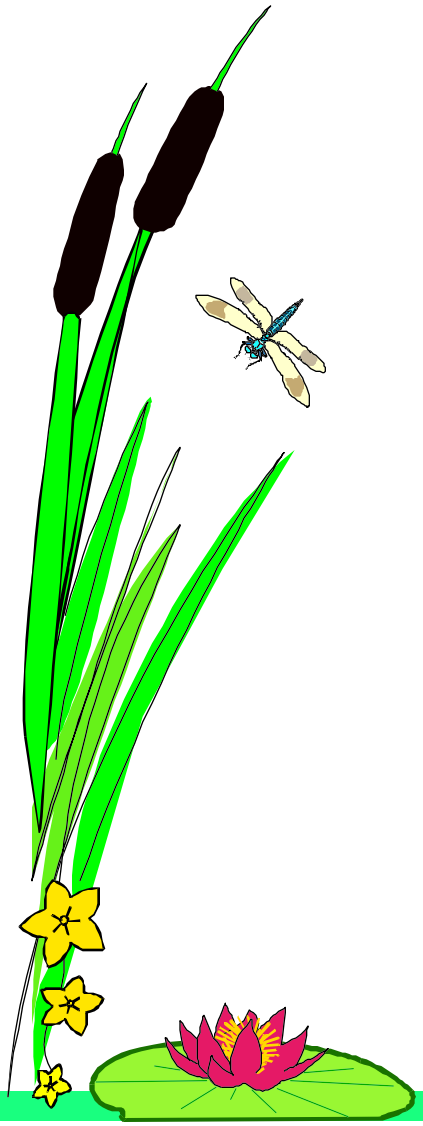
Appendix 2-2 Rangeland Succession Models and Noxious Weeds

(Comparable to UCRB Appendix F)



This Appendix contains the following items:

- *Succession Models for Rangeland*
  - *Climax Model*
  - *State & Transition Model*
- *Noxious Weed Management*

Succession Models for Rangeland Vegetation

Climax Model

The "climax" model of rangeland vegetation succession ~ which is essentially vegetation change ~ uses concepts of climax and plant succession proposed by Clements (1916) and the application of these concepts to rangelands by Sampson (1919). The climax model is essentially a model upon which range condition, labeled typically as excellent, good, fair, or poor, is assessed (see Figure 1: Climax model for vegetation succession). As used, the climax model assumes three things. (1) A vegetation type has only one stable state, the climax, which is a stable plant community determined by climate. (2) Any change in the plant community away from climax, which is referred to as retrogression, which is caused by improper livestock grazing, results in an unstable state which can be reversed by reduction, manipulation, or elimination of livestock grazing. This reversal represents a movement of the plant community back towards the climax community, which is referred to as secondary succession. Thus, retrogression and secondary succession are opposite pathways of vegetation change; retrogression leads vegetation away from climax and thus into poorer condition, and secondary succession leads vegetation toward climax or excellent condition. (3) For a given plant community, its condition can change from poor to excellent or from excellent to poor. The change is continuous, along a continuum (Vavra et al. 1994).

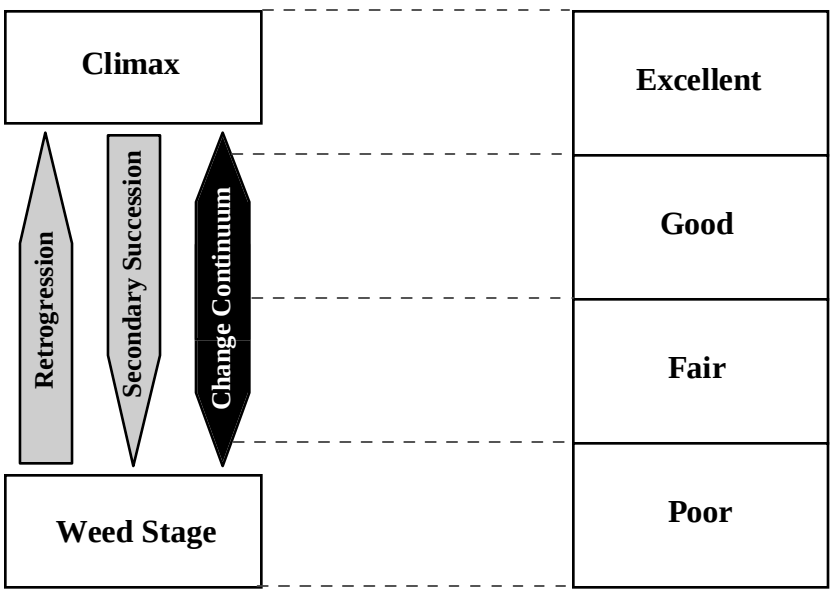


Figure 1. Climax model for vegetation succession *- The climax model of vegetation succession and the approximate relationships between range condition and degree of retrogression from climax conditions. (Adapted from Ecological Implications of Livestock Herbivory in the West.)*

