

VI. Swauk LSR

A. General Description of LSR

1. Vegetation

This section describes the current condition of vegetation groups (see Vegetative Landscape section above) within the Swauk LSR. Data was derived by a combination of aerial photo interpretation (only in the northern portion, north of the Cle Elum and Leavenworth Ranger District Boundary) and modeling (see Vegetative Landscape section above). 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) Description by Vegetative Group

Information is provided below regarding each vegetation group, refer to the "LSR Vegetation Photo Mapping Key" in the Appendix for definitions of structural classes.

(1) Dry Forest Group and Grassland/Shrubland

Fifty-four percent (58,065 acres) of the Swauk LSR consists of the dry forest group (Appendix 4). Within this group, 56% (32,845 acres) is mapped as high density and only 9% mapped created openings. The actual amount of created openings in this group is probably even less because of the inability of the modeling effort (in the southern portion) to distinguish between created (fire or human caused) openings in forest environments and inherent openings (scattered forest, grassland/shrubland).

Fairly detailed vegetation data can be found in the Mission Creek Watershed Assessment which covers most of the northern portion of the LSR and in the Swauk and Table Mountain Watershed Assessments for the south end of the LSR. Little information is currently available for the southern portion, but some generalizations can be made. Within this forest group, the ponderosa pine series is limited within the LSR. In some locations, ponderosa pine exists as the sole overstory dominate, but more often is co-dominant with Douglas-fir and in some locations, grand fir. In the driest associations, shrub understory composition is dominated almost exclusively by *Purshia tridentata* (Mission Creek Watershed Assessment, on file at the Leavenworth RD). Shrubs such as *Artemisia tridentata*, *Berberis aquafolium*, *Arctostaphylos uva-ursi*, and *Phlox speciosa* may also occur as subordinate members of these communities. Grasses include *Agropyron spicatum*, *Calamagrostis rubescens*, and *Carex geyeri*. Forbs composition is represented by *Balsamorhiza sagittata*, *Achillea millefolium*, *Lupinus sereciuss*, *L. latifolius* and *Lomatium* spp. (Mission Creek Watershed Assessment, on file at the Leavenworth RD).

(2) Mesic Sites-

Mesic sites were only mapped within the northern portion of the Swauk LSR because of the limitations of the modeling process used in the southern portion. In general, mesic sites occur on steep (>40% slope), northerly aspects, riparian areas, or moist benches within the dry forest group (see Vegetative Landscape section). In the northern portion of the LSR, 1,495 acres of mesic sites have been identified. It will be important that these sites in the southern portion are identified through restoration projects since suitable spotted owl habitat may need to be promoted or maintained

within 1.8 mile radius spotted owl circles. Mesic sites outside of 1.8 mile radius spotted owl circles (see wildlife section) would be *managed* similarly to dry forest sites.

Mesic sites are typically within the Douglas-fir series and include the more moist plant associations. Common plant associations include *P. menziesii/Symphoricarpos albus* and *P. menziesii/Spirea betulifolia*. Ponderosa pine may be present, but generally only as remnants from early seral establishment. The understory tends to be more lush and often with a higher shrub component than in the more dry plant associations within the Douglas-fir and ponderosa series. Understory shrub species include tall shrubs such as *Symphoricarpos albus*, *Holodiscus discolor*, *Spirea betulifolia*, and *Rosa* spp., and *Arctostaphylos uva-ursi*, *Berberis nervosa* and *Pachistima myrsinites* as low shrubs. Herb composition includes *Festuca occidentalis*, *Carex geyeri*, *Calamagrostis rubescens*, *Smilacina stellata*, and *Claytonia lanceolata* (Mission Creek Watershed Assessment, on file at the Leavenworth RD).

(3) Moist Grand Fir Group

About one-fifth (16%, 17,421 acres) of the Swauk LSR consists of the moist grand fir group. The majority (71%) of this forest group is currently layered and/or mature (mid- to late-successional) (Appendix 4). The layered/mature forest are located in two disjunct locations within the Swauk LSR; in the vicinity of Table Mountain and near upper Teanaway. Created openings and single-layered stands are dispersed throughout this forest group within the LSR.

Within this forest group, there is a moisture/temperature gradient which results in development of plant associations from dry, cool conditions adjacent the dry forest group to moist, cool adjacent the subalpine fir series. At the dry end of the moisture gradient, association are dominated in the understory by herbaceous species such as *Calamagrostis rubescens*, *Carex concinnoides*, *Carex geyeri*, *Arnica latifolia*, *Lupinus latifolius*, and *Arenaria macrophylla*. Moister associations typically include a shrub component typified by species such as *Spirea betulifolia*, *Rosa gymnocarpium*, *Vaccinium* spp., *Symphoricarpos albus*, *Linnaea borealis*, *Chimaphila umbellata*, and *Pyrola* spp. Forb composition in the most moist plant associations is lush and includes diverse species such as *Achlys triphylla*, *Adenocaulon bicolor*, *Smilacina stellata*, *Rubus parviflora* and *Trillium ovatum* (Wenatchee National Forest, Ecology Plot Database, and Mission Creek Watershed Assessment, on file at the Leavenworth RD).

(4) Subalpine Fir Series

The subalpine fir series constitutes about one-quarter of the Swauk LSR with 24,286 acres (22% of LSR) (Appendix 4). This series is concentrated in the middle portion of the LSR along Mission and Wenatchee Ridges (Appendix 6 of the Forest-Wide LSR/MLSA Assessment). The majority (63%, 15,418 acres) of this series is mapped as layered or mature, while only 7% (1,846 acres) is mapped as created openings and 29% (6,943 acres) as single layered stands (Appendix 4).

Subalpine fir is the most widespread species within the overstory (Wenatchee National Forest, Ecology Plot Database). Common seral dominants include lodgepole pine, Engelmann spruce, and western larch. Understory composition may be shrub dominated with common species represented by *Vaccinium myrtillus*, *Vaccinium membranaceum*, *Vaccinium scoparium*, *Chimaphila umbellata*, *Pachistima myrsinites*, *Sorbus sitchensis*, and *Pyrola* spp. Herb composition may also be lush with species such as *Valeriana sitchensis*, *Lupinus* spp., *Carex* spp., *Calamagrostis rubescens*, and *Arnica latifolia* dominating. Subordinate community associates may include *Polemonium pulcherrimum*, *Pedicularis racemosa*, and *Elymus glaucus*. (Wenatchee National Forest, Ecology Plot Database).

(5) Wet Forest Group

A minimal amount of wet forest vegetation was mapped within the Swauk LSR. Approximately forty-one acres of this type was identified, with 40 acres being layered/mature and one acre of created opening.

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

A minimal amount of this forest vegetation was mapped within the Swauk LSR. The population mapped on Table Mountain is in error and needs to be corrected before project implementation. No further discussion of this group will follow.

(7) Non-Forest Vegetation

There are approximately 6,646 acres (6% of LSR) of non-forest vegetation within the Swauk LSR. Included in this group are: grassland/shrubland (21,047 acres), bedrock (1,677 acres), talus (1,173 acres), wet meadows (769 acres), upland meadow (452 acres), brushfield (147 acres), cliff (139 acres), scree (127 acres), water (11 acres), and dry meadow (5 acres). Since half of the Swauk LSR was modeled, grassland/shrubland acres are over-estimated, and wet, dry, upland meadows, brushfields and cliffs are under-estimated.

b) Species with Special Status

Within the Swauk LSR, there is potential habitat for a number of special species, but few surveys have been carried out 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 six Forest Service sensitive (see Late-Successional Associated Plant Species) species within the Swauk LSR (Appendix 6); *Cypripedium fasciculatum*, *Delphinium viridescens*, *Anemone nuttalliana*, *Agroseris elata*, *Chaenactis thompsonii*, and *Orobancha pinorum*. Two species, *Cypripedium fasciculatum* and *Delphinium viridescens*, are federal species of concern.

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 is endemic to the area between Leavenworth and Liberty. It requires adequate soil moisture during the spring and dry soil conditions in late summer. Suitable habitats are often found on old land slumps (Carl Davis, Soil Scientist, Wenatchee National Forest, personal communication). In the Swauk LSR, this species is often found along relatively open riparian areas as well. Most populations occur where shading is 60% or less (Richard Everett, Forestry Science Lab, personal communication).

A recent study by Harrod et al. (in press) found that *Delphinium viridescens* apparently responds favorably to fire. Plants in burned plots were found to be more robust and produced nearly 2.5 times more flowers and fruits as compared to unburned plots. It is unclear, however, if fire is actually required for maintenance of this species. Fire may change habitat conditions, be required for seed germination, or may stimulate sprouting of rhizomes.

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 tuberacle. 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 460 and 1220 meters 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*.

c) Survey and Manage Species

There are two known survey and manage plant species within the Swauk LSR; *Cypripedium fasciculatum* and *C. montanum* (Appendix 7). A few species are suspected, even more are simply unknown. The ROD provides standards and guidelines for survey and manage species, and these should be addressed within the Swauk LSR.

Few if any surveys have been carried out for non-vascular plants. Surveys should be a priority project within the Swauk LSR.

Table VI-1, Sensitive and Survey and Manage Species in Swauk LSR

Group	Latin name	Common name	Federal *	State +	Forest Service ++	Presence **
FUNGI	<i>Albatrellus ellisii</i>				SM	S
FUNGI	<i>Albatrellus flettii</i>				SM	S
FUNGI	<i>Arcangeliella crassa</i>				SM	S
FUNGI	<i>Boletus pulcherrimus</i>				SM	S
FUNGI	<i>Bondarzewia montana</i> (= <i>B. mesenterica</i>)				SM	S
FUNGI	<i>Cantharellus cibarius</i>				SM	S
FUNGI	<i>Cantharellus subalbidus</i>				SM	S
FUNGI	<i>Clavariadelphus ligula</i>				SM	S

Group	Latin name	Common name	Federal *	State +	Forest Service ++	Presence **
FUNGI	<i>Clavariadelphus pistillaris</i>				SM	S
FUNGI	<i>Clavariadelphus truncatus</i>				SM	S
FUNGI	<i>Clavulina cinerea</i>				SM	S
FUNGI	<i>Clavulina cristata</i>				SM	S
FUNGI	<i>Gastroboletus turbinatus</i>				SM	S
FUNGI	<i>Gomphus clavatus</i>				SM	S
FUNGI	<i>Gomphus floccosus</i>				SM	S
FUNGI	<i>Gomphus kauffmanii</i>				SM	S
FUNGI	<i>Gyromitra esculenta</i> (<i>Helvella</i>)				SM	S
FUNGI	<i>Gyromitra infula</i> (<i>Helvella</i>)				SM	S
FUNGI	<i>Gyromitra melaleucoides</i> (<i>Helvella</i>)				SM	S
FUNGI	<i>Gyromitra montana</i> (= <i>G. gigas</i>)				SM	S
FUNGI	<i>Helvella elastica</i>				SM	S
FUNGI	<i>Hydnum repandum</i> (<i>Dentinum</i>)				SM	S
FUNGI	<i>Hydnum umbilicatum</i> (<i>Dentinum</i>)				SM	S
FUNGI	<i>Mycena lilacifolia</i>				SM	S
FUNGI	<i>Mycena monticola</i>				SM	S
FUNGI	<i>Otidea leporina</i>				SM	S
FUNGI	<i>Otidea smithii</i>				SM	S
FUNGI	<i>Phlogiotis helvelloides</i>				SM	S
FUNGI	<i>Phytoconis ericetorum</i> (<i>Omphalina</i>)				SM	S

Group	Latin name	Common name	Federal *	State +	Forest Service ++	Presence **
FUNGI	<i>Plectania latahensis</i> (<i>Sarcosoma</i>)				SM	S
FUNGI	<i>Polyozellus multiplex</i>				SM	S
FUNGI	<i>Ramaria abietina</i>				SM	S
FUNGI	<i>Rhizopogon abietis</i>				SM	S
FUNGI	<i>Rhizopogon atroviolaceus</i>				SM	S
FUNGI	<i>Rhizopogon truncatus</i>				SM	S
FUNGI	<i>Sarcodon imbricatum</i> (<i>Hydnum</i>)				SM	S
FUNGI	<i>Sarcosphaera eximia</i> (= <i>S. crassa</i>)				SM	S
FUNGI	<i>Sparassis crispa</i>				SM	S
FUNGI	<i>Spathularia flavida</i>				SM	S
FUNGI	<i>Thaxterogaster pingue</i>				SM	S
VASCULAR PLANTS	<i>Agoseris elata</i>	tall agoseris		S		K
VASCULAR PLANTS	<i>Anemone nuttalliana</i>	pasqueflower		S		K
VASCULAR PLANTS	<i>Astragalus arrectus</i>	Palouse milk-vetch		S		S
VASCULAR PLANTS	<i>Chaenactis thompsonii</i>	Thompson's chaenactis		S		K
VASCULAR PLANTS	<i>Cypripedium fasciculatum</i>	clustered lady's slipper	SP	T	SM	K
VASCULAR PLANTS	<i>Cypripedium montanum</i>	mountain lady's slipper			SM	K
VASCULAR PLANTS	<i>Delphinium viridescens</i>	Wenatchee larkspur	SP	E		K
VASCULAR PLANTS	<i>Hackelia hispida</i> var. <i>disjuncta</i>	sagebrush stickseed		S		S
VASCULAR PLANTS	<i>Hackelia venusta</i>	showy stickseed	SP	E		S

Group	Latin name	Common name	Federal *	State +	Forest Service ++	Presence **
VASCULAR PLANTS	<i>Iliamna longisepala</i>	longsepal globemallow		S		S
VASCULAR PLANTS	<i>Orobanche pinorum</i>	pine broomrape		S		K
VASCULAR PLANTS	<i>Pellaea brachyptera</i>	Sierra cliff-brake		S		S
VASCULAR PLANTS	<i>Sidalcea oregana</i> <i>var. calva</i>	Oregon checker-mallow	SP	T		S
VASCULAR PLANTS	<i>Silene seelyi</i>	Seely's silene	SP	T		S

Key to Columns: “*” **Federal status** - “SP” = Special Protection; “+” **Washington state status** - “S” = Sensitive, “T” = Threatened, “E” = Endangered; “++” **Forest Service designations** - “SM” = Survey and Manage; “**” **Present (or absent in LSR/MLSA)** - “K” = Known, “S” = Suspected

d) Noxious Weeds

A portion of the Swauk LSR was surveyed in 1992 for noxious weed species that occur along roadsides (McRae and Harrod unpubl. report). High densities of *Centaurea diffusa*, *C. maculosa* and *Linaria dalmatica* are present along roads particularly Highway 97, Mission Creek, and the Teanaway. Other species include *C. repens*, *Chrysanthemum leucanthemum*, *Hypericum perforatum*, and *Cirsium canadensis*. Surveys for species presence and extent should be completed in order to develop a noxious management plan for this LSR (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 Swauk LSR. 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 LSR. 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, candidate, 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 Swauk LSR 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 the northern spotted owl, elk and barred owl. Northern spotted

owl inventories have been conducted over 100% of the suitable habitat within the LSR and includes a radio telemetry and demography study conducted by the PNW Research Station.

b) Late Successional Species By Habitat Type

(1) Dry Forests

About 58,065 acres (54%) of the Swauk LSR is 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, 32,845 acres (57%) of the dry forest is in a successional advanced condition. About 19,944 acres (34%) 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). Eighteen spotted owl activity centers occur in the Dry Forests. This comprises 75% of the total known spotted owl activity centers within the Swauk LSR.

(2) Mesic Sites Within the Dry Forest

The mesic forest group could only be mapped for the Leavenworth district portion of the Swauk LSR. They were not mapped on the remainder of the LSR because of limitations posed by having to model the vegetation. Mesic sites within the dry forests provide important wildlife habitat and add diversity across the landscape. It is suggested that these sites be identified during project level analysis and that the appropriate treatment criteria be applied.

Historically, fire occurred less frequently at these sites (refer to Chapter III) 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, 1,495 acres have been mapped as Mesic Sites on the Leavenworth portion of the LSR. About 1,151 acres (77%) are in a late-successional condition.

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.

(3) Moist Grand Fir Group

The Moist Grand Fir group covers about 17,421 acres (16%) of the LSR. Historically, fire occurred less frequently than in the Dry and Mesic vegetation groups (refer to Chapter III), 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 Swauk LSR.

Currently, about 12,318 acres (71%) of the Moist Grand Fir group in this LSR is in a late-successional condition. In the absence of any major disturbance, it is expected that in 50 years 16,440 acres (95%), and in 100 years 17,335 acres (99%) 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, Cascade 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. Six (25%) of the spotted owl activity centers located within this LSR are located within this vegetation group.

(4) Wet Forest Group

The Wet Forest Group covers only about 41 acres (12%) of the Swauk LSR. Historically fire occurred relatively infrequently (refer to Chapter III) allowing for succession to result in complex forest structures such as high crown closure, multilayering, and high numbers of snags and down logs. These conditions provide habitat for about 54 species that are associated with the late-successional conditions of these forests.

Currently all of the 41 acres are in a late-successional condition.

Wildlife species that are associated with the late-successional conditions of this vegetation group and are of special status include 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 Wet Forest Group is capable of providing structure that composes suitable spotted owl nesting, roosting and foraging habitat while remaining within the historic range of variability. No known spotted owl activity centers are located within this vegetation group in the Swauk LSR.

(5) Subalpine fir/Subalpine Larch

Subalpine fir covers about 23,915 acres (22%) of the Swauk LSR. Historically, fire frequency was relatively low but when fires did occur they were of high intensity. The longer fire return interval allowed for successional advancement that resulted in complex habitat structure such as high canopy closure, high numbers of snags and down logs. Landscape pattern was historically highly variable with a mosaic of seral stages providing habitat for a variety of wildlife species. About 41 wildlife species within the LSR are associated with the late-successional conditions of these forests.

Currently, about 15,047 acres (63%) of the Subalpine fir forests are in a late-successional condition. In the absence of any large scale disturbances it is expected that in 50 years 21,990 acres (92%), and in 100 years 23,836 acres (99%) would be in a late-successional condition.

Wildlife species that are associated with the late-successional forest in this vegetation group and have special status include the tailed frog, Cascade frog, larch mountain salamander, northern goshawk, bald eagle, northern spotted owl, great gray owl, pileated woodpecker, downy woodpecker, hairy woodpecker, black-backed woodpecker, three-toed woodpecker, Williamson's sapsucker, little willow flycatcher, olive-sided flycatcher, pygmy nuthatch, long-eared myotis, Yuma myotis, lynx, and marten.

Spotted owls occasionally use these forests, however, usually they only provide foraging habitat

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 and one Critical Habitat that are federally listed as Threatened or Endangered and could occur within the Swauk LSR. These include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), northern spotted owl (*Strix occidentalis caurina*), grizzly bear (*Ursus arctos*), gray wolf (*Canis lupus*) and Critical Habitat Unit for spotted owls.

The bald eagle is known to occur within the Swauk LSR, however, because no large bodies of water occur in the LSR it is only an occasional visitor to the area. It is unknown if peregrine falcons occur within the LSR and none of their habitat has been surveyed.

(a) Spotted Owls

The Swauk LSR is one of the "big three" spotted owl population cluster/source center LSR's. They are designed to act as a source population for spotted owls, so they can disperse into adjacent smaller LSR/MLSA's. These cluster sources must be large enough to hold multiple breeding pairs, and to support juveniles, subadults and "floaters". Spotted owl populations must be capable of acting as sources of surplus owls for the species' metapopulation. Local populations might cease to act as sources if they are too small or if they occupy highly fragmented habitat (Thomas et al 1990, FSEIS App G-7 to 8, 1994). It is crucial for these large LSR's to provide for stable or improving habitat conditions as they are expected to act as sources of surplus owls for the species' recovery, yet

allowing more flexibility in smaller LSR's. For these areas to function as source centers, at least 20 pairs of spotted owls should be managed for.

A total of 24 spotted owl activity centers occur within the Swauk LSR and about all of the habitat has been surveyed. There are 45,675 acres (42%) of suitable nesting/roosting/foraging habitat within the LSR. The Swauk is capable of having up to 73,792 acres or 68%, in suitable spotted owl habitat. However, 32,845 acres of potential habitat are in the dry forest group, which would not be sustainable. The estimated amount of habitat within a 1.8 mile radius of these activity centers is shown in Table 69. Spotted owls within the Swauk LSR have been included in a radio telemetry study and demography study conducted by PNW USFS Research. This research has shown that spotted owls within the Swauk may be declining (Forsman et al. In press) and that they are experiencing a high level of adult and juvenile mortality (S.Sovern, pers. comm.). Because the Swauk is one of the "Big Three" LSR's on the Wenatchee National Forest and is designed to function as a "source" of spotted owls for the other LSR's/MLSA's (USFWS 1992), it is important to emphasize spotted owls and their habitat. Currently 22 (92%) of the spotted owls activity centers are below habitat thresholds and 2 (8%) are at threshold levels.

