

## VI. Sand and Camas MLSAs

### A. General Description of MLSA'S

This portion of the document describes the vegetation, wildlife resources and human uses associated with these MLSAs.

#### 1. Vegetation

This section describes the current condition of vegetation groups within the Camas and Sand Creek MLSAs. Data was derived from aerial photograph interpretation (Appendix 3). It should be noted that site-specific information regarding vegetation structure and distribution will need to be updated, as restoration projects are initiated. The idea would be to use the vegetation layer derived for this analysis as a starting point only.

##### a) Dry Forest Group and Grassland/Shrubland

Ninety-four percent (1,457 acres) of the Camas MLSA and 78 percent (7,163 acres) of the Sand Creek MLSA consist of the dry forest group. Within this group, 64 percent (926 acres) of the Camas MLSA and 65 percent (4,630 acres) of the Sand Creek MLSA are mapped as high density. Created openings are mapped for 26 percent (382 acres) of the Camas MLSA and for 6 percent (445 acres) of the Sand Creek MLSA (Appendix 4). In Camas, created openings are largely the result of the Rat Creek Fire of 1994.

Within this forest group, the ponderosa pine series is limited within the MLSA. In some locations, ponderosa pine exists as the sole overstory dominant, but more often is co-dominant with Douglas-fir. Shrub composition in the understory is dominated almost exclusively by *Purshia tridentata*. Grasses include *Agropyron spicatum*, *Calamagrostis rubescens*, *Carex geyeri*, and *Poa wheeleri*, and forbs present include *Achillea millefolium*, *Lupinus serecius*, *Balsamorhiza sagitata*, and *Lomatium* spp.

Five percent (484 acres) of the Sand Creek MLSA and 72 acres of the Camas MLSA consist of grassland or shrubland vegetation. This vegetation is mostly restricted to dry, south aspects within the dry forest group. Grassland or shrubland vegetation is similar to *P. tridentata* or *Agropyron spicatum* habitat types described by Daubenmire (1988).

##### b) Mesic Forest Sites (Embedded within the Dry Forest Group)

Mesic sites were mapped on 15 percent (1,357 acres) of the Sand Creek MLSA and none of the Camas MLSA. Ninety-four percent (1,280 acres) of this group was mapped as high density. It will be important for these sites to be identified through restoration projects since suitable spotted owl habitat may need to be promoted or maintained within a 1.8-mile radius of spotted owl circles on mesic sites. Mesic sites outside of these circles (see wildlife section) would be managed similarly to dry forest sites, but different species compositions and structures would direct specific management strategies.

Mesic sites are typically within the Douglas-fir series and include the more moist plant associations. Ponderosa pine may be present, but only as remnants from early seral establishment. The understory tends to be more lush, often with a higher shrub component than in the more dry plant associations within the Douglas-fir and ponderosa series. Understory

species include *Symphoricarpos albus*, *Arctostaphylos uva-ursi*, *Spiraea betulifolia*, *Pachistima myrsinites*, *Carex concinoides*, *Festuca occidentalis*, *Carex geyeri*, and *Calamagrostis rubescens*.

c) Moist Grand Fir Group

One percent (77 acres) of the Sand Creek MLSA and none of the Camas MLSA consist of the moist grand fir group. Within this group, 82 percent (63 acres) is mapped as high density. Because of the small acreage present, little information is available to accurately describe community composition. However, communities are likely similar to those described elsewhere. Understory composition is likely graminoid and forb dominated with such species as *Calamagrostis rubescens*, *Spiraea betulifolia*, *Rosa gymnocarpium*, *Linnaea borealis*, and *Chimaphila umbellata*.

d) Wet Forest Group

The wet forest group is not mapped within the Camas or the Sand Creek MLSAs.

e) Subalpine Fir Series

The Camas MLSA and Sand Creek MLSA contain none of the subalpine fir series (Appendix 4). This series is typically restricted to higher elevations.

f) Whitebark Pine/Subalpine Larch Group and High Elevation Nonforest Types

The Camas MLSA and Sand Creek MLSA have none of this group. This series is typically restricted to higher elevations.

g) Non-Forest Vegetation

Five percent (82 acres) of the Camas MLSA and 7 percent (628 acres) of the Sand Creek MLSA were mapped as non-forest vegetation (Appendix 4). A large portion (110 acres) of this vegetation group within the Sand Creek MLSA is mapped as bedrock. Grassland or shrubland (described above) and brushfields make up the remainder of this group in both MLSAs.

h) Species with Special Status

Within the Camas MLSA and Sand Creek MLSA, there is potential habitat for a number of special status species, but only a portion of both has been surveyed to determine presence or absence. Surveys should be carried out in conjunction with restoration projects, as well as surveys independent of other activities. It is important that species ranges are known so that better estimates of species viability can be assessed. In addition, little is known about most special status species habitat and biological requirements, and inventories provide a first and necessary step in obtaining this information.

There are five known Forest Service sensitive (see Late-Successional Associated Plant Species, Chapter IV) species within the Sand Creek MLSA and four within the Camas MLSA (Appendix 6). These species include *Delphinium viridescens*, *Cypripedium fasciculatum*, *Iliamna longisepala*, *Orobancha pinorum*, and *Sidalcea oregana* var. *calva*.

*Cypripedium fasciculatum* has been the focus of a number of research and monitoring projects over the past four years on the Leavenworth Ranger District. Project include pollination ecology, seed dispersal, habitat characteristics, seed germination, electrophoresis, and fire ecology.

*Delphinium viridescens* occurs on seasonally moist meadows, often on old (hundreds of years) landslides, or riparian areas. These habitats provide early spring moisture which appears to be critical for species' survival. The species is rhizomatous and often fully occupies suitable habitat. A recent study (Harrod et al. in press) found that this species increases in size and reproductive potential in the first year following fire.

Most of what is known relative to habitat requirements of *Iliamna longisepala* has been made through casual observations. It has been observed (Harrod, personal observation) that this species occurs in disturbed areas including burns, roads, and skid trails. This observation suggests that *I. longisepala* is an early successional species and appears to require open habitats for seed germination, seedling establishment, avoidance of interspecific competition, and/or some other aspect of its life history.

A recent study by Kuhlmann and Harrod (unpubl. report) reports the results of one year of post-fire monitoring on *I. longisepala*. This study found that post-burn populations are younger than unburned populations based on an analysis of morphological characters. Greater percent vegetative and lower percent reproductive plants were also present in burned sites. These results suggest that *I. longisepala*, in fact, may respond to fire similar to that of *I. rivularis* which has fire-stimulated germination (Crane and Fischer 1986).

*Orobanche pinorum* is an achlorophyllous plant and obligate root parasite of *Holodiscus discolor*. Aerial stems are annual developing from a haustorial tuber. From each stem, 50-150 flowers are produced in late June or early July. The species is facultatively autogamous and it apparently only reproduces by seed (Ellis et al. 1994).

*Orobanche pinorum* is often found in *Pseudotsuga menziesii* dry forest associations with incomplete upper canopies between 1,500 and 4,100 feet in elevation (Harrod et al. in press). These sites have scattered herb and low shrub understories, and a tall shrub layer dominated by its host, *H. discolor*.

*Sidalcea oregana* var. *calva* is known only from five extant locations. Little is known about the biology and/or ecology of this species.

There are two known survey and manage plant species within the Camas MLSA and one within the Sand Creek MLSA. These species are *Cypripedium fasciculatum* and *C. montanum*. Appendix J2 of the ROD provides standards and guidelines for these survey and manage species, and these should be addressed within the Camas MLSA and Sand Creek MLSA when restoration projects are implemented.

Few if any surveys have been carried out for non-vascular and vascular plants. Surveys should be a priority project within the Camas MLSA and Sand Creek MLSA.

#### i) Noxious Weeds

The Camas MLSA and Sand Creek MLSA have been formally surveyed in 1992 for noxious weeds species. *Centaurea diffusa*, *Linaria dalmatica*, and *Chrysanthemum leucanthemum* are known to occur along roadsides within the MLSAs. Updated surveys for species presence and extent should be completed in order to develop a noxious management plan for these MLSAs (refer to Harrod 1994).

## 2. Late Successional Associated Wildlife Species

a) Introduction

In this chapter, information is presented about wildlife species that are associated with the late-successional habitats that are either present or would be managed for in the Camas MLSA and Sand Creek MLSA. A total of 80 species have been identified as being associated with these kinds of forest conditions and are present, unknown or suspected to occur within the MLSAs. The list of these species can be found in Appendix 27.

In addition to consideration for the groups of species associated with the various kinds of late-successional forests, individual species assessments were also conducted. These assessments were completed for all threatened, endangered, sensitive, species of concern (USFWS), management indicator, protection and buffer, and survey and manage species. Collectively this group of species is referred to as species of special status. What information is available about the status of these species within the Camas and Sand Creek MLSAs is summarized in this chapter. However, relatively little is known about a number of them.

Inventories or surveys have been conducted for only a few of the wildlife as shown in Appendix 27. The most extensive of these were for mule deer, elk and spotted owls. Northern spotted owl inventories have been conducted over about 60% of the suitable habitat within the Camas MLSA and 70% of the suitable habitat within the Sand Creek MLSA.

b) Late Successional Species By Habitat Type

(1) Dry Forests

About 1,457 acres (94%) of the Camas MLSA and 7,163 acres (78%) of the Sand Creek MLSA are composed of the dry forest vegetation group. Fire climax ponderosa pine forests historically dominated these areas and 49 wildlife species are associated with these forests.

Currently, 926 acres (64%) of the dry forest in the Camas MLSA and 4,630 acres (65%) in the Sand Creek MLSA are in a successional advanced condition. About 139 acres (10%) in the Camas MLSA and 2,078 acres (29%) of the Sand Creek MLSA are in a low density condition and could be fire-climax.

Some species that are associated with the late successional or fire-climax conditions of these forests and that have special management status include: tailed frog, larch mountain salamander, northern goshawk, bald eagle, flammulated owl, pileated woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, Williamson's sapsucker, northern flicker, chestnut backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared myotis, silver haired bat, fringed myotis, western big-eared bat, pallid bat, marten, and fisher.

Historically, only a minor portion of these areas provided the structures that are associated with suitable spotted owl habitat (Thomas et al. 1990, Buchanan et al. 1995). However, fire exclusion has allowed successional advancement for suitable spotted owl habitat to develop in some areas (Agee and Edmunds 1992, Buchanan et al. 1995). These areas are now being used by spotted owls, however the risk of large scale disturbances causing large scale habitat loss is of major concern (Agee and Edmunds 1992, Buchanan et al. 1995, Gaines et al. in press). One spotted owl activity center occurs in the Dry Forest within the Sand Creek MLSA, another activity center is within the boundary of the MLSA but is located on private land.

## (2) Mesic Sites Within the Dry Forest

The mesic forest group covered about 6 acres (1%) of the Camas MLSA and 1,357 acres (15%) within the Sand Creek MLSA. Mesic sites within the dry forests provide important wildlife habitat and add diversity across the landscape.

Historically, fire occurred less frequently at these sites (refer to the Disturbance Chapter in the Forest-wide Assessment) allowing for succession that resulted in more complex forest structure such as a higher canopy closure, multilayering, snags and down logs. These forests occurred in a variety of successional stages across the landscape. The late-successional conditions of these Mesic Forests provide habitat for about 66 wildlife species. The high potential for future fires presents a concern about the sustainability of these forests.

Currently, 6 acres (100%) of the mesic sites in the Camas MLSA and 1,280 acres (94%) in the Sand Creek MLSA are in a late-successional condition. In the absence of any major disturbances the amount of late-successional habitat within the mesic forests in 50 years would be about 1,357 acres (100%) in the Sand Creek MLSA.

Wildlife species that occur in these habitats and are of special management status include: tailed frog, Cascades frog, larch mountain salamander, northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, chestnut-backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis, western big-eared bat, silverhaired bat, pallid bat, marten, and fisher.

This forested vegetation group is capable of providing habitat structure that typically composes spotted owl nesting, roosting, foraging and dispersal habitat, while remaining within the historic range of variability. The one spotted owl activity center that occurs within the dry forests is on a mesic site.

## (3) Moist Grand Fir Group

The Moist Grand Fir group covers about 77 acres (1%) of the Sand Creek MLSA and is not found in the Camas MLSA. Historically, fire occurred less frequently than in the Dry and Mesic vegetation groups (refer to the Disturbance Chapter in the Forest-wide Assessment), allowing successional advancement and complex habitat structure such as high crown closure, multilayering, and many snags and down logs. These conditions provide habitat for a wide array of wildlife species, including 73 species within the Eagle Creek MLSA.

Currently, about 63 acres (82%) of the Moist Grand Fir group in this MLSA is in a late-successional condition. In the absence of any major disturbance, it is expected that in 50 years 77 acres (100%) of this habitat would be in a late-successional condition.

Wildlife species associated with the late-successional conditions of this vegetation group and of special status include the northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, red-breasted nuthatch, pygmy nuthatch, tailed frog, spotted frog, Cascades frog, larch mountain salamander, warty jumping slug, blue-gray tail-dropper, papillose tail-dropper, Columbia pebblesnail, long-legged myotis, long-eared myotis, fringed myotis,

Yuma myotis, silver-haired bat, western big-eared bat, pallid bat, elk, lynx, marten and fisher.

The Moist Grand Fir vegetation group is capable of providing structures that compose suitable spotted owl nesting, roosting, and foraging habitat while remaining within the range of historic variability. No known spotted owl activity centers are located within this vegetation group.

### c) Species Specific Information

The information presented in this section provides an overview of what is known about the species identified in Appendix 27 as species of special status. Information is provided on a species by species basis whenever it is available.

#### (1) Endangered Or Threatened Wildlife Species

There are five wildlife species that are federally listed as Threatened or Endangered and could occur within the Camas MLSA and Sand Creek MLSA. These include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), northern spotted owl (*Strix occidentalis caurina*), grizzly bear (*Ursus arctos*), and gray wolf (*Canis lupus*). In addition, a critical habitat unit (WA-12) overlays a portion of the Sand Creek MLSA.

##### (a) Bald Eagle and Peregrine Falcon

The bald eagle and peregrine falcon are considered to be absent from these MLSAs.

##### (b) Northern Spotted Owls

There are 2 spotted owl activity centers within the Sand Creek MLSA, two additional historical owl sites are to the northeast of the MLSA boundary. There are no spotted owl sites in the Camas MLSA. The Camas MLSA did have the Larson Canyon spotted owl site, which was lost in the 1994 Rat Creek fire. Habitat to the east of these MLSAs is highly fragmented. Habitat to the north and west is fragmented open shrub steppe. The Sand Creek MLSA connects to the Swauk LSR, to the south. Matrix to the south of Sand MLSA includes some of the most sustainable spotted owl sites in the area (moist forest groups).

The Sand Creek MLSA has 3,728 acres (40%) of spotted owl habitat for nesting/roosting and foraging. There is potential for 6,064 acres (66%) in the Sand MLSA. Camas MLSA has 541 acres (35%) of suitable nesting/roosting and foraging for spotted owls. There is potential for 932 acres (60%) in the Camas MLSA. (see appendix 13 LSR/MLSA Suitable Spotted Owl Habitat Acreage's). There is very little wetter forest (< 1% moist) groups in the Sand and Camas MLSAs (see appendix 4 & 5 Vegetation in LSRs and MLSAs). The forest vegetation is primarily dry and mesic. The Sand Creek and Camas MLSAs are at a high risk and are not likely to sustain spotted owls in the long-term.

Within the Sand Creek MLSA, 70% of the spotted owl habitat has been surveyed for spotted owls. The Camas has been surveyed over 60% of it's area.

The estimated amount of habitat within a 1.8 mile radius of the activity center is shown in Table VI-1. There is one spotted owl SO729 that is at threshold spotted owl habitat of 2,663 acres. Spotted owl SO758 which is located on private land, is below threshold acreage's. In addition, much of the habitat for these owls is shared with DNR and private lands (as much as 42% of the suitable habitat in a home range). See Appendix 12 "Spotted Owl Activity Centers, Reproductive Status and Habitat Availability" and 12a (owl sites from 1996 field data).

#### Table VI-1, Spotted Owl Information for Sand MLSA and Camas MLSA

Spotted Owl SAND CR	Repro Status <sup>3</sup>	Ownership <sup>4</sup>	Dry or Wetter Owl <sup>5</sup>	Threshold <sup>6</sup>	Critical Habitat Unit (CHU)	Forest Interior? <sup>8</sup>	Suitable Spotted Owl Habitat	Total Dispersal Habitat
SO729	PY	FS	DRY	At Threshold	WA-12	Near	2,726 in 1.8mi 58%FS, 33%P, 9%DNR 527 in 0.7mi 91% FS, 9% P	1,590 1.8mi
SO758 (1996 site)	P	PVT	DRY	Below Threshold	None	None	2,227 in 1.8mi 67%FS-28%P, 5%DNR 351 in 0.7 43% FS, 57% P	1,367 1.8mi
Historic s.owls								
SO752 <sup>1</sup>	HS	PVT	DRY	Below Threshold	None	None	2,084 in 1.8mi	--
SO753	HS	FS	DRY	Below Threshold	None	None	1,839 in 1.8mi	2,032 1.8mi

**Table VI-2, Spotted Owl Information for Camas MLSA**

Spotted Owl CAMAS	Status <sup>3</sup>	Ownership <sup>4</sup>	Dry or Wetter Owl <sup>5</sup>	Threshold <sup>6</sup>	Critical Habitat Unit (CHU)	Forest Interior? <sup>8</sup>	Suitable Spotted Owl Habitat	Total Dispersal Habitat
Larson Historic s.owls	Burned in 1994	PVT	dry	n/a	none	none	--	--

<sup>1</sup> Activity Center is Near the LSR or MLSA, but not inside the LSR or MLSA map boundary (< 1/4 mile).

<sup>3</sup> RS = Residential Single; P = Pair; PY = Pair with Young, HS = Historic Single. Site based on highest Reproductive occupancy.

<sup>4</sup> FS = Forest Service; PVT = Private Ownership (ownership at activity center).

<sup>5</sup> If the majority of suitable spotted owl habitat in 0.7 mile circle is dry or mesic forest groups, then it is a “dry” spotted owl. If the majority is wetter forest groups, then it is a “wetter” spotted owl.

<sup>6</sup> **Below Threshold:** < 2,663 total suitable spotted owl habitat acres in 1.8 mile circle **OR** < 500 total suitable spotted owl habitat acres in 0.7 mile circle.

**At Threshold:** 2,663-3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

**Optimum:** > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

<sup>7</sup> The activity center is within 1/2 mile of the CHU.

<sup>8</sup> **Inside** = activity center is at least 600' inside (forest interior) late successional habitat.

**Near** = activity center is inside late successional habitat that creates a forest interior.

<sup>9</sup> **Habitat** within 1.8 mile circle around activity center. Dry dispersal habitat includes vegetation codes 11, 13, and 52; mesic dispersal includes code 21; and wet dispersal includes codes 31, 35, 61, and 41.

<sup>10</sup> **Habitat** within 1.8 mile radius. Dry suitable spotted owl habitat includes vegetation code 12 where size/structure is multistory greater than 9" DBH; mesic Suitable includes code 22; and wet

Suitable includes codes 32, 36, 62, 64, and 42 (see appendix 2 GIS Veg Model & appendix 3 Veg Photo Mapping Key). Use the highest quality habitat available.

<sup>11</sup> A larger circle than 1/3 mile radius will be used to develop **100 Acre Activity Center**, if there is less than 100 acres of suitable habitat.

(c) Critical Habitat Unit for Northern Spotted Owls

The Sand MLSA includes part of a Critical Habitat Unit (CHU WA-12) for spotted owls. CHU WA12 is primarily in the Swauk LSR, however the southern portion of the Sand Creek MLSA is in the CHU (see appendix 13 LSR/MLSA S.Owl Acreage's and Appendix 34 CHU Maps). Of the approximately 90,000 acre Swauk CHU WA-12, there are 4,596 acres overlapping into the Sand Creek MLSA (50% of the MLSA). The CHU WA-12, north of the old Swauk HCA should support 2-3 pairs of spotted owls (USFWS Memorandum, 1991), this area includes Sand Creek, Ruby Creek, Culver Gulch, Ingalls Creek and Hansel Creek (See Appendix 13: LSR/MLSA S.Owl Acreage's, and Appendix 34: CHU Maps Wenatchee National Forest). Only Sand Creek is within an MLSA/LSR, the other sites are in Matrix..

The CHU was established to compensate for checkerboard ownership and poor habitat quality conditions in the Swauk and Boundary Butte CHUs. The Sand Creek and Camas MLSA habitat is important because of checkerboard ownership, increasing residential development and other related habitat loss in the Peshastin and Mission Creek areas. Since the 1991 and 1992 Draft Northern Spotted Owl Recovery Plan, there has been a land exchange in the Poison Creek portion of the Sand MLSA and the Larson Canyon portion of the Camas MLSA. What was once Federal lands, is now private, which means less of the MLSAs can contribute towards spotted owl recovery.

Sand Creek MLSA is on the edge of forested habitat to the north and east. The Sand Creek area does provide for some genetic interchange for species on the edge of the range of the northern spotted. Breeding habitat connectivity is between Boundary Butte CHU, Swauk CHU, and Teanaway CHU. The adjacent Swauk LSR and the moist forested habitats of the Tronson Ridge/Red Hill areas are important for the functioning of this connectivity.