State and Transition Model

According to the "state and transition" model (see Figure 2: State and transition model for sagebrush grass ecosystems), "states" are recognizable, relatively stable groups of species occupying a site. Forces that cause vegetation to cross a threshold and move toward another state are known as transitions. Once a threshold is crossed, removal of the force will not result in reversal, that is, secondary succession back to climax. Thus, vegetation in this model does not necessarily succeed or retrogress continuously, in a linear way, with change in livestock grazing pressure, as the climax model asserts (adapted from Vavra et al. 1994).

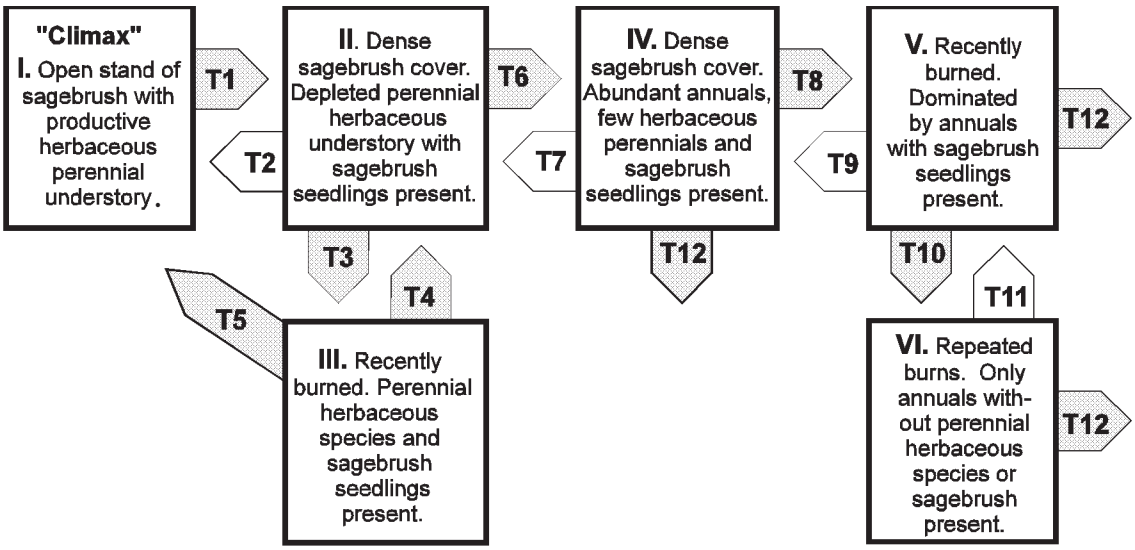


Figure 2. - State and Transition Model for Sagebrush Grass Ecosystem. States I, II, *and* ***III*** *exist in areas without annual species (for example, cheatgrass or medusahead).*

State I *is the "climax" or condition undisturbed by livestock grazing. Transition arrow* ***T1*** *represents heavy grazing which causes deterioration of the understory and increased density and vigor of sagebrush.*

State II *is dominated by sagebrush and will remain stable for long periods of time. Transition* ***T3*** *is fire or some other force (for example, insects, disease, or an herbivore that eats sagebrush) that reduces the sagebrush, which permits the understory to improve (****State III****).*

With proper livestock grazing management (Transition ***T5****).* ***State III*** *can move back to a state resembling* ***State I.*** *With heavy grazing (Transition* ***T4****),* ***State III*** *will move to* ***State II****, and sagebrush will again dominate the stand.* ***State IV*** *represents the situation in a heavily grazed area where a well-adapted annual-like cheatgrass exists. Continuous heavily grazing (Transition* ***T6****) of* ***State II*** *results in* ***State IV****, and perennials in the understory have been replaced by annuals.*