Table VI-2, Spotted Owl Status and Habitat Information for the Swauk LSR

Spotted owl	Status ³	Owner ship ⁴	Dry or Wet Owl ⁵	Threshold ⁶	Critical Habitat Unit (CHU)	Forest Interior? ⁸	Suitable Spotted Owl ¹⁰ Habitat	Total Dispersal Habitat ⁹
SO301	PY	FS	Dry	Below Threshold	WA-12		2,292	1,550
SO304	PY	FS	Wet	Below Threshold	WA-12		2866	2267
SO309	PY	FS	Dry	Below Threshold	WA-12		1711	1915
SO310	PY	FS	Dry	Below Threshold	WA-12		2759	1818
SO312	PY	FS	Dry	Below Threshold	WA-12		1496	3539
SO317	PY	FS	Dry	Below Threshold	WA-12	INSIDE	2241	1889
SO318	PY	FS	Dry	Below Threshold	WA-12		1894	2812
SO323	PY	FS	Wet	Below Threshold	WA-12	1	2918	1644
SO324	P	FS	Dry	Below Threshold	WA-12		2077	2163
SO335	PY	FS	Dry	At Threshold	WA-12	INSIDE	2762	2036
SO336	PY	FS	Dry	Below	WA-12	INSIDE	1720	2923

Spotted owl	Status ³	Ownership ⁴	Dry or Wet Owl ⁵	Threshold ⁶	Critical Habitat Unit (CHU)	Forest Interior? ⁸	Suitable Spotted Owl ¹⁰ Habitat	Total Dispersal Habitat ⁹
				Threshold				
SO337	PY	FS	Dry	Below Threshold	WA-12		2094	2317
SO345	PY	FS	Wet	Below Threshold	WA-12		1258	988
SO350	PY	FS	Dry	Below Threshold	WA-12	NEAR	1547	3141
SO352	P	FS	Wet	At Threshold	WA-12		3399	1355
SO370	P	FS	Dry	Below Threshold	WA-12	INSIDE	2489	954
SO387	PY	FS	Wet	Below Threshold		NEAR	1865	1015
SO701	PY	FS	Dry	Below Threshold	WA-12	NEAR	2348	1593
SO712	PY	FS	Wet	Below Threshold	WA-12		2830	1642
SO713	PY	FS	Dry	Below Threshold	WA-12	NEAR	2403	1944
SO756	PY	FS	Dry	Below Threshold	WA-12		2702	1567
SO757	RS	FS	Dry	Below Threshold	WA-12	NEAR	2865	1688
SO761	PY	FS	Dry	Below Threshold	WA-12		2295	1960
SO764	RS	FS	Dry	Below Threshold	WA-12		2100	1768

¹ Near the LSR or MLSA but not inside the LSR or MLSA.

² Spotted owl site overlaps with other LSR/MLSA.

³ RS = Residential Single; P = Pair; PY = Pair with Young, based on highest occupancy.

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

⁵ If the majority of suitable spotted owl habitat in .7 mile circle is dry or mesic, then it is a dry spotted owl. If the majority is wet, then it is a wet spotted owl..

⁶ **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/Target: > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

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

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

Near = activity center is inside late successional habitat near forest interior.

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

¹⁰ Dry suitable spotted owl habitat includes 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.

¹¹ A larger circle will be needed if there is less than 100 acres of suitable habitat

(b) Grizzly Bear and Gray Wolf

No class 1 grizzly bear observations have been made within the Swauk LSR, however, class 1 observations have been reported nearby (Almack et al. 1993). Grizzly bears are suspected to occur within the LSR and about 20% of their available habitat has been surveyed. Gray wolves are suspected to occur within the LSR and about 30% of their habitat has been surveyed. In addition, confirmed wolf locations have been made to the north of this area (Gaines et al. 1995).

(c) Marbled Murrelet

There is no marbled murrelet habitat within the Swauk LSR.

(d) Critical Habitat Unit for Spotted Owls

The Swauk CHU WA-12 overlaps into 80% of the Swauk LSR (86,098 acres), 8% of the Teanaway LSR (2,573 acres), and 50% of the Sand Creek MLSA (4,596 acres). This CHU includes parts of two LSR's and one MLSA, it would support 46 spotted owl pairs. It includes portions of the I-90 corridor, an area of concern. The Swauk CHU provides essential east-west and north-south breeding habitat connectivity. This CHU also is necessary to insure protection for the essential elements, since some of the area is checkerboard ownership. This CHU provides essential breeding habitat connectivity adjacent to the Alpine Lakes Wilderness and other CHU's important for the range wide distribution of spotted owl.

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.

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 6 of the 27 LSR/MLSAs, one of these is Swauk LSR. 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 Swauk LSR, which is important for spotted owl connectivity, but low in sustainability, include (wetter habitat to the north).

(2) Sensitive And Candidate Wildlife Species

There are 15 wildlife species that are on the R6 Sensitive Species list or are federal candidate species that could occur within the Swauk LSR. These include the goshawk (*Accipiter gentilis*), willow flycatcher (*Empidonax trailii*), olive-sided flycatcher (*Contopus borealis*), tailed frog (*Ascaphus trueii*), spotted frog (*Rana pretiosa*), Cascade 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 known to occur and surveys have been completed over about 10% of the available habitat. It is unknown if the little willow flycatcher occurs in the Swauk and the olive-sided flycatcher is known to occur. Surveys have been completed over about 10% of their available habitat.

(b) Amphibians

Surveys for amphibians have been completed over about 5% of the habitat within the Swauk LSR. The tailed frog, spotted frog and Cascade's frog are all known to occur in the LSR.

(c) Mollusks

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

(d) Mammals

Surveys for the western big-eared bat have been completed over about 10% of the available habitat within the LSR. Surveys for other 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 the Swauk LSR.

Surveys for wolverine and fisher have been conducted over about 20% of the available habitat, and surveys for lynx have not been completed. Lynx and fisher are known to occur and it is unknown if wolverines are present.

(3) Management Indicator Species

There are 12 wildlife species that are listed as management indicator species that occur or could occur within the Swauk LSR. 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, downy woodpecker, three-toed woodpecker, Williamson's sapsucker, hairy woodpecker and northern flicker are known to occur within the LSR 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 or beavers have been completed. Ruffed grouse and beaver are known to occur in this LSR.

(b) Mule Deer, Elk

Surveys for mule deer and elk have covered most of the available habitat. Both species are known to occur within the LSR.

(c) Marten

Marten are known to occur in the LSR and about 20% of their available habitat has been surveyed.

(5) Survey And Manage, Protection And Buffer Species

There are eight species that do or could occur within the Swauk LSR 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 Swauk LSR and no surveys have been completed. No surveys have been completed for the flammulated owl, white-headed woodpecker, or black-backed woodpecker. About 10% of the habitat for the pygmy nuthatch has been surveyed. The pygmy nuthatch, flammulated owl, white-headed woodpecker, three toed woodpecker, and black-backed woodpecker are known to occur in the Swauk LSR.

(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) Amphibians

No surveys of the larch mountain salamander or the Van Dyke's salamander have been conducted within the LSR and it is unknown if they occur here.

3. Aquatic

The land area in the Swauk LSR has been broken down into the following fish production units (subwatershed's) : Upper Naneum, Lower Naneum Tributaries, Headwaters Swauk, Upper Swauk, Lower Swauk, Williams, Stafford, Lower N.F. Teanaway, Lower Teanaway within in the Cle Elum Ranger District and Headwaters Peshastin, Devil's Gulch and East Fork Mission on the Leavenworth Ranger District. Parts of the Teanaway, Swauk, Peshastin and Mission drainages are contained in this LSR. Swauk LSR has as estimated 12,678 acres of riparian reserve and is about 12% of the acres of the LSR. Mission Creek is designated a Key Watershed.

Swauk LSR is located in the precipitation zones that receive between 20 inches and 50 inches of average annual rainfall. Soils in some portions of the LSR are dry and described as having low stream density and intermittent flow patterns. Other soils are described as having potential for high surface erosion and/or shallow rapid soil failure hazards, high sediment delivery, and fine sediment response. Reactions of these two types of soil should be considered in making management decisions about activities planned for the LSR.

Level of dispersed recreation and livestock grazing within the riparian zone are causes for concern throughout the LSR.

Swauk drainage: Suffers from roads located in the floodplains, developments in the floodplains, past and present mining activities in channels and floodplains, and harvest removing riparian vegetation. Approximately 98% of the watershed has been managed in one form or another. This has resulted in impacts to stream channel stability and aquatic habitat.

Teanaway drainage: Stafford Creek in Stafford subwatershed has riparian zones is in good condition overall and this state needs to be maintained.

Peshastin drainage: Flood damage from the 1995/96 floods showed problems of floodplain entrapment and the unstable soils along the stream.

Mission drainage: The East Fork Mission subwatershed contains riparian zones in good overall condition and this state need to be maintained. Devil's Gulch drainage is mainly untouched by management activities, it is in relatively natural condition.

4. Human Uses

a) Overview

The Swauk LSR is located on the Leavenworth and Cle Elum Ranger Districts. U.S. Highway 97, a major automobile route passes through a portion of the LSR. Much of the southern border of the LSR lies adjacent to privately owned lands.

b) Prehistoric and Historic Summary

American Indian use of this area, from information gleaned from known sites and other cultural sources appears to have been mostly in the summer and focused on hunting, fishing and root digging. Most of the historical resources in this area are associated with early-day mining activity beginning in the 1860's that focused on exploration for gold. The town of Liberty was founded in 1892. This site has been designated a historic district. Another mining community, Blewett, was established due to mining activities. In 1919 the first road over Blewett Pass was constructed. This highway was later relocated over Swauk Pass in 1956. Some railroad logging occurred in the 1930's and 1940's. The area was heavily grazed in the late 1800's and early 1900's by sheep to take advantage of the forage in the open areas.

c) Recreation

(1) Campgrounds

There are five campgrounds located within this LSR, all on the Cle Elum District. The Swauk Campground has 23 campsites and 22 day use sites. The Mineral Springs Campground consists of 12 campsites. Both campgrounds are fairly well used as they are easily accessed from Highway 97. The Haney Meadows Horse Camp with 35 units was completed in the last few years. This camp was constructed to better accommodate the high equestrian use of this area. Lion Rock (three units) which for a high elevation, remote campground is quite popular as a destination for equestrian rides, site for amateur astronomers, hunters, Ellensburg area stockmen during roundup of the range cattle and a winter snowmobiler destination.

(2) Dispersed Camping

Since there are no lakes or major rivers within the LSR there are few places that are popular for dispersed camping (camping at undeveloped location, no toilets, fire rings, etc.). However certain locations such as near Haney Meadows has long been a popular dispersed camp area for equestrians. This LSR receives considerable hunting use, considerable dispersed camping occurs during the hunting season.

(3) Trails

There are many miles of trails within this LSR. A portion of these are motorized trails. The Devil's Gulch trail system is composed entirely of trails open to motorized use in the Mission Creek drainage. The most predominant user of this trail system are mountain bikers, the second most frequent user are the motorcycle riders followed by hikers. Since 1990 the Devil's Gulch trail system has undergone considerable reconstruction and new construction to improve the quality of the trail system and better meet the needs of recreationists. There are also some motorized trails located on the Cle Elum District. A number of miles of non-motorized trail is located near Haney Meadow on the Cle Elum Ranger District. These trails are popular with equestrians using the Haney Meadows Horse Camp.

The Swauk Forest Discovery Trail, located near Blewett Pass, is a three mile non-motorized trail that focuses on eastside forests. This trail is moderately popular with families and formal classes from nearby schools and colleges.

A number of roads, trails and trailheads on the west side of this LSR provide access to the Alpine Lakes Wilderness.

(4) Winter Use

This LSR is popular in the winter for snowmobiling and cross country skiing. A sno-park located at Blewett Pass provides access for many of the users. Because of the steep terrain there is little access off Highway 97 north of Blewett Pass. The Swauk Sno-park is shared by snowmobilers and cross country skiers. There are some restrictions on snowmobile use, however there are over 100 miles of groomed sno-mobile trails in the area. The groomed snowmobiling routes receive fairly heavy use, however snowmobiling use does occur on many of the forest roads which are not closed to snowmobile use. There are a number of winter access points for snowmobilers and cross country skiers on the Cle Elum Ranger District. This includes the Swauk Campground and Pipe Creek Sno-parks which are for non-snowmobile use only.

(5) Other Recreation Uses

The Red Top Agate Beds is an area known for it's non-gem stone quality specimens. The beds receive use from rockhounds, college geology classes, and sightseers. The site is accessed by trail from Red Top Lookout. Quite a few holes have been dug along the ridge top in efforts to find the stones.

Some recreational dredging and panning continues to occur in the streams.

(6) Mining

A number of claims continue to be improved upon in the LSR as prospectors pursue their search for gold. At this time no large scale mining efforts are underway.

(7) Social and Economic Considerations

This LSR provides a number of benefits, including:

- Winter recreation for cross country skiers and snowmobilers.

- Scenery and history for Highway 97 travelers
- Deer and elk hunting
- Trail users - motorized and non-motorized
- Forest products.

B. Analysis Between LSR/MLSA's

1. Sustainability

a) Sustainability Analysis

The sustainability of LSR's/MLSA's across the forest is displayed in Table 19. The Swauk LSR falls in the upper 1/3 of all LSR's/MLSA's in terms of the amount of vegetation at risk of loss to catastrophic fire. An important consideration in terms of sustainability is the relationship of the Swauk compared to its neighboring LSR's/MLSA's. Two LSR's, (Teaway and Manastash Ridge) and one MLSA (Sand Creek) are, for the purposes of this analysis, considered to be neighbors. The two neighboring LSR's fall in the upper 1/3 of LSR's/MLSA's forest-wide in terms of sustainability and Sand Creek is in the lower 1/3 and actually has a higher percentage of at risk vegetation than the Swauk, making it one of the least sustainable LSR's/MLSA's on the forest. The following table shows the acres at risk and the ignition risk determined in the forest-wide sustainability analysis for the Swauk and its three neighboring LSR's/MLSA's.

Table VI-3, Acres at Risk and Ignition Risk, Swauk LSR

LSR/MLS A	% of LSR/MLSA at Risk		% of LS Forest at Risk		Ignition Risk
	Acres	Pct.	Acres	Pct.	
Swauk	59,948	55%	55,996	91%	High
Manastash Ridge	38,858	37%	33,648	49%	Moderate
Teaway	6,840	20%	6,340	35%	Moderate
Sand Cr.	5,998	66%	5,973	100%	High

The factor driving this analysis, looking at sustainability issues between LSR's/MLSA's, is the amount and location of at risk vegetation between the Swauk and its three neighbors. In other words, linkages in at risk vegetation that would facilitate the spread of fire from one LSR/MLSA to the other. Review of maps of at risk vegetation reveals that there is no such linkage between the Swauk and the Manastash Ridge, because any linkage in forested vegetation that may have existed historically has been broken by residential and agricultural development on private land lying between the two.

This situation is however quite different when comparing the Swauk to both Teaway and Sand Creek. Here there is continuous at risk vegetation between the Swauk and these two LSR's/MLSA's and the potential for fires to spread from one to the other is present. The actual amount of this vegetation is mapped but not quantified at this time. Estimates from the maps show that approximately 1/3 of the vegetation between the Swauk and the Teaway is at risk, and for the area

between the Swauk and Sand creek approximately 2/3 of the existing vegetation is in an at risk condition.

(1) Implications

1. Reduce stand density in dense dry successional advanced vegetation types (types 12 and 22) where they exist between the Teanaway and Swauk and between Sand Creek and Swauk.
2. Reduce fuel loadings along roads that exist between these LSR's to increase the roads effectiveness as fuelbreaks.

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

3. Reduce fuel loadings in young stands.

Potential Projects - Precommercial thinning.

2. Forest-wide Northern Spotted Owl

The following is the discussion and results of the Forest-wide Spotted Owl Module for the Swauk LSR. See appendix for order, explanations and process of modules.

The Swauk LSR is one of the "big three" LSR's, which is important as sources for spotted owl distribution throughout the North Cascades province. The south and western portions of this LSR lay in the I-90 corridor area of concern, the LSR network needs to provide essential east-west breeding habitat connectivity across the Cascade Crest to LSR's on the Mt. Baker Snoqualmie National Forest. However, the I-90 corridor has high potential for inter- and intra- provincial isolation resulting from extremely poor habitat conditions. The Swauk is in a location to provide important linkage for north-south connectivity, radio telemetry research in the Swauk shows dispersal distances of 25 to 30 miles, and up to 70 miles. The Swauk is in the northeastern edge of the range of the northern spotted owl. There is very little habitat beyond the Swauk to the east.

This LSR provides essential breeding habitat connectivity with the Sand Creek MLSA directly to the north and the Teanaway MLSA directly to the west. Connectivity further north to Boundary Butte LSR, has been disrupted from the Rat Creek fires in 1994. Connectivity to the Manastash Ridge LSR to the south is essential for the recovery of the species, providing genetic interchange from north to south.

The linkage between the Swauk and Manastash Ridge is dependent upon maintaining habitat in the AMA, outcome of land exchanges, and linkage at Snoqualmie Pass

There is 45,675 acres (42%) of nesting, roosting and foraging habitat for spotted owls in this LSR, this is a high amount of habitat acreage, but a low percentage of area within habitat for a large LSR, such as this. It also has one of the highest amounts of potential N/R/F habitat (73,792 acres - 68%), yet one of the lowest predicted sustainable habitat over time (27,521 acres - 25% wet, moist, high elevation).

For these large LSR's to function as source populations, at least 20 pairs of owls should be managed for (see Table 71 "Spotted Owl Pair Goals for 'Big e' LSR's" below). Currently there are 24 spotted owl activity centers within the Swauk LSR. Early historical reports of spotted owls show they have been part of these ecosystems at least since 1930 in Cle Elum and 1939 in Blewett (Condor 1946). The current 24 activity centers include 22 spotted owl pairs, of which all but 2 are below threshold acreage (2,663 acres within 1.8 mile radius).

Table VI-4, Spotted Owl Pair Goals for "Big 3" LSR's with CHU's

Source Center LSR	S.Owl Pairs -1994, FSEIS Appendix G, Table G-3	S.Owl Pairs - 1996	Number of Owl Pairs LSR Should Support, as per CHU discussion.
Chiwawa RW 135	11 Pairs + 1 Res Single	16 Pairs + 3 Res Singles	21+ Pairs
Swauk RW 129	15 Pr + 1 RS	22 Pr + 2 RS	20+ Pr
Manastash Ridge RW 125	13 Pr	31 Pr + 2 RS	20+ Pr

Connectivity is essential within spotted owl home ranges, between home ranges, between LSR's/MLSA's and throughout the provinces and the range of the northern spotted owl. The ability of spotted owls to disperse to adjacent LSR/MLSA's is of particular importance, as this LSR is intended to act as a source for these other areas. The spotted owl radio telemetry research in the Swauk, shows spotted owls in the Swauk have a very high reproductive rate, go long distances for dispersal (mostly to the north and west), and have a very high juvenile and adult mortality rate. Spotted owls in this Eastern Cascades area, are showing a high winter loss of juvenile birds, higher than the other study areas within the range of the spotted owl. Winter diet includes higher amounts of flying squirrel and bushy-tailed woodrat. Summer diet is composed of flying squirrel, small mammals, snowshoe hare, bushy-tailed woodrat, insects, red-backed vole, deer mouse, pocket gopher and birds. The reasons for this spotted owl mortality are predation, starvation, trauma and unknown causes. Understanding the role of prey base and winter habitat, helps in management and design of future spotted owl habitat.

Spotted owl dispersal habitat is necessary to provide immigration and between the network sites across the range. Wilderness areas have been integrated with the LSR network to provide late successional forests. Specific to spotted owls, wilderness protects populations and nesting/roosting/foraging habitat (ROD pg. 19, NWFP App 3-4 pg. 240, 1994). The Swauk LSR does not adjoin a wilderness, though it is close to the Alpine Lakes Wilderness in the northwestern portion. Though the Alpine Lakes Wilderness is naturally fragmented by high elevation rocks and glaciers, the forested component around those high points provides connectivity to other LSR's, especially to the north and west.

The four nearest LSR/MLSA's were evaluated to determine their potential for dispersal to occur. This analysis showed that spotted owls could likely disperse to the Sand Creek MLSA and the Teanaway LSR. There may be difficulty along the I-90 Corridor connecting to the Manastash Ridge LSR and along the Highway 97 Corridor to Boundary Butte LSR, which recently burned in the Rat Creek fire.

Habitat providing dispersal/Connectivity corridors and patches between LSR's (outside LSR/MLSA's) include: Crow Canyon to Bear Gulch; Scotty Creek to Peshastin Creek; Standup Creek; Yellow Hill to Davis Creek to Domerie Creek; Cabin Creek to Coles Creek to North Ridge; Peoh Point area (see Forest Interior map and Suitable owl habitat map).

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 6 of the 27 LSR/MLSAs, one of these is Swauk LSR. 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 Swauk LSR, which is important for spotted owl connectivity, but low in sustainability, include (wetter habitat to the north).

In all LSR/MLSAs, except the six noted above, reserves are predicted to provide the needs for spotted owl recovery over time (50+ years). The Chiwawa LSR and the Manastash LSR are predicted to be sustainable from fire over time. The LSR/MLSA reserve network 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.

a) Restoration Opportunities And Potential Projects

1. Meet goals of LSR for 20 pairs of spotted owls.
2. Improve and accelerate N/R/F habitat, to maintain high number of spotted owl pairs.
3. Aggressive protection of remaining suitable spotted owl habitat, from outside LSR on Matrix lands, etc.
4. Monitor/maintain connectivity outside LSR.
5. Monitor spotted owl activity centers, 500 acre core and home ranges of owls below threshold and below LSR target acres.
6. To strengthen connectivity, home ranges and spotted owl viability, expand 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).

3. Connectivity (Plant and Wildlife)

a) Plant Connectivity

Connectivity can be addressed at several spatial scales when assessing an individual LSR. Connectivity of the LSR/MLSA network on the Wenatchee National Forest has been addressed above in the section title "Species with Special Status." Connectivity specific to the Swauk LSR for vascular plants is analyzed here. Refer to the Forest-wide Assessment discussions for connectivity description for lichens, bryophytes and fungi.

First, connectivity relative to the Swauk LSR can be viewed from how well habitat is connected to surrounding LSR's or MLSA's. Species associated with the dry forest and moist grand fir vegetation groups are connected for all dispersal classes between the Swauk and the Teanaway LSR and the Sand Creek MLSA. There is no connectivity for the subalpine fir series between the Swauk and the Teanaway LSR, but this series absent from the Sand Creek MLSA. There is no connectivity for any dispersal class for those species associated with the dry forest group and the subalpine fir series between the Swauk and Manastash Ridge LSR's. In the moist grand fir group, there is no connectivity between the Swauk and Manastash Ridge LSR's for the low dispersability species, but the moderate and high dispersal species are dependent on habitat in between these LSR's. Finally, the wet forest and whitebark pine/subalpine larch vegetation groups are absent from Swauk, so discussion of connectivity is not applicable.