It is recognized that the LSR/MLSAs were designed with the intent that habitat may be lost due to fire or other disturbances, while other LSR/MLSAs will increase in spotted owl habitat as late successional habitat is recovered. However, some LSR/MLSAs are in strategic locations for dispersal, connectivity and genetic interchange. Overtime, there is some question of sustainability of spotted owl habitat in 6 of the 27 LSR/MLSAs. The need is a long-term (>50 years) support for connectivity and home range goals for spotted owls in these LSR/MLSAs and across the province. The sustainability question is due to the amount of dry and mesic forested habitat at risk to fires in these 6 LSR/MLSAs.

The six LSR/MLSAs with sustainability questions are Swauk LSR, Shady Pass LSR, Deadhorse LSR, Boundary Butte LSR, Tumwater MLSA and Sand MLSA. In these areas, to strengthen connectivity, home ranges and spotted owl viability, parts of the CHUs may need to be maintained or adjusted. Adjusted areas should include wetter spotted owl habitat within spotted owl home ranges, which will strengthen the connectivity and species viability. Possible adjusted areas for LSR or MLSA important for spotted owl connectivity, but low in sustainability, include: Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module); Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4); Deadhorse LSR and Tumwater MLSA (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve); Boundary Butte LSR (wetter habitat to the south, including spotted owls

inside the CHU WA-11); and Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12).

In all LSR/MLSAs, except the six noted above, reserves are predicted to provide the needs for spotted owl recovery over time (50+ years). They will also provide the function the CHUs were designated for. Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. These reserves function for connectivity and spotted owl home ranges. It is concluded that the LSR/MLSAs meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing.

Spotted owl connectivity and sustainability was analyzed individually and collectively, see Appendix 1, "Forest Wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module". The Critical Habitat Units were compared with LSRs and MLSAs, to determine if the reserves meet the intent of the CHU needs (connectivity, home range goals, juxtaposition, and range-wide distribution). The existing condition was then compared to sustainable spotted owl habitat.

(d) Grizzly Bears and Gray Wolves

No class 1 grizzly bear observations have been made within the Camas MLSA or Sand Creek MLSA, however, class 1 observations have been reported nearby (Almack et al. 1993). Grizzly bears are suspected to occur within both MLSAs and none of their available habitat has been surveyed. Gray wolves are suspected to occur within the MLSAs and about 60% of their habitat in the Camas MLSA and 30% in the Sand Creek MLSA has been surveyed.

(e) Marbled Murrelet

The Sand Creek and Camas MLSAs do not include any Marbled Murrelet habitat, they are well outside the marine foraging zone.

(2) Sensitive And Wildlife Species of Concern

There are 15 wildlife species that are on the R6 Sensitive Species list or are USFWS species of concern that could occur within the Camas and Sand Creek MLSAs. These include the goshawk (*Accipiter gentilis*), willow flycatcher (*Empidonax trailii*), olive-sided flycatcher (*Contopus borealis*), tailed frog (*Ascaphus truei*), spotted frog (*Rana pretiosa*), Cascades frog (*Rana cascadae*), Columbia pebblesnail (*Fluminicola columbiana*), long-legged myotis (*Myotis volans*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanoides*), Yuma myotis (*Myotis yumanensis*), western big-eared bat (*Plecotus townsendii*), lynx (*Lynx canadensis*), fisher (*Martes pennanti*), and wolverine (*Gulo gulo*).

(a) Birds

The goshawk is suspected to occur and no surveys have been completed in either MLSA. It is unknown if the little willow flycatcher and suspected that the olive-sided flycatcher occur. No surveys have been completed.

(b) Amphibians

Surveys for amphibians have been completed over about 10% of the habitat within the Sand Creek MLSA and have not been conducted in the Camas MLSA. It is unknown if spotted frogs, Cascades frogs or tailed frogs occur in the Camas MLSA. It is known that the tailed frog occurs in the Sand Creek MLSA and unknown if the Cascades and spotted frogs occur.

(c) Mollusks

No surveys for the Columbia pebblesnail have been conducted and it is unknown if they are present.

(d) Mammals

Surveys for bat species have not been completed. It is unknown or suspected that the long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis or the western big-eared bat occur in these MLSAs.

Surveys for lynx and wolverine have not been conducted in either MLSA and it is unknown if they occur. Surveys for fisher have been conducted on about 20% of the available habitat in the Sand Creek MLSA and have not been conducted in the Camas MLSA.

(3) Management Indicator Species

There are 12 wildlife species that are listed as management indicator species that occur or could occur within the Eagle Creek MLSA. These species include the pileated woodpecker (*Dryocopus pileatus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), three-toed woodpecker (*Picoides tridactylus*), red-breasted sapsucker (*Sphyrapicus ruber*), Williamson's sapsucker (*Sphyrapicus thyroideus*), northern flicker (*Colaptes auratus*), ruffed grouse (*Bonasa umbellus*), mule deer (*Odocoileus hemionus*), elk (*Cervus elephus*), beaver (*Castor canadensis*), and marten (*Martes americana*).

(4) Primary Cavity Excavators

No formal surveys for primary cavity excavators have been completed. The pileated woodpecker and hairy woodpecker are suspected to occur, downy woodpecker and northern flicker are known to occur, and the three-toed woodpecker, red-breasted sapsucker, and Williamson's sapsucker are unknown within the Camas MLSA. In the Sand Creek MLSA the downy woodpecker, hairy woodpecker, three-toed woodpecker, and northern flicker are known to occur and the remaining MIS primary cavity excavators are suspected or it is unknown if they occur.

(a) Ruffed Grouse and Beaver

No surveys for the ruffed grouse have been completed and they are suspected to occur in the MLSAs. No surveys for beavers have been completed in the Camas MLSA and they are suspected to occur. Surveys for beavers have occurred on about 70% of the available habitat in the Sand Creek MLSA and they are considered to be absent.

(b) Mule Deer, Elk

Surveys for mule deer and elk have covered about 100% of the available habitat and they are known to occur within the MLSAs.

(c) Marten

Marten are suspected to occur in the Camas MLSA and about 20% of their available habitat has been surveyed. In the Sand Creek MLSA marten are known to occur and about 20% of their habitat has been surveyed.

(5) Survey And Manage, Protection And Buffer Species

There are eight species that do or could occur within the Camas MLSA and Sand Creek MLSA and are identified as survey and manage, or protection and buffer species. These include the great gray owl (*Strix nebulosa*), flammulated owl (*Otis flammeolus*), white-headed woodpecker (*Picoides albolarvatus*), black-backed woodpecker (*Picoides arcticus*),

pygmy nuthatch (*Sitta pygmaea*), warty jumping slug (*Hemphillia glandulosa*), blue-gray tail-dropper (*Prophyaon coeruleum*), and papillose tail-dropper (*Prophyaon dubium*).

(a) Birds

It is unknown if the great gray owl occurs within the Sand Creek MLSA and they are suspected to occur in the Camas MLSA. No surveys for great gray owls have been completed. No surveys have been completed for the flammulated owl, white-headed woodpecker, black-backed woodpecker, or pygmy nuthatch. The flammulated owl is known to occur in both MLSAs. It is unknown if the pygmy nuthatch, flammulated owl, white-headed woodpecker, three toed woodpecker and black-backed woodpecker occur in these MLSAs.

(b) Mollusks

It is unknown if the warty jumping slug, blue-gray tail-dropper, or papillose tail-dropper occur in the LSR and no surveys have been completed.

(c) Habitat Effectiveness

Habitat effectiveness was measured using the current open road density and the amount of security habitat. The current open road density within the Camas MLSA is 2.2 mi./sq.mi. and the amount of area in security habitat is 32%. This information shows that habitat effectiveness is considered to be "low" (>2 mi./sq.mi.) relative to roads and "low" relative to security habitat (<50%). The current open road density in the Sand Creek MLSA is 1.8 mi./sq.mi. and the area in security habitat is 38%. This information suggests that the habitat effectiveness relative to roads is considered to be "moderate" (1-2 mi./sq.mi.) and "low" relative to security habitat (<50%). The long term management objective for LSR/MLSAs is to manage towards a "high" level of habitat effectiveness defined as <1mi./sq.mi. open road density and >70% security habitat.

### 3. Human Uses

a) Prehistoric and Historic Summary

Although the Camas and Sand Creek MLSAs have few American Indian sites, however it is assumed that these areas were seasonally used. "Camas Land", located near both MLSAs, was a well known and heavily used area for digging camas roots. This area had been used as a traditional food gathering area up to recent years when private ownership begin restricting access to this area. The Sand Creek MLSA may have also served as a travelway to Camas Land and the Mission Creek drainage afforded access into the forest for tribes located along the Wenatchee River.

Historic use of the Sand Creek MLSA began with the sheep grazing in the late 1800's and early 1900's. Some areas were logged in these early years, an activity that was later believed to be the cause of some severe erosion and mudslide problems in the drainage. In the 1930's a Civilian Conservation Corps camp was established near the present day Red Hill trailhead on Sand Creek. These workers performed soil stabilization and tree planting work as well as built some recreation facilities.

b) Recreation

(1) Campgrounds

There are no campgrounds in either of these MLSAs.

(2) Dispersed Camping

One of the more popular dispersed campsites is located at the Red Hill trailhead. This site has been modified to better control camping use of the area to retain ground vegetation and lessen further effects on Sand Creek. Additional dispersed camping occurs adjacent to the open roads in both MLSAs. This type of camping occurs at a very low level in this area and the campsites are quite scattered, mostly attributable to hunter use in the fall.

(3) Trails

There are no trails in the Camas MLSA. The Sand Creek MLSA encompasses the north end of the Devils Gulch ORV trail system. These trails are open to hiker, horse, mountain bike and motorcycle use. The predominant user is mountain bike with motorcyclists the next most popular user. This trail system was one of the first ORV trail systems developed on the Wenatchee National Forest specifically for motorized use in the 1960's. In recent years the popularity of the area has grown as the District, with assistance from Washington state's trail grant monies, has reconstructed many of the trails and has added some additional trail miles. The area opens early in the spring, April or May depending upon snow levels, and is quite popular during early season. Later in the summer as other riding areas higher in elevation open up, the use declines. In 1997 a master planning effort will begin to identify and evaluate other potential trail additions, determine the feasibility of relocating trails around private land parcels, consider the closure of some trail segments and identify further reconstruction needs.

There are two major trailheads within the Sand Creek MLSA, this includes the one on Sand Creek accessing the Red Hill trail and the other on Mission Creek accessing the Devils Gulch and Mission Ridge trails.

(4) Winter Use

During winter months there is some use of the road systems by snowmobiles and cross country skiers. This level of use is generally very low and is related to snow availability.

(5) Other Recreation

Hunting is another recreational use that occurs in these MLSAs, there is considerable elk hunting that occurs in this area. There are a few recreationists driving for pleasure on forest roads.

c) Mining

There are no active mining operations within either MLSA.

d) Social and Economic Considerations:

These MLSAs include and lie adjacent to privately owned land. This intermixed ownership places particular concern on how to manage wildland fires that might spread between the two ownership's.

The Devil's Gulch ORV trail system provides a nearby trail system for recreationists from Wenatchee. This trail system is particularly important in the early season when other areas are closed by snow or seasonal restrictions. This trail system is used by recreationists from other parts of the state as well.

## **B. Analysis Between LSR/MLSAs**

## 1. Sustainability

The sustainability of LSRs/MLSAs across the Forest is displayed in Table 19, *Vegetation Hazard and Ignition Risk Ratings* of the "Forest-wide Assessment for Late Successional Reserves and Managed Late Successional Areas, Wenatchee National Forest". The Sand Creek and Camas MLSAs both fall in the upper 1/3 of all LSR/MLSAs in terms of amount of vegetation at risk to loss from catastrophic fire. An important consideration in terms of sustainability is the relationship between Sand Creek and Camas and their neighboring LSR/MLSAs. This includes the amount of at risk vegetation within the LSR/MLSAs as well as the extent of at risk vegetation between them. For the purposes of this analysis three LSRs are considered to be neighbors: Boundary Butte; Swauk; and Eagle.

The following table shows a comparison of the acres at risk and the ignition risk determined in the Forest-wide sustainability analysis for the Sand Creek and Camas MLSAs and their three neighboring LSRs.

Table VI-3, Acres at Risk and Ignition Risk, Sand Creek and Camas, MLSAs

LSR/MLSA	% of LSR/MLSA at Risk		% of LS Forest at Risk		Ignition Risk
	Acres	Pct.	Acres	Pct.	
Sand Creek	5,996ac	65%	5,973ac	100%	High
Camas	941ac	61%	932ac	100%	High
Boundary Butte	No Inform.				
Eagle	3,501ac	66%	3,163ac	100%	High
Swauk	59,488ac	55%	55,996ac	91%	High

When looking at sustainability issues between LSRs/MLSAs, the factor that drives the analysis is the amount and location of at-risk vegetation between the Sand Creek and Camas MLSAs and their three neighbors. In other words, identifying linkages in at-risk vegetation that would facilitate the spread of fire from one LSR/MLSA to another. A review of at-risk vegetation maps reveals that this linkage does exist between Camas and Sand Creek and the Boundary Butte LSR. The 1994 Rat Creek fire burned out of Icicle Creek and across the north half of the Boundary Butte LSR and into Camas MLSA, burning 794 acres within the Camas MLSA. This fire and follow-up salvage logging of fire killed trees decreased the likelihood of another fire doing the same thing in the near term. However, the potential for a fire to burn similarly across the south half of these two LSR/MLSAs and on into the Sand Creek MLSA and Swauk LSR still exists. The likelihood of a fire burning from Camas or Sand Creek into the Eagle LSR is low due to the presence of the Wenatchee River and private land orchards that exist between them.

### a) Implications

1. Reduce stand density in dense dry successional advanced vegetation types (types 12 and 22 - Appendix 3) where they exist between Sand Creek and Camas MLSAs and the Boundary Butte and Swauk LSRs and also areas north of Sand Creek in Slawson and Sherman canyons.

### Potential Projects - Commercial Thinning

2. Encourage private land owners in the vicinity of these LSR/MLSAs to take stand density management actions on private forested areas including education on the ecological values of maintaining large ponderosa pine.

**Potential Projects** - Communicate need to local landowners. Work through State and Private Forestry to help local landowners manage their forests.

3. Reduce fuel loading along roads that exist between these LSR/MLSAs to increase the roads effectiveness as fuel breaks. The best chance for this are along US Highway 97, and the Camas Creek and Mission Creek roads.

**Potential Projects** - Piling of down fuels, firewood gathering, pruning to reduce vertical fuel concentrations (all vegetation types), construction of shaded fuel breaks.

4. Reduce fuel loading in young stands.

**Potential Projects** - Precommercial Thinning, Pruning

5. Maintain desired fuel levels and vegetation characteristics in low density dry forest vegetation types.

**Potential Projects**- Prescribed fire.

## 2. Forest-Wide Northern Spotted Owl

The Sand Creek and Camas MLSAs are not one of the "big three" LSR's on the forest designated as a large population cluster/source center LSRs, for the recovery of the spotted owl. The Sand and Camas MLSAs are part of the smaller "local population" centers, which are linked to the metapopulations through dispersing individuals (see LSR/MLSA maps in the Forest-wide Overview). The spotted owl is a Threatened species, with recovery dependent on the implementation of the NWFP, especially in LSR/MLSAs (FSEIS Appendix G, Biological Opinion, 1994).

## 3. Connectivity (Plant, Wildlife, and Northern Spotted Owl)

### a) Plant Connectivity

Connectivity can be addressed at several spatial scales when assessing an individual MLSA. Connectivity of the LSR'S/MLSA network on the Wenatchee National Forest has been addressed above in Chapter VII and in Appendix 1. Vascular plant connectivity with surrounding LSRs or MLSAs is analyzed in this section. Refer to the Forest-wide Assessment discussions for connectivity descriptions of lichens, bryophytes and fungi.

Species with low dispersal ability within the dry/mesic forest group are dependent on vegetation outside of the LSR/MLSA network for connectivity between Camas and Sand Creek and Boundary Butte. There is no connectivity for low and moderate dispersal species with Eagle Creek MLSA and Camas or Sand Creek, high dispersal species are dependent on outside vegetation. Dry/mesic habitats within the Sand Creek MLSA are connected to the Swauk LSR for all dispersal classes. Connectivity for species in all dispersal class in the Camas MLSA are dependent on vegetation outside the network for connectivity with the Swauk. Moderate and high dispersal species are connected between the Camas and Sand Creek MLSAs and with Boundary Butte.

Within the Sand Creek MLSA, species with low dispersal ability that are associated with the moist grand fir group are not connected with any surrounding LSR or MLSA. There is no

connectivity for any dispersal class between Eagle and Sand Creek or Camas. Moderate and high dispersal species in Sand Creek are connected to Camas, Swauk and Boundary Butte. All dispersal classes within the Camas MLSA are dependent on vegetation outside the network for connectivity to the Swauk LSR.

a) Implications

1. No specific projects were identified as a result of this analysis.

**Table VI-4, Sand Creek -- Vascular Plant Connectivity**

LSR/MLSA	Vegetation Group														
	Dry/Mesic			Moist GF			Subalpine			Wet			Whitebark		
Dispersal Class	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Camas	D	Y	Y	N	Y	Y									
Boundary Butte	D	D	Y	N	D	Y									
Swauk	Y	Y	Y	N	Y	Y									
Eagle	N	N	D	N	N	N									

Dispersal Codes = Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Outside Habitat)

**Table VI-5, Camas -- Vascular Plant Connectivity**

LSR/MLSA	Vegetation Group														
	Dry/Mesic			Moist GF			Subalpine			Wet			Whitebark		
Dispersal Class	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Sand Creek	D	Y	Y	N	Y	Y									
Boundary Butte	D	Y	Y	D	Y	Y									
Swauk	D	D	D	D	D	D									
Eagle	N	N	D	N	N	N									

Dispersal Codes = Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Outside Habitat)

b) Wildlife Connectivity

Connectivity between late-successional patches is important to providing movement between patches, minimizing local extinction's, and reducing genetic isolation (Harris 1984, Noss and Harris 1986). In order to assess connectivity between the Camas MLSA and adjacent LSR/MLSAs the dispersion index was used (as described in Appendix ?). A total of two potential linkages were evaluated: Camas to Boundary Butte LSR, and Camas to Sand Creek MLSA. The overall dispersion index for this LSR was 1.3.

**Table VI-6, Dispersion Indices for the Camas MLSA**

Linkage	Distance(km)	Dispersion			Index
		High	Moderate	Low	
Camas-Boundary	2	Yes	No	No	1

Linkage	Distance(km)	Dispersion			Index
		High	Moderate	Low	
Butte					
Camas-Sand Creek	3	Yes	Yes	No	2
<b>Overall</b>					<b>1.3</b>

Connectivity between late-successional patches is important to providing movement between patches, minimizing local extinction's, and reducing genetic isolation (Harris 1984, Noss and Harris 1986). In order to assess connectivity between the Sand Creek MLSA and adjacent LSR/MLSAs the dispersion index was used (as described in Appendix ?). A total of two potential linkages were evaluated: Sand Creek to Camas MLSA, and Sand Creek to the Swauk LSR. The overall dispersion index for this LSR was 2.5.

Table VI-7, Dispersion Indices for the Sand Creek MLSA

Linkage	Distance(Miles)	Dispersion			Index
		High	Moderate	Low	
Sand Creek-Camas	3	Yes	Yes	No	2
Sand Creek-Swauk	0	Yes	Yes	Yes	3
<b>Overall</b>					<b>2.5</b>

### c) Northern Spotted Owl Connectivity

The CHU portion of the Sand Creek MLSA was established adjacent to the Swauk LSR, to provide for spotted owl habitat in the checkerboard ownership areas, and over-time to reduce risk in the Swauk LSR (USFWS Memorandum, 1991). The Camas MLSA was provided habitat around the Larson Canyon spotted owl pair, and connectivity between the Boundary Butte and Swauk LSRs. Connectivity between LSRs and MLSAs is essential for genetic interchange. The Sand and Camas MLSAs are fairly fragmented by private lands, burning (Camas MLSA) and natural fragmentation. Dispersal probably occurs along the northern aspects of Peshastin Creek and Mission Creek.

For final recovery of the northern spotted owl, smaller LSRs/MLSAs contribute to the goal of occupied home ranges (See Table VI-8). The Sand MLSA area was discussed as a Northern Spotted Owl Critical Habitat Unit. The goal of 2-3 pairs of spotted owls for the Peshastin/Sand Creek drainages is noted in the CHU discussion. The Sand MLSA does not have enough sustainable habitat on National Forest lands to support 2-3 pairs of owls. There is a possibility to meet the CHU goal either as an adjustments in the MLSA boundary (Tronsen and Red Hill) or counting additional spotted owls from the Swauk LSR.