The transitions of ***State IV*** *to* ***State V*** *(Transition* ***T8****), and* ***State V*** *to* ***State VI*** *(Transition* ***T10****) represents the role of fires in the conversion to a stable cheatgrass-dominated plant community. Transition* ***T12*** *represents intervention by humans, such as seeding of exotic perennial grasses, like crested wheatgrass. The Bureau of Land Management, for example, plants strips of vegetative fuel breaks consisting of crested wheatgrass, other grasses, forbs and shrubs to slow the spread of fires. (Adapted from Ecological Implications of Livestock Herbivory in the West).*

Noxious Weed Management

Introduction

The magnitude and complexity of noxious rangeland weeds in the assessment area, combined with their cost of control, necessitates using Integrated Weed Management (IWM). IWM involves the use of several control techniques in a well-planned, coordinated, and organized program to reduce the impact of weeds on rangelands. Inventory and mapping is the first phase of any IWM program. The second phase includes prioritizing weed problems and choosing and implementing control techniques strategically for a particular weed management unit on the ground. The third phase is adopting proper range management practices as a portion of the IWM program. The IWM program must fit into an overall range management plan.

Integrated Weed Management

Step 1. Inventory and Mapping

The goal of inventory and mapping is to determine and record the weed species present, the area infested, the density of the infestation, the rangeland under threat of invasion, the soils and range vegetation types, and other site factors pertinent to successfully managing infested rangeland and rangeland susceptible to invasion. Inventories and mapping can be conducted by field surveys, aerial photography, and geographic information systems.

Planning and Implementation

Planning is the process by which weed problems and solutions are identified and prioritized. In addition, an economic plan of action is developed to provide direction for implementing the IWM program. Implementing control techniques includes (1) preventing encroachment into uninfested rangeland, (2) detecting and eradicating new introductions, (3) containing large-scale infestations, (4) controlling large-scale infestations using an integrated approach, and often (5) revegetation. The key component of any successful weed management program is sustained effort, constant evaluation, and the adoption of improved strategies.

Step 2. Preventing Weed Encroachment

Preventing the introduction of rangeland weeds is the most practical and cost-effective method for their management. Prevention programs include such techniques as limiting weed seed dispersal, minimizing soil disturbance, and properly managing desirable vegetation. New weed introductions can be minimized by (1) using weed seed free hay, feed grain, straw, or mulch, (2) refraining from driving vehicles and machinery through weed infestations and, before driving from a weed infested area to an uninfested area, washing the undercarriage of vehicles and machinery, (3) permitting livestock to graze weed infested areas only when weeds are not flowering or producing seeds, or, if livestock are grazing weed infested areas, moving them to a holding area for about 14 days before moving them to weed-free areas, (4) requesting that campers, hikers, and sportsmen who are recreating in weed infested areas, brush and clean themselves and their equipment before moving to uninfested areas, (5) minimizing unnecessary soil disturbance by vehicles, machinery, waterflow, and livestock, and (6) managing grasses for vigor and competition with weeds.

Step 3. Detecting and Eradicating New Introductions

Early detection and systematic eradication of weed introductions are central to IWM. Weeds encroach typically by establishing small “satellite” infestations, that are generally the spreading front of the large infestation. Eradication involves total removal of the weed and is achievable on a small scale. An eradication program involves delimiting the boundaries of the infestation, both on the ground and on maps, determining the proper control procedures, and the number and timing of follow-up applications. This generally requires aggressive annual applications of herbicides. Revegetation of infested areas might be required to eradicate weeds in areas that do not have an understory of desirable species that can reoccupy the area after weeds are controlled. Eradication of small patches requires continual monitoring and evaluation to ensure successful removal of the weed.

Step 4. Containing Large-Scale Infestations

Containment programs are generally used to restrict the encroachment of large-scale weed infestations. Studies have shown that containing weed infestations, which are too large to eradicate, is cost-effective because it preserves neighboring uninfested rangeland and enhances the success of future large-scale control programs. Containing a large-scale infestation requires using preventive techniques and spraying herbicides on the border of weed infestations to stop the advancing front of weed encroachment. Containment programs typically require a long-term

commitment to herbicide application because they are designed to limit spread and are not designed to modify or reduce the infestation level. Roadways and railways, where weed infestations often begin, should be subjected to a constant prevention and containment program.

Step 5. Controlling Large-Scale Infestations

Most successful large-scale weed control programs are completed in a series of steps. Weed control areas should be divided into smaller units to make them more manageable. Weed control should be implemented unit by unit at a rate compatible with economic objectives.

