest |
| | Western Redcedar / Western Hemlock | Old Multi-strata Forest |
| Late-seral Shade-tolerant Single-layer Forest | Grand Fir / White Fir | Old Single-strata Forest |
| | Interior Douglas Fir | Old Single-strata Forest |
| | Mountain Hemlock | Old Single-strata Forest |
| | Sierra Nevada Mixed-Conifer | Old Single-strata Forest |
| | Western Redcedar / Western Hemlock | Old Single-strata Forest |
| Mid-seral Shade-intolerant Forest | Interior Ponderosa Pine | Stem Exclusion Closed Canopy Forest |
| | | Stem Exclusion Open Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Lodgepole Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Pacific Ponderosa Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Western Larch | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Western White Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Whitebark Pine / Subalpine Larch | Stem Exclusion Open Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Whitebark Pine | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |

| Physiognomic Type with Shade-Tolerance Modifer | Cover Type | Structural Stage[1] |
|---|---|---|
| Mid-seral Shade-tolerant Forest | Engelmann Spruce / Subalpine Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Grand Fir / White Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Interior Douglas-fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Mountain Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Pacific Silver Fir / Mountain Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Red Fir | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Sierra Nevada Mixed-Conifer | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Western Redcedar / Western Hemlock | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| Riparian Herbland | Herbaceous Wetlands | Closed Herbland |
| | | Open Herbland |
| Riparian Shrubland | Shrub Wetlands | Closed Low Shrub |
| | | Closed Mid Shrub |
| | | Closed Tall Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| Riparian Woodland | Aspen | Stand Initiation Forest |
| | | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |
| | Cottonwood / Willow | Old Multi-strata Forest |
| | | Stand Initiation Forest |
| | | Stem Exclusion Closed Canopy Forest |
| | | Understory Reinitiation Forest |
| | | Young Multi-strata Forest |

| Physiognomic Type with Shade-Tolerance Modifer | Cover Type | Structural Stage[1] |
|---|---|---|
| Rock / Barren | Barren | Rock |
| Upland Herbland | Wheatgrass Bunchgrass | Closed Herbland |
| | | Open Herbland |
| | Fescue-Bunchgrass | Closed Herbland |
| | | Open Herbland |
| | Native Forb | Closed Herbland |
| | | Open Herbland |
| Upland Shrubland | Antelope Bitterbrush / Bluebunch Wheatgrass Big Sagebrush | Closed Low Shrub |
| | | Closed Low Shrub |
| | | Closed Mid Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | Chokecherry / Serviceberry / Rose | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| | | Open Tall Shrub |
| | Low Sagebrush | Closed Low Shrub |
| | | Open Low Shrub |
| | Mountain Big Sagebrush | Closed Low Shrub |
| | | Closed Mid Shrub |
| | | Open Mid Shrub |
| | Mountain Mahogany | Closed Low Shrub |
| | | Open Mid Shrub |
| | Salt Desert Shrub | Closed Low Shrub |
| | | Open Low Shrub |
| | | Open Mid Shrub |
| Upland Woodland | Juniper / Sagebrush | Old Single-strata Woodland |
| | | Stand Initiation Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | Juniper Woodlands | Old Multi-strata Woodland |
| | | Old Single-strata Woodland |
| | | Stand Initiation Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | Limber Pine | Old Multi-strata Forest |
| | | Stand Initiation Forest |
| | | Stem Exclusion Open Canopy Forest |
| | | Understory Reinitiation Forest |

| Physiognomic Type with Shade-Tolerance Modifer | Cover Type | Structural Stage[1] |
|---|---|---|
| | Mixed-Conifer Woodlands | Old Multi-strata Woodland |
| | | Stand Initiation Woodland |
| | | Stem Exclusion Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| | Oregon White Oak | Old Multi-strata Woodland |
| | | Old Single-strata Woodland |
| | | Stand Initiation Woodland |
| | | Understory Reinitiation Woodland |
| | | Young Multi-strata Woodland |
| Urban | Urban | Urban |
| Water | Water | Water |

[1] The crosswalk between structural stage, cover type, and physiognomic type is simplified in this appendix. For more detailed crosswalk see metadata, on file with: U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Bureau of Land Management; Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362.

# APPENDIX 3-D

Physiognomic type is a plant community of vegetation sharing characteristics, features, or appearance. Four progressions of data reduction with respect to physiognomic types are outlined in this appendix; from left to right, the data groupings reduce from most simplistic to most complex. Each of these physiognomic type groupings were used in our analysis of the Basin and are applied in differing circumstances throughout the Landscape Dynamics chapter. Structural stage is also included in the table in order to provide pertinent information and clarification for the reader.

Table 3D-1—Physiognomic type reduction and corresponding structural stage.

| Physiognomic Group | Physiognomic Type Group | Physiognomic Type | Physiognomic Type with Shade-Tolerance Modifier | Structural Stage |
|---|---|---|---|---|
| Agriculture | Agriculture | Agricultural | Agricultural | Agricultural |
| | | | | Closed Herbland |
| NU[1] | Herbland | Alpine | Alpine | Closed Low Shrub |
| | | | | Open Low Shrub |
| Forest/Woodland Early-seral | Early-seral Forest | Early-seral Forest | Early-seral Shade-intolerant Forest | Closed Herbland |
| | | | | Closed Mid Shrub |
| | | | | Open Low Shrub |
| | | | | Open Tall Shrub |
| | | | | Stand Initiation Forest |
| Forest/Woodland Early-seral | Early-seral Forest | Early-seral Forest | Early-seral Shade-tolerant Forest | Stand Initiation Forest |
| | Exotics | Exotic Herbland | Exotic Herbland | Closed Herbland |
| | | | | Open Herbland |
| Forest/Woodland Late-seral Multi-layer | Late-seral Multi-layer Forest | Late-seral Multi-layer Forest | Late-seral Shade-intolerant Forest Multi-layer | Old Multi-strata Forest |
| Forest/Woodland Late-seral Single-layer | Late-seral Single-layer Forest | Late-seral Single-layer Forest | Late-seral Shade-intolerant Single-layer Forest | Old Single-strata Forest |
| Forest/Woodland Late-seral Multi-layer | Late-seral Multi-layer Forest | Late-seral Multi-layer Forest | Late-seral Shade-tolerant Multi-layer Forest | Old Multi-strata Forest |
| Forest/Woodland Late-seral Single-layer | Late-seral Single-layer Forest | Late-seral Single-layer Forest | Late-seral Shade-tolerant Single-layer Forest | Old Single-strata Forest |
| Forest/Woodland Mid-seral | Mid-seral Shade-intolerant Forest | Mid-seral Forest | Mid-seral Shade-intolerant Forest | Stem Exclusion Closed Canopy Forest |
| | | | | Stem Exclusion Open Canopy Forest |
| | | | | Understory Reinitiation Forest |
| | | | | Young Multi-strata Forest |

| Physiognomic Group | Physiognomic Type Group | Physiognomic Type | Physiognomic Type with Shade-Tolerance Modifier | Structural Stage |
|---|---|---|---|---|
| Forest/Woodland Mid-seral | Mid-seral Shade-tolerant Forest | Mid-seral Forest | Mid-seral Shade-tolerant Forest | Stem Exclusion Closed Canopy Forest<br>Understory Reinitiation Forest<br>Young Multi-strata Forest |
| Herbland | Herbland | Riparian Herbland | Riparian Herbland | Closed Herbland<br>Open Herbland |
| Low Shrub<br>Mid Shrub<br>Tall shrub | Shrubland | Riparian Shrubland | Riparian Shrubland | Closed Low Shrub<br>Closed Mid Shrub<br>Closed Tall Shrub<br>Open Low Shrub<br>Open Mid Shrub<br>Open Tall Shrub |
| Forest/Woodland Early-seral | Woodland | Early-seral Riparian Woodland | Riparian Woodland | Stand Initiation Forest |
| Forest/Woodland Late-seral | | Late-seral Riparian Woodland | | Understory Reinitiation Forest<br>Old Multi-strata Forest |
| Forest/Woodland Mid-seral | Woodland | Mid-seral Riparian Woodland | | Young Multi-strata Forest<br>Stem Exclusion Closed Canopy Forest |
| Rock | Rock | Rock / Barren | Rock / Barren | Rock |
| Herbland | Herbland | Upland Herbland | Upland Herbland | Closed Herbland |
| Low Shurb<br>Mid Shrub<br>Tall Shrub | Shrubland | Upland Shrubland | Upland Shrubland | Closed Low Shrub<br>Closed Mid Shrub<br>Closed Tall Shrub<br>Open Low Shrub<br>Open Mid Shrub<br>Open Tall Shrub |
| Forest/Woodland Early-seral | Woodland | Early-seral Woodland | Upland Woodland | Stand Initiation Forest<br>Stand Initiation Woodland |
| Forest/Woodland Late-seral | | Late-seral Woodland | | Old Multi-strata Forest<br>Old Multi-strata Woodland<br>Old Single-strata Woodland<br>Understory Reinitiation Forest<br>Understory Reinitiation Woodland |
| Forest/Woodland Mid-seral | | Mid-seral Woodland | | Young Multi-strata Woodland<br>Stem Exclusion Open Canopy Forest<br>Stem Exclusion Woodland |
| Urban | Urban | Urban | Urban | Urban |
| Water | Water | Water | Water | Water |

[1]NU = Not Used, there was no change from the historical to the current period so category was not used in this data set.

# APPENDIX 3-E

## Broad-scale cover types

| Cover Type | Description |
|---|---|
| Alpine Tundra | *Phyllodoce* spp. (low shrubs) |
| Aspen | *Populus tremuloides* |
| Barren | Rock / Barrenlands |
| Big Sagebrush | *Artemisia tridentata wyomingensis*<br>*Artemisia tridentata tridentata / Elymus cinereus*<br>*Artemisia tripartita / Agropyron cristatum*<br>*Artemisia tripartita /* Exotic Herbs<br>*Artemisia tridentata tridentata / Agropyron* spp.<br>*Artemisia tridentata tridentata / Bromus tectorum*<br>*Artemisia* spp. / *Bromus tectorum*<br>*Artemisia tripartita* |
| Bitterbrush / Bluebunch Wheatgrass | *Purshia tridentata* / *Bromus tectorum*<br>*Purshia tridentata* / *Agropyron spicatum* |
| Chokecherry / Serviceberry / Rose | *Prunus virginiana / Amelanchier alnifolia / Rosa* spp. |
| Cottonwood / Willow | *Populus trichocarpa* / *Salix* spp.<br>*Populus* spp. / *Cornus* spp.<br>*Populus* spp. / *Poa pratensis* |
| Cropland / Hay / Pasture | Dryland Crop<br>Dryland Pasture / Hayland<br>Irrigated Crop<br>Irrigated Pasture / Hayland |
| Engelmann Spruce / Subalpine Fir | *Picea engelmannii* / *Abies lasiocarpa* |
| Exotic Forbs / Annual Grass | Exotic Forbs<br>Exotic Grass (*Bromus tectorum / Taeniatherum caput-medusae / Poa secunda*)<br>Exotic Herbaceous<br>Exotic Herbs<br>Exotic Perennial Grass |

| Cover Type | Description |
| --- | --- |
| Fescue-Bunchgrass | *Festuca idahoensis* / *Agropyron* spp.<br>Low Productivity Perennial Grass<br>Perennial Native Bunchgrass<br>Perennial Native Herbaceous<br>Seeded Native Grass (*Agropyron spicatum / Festuca idahoensis*)<br>Seeded Native Grass (*Poa secunda / Agropyron spicatum*)<br>Small Perennial Grass |
| Grand Fir / White Fir | *Abies grandis / Abies concolor* |
| Herbaceous Wetlands | *Carex nebraskensis*<br>*Carex rostrata / Carex aquatilis*<br>Grass / *Carex* spp.<br>*Elymus* spp. |
| Interior Douglas-fir | *Pseudotsuga menziesii* var. *glauca*<br>*Pseudotsuga menziesii / Abies grandis* / Exotic Herbs<br>*Pseudotsuga menziesii / Abies grandis* / *Populus* spp. / Shrub |
| Interior Ponderosa Pine | *Pinus ponderosa* var. *scopulorum*<br>*Pinus* spp. / *Populus* spp. / Exotic Herbs<br>*Pinus* spp. / *Populus* spp. / Shrub |
| Juniper / Sagebrush | *Juniperus* spp. / *Artemisia arbuscula* / *Festuca idahoensis* / Forb<br>*Juniperus* spp. / *Artemisia* spp. / *Agropyron* spp. |
| Juniper Woodlands | *Juniperus* spp. / Exotic Herbs<br>*Juniperus* spp. / *Artemisia arbuscula* / Shortgrass<br>*Juniperus* spp. Forest / Exotic Herbs<br>*Juniperus* spp. Woodlands<br>*Juniperus* spp. / Native Bunchgrass<br>*Juniperus* spp. / *Poa secunda* |
| Limber Pine | *Pinus flexilis* |
| Lodgepole Pine | *Pinus contorta* |
| Low Sagebrush | *Artemisia arbuscula* / Native Forbs<br>*Artemisia arbuscula* / *Bromus tectorum*<br>*Artemisia arbuscula* / Native Bunchgrass<br>*Artemisia* spp. / *Poa secunda* |