(1) Restoration Opportunities

No opportunities were identified as a result of this analysis.

b) Wildlife Connectivity

The following are the results of applying the forest wide connectivity module to the Swauk LSR (Refer to the Dispersion Index in Appendix A). A total of four potential linkages were evaluated. These included Swauk to Sand Creek, Swauk to Boundary Butte, Swauk to Teanaway, and Swauk to Manastash Ridge.

Table VI-5, Dispersal Indices for the Swauk LSR Forest Wide Connectivity Module.

Linkage	Distance (Mi.)	Low	Moderate	High	Index
Swauk/Sand Creek	0	Yes	Yes	Yes	3
Swauk/Boundary Butte	5.3	No	No	Yes	1
Swauk/Teanaway	1.3	No	Yes	Yes	2
Swauk/Manastash Ridge	9.0	No	No	Yes	1
Overall Rating					1.75

Two (50%) of the linkages were indexed as a 1 providing for dispersal of highly mobile species only. The linkage between the Swauk and Manastash Ridge is dependent upon maintaining habitat in the AMA, outcome of land exchanges, and linkage at Snoqualmie Pass. One linkage was indexed as a 2 providing for dispersal of moderate and high mobile species. The linkage between the Swauk and

Sand Creek was indexed as a 3 providing for low, moderate and high mobility species. This linkage is important as few areas on the forest provide connectivity for low mobility species.

(1) Restoration Opportunities

There is an opportunity to improve the linkage between the Swauk and Teanaway from a 2 to a 3. This could be accomplished by identifying, on a site specific basis, the best potential linkage and managing it to provide for low mobility species.

A careful, site specific evaluation of the linkage at Snoqualmie Pass is needed in order to fully assess what species are provided for and how to improve this linkage. It may be necessary to coordinate with the Department of Transportation to provide for dispersal of wildlife.

C. Analysis Within LSR

1. Unique Habitat and Species

The following is the discussion and results of the Unique Habitat and Species module for the Swauk LSR. See appendix for order, explanations and process of modules.

a) Forest-wide Overview of Unique Habitats and Species

The Swauk LSR, over all, is high in unique habitats and species. It is located in the Wenatchee Mountains, an area for plant rarity and endemism noted by Columbia Basin Ecosystem Management Project, 1995. The Wenatchee NF plan noted the Drop Creek RNA for Engleman spruce/subalpine fir forests. There are two other areas of Special Interest, one in the Upper Naneum Meadows and one in Miller/Bear Creeks. With the Alpine Lakes Wilderness close to the north, many species found in the wilderness may also inhabit the Swauk LSR.

The Swauk LSR has comparatively high amounts of natural openings, wet meadows, riparian reserves (see Table 26 "Unique Habitats and Species" for all LSR/MLSA's). It also has a high amount of known special wildlife species, 57 species, and of known special plant species, 28 species, (see same table 26 noted above, and Appendix 6 Plant Species Lists and Appendix 27 Wildlife Species List).

From a Forest perspective, the Swauk LSR has relatively high amounts of forest interior, in all vegetative groups (dry, high elevation and moist/wet). There is a higher percentage (54%) of dry forest in this LSR, compared to the other large LSR's. Higher percentages of dry forest are found only in Lucerne LSR, Deadhorse LSR, Slide Peak LSR and Boundary Butte LSR. Overall, the Swauk LSR has moderate quality snags.

American Indian food gathering and other material collections would be moderate to high. The gathering of bitterroot, camas, as well as deer and elk are past traditions of this area. With the amount of talus in the Swauk there are probably several lithic and vision quest sites. This area provided early season root digging, as well as travel and trade routes and camp sites later through the year.

b) Unique Habitats and Species Within

Each LSR/MLSA was evaluated for biodiversity, connectivity and function (see Function of Unique Habitats in the main body of the Forest-wide Assessment). As part of the analysis, past management activities were found to effect the function of unique habitats and species. For the Swauk LSR these include: total open road density of 3.13 miles per square mile; security habitat of 50%; roads and trails in riparian reserves of 5.49 miles per square mile; and past harvest activities of 75% in the LSR. The following describe abundance, connectivity and function for unique habitats and species.

(1) Abundance and Ecological Diversity

Compared to all the other LSR's, the Swauk is in the high quality group that provides high amounts of acreage and wide variety of plant communities and environments. 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.

(2) Connectivity for Unique Habitats and Species

The Swauk is also in the high group for providing high connectivity in a landscape pattern for biological flow to sustain unique animal and plant communities. 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.

(3) Process and Function of Unique Habitats and Species

The Swauk is again in the high group providing quality functioning for unique species and habitat. 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.

Identified areas of high abundance, connectivity and function for unique habitats and species in the Swauk LSR are:

1. Table Mountain Area: meadows, talus/rock, forest interior, wetlands, riparian reserves, PETS spp.
2. Devils Gulch/Tronson Ridge/Mission Ridge: springs, wetlands, natural openings, meadows, forest interior, rock/talus, riparian reserves.
3. Miller/Bear Creek: Special Interest Area, meadows, shrubs, talus/rock, forest interior.
4. Upper Naneum Meadow/Mount Lillian: Special Interest Area, forest interior, meadows, riparian reserves, talus/rock.
5. Drop Creek: RNA for Engleman spruce, talus/rock, forest interior, riparian reserves.
6. Peavine/Mission: Natural openings, rock/talus, riparian reserves, PETS spp.
7. Baker/Mill Creek: forest interior, PETS spp, natural openings, riparian reserves.
8. Headwaters Swauk Meadows: wetlands, riparian reserves, forest interior, talus/rock/ PETS spp.
9. Headwaters Jack Cr.: wetlands, riparian reserves, forest interior.
10. Lower First Creek: forest interior, wetlands, riparian reserves, PETS spp.

c) Restoration Opportunities And Potential Projects for Unique Habitats and Species:

1. Reduce road and trail densities in riparian reserves.
2. Reduce open road densities throughout the LSR.
3. Increase amount of security habitat.
4. Increase and accelerate late successional habitat and forest interior habitat. Thin to accelerate old growth.
5. Reduce roads and trails in unique habitats (meadows, talus, wetlands, etc.).
6. Reduce noxious weed spread in meadows and natural openings.
7. Reduce roads in forest interior patches.

8. Protect large trees and forested screening near talus, cliffs, caves, meadows.
9. Reduce encroaching trees in subalpine meadows.
10. Prescribed fire in ponderosa pine.
11. Reduce fragmentation of wet forest.
12. Protect riparian from grazing.
13. Provide American Indian site access.
14. Maintain black-backed woodpecker nesting/roosting/foraging habitat.
15. Meet high end snag levels.
16. Create log den sites in low quality roaded/forest for marten, fisher, lynx.
17. Protect/maintain/enhance/monitor PETS.
18. Prescribed fire in natural openings as part of fire climax.
19. Interpret values and protection/maintenance of unique habitats and species.
20. Acquire non-Forest System lands with high degree of unique species or habitat.

d) Snag/Log/Green Tree Recruitment

The following is the discussion and results of the Snag/Log/Green Tree Recruitment sub-set module of the Unique Habitats module for the Swauk LSR. See appendix 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.

A landscape level approach was used to analyze snag, green tree recruitment, and downed wood habitat in the Swauk LSR. The landscape approach reviews the quality of snag, down logs, and green tree recruitment for the LSR's. GIS and specific knowledge was used: including: forest vegetation types and acreages, amount of forest burned, percentage of past timber harvest (clearcuts and partial cuts), road densities, security habitat, Riparian Reserve acreages, pathogens, the number of spotted owl home ranges, forest interior amounts, and the percentage of late successional habitat. The qualitative analysis for the LSR included green tree availability, short term and long term snag/log availability, burn intensity, site specific wildlife needs, land allocation goals, and the quality of refugia/security habitats.

(1) Quality Rating

Each attribute for snag/downed log/green tree recruitment has a rating (see chart), a final rating incorporates all values towards one rating for the LSR. Actual snag, downed log and green tree recruitment numbers, sizes, stages of decay and species is not practical to analysis on a landscape basis. This can also be done on a 40 acre grid, or sub-watershed basis. When data is available, incorporate actual availability data into the analysis. Snag and Downed Log levels are based on Wenatchee National Forest Snag Levels, Fire Recover y Snag Levels, Everett et al Spotted owl and Snag studies, and wildlife needs. Qualitative ratings are based on habitat needs for snag, downed log, and recruitment tree wildlife and plant species needs. Species using these habitats include:

piledated woodpecker	spotted owl	hoary bat	marten & fisher	tailed frog
black-backed woodpecker	flamulated owl	silver-haired bat	flying squirrel	NW & PG salamander
white-headed	great gray owl	big brown bat	lynx	lichens & fungi

woodpecker
olive-sided
flycatcher

Vaux's swift

voles, shrewmole

bald eagle

land snails

*** SWAUK **

<u>HIGH QUALITY</u>	<u>MEDIUM QUALITY</u>	<u>LOW QUALITY</u>
Moist & Wet Veg Groups 16%	Subalpine Fir & Mesic Veg 23%	Dry & Whitebark Veg 54%
>60% LS (non-dry) Habitat	15% - 60% LS Habitat 31%	<15% LS Habitat
80% - 100% LS (all) Habitat 82%	40% - 80% LS/M Habitat	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry	<15% Forest Interior ND 9%
>10% Forest Interior Dry	5% - 9% Forest Interior Dry	< 5% Forest Interior Dry 2%
>16% in Riparian Reserves	10% to 16% in Riparian Res 12%	<10% in Rip Res
0 Mi/Sq Mi Any Rds in Rip Res	0 to 1 Mi/Sq Mi Rds in Rip Res	> 1 Mi/Sq Mi Rd Rip Res 5.49 mi/sq/mi
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads	> 2.5 Mi/Sq Mi Roads 2.68 mi/sq/mi
>70% Security Habitat	50% to 70% Security Habitat	<50% Security Habitat 19%
>10% in Past Burns 22%	--	<10% in Past Burns
>50% Insect/Pathogens	25% - 50% Insect/Pathogens (see Insect/Disease Write Up)	< 25% Insect/Pathogens
<10% Past CC Harvest	11% - 25% Past CC Harvest 20% ?	>25% Past CC Harvest
<10% Past PC Harvest	11% - 50% Past PC Harvest	>50% Past PC Harvest 40%

(2) Restoration Opportunities And Potential Projects For Snags/Logs

Reduce roads in riparian reserves;

Reduce Roads in Forest Interior Patches

Retain Snags at High End of Range;

Incorporate Healthy Insect/Disease Levels,

Complete snag analysis on 40 acre grid

e) Plant Species with Special Status

There are six sensitive and two survey and manage species (one of which is a sensitive species) known to occur within the Swauk LSR. There are no immediate viability concerns associated with any of the above mentioned species. Consequently, the Species with Special Status Module would recommend monitoring these species and subsequent development of a Conservation Strategy for each species.

Although there are no immediate viability concerns for the species identified in this section, it should be noted that *Anemone nuttaliana* has a disjunct distribution throughout its range and is known only in Chelan and Kittitas Counties in Washington from only a few locations. Furthermore, little or no information exists regarding the biology or ecology of this species. It will be important to develop monitoring projects that collect biological information so that population viability can be assessed.

In addition, *Chaenactis thompsonii* is a local endemic known only from a few locations in the Wenatchee Mountains. Again, little or no information exist describing the biology and ecology of this species. It will be important to develop monitoring projects that collect biological information so that population viability can be assessed.

2. Connectivity (Plant and Wildlife)

a) Plant Connectivity

Connectivity can also be addressed by qualitatively describing the connectedness of habitats within the LSR. Within the Swauk LSR, the subalpine fir series is particularly well connected within the southeastern portion of the LSR. However, the dry forest habitat in Mission Creek is disconnected, particularly for low dispersal species, from that in lower Swauk Creek. The same is true for the moist grand fir habitat type when comparing the eastern and western portions of the LSR. Species with low and moderate dispersal abilities associated with the dry forest and the moist grand fir vegetation groups are apparently disconnected within the LSR. This is due, in large part, to inherent breaks in the vegetative landscape.

Disconnectivity identified in this analysis results from inherent breaks in the vegetative landscape. For example, the lack of connectivity for the subalpine fir series between the Swauk, Teanaway, and Manastash Ridge LSR's, as well as within the Swauk LSR, is because of landform. The results of this analysis does not necessarily lead to any proposed projects.

b) Wildlife Connectivity

The results of applying the within LSR connectivity module are presented in this section for the Swauk LSR.

Table VI-6, Swauk LSR Connectivity Rankings

Connectivity Variable	DF/MS	MGF	SAF	RR	OVERAL L
%LS or Fire Climax	FC=L, LS=M	H	M	M	M
Open Road Density	L	L	L	L	L
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 moderate in all vegetation groups except the moist grand fir. Restoration projects that promote the development of fire-climax conditions, given the need to maintain spotted owl habitat, would improve the connectivity of this vegetation group. The overall open road density is 2.68 mi./sq.mi. resulting and a low rating for habitat connectivity relative to open roads and security habitat. This is particularly a concern for species with low levels of mobility as roads present barriers to movement. The percent of each vegetation type in forest interior will improve over time unless large scale disturbances occur. 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 to be managed for 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 less mobile species. This could not be adequately addressed at the course/moderate filter approach used in this assessment.

(1) Restoration Opportunities

(a) Dry Forest Group

It is important to locate and map the mesic sites within the Dry Forest Group in order to apply appropriate DEC's. Mesic sites have been identified on the Leavenworth portion of the LSR but could not be identified on the remainder to the LSR from available vegetation data.

There is an opportunity to restore habitat for fire-climax ponderosa pine associated species. These restoration activities should occur outside of areas currently identified as providing suitable spotted owl habitat unless habitat is in imminent danger from fire. There is opportunity to manage towards the DEC in areas outside or suitable spotted owl habitat using tools such as thinning and prescribed fires. This should include nonforested areas that could benefit from the use of prescribed fires.

Perhaps the most immediate opportunity to improve the connectivity of the Swauk LSR is through the active management of roads. To improve connectivity for low mobility species, these restoration actions should include recontouring and/or revegetation of roads.

(b) Moist Grand Fir, Wet Forest

There is opportunity to improve the habitat connectivity for LS associated species by promoting the development of LS habitat in areas that do not currently provide it. The tools that could be used include thinning to improve tree growth.

Again, there is a opportunity to improve connectivity through active management of roads. For low mobility species, recontouring and revegetating roads could be considered.

(c) Riparian Reserves

The current open road density within Riparian Reserves is 4.8 mi./sq.mi. There is an opportunity to greatly improve habitat connectivity by restoring vegetation and cover where roads currently exist.

(d) 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 LSR is 2.7 mi./sq.mi. and the amount of area in security habitat is 19%. This information shows that habitat effectiveness is considered to be "low" (>2mi./sq.mi.) relative to roads and "low" relative to security habitat (<50%). The long term management objective for LSR/MLSA's is to manage towards a "high" level of habitat effectiveness defined as >1mi./sq.mi. open road density and >70% security habitat.

3. Disturbance Risk Analysis

The Swauk LSR contains nearly 34,000 acres of successional-advanced dry forest. Most of this is concentrated and connected along both sides of the Highway 97 corridor. Road densities and recreational use in the Swauk LSR are high, elevating the risk of human-caused fires. A second block of successional-advanced dry forest lies within the Mission Creek drainage, in the eastern portion of the LSR. Although much of this area is unroaded, it receives considerable use from hunters in the fall, and its distance from the crest of the Cascades makes it one of the driest areas within the Wenatchee NF LSR network. There are also about 15,000 acres of mature/layered forest and nearly 7,000 acres of single-layered forest in the subalpine fir series, primarily on Table Mountain, in the eastern portion of the LSR. Many single-layered stands within the subalpine fir series are dominated by mature lodgepole pine. As part of a study conducted within the Swauk LSR, Camp (1995) cored and aged trees throughout the reserve. Of the 161 lodgepole pine sampled on 63 plots, more than half (57 percent) were 75 years or older and 32 percent were at least 100 years. Only 12 lodgepole pines in the sample were younger than 50 years. Lodgepole pine becomes increasingly susceptible to mountain pine beetle attacks as it matures; on the Wenatchee National Forest, trees 100 years or older are very susceptible (P. Flanagan, pers. comm.).

A recently-completed study found that immediately prior to Euro-American incursion and settlement, between 7 to 12 percent of the Swauk LSR contained late-successional forest, and, based on topography and physiography, about 60 percent of this LSR has less than a 2 percent probability of sustaining late-successional composition and structure under inherent disturbance regimes (Camp 1995, Camp and others 1996 in press). Of all the LSR's on the Wenatchee National Forest, the Swauk is one of the least likely to provide quality late-successional habitat over time, yet it is one of the three LSR's most heavily utilized by the northern spotted owl.

The above-mentioned study provides information about trees, snags, logs, and cut stumps within the Swauk LSR. In 9 subdrainages (487 plots) over 3,000 live trees were cored and aged. In 5 of the subdrainages (345 plots), snags, logs, and stumps were also sampled. Table 76 lists snags greater than 6' in height by species and size class. Of 343 snags for which diameter measurements were obtained, 49 percent were less than 10" in diameter and 74 percent were less than 15". Only 14 percent were 20" or more. Most snags were grand fir or Douglas-fir, the preferred host species for many insects and pathogens currently exhibiting high activity levels in the Swauk LSR. Eleven percent of the snags were ponderosa pine or western larch, possibly killed by either western bark beetle (pine) or larch dwarf mistletoe infestation. An interesting comparison can be made between the sizes of snags, logs, and cut stumps within the LSR. Most cut stumps were ponderosa pine (136) or Douglas-fir (125). Ponderosa pine stumps ranged in size from 5 to 75.9 inches in diameter; 79 were 20" or greater in diameter. Douglas-fir stumps ranged from 5.6 to 59.5"; 59 of these were 20" or greater in diameter. Logs tallied in the study and measured at the butt end showed that a

preponderance were less than 10" in diameter. The disturbance risk from large numbers of logs and snags in small size classes is that these lose moisture exponentially faster and become more rapidly flammable than snags and logs in larger size classes. Flammability decreases as moisture content in snags and logs increases since more of a fire's heat is required to vaporize the water.

High levels of recent snags (those still retaining fine branch and twig structure) are to a large extent the result of western spruce budworm defoliation in the 1980s. Many trees not killed by defoliation later succumbed to Douglas-fir beetle and fir engraver beetles. Over 50 percent of snags sampled in Baker, Mill, and Medicine Creeks are from recently killed trees. This heavy pulse of dead structure probably benefits wildlife, but also contributes to the likelihood of fires moving into the canopy using these dead ladder fuels. The fine twig and branch structure of recently-killed trees provides an abundance of fast-drying fuels, and these fuels are vertically connected from the forest floor into the canopy, increasing the likelihood of fires crowning.

Over 14 percent of all live trees sampled within the LSR showed evidence of damage from insects and/or pathogens. The pathogen and insect activity is a result of past overstory harvests and excluding fires within the LSR. Nineteen percent of more than 1,000 Douglas-fir sampled had mistletoe in at least two-thirds of the live crown. Some western larch and ponderosa pine in the sample also had heavy mistletoe infestations. Six percent of the sampled trees exhibited evidence of stem decay. Most decayed trees were grand fir and Douglas-fir, although some individuals of every species in the sample were infected. Ten percent of the sampled trees had mechanical damage to the bole or top, including dead tops, forked tops, wounds, and scars. Damaged areas can provide infection courts for several decay fungi. In addition, 208 ponderosa pine, western larch, and Douglas-fir in the sample were scarred by past fires. Most fire-scarred trees were in stands that currently have live and dead structure from the ground into the crowns. These stands are highly susceptible to stand-replacing fires that would kill most trees in the stand, including those that survived past fires.

Aerial surveys conducted by the Insect and Disease Group of Region 6 since the late 1940s indicate the following insect outbreaks occurring within the Swauk LSR:

- Western pine beetle: 1954, 1963, 1965, 1981, 1984-94
- Mountain pine beetle (lodgepole pine): 1950, 1952, 1956-7, 1963, 1982, 1985, 1987-8
- Mountain pine beetle (w. white pine): 1953, 1960-62, 1969, 1976-79, 1981, 1983-93
- Mountain pine beetle (ponderosa pine): 1963, 1968-9, 1974, 1977-81, 1983, 1986-94
- Mountain pine beetle (whitebark pine): 1980-1, 1989, 1994
- Douglas-fir beetle: 1952-6, 1960, 1962-3, 1965, 1970, 1973, 1976, 1978-9, 1988, 1990-1
- Fir engraver: 1953-6, 1959-60, 1968-71, 1973, 1977-79, 1985-8, 1990-93
- Spruce beetle: 1954, 1959, 1976, 1988, 1990, 1992
- Western spruce budworm: 1972-80, 1986-87
- Larch budmoth: 1986

For nearly all insects surveyed, damage during the past decade has been more frequent and of longer duration than in the previous 50 years. In particular, mortality associated with western bark beetle, Douglas-fir beetle, and the fir engraver has increased dramatically during the past two decades, partially as a result of an extended drought. The susceptibility of stands in the Swauk LSR to fires and several biotic disturbance agents are shown in Table 74. Mortality 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, western spruce budworm and

Douglas-fir beetle or fir engraver). Moreover, risk to the biotic disturbance agents generally elevates the risk of catastrophic fires by potentially increasing fuel levels.

The Swauk LSR has and continues to support small-scale mining activity. Disturbances are localized, but frequently concentrated in riparian areas. Soils are frequently severely damaged by mining-related activities, lowering future site productivity. Numerous residences along the major highway that bisects the Swauk LSR are within some of the driest portions of the LSR. Escaped trash fires constitute a real threat to sustaining this LSR as do fires ignited by hunters and recreationists in dispersed campsites within the Swauk.