Table VI-8, Connectivity Between LSRs: Spotted Owl Pair Goals for LSRs and MLSAs, and CHUs

LSR or MLSA Status and Connectivity	S.Owl Pairs --1994, FSEIS Appendix G, Table G-3	Highest Occupancy and Reproductive Status, for Field Seasons 1995 ---- 1996		Number of Owl Pairs CHU Contributes Towards Goal of , as per USFWS - CHU Memo**	
Tumwater DM3	--	1 Pr	1 sites*	1 Pr	WA-9
Icicle RW132	1 Pr	2 Pr	2 sites	1 Pr	WA-10
Eagle DM5	--	1 Pr	1 site	--	NA
Boundary Butte RW131	3 Pr	2 Pr	2 sites (1site)*	3 Pr	WA-11
<b>Camas DM6</b>	--	<b>0*</b>	<b>0*</b>	--	NA
<b>Sand Cr DM7</b>	--	<b>2 Pr</b>	<b>2 Pairs (1 sites<sup>2</sup>)</b>	<b>2-3 Pr</b>	<b>WA-12</b>
Swauk RW 129	15 Pr + 1 RS	22 Pr + 2 RS	23 sites + 2 sites <sup>1</sup>	20+ Pr	WA-12
Teanaway RW130	2 Pr	5 Pr	4 sites +3 site <sup>1</sup>	5 Pr	WA-13 WA-12

<sup>1</sup> Spotted owl activity center within 1/4 mile of LSR/MLSA boundary.

\* S.owl activity center may have been lost, due to 1994 Chelan Forest Fires, monitoring still underway.

<sup>2</sup> Spotted owl activity center on Private Land.

\*\* USFWS CHU Memo: "Internal Draft Memo, J. Tehan, "Critical Habitat Narratives, 1992".

The three nearest LSR/MLSA's were evaluated to determine their potential for dispersal to occur. This analysis showed that spotted owls could likely disperse to Swauk LSR through Mission Creek, and the upper Sand Creek/Tronson Ridge. From the Swauk LSR, connectivity adjoins the Teanaway LSR. Connection could occur to the Boundary Butte LSR through north aspects of TipTop to Allen Creek, however the area is highly fragmented and interspersed with private lands. Additional connectivity exists from Sand and Camas MLSAs to Alpine Lakes Wilderness, this is through Ruby Creek and Hansel/Ingalls Creeks.

Lower grade dispersal and connectivity habitat exists to Eagle MLSA (Derby Canyon to lower Larson Canyon), Tumwater MLSA (Mountain Home to Icicle Ridge) and Icicle LSR (Wedge Mountain to 8-Mile Creek). These connections are possible, but would take a high degree of effort for spotted owls to move, due to severe fragmented fragmentation. See Forest Interior Map and Suitable Spotted Owl Habitat Maps. Connectivity corridors should be monitored for effectiveness, and should overlap into Riparian Reserves, and unmapped LSR's. Outside the LSR/MLSA network, dispersal habitat is found in all land allocations, and will be provided mainly in Riparian Reserves, in unmapped LSR's in Matrix, and in AMA's and in wilderness areas (NWFP 1994, Rod pg 19, C-3, C-10 to 11, C-39, C-45, D-9, App 3-4 pg 240-241).

#### d) Restoration Opportunities And Potential Projects Between LSRs

1. Meet pair goals of CHU for spotted owls. Monitor potential for Sand MLSA to support 2-3 pairs, and adjust either Sand MLSA boundary or incorporate additional Swauk spotted owl pairs to meet CHU goal.
2. Protection of MLSA from fires originating outside on Matrix lands, in lower Mission Creek and Peshastin Creek.
3. Monitor/maintain connectivity outside the MLSAs.

## C. Analysis Within the MLSA

### 1. Unique Habitats And Species

The following is the discussion and results of the Unique Habitat and Species module for the Sand and Camas MLSAs. For more information see Unique Habitats Maps, "Forest-wide Unique Habitats and Species by LSR/MLSA" table (Appendix 37), Forest Interior Map and Tables (Appendix 19), Riparian Reserves Map, Road Density tables (Appendix 20) in the Forest-wide Assessment. For process see Unique Habitats and Species Module in Appendix 1 for order, explanations and process of modules.

#### a) Forest-wide Overview of Unique Habitats and Species

##### (1) Unique Ecosystems Landscape Analysis

Each LSR/MLSA is compared Forest-wide for unique habitats and species abundance, connectivity and function (See the "Function of the Network for Unique Habitats and Species", Chapter VII, Forest-wide Assessment). Though quite diverse habitats adjoin the MLSAs, the Sand and Camas MLSAs has comparatively low amounts of habitats and species numbers: approximately 7% in non-forested vegetation types (natural openings/grass, shrubs, riparian reserves, rock); 0% in Forest Interior moist habitat, but 7% and 18% Forest Interior Dry for Sand and Camas respectively); 13 wildlife late-successional associated species and species of Special Status; and 19 plant late-successional associated species and species of special status.

The Sand and Camas MLSAs are within the Wenatchee Mountains area of plant rarity or endemism along the east-west ridges east of the Cascades, as per Columbia Basin Ecosystem Plan (Marcot et al, 1995 Draft). In general, the Camas Lands and Deer Park Springs areas (outside of the MLSAs) are noted for important rare plant sites. The Wenatchee Forest Plan noted the Camas Potential Botanical Area for *Delphinium viridescens* (*Devi*), it is adjacent to the Sand Creek MLSA. (see Appendix 1: Unique Habitat Module for identification of landscape-scale unique areas). Between Sand Creek MLSA and Camas MLSA, there lies the Camas Natural Area Preserve, so designated by the State of Washington. This natural area is set aside for the Wenatchee Larkspur (*Devi*) and is called "Larkspur Meadows". The Nature Conservancy also owns a portion of Camas Lands, for native plant species. The adjacent Tiptop/Camas/Deer Park Springs areas include one of the highest concentrations of special plant species and diversity.

There are no Special Interest Areas identified in the WNF Plan within either MLSA.

Identified areas of high abundance, connectivity and function for unique habitats and species within the Sand/Camas MLSAs are:

- **Little Camas Headwaters:** Rock/Cliff, Grass/Natural Openings, Forest Interior, Spotted Owl, Riparian Reserves, PETS plants, potential Peregrine foraging/nesting, *Lewisia tweedyi*.
- **Tronson Ridge/Headwaters Sand Cr:** Riparian Reserves, Security Habitat, Grass/Natural Openings, MIS spp.
- **Sand Creek:** Forest Interiors, Riparian Reserves, Redband, spotted owls, and PETS plant and animal spp.
- **Poison Creek:** Natural Openings/Grass, Rock, Seeps, Shrubs, Spotted Owl, Forest Interiors, Security Habitat, PETS spp.
- **Mission/Devils Gulch/Motorblock:** Riparian Reserves, Red-band, Spring Chinook, Brook Trout, Forest Interior, Security Habitat, Rock, Blue-bunch Wheat Grass Stands, Grass, Shrub, Deer Winter Range.

- **Camas/Tiptop:** Forest Interior, Riparian Reserves, Wetland/Seeps, PETS Plants.
- **Head Pendleton Canyon:** Forest Interior, Security Habitat.

Each LSR/MLSA can be evaluated for biodiversity, connectivity and function (see Function of Unique Habitats in the main body of the Forest-wide Assessment). Past management activities affect the function of unique habitats and species. This includes open roads, roading of riparian reserves, and past harvest activities. For the Sand MLSA: total open road density of 1.75 miles per square mile (moderate); security habitat of 38% (low); roads and trails in riparian reserves of 3.64 miles per square mile (high); and past harvest activities of 30% in the MLSA. For the Camas MLSA: total open road density of 2.22 miles per square mile (moderate); security habitat of 32% (low); roads and trails in riparian reserves of 7.01 miles per square mile (very high); and past harvest activities of 30% in the MLSA.

(2) Abundance and Ecological Diversity

Forest-wide, the Sand and Camas MLSAs has low amounts of unique habitats and species abundance. This includes acreage for unique plant and animal habitats, juxtaposition of habitats, availability of wilderness or areas of rarity, and known observations from the plant and animal species list. There is 7% of the MLSA in non-forested vegetation types, and there are 13 wildlife species of Special Status and 19 plant species of special status (of note is many PETS plant species).

(3) Connectivity for Unique Habitats and Species

This MLSA provides moderately to low amounts of connectivity for unique habitats and species. This includes the amount, percent and number of patches of late successional habitat, forest interior habitat patches, and the juxtaposition of wilderness and areas of rarity. These MLSAs are among the lower amounts of Forest Interior and Late Successional habitat. The MLSAs are nearly surrounded by private land and shrub steppe vegetation. The nearest Wilderness area is 4 miles west, Alpine Lakes Wilderness. The MLSAs are well within the important areas for plant species of rarity.

(4) Process and Function of Unique Habitats and Species

The MLSA has a low degree of function for unique habitats and species, as determined by the amounts of Special Status plants and animals, juxtaposition to wilderness and areas of rarity. This includes development and maintenance of unique ecosystems, including ecological values for unique species and populations. The plant and animal species list for known observations makes up a large part of this analysis, as well as proximity to wilderness and areas of rarity, which sustain habitat function. See Chapter VII, Forest-Wide Function of the Network for Unique Habitats and Species and Appendix 37 Forest-wide Unique Habitats and Species by LSR/MLSA.

b) Unique Habitats and Species Known Within MLSA

(1) Unique Habitats and Species Site Specific Analysis

The following is a summary of the Unique Habitats and Species Module for the Sand and Camas MLSAs. For more information see Unique Habitats Map and Tables, Forest Interior Map and Tables, Riparian Reserves and Roading Map and Tables.

**Table VI-9, Unique Habitats and Species Site Specific Analysis**

Habitats and Species	Sand	Camas MLSA
Riparian Reserves	Over-all 9% of MLSA in riparian reserves, low amounts.	Over-all 11% of MLSA in riparian reserves, moderate amounts.
	Streams (862 acres), Wetlands (Little Camas) and Seeps.	Streams (162 acres), Wetlands (Camas tributary) and Seeps.
Non-Forested Vegetation	(628 acres) of MLSA	82 acres of MLSA
	Grass/Shrub/Natural Opening 5% (484 acres), Rock 1% (110 acres), Shrub/Brush fields <1% (33 acres), Subalpine Meadows <1% (8 acres).	Grass/Natural Openings 5% (72 acres), Shrub/Brush Fields 1% (10 acres).
Unique Forest Groups	Forest Interior Patches 7% (630 acres).	Forest Interior Patches 18% (279 acres).
	Dry Forest Interior patches Sand/Little Camas & tributaries, Poison to Little Camas.	Dry Forest Interior patches Camas tributary junctions, headwaters Pendleton Canyon.
	Disjunct Western Red Cedar, Black Cottonwood in bottom lands Sand and Poison Creeks.	Aspen and Cottonwood in bottom lands of Camas Creek.
	Late-successional Habitat (1% moist) and Fire Climax/Successionally Advanced (64% dry), this MLSA has the highest percentage of dry successional advanced habitat on the Forest.	Late-successional Habitat (0% moist) and Fire Climax/Successionally Advanced (60% dry), this MLSA has the 2nd highest percentage of dry successional advanced habitat on the Forest
	Snags/Logs Moderate-Low quality from Landscape Level (see Snag sub-module)	Snags/Logs Moderate quality from Landscape Level (see Snag sub-module)
Animal - Late Successional Associated Species and Species of Special Status	19 Species of Special Animals	13 Species of Special Animals
PETS - Animals	3 species: Spotted Owl, CHU, Red Band Trout, Peregrine Falcon nesting structure/cliffs.	0 species: spotted owl 60% surveyed, none found. Other spp not surveyed.
Survey & Manage and Protection & Buffer	2 species: Flammulated Owl, Great Gray Owl suspected.	0 species: Not surveyed.

Habitats and Species	Sand	Camas MLSA
Management Indicator Species (WNF)	9 Species: Spotted Owl, Marten, Three-toed Woodpecker, Primary Cavity Excavators, Ruffed Grouse, Elk, Mule Deer (winter range), Red Band Trout, Steelhead. Brook Trout & Spring Chinook (Mission).	5 Species: Primary Cavity Excavators, Ruffed Grouse, Elk, Mule Deer (winter range), Red-band trout.
Other Animal Species of Special Status	Species of Concern: Fisher, Northern Goshawk.	No Species of Concern: Not surveyed.
	Birds: along the streams, rivers, shrub fields, meadows.	Birds: along the streams, rivers, wetlands, shrub fields, meadows.
	Late Successional Species: Barred Owl, Tailed Frog, Pygmy Owl, Northern Saw-whet Owl, Hairy Woodpecker, Downy Woodpecker.	Two Late Successional Species: Barred Owl, Long-toed Salamander.
	Significant Fish Populations: Red-band trout in Devils Gulch and Sand Creek	Significant Fish Populations: None
		Other Species: Cougar den in sandstone boulder.
Plants - Late Successional Associated Species and Species of Special Status		
PETS - Plants	<b>5 Spp:</b> <i>Delphinium viridescens</i> , <i>Cypripedium fasciculatum</i> , <i>Illiamna longisepala</i> , <i>Orbanche pinorum</i> , <i>Sidalcea oregana var. calva</i>	5 PETS Spp: <i>Delphinium viridescens</i> , <i>Cypripedium fasciculatum</i> , <i>Illiamna longisepala</i> , <i>Orbanche pinorum</i> , <i>Sidalcea oregana var. calva</i> .
Survey & Manage and Protection and Buffer Plants	Fungi, Lichens, Vascular Plants.	Fungi, Lichens, Vascular Plants.
Other Plant Species of Special Status	Other late-successional associated species: <i>Lewisia tweedyi</i>	Late-successional associated species
American Indian Uses	Traditional Use Sites: Camas root digging, deer hunting out of Cashmere area.	Traditional Use Sites: Camas root digging, deer hunting out of Cashmere area, access to campouts.
	Vision Quest Sites: Potential in Rock and off major ridges and	Vision Quest Sites.

Habitats and Species	Sand	Camas MLSA
	peaks.	
	Traditional Food Plants: Camas Roots.	Traditional Food Plants: Camas Roots.
	Food Gathering: Bulb digging, Elk, Deer, Fish.	Food Gathering: Bulb digging, Elk, Deer.

c) Restoration Opportunities and Potential Treatments Unique Habitats and Species Within LSR/MLSA:

**Weeds** (Diffuse and Spotted Knapweed, Dalmation Toadflax):

1. Highest priority to reduce knapweed on motorcycle trails, especially blue-bunch wheat grass stands;
2. Decrease weeds along roads and trailheads;
3. Protect riparian reserves and forest interior areas from encroachment;
4. Keep weeds from encroaching further into MLSAs, especially into meadows and natural openings; and
5. Reduce noxious weed spread in clearcuts, partial cuts, trailheads, and roads throughout the MLSA.

**Roads:**

1. Reduce roads/trails in Riparian Reserves and wet meadows;
2. Reduce roads and trails in rock habitat;
3. Increase Security Habitat;
4. Reduce open road density;
5. Reduce roads in forest interior patches;
6. Reduce road/trail densities along riparian reserves both inside and outside of MLSA; and
7. Retain American Indian access to traditional use sites.

**Habitat Improvement:**

1. Use prescribed fire in ponderosa pine climax forests for low density and large tree sizes;
2. Thin to accelerate late successional characteristics in clearcuts and areas near private land; and
3. Reduce conifer encroachment in meadows and grasslands.

**Protect:**

1. Connectivity within and between LSR/MLSA is dependent on the Devils Gulch/Motorblock Creek, maintain and protect this habitat;

2. Protect riparian areas, wetlands, intermittent streams, and dispersal corridors in Riparian Reserves from fires originating outside of MLSA in order to help meet aquatic conservation strategy objectives.
3. Provide buffers near talus, cliffs, caves, meadows;
4. Protect/maintain/enhance/monitor PETS species;
5. Meet high end snag levels and spp; and
6. Protect caves and cliff/caves for 250' around (roads/trails/cutting) to benefit bat species.

**Coordinate and/or Acquire:**

1. Consider Acquisition of non-Forest System lands with high degree of unique species or habitat; and
2. Coordinate unique habitat management on private lands OR acquire habitat from private ownership, for habitat diversity and for connectivity.

**Interpret:**

1. Interpret values and protection/maintenance of unique habitats and species.

**Monitor:**

1. Validation monitor riparian reserves habitat and effectiveness;
2. Monitor areas noted above for high species/habitat abundance, connectivity and function;
3. Monitor and maintain unique habitat concentrations;
4. Monitor and maintain connectivity corridors;
5. Monitor burns and dry-forest groups for snag levels and wildlife/plant species use;
6. Survey & Manage prior to activities: Great Gray Owl, Larch Mt. Salamander, Lynx, Mollusks and other S&M or P&B species;
7. Survey & Manage prior to activities: fungi, lichen, bryophytes, vascular plants;
8. Follow PETS, Species of Concern, Species of Special Status guidelines in Biological Evaluations for projects;
9. Monitor effectiveness of habitat for mule deer winter range, MIS; and
10. Inventory and monitor plant special areas adjacent to the MLSAs, and within MLSAs.

d) Snag/Log/Green Tree Recruitment Module

The following is the discussion and results of the Snag/Log/Green Tree Recruitment sub-set module of the Unique Habitats module in Appendix 1, for the Sand and Camas MLSAs. Over-all, the Sand MLSA has a Moderate to Low quality of available snags and future green tree recruitment snags and logs. The Camas MLSA has a Moderate to High quality of available snags and future green tree recruitment. See Appendix 1 for order, explanations and process of modules. Snag quality can be judged by a continual supply of tree structure in various stages of decay, size and species. This can be best provided in the moist and wet vegetation groups, areas with large amounts of late-successional habitat, areas with little fragmentation, areas with high amounts of forest interior, and areas with high functioning riparian reserves. (See "LSR/MLSA Snag/Downed Logs/Green Tree Recruitment Analysis", Appendix 38, Forest-wide Assessment)

**Table VI-10, Snag Habitat Quality/Landscape Scale, Sand MLSA**

<u>HIGH QUALITY</u>	<u>MEDIUM QUALITY *</u>	<u>* LOW QUALITY</u>
Moist & Wet Veg Groups 1%	Subalpine Fir & Mesic Veg 15%	Dry & Whitebark Veg 78%
>60% LS (non-dry) Habitat	15% - 60% LS Habitat	<15% LS Habitat 1%
80% - 100% LS (all) Habitat	40% - 80% LS/M Habitat 65%	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior Not Dry 0%
>10% Forest Interior Dry	5% - 9% Forest Interior Dry 7%	< 5% Forest Interior Dry
>16% in Riparian Reserves	10% to 16% in Riparian Reserves	<10% in Rip Res 9%
0 Miles/Square Mile Any Roads in Riparian Reserves	0 to 1 Miles/Square Mile Roads in Riparian Reserves	> 1 Mi/Sq Mi Rd Rip Res 3.64 mi/sq/mi
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads 1.75 mi/sq/mi	> 2.5 Mi/Sq Mi Roads
>70% Security Habitat	50% to 70% Security Habitat	<50% Security Habitat 38%
>10% in Past Burns-snags available		<10% in Past Burns %
>50% Insect/Pathogens (See Disturbance Section in this Chapter)	25% - 50% Insect/Pathogens 25-50%	< 25% Insect/Pathogens
<10% Past Clearcut Harvest 5%	11% - 25% Past Clearcut Harvest	>25% Past Clearcut Harvest
<10% Past Partial Cut Harvest	11% - 50% Past Partial Cut Harvest %	>50% Past Partial Cut Harvest

(Percentages in bold indicate values for MLSA)

**Table VI-11, Snag Habitat Quality/Landscape Scale, Camas MLSA**

<u>HIGH QUALITY</u>	<u>***MEDIUM QUALITY</u>	<u>LOW QUALITY</u>
Moist & Wet Veg Groups 0%	Subalpine Fir & Mesic Veg 0%	Dry & Whitebark Veg 94%
>60% LS (non-dry) Habitat	15% - 60% LS Habitat	<15% LS Habitat 0%
80% - 100% LS (all) Habitat	40% - 80% LS/M Habitat 60%	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior Not Dry 0%
>10% Forest Interior Dry 18%	5% - 9% Forest Interior Dry	< 5% Forest Interior Dry
>16% in Riparian Reserves	10% to 16% in Riparian Reserves	<10% in Riparian Reserves

<u>HIGH QUALITY</u>	<u>***MEDIUM QUALITY</u>	<u>LOW QUALITY</u>
	<b>11%</b>	
0 Miles/Square Mile Any Roads in Riparian Reserves	0 to 1 Mile/Square Mile Roads in Riparian Reserves	> 1 Mi/Sq Mi Rd Rip Res <b>7.01 mi/sq/mi</b>
< 1 Miles/Square Mile Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads <b>2.22 mi/sq/mi</b>	> 2.5 Miles/Square Mile Roads
>70% Security Habitat	50% to 70% Security Habitat	<50% Security Habitat <b>32%</b>
>10% in Past Burns-snags available <b>20%</b>		<10% in Past Burns
>50% Insect/Pathogens (See Disturbance Section in this Chapter)	25% - 50% Insect/Pathogens <b>25-50%</b>	< 25% Insect/Pathogens
<10% Past CC Harvest	11% - 25% Past CC Harvest <b>25%</b>	>25% Past CC Harvest
<10% Past PC Harvest <b>&lt; 10%</b>	11% - 50% Past PC Harvest	>50% Past PC Harvest

(Percentages in bold indicate values for MLSA)

\* denotes quality of this MLSA

(1) Restoration Opportunities And Potential Projects For Snags/Logs:

1. Reduce roads in Forest Interior patches;
2. Increase Security Habitat;
3. Reduce roads in Riparian Reserves;
4. Manage at endemic insect/disease levels;
5. Complete snag analysis on 40 acre grid;
6. Retain snags at high end of range;
7. Monitor for snag dependent species, especially in the burn in Camas MLSA; and
8. Validation monitoring for assumptions in snag analysis.

e) Species with Special Status (Plant)

There are six species with special status known to occur within the Sand Creek or Camas MLSAs. None of these species have immediate viability concerns and, therefore, conservation strategies should be developed. A conservation strategy for *Delphinium viridescens* was developed, but this document needs to be updated to include new information regarding this species response to disturbance. For example, prescribed burning within known populations is thought to be a means for restoring habitat and improving population vigor.