| Cover Type | Description |
|---|---|
| Mixed-Conifer Woodlands | Conifer / Exotic Herbs |
| | Conifer Encroachment / Exotic Grass |
| | Conifer Encroachment / *Artemisia* spp. / Perennial Grass |
| | Conifer / Perennial Grass |
| Mountain Big Sagebrush | *Artemisia tridentata vaseyana* / Perennial Grass |
| | *Artemisia tridentata vaseyana* / Exotic Herbs |
| | *Artemisia tridentata vaseyana* / Perennial Herbs |
| Mountain Hemlock | *Tsuga mertensiana* |
| Mountain Mahogany | *Cercocarpus* spp. |
| Native Forb | *Deschampsia* spp. / *Calamagrostis* spp. |
| | Exotic Moist Herbs |
| | Exotic Riparian Herbs |
| | Native Forbs |
| | Pioneer Forbs |
| Oregon White Oak | *Quercus alba* / Exotic Herbs |
| | *Quercus alba* / Shrub |
| Pacific Ponderosa Pine | *Pinus ponderosa* var. *ponderosa* |
| Pacific Silver Fir / Mountain Hemlock | *Abies amabilis* / *Tsuga mertensiana* |
| Red Fir | *Abies magnifica* var. *shastensis* |
| Salt Desert Shrub | *Sarcobatus vermiculatus* |
| | *Sarcobatus vermiculatus / Distichlis stricta* |
| | Salt Desert Shrub[1] |
| Shrub or Herb / Tree Regen | General Shrub |
| | Grass / Forb |
| | Mid Shrub West Cascades |
| | Mountain Shrub - No other |
| | Mountain Shrub / *Ceanothus* spp. |
| | Shrub / Regen |
| Shrub Wetlands | *Cornus* spp. / *Crataegus* spp. |
| | Gravel Bar |
| | *Salix* spp. low / *Carex* spp. |
| | *Salix* spp. low / Grass |
| | *Salix* spp. / *Calamagrostis* spp. |
| | *Salix* spp. / *Carex* spp. / *Castor canadensis* |
| | *Salix* spp. / *Poa pratensis* |
| | *Sarcobatus vermiculatus* |

| Cover Type | Description |
|---|---|
| Sierra Nevada Mixed-Conifer | Sierra Nevada Mixed-Conifer |
| Urban | Urban Land |
| Water | Water |
| Western Larch | *Larix occidentalis* |
| Western Redcedar / Western Hemlock | *Thuja plicata* / *Tsuga heterophylla* |
| Western White Pine | *Pinus monticola* |
| Wheatgrass Bunchgrass | *Agropyron cristatum* |
| | *Agropyron cristatum* / *Bromus tectorum* |
| | *Agropyron spicatum* |
| | *Agropyron* spp. / *Poa secunda* |
| | *Aristida longiseta* |
| | *Bromus tectorum* |
| | *Elymus cinereus* |
| | *Elymus cinereus* / *Agropyron* |
| | *Elymus cinereus* / *Bromus tectorum* |
| | Exotic Annual Grass |
| | Fire Maintained Grass (*Poa secunda / Agropyron spicatum*) secunda/AgroSP)[1]pyron |
| | Native Perennial Grass |
| | Perennial Herbs |
| | *Poa secunda / Festuca octoflora* |
| | *Poa pratensis* |
| | *Poa secunda* |
| | *Poa secunda* / Perennial Forbs |
| | Seeded Exotic *Agropyron* spp. |
| | *Sitanion hystrix* |
| Whitebark Pine / Subalpine Larch | *Pinus albicaulis / Larix lyallii* |
| | *Pinus albicaulis / Larix lyallii / Abies lasiocarpa* |
| Whitebark Pine | *Pinus albicaulis* |

[1] Four representative plants in the Salt Desert Shrub type found within the Basin are *Eurotia lanata* (winterfat), *Atriplex confertifolia* (shadscale), *Elymus cinereus* (Great Basin wildrye), and *Grayia spinosa* (spiny hopsage).

# APPENDIX 3-F

## Historical potential vegetation types, associated cover types, and structural stages.

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Historical Wheatgrass Grassland | Wheatgrass Bunchgrass | CHERB |
| | Native Forbs | OHERB |
| Historical Antelope Bitterbrush | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Bitterbrush / Bluebunch Wheatgrass | CLSHR |
| Historical Big Sagebrush | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | CLSHR |
| Historical Low Sagebrush - Mesic | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Historical Low Sagebrush - Mesic with Juniper | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Juniper / Sagebrush | OSS_W |
| | | SI_W |
| | | UR_W |
| | | YMS_W |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Historical Low Sagebrush - Xeric | Wheatgrass Bunchgrass | OHERB |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Historical Low Sagebrush - Xeric with Juniper | Wheatgrass Bunchgrass | OHERB |
| | Juniper Woodlands | OMS_W |
| | | SI_W |
| | | YMS_W |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Historical Big Sagebrush - Warm | Wheatgrass Bunchgrass | CHERB |
| | Big Sagebrush | OLSHR |
| | Low Sagebrush | OLSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Historical Big Sagebrush - Cool | Wheatgrass Bunchgrass | CHERB |
| | Big Sagebrush | OLSHR |
| | Low Sagebrush | OLSHR |
| Historical Cottonwood Riverine | Cottonwood / Willow | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | UR_F |
| | Shrub Wetlands | CMSHR |
| | | OMSHR |
| Historical Fescue Grassland | Fescue-Bunchgrass | CHERB |
| | | OHERB |
| | Native Forbs | CHERB |
| Historical Mountain Big Sagebrush - Mesic / East | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | OHERB |
| | Mountain Big Sagebrush | CMSHR |
| Historical Mountain Big Sagebrush - Mesic / East with Juniper | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | OHERB |
| | Mixed Conifer Woodlands | SI_W |
| | | UR_W |
| | Mountain Big Sagebrush | CMSHR |
| Historical Mountain Big Sagebrush - Mesic / West | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | CHERB |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Historical Mountain Big Sagebrush - Mesic / West with Juniper | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | CHERB |
| | Juniper / Sagebrush | OSS_W |
| | | SI_W |
| | | UR_W |
| | | YMS_W |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Historical Salt Desert Shrub | Wheatgrass Bunchgrass | OHERB |
| | Salt Desert Shrub | CLSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
| --- | --- | --- |
| Historical Threetipp Sagebrush | Wheatgrass Bunchgrass | OHERB |
| | Big Sagebrush | CHERB |
| | | CLSHR |
| Historical Willow / Sedge | Herbaceous Wetlands | OHERB |
| | Shrub Wetlands | CTSHR |
| Historical Aspen | Aspen | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Fescue-Bunchgrass | CHERB |
| | Shrub or Herb / Tree Regen[2] | CMSHR |
| Historical Mountain Mahogany | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | OHERB |
| | Mountain Mahogany | CLSHR |
| | | OMSHR |
| Historical Mountain Mahogany with Big Sagebrush | Wheatgrass Bunchgrass | OHERB |
| | Fescue-Bunchgrass | OHERB |
| | Mountain Big Sagebrush | CLSHR |
| | Mountain Mahogany | CLSHR |
| | | OMSHR |
| Historical Mountain Shrub | Chokecherry / Serviceberry / Rose | CLSHR |
| | | OLSHR |
| | | OMSHR |
| | | OTSHR |
| | Fescue-Bunchgrass | CHERB |
| Historical Riparian Graminoid - | Native Forbs | CHERB |
| Historical Saltbrush Riparian | Herbaceous Wetlands | CHERB |
| | Salt Desert Shrub | OMSHR |
| | Shrub Wetlands | OLSHR |
| Historical Riparian Sedge | Herbaceous Wetlands | CHERB |
| Historical Mountain Riparian Low Shrub | Herbaceous Wetlands | CHERB |
| | Shrub Wetlands | CLSHR |
| Historical Fescue Grassland with Conifer | Fescue-Bunchgrass | CHERB |
| | Mixed-Conifer Woodlands | OMS_W |
| | | SE_W |
| | | SI_W |
| | | YMS_W |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Historical Juniper | Fescue-Bunchgrass | CHERB |
| | | OHERB |
| | Juniper Woodlands | OMS_W |
| | | OSS_W |
| | | SI_W |
| | | UR_W |
| | | YMS_W |
| Historical Alpine Shrub - Herbaceous | Alpine Tundra | CLSHR |
| | | OLSHR |
| Cedar / Hemlock - Eastern Cascades | Grand Fir / White Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western Redcedar / Western Hemlock | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Cedar / Hemlock - Inland | Grand Fir / White Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western Redcedar / Western Hemlock | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| Dry Douglas-fir / without Ponderosa Pine | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Big Sagebrush | CMSHR |
| | Shrub or Herb / Tree Regen | CHERB |
| | | CMSHR |
| | | OLSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Dry Douglas-fir / with Ponderosa Pine | Fescue-Bunchgrass | OHERB |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CHERB |
| | | CMSHR |
| Dry Grand Fir / White Fir | Grand Fir / White Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| Limber Pine | Limber Pine | OMS_F |
| | | SEO_F |
| | | SI_F |
| | | UR_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| Lodgepole Pine - Yellowstone | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Lodgepole Pine - Oregon | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| Moist Douglas-fir | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Interior Ponderosa Pine | | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| | Western Larch | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Grand Fir / White Fir - Eastern Cascades | Grand Fir / White Fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Grand Fir / White Fir - Inland | Grand Fir / White Fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Mountain Hemlock - Eastern Cascades | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Hemlock | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | MS_F |
| | Shrub or Herb / Tree Regen | OTSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Mountain Hemlock - Inland | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Hemlock | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | OTSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Interior Ponderosa Pine | Exotic Forbs / Annual Grass | CHERB |
| | Fescue - Bunchgrass | CHERB |
| | Interior Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | SEO_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Big Sagebrush | OMSHR |
| | Shrub or Herb / Tree Regen | OLSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Pacific Ponderosa Pine / Mixed-Conifer | Pacific Ponderosa Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | OLSHR |
| | Sierra Nevada Mixed-Conifer | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Mountain Hemlock / Shasta Fir | Grand Fir / White Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Hemlock | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Red Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | OTSHR |
| | Western White Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Pacific Silver Fir | Engelmann Spruce / Subalpine Fir | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Mountain Hemlock | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | Pacific Silver Fir / Mountain Hemlock | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western Redcedar / Western Hemlock | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Spruce / Fir - Dry with Aspen | Aspen | SEC_F |
| | | SI_F |
| | | UR_F |
| | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| Spruce / Fir - Dry without Aspen | Aspen | SEC_F |
| | | SI_F |
| | | UR_F |
| | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| Spruce / Fir - Wet | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Interior Douglas-fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | Shrub or Herb / Tree Regen | OLSHR |
| | Western Larch | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Western White Pine | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Spruce / Fir (WBP>LPP[3]) | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| | Whitebark Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Spruce / Fir (LPP>WBP[4]) | Engelmann Spruce / Subalpine Fir | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Lodgepole Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Shrub or Herb / Tree Regen | CMSHR |
| | Whitebark Pine | OMS_F |
| | | OSS_F |
| | | SEC_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| Whitebark Pine / Subalpine Larch - North | Shrub or Herb / Tree Regen | CMSHR |
| | Whitebark Pine / Subalpine Larch | OMS_F |
| | | SEO_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Whitebark Pine | OSS_F |
| Whitebark Pine /Subalpine Larch - South | Shrub or Herb / Tree Regen | CMSHR |
| | Whitebark Pine / Subalpine Larch | OMS_F |
| | | SEO_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Whitebark Pine | OSS_F |
| White Oak | Wheatgrass Bunchgrass | OHERB |
| | Oregon White Oak | OMS_W |
| | | OSS_W |
| | | SI_W |
| | | UR_W |
| | | YMS_W |
| | Shrub or Herb / Tree Regen | CMSHR |
| Wheatgrass Grassland | Wheatgrass Bunchgrass | CHERB |
| | Exotic Forbs / Annual Grass | CHERB |
| | | OHERB |
| | Fescue-Bunchgrass | CHERB |
| | Native Forbs | OHERB |
| Antelope Bitterbrush | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Antelope Bitterbrush / Bluebunch Wheatgrass | CLSHR |
| Big Sagebrush Grassland | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | CLSHR |
| Low Sagebrush - Mesic | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | OHERB |
| | Low Sagebrush | CLSHR |
| | | OLSHR |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Low Sagebrush - Mesic with Juniper | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | OHERB |
| | Juniper / Sagebrush | OSS_W |
| | | SI_W |
| | | UR_W |
| | Juniper Woodlands | OMS_W |
| | | UR_W |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Low Sagebrush - Xeric | Wheatgrass Bunchgrass | OHERB |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Low Sagebrush - Xeric with Juniper | Wheatgrass Bunchgrass | OHERB |
| | Juniper Woodlands | OMS_W |
| | | SI_W |
| | | YMS_W |
| | Low Sagebrush | CLSHR |
| | | OLSHR |
| Big Sagebrush - Warm | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | OLSHR |
| | Exotic Forbs / Annual Grass | CHERB |
| | Fescue - Bunchgrass | CHERB |
| | Low Sagebrush | OLSHR |
| Big Sagebrush - Cool | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | OLSHR |
| | Exotic Forbs / Annual Grass | CHERB |
| | Fescue - Bunchgrass | CHERB |
| | Low Sagebrush | OLSHR |
| Cottonwood Riverine | Cottonwood / Willow | OMS_F |
| | | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Exotic Forbs / Annual Grass | CHERB |
| | Interior Douglas-fir | OMS_F |
| | | YMS_F |
| | Interior Ponderosa Pine | OMS_F |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | | OSS_F |
| | | UR_F |
| | Shrub Wetlands | CMSHR |
| | | OMSHR |
| Fescue Grassland | Wheatgrass Bunchgrass | OHERB |
| | Cropland / Hay / Pasture | CHERB |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | CHERB |
| | | OHERB |
| | Native Forbs | CHERB |
| Mountain Big Sagebrush - Mesic / East | Wheatgrass Bunchgrass | OHERB |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue-Bunchgrass | OHERB |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Mountain Big Sagebrush - Mesic / East with Conifer | Wheatgrass Bunchgrass | OHERB |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | OHERB |
| | Mixed-Conifer Woodlands | SI_W |
| | | UR_W |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Mountain Big Sagebrush - Mesic / West | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | CMSHR |
| | | OMSHR |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | CHERB |
| | | OHERB |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Mountain Big Sagebrush - Mesic / West with Juniper | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Big Sagebrush | CMSHR |
| | | OMSHR |
| | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | CHERB |
| | | OHERB |
| | Juniper / Sagebrush | OSS_W |
| | | SI_W |
| | | UR_W |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| | Juniper Woodlands | OMS_W |
| | | YMS_W |
| | Mountain Big Sagebrush | CMSHR |
| | | OMSHR |
| Salt Desert Shrub | Wheatgrass Bunchgrass | CHERB |
| | | OHERB |
| | Salt Desert Shrub | CLSHR |
| | | OLSHR |
| Three Tipp Sagebrush | Wheatgrass Bunchgrass | OHERB |
| | Big Sagebrush | CHERB |
| | | CLSHR |
| | | OLSHR |
| | Exotic Forbs / Annual Grass | OHERB |
| Willow / Sedge | Exotic Forbs / Annual Grass | OHERB |
| | Herbaceous Wetlands | OHERB |
| | Shrub Wetlands | CTSHR |
| Aspen | Aspen | SEC_F |
| | | SI_F |
| | | UR_F |
| | | YMS_F |
| | Exotic Forbs / Annual Grass | CHERB |
| | Fescue - Bunchgrass | CHERB |
| | Shrub or Herb / Tree Regen | CMSHR |
| Mountain Mahogany | Wheatgrass Bunchgrass | OHERB |
| | Fescue - Bunchgrass | OHERB |
| | Mountain Mahogany | CLSHR |
| | | OMSHR |
| Mountain Mahogany with Big Sagebrush | Wheatgrass Bunchgrass | OHERB |
| | Fescue - Bunchgrass | OHERB |
| | Mountain Big Sagebrush | CLSHR |
| | Mountain Mahogany | CLSHR |
| | | OMSHR |
| Mountain Shrub | Chokecherry / Serviceberry / Rose | CLSHR |
| | | OLSHR |
| | | OMSHR |
| | | OTSHR |
| | Fescue - Bunchgrass | CHERB |
| Riparian Graminoid | Native Forbs | CHERB |