Initially, large-scale weed control should focus on rangeland sites with an understory of residual grasses and the highest potential productivity. Suppressed grasses have the greatest chance of reestablishing dominance on these sites. These areas areas must be spot treated each year to ensure control and minimize reinvasion. In most cases, some percentage of the management unit will require that control measures be repeatedly applied until the weed seed bank and root reserves are exhausted.

Next, control efforts should focus on the sites adjacent to those initially treated to minimize reintroduction of the weeds. Usually, large-scale control is most effectively applied from the outside of the weed management unit inward toward its center. Selection and application of weed control techniques in large-scale control programs depends on the specific circumstances for each portion of the management unit. Control techniques used in one area of the management unit might be inappropriate for another area. For example, sheep grazing leafy spurge in one area might provide cost-effective control, but sheep do not readily consume spotted knapweed and herbicides might be more appropriate. Similarly, the most effective herbicide for a particular weed species might not be labeled for use in an environmentally sensitive area. Selection will depend on the (1) weed species, (2) effectiveness of the control technique, (3) availability of control agents or grazing animals, (4) land use, (5) length of time required for control, (6) environmental considerations, and (7) relative cost of the control techniques.

Researchers are currently determining if combining treatments will provide a synergistic (the effects of the treatment combination are greater than the sum effects of each treatment applied individually) response in controlling weeds. Some preliminary evidence suggests most control techniques are compatible. The later discussions of each weed species in this report include recommendations for treatment combinations that might be effective.

Step 6. Revegetation

Revegetation with desirable plants might be the best long-term alternative for controlling weeds on sites without an understory of desirable species. Establishing competitive grasses can minimize there invasion of rangeland weeds and provide excellent forage production. In most areas, a fall herbicide application after weeds have emerged with subsequent plowing or disking and drill seeding is most effective for establishing desirable species.

Step 7. Proper Range Management

Proper range management is especially critical during the management phase after weed control. Proper livestock grazing is essential to maintain competitive desirable plants, which will help prevent weed reinvasion after control. A grazing plan should be developed for any management unit involved in a weed management program. The plan should include altering the season of use and stocking rates to achieve moderate utilization of the herbaceous component. Grazing systems should rotate livestock to permit plants to recover before being regrazed and should promote litter accumulation. Range monitoring and annual evaluations should be conducted to determine the adequacy of existing management.

Noxious Weed Control Guidelines for an IWM Strategy

Use the following cultural, physical, biological, and chemical control guidelines to implement and determine the best method(s) for an integrated approach to noxious weed management. (U.S. Department of the Interior, Bureau of Land Management. 1994. Noxious weed strategy for Oregon/ Washington. Oregon State Office, Portland, Oregon. BLM/OR/WA/PT-94/36+4220.9.)

Cultural

Prevention

1. Develop available preventive measures, such as quarantine and closure, to reduce the spread of the infestation.
2. Determine whether policy and laws allow for the use of all preventive measures, including local quarantine and closure.
3. If past management activities have allowed the introduction and spread of noxious weeds, determine how to change management after selecting a treatment method.

Livestock Manipulation

1. Determine whether changes in livestock grazing will affect the target weeds. Reduced grazing may allow for increased competition from beneficial vegetation or just allow for more seeds to be disseminated. Increased grazing may reduce beneficial vegetation or may be used to reduce seed source.
2. Determine whether changes in movement or type of livestock is necessary to reduce or contain the infestation due to movement of seeds on or in the animals.
3. Determine whether containing livestock in a weed free area prior to introduction to the area would prevent new infestations.

Wildlife Manipulation

1. Determine whether wildlife or wildlife feeding programs can be managed to reduce weed infestations.
2. Determine feasibility of changes in wildlife movement that would reduce or contain the infestation due to movement of seeds on or in the animals.

Soil Disturbance Activities

1. Revegetate all bare soil following disturbance.
2. Select plant species that will reduce the spread of noxious weeds.
3. Defer soil disturbance if possible until weeds are controlled or under management.

Rock Sources

1. Develop rock source management plans.
2. Keep use of rock source confined to existing contaminated roads.
3. Keep new or “clean” rock stockpiles separate from contaminated stockpiles.
4. Obtain rock from uncontaminated sources.