Table VI-7, Disturbance Matrix, Swauk LSR

Veg Type	Fir e	Dwarf mistletoes			Root disease		WPB R	FE	WSB	DFB	MP B	WPB	TOTAL
		PP	DF	WL	AR	HE OS AN							
10	M	M	M	L	L	M	-	L	L	L	L	L	M
11	M	M	M	L	M	M	-	M	M	L	L	M	M
12	H	H	H	L	M	M	-	H	H	H	L	H	H
13	H	H	H	L	M	M	-	H	H	M	L	M	H
20	M	L	M	M	M	M	-	L	L	L	L	L	M
21	M	M	M	M	M	M	-	L	L	M	L	L	M
22	H	M	H	H	M	M	-	L	M	H	L	L	H
23	H	M	M	M	L	L	-	L	M	M	L	L	H
30	M	L	M	M	L	M	H	L	L	L	L	L	M
31	M	L	M	M	L	M	H	L	L	L	L	L	M
32	H	L	H	H	L	M	H	H	M	M	L	L	H
33	H	L	H	H	M	H	H	H	M	M	L	L	H
40	L	-	L	L	L	L	H	L	L	L	L	L	L
41	H	-	L	L	L	L	H	L	L	L	H	L	H
42	H	-	L	L	L	L	H	M	L	M	H	L	H
43	M	-	L	L	L	L	H	L	L	L	M	L	M

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 = 0; “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”

Table VI-8, Live and Dead Structure in Swauk LSR

	Live Trees	Snags - All	Snags - < 6 feet	Snags - Old	Snags - Recent	Logs	Cut Stumps
Total	2107	467 22.2% *	110 23.6%* *	162 35.0%* *	195 41.8%**	105	361 17.1%***
Boulder	1055	239 22.7%	59 24.7%	98 41.0%	82 34.3%	33	143 13.6%
Medicine	721	198 27.5%	41 20.7%	57 28.8%	100 50.5%	69	162 22.5%
Baker	71	17 23.9%	3 17.7%	5 29.4%	9 52.9%	0	2 2.8%
Mill	134	6 4.5%	3 50.0%	0	3 50.5%	2	10 7.5%
Lion	126	7 5.6%	4 57.1%	2 28.6%	1 14.3%	1	44 34.9%
ABGR	649	160 24.7%	20 12.5%	38 23.8%	102 63.8%	27	62
ABLA	111	14 12.6%	0	6 42.9%	8 57.1%	5	0
PICO	59	21 35.6%	3 14.3%	4 19.1%	14 66.7%	10	4
PIPO	391	37 9.5%	16 43.2%	12 32.4%	9 24.3%	12	136
PSME	865	172	54	86	32	33	125

	Live Trees	Snags - All	Snags - < 6 feet	Snags - Old	Snags - Recent	Logs	Cut Stumps
		19.9%	31.4%	50%	18.6%		
LAOC	62	26 41.9%	4 15.4%	6 23.1%	16 61.5%	10	10

* Proportion to live trees, ** Proportion of total snags, *** Proportion to live trees

Data taken from a sample in five randomly chosen subdrainages - 1993 (see Camp 1995)

Table VI-9, Snags in the Swauk LSR

	< 10"	10 - 14"	15 - 19"	> 20"
Grand fir	77	40	15	7
Douglas-fir	39	23	21	29
Western larch	10	6	1	3
Lodgepole pine	10	5	1	1
Subalpine fir	8	5	1	0
Ponderosa pine	7	5	1	6
W. white pine	4	1	1	0
Other species	12	2	1	1
Total	167	87	42	47

Table VI-10, Log Data, Swauk LSR

	<10"	10"-14"	15"-19"	≥ 20"
Grand fir	10	6	4	1
Subalpine fir	3	1	2	1
Douglas-fir	15	4	4	6
Western larch	6	2	0	2
W. white pine	2	1	0	0
Lodgepole pine	6	3	2	0
Ponderosa pine	3	3	2	4

	<10"	10"-14"	15"-19"	³ 20"
Undetermined	3	0	0	0
TOTAL	48	20	14	14

Sixty-four percent of the Swauk LSR has a high composite risk to disturbances. Areas at risk include the dense, dry forest types, the partially-harvested dry forests, the mesic sites within dry forest, layered mature and partially-harvested moist grand fir, and the single-layered and layered subalpine fir forests. The moist grand fir and subalpine fir types are at high risk both from adjacency to drier forests and because insect and pathogen activity has greatly increased fuel loads and vertical and horizontal fuel connectivity within these vegetation types.

This LSR is a major population center for the northern spotted owl; therefore management options must take into account that protecting and enhancing habitat for this species is the primary goal. Management within this LSR will focus on protecting existing spotted owl habitat around all activity centers. Management activities will primarily take place in non-spotted owl habitat within spotted owl circles (e.g. fuelbreaks on south-facing aspects) or outside spotted owl circles. Management objectives to reduce risk of habitat loss to catastrophic wildfires, insects, and pathogens include reducing stand density in non-spotted owl habitat and outside spotted owl circles; altering species compositions to favor fire-tolerant and insect/disease resistant species; and reducing vertical and horizontal fuel continuity outside spotted owl circles and outside LSR boundaries. Silvicultural and other options to attain objectives within dry and mesic forest types include thinning (PCT/CT); pruning; fuelwood collection; mechanical fuel treatments; handpiling fuels; prescribed fire; favoring seral, fire-resistant species such as ponderosa pine, and western larch; and developing or maintaining fuelbreaks. Silvicultural options to protect moist grand fir and subalpine fir forests include treating adjacent dry forest stands as described above; favoring fire tolerant and insect/disease resistant species; reducing negative impacts of insects and pathogens by reducing the vertical and horizontal continuity of host species; and developing or enhancing fuelbreaks.

4. Northern Spotted Owl

A total of 24 spotted owl activity centers are currently known within the Swauk LSR. Of these, 22 (92%) are below the habitat threshold levels and two (8%) at currently at the threshold levels. Research has shown that the numbers of owls in the Swauk may be declining (Forsman et al. In press). Because this area is one of the "big three" it is important to emphasize the development of suitable spotted owl habitat conditions.

Currently, the connectivity of habitat within the LSR is considered to be low as a result of high open road densities and habitat fragmentation.

Restoration activities that could be used include the use of silvicultural practices to promote suitable habitat development in areas not currently providing suitable habitat. This is especially desirable in the mesic and moist forests. The risk of habitat loss from fires could be accomplished by reducing fuels in area that are not currently spotted owl habitat such as south slopes or open pine stands with high brush fuels. Habitat effectiveness and connectivity could be enhanced by reducing the open road density and revegetating the road beds. This would be especially effective in the areas identified as forest interior.

The following is the discussion and results of the within LSR Spotted Owl Module for the Swauk LSR. This module reviews the home range sites for spotted owls, as well as connectivity within the LSR. See appendix for order, explanations and process of modules. See Suitable Spotted Owl/Dispersal Habitat and Activity Center map and tables, Forest Interior Map and tables, Riparian Reserve map and tables and Security Habitat map and tables.

a) Suitable Spotted Owl Habitat

The Swauk LSR has 45,675 acres (42%) of nesting/roosting/foraging habitat, of that 27,521 acres are in the wetter vegetation type and have a good chance of sustainability. There is a potential for the LSR to have 73,792 acres (68%), but much of that is in the dry and not sustainable. The most contiguous (sustainable) suitable spotted owl habitat in the LSR is between Teanaway Ridge /Baker/Deer Gulch and the Table Mountain area. Secondly are Devils' Gulch and Bear Creek. There are extensive past clear cuts and shelterwood harvests, that currently fragment habitat. To meet the recovery goals for the spotted owl, there is a need to increase/accelerate spotted owl habitat, especially accelerating old plantations..

b) Spotted Owl Home Ranges

The Swauk is one the "big 3" LSR's, which will manage owls over risk. Owl home ranges will have a target of optimal habitat per owl pair, to assist recovery of the species. Currently for the Forest, that amount of acreage is 3,994 acres within a 1.8 miles radius, or 60% of the home range. The goal for recovery of the owl, is 20+ pairs of owls in the Swauk LSR. There are a total of 24 spotted owl activity centers. This includes 22 pairs of owls. This LSR has 22 of the 24 sites below threshold, the other 2 sites are at or above threshold. No owl sites are at target amounts over 3,994.

There are 18 dry owl sites, making this a risk for long term sustainability in the dry forests, if the wetter forests are not allowed to recover. There is great potential to restore sustainable habitat in the wetter forest groups for long-term population viability. There is also a need to protect existing habitat and home ranges, especially in sites below threshold and target acreages. Overtime, it is expected that higher quality and more sustainable habitat will be restored to the western portion of this LSR. The drier forests will eventually be managed for other late-successional species, after the northern spotted owl population has recovered.

Table VI-11, Status Individual Spotted Owl Home Ranges and Restoration Opportunities

Spotted owl	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				.33 mile Circle Around Activity Center ¹¹				Restoration
	Dry	Mesic	Wet	Total	Dry	Mesic	Wet	Total	Dry	Mesic	Wet	Total	
SO301	1029	0	126 3	2292	282	0	111	394	81	0	1	82	mpa
SO304	435	0	243 1	2866	58	0	415	473	14	0	77	91	mpa
SO309	1260	0	451	1711	282	0	137	419	61	0	59	120	mpa
SO310	1097	0	166 2	2759	249	0	243	492	71	0	47	118	mpa

Spotted owl	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				.33 mile Circle Around Activity Center ¹¹				Restoration
	Dry	Mesic	Wet	Total	Dry	Mesic	Wet	Total	Dry	Mesic	Wet	Total	
SO312	1369	0	128	1496	255	0	0	255	79	0	0	79	mpa
SO317	2138	0	104	2241	427	0	0	427	98	0	0	98	mpa
SO318	1239	0	655	1894	151	0	37	188	38	0	13	51	mpa
SO323	813	0	2105	2918	126	0	271	398	48	0	13	61	mpa
SO324	1916	0	161	2077	323	0	0	323	66	0	0	66	mpa
SO335	1015	0	1748	2762	332	0	204	536	103	0	8	111	mpa
SO336	1068	0	651	1720	234	0	0	234	72	0	0	72	mpa
SO337	1868	0	226	2094	284	0	2	286	47	0	0	47	mpa
SO345	633	0	625	1258	53	0	76	129	22	0	23	45	mpa
SO350	1355	0	292	1647	221	0	0	221	59	0	0	59	mpa
SO352	839	0	2560	3399	187	0	419	607	45	0	91	135	mpa
SO370	2141	0	348	2489	449	0	1	450	102	0	0	102	mpa
SO387	559	0	1306	1865	137	0	231	369	62	0	19	81	mpa
SO701	1653	565	130	2348	291	73	0	364	83	29	0	112	mpa
SO712	985	186	1659	2830	209	0	210	419	44	0	4	48	mpa
SO713	1491	556	357	2403	328	119	0	447	72	23	0	95	mpa
SO756	1336	332	1034	2702	278	67	89	434	69	18	14	101	mpa
SO757	1048	184	1633	2865	259	7	126	392	83	0	24	107	mpa
SO761	1817	468	10	2295	205	115	0	320	22	54	0	75	mpa
SO764	1284	371	445	2100	229	107	3	339	43	59	0	102	mpa

¹ Near the LSR or MLSA but not inside the LSR or MLSA.

² Spotted owl site overlaps with other LSR/MLSA.

³ RS = Residential Single; P = Pair; PY = Pair with Young, based on highest occupancy.

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

⁵ If the majority of suitable spotted owl habitat in .7 mile circle is dry or mesic, then it is a dry spotted owl. If the majority is wet, then it is a wet spotted owl.

⁶ **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/Target: > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

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

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

Near = activity center is inside late successional habitat near forest interior.

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

¹⁰ Dry suitable spotted owl habitat includes 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.

¹¹ A larger circle will be needed if there is less than 100 acres of suitable habitat

Restoration Opportunities: “**m**” Monitor site; “**a**” Accelerate habitat around site and home range; “**p**” Protect what nesting/roosting/foraging habitat exists.

c) Spotted Owl Dispersal And Connectivity

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 LSR is 32,642 acres (30%) and will grow up to be nesting/roosting/foraging habitat. Habitat providing dispersal/Connectivity corridors and patches within the Swauk LSR is noted on 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 Swauk has 31% in late-successional wetter forest habitat, this needs to increase. There is a high amount of forest interior, dry habitat, which currently provides good connectivity for spotted owls, but over time is not sustainable. Roding 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 and in AMA's, and in wilderness areas (NWFP 1994, Ch 3-4 pg. 240-241).

d) Restoration Opportunities And Potential Projects

1. Meet goals of LSR for 20 pairs of spotted owls.
2. Improve and accelerate N/R/F habitat, to maintain high number of spotted owl pairs.
 - Plantations in wet/moist vegetation groups predicted to be habitat in 100 years.
 - Pole sized stands in wet/moist will be habitat in 50 years.
 - Plantations in mesic/dry vegetation groups will be habitat in 120 years.
 - Pole sized stands in mesic/dry will be habitat in 70 years.
3. Aggressive protection of remaining suitable spotted owl habitat, from outside LSR, on Matrix lands.
4. Protect spotted owl home ranges within LSR, between owl circles, by implementing risk reduction on first on non-suitable habitat, then on Dry and Mesic habitat:

5. Fuels reduction and hazard reduction occur outside N/R/F habitat in short term, shift emphasis in 50 years. Accept more risk from fire, manage at high end of spotted owl habitat DC. Spotted owl habitat maintained at 60% of home range in "big 3 LSR's, 500 Acre core area protected, 100 acre activity center protected.
6. Monitor/maintain connectivity outside LSR.
7. Monitor spotted owl activity centers, 500 acre core and home ranges of owls Acres below Threshold highest priority.
8. Monitor spotted owl activity centers, 500 acre core and home ranges of owls at threshold (see list).
9. Field verify habitat within 500 acre home ranges of spotted owl sites below threshold in that core, but above threshold in the home range.
10. Increase habitat effectiveness and connectivity by reducing open roads and revegetating road beds. Especially in forest interior habitat patches.
11. Reduce road densities
12. Maintain dispersal/connectivity habitat

5. Aquatic

a) Summary of Aquatic Goals for Swauk LSR

- Protect salmon and resident non-salmonid fish populations and habitat in core areas.
- Prevent increases in water temperature
- Reduce water temperature
- Minimize fine sediment input
- Increase large woody debris recruitment potential
- Reduce ground to surface water conversion by roads, especially in land types A and B.
- Evaluate road surfacing maintenance, especially in land types C.
- Reduce and avoid increase in riparian roads.
- Manage upslope vegetation, roads, and activities to increase base flows and to avoid increase in peak flows.
- Preserve and restore all floodplains, side channel and riparian wetland habitat, especially in C and E channel types.
- Protect and inventory upslope wetlands and ponds.
- Restore natural disturbance regimes (landslides, fire, flood, disease) as practicable.
- Discourage the spread of brook trout.
- Gather more information on salmonid and non-salmonid aquatic biota.
- Upgrade culverts and other stream crossings to pass 100 year flood events and provide fish passage.

(Table Mountain Watershed Analysis, Projects were identified in the watershed analysis.)

b) Key Issues

1. Core fish areas have been identified within and downstream of Swauk LSR. Cutthroat trout, in the Upper Stafford subwatershed. Cutthroat trout are found throughout the majority of the LSR. Steelhead population strongholds occur in the Teanaway drainage, the Lower Teanaway and Lower N.F. subwatershed. The Swauk drainage contains critical steelhead habitat that needs to be protected. Sockeye/Kokanee salmon are known absent throughout the subwatershed's. Mountain whitefish are unknown. Lamprey are unknown. Summer Chinook are known absent.

Redband/native rainbow trout are known to occur in the Headwaters Peshastin, Devils Gulch and East Fork Mission subwatershed's, they have an unknown status in the Upper Naneum, Williams, Swauk, Upper Swauk and Lower Swauk subwatershed's and a stronghold exists in the Headwaters Peshastin subwatershed.

Spring Chinook are known present in the Lower Swauk subwatershed's, in Devil's Gulch subwatershed's they are known absent, in the Headwaters Peshastin, East Fork Mission, Upper Naneum, Headwaters Swauk, Upper Swauk, Williams, Lower Naneum Tributaries, Lower Teanaway, Lower North fork Teanaway and Stafford subwatershed's the presence is unknown.

2. Federal candidate species and other species of concern:

Bull trout populations are not abundant in the Swauk. Swauk Creek has a few entries from the Yakima River, but it is speculated that the irrigation diversions associated with the creek cause dewatering and high water temperatures that discourage bull trout from remaining as residents of the lower reach. Bull trout are found in the Teanaway system in portions of the subwatershed west of the LSR boundary.

Aquatic mollusks found in Swauk LSR are *Menetus operculus* and *Pisidium sp.* The recorded individuals are incidental. Little is known about populations of mollusks as there have been no formal studies of populations or habitats within the Wenatchee National Forest.

3. Anadromous salmonid populations within the LSR are spring chinook salmon and steelhead trout.

Concerns include the severely reduced number of returning spawning adults from historic levels (pre 1880's), loss of anadromous species historically using the watershed for spawning, loss of genetic diversity of the returning population, condition of the physical habitat and water quality for incubation, rearing, over-wintering of young, migration, and spawning. All life stages are vulnerable to management and recreation activities causing changes in habitat.

4. Resident salmonids: Salmonids have access to all part of the LSR at high flows and have been confirmed to utilize the streams throughout the LSR during their development. Spring chinook salmon and steelhead trout are found in the Peshastin and Mission drainages. Steelhead are also found in the Swauk drainage.

Concerns include maintaining existing populations, protecting against habitat degradation through management activities and dispersed recreation.

5. Introduction species: Eastern brook trout have access to the Teanaway and Swauk systems. They are recorded in Iron Creek and in the Peshastin and Missions systems.

Concerns include changes as result management activities or recreation that would favor brook trout over native species.

6. Non-salmonid aquatic biota : There is little information about other aquatic biota in this area.
7. Water temperature: Maximum temperatures recorded in 1993-1994 max-min thermometer monitoring for Swauk exceeded Washington State water quality standards. The temperatures were 68 degrees Fahrenheit in Swauk Creek, 70 degrees in Iron Creek and 76 degrees in Hurley Creek. Lower reaches of creeks within the LSR passing through private/state lands have been tapped for irrigation diversion. These low flow, unshaded, riparian zones cause higher water temperatures in Swauk Creek and others. Swauk Creek has had much mining development and dispersed recreational activity within the riparian zone and Highway 97 parallel to the creek often passing within the floodplain. Much of the overstory has been altered and much of the LWD has been removed from the creek. In the Headwaters Swauk subwatershed, Iron Creek has been disturbed by timber harvest removing stream bank vegetation at several sites. Dispersed recreation, camping and recreational mining are retarding the recovery of the riparian vegetation.

In Lower Naneum subwatershed, High Creek and Wilson Creek have one reach each that has poor canopy closure to protect the stream from solar heating. In the Upper Naneum subwatershed, West Fork Naneum Creek has shown temperature problems. Naneum Creek, Nealey Creek, Howard Creek and the West Fork Naneum have poor canopy closure.

Based on available data, the most severe temperature problems in the LSR occur in Mission Creek and Peshastin Creek. Private land ownership, railroad and highway right-of-way probably play an important role in the temperature problems with some contribution from Forest Service activities upstream. The concern is focused by these streams importance for their steelhead spawning runs.

8. Fine sediment: Sediment sampling information pointed to Peshastin and Mission as the two rivers with the highest sediment levels of the water ways sampled by the Wenatchee National Forest surveys. Of note is that all samples collected data below heavily managed areas. In the Upper Naneum subwatershed, the West Fork Naneum and Howard Creek have sedimentation problems. In Lower Naneum Tributaries subwatershed Wilson Creek and High Creek have sedimentation problems. In all three Swauk subwatershed have streams with sedimentation problems, but they are not as severe as the problem in Swauk Creek. Iron Creek in the Headwaters Swauk subwatershed, was surveyed in 1992 showing sedimentation problems. In Williams subwatershed, Williams Creek, Boulder Creek, Lion Gulch, Cougar Gulch, Harknes Gulch and Deer Gulch have not been surveyed, but based on development and current mining activities there are likely sedimentation and temperature problems. Much of the Williams subwatershed is privately owned.
9. Channel complexity: Channel complexity and lack of LWD is a concern in the Peshastin, Mission, Swauk and Teanaway mainstems. Tributaries are overall deficient in LWD, with some having little potential for future LWD recruitment.

Channel complexity has implications for fish habitat and for hydraulic regime. Components of channel complexity include: Large woody debris (LWD), pool abundance, pool type, pool depth, width:depth ratio, substrate diversity, sinuosity, cover, undercut banks, bank vegetation, riparian vegetation, roughness coefficient, side channels, floodplain connectivity.

Riparian road density is often inversely related to channel complexity and quality of riparian habitat.