| Potential Vegetation Type | Cover Type | Structural Stage[1] |
|---|---|---|
| Saltbrush Riparian | Herbaceous Wetlands | CHERB |
| | Salt Desert Shrub | OMSHR |
| | Shrub Wetlands | OLSHR |
| Riparian Sedge | Herbaceous Wetlands | CHERB |
| Mountain Riparian Low Shrub | Wheatgrass Bunchgrass | CHERB |
| | Herbaceous Wetlands | CHERB |
| | Shrub Wetlands | CLSHR |
| Fescue Grassland with Conifer | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | CHERB |
| | Mixed Conifer Woodlands | OMS_W |
| | | SE_W |
| | | SI_W |
| | | YMS_W |
| Juniper | Exotic Forbs / Annual Grass | OHERB |
| | Fescue - Bunchgrass | CHERB |
| | | OHERB |
| | Juniper Woodlands | OMS_W |
| | | OSS_W |
| | | SI_W |
| | | UR_W |
| | | YMS_W |
| Alpine Shrub - Herbaceous | Alpine Tundra | CLSHR |
| | | OLSHR |
| Irrigated Crop Land | Cropland / Hay / Pasture | CHERB |
| | | CROP |
| | Fescue - Bunchgrass | CHERB |
| | | OHERB |
| | Urban | URBAN |
| Dry Crop / Pasture Land | Cropland / Hay / Pasture | CHERB |
| | | CROP |
| | Fescue - Bunchgrass | CHERB |
| | Urban | URBAN |
| Urban | Urban | URBAN |
| Water | Water | WATER |
| Barren | Barren | ROCK |

[1]See appendix 3-G for description of structural stages:

| Structural Stage | Abbreviation |
|---|---|
| Stand Initiation Forest | SI_F |
| Stem Exclusion Open Canopy Forest | SEO_F |
| Stem Exclusion Closed Canopy Forest | SEC_F |
| Understory Reinitiation Forest | UR_F |
| Young Multi-strata Forest | YMS_F |
| Old Multi-strata Forest | OMS_F |
| Old Single-strata Forest | OSS_F |
| Stand Initiation Woodland | SI_W |
| Stem Exclusion Woodland | SE_W |
| Understory Reinitiation Woodland | UR_W |
| Young Multi-strata Woodland | YMS_W |
| Old Multi-strata Woodland | OMS_W |
| Old Single-strata Woodland | OSS_W |
| Open Herbland | OHERB |
| Closed Herbland | CHERB |
| Closed Low Shrub | CLSHR |
| Open Low Shrub | OLSHR |
| Open Mid Shrub | OMSHR |
| Closed Mid Shrub | CMSHR |
| Open Tall Shrub | OTSHR |
| Closed Tall Shrub | CTSHR |
| Agricultural | CROP |
| Urban | URBAN |
| Water | WATER |
| Rock | ROCK |

[2]Regeneration (renewal or restoration of structures).
[3]Whitebark pine more abundant than Lodgepole pine.
[4]Lodgepole pine more abundant than Whitebark pine.

# APPENDIX 3-G

## Structural stages and description.

| Structural Stage | Description[1] |
|---|---|
| Forest | |
| Stand Initiation | LgT_cc < 30 % (for example, = 0, 10, or 20%) and SS_cc ≥ 10 % and [(PT_cc + SmT_cc + MedT_cc < 20%) or (PT_cc + SmT_cc + MedT_cc ≤ 60% and PT_cc + SmT_cc + MedT_cc ≥ 20% and SmT_cc + MedT_cc < 10%)]. |
| Stem Exclusion Open Canopy | LgT_cc < 30 % (for example, = 0, 10, or 20%) and SS_cc < 10 % and PT_cc + SmT_cc + MedT_cc ≤ 70 %. |
| Stem Exclusion Closed Canopy | LgT_cc < 30 % (for example, = 0, 10, or 20%) and SS_cc < 10 % and PT_cc + SmT_cc + MedT_cc > 70 %. |
| Understory Reinitiation | LgT_cc < 30 % (for example, = 0, 10, or 20%) and SS_cc ≥ 10 % and PT_cc + SmT_cc + MedT_cc > 60 %. |
| Young Multi-Story | LgT_cc < 30 % (for example, = 0, 10, or 20%) and SS_cc ≥ 10 % and PT_cc + SmT_cc + MedT_cc ≤ 60 % and SmT_cc ≥ 10% or MedT_cc ≥ 10 %. |
| Old Multi-Story | LgT_cc ≥ 30 % and SS_cc + PT_cc + SmT_cc + MedT_cc > 20 % |
| Old Single-Story | LgT_cc ≥ 30 % and SS_cc + PT_cc + SmT_cc + MedT_cc ≤ 20 %. |
| Woodland | |
| Stand Initiation | PT_cc + SmT_cc + MedT_cc + LgT_cc < 10% and SS_cc ≥ 10%. |
| Stem Exclusion | LgT_cc < 10% and PT_cc + SmT_cc + MedT_cc ≥ 10% and SS_cc < 10%. |
| Understory Reinitiation | LgT_cc < 10% and PT_cc + SmT_cc + MedT_cc ≥ 10% and SS_cc ≥ 10%. |
| Young Multi-story | LgT_cc < 10%, and SmT_cc + MedT_cc ≥ 10%, and PT_cc ≥ 10%, and SS_cc ≥ 10%. |
| Old Multi-story | LgT_cc ≥ 10%, and SS_cc + PT_cc + SmT_cc + MedT_cc ≥ 10%. |
| Old Single-story | LgT_cc ≥ 10%, and SS_cc + PT_cc + SmT_cc + MedT_cc < 10%. |
| Non-Forest / Non-Woodland | |
| Open Herbland | a canopy of herbaceous vegetation with < 66% projected canopy cover; < 10 % cover each of shrubs or trees; ≥ 1 stratum. |
| Closed Herbland | a canopy of herbaceous vegetation with ≥ 66% projected canopy cover; < 10 % cover each of shrubs or trees; ≥ 1 stratum. |
| Closed Low Shrub | a canopy of low (<50 cm) shrubs with < 66% projected canopy cover; shrubs dominate; tree cover < 10%; ≥ 2 strata, ≥ 2 cohorts possible. |
| Open Low Shrub | a canopy of low (<50.8 cm) shrubs with ≥ 66% projected crown cover; shrubs dominate; tree cover < 10%; ≥ 2 strata, ≥ 2 cohorts possible. |

| Structural Stage | Description[1] |
|---|---|
| Open Mid Shrub | a canopy of medium-sized (50 cm - 2 m) shrubs with < 66% projected canopy cover; shrubs dominate; tree cover < 10%; ≥ 2 strata, ≥ 2 cohorts possible. |
| Closed Mid Shrub | a canopy of medium-sized (50 cm - 2 m) shrubs with ≥ 66% projected crown cover; shrubs dominate; tree cover < 10%; ≥ 2 strata, ≥ 2 cohorts possible. |
| Open Tall Shrub | a canopy of herbaceous vegetation with ≥ 66% projected canopy cover; < 10 % cover each of shrubs or trees; ≥ 1 stratum. |
| Closed Tall Shrub | a canopy of tall (2 - 5 m) shrubs with ≥ 66% projected crown cover; shrubs dominate; tree cover < 10%; ≥ 2 strata, ≥ 2 cohorts possible. |
| Agricultural | dominated by crop and pasture land use. |
| Urban | dominated by rural and urban buildings and facilities. |
| Water | large bodies of water. |
| Rock | large areas of rock with < 5% vegetative canopy cover. |

[1]Structural stage descriptions include the following abbreviations:

tree size class: SS - seedlings and saplings [<12.6 cm diameter at breast height (dbh)]; PT - pole trees (12.7 - 22.6 cm dbh); SmT - small trees (22.7 - 40.4 cm dbh); MedT - medium trees (40.5 - 53.1 cm dbh); LgT - large trees (> 53.2 cm dbh).

cc - crown cover; crown cover was interpreted in 10% increments and class % ages were expressed as midpoints, for example, 10% = 5 to 14%, and 20% = 15 to 24%.