It is important that research regarding the ecology and biology of *Sidalcea oregana* var. *calva* be carried out to help facilitate the development of a conservation strategy. It is possible that this species does have immediate viability concerns, but these can not be identified at this time because of lack of population information for this species.

A draft conservation strategy exists for *Cypripedium fasciculatum*, but this document will need to be finalized. This strategy is being developed by the BLM in Oregon.

Habitat conditions for *Iliamna longisepala* could be improved and/or restored through the use of prescribed burning. This could be carried out in conjunction with prescribed burning to reduce fuels or maintaining open, park-like structure in the dry forest group.

## 2. Plant Connectivity

Connectivity can be addressed by analyzing the connectedness of habitats within the MLSA. Within the Camas MLSA and Sand Creek MLSA, most forest groups are fairly well connected. Many disjunct populations result from inherent breaks or openings in the landscape. At this time, information is not available to complete this type of analysis for the Camas MLSA and Sand Creek MLSA.

## 3. Wildlife Connectivity

### a) Wildlife Connectivity for Sand Creek MLSA

The following is a result of applying the "within LSR/MLSA connectivity assessment process" to the Sand Creek MLSA.

**Table VI-12, Connectivity Rankings for Sand Creek MLSA**

Connectivity Variable	Dry	Mesic	MGF	RR	Overall
% Late-success or Fire Climax	L	H	H	M	M
Open Road Density	L	L	M	L	M
Security Habitat	L	L	L	L	L
Forest Interior Roads	L	L	L	L	L
% Forest Interior*	L	L	L	L	L

Currently, the availability of habitat in a late-successional or fire-climax condition is high in all vegetation groups except the dry forests. Restoration projects that promote the development of fire-climax conditions would improve the connectivity in this forest group. The overall open road density and level of security habitat provides for a low to moderate level of connectivity. However, the existing roads are concentrated in Riparian Reserves where the current open road density is 4.9 miles/sq mi.. The current level of forest interior connectivity is considered to be low, as a result of habitat patches being fragmented by roads. This is a concern for species with low mobility. The percent of each vegetation type in a forest interior will improve over time unless a large-scale disturbance occurs. It should be noted that the ranking for this variable may never be high as a result of natural landscape fragmentation. The amount of habitat within a forest interior needs to be evaluated based upon the ecological capabilities of the site and sustainability on a site-specific basis. Site-specific analysis is also necessary to more adequately address connectivity for the less mobile species. This was not adequately addressed at the coarse/moderate filter approach used in this assessment.

### (1) Restoration Opportunities

#### (a) Dry Forest Group

There is an opportunity to improve connectivity within the dry forest vegetation group through the implementation of thinning, prescribed fires, and road closures with associated revegetation.

## (b) Moist Grand Fir, Riparian Reserves

There is an opportunity to improve habitat connectivity within riparian reserves and interior forest patches by reducing the number of roads. This could include relocating roads or revegetating them to provide for connectivity for low mobility wildlife species.

## b) Wildlife Connectivity for the Camas MLSA

The following is a result of applying the "within LSR/MLSA connectivity assessment process" to the Camas MLSA.

**Table VI-13, Connectivity Rankings for Camas MLSA**

Connectivity Variable	Dry	RR	Overall
% Late-success or Fire Climax	L	L	M
Open Road Density	L	L	L
Security Habitat	L	L	L
Forest Interior Roads	L	L	L
% Forest Interior*	L	L	L

Currently, the availability of habitat in a late-successional or fire-climax condition is low in all vegetation. Restoration projects that promote the development of fire-climax conditions would improve the connectivity in this forest group. The overall open road density and level of security habitat provides for a low level of connectivity. However, the existing roads are concentrated in Riparian Reserves where the current open road density is 7.0 miles/sq mi.. This is a concern for species with low mobility. The percent of each vegetation type in a forest interior will improve over time unless a large-scale disturbance occurs. It should be noted that the ranking for this variable may never be high as a result of natural landscape fragmentation. The amount of habitat within a forest interior needs to be evaluated based upon the ecological capabilities of the site and sustainability on a site-specific basis. Site-specific analysis is also necessary to more adequately address connectivity for the less mobile species. This was not adequately addressed at the coarse/moderate filter approach used in this assessment.

## (1) Restoration Opportunities

## (a) Dry Forest Group

There is an opportunity to improve connectivity within the dry forest vegetation group through the implementation of thinning, prescribed fires, and road closures with associated revegetation. Road closures and revegetation within the Riparian Reserves would greatly enhance habitat connectivity.

#### 4. Disturbance Risk Analysis

Camas MLSA contains 1,545 of which 61% is successional advanced or partially harvested dry forest. Sand Creek MLSA contains 9,225 acres of which 64% is successional advanced or partially harvested dry or mesic forest. Both of these MLSAs are on the eastern edge of the Wenatchee National Forest and thus receive very low amounts of annual precipitation. Neither MLSA contains wet forest types. Many acres reported as successional advanced were harvested at least once. Much of the large ponderosa pine was removed in these harvests. Many stands are now more heavily stocked than historically. Stands are primarily pine or mixed with Douglas-fir. Grand fir exists on more mesic sites, especially along valley bottoms. Recent

research within the Sand Creek MLSA found nearly all individuals of either Douglas-fir or grand fir established within the past 90 years. This was true regardless of aspect and topographic position. There are some areas of grassland and shrubland.

Insect-caused mortality within the Camas and Sand Creek MLSAs is increasing, with recent heavy mortality in pole-sized stands of ponderosa pine caused by western pine beetle. Historically, this insect killed individual or small groups of large, old pine. Mountain pine beetles and pine engraver beetles are also present. Where grand fir is present, there have been outbreaks of fir engraver triggered by drought and moisture stress in heavily stocked stands. A small portion of the Camas MLSA burned in 1994. This area and adjacent stands may be at elevated risk to outbreaks of the Douglas-fir beetle. These areas are also at risk to outbreaks of western spruce budworm.

Pathogen activity within these two MLSAs is also high. Many Douglas-fir are infected by dwarf mistletoe, some very heavily. Armillaria root disease and laminated root rot are prevalent. Past high-grade logging likely resulted in establishment of P-type annosus root rot.

Both Camas and Sand Creek MLSAs are at high risk to stand-replacing fires. Areas surrounding these MLSAs include private land, with increasing development. A long drought during the 1980s and 1990s stressed trees growing in overstocked stands, causing mortality from insects and diseases. Dead and live fuels are connected horizontally and vertically across the landscape. The area within which these MLSAs are located is well-roaded and receives heavy local recreational use.

The following information on insect activity in the three reserves is from data collected during the aerial surveys conducted by Region 6 Insect and Disease Group. Light infestations are not reported.

- Mountain pine beetle (ponderosa): 1968, 1977-80, 1984, 1992, 1994-95
- Western pine beetle: 1959, 1973, 1986, 1988, 1991, 1993 (heavy in pole-size stands), 1995 (heavy)
- Pine needle scale: 1989 (Possibly black pineleaf scale)
- Fir engraver: 1968, 1989 (heavy), 1990-91, 1995 (heavy)
- Western spruce budworm: 1952, 1973, 1975-77
- Pine Ips: 1965

Susceptibility of the Camas and Sand Creek MLSAs to fires, insects, and pathogens is shown in Table VI-14. Mortality from biotic disturbance agents will be greatest where host continuity across the landscape is high and where there is overlapping moderate to high risk among two or more disturbance agents that act synergistically (for example Douglas-fir dwarf mistletoe and fire). Risk associated with biotic disturbance agents generally elevates the risk of catastrophic fires by potentially increasing fuel levels: this is especially true in the dry forest vegetation group and in less-susceptible vegetation upslope or surrounded by dry forest.

**Table VI-14, Disturbance Matrix, Camas and Sand Creek MLSAs**

	Fire	DF Dwar f Mistle Toe	Root Decay			Insect					Total Risk
			AROS	HEAN	PHWE	WSB	DFB	MPB	FE	WPD	

10	M	M	M	L	L	L	H	L	-	L	M
11	M	M	M	L	L	M	M	-	-	H	M
12	H	H	M	L	M	H	M	-	-	H	H
13	H	H	M	L	M	H	M	L	-	M	H
21	H	M	M	M	M	M	M	L	M	M	H
22	H	H	M	M	M	H	H	M	H	L	H
31	H	M	M	M	H	L	M	M	M	L	H
32	H	H	M	M	H	M	M	M	H	L	H

**Key to Column Headings:** PP = Ponderosa Pine, DF = Douglas-fir, WL = Western Larch, PIPO = Ponderosa Pine; PSME = Douglas-fir; LAOC = Western Larch; AROS = Armillaria root disease; HEAN = Annosus root disease; WPBR = White Pine Blister Rust; WSB = Western Spruce Budworm; DFB = Douglas-fir Beetle; MPB = Mountain Pine Beetle; WPB = Western Pine Beetle.

**Key to Letters** “-” = no risk; “L” = low risk, “M” = moderate risk, “H” = high risk

**Veg Type codes:** refer to Appendix 3, in the “Forest-wide Assessment for Late Successional Reserves and Managed Late Successional Areas, Wenatchee National Forest”.

Projects within the Camas and Sand Creek MLSAs should focus on restoring ponderosa pine stands. Where P-type annosus root disease threatens ponderosa pine regeneration, species diversity, but not necessarily stand density, should be increased. This area is heavily used by the local population, offering opportunities for fuelwood collection areas to reduce stand density.

## 5. Northern Spotted Owl

The following is the discussion and results of the within LSR/MLSA Spotted Owl Module for the Sand MLSA/Camas MLSA. There are a total of two spotted owls in these two MLSAs, there are an additional 3 historic owl sites near these MLSAs. Both MLSAs are primarily in dry forest types. The spotted owl module reviews the home range sites for spotted owls, the spotted owl pair goals for the LSR/MLSAs, as well as connectivity within the LSR/MLSAs. See Appendix 1 “Northern Spotted Owl Module, Individual LSR/MLSA” for further description of the order, explanation and process of the modules. See also “Suitable Spotted Owl/Dispersal Habitat and Activity Center” maps and tables, Forest Interior Map and tables, Riparian Reserve map and tables and Security Habitat map and Tables.

LSRs and MLSAs are important for maintaining well distributed and well-connected spotted owl populations. The recovery of the federally Threatened northern spotted owl is highlighted in management strategies within LSRs and MLSAs (See appendix 1 - Northern Spotted Owl Module, Individual LSR/MLSA). Protection and enhancement of habitat includes providing late successional and old growth forest ecosystems, and habitat for late successional forest related species, including the northern spotted owl (NWFP A-4, 1994). Spotted owl management strategies includes:

- LSRs and MLSAs will meet the goals for the number of owl pairs or sustainable spotted owl habitat within each LSR or MLSA. (NWFP 1994 B-4; NWFP C-9; FSEIS Appendix G, Biological Opinion, 1994; USDI 1992, Northern Spotted Owl Recovery Plan; and USFWS Memorandum, 1991);
- Each spotted owl’s 100 acre Activity Center will have the best quality habitat established and retained;

- Each spotted owl's 500 acre Core Area will have the best quality habitat and will not be reduced (habitat will be retained);
- Each spotted owl home range will meet threshold acreage's (2,663 acres) as a minimum. Wetter LSRs will meet target or optimal habitat of 3,994 acres.;
- The risk of habitat loss and nest site loss will be reduced (NWFP 1994, C-12 to 16, C-26);
- Sustainable/suitable spotted owl habitat outside home ranges will be maintained;
- Dispersal habitat within and outside LSR/MLSA will be maintained (NWFP 1994, ROD pg 19, C-3, C-10 to 11, C-39, C-45, D-9, app 3-4 pg 240-241); and
- Habitat conditions for long-term (> 50 years) sustainable nesting/roosting/foraging habitat will be improved (see DEC's and DC's in Forest-wide Chapter III).

Combined, both MLSAs are mostly in the dry forest groups (93% at 9,997 acres). All spotted owl pairs are in dry and mesic forest habitats. Not all of the spotted owl home ranges are within the MLSAs, home range circles overlap onto Matrix and private land habitat outside. The Desired Condition for spotted owl habitat in MLSAs is 40% of the 1.8 mile home range radius, which is 2,663 acres. These drier forest MLSAs will be managed for risk and hazard reduction, over spotted owl habitat maintenance (after reaching threshold goals). MLSAs in general, accept more risk of hazards, than do lands outside in Matrix. Yet, MLSAs accept less risk of hazards than do LSRs.

Though private and non-federal lands are sometimes within LSR/MLSA boundaries, they do not apply towards management for late-successional habitat. The Sand Creek MLSA is approximately 45% in private or DNR ownership, the Poison Creek owl SO758 is on private land. The Camas MLSA is approximately 66% in private ownership. There was a land exchange in the Camas and Sand MLSAs that reduced the amount of Federal ownership, this has effected the ability of these MLSAs to function for spotted owls.

The Northwest Forest Plan describes the spotted owl MLSA's to "be configured so that it contains an amount of suitable habitat that approximates at least the median amount observed in pair home ranges for the province" (NWFP C 23-25). The median home range size for pairs in the Eastern Cascades Province was estimated to be 7,124 acres (NWFP C-24). For this assessment, each MLSA was reviewed for spotted owl sites, acreage size, and connectivity to other LSR's and to Wilderness areas. There are 6 MLSA's that have fewer acres than the median home range size. These are Twin Lakes DM-1, Natapoc DM-2, Tumwater DM-3, Eagle DM-5, Camas DM-6, and Lost Lake DM-12. However, most of these are adjacent to other LSR's or Wilderness areas. There are two that are not, Eagle MLSA and Camas MLSA. The acreage within the MLSA's may not sustain a spotted owl home range, surrounding matrix lands are probably used by spotted owl pairs within these MLSA's.

a) Suitable Spotted Owl Habitat

(1) Sand MLSA

The amount of nesting/roosting/foraging habitat within the Sand MLSA is 3,728 acres (40% of the MLSA). Of this, 60 acres (1%) are in moist forests. This wetter spotted owl habitat has a higher chance of sustainability, than the predominate dry and mesic forest groups. The MLSA's main forest vegetation is dry (7,163 acres - 78%), of which 2,395 acres (26%) is N/R/F spotted owl habitat. An additional 1,273 acres (14%) is mesic forest suitable habitat.

There is a potential for the MLSA to reach 6,604 acres (66%) of suitable habitat. However, most of this potential habitat is in the drier/mesic forest groups, and not sustainable. Sustainable spotted owl habitat within this MLSA is approximately 77 acres of moist forest group habitat. See Table VI-15, Spotted Owl Habitat, Potential Habitat, and Sustainable Habitat in LSRs/MLSAs, on page 240, which displays the potential number of owl pairs for the various scenarios. It is doubtful that 2-3 pairs of spotted owls can be sustained in this MLSA over the long-term (> 50 years). The two spotted owl activity centers in the upper Sand Creek/Red Hill (SO730) and Tronson Ridge (SO736) areas may provide better long term spotted owl viability.

Dispersal habitat currently is 4,414 acres, and is a mix of dry and mesic forest groups. (See appendix 13 Suitable Habitat Acreage's, appendix 4 & 5 Vegetation Acreage's, and Suitable Spotted Owl Habitat Maps). The most contiguous and sustainable suitable spotted owl habitat in the MLSA is in the valley bottoms of Sand Creek, Mission Creek and Poison Creek, as well as north aspects.

There are two spotted owl activity centers, both on drier habitats. Habitat analysis for the Sand Creek and Camas MLSAs is based on vegetation mapping, and a model of spotted owl habitat structure. The map and acreage's should be validated prior to project implementation.

Potential disruption to spotted owl habitat, inside and outside the MLSAs, is the dry forest risk to fire surrounding the MLSA. Other potential disruptions are the private land fragmentation and development. To meet the recovery goals for the spotted owl, there is a need to increase/accelerate spotted owl dispersal habitat within the spotted owl core area and home range. Coordination with private land owners and the DNR is important for the Sand Creek MLSA.

From a Forest-wide perspective, there are 5 LSR/MLSAs that may not provide spotted owl connectivity and sustainability over time, these are Sand MLSA, Swauk LSR, Boundary Butter LSR, Deadhorse LSR, and Shady Pass LSR (see Appendix 1, "Forest Wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module", Table 2, "Spotted Owl Habitat, and Sustainable Habitat in LSRs/MLSAs" and Table 3 "Summary LSR/MLSA Status & Spotted Owl Pairs Existing and Sustainable on the Forest"). LSR/MLSA spotted owl connectivity and sustainability was analyzed individually and collectively. The Critical Habitat Units were compared with LSRs and MLSAs, to determine if the reserves meet the intent of the CHU needs (connectivity, home range goals, juxtaposition, and range-wide distribution). The existing condition was then compared to the sustainable habitat conditions, for long term spotted owl habitat.

It is recognized that the LSR/MLSAs were designed with the intent that habitat may be lost due to fire or other disturbances, while other LSR/MLSAs will increase in spotted owl habitat as late successional habitat is recovered. However, some LSR/MLSAs are in strategic locations for dispersal, connectivity, genetic interchange. Overtime, there is some question of sustainability of spotted owl habitat in 5 of the 27 LSR/MLSAs. The need is a long-term (>50 years) support for connectivity and home range goals for spotted owls in these LSR/MLSAs and across the province. The sustainability question is due to the amount of dry and mesic forested habitat at risk to fires in these 5 LSR/MLSAs. To strengthen connectivity, home ranges and spotted owl viability, the reserve boundaries could be expanded to include wetter forest and spotted owl home ranges in areas of important connectivity. LSR or MLSA boundary extensions in reserves important for spotted owl connectivity (but low in sustainability) include: Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12); Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module).

The amount of nesting/roosting/foraging habitat within the Camas MLSA is 541 acres (35% of the MLSA). Of this, no acres are in moist forests. The MLSA's predominate forest vegetation is dry (1,457 acres - 94%), of which 536 acres (35%) is N/R/F spotted owl habitat. There are no other forested groups in this MLSA. There is a potential for the MLSA to reach 932 acres (60%) of suitable habitat. However, all of this potential habitat is in the drier forest group, and not sustainable. There is no sustainable spotted owl habitat within this MLSA, with the possible exception of fire refugia areas on north aspects or stream bottoms. As a result of the 1994 fires, the only spotted owl pair in this MLSA was burned. It is doubtful that any pairs of spotted owls can be sustained in this MLSA over the long-term (> 50 years).

Dispersal habitat currently is 538 acres, and is dry forest group. (See appendix 13 Suitable Habitat Acreage's, appendix 4 & 5 Vegetation Acreage's, and Suitable Spotted Owl Habitat Maps). The most contiguous and sustainable suitable spotted owl habitat in the MLSA is in the valley bottoms of Camas Creek, the headwaters of Pendleton Canyon, as well as north aspects.

**Table VI-15, Spotted Owl Habitat, Potential Habitat, and Sustainable Habitat in LSRs/MLSAs.**

LSR or MLSA	1996 Known Pairs & Singles	CHU S.Owl Pair Goals	Existing Suitable Spotted Owl Habitat			Potential Suitable Spotted Owl Habitat			Sustainable Suitable Spotted Owl Habitat			% Forest Interior
			Acres	Thres hold Pairs	Target Pairs	Acres	Thres hold Pairs	Target Pairs	Acres	Thres hold Pairs	Target Pairs	
Deadhorse RW133	7 sites + 1 <sup>1</sup> (2 Sites*)	4+ Pr	6692	2.5	NA	11044	4.2	NA	2391	0.9	NA	2%
Bnd Butte RW131	2 sites (1 Site*)	3 Pr			NA			NA		0.5 pairs	NA	2%
Camas DM6	0* Much Pvt Lnd	--	541	0.2	NA	932	0.4	NA	0	0	NA	18%
Sand Cr DM7	2 sites (1 sites <sup>2</sup> ) Much Pvt Lnd	2-3 Pr contri- butes toward	3728	1.4	NA	6064	2.3	NA	77	0.03	NA	7%
Swauk RW 129	23 sites +2 site <sup>1</sup>	20+ Pr	45675 acres	17.2 Pairs	11.4 Pairs	73792 acres	27.7 Pairs	18.5 Pairs	39452 acres	14.8 Pairs	9.9 Pairs	12%

This LSR/MLSA is part of the reserves that are predicted to provide the needs for spotted owl recovery over time (50+ years). Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. The reserves function for connectivity and spotted owl home ranges. With the exception of a few LSR/MLSAs that are not sustainable, it is concluded that the LSR/MLSA reserves on the Wenatchee National Forest meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing. (See Appendix 1, "Forest-wide Spotted Owl Module" and "Individual LSR/MLSA Spotted Owl Module")

b) Spotted Owl Home Ranges

Within the Sand and Camas MLSAs, the estimated amount of habitat within a 1.8 mile radius of the activity center is shown in Table VI-16. One spotted owl home range is at threshold acres, both within the core area of 0.7 miles radius (>500 acres) and the home range of 1.8 miles radius (>2,663 acres). The other owl site is below threshold, additionally much "threshold" habitat is on private land and State land (approximately 33%).