10. Aquatic nutrient cycling depends in part on the riparian understory vegetation, groundwater/surface water partitioning, in-channel LWD, hydraulic retentively, pool depth and character, micro invertebrate community structure, and returning anadromous biomass. We have inadequate data to evaluate aquatic nutrient cycling at this time. There is also a relationship between soil productivity of the upland soils, the overall health of the land and aquatic nutrient cycling. Management activities on uplands need to be evaluated for their impacts on the aquatic community downstream.
11. Hydraulic Regime: The upland areas have been subject to a considerable amount of timber harvest activities. In many areas this has caused a large percent of the harvest area to have compacted soils. Compacted soils are found to increase overland flow and sediment pick up, they usually cause the timing of peak flows to be earlier than historic.
12. Landtype: Landtypes in Swauk LSR are categorized as C, E, F, G. See the map in Appendix 21 of the Forest-Wide LSR/MLSA Assessment. Land type association C is Glaciated Mountain slope of crystalline bedrock. Type E is a mountain slope also of crystalline bedrock; type F has structurally controlled mountain slope land of volcanic or sedimentary formation. Land type G is a plateau land form.
13. Channel type: Source, transport, and deposition are the major functions that result from channel type. Channels are influenced by gradient, confinement and size of the substrate that makes up the stream bed and banks (Rosgen). Concern occurs when management activities interfere with or change the natural channel functioning. The large proportion of roads within the riparian zone and floodplains in Swauk LSR act to confine the stream channels and functioning. The crossings can interrupt the input of LWD and change natural stream flow pattern.
14. Peak flows: Generally snow melt during spring and early summer supplies the water for the aquatic system. Rain on snow events, warm "chinook" winds cause unseasonable snow melts that may result in flooding. Management activities that alter the riparian zone or the adjacent upland vegetation influence the rate of snow melt, percolation of water into or over the soil. Protection of meadows, side channels and other floodplain areas will help lower the impact of peak flows. Careful upslope management, road placement, grazing and recreation practices will also help mitigate peak flow impacts.
15. Low flow periods occur seasonally, extremely low flows can strand organisms, reduce aquatic habitat, create passage barriers, increase water temperatures, and reduce the streams ability to move sediment and bed load. The management factors that help mitigate peak flows will also help mitigate against low flows.
16. Water withdrawals are mostly located on non Wenatchee National Forest lands and in the lower portions of drainages. First Creek has a diversion into Green Canyon. The dewatering of some creeks lower reaches at low flow contributes to the isolation of fish populations. Swauk Creek, Peshastin Creek and Mission Creek have had dry portions in the past drought years. Peshastin has a water diversion and Mission has a series of pump locations. Additional water diversions occur in Williams Creek, Wildcat Gulch, and the head of Lion Gulch.
17. Road Density: Average road density for the 168.7 square mile of Swauk LSR is 5.49 miles per square mile within the riparian zones. There are as estimated 108 miles of roads within the riparian reserve area. Lower N.F. Teanaway, Lower Swauk, Williams, Upper Swauk, Headwaters Swauk and Headwaters Peshastin have riparian road density problems.
18. Upslope vegetation:

Lower N.F. Teanaway subwatershed, Jack Creek has had a lot of harvest activity, the dominant seral stage in the riparian zone is sapling pole size. The Headwaters Peshastin subwatershed has both roads and timber harvest units within the riparian zone. There have been shifts in vegetation from coniferous to deciduous (alder) in some areas.

Lower Teanaway subwatershed is largely state or private (Boise Cascade) land. Drainages that are privately owned lands include Indian Creek, Dickey Creek, and Lick Creek. The owners have and are harvesting their lands.

In Stafford and Devil's Gulch subwatershed's, the dominate successional stage is large trees. There have been minimal harvest activities and the riparian zone is generally healthy.

19. Floodplain connectivity: The large proportion of roading in the riparian zones has confined many of the floodplains. The major drainage mainstems are very altered, without much opportunity to do recovery projects. They contain portions of state highway and large portions of the lower reaches are privately owned.

20. Upslope wetlands:

Upslope wetlands are known to occur with the LSR, they are not currently mapped, but need to be protected as Riparian Reserves/Unique Habitats.

21. Disturbance Regimes: We have come to recognize that suppression or alteration of natural disturbance regimes can lead to fundamental long term recourse changes. Concern for minimum viable populations or habitats may not be able to withstand moderate disturbance. Aquatic systems are now seen to be dependent on disturbance by fire, flood, insect and disease use of forest vegetation, landslides, volcanic actions. Humans have a different agenda than natural systems, and have used other activities to build and maintain the habitats more to their needs. Historic and current grazing, mining, travel, vegetative management, fire exclusion and other activities have altered the habitats from their 'natural' balances (pre 1700 conditions).

6. Noxious Weeds

Centaurea diffusa, *C. maculosa* and *Linaria dalmatica* are present along roads particularly Highway 97, Mission Creek, and the Teanaway. Other species include *C. repens*, *Chrysanthemum leucanthemum*, *Hypericum perforatum*, *Senecio jacobaea* and *Cirsium canadensis*. Following through the noxious weed module, there are no Class A noxious weeds within the Swauk LSR. The Class B-designates and Class C noxious weeds that are known to occur within the LSR are more or less widespread. One exception is *Senecio jacobaea* at Jack Road 9738-112. This population is high priority for control efforts. Control efforts should focus on the Devil's Gulch, Haney Meadow, Teanaway Ridge, Bear Creek, and Lion Rock Trailheads, and Campgrounds throughout the Swauk corridor. The extent of *Cirsium canadensis* is likely limited and local populations should be controlled or eradicated. Harrod (1994) provides a brief synopsis of control methods available and provides recommendation for noxious weed management.

7. Fire Plan

a) Overview

This plan is intended to provide guidance for the management of the Swauk LSR. It is intended to supplement the Fire Management Plan for the Late Successional Reserve System and will become a portion of the Fire Management Action Plan for the Wenatchee National Forest.

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

b) Fire Prevention Actions

The following actions are specific for the Swauk LSR. They are intended to supplement the actions which will be implemented on a Forest wide basis.

- Emphasize fire prevention actions at all dispersed sites.
- Utilize educational opportunities at the Swauk Discovery Trail, Swauk Campground, and Haney Meadows Horse Camp.
- Develop a comprehensive fire prevention sign plan for the entire reserve.
- Implement campfire restrictions as warranted from July - September in the Swauk and Mission Cr. drainages.
- Develop a fire prevention plan specific to preventing fires started by miners and their operations.
- Develop an interagency fire prevention plan to contact local residents. (Lion Gulch & Liberty)
- Initiate hazard reduction actions adjacent to developed and dispersed recreation sites. (Swauk, Mineral Springs, Lion Rock, Haney Meadows, Red Top Lookout, Liberty Work Center, and Swauk Discovery Trail)
- Make hunter education an emphasis item in fire prevention plans.
- As a hazard reduction measure emphasize fuelwood collection around recreation use sites in the dry forest type and along the Highway 97 corridor, also near residences. (Liberty)
- Emphasize contact with the following special interest groups; homeowners' associations' miner's association, O.R.V. groups, Backcountry Horseman, Town of Liberty, all groups that use the Swauk Discovery Trail, organized rockhounding groups, and grazing permittees.
- Implement road restrictions and closures as warranted during periods of extreme fire danger.

The following proposed actions to protect the LSR from fires originating outside the LSR boundaries.

- Develop pre-attack facilities (fuel breaks) near Lauderdale Junction in the Swauk drainage.
- Develop pre-attack facilities in First Creek, Green Canyon, and Reecer Creek.
- Develop pre-attack plans and fuel breaks for Mission Creek and the following areas of specific concern. Beehive Reservoir, Valley High, Camas, Sand Creek, Mission Ridge, Lake Clara.
- Develop fuelbreaks on the west side of Teanaway Ridge to separate private land slash.
- Develop fuelbreaks around the town of Liberty.
- Stress the prevention of fires on lands immediately adjacent to the LSR (Timber Sales)

c) Fire Detection

- Staff Red Top Lookout during the months of July through September.
- Consider supplemental staffing of Tip Top, Boundary Butte, and or Beehive during periods of high fire danger or after lightning occurrence.

- Work with the residents of the Town of Liberty, Mineral Springs Restaurant, Liberty Cafe, and Ingalls Creek Lodge on how to report fires.
- Implement aerial detection after all lightning storms which occur over the reserve.

d) Fire Suppression

- Spotted owl activity centers are the highest priority for protection of resources (following protection of human life and improvements). All wildfires in the 1.8 mile buffer will be suppressed at minimum acres.
- Because of the flammability of this LSR and desire to maintain late successional attributes, aggressive initial attack will take place on all areas in this LSR.
- Fire suppression actions will be implemented on an interagency basis as appropriate.
- Protection of riparian areas from fires and fire suppression damage is a priority.
- Improvements will be a priority for protection (Liberty Guard Station, Red Top Lookout.
- Swauk Discovery Trail, Swauk RAWS, Tip Top microwave, all recreation facilities and all special use permits)
- Pre-planned dispatch cards will be prepared for the entire reserve.
- The use of aerially delivered firefighters and retardant is appropriate in the LSR.
- The use of dozers requires the approval of the appropriate District Ranger.
- Burning out is an appropriate strategy when required.
- The Escaped Fire Situation Analysis process will be used to guide large fire suppression. Utilize pre-attack plans and materials. These may be prepared in advanced and updated annually prior to the fire season.
- Protect known Threatened and Endangered Species Habitats from wildfire.

e) Vegetation Management

- Where recommended by biologists, return dry forest types to conditions encountered under historic disturbance regimes.
- Suggested activities to reduce fire hazard include pruning, commercial and pre-commercial thinning, wood gathering and the use of prescribed fire.
- High density , multi-storied refugia will be maintained as described by an interdisciplinary team.
- Prescribed fire projects in meadows and steppe are encouraged for the enhancement of native species.
- Maintain a mosaic of age classes and structural conditions across the landscape outside dry forest to support late successional species. (Table Mountain)

f) Prescribed Fires

Prescribed fire opportunities are outlined below;

- There may be an opportunity to utilize natural and management ignited prescribed fires in the upper Iron Creek drainage and Miller Peak area . Additional prescribed fire planning will be necessary to pursue this action.

- The dry site ecosystems should be the priority areas for the use of prescribed fire.
- Hazard reduction near improvements should be priority projects.
- The use of prescribed fire to prevent the spread of noxious weeds is encouraged as appropriate.
- The scale and location of prescribed fire projects to enhance landscape-level diversity as it is tied to the Inherent Disturbance Regimes.
- Prescribed fire should be utilized to enhance the habitat of threatened and endangered botanical species as indicated by the botanists.
- Prescribed fire projects should attempt to minimize the risk of future catastrophic wildfires.

g) Summary

Initial and extended attack are appropriate on all wildfires through out this reserve. The use of prescribed fire is also appropriate, but will be limited due to the density of the spotted owl population and the desire to maintain this habitat. It is realized that this does not promote the desired ecological condition for this reserve and that with this approach there will be a high degree of risk for catastrophic fires to occur.

D. Restoration Opportunities and Potential Project Summary

Table VI-12, Restoration Opportunities and Potential Projects, Swauk LSR

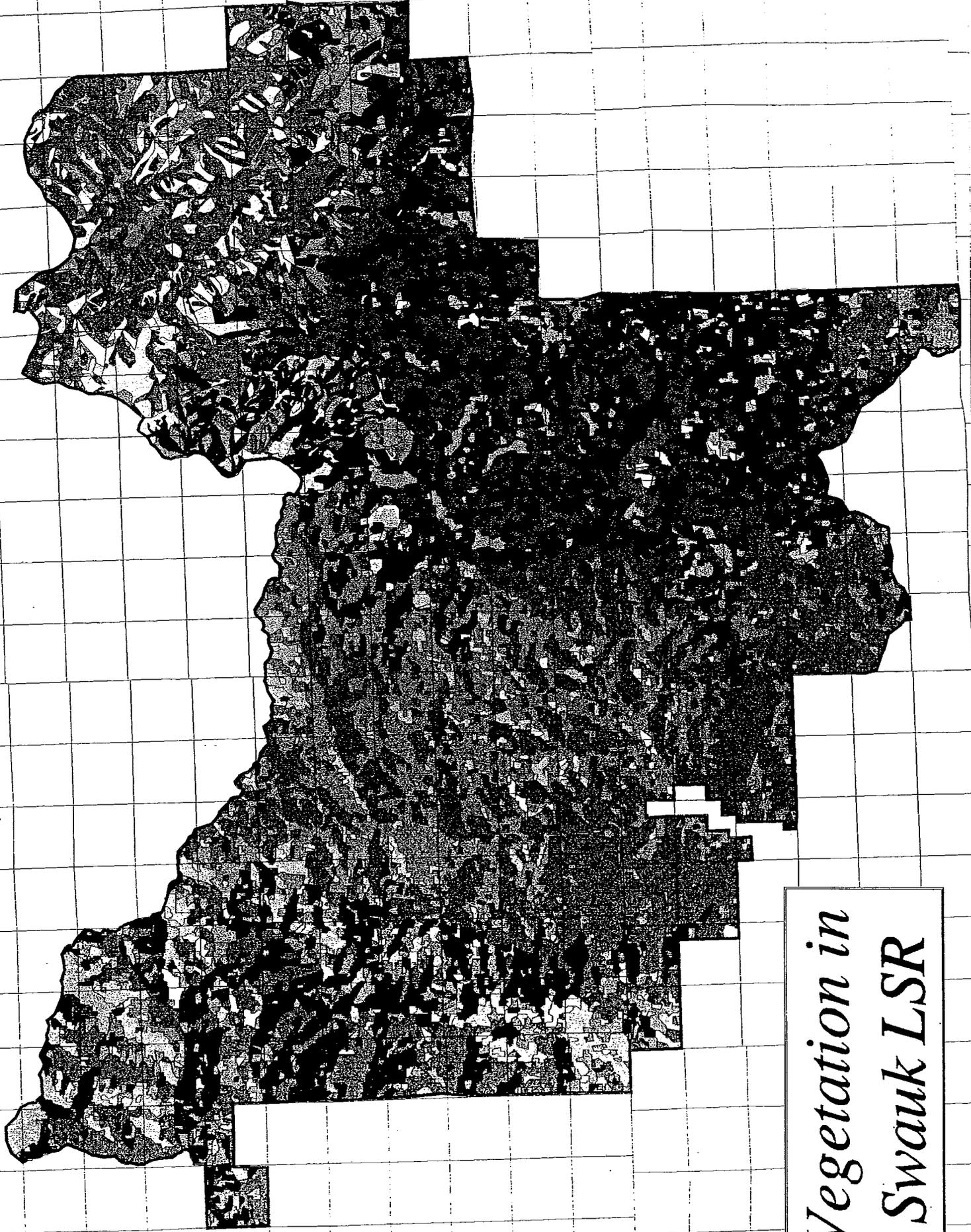
Analysis Module	Restoration Opportunity	Potential Projects	Schedule ¹
Forest-Wide Sustainability	1) Reduce fuel loading and stocking levels in dense successional advanced dry forest stands where they exist between Swauk and the Teanaway LSR and between Swauk and Sand Creek MLSA.	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe sufficient treatments to make landscape level changes in fire susceptibility.	A
	2) Reduce fuel loadings along roads that exist between these LSR's to increase the roads effectiveness as a fuelbreak.	2) Piling of down fuels, firewood gathering, pruning to reduce vertical fuel continuity, construction of shaded fuelbreaks.	B
	3) Reduce fuel loadings in young stands.	3) Precommercial thinning	C
Forest-Wide Spotted	1) Reduce fuel loading and stocking levels in dense successional advanced dry	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described	A

Analysi s Module	Restoration Opportunity	Potential Projects	Sched- ule¹
owl	forest stands where they exist between Swauk and the Teanaway LSR and between Swauk and Sand Creek MLSA	in disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe sufficient treatments to make landscape level changes in fire susceptibility.	
Forest- Wide Connecti vity	1) Improve the linkage for low mobility wildlife species between the Swauk and Teanaway LSR's	2) Do site specific analysis to identify the best area between the two LSR's to manage low mobility species linkage.	C
Unique Habitats and Species	1) Reduce road densities in riparian reserves and in talus areas.	Close or relocate roads as opportunities are identified in Access and Travel Management Planning.	A
	2) Maintain existing subalpine meadows.	2) Remove encroaching conifers from meadows.	C
	3) Increase the amount of interior forest area within the LSR.	3) Close roads near interior forest areas as opportunities are identified through Access and Travel Management Planning.	A
	4) Accelerate the development of late successional forest.	4) Use commercial thinning to accelerate the development of layered stands as described in disturbance module treatment key.	C
	5) Verify the viability of <i>Anemone muttaliana</i> and <i>Chaenactis thompsonii</i> within the LSR	5) Monitor known sites and develop conservation strategy for these species.	B
Connec- tivity Within the LSR	1) Reduce road densities in riparian reserves to improve connectivity for low mobility species that use these areas.	1) Close roads in riparian reserves as identified in Access and Travel Management Planning, revegetate disturbed areas.	A
	2) Promote the development of fire climax stands within the dry forest vegetation group.	2) Thin from below favoring ponderosa pine. Use prescribed fire where current fuel loadings permit the	A

Analysis Module	Restoration Opportunity	Potential Projects	Schedule ¹
		attainment of objectives.	
Disturbance	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. (Vegetation Type #12 - Dense successional advanced.)	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 and western larch. Priority areas for treatment of this stand type are: 1) Outside the LSR to the south and west, 2) Within the LSR but outside of activity centers. 3) Over threshold acres within the activity center. 4) See item 4 under spotted owl for treatment of threshold acres.	A
2)	2) Minimize the extent of stand replacement fires within the LSR.	2) Conduct activities that improve the effectiveness of the existing road system as fuelbreaks, focus on highway 97 corridor.	B
	3) Protect layered true fir forests from fire originating outside of these type, primarily lower elevation dry forest types.	3) Use treatments described in #1 above in the adjacent dry forest types.	B
Spotted Owl	1) See Appendix 39, Northern Spotted Owl Nest Site Protection Within LSRs and MLSAs.		A
	2) Maintain 500 acres of nesting habitat within the 24 Swauk core areas.	2) No Ground or vegetation disturbing activity in spotted owl core area, all 24 are at or below the minimum.	A
	3) Improve sustainability of dense stands (type 12) outside of 1.8 mile spotted owl circles, within the LSR.	3) Use commercial thinning, pruning and fuelwood collection.	A
	4) Improve sustainability of	4) Utilize commercial thinning,	A

Analysi s Module	Restoration Opportunity	Potential Projects	Sched- ule ¹
	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)	pruning and fuelwood collection.	
	5) Improve habitat quality in dense single story stands in spotted owl circles 304, 323, 345, 352, 387 and 712.	5) Utilize silvicultural activities that accelerate the development of multi-layered stands. Focus on single layered pole size stands in moist grand fir and wet forest groups.	A
	6) Obtain information on spotted owl locations.	6) Survey areas to 1994 spotted owl protocol.	B
Aquatic	1) See goals listed in Aquatic section for Swauk	1) Coordinate projects with Table Mountain, Mission and Peshastin Creek Watershed Assessments.	
Noxious Weed	1) Limit the extent and spread of <i>Centaurea diffusa</i> , <i>C. maculosa</i> and <i>Linaria dalmatica</i> which occur primarily along roadways in the Swauk LSR	1) Consider treatments such as handpulling and herbicides to limit extent and spread. Focus should be at Devils Gulch, Haney Meadow, Teanaway Ridge, Bear Creek, and Lion Rock trailheads.	B
	2) Control or eradicate <i>Cirsium canadensis</i> where it occurs within the Swauk LSR.	2) Use combination of treatments such as handpulling, and spot herbicide application to eliminate these populations.	A
	3) Increase knowledge regarding noxious weed presence in the Swauk LSR.	3) Survey LSR for presence of noxious weeds.	C
Fire Plan	1) Protect LS values from loss due to wildfire	1) See fire plan for specific actions	

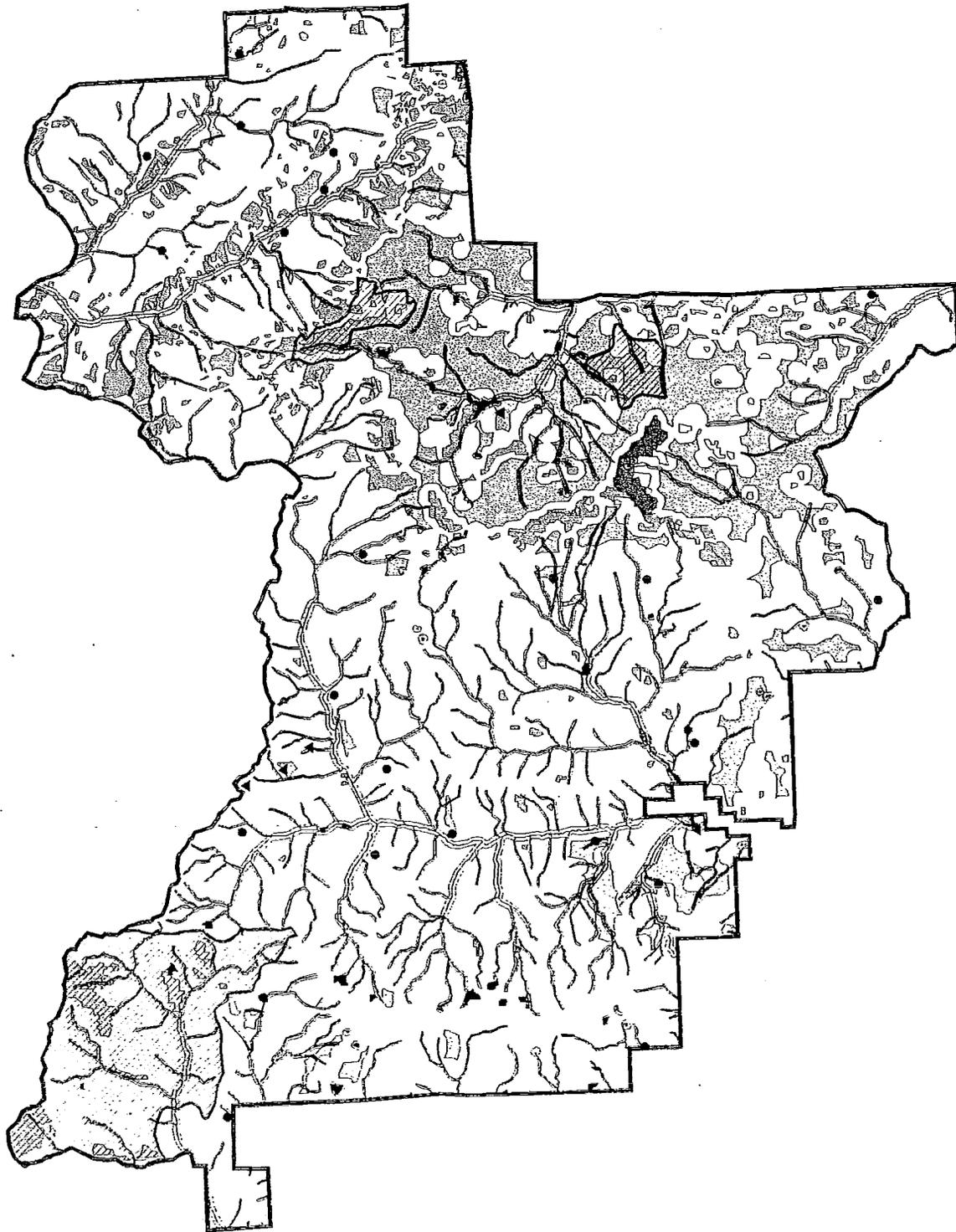
¹ Implementation Schedule; (A) = within 1 year; (B) = within 3 years; (C) = within 5 years