Quigley, Thomas M.; Lee, Kristine M.; Arbelbide, Sylvia J., tech.eds. 1997. Evaluation of the Environmental Impact Statement Alternatives by the Science Integration Team. 2 Vols. Gen Tech. Rep. PNW-GTR-406. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 1092 p.

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# CHAPTER 2
# Landscape Ecology Evaluation of the Preliminary Draft EIS Alternatives

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## Simulation Strategies Used for Evaluation of Alternatives

The basic platform we used for simulating the vegetation composition and structure and its associated disturbance for the preliminary draft EIS alternatives was a spatial and temporal model called the Columbia River Basin SUccession Model (CRBSUM) (Keane 1996), along with the Columbia River Basin Landscape Analysis Data Base System (CRBLAD) (Gravenmier and others, in press) and other associated models and data (Hann and others 1997). CRBSUM predicts disturbance dynamics and vegetation response through time at a landscape level. Differences in alternatives were simulated by using various combinations of types, rates, and spatial allocations to subbasin clusters, of disturbances. The data system, called CRBLAD, predicts many other attributes that aid in landscape, aquatic, terrestrial, social, and economic assessment.

Management disturbances assessed included livestock grazing, timber harvest and thinning, range improvements, prescribed fire, and fire suppression emphasis; other disturbances included wildfire, insect and disease mortality, and drought. The simulations of the various alternatives showed how different types of disturbance interact to produce various temporal and spatial mixes of vegetation types and associated attributes. The response for a given spatial location varied depending on the current and potential vegetation types, the type of management assigned to the area in the alternative, and the kinds of disturbances projected in the simulation period.

## Prescription Models

The types and rates of disturbances varied among the different potential vegetation types and prescription models (Hann and others, in press; Long and others 1996). While each prescription represented a specific type of management, they generally fell into one of five broad categories of management:

- Traditional management of vegetation for production of commodities using traditional treatments and suppression of wildfires.
- No management of vegetation in reserves (road-less areas), and suppression of wildfires

within the National and Regional Interagency fire policy requirement.

- Traditional protection for visual quality or habitat objectives and suppression of wildfires while producing minimal commodities.
- Ecological approach to conserving a balance of ecosystem integrity and native diversity while meeting human resource objectives, and integrating wildfire management with prescribed fire management in roaded areas.
- Ecological approach to restoration of landscapes to achieve a balance between ecosystem integrity and native diversity while meeting human resource objectives, and integrating wildfire management with prescribed fire management in roadless areas.

There were 18 prescriptions: the historical regime and 17 simulations representing various types of management (table 2.4). The historical regime was simulated once for a 100-year period and a second time for a 400-year period. These simulations used the historical (circa 1850s) map as a starting input layer and modeled a 100-year historical range of variability (HRV) and a 400-year HRV.[1]

The management regimes were simulated for a 100-year period from current. All prescriptions were simulated for all lands in the Basin and data were stored in a prescription database (Hann and others, in press; Hann and others 1997).

Each prescription had a different response used to simulate the application of management activities and associated effects. The historical prescription set was used to define the historical range of variability (HRV) for the Basin, and also for each EIS area, management class, potential vegetation group (PVG), and subbasin. The historical prescription set was not appropriate for current management due either to differences in objectives and current conditions, or to a change in the response of the potential vegetation (Hann and others, in press).

The general characteristics of the 17 management prescriptions are described in tables 2.5 and 2.6. General responses of all 18 prescriptions are documented by Hann and others (in press) and Long and others (1996). Documentation of the detailed model probability and associated response data is provided in the landscape assessment data record (Hann and others 1997). Levels of disturbance were identified by management prescription type in relation to management emphasis: conserve, restore, restore-produce, conserve-produce, restore-conserve, or produce (table 2.6). These categories correspond with emphasis categories in the alternatives of the preliminary draft EISs. Also identified for simulation purposes were relative rankings of fine-scale attributes associated with the prescription (table 2.7). These attributes had substantial fine- and mid-scale differences within a broad-scale disturbance or vegetation type. In the assessment of current and historical conditions, for example, there were substantial differences within a given broad-scale type in:

- Composition and structure of such components as vegetation species and density; snags; down wood; and bare soil.
- Disturbances, such as: fire behavior, grazing effects, insect/disease mortality; and their patterns including patch size and shape, and position relative to biophysical relationships.

In general, these differences were correlated with:

- Roaded areas disturbed by management activities.
- Roadless areas substantially affected by fire exclusion.
- Roadless areas with minimal or no effect by fire exclusion.

We used the response differences between management prescriptions to characterize disturbance probabilities and associated response. Our interpretations of the broad-, mid-, and fine-scale data were done, either quantitatively or qualitatively, based on our hierarchical knowledge of the broad-scale patterns of vegetation and disturbance type and its associated composition, structure, or landscape patterns at mid- and fine-scales.

## Alternative Emphasis and Prescription Assignments

Management classes represented areas of different ownership and management emphasis within an EIS area. The BLM- and FS-administered lands included the following five management classes :

- Roadless, natural process dominated areas (wilderness and wilderness-like).
- Roadless, human/natural process dominated areas (typically visually sensitive or semi-primitive areas).
- Roadless, human process dominated areas (typically roadless areas managed for commodities or dispersed recreation or visuals).
- Roaded, human/natural process dominated areas.
- Roaded human process dominated areas.

Spatial and temporal prescription assignments differed by alternative, with prescriptions assigned systematically to stratifications by:

- Subbasin [4th-field hydrologic unit code (HUC)]
- EIS area
- Management class
- Potential Vegetation Group.

To develop an integrated map of management prescriptions for each alternative, we developed a data file stratified to the subbasin, EIS area, management class, and potential vegetation group that had management emphasis codes from the preliminary draft EISs for forest and range by alternative. We then used the information from the preliminary draft EIS on alternative activity levels, theme, DFCs, and standards to correlate with the “best fit” or management prescription model.

Prescriptions were assigned a management emphasis based on the following factors, in successive order:

- Emphasis maps (preliminary draft EISs, Ch. 3)
- Activity level descriptions
- Desired future conditions (DFCs)
- Theme of the alternative
- Standards of the alternative.

Using this data, we developed a rule set to assign a management prescription code for each map stratification (table 2.6). The rule set was applied and then adjusted for “best fit” based on:

- Our assumptions for the alternatives, as discussed in the “Introduction” section of this chapter.

- Management emphasis and activity levels from the preliminary draft EIS, Chapter 3.
- Themes and desired future conditions of the alternatives.
- Standards from Chapter 3 of the preliminary draft EIS.
- An iterative process for assigning prescriptions and summarizing estimated effects levels to achieve the standards (see appendix I, Vol. II of this document).
- Qualitative review of Chapter 3 of the preliminary draft EISs to check for logical mapping of prescription codes.
- Knowledge of ecological integrity, socioeconomic resiliency, forest and range clusters, and the desired response as written in the preliminary draft EIS, Chapter 3 (see appendix I).
- Correction of errors in management class with the appropriate prescriptions.

Management emphasis maps for forest and range were based on the integrity clusters and preliminary draft EISs. Management emphases are shown on maps 2.1 through 2.14. Descriptions of each kind of management emphasis are provided in appendix 2-C. The prescription assignments for each alternative are shown on maps 2.15 through 2.21. Tables 2B.1 through 2B.28 in appendix 2-B summarize prescription model characteristics for forest and range areas for each EIS area by alternative, based on the prescription assignment and other appropriate information.

## Preliminary Draft EIS Alternative Disturbances and Simulated Disturbances

The simulation of alternatives had three objectives for evaluating vegetation and disturbance response at the broad-scale assessment level:

Objective 1. Prescription maps and associated simulation data were adequate to determine the relative differences in trends among the responses for different landscape variables of Alternatives 1 through 7.

Objective 2. Understand the dynamics and variability of the responses of each alternative, based on their ability to be successfully implemented. For this objective, it was important that the simulation would quantify the dynamic cause and effect relationships of management activities, alternative standards, disturbances, and landscape variables through time.

Objective 3. Quantify general levels of differences among activity levels and other disturbances for comparison purposes. For this objective, it was also important to generally quantify any differences in the management activities specified in Chapter 3 of the preliminary draft EISs and compare them to the simulated levels. This provided a base for assessing if differences were related to actual spatial and disturbance factors or if the prescription map was in error.

The simulations of alternatives met Objective 1. Figures 2.3 through 2.6 provide comparisons of the simulated responses during the first decade to the preliminary draft EISs' minimum and maximum levels of activities. Tables 2.8 and 2.9 show values of forest and range activities. Additional information on the simulated responses is included in other sections of this evaluation.

The second objective was met to a moderate degree with Alternatives 3 through 6, but only partially met with Alternatives 1, 2, and 7. The themes, desired future conditions, and standards of Alternatives 3 through 6 provided a base for predicting landscape dynamics in response to management. Alternatives 1 and 2, which emphasize traditional management, were difficult to model into the future with predictability because treatment assumptions were not consistent with the inherent disturbance processes and limitations of the biophysical template. This difficulty led to a response that has relatively poor reliability. Alternative 7 also presented modeling difficulty due to its large and frequently narrow reserves, and an associated unpredictability of wildfire. This response is indicative of the poor predictability and resiliency of systems managed with traditional commodity or reserve patterns, as compared to ecologically based management (Hann and others, in press).

Some discussion points relative to Objective 3 are listed below:

- For both EIS areas, the simulated levels of harvest in forests were relatively close to the preliminary draft EIS levels. Alternative 2 was slightly high, but the difference was not substantial for this spatial and temporal scale. However, because of the transition time necessary to change from from traditional management to ecological management in Alternatives 3 through 7 we are not highly confident that the harvest levels can be implemented.

- For both EIS areas, the simulated thinning levels in forests were generally low compared to the preliminary draft EIS levels. In contrast, the prescribed fire levels in forests were high for both EIS areas. Given that simulated thinning also assumed some prescribed fire or treatment of fuels, and that prescribed fire assumed some pre-treatment thinning, these two activities could be grouped or interchanged to some degree. The prescribed fire levels were high because the simulated levels included prescribed natural fire in wilderness and roadless areas, that was not quantified in the prescribed fire levels in the preliminary draft EISs.

- The simulated prescribed fire in rangeland was generally low in Alternatives 1 and 2, and high in Alternatives 3 through 7. These differences did not affect our ability to evaluate Objective 1, but did affect our ability to evaluate Objective 3. We discuss these differences qualitatively.

- The level of simulated rangeland improvements was low compared to the levels in the preliminary draft EIS, which included more than just vegetation improvements. When we included an estimate of other range improvements to improve livestock distribution, the level was comparable.

- The preliminary draft EIS used “livestock management acres” as a measure of implementation by permittees. We used a comparable estimate of range plan revision and implementation levels that combined the responsibilities of both the Bureau of Land Management and the Forest Service for rangeland plan revision within the context of the alternatives and associated implementation of grazing operating plans by permittees.

## Implementation and Allocation of Activity Levels from Preliminary Draft EIS

The process of modeling management activities and landscape evaluation variables was done differently for Alternatives 1 and 2 than for Alternatives 3 through 7.

### Alternatives 1 and 2

For Alternatives 1 and 2, we used a traditional programmatic process that allocated management activities through mapping prescriptions by management region and potential vegetation group to simulate the appropriate levels of management activity by EIS area and subbasin cluster.

### Alternatives 3 through 7

To allocate activities for Alternatives 3 through 7, which incorporate multi-scale spatial and temporal relationships, we used a process that was based on the multi-scale assumption identified in the “Introduction” section of this chapter. This process was necessary to achieve the integrated activity sets for Chapter 3 of the preliminary draft EISs, and for the effects predictions and interpretations in this evaluation of alternatives and in Chapter 4 of the preliminary draft EISs. The following “step-down/step-back” process provides the steps for spatial and temporal allocation of activities that would be consistent with this evaluation of alternatives and with the information provided for the effects in Chapter 4 of the preliminary draft EISs.