Public Use

1. Determine most feasible land use to reduce and prevent infestations.
2. Determine whether specific public awareness programs could reduce the infestation or control the spread of weeds.
3. Determine whether exclusion is a possibility and how it would affect the weed infestation.

Physical

Manual Control

1. Determine whether hoeing or "grubbing" will reduce (or increase) the infestation.
2. Determine whether hand pulling the weeds reduces the seed source.

Mechanical Control

1. Evaluate terrain to allow for mowing and determine whether it is an acceptable option for control of the spread of seeds.
2. Evaluate cultivation and other conventional farming practices options that could be used cost effectively.

Control by Burning

1. Determine whether policy and laws allow controlled burning and address regulations regarding smoke management.
2. Determine whether the terrain and vegetative cover allow for a controlled burn program.
3. Evaluate a controlled burn program to reduce the infestation.
4. Determine long-term effect of burning on nontarget species.

Biological

Natural Competition

1. Determine whether there are naturally occurring agents within the ecosystem which can reduce the infestation.
2. Determine which elements affect naturally occurring control agents. Determine whether these elements can be modified to reduce the negative effect on these agents. Determine whether these elements can be enhanced to increase the effectiveness of these agents on the weed infestation.

Introduced Competition

1. Determine whether biological control agents can be introduced into the ecosystem to reduce the amount of infestation.
2. Determine which introduced biological agents provide an acceptable control method for this infestation.
3. Evaluate if the biological control agent has been tested for adverse effects against all nontarget species within the treatment area.
4. Determine whether the introduced biological agent can survive in the environment of the treatment area.
5. Determine whether policy and laws allow for the introduction of biological control agents.

6. Determine whether policy and laws allow for introduction and grazing of livestock as a biological control measure.

Chemical

Fertilization

1. Determine whether chemical fertilization would reduce the amount of weeds by increasing competition of beneficial plant species.
2. Determine whether increased nitrogen (or other nutrients) would reduce weeds due to direct effect (for example, Curlycup gumweed).

Pesticides

1. Evaluate the acceptability of herbicides (or other pesticides) to control the infestation.
2. Determine whether pesticides are labeled for use on the target weed and use on the infested site (consider nontarget plants, soil type, groundwater location, topography, climate, state labeling). Determine the most effective application techniques.
3. Determine the most effective and cost-efficient types of conventional application equipment.
4. Determine whether properly trained personnel are available to apply the pesticides.

Table A. Broad-scale cover types in the project area and their susceptibility to invasion by 25 weed species (24 legally declared noxious, plus cheatgrass).

Cover Type	Brte[1]	Canu	Caspp	Cedi	Cema	Cere	Ceso	Cevi	Chju	Chle	Ciar	Civu	Crvu	Eues	Hagl	Hiau	Hipr	Isti	Lida	Livu	Lysa	Onac	Pore	Saae	Taas
Alpine Tundra	L[2]	L	L	L	L	L	L	L	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	L
Aspen	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	M	M	L	U	M	U	M
Big Sagebrush	H	U	M	M	M	M	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	M	U	H	M
Bitterbrush/ Bluebunch Wheatgrass	H	M	M	H	M	U	M	M	U	U	M	M	M	M	M	L	L	M	M	M	L	U	M	U	M
Chokecherry/ Serviceberry/Rose	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	U	M
Cottonwood/Willow	M	M	M	M	H	M	M	M	M	H	H	M	L	H	L	M	H	M	M	M	M	M	M	U	M
Cropland/ Hay/Pasture	M	M	H	M	H	M	H	M	H	M	M	M	M	H	M	M	M	H	M	M	L	M	M	U	M
Engelmann Spruce/ Subalpine Fir	H	H	M	M	M	M	M	M	M	H	H	H	L	M	L	M	M	L	M	M	M	U	M	U	M
Exotic Forbs/ Annual Grass	H	M	H	M	M	M	H	H	H	M	M	M	M	M	M	M	M	H	H	H	M	M	H	M	M
Fescue-Bunchgrass	H	H	M	H	H	M	H	M	M	M	H	H	M	H	M	L	L	H	H	H	L	M	H	H	M
Grand Fir/White Fir	M	M	M	M	M	M	M	M	M	M	M	M	L	M	L	M	U	L	M	M	M	U	M	U	M
Herbaceous Wetlands	M	M	M	M	H	M	H	M	L	H	H	M	L	M	L	H	M	M	M	H	H	M	H	U	M
Interior Douglas-fir	H	H	M	M	H	M	M	M	M	M	H	H	M	M	M	M	M	M	M	M	L	M	H	U	M
Interior Ponderosa Pine	H	M	M	H	H	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	H	U	M

Table of Contents

Table A. Broad-scale cover types in the project area and their susceptibility to invasion by 25 weed species (24 legally declared noxious, plus cheatgrass) (cont).