*Vegetation in
Swauk LSR*

Swauk Late Successional Reserve

UNIQUE HABITATS



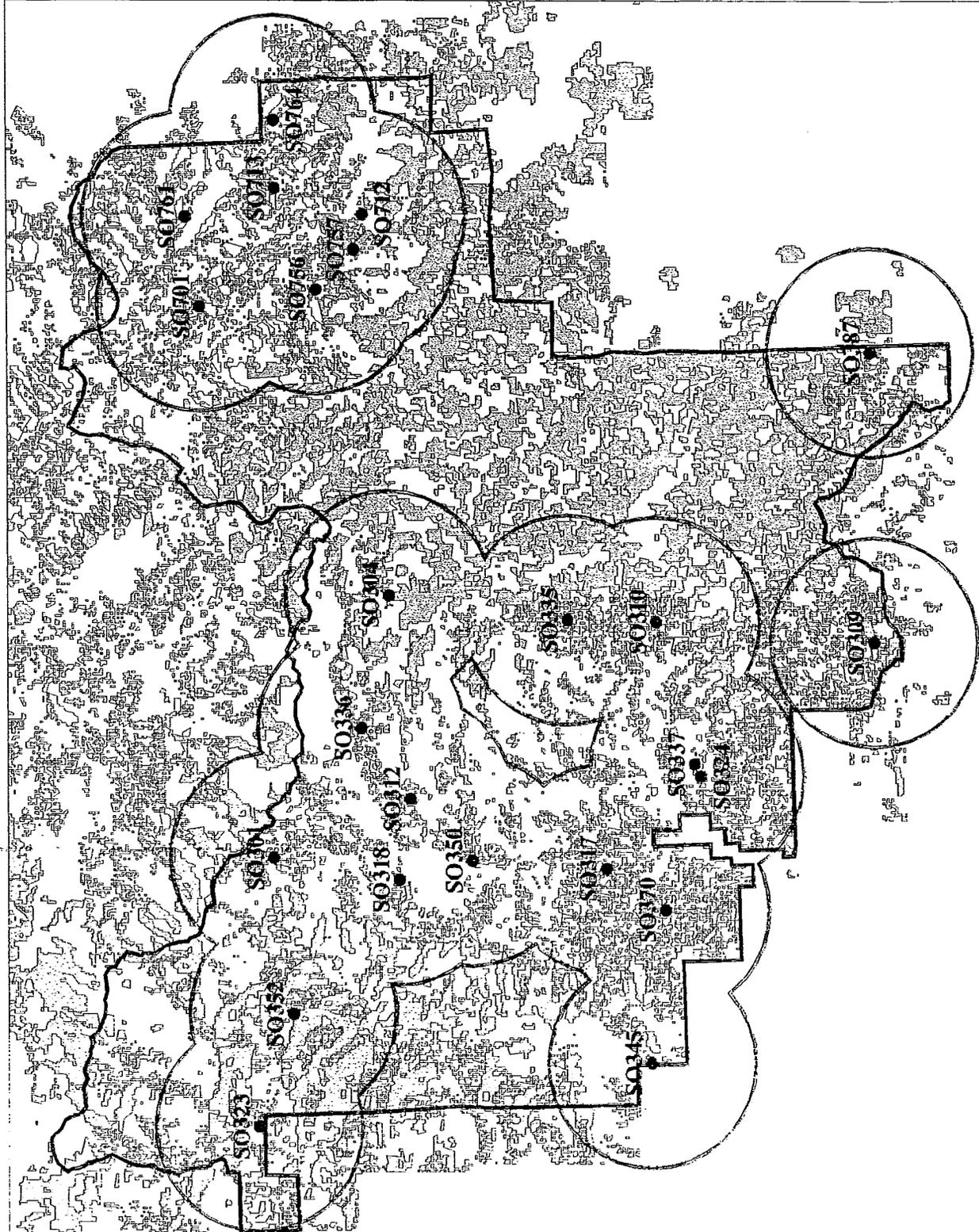
- Large Forest Interior Patches
- Whitebark Pine
- Talus, Scree, Bedrock, Cliff
- Meadows
- Natural Opening
- Shrub
- Deciduous Forest
- Wenatchee Forest Plan Allocations RN1, S11, S12
- Riparian Reserves
- Lakes and Wetlands
- Streams
- Spotted Owl Activity Centers
- Wildlife PETS
- Late Successional Reserve Boundary



Map Scale: 1 inch = 0.380 miles

Swaik Late Successional Reserve

SUITABLE SPOTTED OWL HABITAT



-  DRY Suitable Spotted Owl Habitat (N/R/F)
-  MESIC Suitable Spotted Owl Habitat (N/R/F)
-  WET Suitable Spotted Owl Habitat (N/R/F)

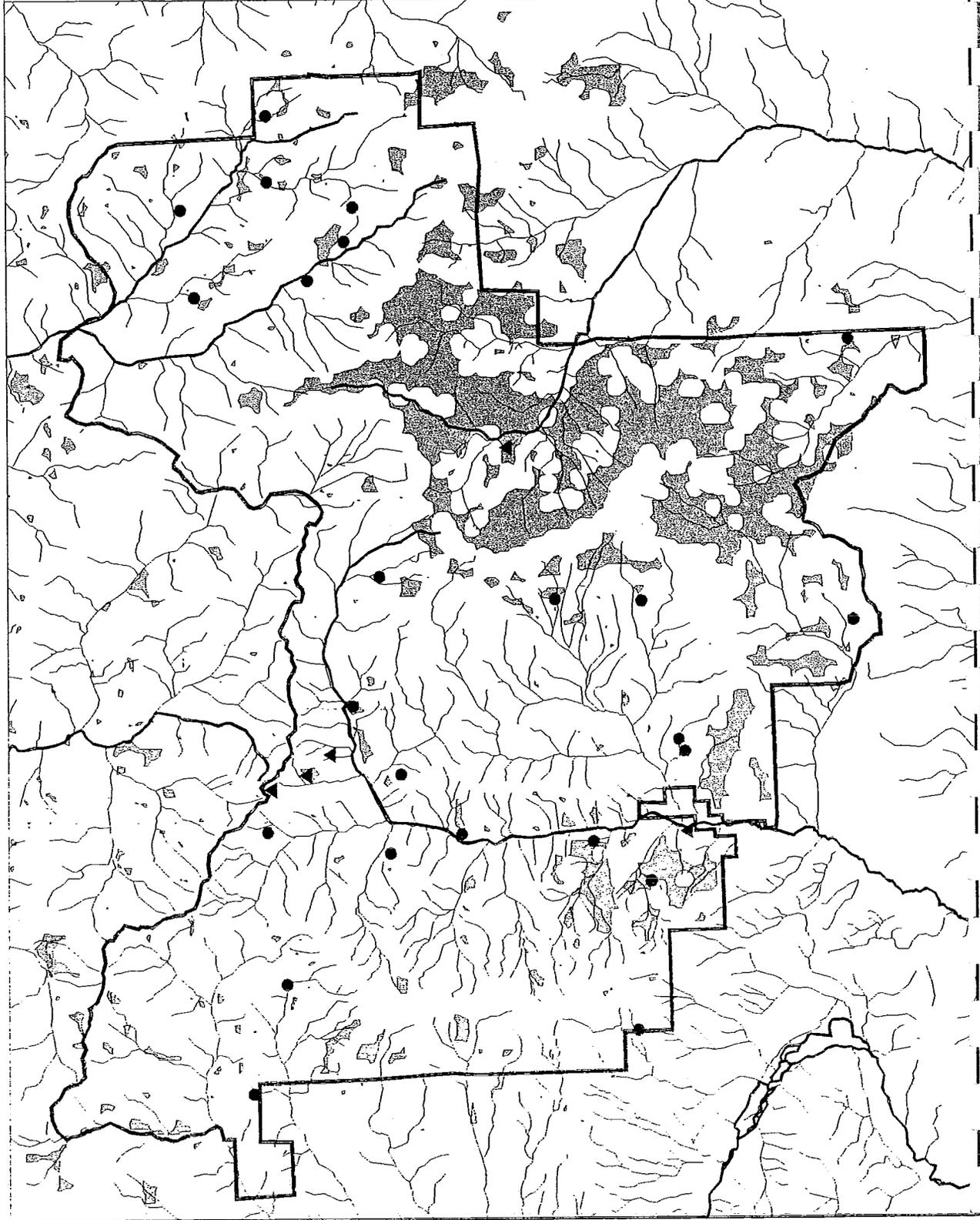
-  1.8 mile buffer around Spotted Owl Activity Centers
-  Spotted Owl Activity Centers
-  Late Successional Reserve Boundary



Map Scale: 1 inch = 0.380 miles

Swauk Late Successional Reserve

FOREST INTERIOR



DRY Forest Interior
MOIST Forest Interior
HIGH Forest Interior

Streams
Major Streams

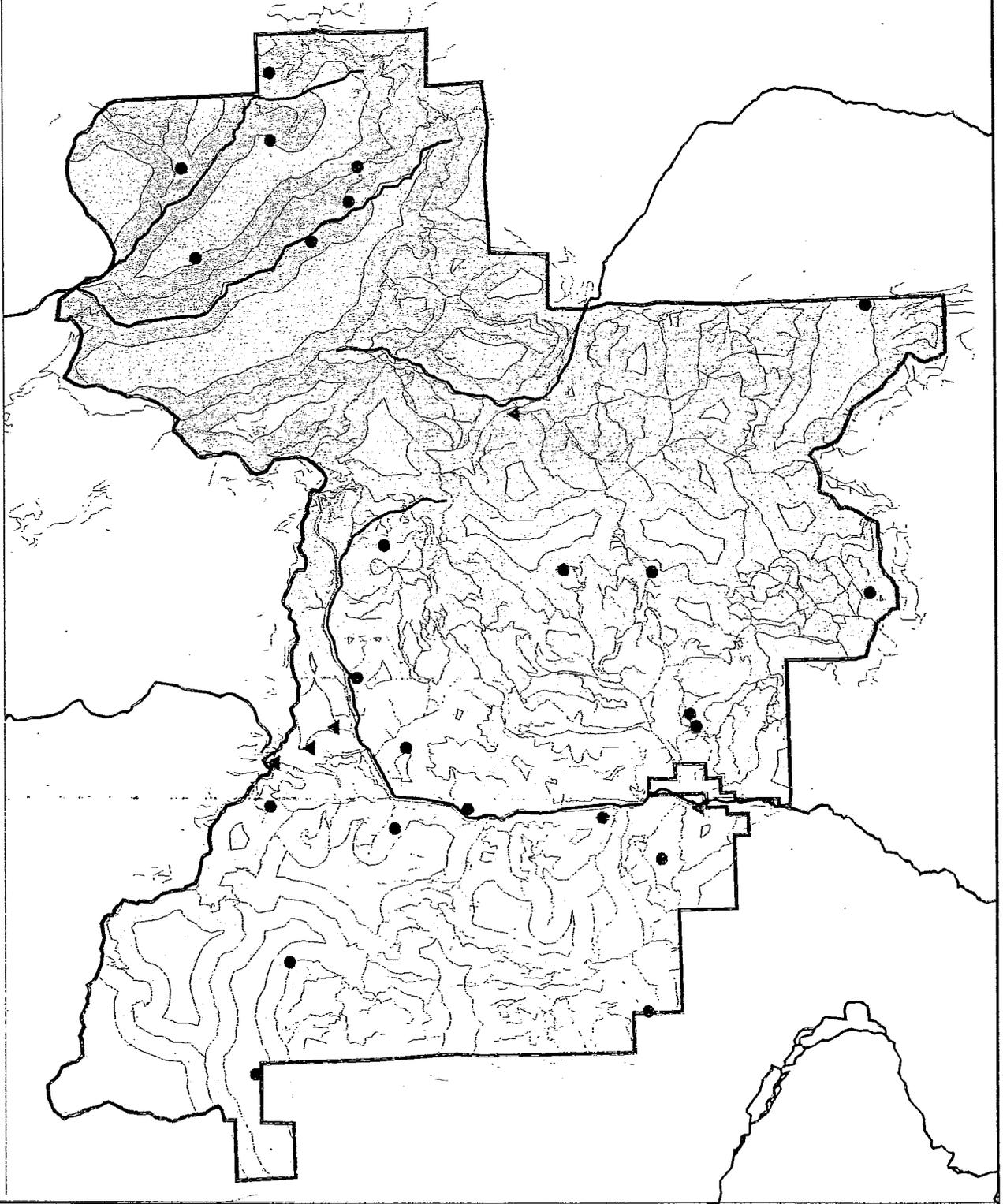
Spotted Owl
Activity Centers
Wildlife PETS

Late Successional
Reserve Boundary



Map Scale: 1 inch = 0.380 miles
04/2/96

Swauk Late Successional Reserve
SECURITY HABITAT



Security Habitat
NOT Security Habitat

Open roads and motorized trails
Closed roads and non-motorized trails

Major Streams

Spotted Owl Activity Centers

Wildlife PETS

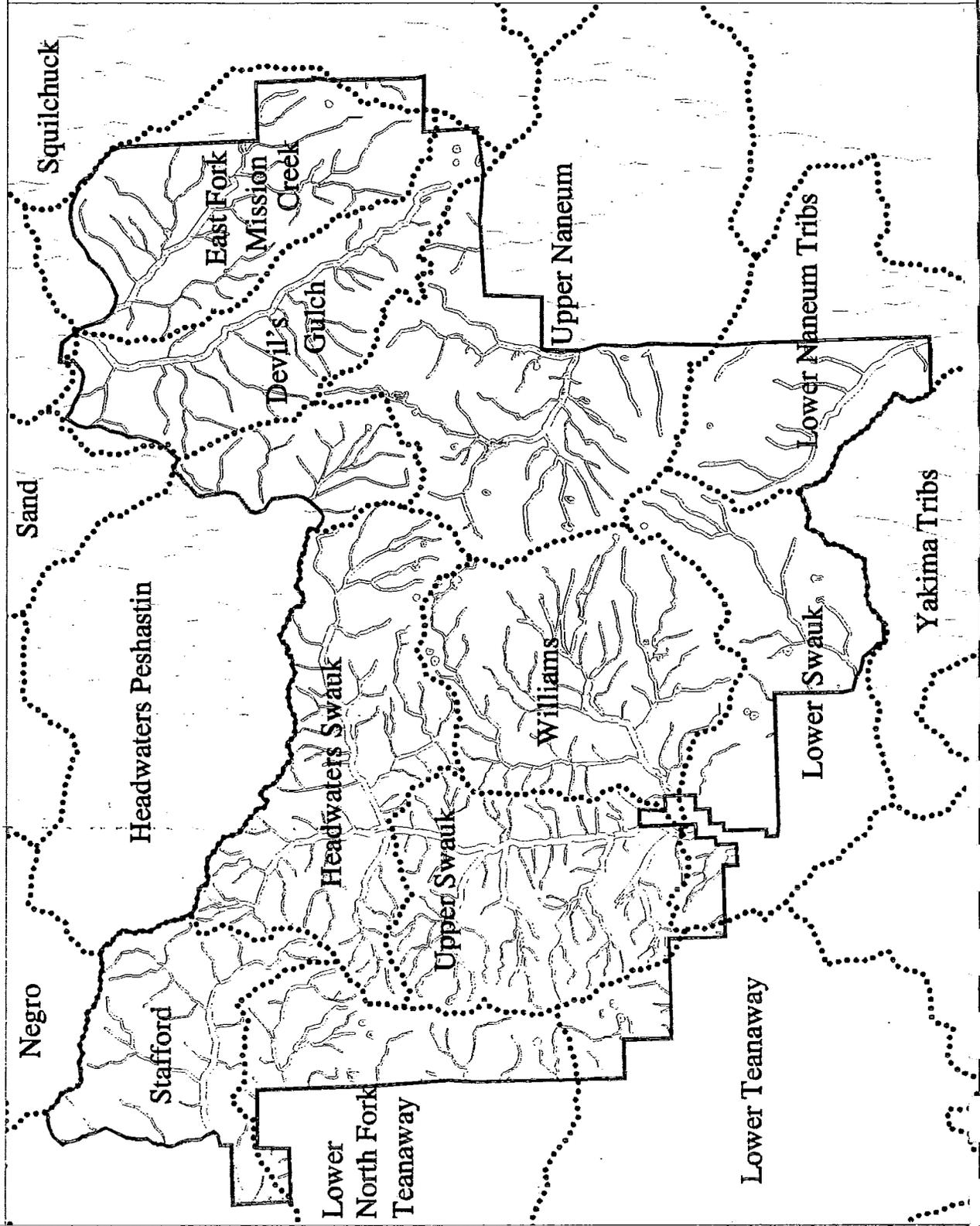
Late Successional Reserve Boundary



Map Scale: 1 inch = 0.380 miles

Swauk Late Successional Reserve

FISH PRODUCTION UNITS (SUBWATERSHEDS)

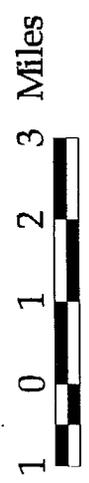
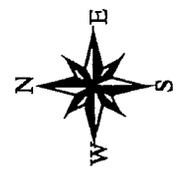
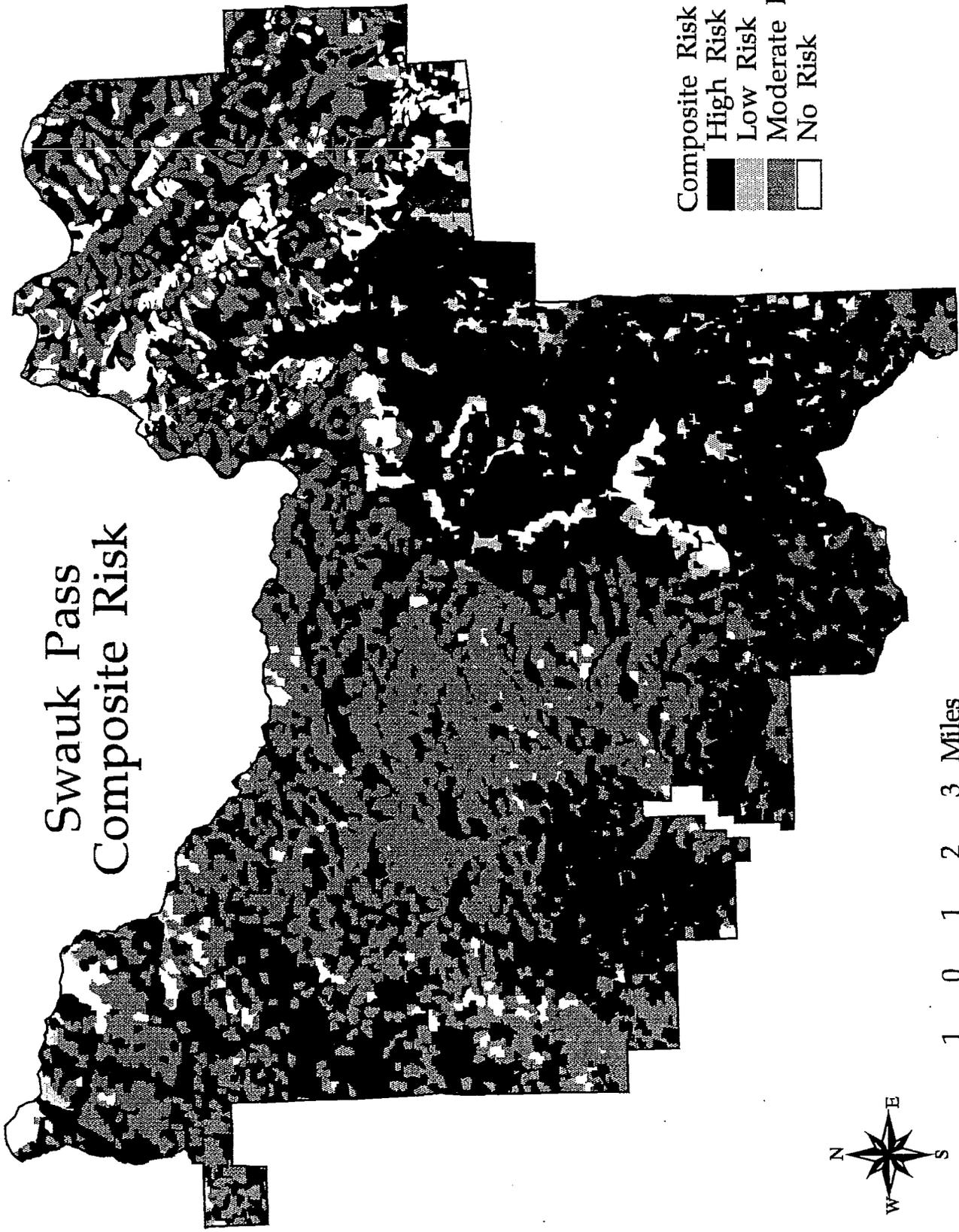