1. Prioritize management activity levels spatially and temporally for the selected alternative for subbasins within a cluster using an integrated proper functioning systems (landscape health) assessment for risk and opportunity analysis. Follow the same methods used for the ecosystem integrity analysis, landscape fire risk, and landscape patterns of succession/disturbance regime analysis. Conduct this prioritization to provide “best fit” to minimize risks such as erosion, sediment transport, wildfire, loss of socioeconomic opportunities, terrestrial community departure, riparian degradation, and impact on aquatic strongholds, rare terrestrial species, clean air, and clean water. Prioritizing is necessary because the effects tables were adjusted to fit the landscape assumptions of differences in strategies among Alternatives 3 through 7. Assess linkages to adjacent subbasins within the cluster, EIS area, and the Basin to assess cumulative effects. Compare optional “best fits” to select the prescription that minimizes risk and achieves opportunity objectives; then compare with original projections of effects to validate predictions in Chapter 4 of the preliminary draft EISs.

2. Prioritize management activity levels within subbasins at the watershed or subwatershed level, using a similar process. Conduct this prioritization to provide “best fit” to minimize negative effects as listed in Step 1. Summarize effects across watersheds or subwatersheds in the subbasin to assess cumulative effects. As in Step 1, compare optional “best fit” to select the one that minimizes risks and achieves opportunity objectives. Then compare with original projections of effects to validate preliminary draft EIS Chapter 4 predictions.

3. Design projects in context with step 2 and adjust based on site-specific conditions. Statistically extrapolate project data to update, validate, and adjust Steps 1 and 2.

## Summary of Confidence in Predictions and Qualifiers

Table 2.10 provides a summary of variables and their comparability between the simulations and the preliminary draft EISs’ alternative levels.

Table 2.11 provides a summary about the predictability of the terrestrial vegetation simulation results relative to the preliminary draft EISs' alternatives.

Table 2.12 provides a summary relative to simulation results by potential vegetation group and relationship to preliminary draft EISs' alternatives.

Table 2.13 provides a summary of spatial relationships of the preliminary draft EISs' alternatives to groups of forest and range cluster combinations. It also provides descriptions of alternative emphasis for forest and range cluster groups (map 2.22 and table 2.14). The five cluster groups (F, J, H, L, and M) were derived from 29 combinations of forest and range clusters based on the following criteria:

- Similar dominant management area categories
- Similar forest and range integrity
- Similar aquatic and hydrologic integrity
- Similar fire risk
- Similar amounts of urban/wildland interface.

We conclude that the simulations are adequate for the evaluation of alternatives, considering the dynamic spatial and temporal responses of vegetation, disturbances, and associated conditions. However, due to time constraints that did not allow for mapping of different prescriptions iteratively, to "best fit" direction in Chapter 3 of the preliminary draft EISs, activity levels and landscape response variables are best limited to relative comparisons of trends between alternatives, rather than absolute differences. For this broad level of planning, however, the current simulations are adequate to determine differences in relative trends of alternatives, as well as general outcomes across the EIS areas.

To utilize the activity levels' effects predictions from this evaluation, it will be critical, during alternative implementation, to assess similar variables at multiple scales consistently across BLM- and FS-administered lands within the two EIS areas.

[1] The HRV (Morgan and others 1994) provides a means of understanding succession/disturbance and the biodiversity relationships of paleoecological and historic systems. It incorporates the relationships between the energy of the system in terms of processes of biomass accumulation and the processes of disturbance that convert or physically transport biomass. HRV can serve as a tool for understanding the causes and consequences of change in ecosystem characteristics over time as well as ser ve as a benchmark for understanding the effects of human-induced changes of biophysical systems. We simulated the HRV by developing pre-Euro-American settlement succession/disturbance models for each potential vegetation type and simulating change over a 100- or 400-year period from the historical vegetation map (Long and others 1996).

# CHAPTER 8

## February 1996 and February 1997 EIS Versions: Changes in Effects

Thomas M. Quigley, Technical Editor

## Introduction

The EIS Teams provided the Science Integration Team (SIT) with preliminary Draft Environmental Impact Statements (DEISs) in October 1995 containing chapters on the purpose and need, affected environment, and objectives and standards of alternatives for initial evaluation of effects and consequences. This version of the DEISs did not contain enough detail to make a complete evaluation of effects and consequences. The SIT provided a preliminary analysis of effects to the EIS Teams. In February 1996 the EIS Teams provided an updated version of the preliminary DEISs for evaluation of alternatives by the SIT. Interactions with public groups, other agencies, county and state officials and internal Forest Service and Bureau of Land Management staff continued during the period of alternative development. This resulted in continued evolution of the EIS standards and objectives. The February 1996 preliminary DEISs were the versions on which the SIT focused its analysis of consequences and effects. This publication documents the analysis of the February 1996 version. Nearing completion of the DEISs in February 1997, the EIS Team provided updated versions of the DEISs for final review by the SIT before publication in May 1997. Because of the fluid nature of the alternatives, it is essential to refer directly to the DEISs to obtain an understanding of the alternatives as they are being proposed.

The changes in the DEISs from February 1996 to February 1997 primarily clarify or define processes to be implemented, define completion schedules for standards, tie standards more clearly to objectives, or define desired ecological outcomes. For instance, ecological performance measures or quantifiable ecological goals were added to all alternatives. All alternatives continue to describe the analysis required to modify non-process EIS standards, while providing equal or greater assurance of meeting objectives. The purpose of this chapter is to provide a brief description of the evolution in the EIS and some insight into the changes in effects and consequences that have resulted. The organization of the chapter is by SIT staff area. Within each section, changes to the DEIS are discussed in terms of how they affect outcomes and consequences related to the effects the SIT staff areas reported for the February 1996 preliminary draft EISs. The type of effect is described, but no attempt is made here to describe in complete detail all the associated effects or consequences likely from implementing the revised DEIS alternatives. The SIT worked closely with the EIS team as they documented effects and consequences within the DEIS itself. For an enumeration and discussion of effects refer directly to the revised DEISs.

## Landscape Ecology

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### Major changes that occurred in Standards and Objectives

Changes in the evaluation of alternatives are a result of changes in the DEIS objectives and standards. Some changes clarified understanding or improved the methods of modeling and data analysis. There are no substantial changes in the long-term (50 to 100 year) projections and interpretations. The evaluation of effects for the long-term projected outcomes could not be improved given the time available for this evaluation.

- C The short- and long-term model projections of landscape processes and functions provide moderate confidence in outcomes because of the scale of mapping. Mapping was accomplished at the management region and forest/range PVG group level with statistical data table relationships to infer trends for finer scale stratifications. There was not adequate time during the previous evaluation or this re-evaluation to map to the scale of Potential Vegetation Groups (PVGs) and develop relationships for effects of the fine-scale standards.

  The projection models cannot be applied at a scale to account for changes, refinements, and additions of fine-scale standards that are relatively independent from the model simulations. An assumption is made that after the first decade the alternative themes and Desired Future Conditions (DFCs) will predominate and conflicts with fine-scale standards will be resolved through hierarchical landscape assessment and associated decisions. Consequently, the long term relative differences in trends between the alternatives remain the same.

- C There has been considerable refinement of standards and improved clarity of the differences between alternatives for the short term (first decade). However, there appears to be increased potential for conflict between standards and estimated activity levels in achieving the action alternative (3 through 7) goals, alternative themes, and desired future conditions (DFCs). This potential for conflict was not as evident in the February 1996 version as it is in the February 1997 version. For the earlier evaluation an assumption was made that a hierarchical landscape assessment, implementation, monitoring, and evaluation process would resolve these conflicts to varying degrees for alternatives 3, 4, 5, 6, and 7 (see table 4-1 in DEIS chapter 4). However, the revised draft EIS alternatives present some conflicts that can result in a variety of outcomes in the first decade. For Alternatives 3 through 7, this resulted in some modification of assumptions to eliminate the conflicts.

  However, there are changes in the short-term (first decade) potential outcomes:

- C There is a change in the projected rate of transition to the DFCs during the first decade, caused by changes in some standards, improved understanding of the standards, and improved methods of evaluation. This has resulted in changes in some of the original projected effects for Chapter 4 of the DEISs, as well as the addition of new material. The slowdown in transition to the DFCs caused by changes in standards primarily affected Alternatives 3 and 7. Improved understanding relative to key components of the action alternatives affected Alternatives 3, 4, 5, 6, and 7. This included:

  1) A more realistic understanding of the time of transition from the current traditional management to ecological management for the action alternatives. This transition time is a result of the need for technology transfer, multi-scale integrated risk and opportunity analysis, spatial prioritization, subbasin review, ecosystem analysis, collaboration, and design and implementation of ecological conservation, restoration and production activities.

  2) The intent in Alternatives 3, 4, 6, and 7 for prioritization of restoration and production activities in the BLM/FS wildland interface with private land urban and rural housing developments.

3) The transition time to develop wilderness prescribed natural fire plans for planned ignitions to achieve the desired futures for Alternatives 3, 4, 6, and 7.

## Types of Change in Landscape Dynamics

Minor changes were made in the types of management in Alternatives 1 and 2 (no action alternatives) to correct earlier interpretation of these alternatives. These changes were recognized in the first evaluation of alternatives and accounted for in the qualitative discussion in the Landscape Ecology Chapter's methods section (see Chapter 2 of this document).

For this re-evaluation reliance shifted to different types of data and models for evaluating differences between alternatives. This includes an increased reliance on the type of management prescription model, with its associated long-term effects and assumptions, rather than the modeled projections of amounts of vegetation types and disturbances. The implications of these models retain some level of confidence in detecting differences between alternatives even with substantial conflicts between goals, themes, DFCs, activity levels and standards. In addition, the models are not as susceptible to differences between alternatives being minimized by the coarse resolution of mapping. Descriptions of these models and how they were mapped are included in Chapter 2 of this report.

This re-evaluation reduces the emphasis on quantitative projections of vegetation types and disturbances, which are much more susceptible to conflicts between the goals, themes, DFCs, activity levels, and standards, as well as loss of resolution due to the coarse scale.

Several generalized quantitative measures (landscape health, soil disturbance, succession/disturbance regimes, landscape patterns, and transition times of the different models) were developed that are less susceptible to loss of confidence due to the conflicts of standards and alternative themes.

From a landscape ecology perspective, the rate of landscape change caused by implementing an alternative can be measured by the similarity to the various landscape patterns of succession/disturbance regimes for the desired management model. When this similarity is measured through time a transition rate can be evaluated. There are two general types of management responses:

1) the traditional management response —
Traditional management focuses on sustained yield, protection, or exploitation of specific elements, such as timber production, livestock grazing, wilderness, and riparian buffers, in a manner relatively independent of the interconnected cause-and-effect relationships across landscapes. Consequently, the interaction of effects between managed elements, other elements, and dynamics of landscape disturbances often conflict. In the long term this type of management can result in disequilibrium of ecological systems and decline in ability to produce expected human resource values (both commodity and amenity). This results in the loss of landscape health.

Landscapes in traditional commodity patterns are predominantly early- or mid-seral, highly fragmented, and lack large overstory and emergent live and dead tree characteristics in the forest landscapes. The range landscapes often have widespread effects of soil erosion and exotic plant invasion. These landscapes require a long period of careful application of conservation, restoration, and production activities to develop the landscape elements and patterns representative of the proper functioning system.

2) the ecological management response —
Ecosystem management promotes the transition of current landscape patterns toward healthy (proper functioning) landscape systems by utilizing human technology and energy to mitigate or restore interacting cause-and-effect relationships. These activities are designed to represent the ecological equilibrium interactions, while producing human resource values (both commodity and amenity). In the short term, ecological management is expected to stabilize landscapes that are currently in disequilibrium and slowly increase their predictability of providing for human resource values (both commodity and amenity). In the long term, ecological management is expected to increase a system's ability to produce human resource values at lower cost, while sustaining landscape capability and native biodiversity.

The transition time from the current condition to landscape health for the ecological management response is dependent on the status of the current pattern. Landscapes in traditional reserve patterns that are predominantly mature or late-seral can be transitioned rapidly to healthy landscape (proper functioning) system patterns with conservation, restoration, and production activities. This is because the large overstory and emergent live and dead trees are still present in the forest landscapes, and exotics or soil erosion have not precluded native system potentials in the rangeland landscapes. In contrast, landscapes in traditional reserve patterns that have been cycled by a severe disturbance event have often lost large overstory and emergent live and dead tree characteristics. These landscapes require a long period of careful application of conservation, restoration, and production activities to develop landscape elements and patterns representative of healthy landscapes.

Alternatives 1 and 2 (the no action alternatives) fit the traditional management response. The desired future for Alternative 1 in roaded, non-wilderness areas would generally fit the traditional commodity pattern for forest landscapes, range landscapes, and forest-range landscapes. In contrast, the desired future for Alternative 1 in wilderness areas would generally fit the traditional reserve pattern for forest landscapes, range landscapes, and forest-range landscapes. Alternative 2 would be similar to Alternative 1 in wilderness, but the non-wilderness would be a fragmented combination of the traditional reserve and results of historic management patterns along stream buffers and in remaining late-seral forest areas, and the traditional commodity management patterns in the upland rangeland and mid-seral forest types.