The Sand Creek MLSA owls will need dry forest, risk reduction, and habitat improvement to reach and maintain threshold acreage, as well as potential, and cooperation with DNR and private land owners. Dispersal acres may be used for threshold habitat. Dispersal habitat in the wet, moist, mesic may be accelerated towards late successional structure and size. All spotted owl sites should be monitored and habitat verified. Of note, to reach 2,663 acres habitat, acreage outside the MLSA is utilized within the 1.8 miles. The DNR Section 36 appears to have suitable habitat in mesic and dry forest groups.

For long-term population viability, there is some potential to reduce risk of hazard and to restore sustainable habitat in cut over areas. There is also a need to protect existing habitat and home ranges, especially in sites below threshold and target acreage's. This will cause a higher risk to fire in the dry forest habitat maintained for the spotted owl. Overtime, it is expected that higher quality and more sustainable habitat will be restored to the MLSA and to the nearby Swauk LSR. The drier forests within the MLSA will eventually be managed for other late-successional species.

Table VI-16, Suitable Spotted Owl Habitat, Sand MLSA and Camas MLSA

	SUITABLE SPOTTED OWL HABITAT <sup>10</sup>												Restore
	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				.33 mile Circle Around Activity Center <sup>11</sup>				Opps
SAND MLSA Spotted owl	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	*
SO729 Sand	1910 58%FS 42%P & DNR	815 58%FS 42%P	0	2,726 58%FS 42%P	385 87%FS 13%P	143 100%FS 0%P	0	527 91%FS 9%P	106	19	0	125	m,c,p,a
SO758 Poison '96	1919 73%FS 27%P	307 23%FS 77%P	0	2,227 67%FS 33%P	267 54%FS 46%P	84 7%FS 93%P	0	351 43%FS 57%P	54	58	0	112	m,c,p,a
Historic s.owls													
SO753				1,839				183	39	0	0	33	m,c
SO752 <sup>1</sup>				2,084				394					m,c
Spotted Owl CAMAS MLSA	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	*
Larson Cny Historic s.owls				-- 90%				-- 100%				-- 100%	m

	SUITABLE SPOTTED OWL HABITAT <sup>10</sup>												Restore
	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				.33 mile Circle Around Activity Center <sup>11</sup>				Opps
SAND MLSA Spotted owl	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	Dry	Mesic	Wet-ter	Total	*
				Pvt				Pvt				Pvt	

**Below Threshold:** < 2,663 ac suitable spotted owl habitat in 1.8 mi circle **OR** < 500 ac suitable spotted owl habitat in 0.7 mi circle.

**At Threshold:** 2,663-3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

**Optimum/Target:** > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

<sup>10</sup> **suitable spotted owl habitat** includes **Dry** vegetation code 12 where size/structure is multistory greater than 9" DBH;

**mesic** includes code 22; and

**wet** includes codes 32, 36, 62, 64, and 42.

<sup>11</sup> **Activity Center**, a larger circle will be used if there is less than 100 acres of suitable habitat within 0.33 miles of activity center.

\* **Restoration Opportunities:** **M** = Monitor Habitat & Site; **P** = Protect Habitat From Risk; **A** = Accelerate Habitat Towards Nesting, roosting, Foraging; **C** = Coordinate Habitat and Site Management, or Acquire Habitat.

c) Spotted Owl Dispersal And Connectivity

The Sand and Camas MLSAs have two spotted owl activity centers. There is potential for at most, 2 spotted owl pairs to occur on site, however spotted owl habitat sustainability is very low in this MLSA. Connectivity within the MLSA is based on foraging and dispersal opportunities. Important connectivity habitat exists along Sand Creek, Little Camas, Poison Creek and Mission Creek and Camas and Pendleton Creeks.. Habitat quality for these MLSAs are lower overall, except near the activity center of SO729 Sand Creek area.

Important connectivity between LSRs/MLSAs include Mission Creek, and the upper Sand Creek/Tronson Ridge, north aspects of TipTop to Allen Creek, Derby Canyon to lower Larson Canyon, Mountain Home to Icicle Ridge, Wedge Mountain to Eight-Mile Creek. An important linkage may have been disrupted in the 1994 fires, and no longer functions from Camas MLSA to Boundary Butte LSR and from Boundary Butte to Icicle LSR.

During dispersal - nesting, roosting, foraging habitat is used, as well as habitat of lower quality (dispersal habitat). Dispersal habitat includes single story stands, and smaller trees with at least 40% crown closure. Dispersal habitat within the Sand MLSA is 4,414 acres (48%) and for Camas 538 acres. Dispersal habitat can grow up to be nesting/roosting/foraging habitat. Habitat providing dispersal/connectivity corridors within the MLSA are primarily along riparian reserves and north aspects (see Forest Interior map and Suitable Spotted Owl Habitat Map).

The function of dispersal/connectivity habitat for spotted owls depends on the amount and juxtaposition of late-successional, forest interior, and dispersal habitat. The Sand MLSA currently has 1% in late-successional/successionally advanced wetter forest habitat, Camas MLSA has no wetter forests. For Sand, there is another 64% successional advanced dry forest,

which is not sustainable. There is a low amount of forest interior habitat (7% Sand Creek MLSA and 18% Camas MLSA). The two spotted owl activity centers are located on the forest-interior patches. The inherent landscape pattern accounts for much of the disruption to Forest Interior habitat. Some fragmentation is from created openings (25% Camas MLSA and 5% Sand MLSA). The moderate road densities (Camas MLSA 2.22 miles per square mile and Sand MLSA 1.75 miles per square mile) and low Security Habitat (32% Camas MLSA and 38% Sand MLSA) effects connectivity, in that fragmentation usually occurs along roads, and snag reductions for road maintenance cumulatively effects habitat overtime.

Outside the LSR/MLSA network, dispersal habitat is found in all land allocations, and will be provided mainly in Riparian Reserves, in Unmapped LSR's in Matrix/AMA's, and in wilderness areas (NWFP 1994, ROD pg 19, C-3, C-10 to 11, C-39, C-45, D-9, App 3-4, pg. 240-241).

It is recognized that the LSR/MLSA's were designed with the intent that habitat may be lost due to fire or other disturbances, while other LSR/MLSA's will increase in spotted owl habitat as late successional habitat is recovered. However, some LSR/MLSA's are in strategic locations for dispersal, connectivity and genetic interchange. Overtime, there is some question of sustainability of spotted owl habitat in 6 of the 27 LSR/MLSA's. The need is a long-term (>50 years) support for connectivity and home range goals for spotted owls in these LSR/MLSA's and across the province. The sustainability question is due to the amount of dry and mesic forested habitat at risk to fires in these 6 LSR/MLSA's.

The six LSR/MLSA's with sustainability questions are Swauk LSR, Shady Pass LSR, Deadhorse LSR, Boundary Butte LSR, Tumwater MLSA and Sand MLSA. In these areas, to strengthen connectivity, home ranges and spotted owl viability, parts of the CHUs may need to be maintained or adjusted. Adjusted areas should include wetter spotted owl habitat within spotted owl home ranges, which will strengthen the connectivity and species viability. Possible adjusted areas for LSR or MLSA important for spotted owl connectivity, but low in sustainability, include: Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module); Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4); Deadhorse LSR and Tumwater MLSA (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve); Boundary Butte LSR (wetter habitat to the south, including spotted owls inside the CHU WA-11); and Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12).

In all LSR/MLSA's, except the six noted above, reserves are predicted to provide the needs for spotted owl recovery over time (50+ years). They will also provide the function the CHUs were designated for. Coupled with the LSR/MLSA management, riparian reserve function, Wilderness areas, and Unmapped LSRs, the needs of the spotted owl will be met. These reserves function for connectivity and spotted owl home ranges. It is concluded that the LSR/MLSA's meet the function of the CHU system, as intended in the NWFP (NWFP C-9). Monitoring and maintaining connections, as well as meeting LSR goals will be ongoing.

#### d) Restoration Opportunities And Potential Projects - Within MLSA

##### • MONITORING:

1. To strengthen connectivity, home ranges and spotted owl viability, modify the reserve boundary to include wetter forest and spotted owl home ranges in areas of important connectivity:
  - Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12);

- Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module).
- 2. Meet pair goals of CHU and MLSA for spotted owls. Monitor potential for Sand MLSA to support 2-3 pairs, and adjust either Sand MLSA boundary or incorporate additional Swauk spotted owl pairs to meet CHU goal.
- 3. Validate spotted owl mapping, LSR acreage's, and home range acreage's. Field verify habitat and activity center locations.
- 4. Reconfigure spotted owl habitat home range, based on foraging pattern, rather than 1.8 mile circle. Suspect owl moves through moist/linear habitats rather than circular lower quality. Use the best quality of habitat available.
- 5. Validate assumption that Sand MLSA can not support many pairs of owls. Locate habitat outside MLSA that is sustainable over time, with less private land, and consider moving MLSA boundary. Use extra Swauk owl pairs to compensate for Sand Creek.
- 6. Monitor spotted owl activity centers, 500 acre core and home ranges of spotted owls. SO729, SO758, monitor and accelerate dispersal towards suitable. Monitor historical spotted owl sites SO752 and SO753. Monitor SO730 and SO736 in Tronson/Red Hill.
- **PROTECTION:**
  - 7. Protect spotted owl home ranges within MLSA from fires originating outside the MLSA, between owl circles, by implementing risk reduction first on non-suitable habitat, then on Dry and Mesic habitat.
  - 8. Fuels reduction and hazard reduction occur outside N/R/F habitat in short term, shift emphasis after 50 years. Accept more risk from fire, manage at high end of spotted owl habitat desired condition in wet sites. 500 Acre core area protected, 100 acre activity center protected.
  - 9. Sustain spotted owl habitat inside MLSA in north aspects, riparian reserves.
  - 10. Maintain dispersal/connectivity habitat and connectivity towards Swauk and Boundary Butte LSR.
  - 11. During management proposals, use habitat quality/risk assessment analysis (Appendix 29) to help display best quality habitats and stands of highest risk of loss.
- **HABITAT IMPROVEMENT:**
  - 12. Improve and accelerate N/R/F habitat, to maintain current number of spotted owl pairs.
  - 13. Improve and accelerate N/R/F habitat in wet forest groups, to maintain number of spotted owl pairs. Accelerate dispersal habitat and old plantations, which are predicted to recover on the following rates:
    - Clearcuts in wet/moist vegetation groups predicted to be habitat in 100 years.
    - Clearcuts in mesic/dry vegetation groups will be habitat in 120 years.
    - Pole sized stands in wet/moist will be habitat in 50 years.
    - Pole sized stands in mesic/dry will be habitat in 70 years.
  - 14. Increase habitat effectiveness and connectivity by reducing open roads and revegetating road beds. Especially in forest interior habitat patches.
- **COORDINATE:**
  - 15. Cooperate and encourage DNR and private landowners to manage identified sites for owls.

16. Coordinate habitat and site management on DNR and private land OR acquire habitat from private ownership.

- **Other**

17. To strengthen connectivity, home ranges and spotted owl viability, modify the reserve boundary to include wetter forest and spotted owl home ranges in areas of important connectivity:

- Sand MLSA (wetter habitat to the south, including spotted owls inside the CHU WA-12);
- Swauk LSR (wetter habitat to the north, see Forest-wide spotted owl module);
- Boundary Butte LSR (wetter habitat to the south, including spotted owls inside the CHU WA-11);
- Deadhorse LSR (all available wetter habitat is included in the LSR and CHU WA-9, monitor this reserve, no boundary changes are recommended);
- Shady Pass LSR (habitat to the southeast in the Twenty-five Mile Creek CHU WA-4).

## 6. Aquatic

The Sand and Camas LSRs are located within the Wenatchee River Subbasin. The Sand LSR includes two subwatersheds within the Mission Creek watershed. The Camas LSR lies within the Camas and Lower Peshastin subwatersheds, Peshastin watershed.

### a) Geomorphology

Both the Peshastin and Mission Watersheds lie within the Wenatchee Swauk Sandstone Hills Subsection. The Swauk Sandstone and Chumstick Sandstone geologic formations dominate this subsection. The geomorphology is strongly influenced by folded, inter-bedded bedrock with dipslope/scarp slopes forming narrow, confined v-shaped valleys resulting in highly dissected landform. Surface erosion is the predominate erosion process with occasional mass wasting associated with the weaker, incompetent beds. These landforms lie within the rain shadow of the crest of the Cascade Mountains thus, except for some upper headwaters, are dry landscapes.

The shallow, fine-grained soils are subject to moisture stress and very erodible. The watersheds have numerous first-order drainages many of which are ephemeral. The soils have little moisture holding capacity thus precipitation runs-off the slopes rapidly through the dense first-order drainage network. Flows are flashy with steep peaks rapidly dropping to baseflow levels after storm events or snowmelt. With little near surface ground water, low flows can be very low compared with other areas on the Forest. The low summer flows and hot, dry summers create the potential for high stream temperatures. Ice jams are not uncommon in winter months.

The numerous first-order tributaries within these fine-grained, erosive soils create watersheds with efficient downstream fine sediment delivery. These landscapes are actively eroding. Natural events such as fire and/or high intensity rains, or management activities which remove the little soil protection offered by organic matter may greatly accelerate erosion. Summer thunderstorms may trigger flashfloods and mud flows. The streams are actively degrading (downcutting) through the fine textured material. Mainstem channels are associated with multiple terraces of recent origin.

Much of the Wenatchee Swauk Sandstone Hills, especially the lower elevations, naturally experienced a high frequency, low intensity fire regime. Management actions such as fire suppression and selective timber harvest have changed much of the area to an unnaturally high

intensity fire regime. When fires now occur followed by high intensity precipitation an accelerated rate of erosion may occur. It is also possible that summer low flows may be reduced due to the higher than natural amount of coniferous vegetation due to fire suppression (Mission Creek Watershed Analysis).

(1) Management Concerns due to Geomorphology

Erosive soils combined with numerous first order channels create an efficient delivery system for fine sediment. Fires which consume much of the organic material may also accelerate surface erosion. High intensity precipitation events may result in large pulses of fine sediment through surface erosion or mud/debris flows. Due to the sediment load, wood in the channels generally does not create large pools, as areas upstream of any obstruction may rapidly fill with fines. Wood though does provide hiding cover and habitat diversity for aquatic organisms. Bedrock controls can be important pool forming agents.

Given the rapid runoff characteristics and soil moisture stress, management actions need to prevent accelerated surface erosion. The interception and concentration of flows on roads or trails may accelerate water and sediment delivery to stream channels.

Management of riparian areas needs to focus on; maintaining bank stability given the rapid downcutting observed in these streams, providing a filter for fine sediment, providing shade to ameliorate high summer water temperatures and possible insulation against low winter temperatures. Given the lack of water within the subsection other than that associated with the few perennial streams, riparian vegetation and the associated microclimate may be very important to amphibians and other wildlife

The lowlands of these watersheds near the confluence with the Wenatchee River have been developed for agriculture and urban uses. Water withdrawals not only reduce available aquatic habitat but exacerbate high summer water temperatures and present migration barriers to anadromous fish. Additionally the lower reaches of Mission and Peshastin Creeks have been channelized which may have eliminated wetlands and side channels. Wetland and side channels may have been important fish rearing areas and refugia within the system. Habitat on Federal lands thus becomes very important for maintaining populations in these watersheds.

b) Mission Creek Watershed

The Mission Creek watershed flows in a northerly direction, entering the Wenatchee River at the town of Cashmere, approximately 10 miles west of Wenatchee. Redband/rainbow trout are found throughout the watershed. Summer steelhead are known to inhabit Mission Creek, Sand Creek, and likely the lower reaches of the East Fork Mission. Mission Creek watershed was designated as a key watershed in the Northwest Forest Plan primarily due to the steelhead population. Steelhead within the Wenatchee Subbasin are currently "Proposed" for protection as an Endangered Species under the Endangered Species Act.

The Devil's Gulch subwatershed, a subwatershed adjacent to and upstream of the Sand Creek MLSA is considered a "significant" subwatershed for redband due to the presence of a pure population. Given the potential that the resident redband and steelhead populations are one-in-the-same within the Wenatchee Subbasin, redband populations within the Mission Creek watershed take on additional management emphasis.

Mission Creek and Devil's Gulch in particular, has a history of flash floods and mud flows, often associated with high intensity summer thunder storms. These floods have been observed to kill most all the fish through a significant reach of stream. With poor connectivity with the mainstem Wenatchee it is therefore important that native fish populations are maintained in all the

subwatersheds of Mission to provide a source population for subwatersheds impacted by these flood events.

Low stream flows due to irrigation withdrawals prevent spring chinook from migrating up Mission Creek but juvenile chinook rear in the lower reaches, moving into the system, probably in late summer/early fall from the mainstem Wenatchee. The low flows, high summer water temperatures and channelization have greatly impacted fish habitat in the lower Mission Creek watershed. Mission Creek is included on the Environmental Protection Agency's 303(d) list for temperature.

Two Mission Creek subwatersheds, Lower Mission and Sand are included within the Sand Creek MLSA.

(1) Sand subwatershed

The Sand Creek system supports redband trout and summer steelhead. No other anadromous fish inhabit the subwatershed nor do bull trout. Spring chinook may have historically utilized Sand Creek but chinook salmon access to Sand Creek is blocked by low flows in lower Mission Creek due to irrigation withdrawals. Cutthroat trout have not been documented in the Sand subwatershed. Devil's Gulch, a tributary to Mission Creek draining the subwatershed adjacent to Sand is considered significant for redband trout. Sand Creek redband trout need to be studied genetically to determine if they too are a population of native redband but for now management should assume that they are. If Sand Creek fish are redbands, it would become a significant subwatershed for redband. Management emphasis in the Sand subwatershed should emphasize watershed/aquatic habitat restoration of native redband and steelhead populations. Sand and Devil's Gulch may provide a core population for steelhead and redband within not only the Mission Creek Watershed but also the Wenatchee River.

(2) Lower Mission subwatershed

Mission Creek downstream of the National Forest boundary is the major fish bearing stream in this subwatershed. The bottom lands have been developed for agriculture and homes. High water temperatures, chemical contaminants, channelization, and water withdrawals all limit fish habitat in this subwatershed. Summer steelhead and redband/rainbow trout are found in the subwatershed and spring chinook salmon utilize the lower reaches of Mission Creek for late summer and over-winter rearing habitat. A local volunteer group is working with landowners to improve water quality, fish and riparian habitat on the private lands.

(3) Late Successional Management Implications

The National Forest lands within the Mission Creek watershed provide important fish habitat. Agriculture, homes and urban development have greatly impacted fish and riparian habitat below the National Forest boundary. Management on National Forest lands in the Mission Creek watershed should emphasize watershed health, maintaining adequate flows and not accelerate erosion. Given the proximity to private lands in the Mission Creek drainage Lower Mission may be a priority for aggressive vegetation restoration to reduce wildfire and insect/disease risks associated with dry forest while improving long term watershed health. Portions of the watershed may offer opportunities for aggressive terrestrial treatments that, if carefully planned, may not pose undue risk to aquatic habitat.

Management of late successional habitat in the Mission Creek watershed needs to emphasize maintaining habitat for redband trout and steelhead and protecting current populations. Management prescriptions to return the watershed to a more natural disturbance (fire) regime may be beneficial to long term fish habitat and watershed health but caution must be exercised so

that current habitat and populations are not compromised. With a history of severe mud flows in the Mission Creek drainage it is very important to maintain strong local populations in multiple subwatersheds to reduce the risk of extinction of the native populations if a disturbance greatly impacts a population in one subwatershed. Appropriate road management activities such as reconstruction, resurfacing or obliteration can be implemented to reduce sediment input into these streams.

c) Peshastin Watershed

The Peshastin Watershed borders the Mission watershed to the north. Peshastin Creek enters the Wenatchee River between the towns of Leavenworth and Cashmere west, about 15 miles from Wenatchee. Like Mission Creek, Peshastin Creek flows in primarily northerly direction and like Mission Creek, fish habitat and populations have been impacted by land use activities. Channelization, irrigation withdrawals and highway construction have had significant impact on the mainstem Peshastin Creek. Peshastin Creek is considered to be water quality limited due to temperature. Spring chinook salmon are limited to the lowest reaches of the stream, summer steelhead, redband trout and westslope cutthroat trout are found throughout much of the watershed although not always in the same stream sections. Westslope cutthroat are often found in reaches upstream of the redband and steelhead distribution. Bull trout are only known to inhabit the Ingall's subwatershed. Due to habitat disruption in the lower reaches of Peshastin Creek the Ingall's Creek bull trout population may be somewhat isolated from other Wenatchee River populations. The Camas LSR includes portions of two Peshastin subwatersheds, Camas and Lower Peshastin.

(1) Camas subwatershed

Camas Creek flows into Peshastin Creek approximately seven miles upstream from the mouth of Peshastin. Steelhead inhabit the lower mile of Camas Creek but access to the rest of the stream is blocked by dams creating two ponds. Redband trout are found up to Camas Meadows. No amphibian information is currently available for this subwatershed. Cutthroat trout and bull trout are not believed to inhabit the subwatershed.