- Riparian Reserves
- ▨ Lakes and Wetlands
- Streams
- ⋯ Fish Production Units (Subwatersheds)
- ⌞ Late Successional Reserve Boundary

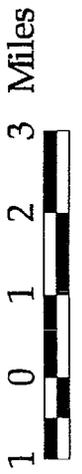
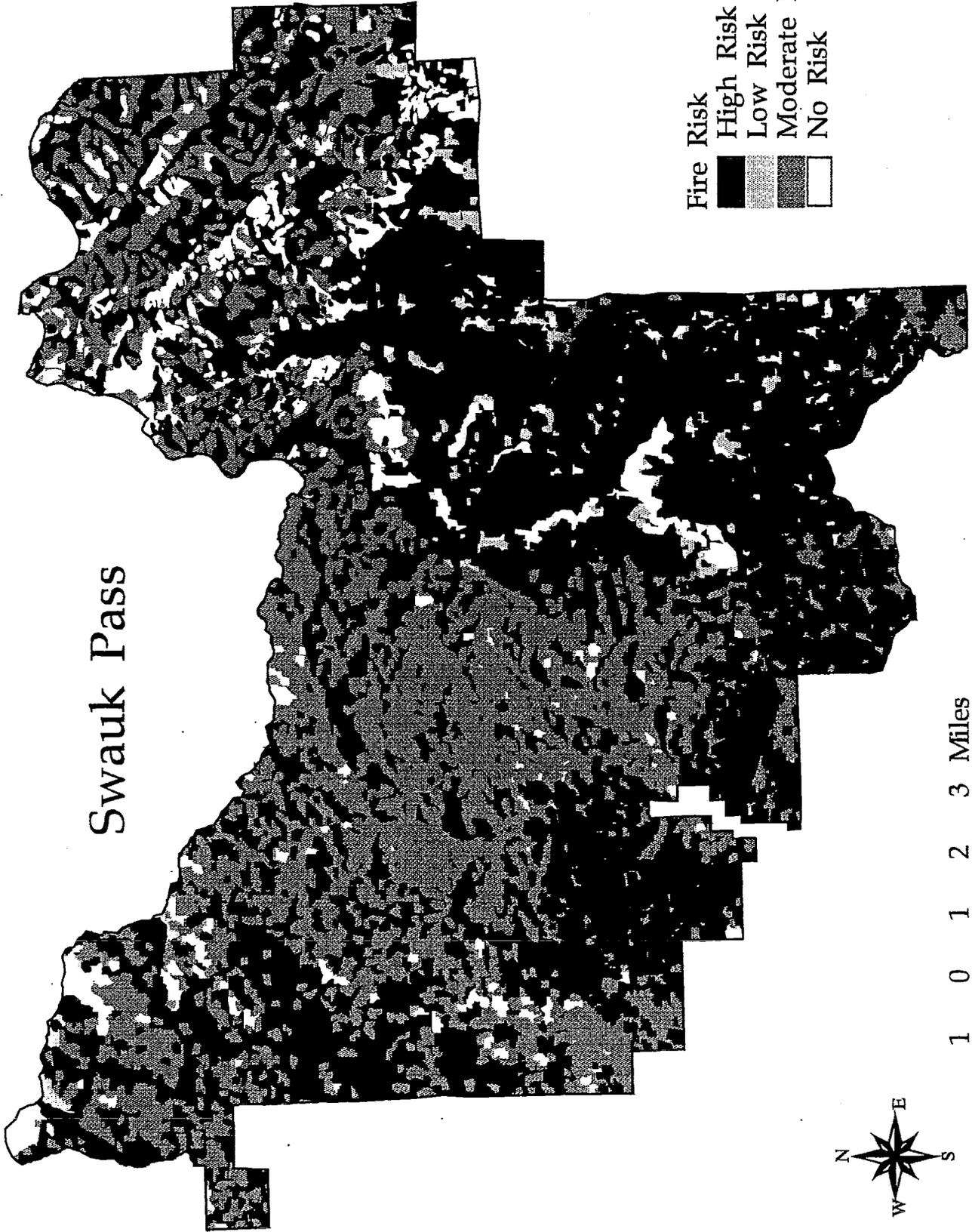


Map Scale: 1 inch = 0.380 miles

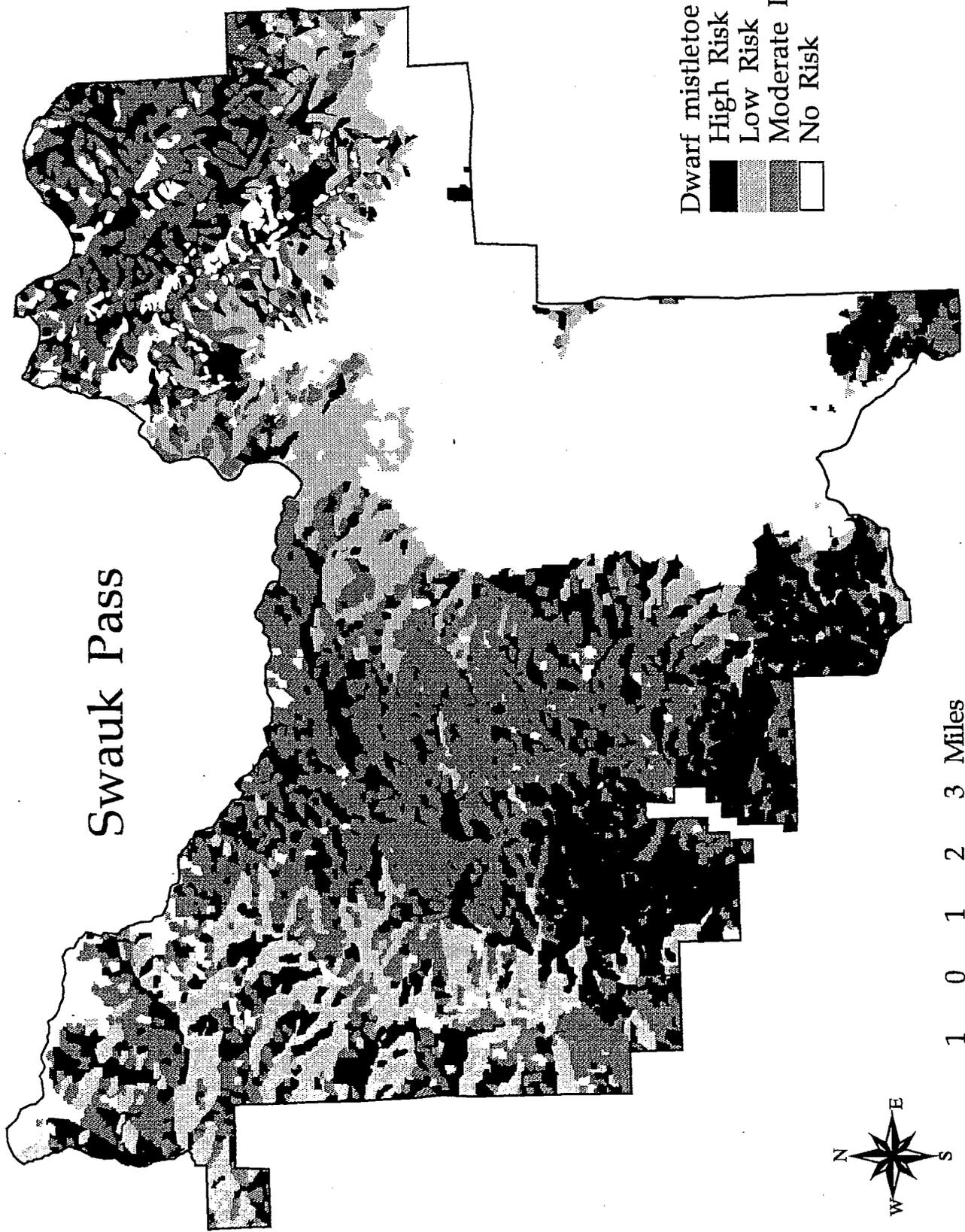
Swauk Pass Composite Risk



Swauk Pass

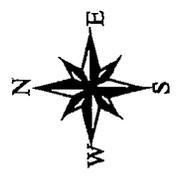


Swauk Pass



Dwarf mistletoe PIPO

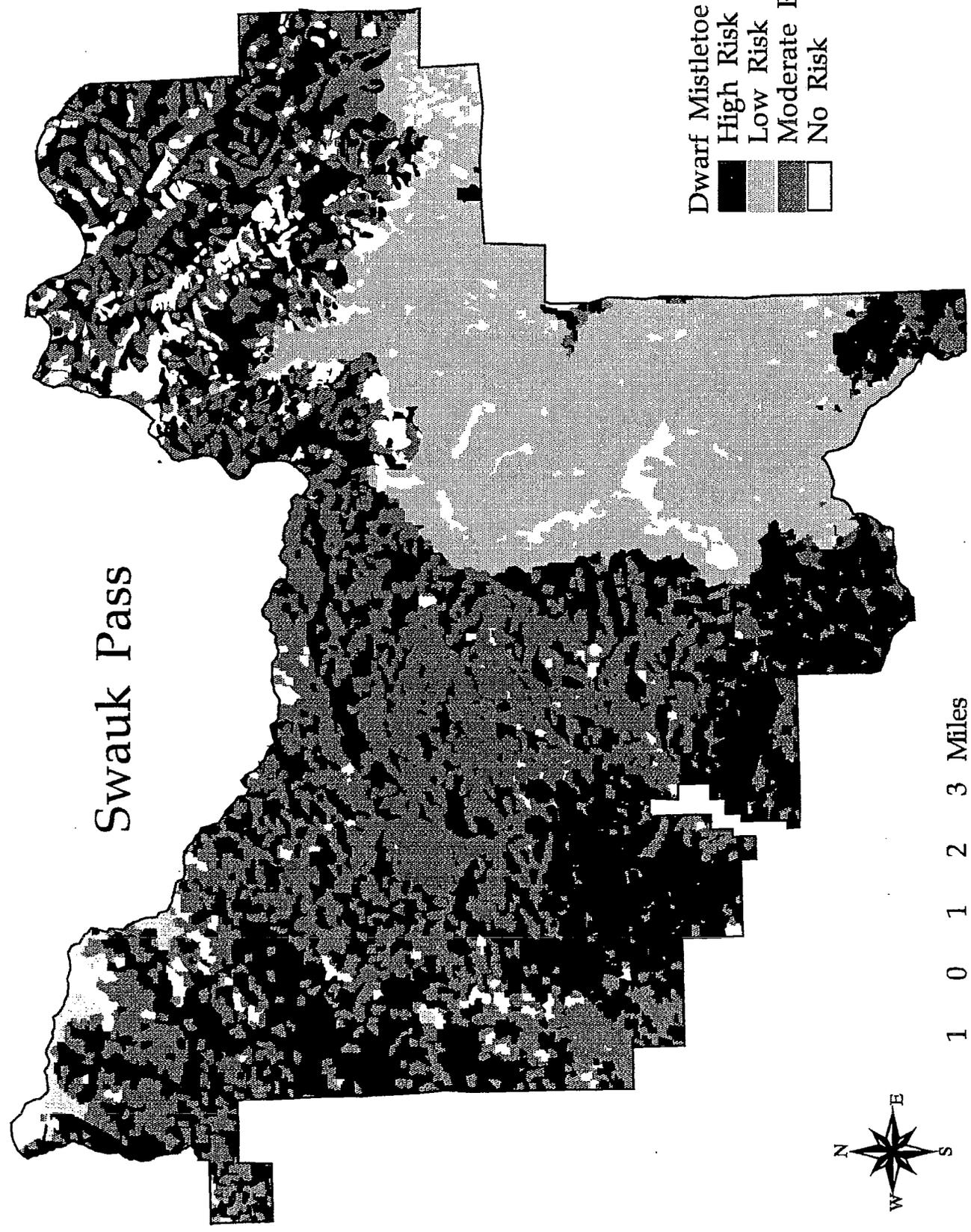
- High Risk
- Low Risk
- Moderate Risk
- No Risk



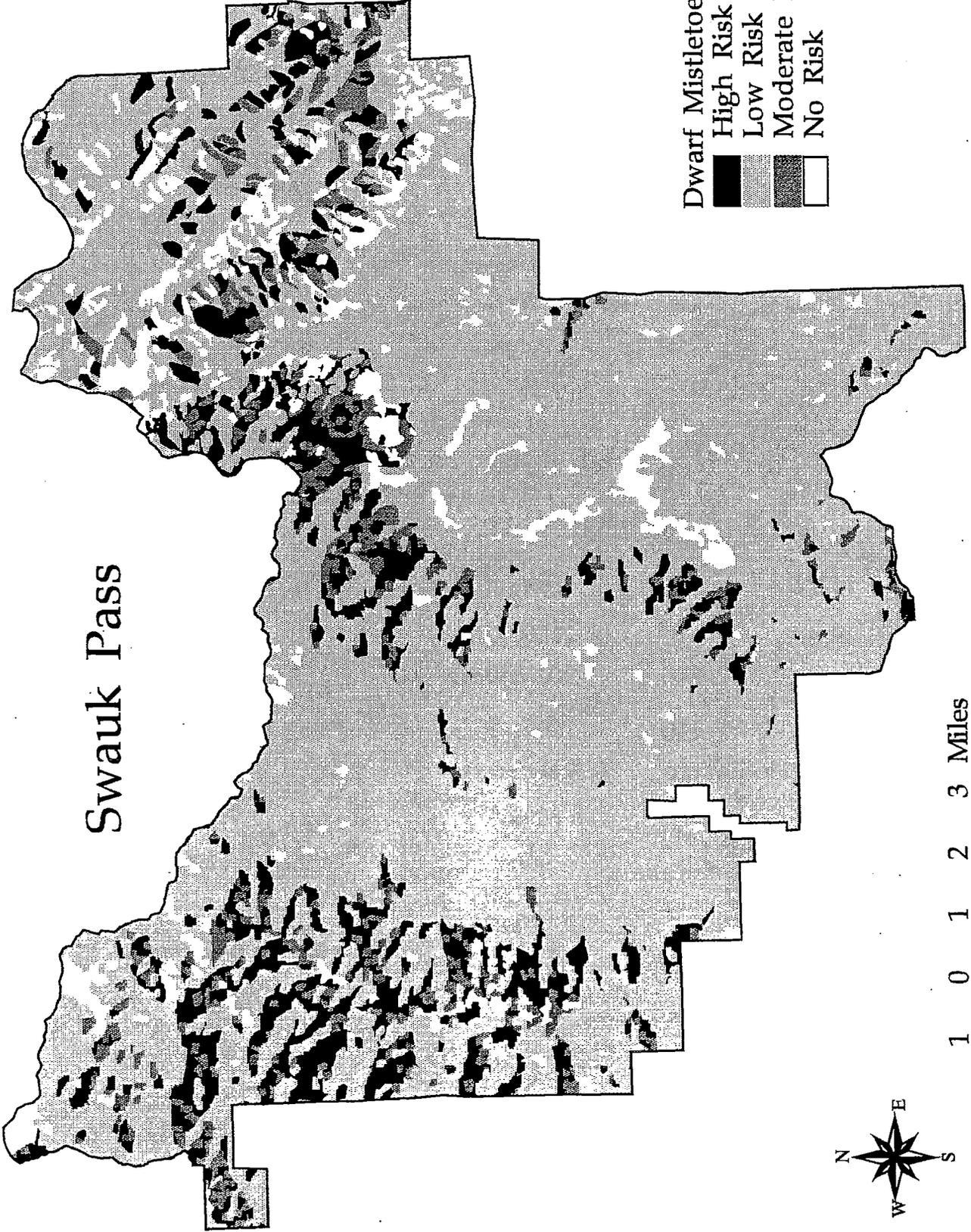
Swauk Pass

Dwarf Mistletoe PSME

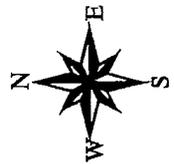
- High Risk
- Low Risk
- Moderate Risk
- No Risk