To varying degrees Alternative 3, 4, 5, 6, and 7 fit the ecological management response. The desired future for Alternatives 4 and 6 would fit the healthy landscape (properly functioning system) pattern for forest landscapes, rangeland landscapes, and forest-range landscapes. While Alternatives 3 and 5 have a DFC for ecosystem management that fits the ecological management response, the emphasis on local priorities for Alternative 3 and production priorities for Alternative 5 would not provide an equal emphasis for conservation, restoration, and production activities based on risks and opportunities across the Basin. Consequently, Alternatives 3 and 5 would result in a mix of ecological and traditional responses. Alternative 3, because of the local emphasis, would have a fine-scale mix caused by local priorities, while Alternative 5, because of the emphasis for activities in more productive areas, would have a coarser scale mix related to potential vegetation and current condition composition.

Alternative 7 has a very conflicting result caused by the mixing of the ecological and traditional responses in the theme and DFCs, as well as in the standards. This would result in traditional reserve patterns clumped in the reserves, and a mix of traditional reserve, commodity, and proper functioning systems patterns on the other lands. While action activities would be the dominant activities causing direct change in Alternatives 3, 4, 5, and 6, other disturbances, such as wildfire, drought, stress mortality, insect/disease mortality, and exotic invasion would predominate in alternative 7.

Areas that currently fit the healthy landscape pattern are relatively easy to maintain through representation of cause-and-effect relationships with application of conservation, restoration, and production activities.

Transition rates from current landscape conditions to the desired future landscape conditions were estimated for each alternative. The estimate considers the likely similarity of the landscape pattern of succession/disturbance regimes to the desired future landscape systems. These transition rates are described in the sections below with reference to short- and long-term trends.

Table 2.4—Landscape management prescription (Rx) map symbol legend names.

| Prescription Type | Rx | Legend Name |
|---|---|---|
| * | HI | Prescription set to model 100-year and 400-year simulations of HRV |
| Ecological | | |
| * | A1 | Restoration[1] with PNF/P[2] |
| * | A2 | Roaded Land High Restoration with Production[1] |
| * | A3 | Roaded Land High Restoration with Production and Area or PVG Emphasis |
| * | N1 | Conservation[1] |
| * | N4 | Roaded Land Moderate Restoration with Production |
| Traditional Reserve | | |
| * | C1 | Roadless Land with Moderate Fire Suppression |
| * | N6 | Roadless Land with Moderate Fire Suppression and PNF/U[3] |
| * | P1 | Roadless Land Reserve with Moderate Fire Suppression |
| Traditional Commodity | | |
| * | C2 | Roaded Land High Commodity with Low Ecological Mitigation |
| * | C3 | Roaded Land High Commodity with No Ecological Mitigation |
| * | N3 | Roaded Land Moderate Commodity with Low Ecological Mitigation |
| * | N5 | Roaded Land Moderate Commodity with High Exotic Weeds |
| * | N8 | Roaded Land Moderate Commodity with Moderate Ecological Mitigation |

| | | |
|---|---|---|
| * | P3 | Roaded Land Very High Commodity with No Ecological Mitigation |
| Traditional Commodity in Sensitive Areas | | |
| * | N2 | Sensitive Visual[4] Area with Moderate Harvest & Livestock |
| * | N7 | Sensitive Visual Area with Moderate Harvest & Low Livestock |
| | P2 | Sensitive Visual Area with Low Commodity & High Wildfire |

[1]Management Emphasis definitions:
1) Conservation—Emphasis provides for the protection of rare native elements and systems while maintaining proper functioning systems and restoring systems where there is low risk to rare elements or systems. Some human commodities may be produced but the emphasis is on human values related to protection of native diversity, aesthetics, and recreation.
2) Restoration—Emphasis provides for subsidizing ecological and landscape processes and functions to shift the transition toward proper functioning systems. Considerable human commodities may be produced that are compatible with restoration, as well as conservation of inclusions of rare elements and systems, but the emphasis is on shifting landscapes that are in high departure from the native regime toward proper functioning ecological relationships.
3) Production—Emphasis provides for production of human needs and values by managing in concert with native ecological and landscape processes to maintain or shift to proper functioning systems. This will typically require subsidies to represent native ecological cause-and-effect relationships at landscape levels, along with some restoration and conservation, but the emphasis is on design of system responses that produce commodities and other values.
4) Traditional—Emphasis on the independent management model for producing commodity values, protecting visually or environmentally sensitive areas, or managing reserves to protect semi-primitive characteristics.

[2]Prescribed natural fire program with planned ignition.

[3]Prescribed natural fire program with unplanned ignition.

[4]Traditional sensitive visual area management similar to traditional reserve.

Table 2.5—General management activity levels [1] by prescription set (Rx).[2]

| | Forest Management | | | | Range Management | | | | | | | | Prescription Type | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rx | Harvest | Thin | Rx Fire | Road Density | Grazing Effects | Upland | Riparian | Wood-land | Rx Fire | Road Density | Wildfire Hazard | Exotics Hazard | Trad[3] | Ecol[3] | Allocation Method |
| H | N | N | N | N | L | N | N | N | N | N | H | N | NA | NA | NA |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecological Prescriptions | | | | | | | | | | | | | | | |
| A1 | N | N | H | N | L | N | N | N | M | N | L | L | NA | 3-7 | Multi-scale |
| A2 | M | H | H | L-M | L | H | H | H | H | L | L | L | NA | 3-7 | Multi-scale |
| A3 | H | H | H | L-M | L | M | M | H | M | L | L | L | NA | 3-7 | Multi-scale |
| N1 | N | N | L | N | L | L | L | N | L | N | M | L | NA | 3-7 | Multi-scale |
| N4 | L | L | L | L | L | L | L | M | L | L | M | M | NA | 3-7 | Multi-scale |
| Traditional Reserve Prescriptions | | | | | | | | | | | | | | | |
| C1 | N | N | L | N | L | N | N | N | L | N | M | M | 1-7 | NA | Area |
| N6 | N | N | L | N | L | L | N | N | L | N | M | L | 1-7 | NA | Area |
| P1 | N | N | N | N | L | N | N | N | N | N | H | M | 1-7 | NA | Area |
| Traditional Commodity Prescriptions | | | | | | | | | | | | | | | |
| C2 | H | M | L | M-H | M | M | M | M | M | M | M | H | 1-7 | NA | Area |
| C3 | H | H | L | H-V | M | M | L | M | M | L | M | H | 1-7 | NA | Area |
| N3 | H | H | L | M-V | M | L | L | M | L | L | H | H | 1-7 | NA | Area |
| N5 | M | M | L | L-M | L | L | L | M | L | L | M | H | 1-7 | NA | Area |
| N8 | H | H | L | M-V | L | L | L | M | L | L | M | H | 1-7 | NA | Area |
| P3 | H | M | L | H-V | H | L | N | M | L | L | M | H | 1-7 | NA | Area |
| Traditional Commodity in Sensitive Areas | | | | | | | | | | | | | | | |
| N2 | M | M | L | L-M | M | L | L | M | L | L | M | H | 1-7 | NA | Area |
| N7 | M | M | L | L-M | L | L | L | M | L | L | M | M | 1-7 | NA | Area |
| P2 | L | N | N | L | L | N | N | L | N | N | H | H | 1-7 | NA | Area |

[1]Levels: L = low; M = moderate; H = high; V = very high; N = none.
[2]As simulated by Columbia River Basin Succession Model.

[3]Rx = prescription; Trad. = traditional prescription; Ecol. = ecological prescription.

Table 2.6—Management prescriptions (Rx) sorted by conservation, restoration, and production emphasis.

| Rx Emphasis | Rx Ability to Achieve Emphasis | Management of Forest Non-Wilderness/ Roaded | Management of Range Non-Wilderness/ Roaded | Wilderness/ Non-Roaded Management |
|---|---|---|---|---|
| | | ------------------------Prescription | ---------------------- | |
| Conserve | High | N1 | N1 | |
| | Moderate | N4 | N4, C1 | N61 |
| | Low | P1 | P1 | C1, P1 |
| Conserve-Produce | High | N2, N7 | N4 | C1 |
| | Moderate | N4 > N5[2] | N1 | N1 |
| | Low | P2[1] | | N6 |
| Produce | High | P3 > C3> C2 | C3 | C1 |
| | Moderate | N8, N3 | N2, N3 | N6 |
| | Low | N7 > N5 > N4 | | |
| Restore | High | A1 | A2 | A1 |
| | Moderate | A1 | A3 | N1 |
| | Low | N4 | N1 | |
| Restore-Conserve | High | A1 | A2 | A2 |

| | | | | |
|---|---|---|---|---|
| | Moderate | N1 | N1 | N1 |
| | Low | N4 | N4 | |
| Restore-Produce | High | A3 | A3 | A1 |
| | Moderate | A2 | A2 | N1 |
| | Low | N2 > N4 > N5 | N1 | |

[1]Model not commonly used in simulations.
[2] > = greater than; Rx has a greater emphasis than the next Rx.

Table 2.7—General attribute response to emphasis of management prescriptions in forest for dead standing/down material conservation and soil exposed to erosion.

| Rx[1] | Large Snag Conservation | Large Down Wood Conservation | Duff/Litter Cover | Bare Soil |
|---|---|---|---|---|
| N4 | Moderate | Moderate | Moderate | Low |
| N5 | Moderate | Moderate | Moderate | Moderate |
| N6 | High | High | High | Low |
| N7 | Low | Low | Moderate | Moderate |
| N8 | None | None | Low | High |
| A2 | High | High | High | Low |
| C2 | Low | Low | Moderate | High |
| N2 | Low | Low | Moderate | Moderate |
| P2 | Low | Low | High | Low |

| | | | | |
|---|---|---|---|---|
| A3 | Moderate | Moderate | High | Low |
| C3 | None | None | Low | High |
| N3 | None | None | Low | High |
| P3 | None | None | Low | High |
| A1 | High | High | High | Low |
| C1 | High | High | High | Low |
| N1 | High | High | High | Low |
| P1 | Low | Low | Low | High |
| | (lost to wildfire) | (lost to wildfire) | (lost to wildfire) | (exposed to wildfire) |

[1]Rx = prescription.

Table 2.8—Alternative simulations compared to the preliminary draft EIS minimum and maximum levels for forest management activities for first decade.

| EEIS Area[1] | Alternative | Forest Harvest, Simulation | Forest Harvest, Preliminary Draft, EIS Minimum | Forest Harvest, Preliminary Draft EIS, Maximum | Forest Thin, Simulation | Forest Thin, Preliminary Draft EIS, Minimum | Forest Thin, Preliminary Draft EIS, Maximum | Forest Prescription Burn, Simulation | Forest Prescription Burn, Preliminary Draft EIS, Minimum | Forest Prescription Burn, Preliminary Draft EIS, Maximum |
|---|---|---|---|---|---|---|---|---|---|---|
| | | --------Hectares[2]-------- | | | | | | | | |
| EEIS | 1 | 615,000 | 500,000 | 674,000 | 158,000 | 164,000 | 221,000 | 121,000 | 132,000 | 176,000 |
| EEIS | 2 | 358,000 | 259,000 | 348,000 | 77,000 | 172,000 | 233,000 | 95,000 | 132,000 | 176,000 |
| EEIS | 3 | 425,000 | 352,000 | 478,000 | 117,000 | 259,000 | 348,000 | 882,000 | 386,000 | 524,000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| EEIS | 4 | 419,000 | 378,000 | 512,000 | 117,000 | 310,000 | 419,000 | 882,000 | 558,000 | 757,000 |
| EEIS | 5 | 439,000 | 431,000 | 583,000 | 113,000 | 249,000 | 338,000 | 834,000 | 362,000 | 490,000 |
| EEIS | 6 | 401,000 | 310,000 | 419,000 | 111,000 | 293,000 | 395,000 | 866,000 | 508,000 | 686,000 |
| EEIS | 7 | 295,000 | 97,000 | 130,000 | 67,000 | 105,000 | 142,000 | 496,000 | 407,000 | 548,000 |
| UCRB | 1 | 573,000 | 455,000 | 617,000 | 265,000 | 259,000 | 348,000 | 156,000 | 212,000 | 289,000 |
| UCRB | 2 | 251,000 | 190,000 | 257,000 | 91,000 | 206,000 | 279,000 | 194,000 | 212,000 | 289,000 |
| UCRB | 3 | 391,000 | 318,000 | 431,000 | 160,000 | 344,000 | 465,000 | 1,182,000 | 421,000 | 571,000 |
| UCRB | 4 | 324,000 | 293,000 | 395,000 | 162,000 | 439,000 | 593,000 | 1,186,000 | 637,000 | 862,000 |
| UCRB | 5 | 393,000 | 378,000 | 512,000 | 162,000 | 370,000 | 500,000 | 577,000 | 370,000 | 500,000 |
| UCRB | 6 | 265,000 | 180,000 | 245,000 | 146,000 | 378,000 | 512,000 | 1,016,000 | 524,000 | 710,000 |
| UCRB | 7 | 204,000 | 168,000 | 229,000 | 103,000 | 134,000 | 182,000 | 423,000 | 415,000 | 561,000 |

[1]EEIS = Eastside EIS area.
UCRB = Upper Columbia River Basin EIS area.