Cover Type	Brte[1]	Canu	Caspp	Cedi	Cema	Cere	Ceso	Cevi	Chju	Chle	Ciar	Civu	Crvu	Eues	Hagl	Hiau	Hipr	Isti	Lida	Livu	Lysa	Onac	Pore	Saae	Taas
Juniper/ Sagebrush	M	M	M	M	M	U	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	U	U	U	M
Juniper Woodlands	M	M	M	M	M	U	M	M	M	U	M	M	L	M	M	L	L	M	M	M	L	U	M	U	M
Limber Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	L	M	M	L	M	M	M	L	L	M	U	M
Lodgepole Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	M	M	M	L	M	M	U	M
Low Sagebrush	M	U	M	M	U	U	M	M	U	U	M	M	L	M	M	L	L	H	M	U	L	U	U	U	M
Mixed-Conifer Woodlands	H	M	M	M	H	M	M	M	M	U	H	M	L	M	M	L	L	M	M	M	L	U	H	U	M
Mountain Big Sagebrush	H	M	M	M	M	M	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	M	M	U	M
Mountain Hemlock	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Mountain Mahogany	M	M	M	M	M	M	H	M	U	U	M	M	M	M	M	L	L	M	H	M	L	U	M	H	M
Native Forb	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	M	M	H	U	M
Oregon White Oak	M	U	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	U	M	L	M	M	U	M
Pacific Ponderosa Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	M	U	M
Pacific Silver Fir/ Mountain Hemlock	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Red Fir	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Salt Desert Shrub	M	M	M	L	L	M	L	M	L	L	M	M	L	M	H	L	L	L	L	L	L	L	L	U	L
Shrub or Herb/ Tree Regen	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	L	M	M	M	L	M	H	U	M
Shrub Wetlands	M	H	M	M	H	M	M	M	L	M	H	H	L	M	L	M	M	M	M	M	H	M	M	U	M

Table of Contents

Sierra Nevada Mixed-Conifer	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	M	U	M
Western Larch	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	M	M	L	M	M	U	M
Western Redcedar/ Western Hemlock	M	H	M	M	M	M	M	M	M	H	H	H	L	M	L	M	M	L	M	M	M	U	M	U	M
Western White Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	U	M	U	M
Wheatgrass Bunchgrass	H	M	M	H	H	M	H	M	M	M	H	M	M	M	M	L	L	H	H	M	L	M	H	H	M
Whitebark Pine	L	L	L	L	L	L	L	M	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	M
Whitebark Pine/ Subalpine Larch	L	L	L	L	L	L	L	L	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	L

[1] Species codes for exotic plants: Brte = cheatgrass; Canu = musk thistle; Caspp = whitetop; Cedi = diffuse knapweed; Cema = spotted knapweed; Cere = Russian knapweed; Ceso = yellow starthistle; Cevi = squarrose knapweed; Chju = rush skeletonweed; Chle = oxeye daisy; Ciar = Canada thistle; Civu = bull thistle; Crvu = common crupina; Eues = leafy spurge; Hagl = halogeton; Hiau = orange hawkweed; Hipr = yellow hawkweed; Isti = Dyers woad; Lida = dalmatian toadflax; Livu = yellow toadflax; Lysa = purple loosestrife; Onac = Scotch thistle; Pore = sulfur cinquefoil; Saae = Mediterranean sage; Taas = medusahead.

[2] Ratings representing susceptibility to invasion, and definitions:

(1) H = High susceptibility to invasion — Exotic plant species is an “invader” and invades the cover type successfully and becomes dominant or codominant even in the absence of intense or frequent disturbance;

(2) M = Moderate susceptibility to invasion — Exotic plant species is a “colonizer” and invades the cover type successfully because high intensity or frequency of disturbance impacts the soil surface or removes the normal canopy cover;

(3) L = Low susceptibility to invasion — Exotic plant species typically does not establish because the cover type does not provide suitable habitat; and

(4) U = Unknown susceptibility to invasion — Herbarium mount labels did not report the species at the collection site that existed in association with the mounted exotic plants, or ecological requirements of the exotic plant are not available in the literature, or there was a lack of distribution records (for example, herbaria mounts) for the exotic plant, or the extent of the cover type in the Project Area might be so minor as to prevent or restrict the probability of obtaining distribution records for the exotic plant within that cover type.