(2) Lower Peshastin subwatershed

This subwatershed includes the lowest reaches of Peshastin Creek. Most other drainages within the subwatershed are ephemeral. Spring chinook rear and there may be some limited spring chinook spawning in Lower Peshastin. Redband/rainbow and steelhead are present. There may be westslope cutthroat but redband and steelhead likely predominate. Bull trout are not known to inhabit Lower Peshastin but the stream may provide a migration corridor between the Wenatchee River and the Ingall's Creek population. This watershed has been heavily developed for agriculture and homes. The stream has been channelized to accommodate this development and provide a corridor for Highway 97. Irrigation withdrawals create a low flow summer migration barrier. The low flows and loss of riparian vegetation help contribute to high summer stream water temperatures. Western long-toed salamanders and Pacific tree frogs are known to inhabit this subwatershed.

(3) Late Successional Management Considerations

Due to the proximity to private lands in a dry Forest type and the relatively few streams, the Lower Peshastin and Camas subwatersheds may be good candidates for aggressive forest restoration designed to restore more natural stand structure and fuel loads while maintaining long term hydrologic and riparian function. Management for aquatic resources should focus on not creating watershed conditions that would aggravate low flow habitat conditions in Peshastin

Creek and maintain redband/rainbow and steelhead habitat in Camas Creek. Management induced accelerated sediment delivery will be a concern with any land management activity. It may be beneficial to determine if the redband/rainbow in Camas Creek are native redbands. If so, late successional habitat restoration treatments may need to be more conservative than if the fish are of introduced rainbow origin.

Late successional restoration activities which reduce the possibility of the spread of an "unnatural" high intensity fire into the Mission Creek watershed may be a good long term aquatic habitat objective.

## 7. Noxious Weeds

Three noxious weed species were identified to occur within the Camas and Sand Creek MLSAs. These species are discussed in priority order as identified by the noxious weed analysis module. There are no Class A presently documented from this area. Class B or B-designate weeds include: *Centaurea diffusa*, *Linaria dalmatica*, and *Chrysanthemum leucanthemum*. These species are found along roadsides within the MLSAs, particularly the Camas and Sand Creek Roads and connections to those roads. Following through the noxious weed analysis module, all species are relatively widespread so the strategy is prevention of further spread. Prevention of spread should focus on areas of high recreation use such as the roadsides developed and dispersed sites. Current surveys for species presence and extent should be completed in order to develop a noxious management plan for these MLSA'S (refer to Harrod 1994).

## 8. Fire Management Plan

### a) Overview

This plan is intended to provide guidance for the management of fire in the Camas MLSA/Sand Creek MLSA. It will supplement the Fire Management Plan for the Late-Successional Reserve System and will be incorporated into the Fire Management Action Plan for the Wenatchee National Forest.

The Sustainability and Disturbance modules for the vegetation groups have been described in a separate portion of this chapter. The intent of this plan is to provide adequate protection of the reserve. Management practices will be initiated to provide for the protection of the late-successional associated species and associated unique habitats. These management actions are expected to include the role of fire disturbance as an important process in the reserve.

### b) Wildfire Prevention Actions

The following actions are site specific for the Camas MLSA/Sand Creek MLSA. They are intended to supplement the actions outlined in the Fire Prevention Plan, which is intended to be implemented on a Forest-wide basis:

1. Initiate campfire restrictions, as warranted, during periods of high fire danger.
2. Implement road restrictions and closures, as warranted, during periods of high fire danger.
3. Emphasize cooperative fire prevention activities.
4. Utilize cooperative law enforcement agreements to emphasize the inspection of spark arrestor and exhaust systems.
5. Continue and improve fire prevention signing program on roads and trails included in, or adjacent to, the MLSA.

6. Emphasize contact with special interest groups (e.g., ORV groups, summer home groups, local user groups, grazing permittees, and other special use permittees).
7. Emphasize fire prevention education for hunters.
8. Emphasize fire prevention and wildfire risk awareness education for the public.
9. Emphasize wildfire risk awareness education for home/landowners in urban/wildland interface areas (e.g., Camas Meadows, Mission Creek, and Blewett Pass).
10. Seek opportunities to initiate hazard reduction actions around private lands.
11. Initiate hazard reduction actions around dispersed recreation sites.
12. As a hazard reduction measure emphasize fuel wood collection in designated areas.
13. Initiate hazard reduction actions along roads.

c) Fire Management Actions Intended to Keep Fire from Spreading into the MLSA

The following methods are proposed to protect the MLSA from fires originating outside MLSA boundaries:

1. Maintain and manage existing fuel breaks.
2. Complete pre-attack planning process for the MLSA. Utilize natural fuel breaks when possible.
3. Maintain existing pre-attack facilities/agreements (e.g., water chances, helispots, fire camps, etc.): Seek opportunities for more.

d) Fire Detection

1. Aerial detection, after lightning episodes, will provide the primary detection resource for this MLSA.
2. Aerial detection may be supplemented with emergency staffing at Boundary Butte.
3. Emphasize fire reporting procedures (e.g., with local residents, Forest users, and cooperators).

e) Wildfire Suppression

1. Spotted owl activity centers are the highest priority for protection of resources (following the protection of human life). All wildfires in the 1.8 mile buffer will be suppressed at minimum acres.
2. Pre-planned dispatch cards for initial attack will be prepared for the MLSA area.
3. The Fire Situation Analysis or the Escaped Fire Situation Analysis process will be used to guide extended attack and large fire-suppression. Utilize pre-attack plans and materials.
4. Consideration for private land, late-successional habitat, and riparian reserves will take place during the development of fire suppression strategies and the implementation of fire suppression tactics.
5. Emphasize the protection of improvements (e.g., historic/cultural sites).
6. Protect known threatened and endangered species habitat from wildfire (i.e., plant or animal).

7. Where appropriate, fire suppression actions will be implemented on an interagency basis.

f) Vegetation and Fuels Management

1. Manage for a mosaic of age classes and structural conditions across the landscape to support late-successional habitat.
2. Manage to sustain dry forest types.
3. Manage for mesic sites with high density, multi-story refugia.
4. Strategic fuel manipulation to reduce the size and intensity of fires within, and adjacent to, the MLSA boundaries (e.g., pruning, thinning, and fuel breaks). Provide a change in the continuity/arrangement of, at risk, vegetation/fuels. Emphasis to utilize existing fuel treatment areas, natural openings, roads, ridgetops, etc. Priority areas: Mission Creek, Mission Ridge, and Tronsen Ridge.
5. Emphasize roadside fuel modification and fuel wood collection (e.g., FS Roads 7100, 7200, 7204, and Hwy. 97 on Blewett Pass).
6. Suggested management tools to sustain, enhance, or produce the conditions for late-successional habitat and provide for wildfire hazard reduction may include: pruning, commercial and pre-commercial thinning, wood gathering, mechanical treatments, and prescribed fire.
7. Prevent the spread and/or introduction of noxious weeds.

g) Prescribed Fire Opportunities

1. Recognize the use of prescribed fire as a management tool in this MLSA and in areas adjacent to this MLSA.
2. Priority outcomes throughout the MLSA are to sustain, enhance, or produce the conditions for late-successional habitat and provide for wildfire hazard reduction.
3. Projects should be of scale/location to enhance landscape-level diversity tied to inherent disturbance regimes.
4. Projects should attempt to minimize the risk of future catastrophic wildfires (those outside the range of inherent disturbance regimes with respect to size and/or severity).

h) Summary

Fire prevention, fire detection, wildfire suppression, vegetation and fuels management, and prescribed fire are all appropriate, integral elements of the overall management of this MLSA.

**D. Restoration Opportunities and Potential Project Summary**

Table VI-17, Restoration Opportunities and Potential Projects, Sand Creek and Camas MLSAs

Analysis Module	Restoration Opportunity	Potential Projects	Schedule <sup>1</sup>
Forest-Wide Sustain-	1) Reduce fuel loading and stocking levels in dense successional advanced dry forest stands where they	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in the disturbance module treatment key.	A

<b>Analysis Module</b>	<b>Restoration Opportunity</b>	<b>Potential Projects</b>	<b>Schedule<sup>1</sup></b>
<b>ability</b>	exist between the Sand Creek and Camas MLSAs and the Boundary Butte and Swauk LSRs.	Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe treatments to make landscape level changes in fire susceptibility.	
	2) Encourage private landowners in the Peshastin Creek watershed to take similar density management as described in 1 above.	2) See 1 above.	B
	3) Improve or maintain existing fuelbreaks (U.S. highway 97 and the Sand Creek and Camas Creek roads.)	3) Piling of down fuels, firewood gathering, pruning, shaded fuel breaks, and encouragement of less flammable deciduous vegetation.	A
	4) Reduce fuel loading in young stands.	4) Pre-commercial thinning.	C
<b>Forest-Wide Spotted owl</b>	Not Applicable. (This LSR is not one of the 3 LSRs on the forest designated as a source population area.)	Not Applicable.	
<b>Forest-Wide Connectivity</b>	1) Maintain connectivity corridor between Swauk and Sand Creek/Camas LSR/MLSAs.	1) Emphasize the importance of the Devils Gulch area in providing Connectivity between these LSR/MLSAs.	A
<b>Unique Habitats &amp; Species</b>	1) Reduce road densities in riparian reserves.	Close or relocate roads as opportunities are identified in Access and Travel Management Planning.	A
	2) Promote the development of fire climax stands within the dry forest vegetation group.	2) Thin from below favoring ponderosa pine. Retain healthy large diameter pine if present.	C
	3) Track population levels and snag use for cavity dependent species.	3) Monitor portion of Camas MLSA burned in the Rat Creek fire.	B
<b>Connectivity Within the LSR</b>	1) Promote the development of fire climax stands within the dry forest vegetation group.	1) Thin from below favoring ponderosa pine. Use prescribed fire where current fuel loading permits the attainment of objectives.	A

<b>Analysis Module</b>	<b>Restoration Opportunity</b>	<b>Potential Projects</b>	<b>Schedule<sup>1</sup></b>
	2) Increase the amount of interior forest area within the LSR.	2) Close roads near interior forest and in dry forest areas as opportunities are identified through Access and Travel Management Planning.	B
	3) Improve the function of Riparian Reserves as connectivity corridors.	3) Close roads and re-vegetate disturbed areas within riparian Reserves as opportunities are identified through Access and Travel Management Planning.	B
<b>Disturbance</b>	1) Reduce the risk of habitat loss to wildfire by reducing stand density, altering species composition and reducing vertical and horizontal fuel continuity in dry forest types.	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in disturbance module treatment key. Favor the development of seral species such as ponderosa pine. Priorities should be 1) Dispersal habitat, 2) NRF habitat within the LSR/MLSA but outside of owl circles, 3) NRF habitat within the owl circle on above threshold acres (All owls are below threshold in these MLSAs), 4) See item #2 under spotted owl for treatment of NRF habitat on threshold acres.	A
<b>Spotted Owl</b>	1) See Appendix 39, "Northern Spotted Owl Nest Site Protection Within LSRs and MLSAs" for #SO729, #SO753 and #SO758.		A
	2) Improve sustainability of dense dry forest (vegetation Type 12) within 0.7 to 1.8 mile home range area on threshold acres. Treatment should maintain suitability of habitat for nesting, roosting and foraging. (see spotted owl desired conditions)	2) Utilize commercial thinning, pruning and fuelwood collection.	A
	3) Obtain information on spotted owl locations.	3) Survey areas to 1994 spotted owl protocol.	B
	4) Change the MLSA boundary to include the best	4) Move the MLSA boundary to the south to include better habitat	C

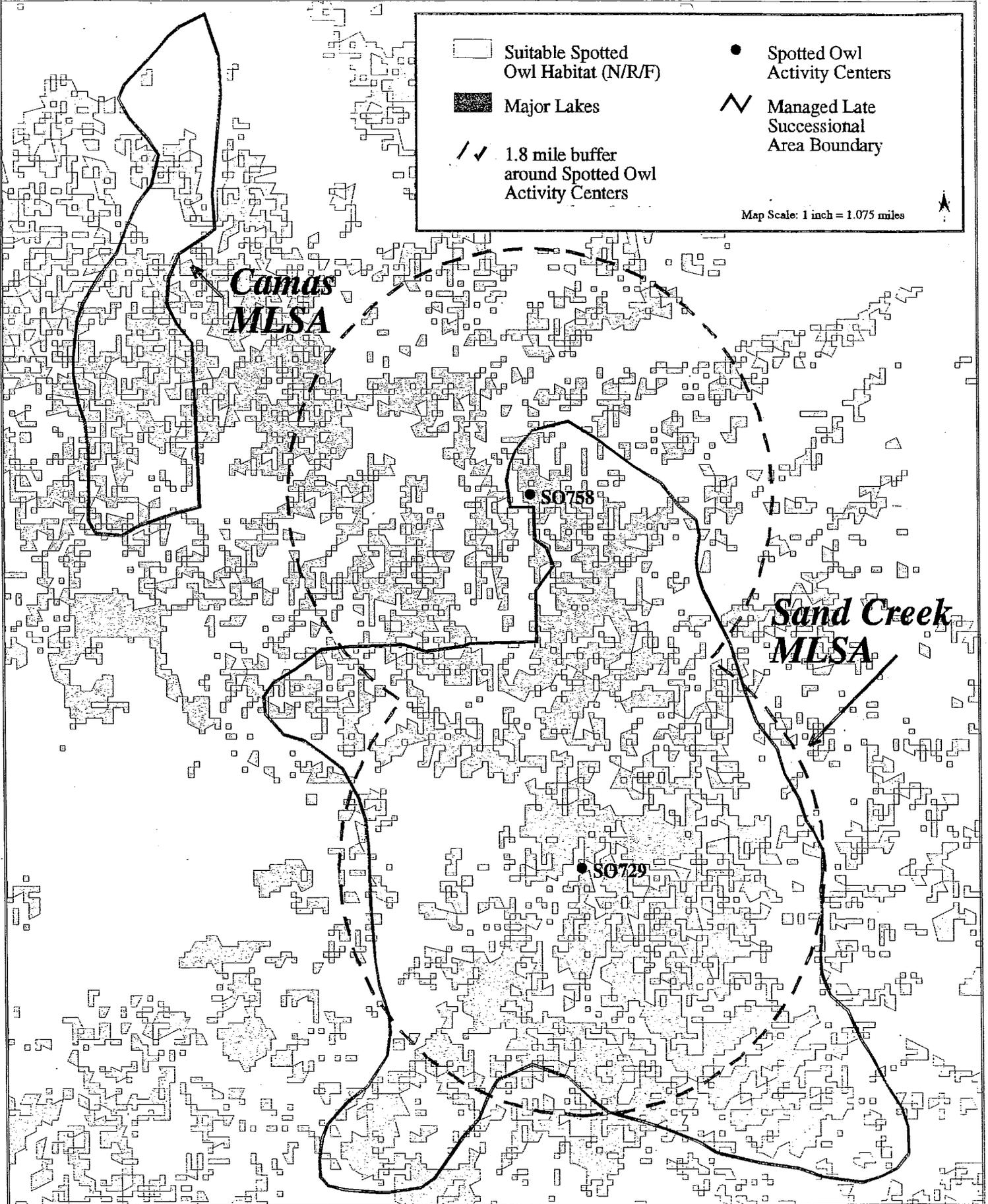
<b>Analysis Module</b>	<b>Restoration Opportunity</b>	<b>Potential Projects</b>	<b>Schedule<sup>1</sup></b>
	spotted owl habitat.	and to match the Critical Habitat Unit boundary.	
<b>Aquatic</b>	1) See late successional habitat implications in Aquatic section.	1) Coordinate projects with the Mission Creek Watershed Assessment and with the Peshastin WA planned for completion in FY 97.	A
<b>Noxious Weed</b>	1) Limit the extent and spread of <i>C. diffusa</i> , <i>L. dalmatica</i> , and <i>C. leucanthemum</i> within the MLSAs.	1) Focus on prevention to limit extent and spread.	A
	2) Increase knowledge regarding noxious weed presence in the Sand Creek and Camas MLSAs.	2) Survey MLSA for presence of noxious weeds.	C
<b>Fire Plan</b>	1) Protect LS values from loss due to wildfire	1) See fire plan for specific actions	

<sup>1</sup> Implementation Schedule; (A) = within 1 year; (B) = within 3 years; (C) = within 5 years

# Sand Creek and Camas Managed Late Successional Areas

## SUITABLE SPOTTED OWL HABITAT

01/14/97



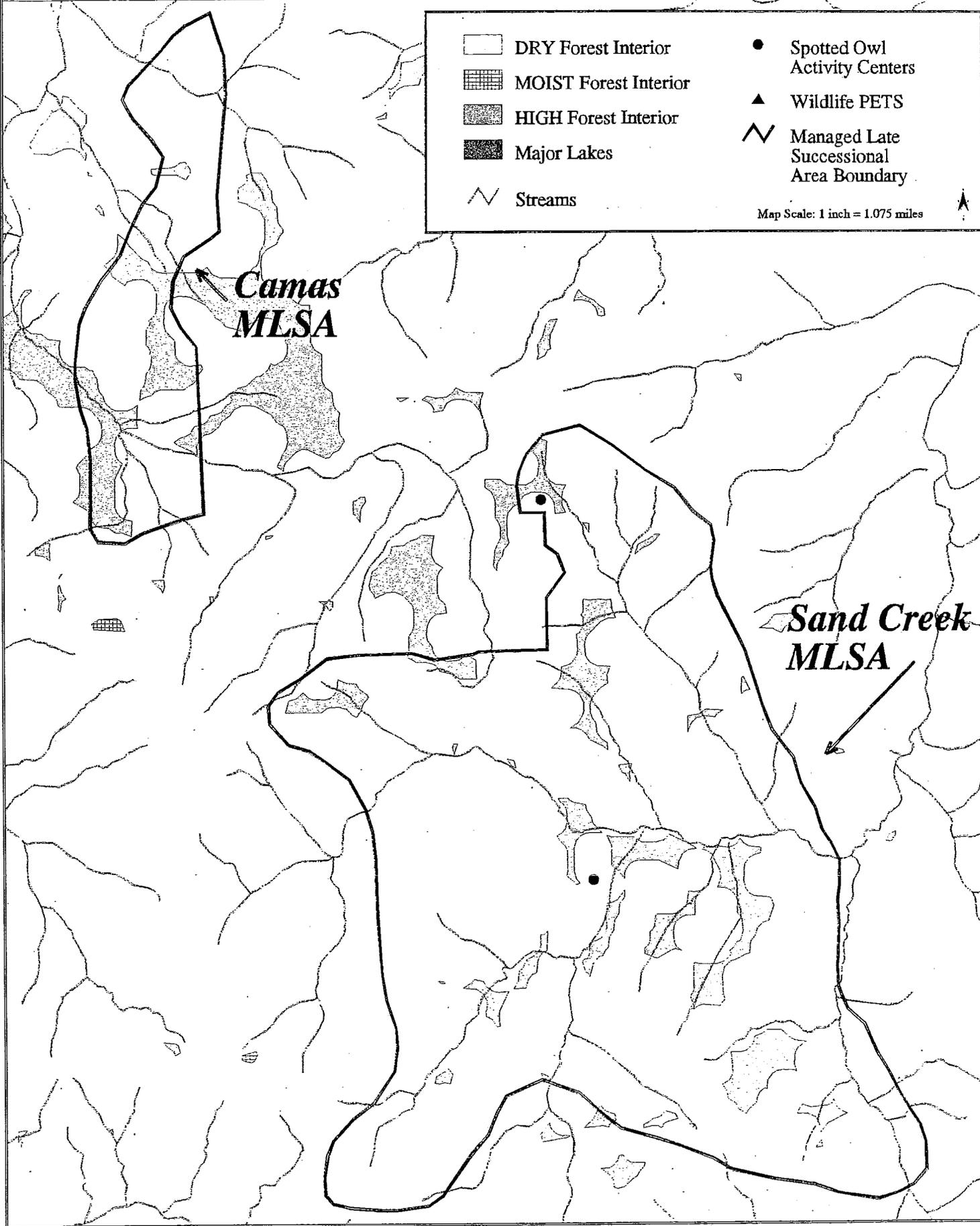
# Sand Creek and Camas Managed Late Successional Areas

## FOREST INTERIOR

01/14/97

	DRY Forest Interior		Spotted Owl Activity Centers
	MOIST Forest Interior		Wildlife PETS
	HIGH Forest Interior		Managed Late Successional Area Boundary
	Major Lakes		
	Streams		