[2]Rounded to nearest thousand; hectare = 2.47 acres.

Table 2.9—Alternative simulations compared to the preliminary draft EIS minimum and maximum levels for range management activities.

| EEIS Area[1] | Alternative | Range Prescription Burn, Simulation | Range Prescription Burn, Preliminary Draft, EIS Minimum | Range Prescription Burn, Preliminary Draft EIS, Maximum | Range Vegetation Improvement, Simulation | Range Total Improvement, Preliminary Draft EIS, Minimum | Range Total Improvement, Preliminary Draft EIS, Maximum | Range Distribution, Improvement Simulation | Range Plan Implementation, Simulation |
|---|---|---|---|---|---|---|---|---|---|
| | | --Hectares[2]-- | | | | | | | |
| EEIS | 1 | 51,000 | 73,000 | 97,000 | 20,000 | 97,000 | 130,000 | 100,000 | 200,000 |
| EEIS | 2 | 55,000 | 73,000 | 97,000 | 20,000 | 97,000 | 130,000 | 150,000 | 500,000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EEIS | 3 | 346,000 | 127,000 | 172,000 | 83,000 | 285,000 | 386,000 | 300,000 | 500,000 |
| EEIS | 4 | 393,000 | 144,000 | 192,000 | 148,000 | 391,000 | 528,000 | 400,000 | 1,000,000 |
| EEIS | 5 | 340,000 | 93,000 | 125,000 | 53,000 | 217,000 | 293,000 | 250,000 | 500,000 |
| EEIS | 6 | 384,000 | 144,000 | 196,000 | 115,000 | 241,000 | 326,000 | 300,000 | 1,000,000 |
| EEIS | 7 | 328,000 | 123,000 | 168,000 | 87,000 | 97,000 | 130,000 | 150,000 | 200,000 |
| UCRB | 1 | 26,000 | 83,000 | 111,000 | 12,000 | 109,000 | 150,000 | 90,000 | 250,000 |
| UCRB | 2 | 28,000 | 83,000 | 111,000 | 12,000 | 109,000 | 150,000 | 110,000 | 550,000 |
| UCRB | 3 | 117,000 | 188,000 | 253,000 | 140,000 | 330,000 | 447,000 | 275,000 | 600,000 |
| UCRB | 4 | 127,000 | 188,000 | 253,000 | 212,000 | 401,000 | 542,000 | 300,000 | 1,200,000 |
| UCRB | 5 | 53,000 | 85,000 | 113,000 | 55,000 | 192,000 | 261,000 | 200,000 | 750,000 |
| UCRB | 6 | 65,000 | 188,000 | 253,000 | 130,000 | 556,000 | 751,000 | 150,000 | 1,200,000 |
| UCRB | 7 | 18,000 | 186,000 | 251,000 | 65,000 | 109,000 | 150,000 | 50,000 | 400,000 |

[1]EEIS = Eastside EIS area.
UCRB = Upper Columbia River Basin EIS area.

[2]Rounded to nearest thousand; hectare = 2.47 acres.

Table 2.10—Notes on CRBSUM simulation comparison with the preliminary draft EISs activities for evaluation of alternative simulations.

| Item | Notes |
|---|---|
| Preliminary Draft EISs Forest Activity & CRBSUM Activity Comparison | Forest activities of harvest [(commercial harvest/thin, thin (noncommercial thin), and prescribed fire] are moderately comparable between tables in the preliminary draft EISs and the simulations. |
| Watershed Restoration and Road Densities | The CRBSUM prescriptions have assumptions related to levels of watershed restoration and road densities that are generally similar to the preliminary draft EISs. |

| | |
|---|---|
| Preliminary Draft EISs Range Activity & CRBSUM Activity Comparison | Range activities of total livestock management (area), range improvements, prescribed burning, riparian restoration, and decrease in roads are generally not comparable between tables in the preliminary draft EISs and the simulations because of different definitions. Prescribed burning is comparable in a relative sense. |
| Preliminary Draft EISs Range Livestock Grazing Comparison to CRBSUM Simulations | Total livestock grazing in the simulations is a function of the amount of grazing effects that affect vegetation change (modeled in CRBSUM) and the amount of grazing that does not affect vegetation change (not modeled in CRBSUM). The second effects are related to assumptions in the prescription models concerning emphasis on achieving livestock distribution and seasonal utilization objectives, which are functions of range plan revisions and permit administration. This is not reflected in the simulation tables, due to a lack of time and insufficient information in the preliminary draft EISs on rate and type of allotment plan revisions and permit administration. However, the CRBSUM simulation trends for vegetation response generally represent the preliminary draft EISs livestock grazing standards by accounting for effects that change vegetation. |
| Range Riparian Restoration | At the scale of CRBSUM simulation, the riparian potential vegetation group and the existing vegetation are not modeled accurately. Consequently, there is no comparison between the riparian restoration amounts in the simulations and the preliminary draft EISs. The amounts of riparian are under-estimated for narrow riparian stringers in CRBSUM and over-estimated for large patches of riparian. The trends in response over time of the riparian vegetation simulations represent a more negative outcome for Alternatives 2 through 6 than the desired future conditions and standards for those alternatives would indicate. Trends in riparian response for Alternatives 1 and 7 are generally correct. |
| Range Decrease Roads | CRBSUM simulations do not report decrease in roads, whereas each of the prescription simulations include assumptions about road densities and watershed restoration. |

Table 2.11—Notes on CRBSUM evaluation of alternative simulations for terrestrial communities.

| Item | Notes |
|---|---|
| Simulation Response of Terrestrial Communities | The general responses of terrestrial communities for the historical range of variability and the alternative simulations represent expected outcomes. The communities listed below have particular notes about use of the information. |

| | |
|---|---|
| Graph Scale Concerns | The bar chart and line graphs tend to over-emphasize the differences in response trend for communities with small amounts, and under-emphasize for communities with large amounts. |
| Range Riparian Terrestrial Communities | The historical range of variability for riparian communities, as simulated by CRBSUM, is non-applicable because: (1) the scale and type of current mapping are too coarse to depict the stringer riparian types and over-emphasize the large patch types; and (2) historical mapping did not map riparian types separate from the upland forest and range types. The CRBSUM trends in vegetation response by alternative for riparian types are useful when placed in the context of scale. The trends in response over time of the riparian vegetation simulations represent a more negative outcome for Alternatives 2 through 6, than the desired future conditions and standards for those alternatives. Trends in riparian response for Alternatives 1 and 7 are generally correct. The increase of riparian herb in Alternative 7 is primarily due to wildfire in riparian woodland and shrub types. |
| Forest Riparian Communities | Because the scale of the forested riparian communities are not separate from the upland communities, assume that the forested riparian community has a similar trend to disturbances as the forested upland community. CRBSUM did not account for these differences in forested riparian desired future conditions and standards from the preliminary draft EISs. Consequently, the response of forested riparian to timber harvest standards is more conservative in Alternatives 2 through 7 than the simulation models. |
| Exotic Herbland | Exotic trend response is generally correct on a relative basis among alternatives, except in Alternative 2, which should be similar to Alternative 1. Exotics are generally replacing upland shrub due to fire and/or livestock grazing, so the concurrent decline of upland shrub in Alternative 2 should be similar to Alternative 1. Rates of exotic increase across alternatives are modeled with conservative increase rates. While it is highly probable that exotics could increase at faster rates, the rates used are the best estimate at a landscape level. Most of the exotics are in the dry shrub and dry grass potential vegetation groups. |
| Upland Herbland | The upland herb response generally simulates the expected historical range of variability and alternative response. Most transitions from upland herb go to upland shrub, upland woodland, to early- or mid-seral forest in the 100 years of current to historical. Most transitions to upland herb come from upland shrub, upland woodland, and late-seral forest fire disturbance in the 100 years of current to historical. The upland herb is common in the dry grass, dry shrub, cool shrub, and dry forest potential vegetation groups. |

| | |
|---|---|
| Upland Shrubland | The upland shrub response generally simulates the expected historical range of variability and alternative response. Most transitions from upland shrub go to exotic or upland herb with fire; or to upland woodland, early-seral, or mid-seral forest with succession in the 100 years of current to historical. Most transitions to upland shrub come from upland herb with succession; or from upland woodland and late-seral forest with fire disturbance in the 100 years of current to historical. Most upland shrub is in the dry or cool shrub potential vegetation groups. |
| Upland Woodland | The upland woodland response generally simulates the expected historical range of variability and alternative response. Most transitions from upland woodland go to upland herb or exotic herbland with fire or cutting; in the 100 years of current to historical. Most transitions to upland woodland come from upland shrub with succession in the 100 years of current to historical. The upland woodland occurs in the woodland, the dry shrub, the dry grass, the cool shrub, and the dry forest potential vegetation groups. Most of the encroachment type is on the dry shrub, cool shrub, and dry forest potential vegetation groups. The models emphasize restoration by burning or cutting of woodlands on the dry shrub potential vegetation groups. Consequently, the Eastside EIS shows a decline in woodlands compared to current. In the Upper Columbia River Basin EIS area, however, most upland woodland is on cool shrub and dry forest, so this emphasis is not present and there is an associated increase of woodlands. |
| Late-seral Multi-layer Communities in Relation to Mid-seral | There is a general trend to more late-seral multi-layer communities across all alternatives, due to the transition of a large component of the current mid-seral into late-seral. These forests are typically on steep, usually roadless areas, in lethal crown fire regimes that were burned in the late 1800s and early 1900s. In Alternative 1 forest and resource plans, these types would not likely be harvested due to their unlikelihood for reaching the late-seral stage and given the steep slopes and generally roadless terrain. They are more likely to recycle to early-seral due to their tendency to occur in large patches and the associated potential for large wildfires, insect infestation, root disease, and stress mortality. |
| Early-seral Lower Montane Forest | Simulation generally represents the historical range of variability and differences among alternatives. Much of the early-seral lower montane forest comes from harvest or fire in the moist potential vegetation group and associated montane communities. Consequently, there is a greater increase in the Upper Columbia River Basin EIS area where there is more of this potential vegetation group |
| Late-seral* Lower Montane Forest | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral Lower Montane Forest Multi-layer | Simulation generally represents the historical range of variability and differences among alternatives. |

| | |
|---|---|
| Late-seral Lower Montane Forest Single-layer | Simulation generally represents the historical range of variability and differences among alternatives. |
| Early-seral Montane Forest | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral* Montane Forest | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral Montane Forest Multi-layer | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral Montane Forest Single-layer | Simulation generally represents the historical range of variability and differences among alternatives. |
| Early-seral Subalpine Forest | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral* Subalpine Forest | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral Subalpine Forest Multi-layer | Simulation generally represents the historical range of variability and differences among alternatives. |
| Late-seral Subalpine Forest Single-layer | Simulation generally represents the historical range of variability and differences among alternatives. |

*Erroneous in the printed document; this terrestrial community should be Mid-seral.