Table of Contents

Table B. Description of broad-scale cover types in the project area used in Table A to characterize the susceptibility of vegetation types to invasion by weed species.

Cover Type	Description
Alpine Tundra	*Phyllodoce* spp. (low shrubs)
Aspen	*Populus tremuloides*
Barren	Rock/Barrenlands
Big Sagebrush	*Artemisia tridentata wyomingensis* *Artemisia tridentata tridentata/Elymus cinereus* *Artemisia tripartita/Agropyron cristatum* *Artemisia tripartita*/Exotic Herbs *Artemisia tridentata tridentata/Agropyron* spp. *Artemisia tridentata tridentata/Bromus tectorum* *Artemisia* spp./*Bromus tectorum* *Artemisia tripartita*
Bitterbrush/Bluebunch Wheatgrass	*Purshia tridentata/Bromus tectorum* *Purshia tridentata/Agropyron spicatum*
Chokecherry/Serviceberry/Rose	*Prunus virginiana/Amelanchier alnifolia/Rosa* spp.
Cottonwood/Willow	*Populus trichocarpa*/*Salix* spp. *Populus* spp./*Cornus* spp. *Populus* spp./*Poa pratensis*
Cropland/Hay/Pasture	Dryland Crop Dryland Pasture/Hayland Irrigated Crop Irrigated Pasture/Hayland
Engelmann Spruce/Subalpine Fir	*Picea engelmannii/Abies lasiocarpa*
Exotic Forbs/Annual Grass	Exotic Forbs Exotic Grass (*Bromus tectorum/Taeniatherum caput-medusae/ Poa secunda*) Exotic Herbaceous Exotic Herbs Exotic Perennial Grass
Fescue-Bunchgrass	*Festuca idahoensis/Agropyron* spp. Low Productivity Perennial Grass Perennial Native Bunchgrass Perennial Native Herbaceous Seeded Native Grass (*Agropyron spicatum/Festuca idahoensis*) Seeded Native Grass (*Poa secunda/Agropyron spicatum*) Small Perennial Grass
Grand Fir/White Fir	*Abies grandis/Abies concolor*
Herbaceous Wetlands	*Carex nebraskensis* *Carex rostrata/Carex aquatilis* Grass/*Carex* spp. *Elymus* spp.

TABLE OF CONTENTS

Interior Douglas-fir	*Pseudotsuga menziesii* var. *glauca* *Pseudotsuga menziesii/Abies grandis*/Exotic Herbs *Pseudotsuga menziesii/Abies grandis/Populus* spp./Shrub
Interior Ponderosa Pine	*Pinus ponderosa* var. *scopulorum* *Pinus* spp./*Populus* spp./Exotic Herbs *Pinus* spp./*Populus* spp./Shrub
Juniper/Sagebrush Forb	*Juniperus* spp./*Artemisia arbuscula/Festuca idahoensis/* *Juniperus* spp./*Artemisia* spp./*Agropyron* spp.
Juniper Woodlands	*Juniperus* spp./Exotic Herbs *Juniperus* spp./*Artemisia arbuscula*/Shortgrass *Juniperus* spp. Forest/Exotic Herbs *Juniperus* spp. Woodlands *Juniperus* spp./Native Bunchgrass *Juniperus* spp./*Poa secunda*
Limber Pine	*Pinus flexilis*
Lodgepole Pine	*Pinus contorta*
Low Sagebrush	*Artemisia arbuscula*/Native Forbs *Artemisia arbuscula/Bromus tectorum* *Artemisia arbuscula*/Native Bunchgrass *Artemisia* spp./*Poa secunda*
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

TABLE OF CONTENTS

Table B. Description of broad-scale cover types in the project area used in Table A to characterize the susceptibility of vegetation types to invasion by weed species (cont).

Cover Type	Description
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*
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*) 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 Project Area are *Eurotia lanata* (winterfat), *Atriplex confertifolia* (shadscale), *Elymus cinereus* (Great Basin wildrye), and *Grayia spinosa* (spiny hopsage).

GO TO APPENDIX 2-1 GO TO APPENDIX 2-3

TABLE OF CONTENTS