Map Scale: 1 inch = 1.075 miles



# Sand Creek and Camas Managed Late Successional Areas

## SECURITY HABITAT

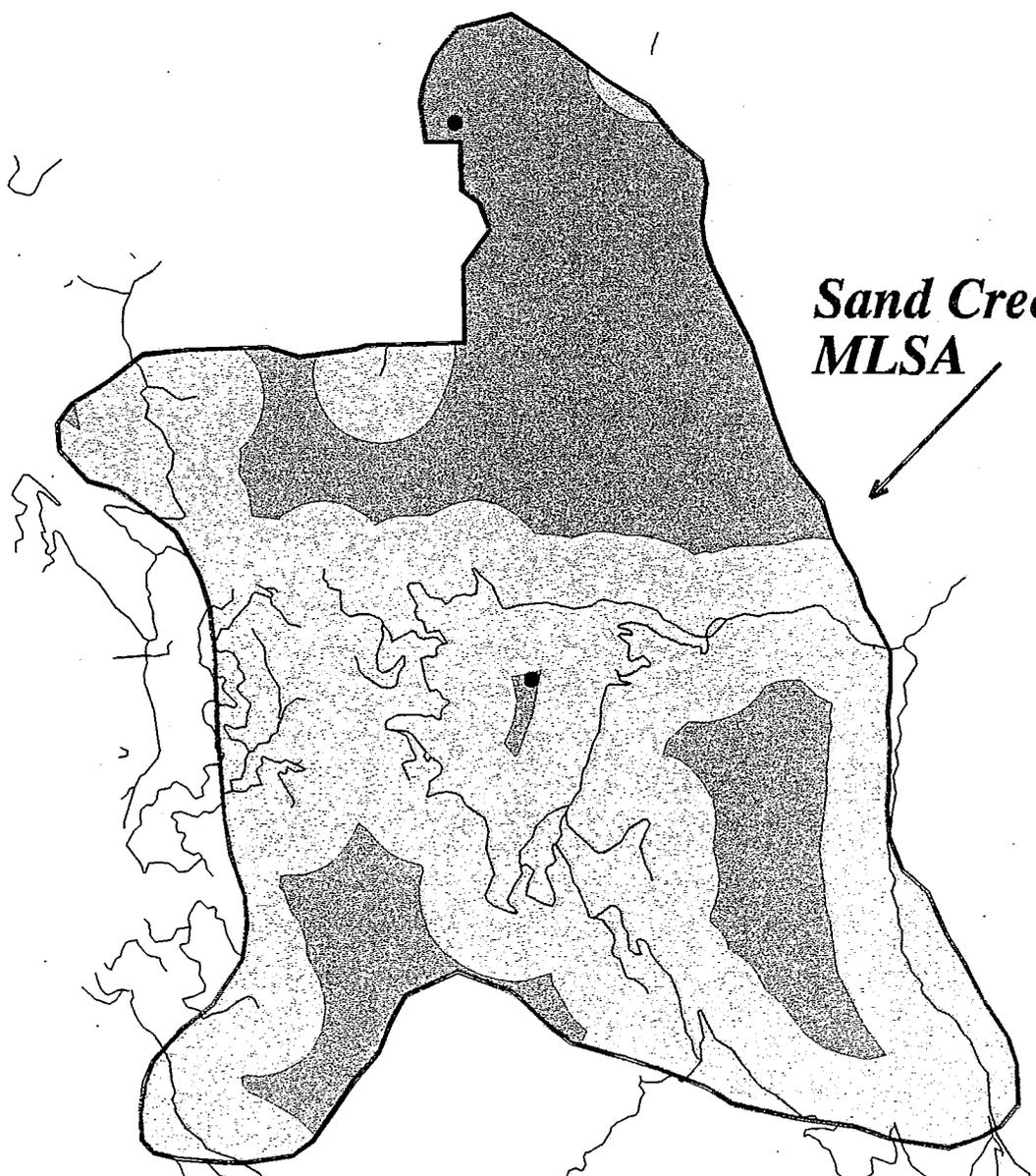
01/14/97

	Security Habitat		Spotted Owl Activity Centers
	NOT Security Habitat		Wildlife PETS
	Major Lakes		Managed Late Successional Area Boundary
	Open roads and motorized trails		
	Closed roads and non-motorized trails		

Map Scale: 1 inch = 1.075 miles



**Camas  
MLSA**

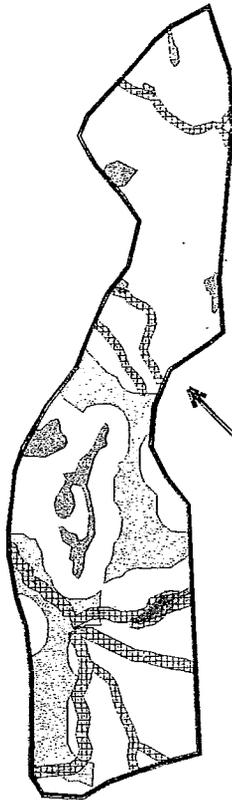


**Sand Creek  
MLSA**

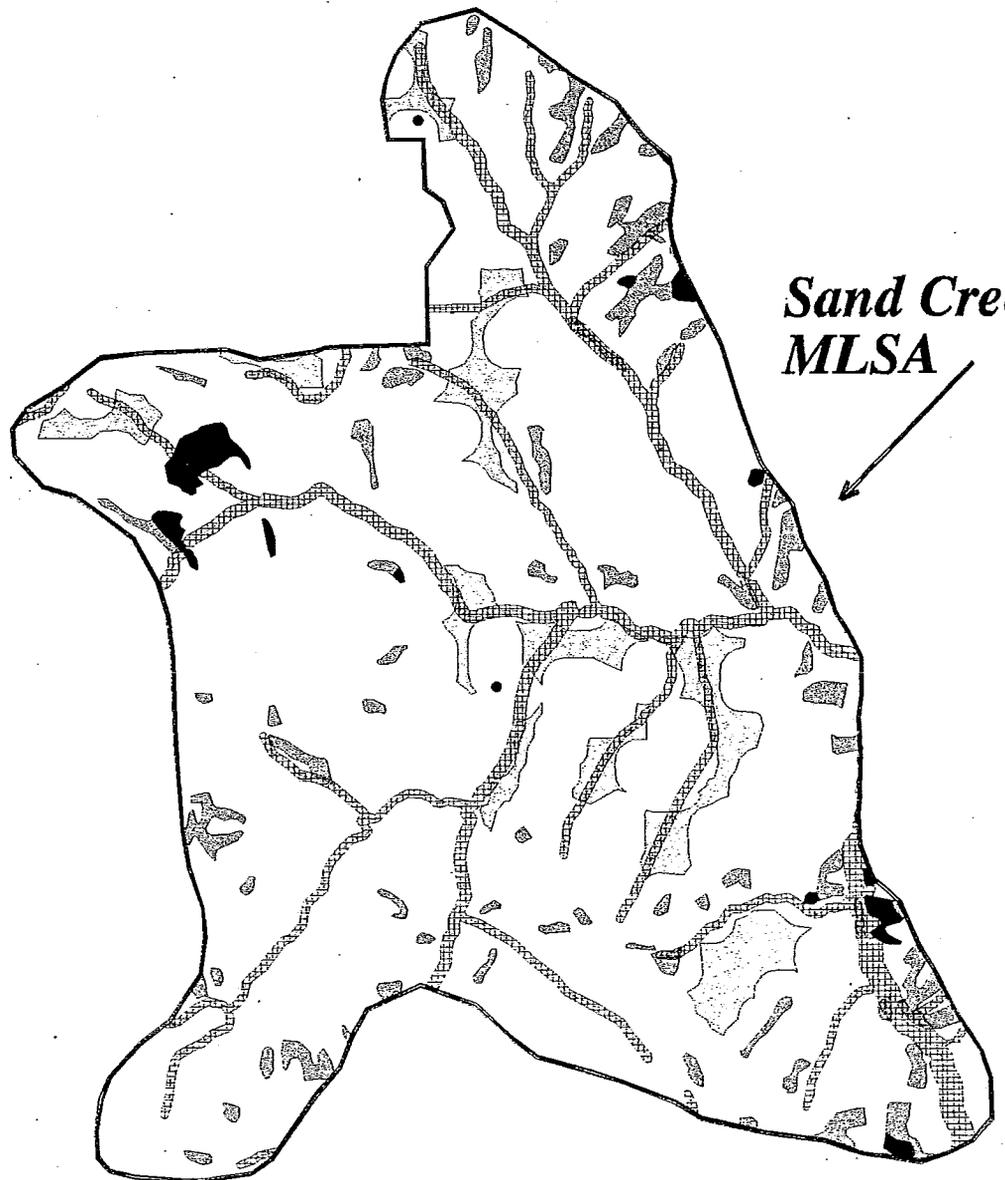
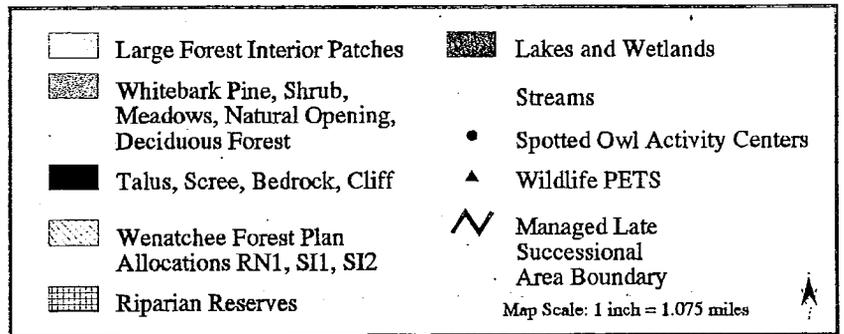
# Sand Creek and Camas Managed Late Successional Areas

## UNIQUE HABITATS

01/14/97



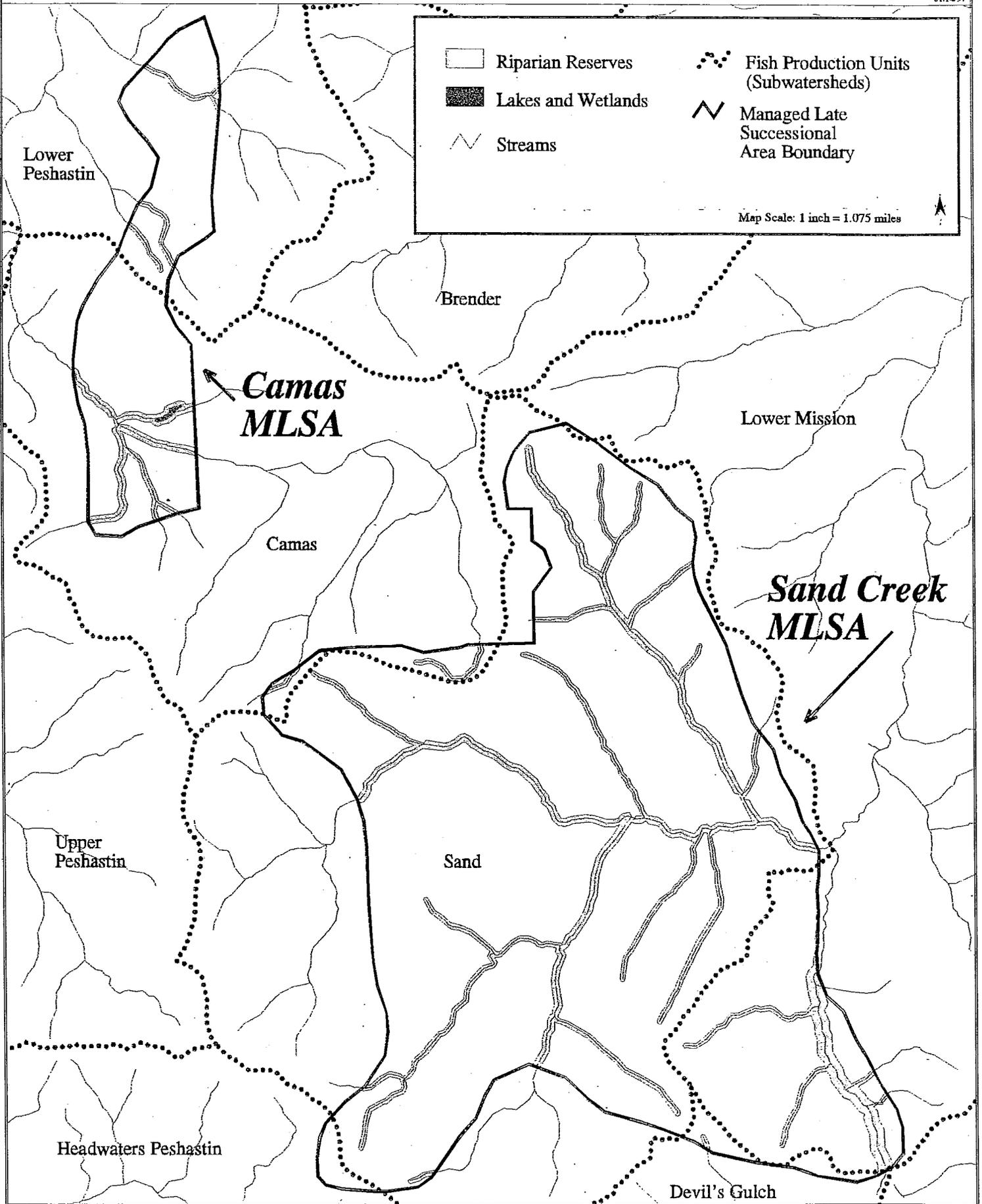
**Camas  
MLSA**



**Sand Creek  
MLSA**

# *Sand Creek and Camas Managed Late Successional Areas* **FISH PRODUCTION UNITS (SUBWATERSHEDS)**

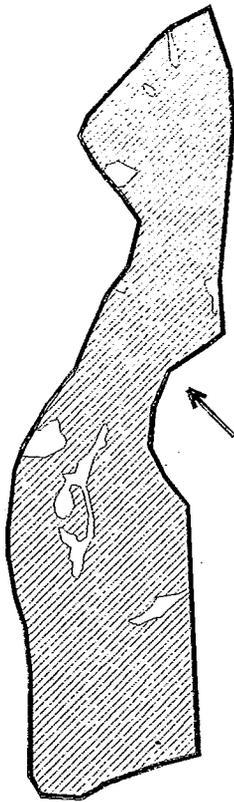
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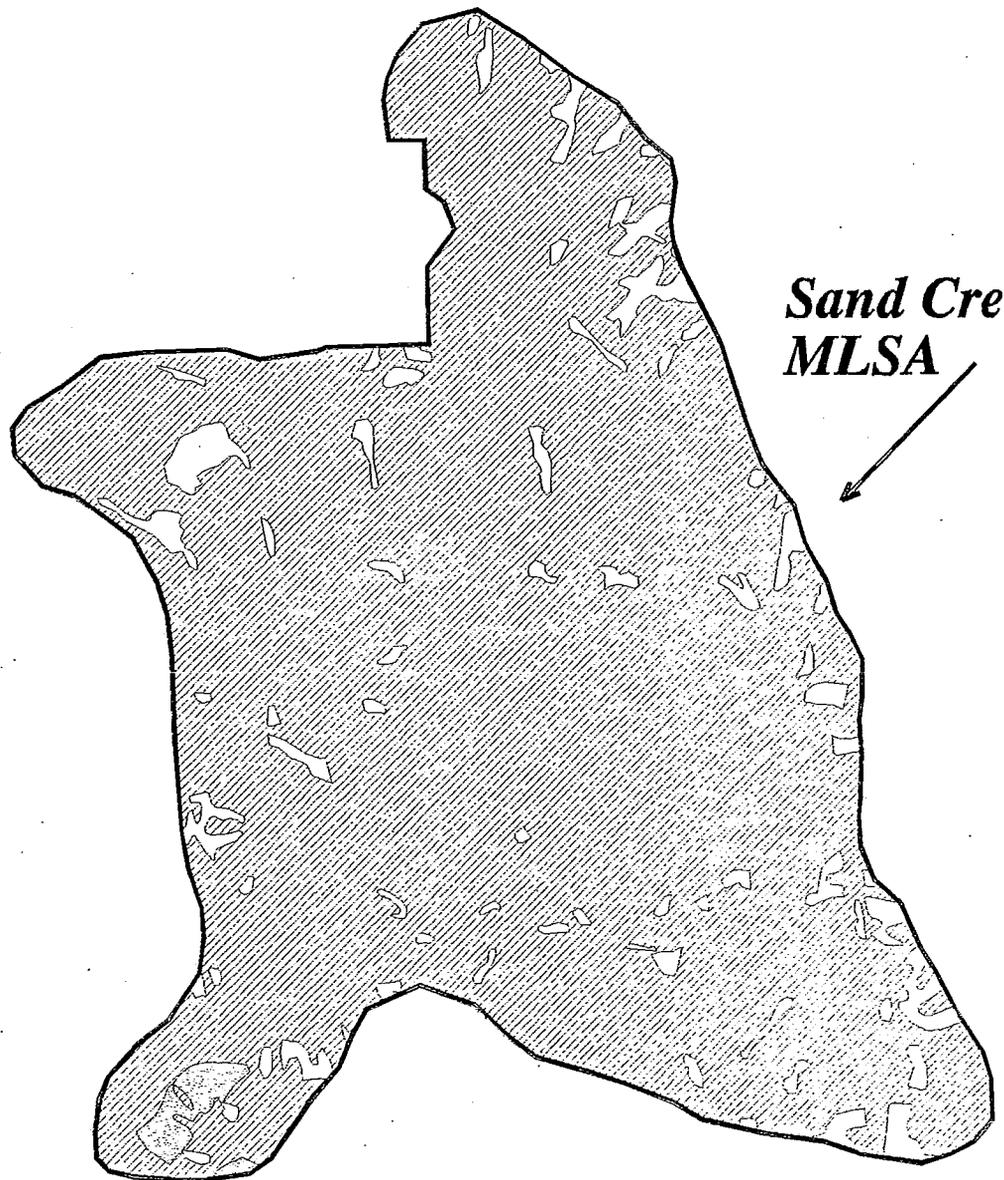
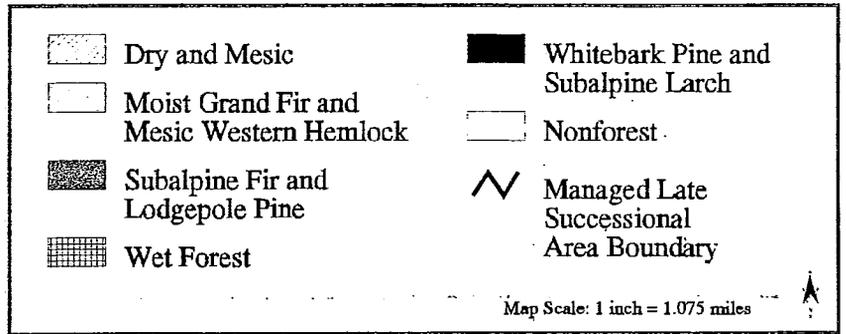
# *Sand Creek and Camas Managed Late Successional Areas*

## **VEGETATION SERIES**

01/14/97



**Camas  
MLSA**

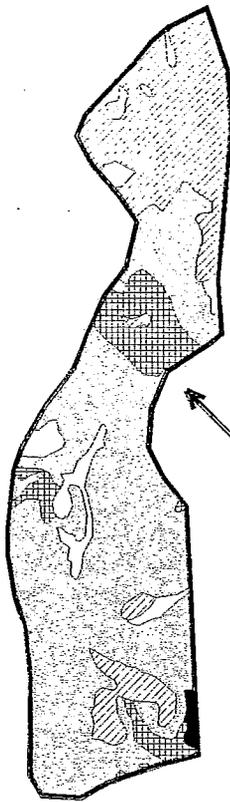


**Sand Creek  
MLSA**

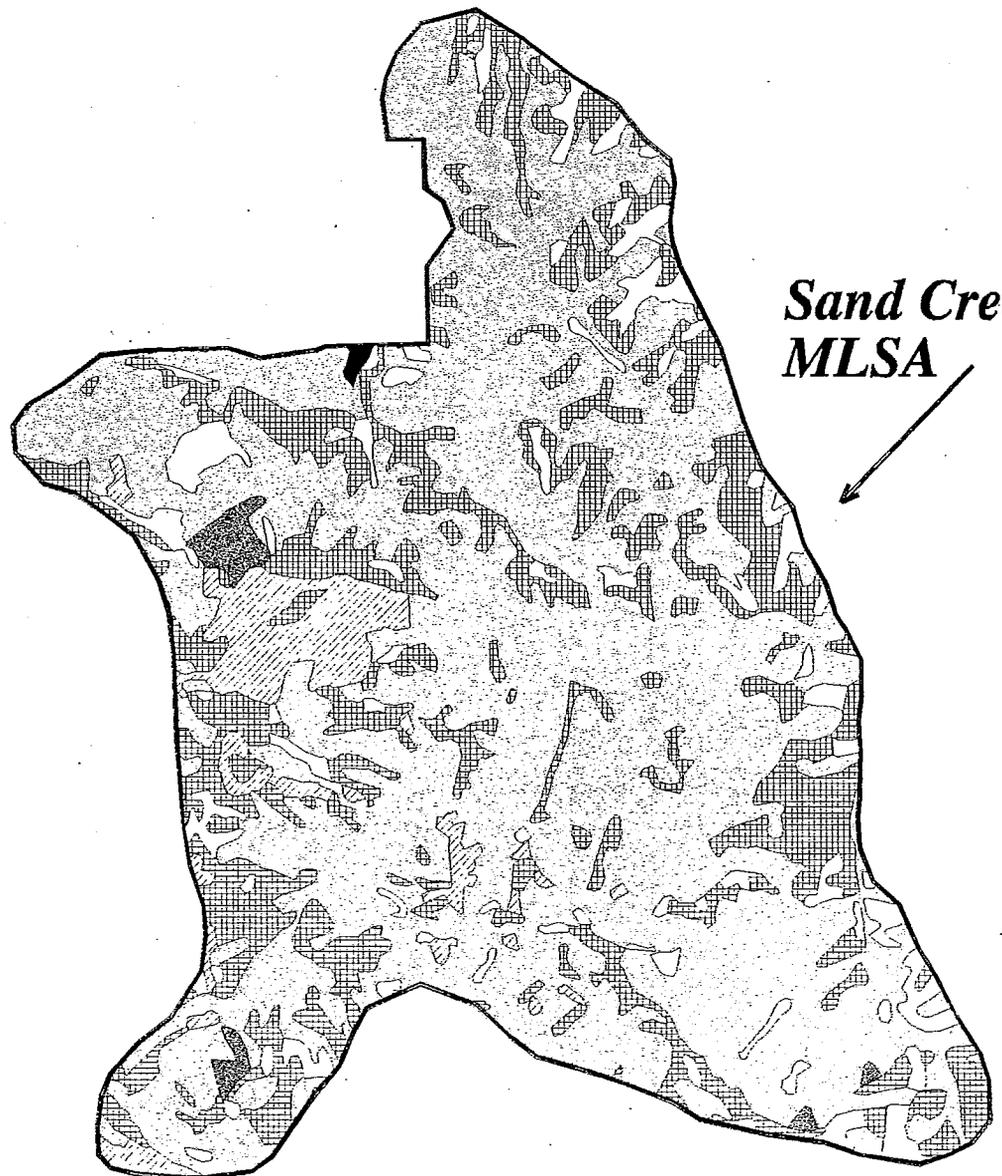
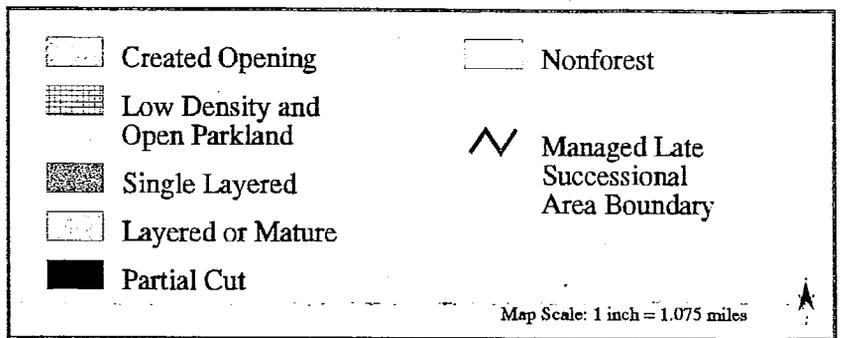
# *Sand Creek and Camas Managed Late Successional Areas*