Table 2.12—Notes on response of potential vegetation groups for CRBSUM evaluation of alternative simulations.

| Item | Notes |
|---|---|
| Simulation Level | The CRBSUM evaluation of alternatives simulations are based on the prescription models mapped at a forest or range level, not at the potential vegetation group (PVG) level. There is varying emphasis by potential vegetation group based on the preliminary draft EISs, alternative desired future conditions, and standards. We did not vary prescriptions models by potential vegetation group within forest or range at the time of simulation due to lack of time and changing desired future conditions and standards within the preliminary draft EISs. |

| | |
|---|---|
| Rangeland Riparian PVGs | The CRBSUM simulation of riparian is non-applicable due to the scale of historical and current riparian mapping. Scale and type of current mapping are too coarse to depict the stringer riparian types and over-emphasize the large patch types. The historical mapping did not map riparian types as separate from the upland forest and range types. The CRBSUM trends in vegetation response by alternative for riparian types are useful when placed in the context of scale. Response trends of the riparian vegetation simulations over time represent a more negative outcome for Alternatives 2 through 6, than for the desired future conditions and the standards for those alternatives. Riparian response trends for Alternatives 1 and 7 are generally correct. |
| Rangeland Dry Shrub, Dry Grass, and Woodland PVGs | The CRBSUM simulation of these types generally meets the expectations, but does not have the restoration emphasis in Alternatives 4 and 6 that could be simulated if prescriptions were mapped to the potential vegetation group level. Based on the preliminary draft EISs' description of alternatives, there should be more restoration in Alternatives 4 and 6 than Alternatives 3 and 5, which have more than Alternatives 1, 2, and 7. This prioritization is not simulated in the current mapping of prescriptions. However, the current prescription for fire suppression does emphasize increased fire suppression in these potential vegetation groups to reduce rates of increase of annual grasses. Exotic trend response in these potential vegetation groups is correct, except in Alternative 2 where exotics increase more rapidly than other alternatives. However, Alternative 2 exotics are generally replacing upland shrub due to fire and/ or livestock grazing, so their response should be similar to Alternative 1. The upland woodland cutting and the restoration to upland herb and shrub is occurring primarily in these potential vegetation groups, not in the woodland potential vegetation group. There are more dry shrub, dry grass, and woodland potential vegetation groups in the Eastside EIS area than in the Upper Columbia River Basin EIS area. |
| Rangeland Cool Shrub PVGs | The CRBSUM simulation of this type meets expectations, except for lacking emphasis on restoration using prescribed fire, exotic forb control, and control of encroachment conifer and woodland in Alternatives 4 and 6 that could be simulated if prescriptions were mapped to the potential vegetation group level. Based on the preliminary draft description of alternatives, the restoration level in Alternatives 4 and 6 should be more than Alternatives 3 and 5, which have more than Alternatives 1, 2, and 7. Because this prioritization is not simulated in the current mapping of prescriptions, there is more cool shrub type in the Upper Columbia River Basin EIS area than in the Eastside EIS area. |

| | |
|---|---|
| Forest PVGs | The CRBSUM simulation of these types generally meets expectations. However, the dry forest potential vegetation group does not have emphasis on using prescribed fire, exotic forb control, and harvest/thinning to restore native structures in Alternatives 4 and 6 that could be simulated if prescriptions were mapped to the potential vegetation group level. Based on the preliminary draft EISs' description of alternative, there should be more restoration in Alternatives 4 and 6 than in Alternatives 3 and 5, which have more than Alternatives 1, 2, and 7. In general, range management is not simulated to the same level in the forest potential vegetation group as in the range potential vegetation group, the desired future conditions, and the standards in the preliminary draft EISs. The reason for this disparity is the time constraint to develop the more complex forested range relationships that occur in these potential vegetation groups. |

Table 2.13—Notes on alternative assumptions relative to spatial prioritization of activities compared to CRBSUM simulation of activities.

| Group[1] and Alternative | Notes |
|---|---|
| _Group F_ | *This group of subbasins represents areas with high levels of urban and wildland interface influence, high fire risks in those zones, and low overall ecological integrity. Subbasins are dominated by the dry forest potential vegetation group (PVG) with intermixed range PVGs.* |
| Alt. 1 & 2 | No particular emphasis in comparison to other groups, except more activities than group H. |
| Alt. 4 & 6 | High emphasis on forest composition, structure, and process restoration activities. Slower rate of implementation in Alternative 6 than Alternative 4. |
| Alt. 3 | Low emphasis on activities relative to Alternatives 4 and 6 due to local concerns for maintenance of forested visual conditions and big game hiding cover. |
| Alt. 5 | Low emphasis on activities relative to Alternatives 4 and 6 due to lack of high net benefit and productivity returns. |
| Alt. 7 | Similar emphasis on activities in this group as for Alternative 3. |
| _Group J_ | *This group of subbasins represents areas with high to moderate levels of urban and wildland interface influence, high fire risks in those zones, and moderate overall ecological integrity. Subbasins are dominated by the dry forest potential vegetation group, with intermixed range potential vegetation groups.* |
| Alt. 1 & 2 | No particular emphasis compared to other groups, except more activities than group H. |

| | |
|---|---|
| Alt. 4 & 6 | High emphasis on forest composition, structure, and process restoration activities in this group. Slower rate of implementation in Alternative 6 than Alternative 4, and less emphasis than in group F. |
| Alt. 3 | Similar emphasis on activities in this group relative to Alternatives 4 and 6. |
| Alt. 5 | Low emphasis on activities relative to Alternatives 4 and 6 due to lack of high net benefit and productivity returns. |
| Alt. 7 | Similar emphasis on activities as Alternative 3. |
| *<u>Group L</u>* | *This group includes subbasins that have moderate levels of urban/wildland interface influence, moderate to high fire risk in those zones, and low integrity. Subbasins are typically dominated with woodland, dry shrub, or dry forest potential vegetation groups. Dry forest dominated subbasins are typically intermixed with range potential vegetation groups.* |
| Alt. 1 & 2 | No particular emphasis in comparison to other groups, except more activities than group H. |
| Alt. 4 & 6 | High emphasis on forest and/or range composition, structure, and process restoration activities. Emphasis on exotic control. Emphasis on fire suppression in dry shrub and dry grass potential vegetation groups. Slower rate of implementation in Alternative 6 than in Alternative 4. |
| Alt. 3 | High emphasis on forest management activities due to local concerns. High emphasis on range activities due to concentrated public land base, working relationships with permittees, and available resources. |
| Alt. 5 | Low emphasis on activities relative to Alternatives 4 and 6 due to lack of high net benefit and productivity returns. |
| Alt. 7 | Similar emphasis on activities as in Alternative 3. |
| *<u>Group M</u>* | *This group includes subbasins that have low to moderate levels of urban/wildland interface influence, low to moderate fire risk in those zones, and fair to high productivity. Integrity on forest dominated subbasins is low, but productivity is high and the succession response relative to restoration opportunities is rapid. However, these subbasins have major historic effects of blister rust on western white pine. Large areas within the forest subbasins are now dominated by shrubs or insect/disease, stress, and fire susceptible tree species, with high risk of cycling. Range-dominated subbasins have moderate integrity and productivity, with good opportunities to conserve or restore ecological integrity.* |
| Alt. 1 & 2 | No particular emphasis in comparison to other groups, except more activities than group H. |

| | |
|---|---|
| Alt. 4 & 6 | High emphasis on: (1) forest and/or range composition, structure, and process restoration activities; (2) western white pine recovery in the forest dominated subbasins; and (3) watershed restoration via road density reductions. Emphasis on fire suppression, exotic control, and restoration of natives in range dominated subbasins. Emphasis on fire suppression in dry shrub and dry grass potential vegetation groups on range dominated subbasins. Slower rate of implementation in Alternative 6 than in Alternative 4. |
| Alt. 3 | Moderate emphasis in forest dominated subbasins on forest management activities due to local concerns. Primary local emphasis will be to maintain flow of timber to the mills. High emphasis in range-dominated subbasins on range activities due to concentrated public land base, working relationships with permittees, and available resources. |
| Alt. 5 | High emphasis on commodity production in the forest dominated subbasins relative to Alternatives 4 and 6. Similar emphasis as group L on range dominated subbasins. |
| Alt. 7 | Similar emphasis as Alternative 3 for forest dominated subbasins. Reserve areas present in the range dominated subbasins. |
| <u>*Group H*</u> | *This group includes subbasins that have low urban/wildland interface influence, but high levels of semi-primitive and peripheral developed recreation use, moderate fire risk in those zones, and high integrity. A substantial amount of these subbasins is in wilderness or roadless condition. Forests have low departures from the historic range of variability in comparison to other subbasin groups. These subbasins contain the largest amount of cold forest, which has the historic effect of blister rust on whitebark pine; blister root causes substantial changes in forest composition, structure, and processes in the subalpine zone. Dry forest potential vegetation groups are also common, and fires in this zone can be large and intense. Intermixed range potential vegetation groups are generally low departure from the historical range of variability.* |
| Alt. 1 & 2 | Less emphasis on activities at the broad scale compared to other groups due to high amounts of designated wilderness. However, substantial projected roading at the watershed level in roadless areas around wilderness areas. |
| Alt. 4 & 6 | High emphasis on conservation of high integrity and associated forest and/or range composition, structure, and processes via protection from development and management for natural processes, such as prescribed natural fire, including both planned and unplanned ignitions. High emphasis on whitebark pine recovery in the cold forest potential vegetation groups. |
| Alt. 3 | High emphasis on conservation due to local concerns about development and visuals. Moderate emphasis on restoration of whitebark pine. Moderate emphasis on restoring composition, structure, and processes. |

| | |
|---|---|
| Alt. 5 | Low emphasis on commodity production. High emphasis on recreation use. Low emphasis on restoration, relative to Alternatives 4 and 6. |
| Alt. 7 | Primarily in reserve areas. Expect unpredictable fire and insect/stress events. Successional cycles not expected to achieve restoration objectives since areas have tendency toward urban/wildland interface areas where there is high concern for maintaining visual conditions. Consequently, many fire starts would be suppressed. Only large fires would not be controlled. Exotics would continue to spread. No recovery of whitebark pine. |

[1]Refers to map 2.22 “FS and BLM Lands CRBSUM Forest and Range Cluster Groups.”
Group F: high urban/wildland interface, low integrity, moderate-high fire risk.
Group J: high urban/wildland interface, moderate integrity, moderate fire risk.
Group L: moderate urban/wildland interface, low integrity, high fire risk.
Group M: low urban/wildland interface, low-moderate integrity, moderate fire risk.
Group H: low urban/wildland interface, high integrity, moderate fire risk.

Table 2.14—River subbasin grouping for display of preliminary draft EIS BLM/FS management and other disturbances, and associated effects.

| Subbasin Group Legend | Description |
|---|---|
| High Urban/Wildlands (F)<br>Low Integrity<br>Mod-High Fire Risk | < Dry river subbasins with high amounts of urban/wildland interface and moderate to high fire risk in those areas.<br>< Generally low consideration of aquatic, and mixed low to moderate consideration for forest and range integrity.<br>< Low amounts of wilderness and semi-primitive areas.<br>< Moderate to high amounts of BLM- and FS-administered lands.<br>< Includes forest cluster 6 and some range clusters 3 and 6. |
| High Urban/Wildlands (J)<br>Low Integrity<br>Moderate Fire Risk | < River subbasins with high/some moderate amounts of urban/wildland interface and moderate fire risk in those areas.<br>< Generally moderate consideration for aquatic and range, and low to moderate for forest integrity.<br>< Moderate amounts of wilderness and semi-primitive areas, typically in the headwaters.<br>< Moderate to high amounts of BLM- and FS-administered lands.<br>< Includes forest cluster 3 and some range cluster 3. |

| | |
|---|---|
| Mod Urban/Wildlands (L)<br>Low Integrity<br>High Fire Risk | < Dry forest or range-dominated river subbasins with moderate amounts of urban/wildland interface and high fire risk in those areas.<br>< Low consideration for forest integrity and low, with some moderate consideration for aquatic and range integrity.<br>< Low amounts of wilderness and semi-primitive areas.<br>< Mixed low to high amounts of BLM- and FS-administered lands.<br>< Includes forest clusters 5 and 7, and primarily range clusters 3 and 6. |
| Low Urban/Wildlands (M)<br>Low-Moderate Integrity<br>Moderate Fire Risk | < Moist forest-dominated or cooler range-dominated river subbasins with low urban/wildland interface and moderate fire risk in those areas.<br>< Low to moderate consideration for aquatic and forest integrity, with moderate to high for range integrity.<br>< Low to moderate levels of wilderness and semi-primitive areas.<br>< High amounts of BLM- and FS-administered lands.<br>< Includes forest clusters 4 and 7, and primarily range clusters 5 and 7. |
| Low Urban/Wildlands (H)<br>High Integrity<br>Moderate Fire Risk | < River subbasins with low amounts of urban/wildland interface and moderate fire risk in those areas.<br>< High, with some moderate, consideration of forest, range, and aquatic integrity.<br>< High amounts of wilderness and semi-primitive areas.<br>< High amounts of BLM- and FS-administered lands.<br>< Forest clusters 1 and 2, and primarily range clusters 2 and 5. |