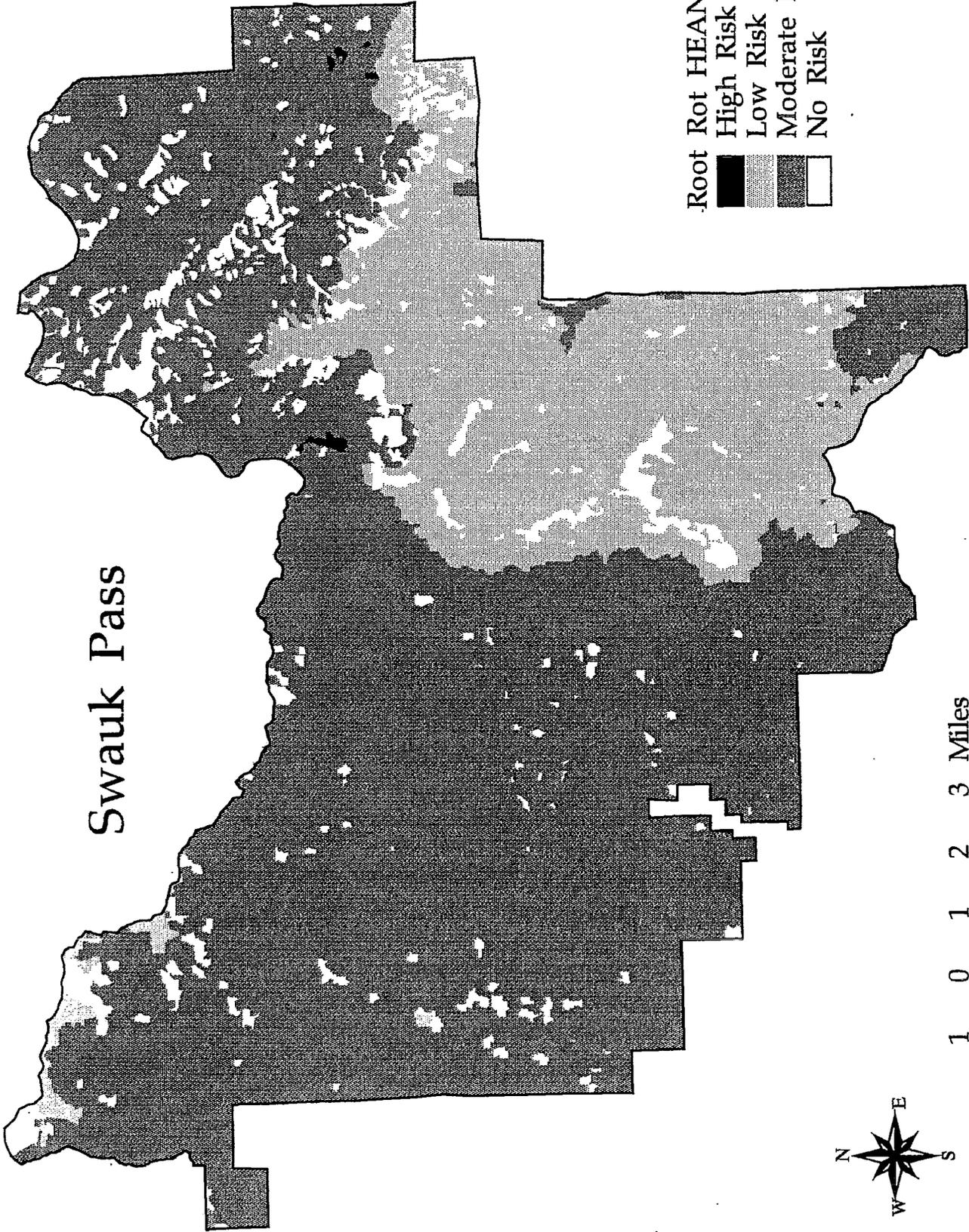
Swauk Pass



Dwarf Mistletoe LAOC
High Risk
Low Risk
Moderate Risk
No Risk



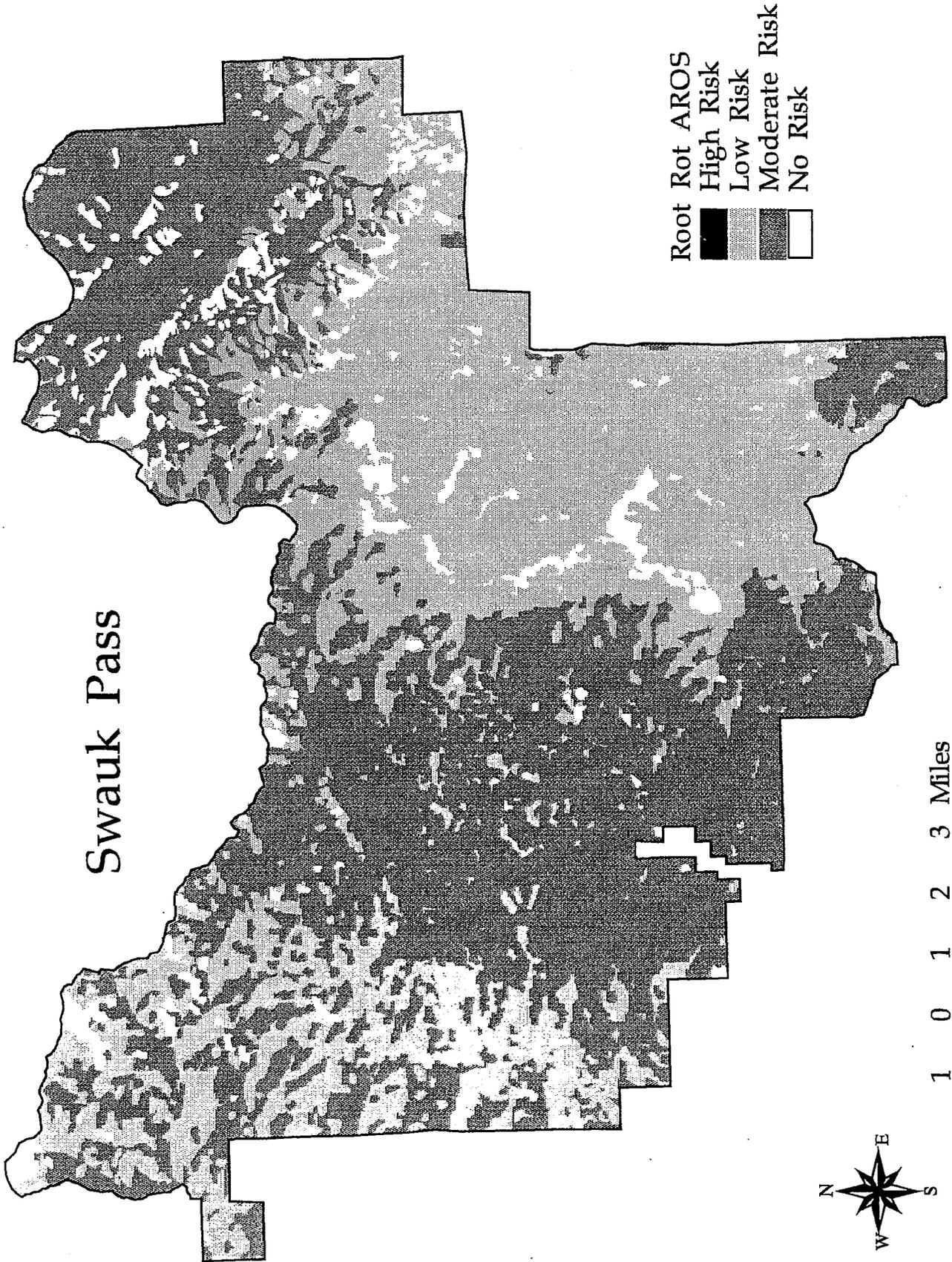
Swauk Pass



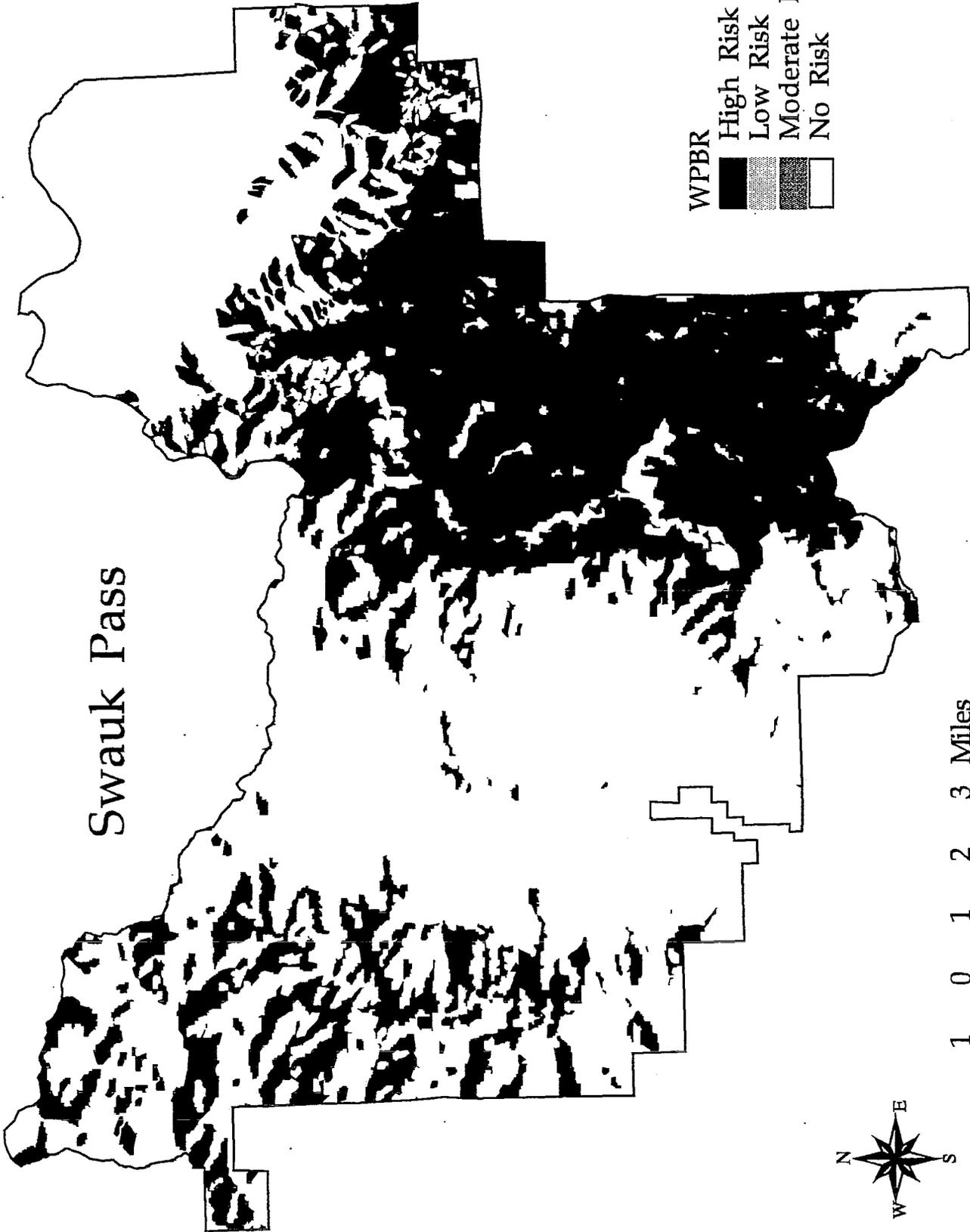
Root Rot HEAN
High Risk
Low Risk
Moderate Risk
No Risk



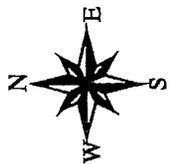
Swauk Pass



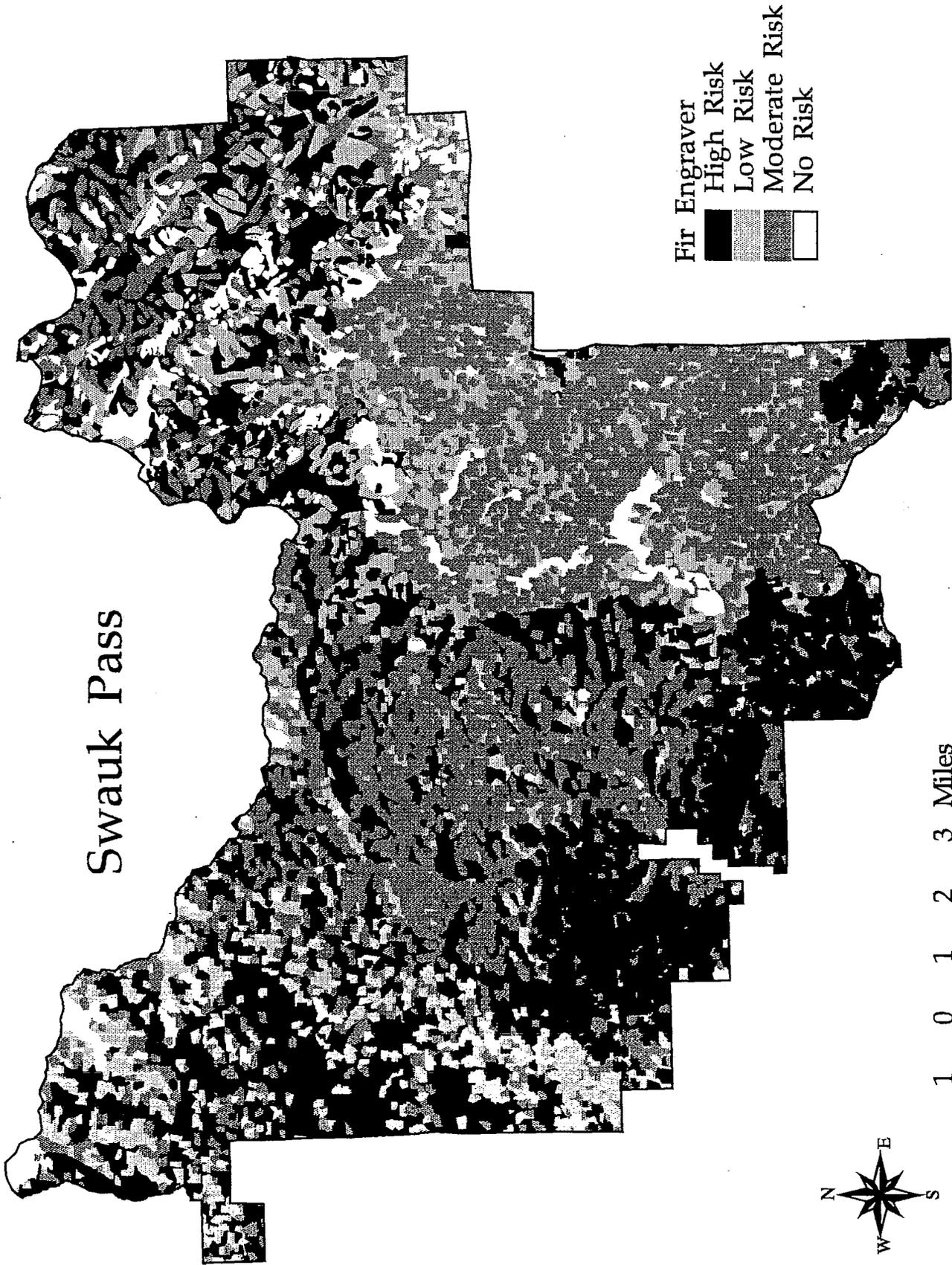
Swauk Pass



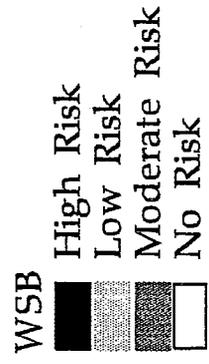
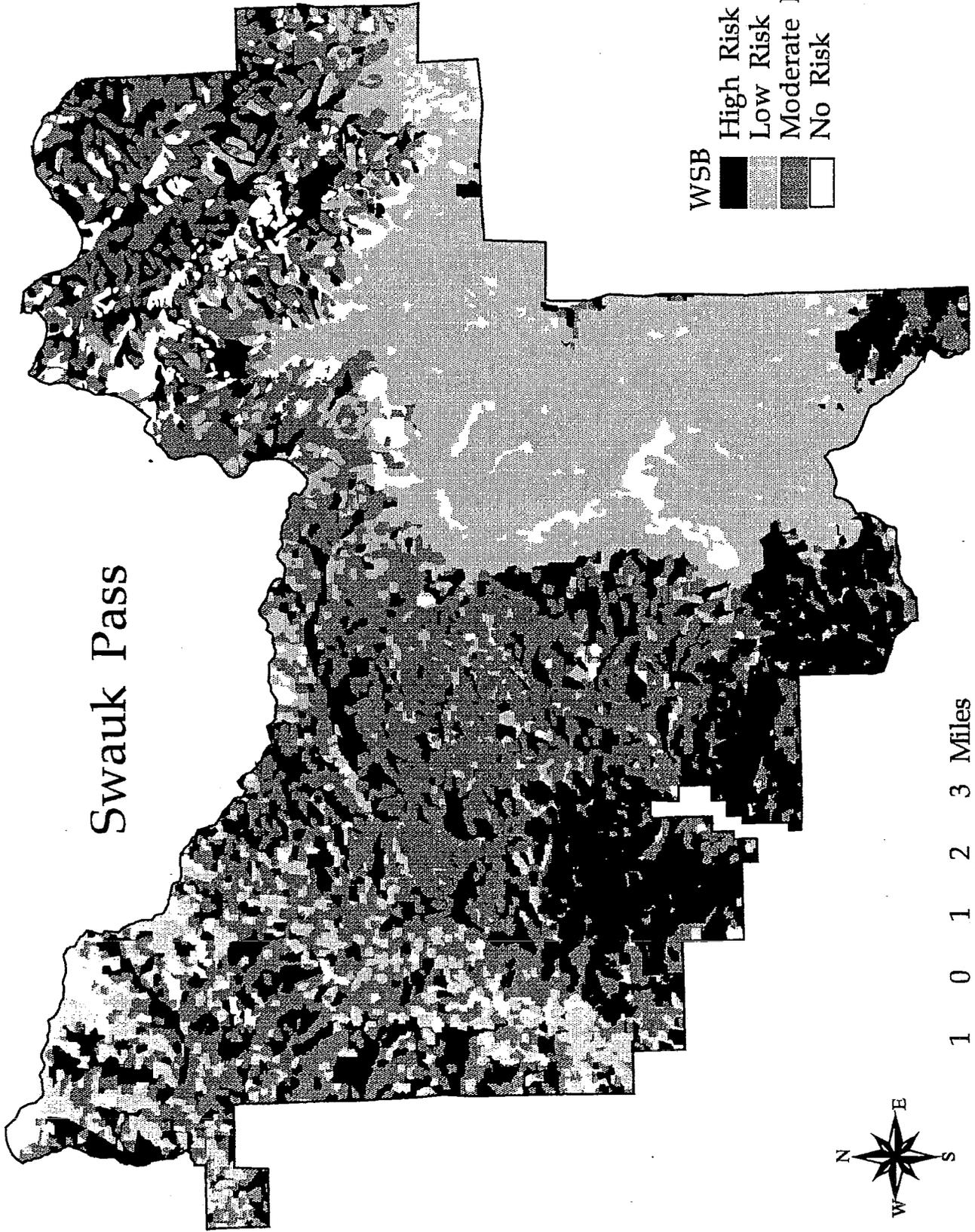
WPBR
High Risk
Low Risk
Moderate Risk
No Risk



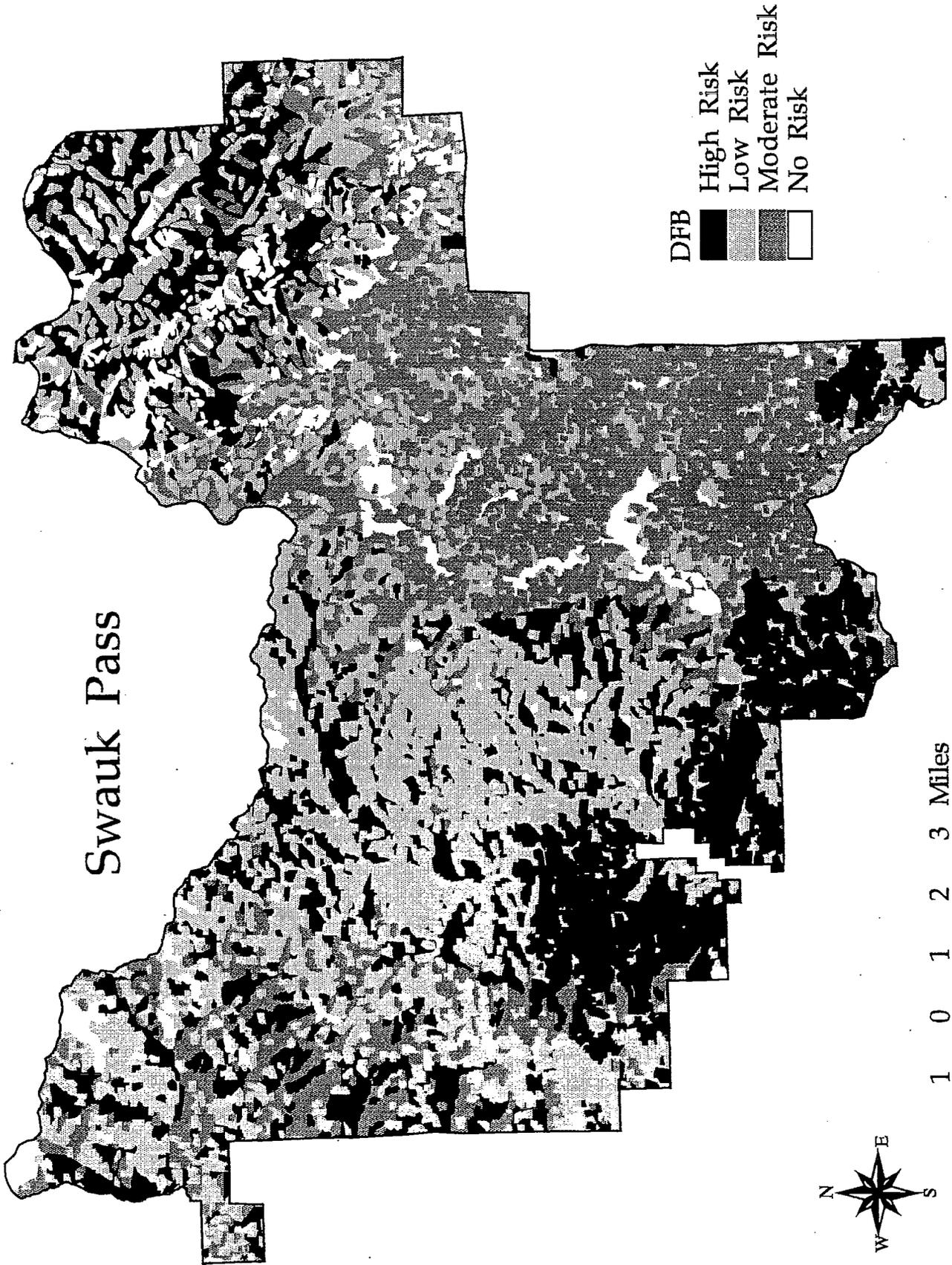
Swauk Pass



Swauk Pass

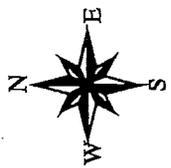


Swauk Pass

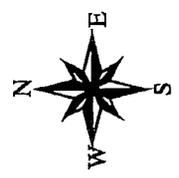
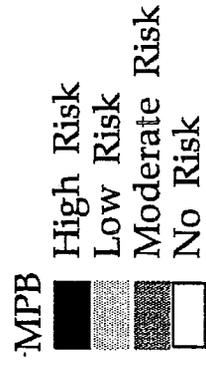
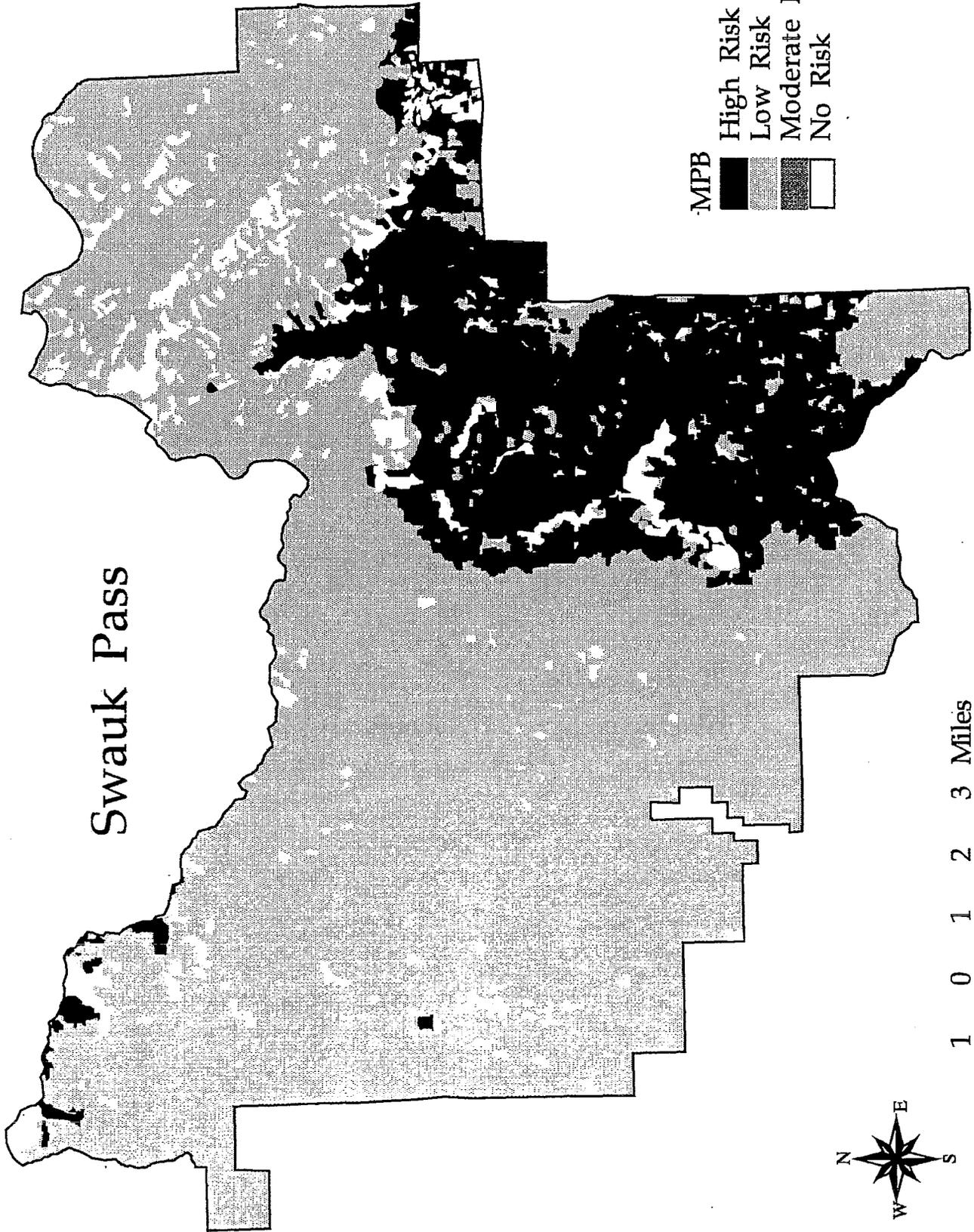


DFB
High Risk
Low Risk
Moderate Risk
No Risk

1 0 1 2 3 Miles



Swauk Pass



Swauk Pass