## **VEGETATION STRUCTURE**

01/14/97

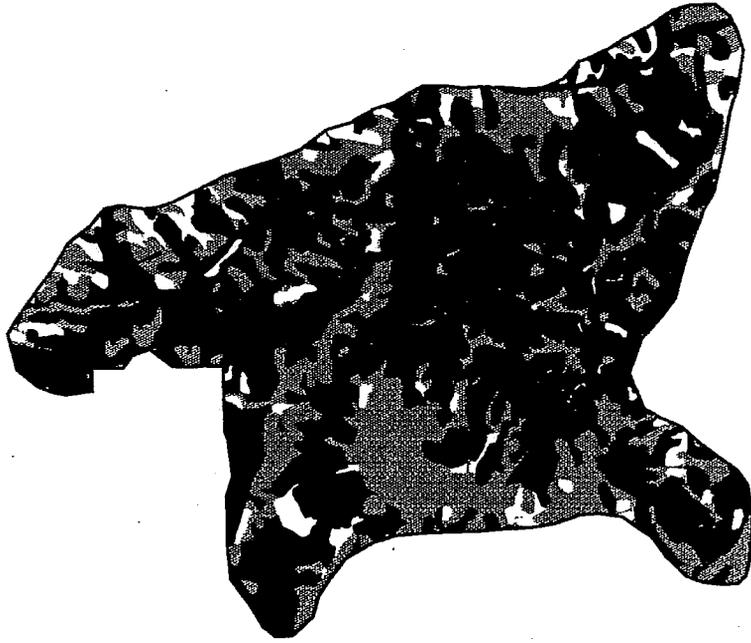


**Camas  
MLSA**

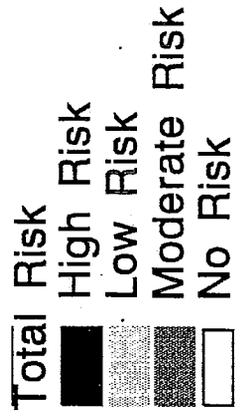


**Sand Creek  
MLSA**

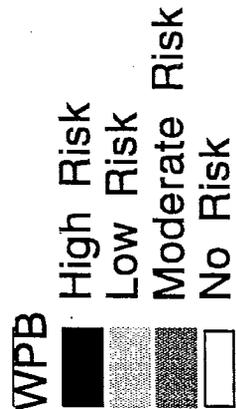
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0.5 0 0.5 1 1.5 2 Miles



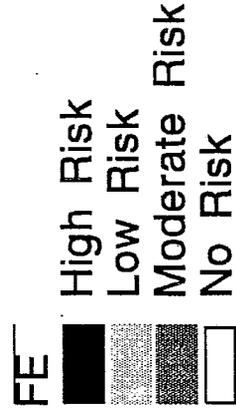
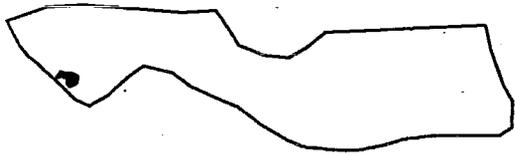
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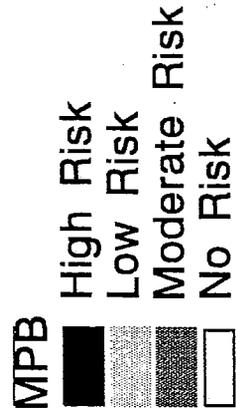
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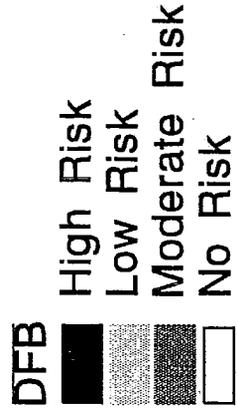
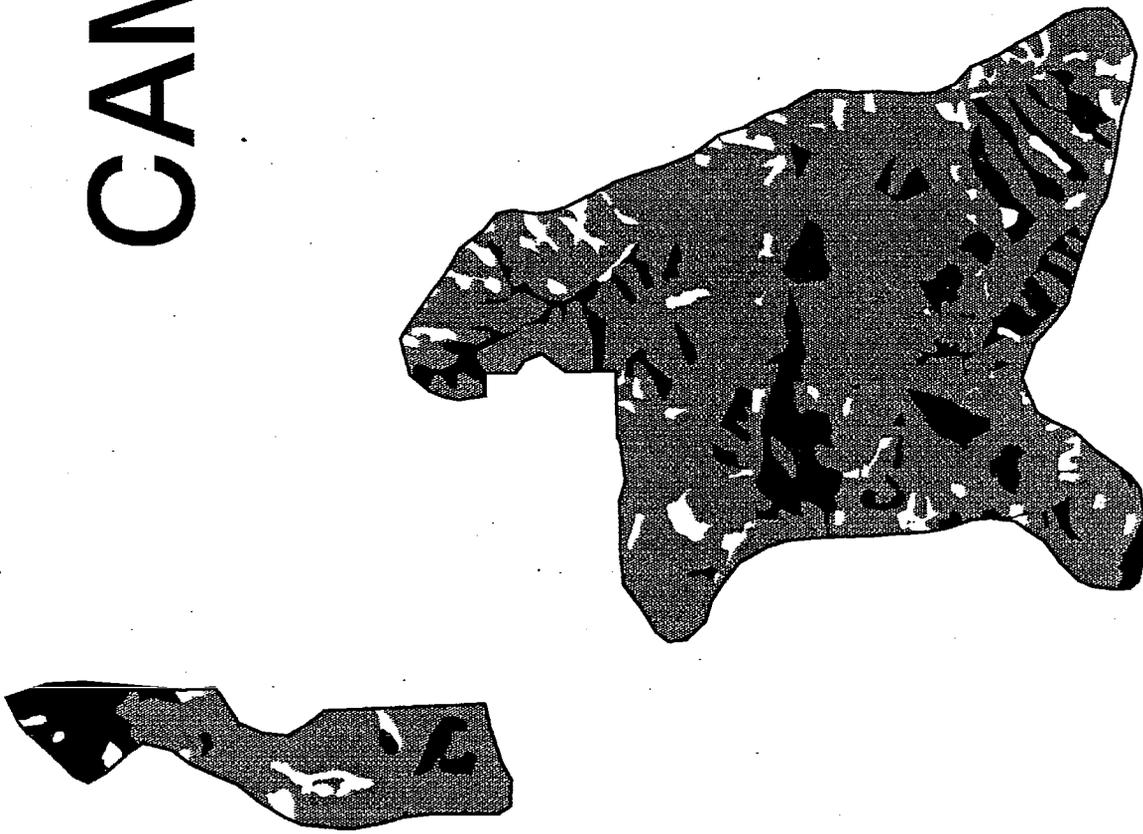
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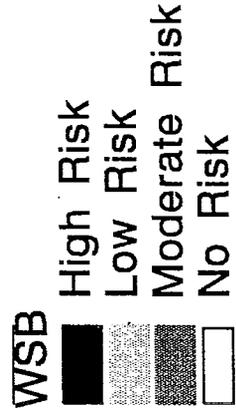
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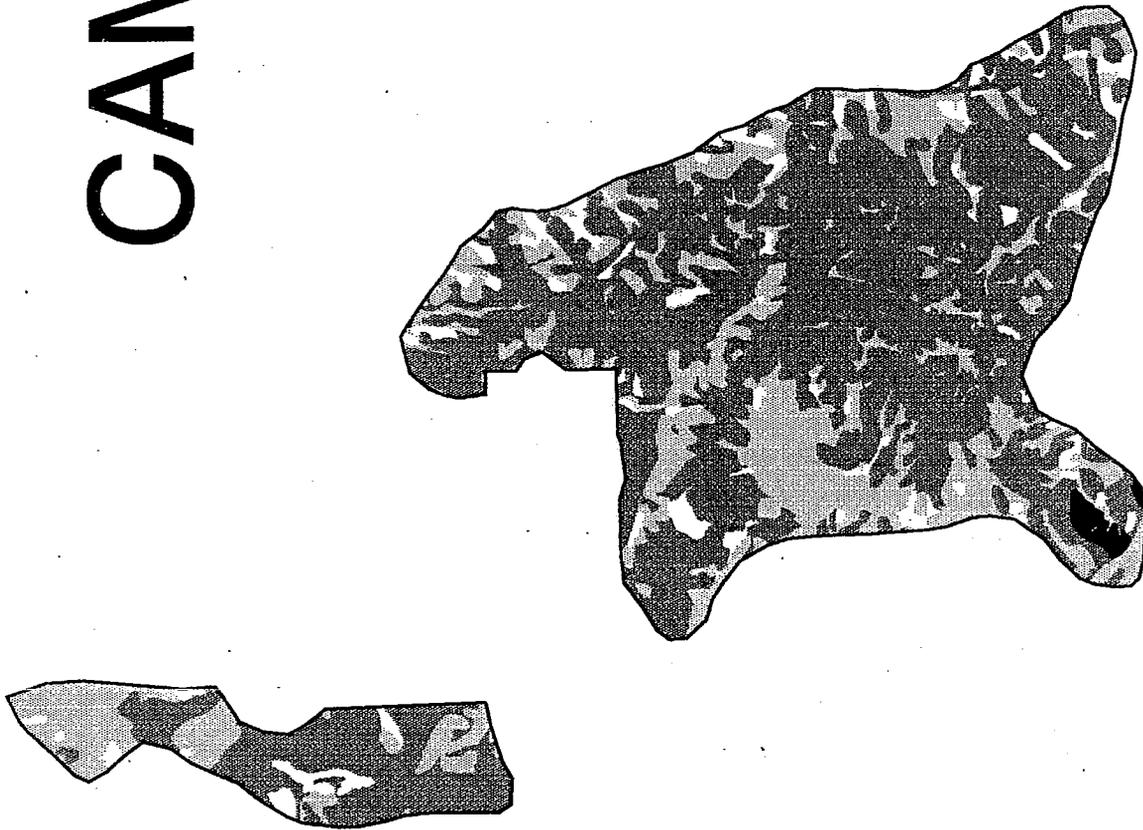
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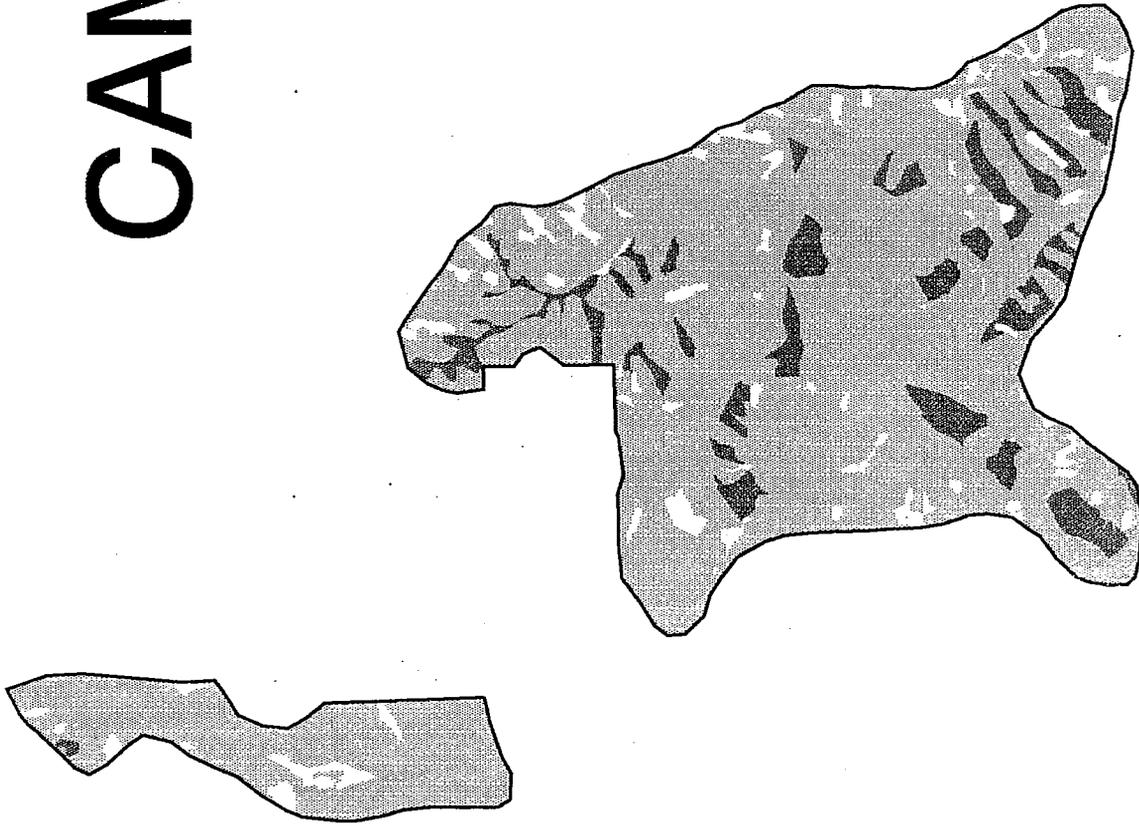
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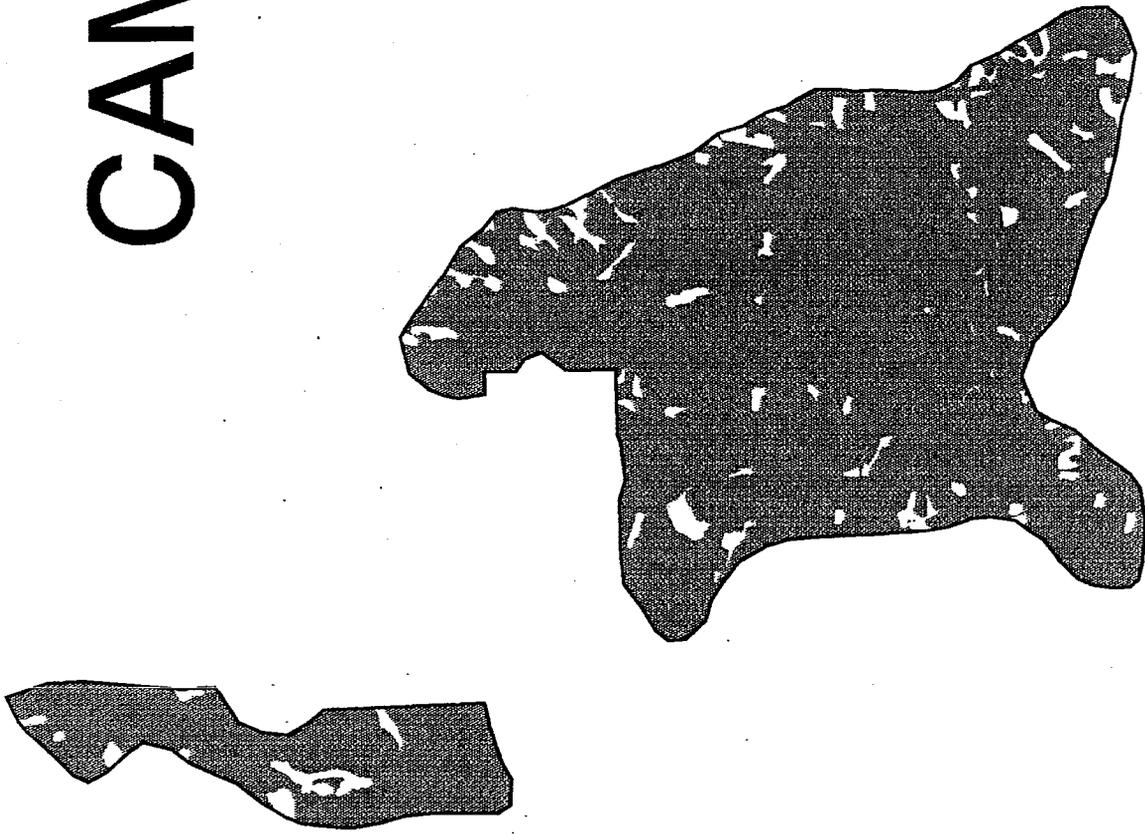
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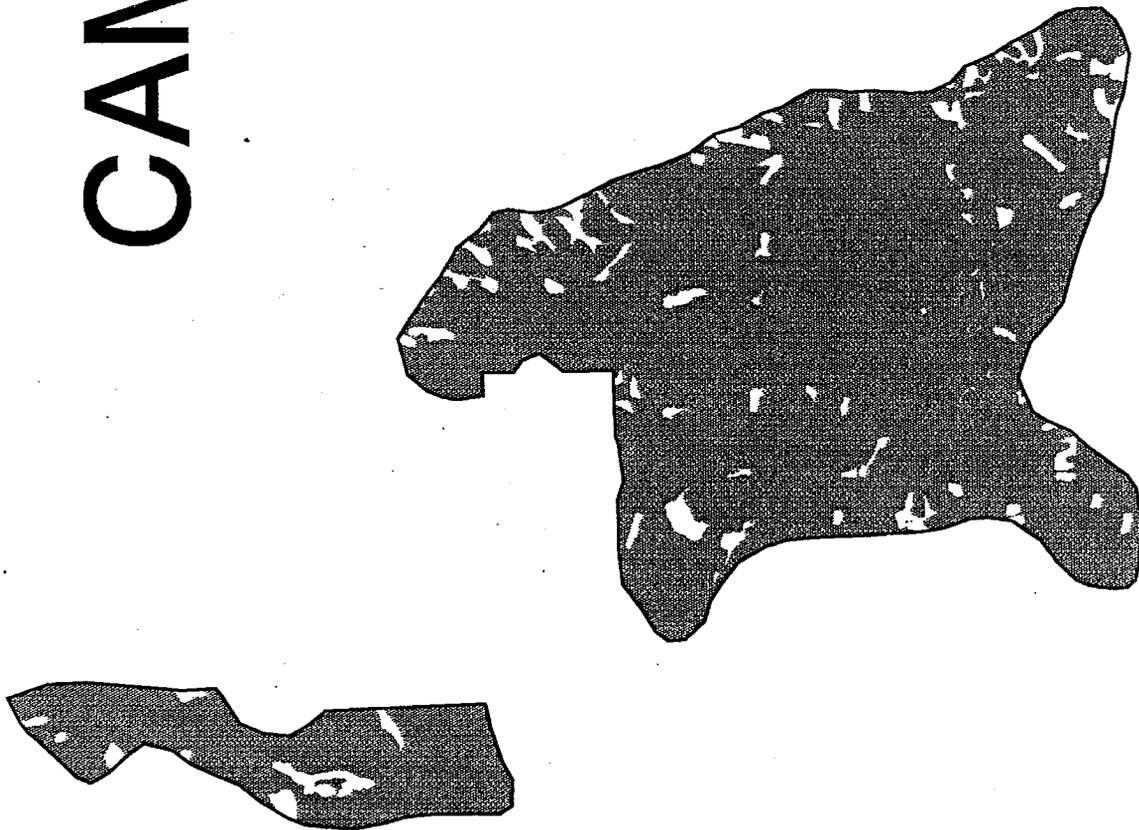
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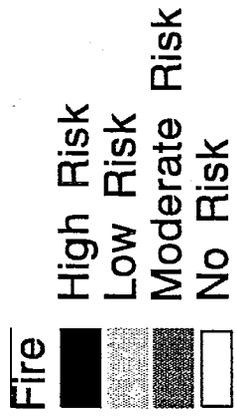
0.5 0 0.5 1 1.5 2 Miles



# CAMAS MLSA



# CAMAS MLSA



0.5 0 0.5 1 1.5 2 Miles

