Eugene BLM Special Habitats Phase IV Interim Report

Authored By: Malcolm Anderson; Northwest Habitat Institute.

Introduction: Phase IV of the ongoing BLM mapping project focused on mapping key special habitat features in the Eugene District. Phase IV furthered an ongoing project to complete an inventory of potential special habitats for the entire Eugene BLM District applying a consistent remote sensing technique (see phase I report). Eventually the coverage will be combined with other data from the Salem BLM, Siuslaw NF and Willamette National Forest. Phase IV adds more sophistication and accuracy to the process of remotely mapping and stratifying special habitats (Attachment 1) by utilizing aerial photo interpretation and GIS geoprocessing.

Background: Special habitats such as meadows, rock gardens, ponds, and swamps, are identified in federal land management planning documents for protection and restoration. Special habitats are important because despite being small in area, they contain a significant amount of biodiversity on the Eugene District and support many native plant and wildlife species, including at-risk due to the limited and diminishing distribution of habitat. Several of the vascular and many of the non-vascular plant species (for which little information on the distribution and abundance is available) are thought to occur in these habitats. Currently special habitats lack a complete habitat inventory, classification and active management. Mapping is the first step towards a complete field inventory.

Phase IV aims to complete an on screen ocular survey of all 93 quads that comprise the Eugene BLM district using the two additional data layers established in Phase II and tested in Phase III. These data layers (the Timber Production Capability Classification (TPCC) provided by the BLM, and the Natural Resources Conservation Service (NRCS) Soil Data Viewer) were successful in identifying more special habitats but not in locating more types of special habitats. Certain types of habitats including bogs and swamps remain difficult to identify due to their small size and canopy cover. Phase IV also continues to use the numerous data layers established in phase I (listed in methods).

Other BLM Districts and National Forests, including Salem BLM and Willamette National Forest, have started to inventory, map and classify these habitats, providing a basis for special status plant and animal surveys. These data layer are consistent and can be merged to develop a regional data layer. Several non-federal agencies such as the NWHI, TNC, etc., are interested in this type of information as well.

Design and Methods: Before mapping could proceed, the digital data sets were acquired and prepared. NWHI used georeferenced 2005 one-meter National Agriculture Imagery Program (NAIP) orthophoto quads for the entire BLM Eugene District. Recent ArcView files from the timber production capability class data layer were obtained on CD-Rom from the Eugene BLM district for areas not acquired during phase III of this project. These data were then converted from a Geo-Tiff format to an ERDAS Imagine format.

Mapping was initially completed using the same methods applied to five United States Geological Survey (USGS) quadrangles during phase II. NAIP orthophoto quads that depict the landscape in 2005 serve as the backdrop for interpretation. Additional datasets aided in further characterization and they were: Timber Production Capability Class, Soil Survey data, Eugene BLM Roads, Eugene BLM Streams, Curvature, Aspect, Contour, Hillshade, and NWHI's Landsat-TM imagery. Special habitats were mapped regardless of ownership.

Using (TPCC) documentation provided by the BLM to the NWHI, categories within the TPCC GIS data layer were selected as indicators of potential special habitats. These designations were determined based on the "Special Habitats Macro", developed by the Salem BLM, and include Fragile Non-suitable Woodland categories, Non-forest categories, and one Suitable Woodland category (Table 1).

USDA-NRCS Soil Survey data were downloaded from the NRCS soils website (http://soils.usda.gov) for appropriate counties in the Eugene District. The NRCS Soil Data Viewer application was installed in ArcMap (this mapping application directly accesses SSURGO soil databases to provide GIS mapping capability for multiple soil data categories). The categories selected as indicators of potential special habitats from the Soil Survey Data are included in Table 2.

Field truthing was necessary to determine the accuracy of ocular polygon delineations and to refine further on screen ocular surveys. To this end, a subsample of polygons representing the amount and array of special habitat types were selected for field validation. GIS Topography and road layers were added to the shapefile and overlaid on 2005 NAIP imagery of each USGS quadrangle to assist in predicting accessibility to the field sites.

Large hard copy maps were printed for each quadrangle with topography, roads, streams and special habitat polygons overlaid on 2005 NAIP imagery. Trimble GeoXT GPS units were loaded with the same layers. All polygons in a given quad that could be efficiently accessed were then visited. Actual special habitat type, dominant vegetation, and any notes that would assist in further refinement of the ocular assessment techniques were recorded for each polygon.

The minimum mapping unit is about 1 ha (2.5 acres). Occurrence of special habitats are classified in accordance to Attachment 1. There are three possible levels of specificity: General Habitat Type, Specific Habitat, and Plant Association. All identified habitats are stratified to General Habitat Type. Generally sufficient information did exist to classify polygons to Specific Habitat. When field verification can be implemented, polygons are amended to plant association when possible. During remote identification, the protocol for classification established in phase I of this project is adhered to. This includes but is not limited to: evaluating gaps in canopy, identifying special habitat indicators from the TPCC and soil survey data layers (tables 1 and 2), identifying areas of convex curvature, and eliminating areas based on manmade features or management schemes.

Table 1. TPCC categories and their associated TPCC codes used as indicators for potential special habitats. TPCC codes are used as the “SYMBOL” attribute in the TPCC GIS data layer.

Non-suitable Woodlands			**Non-forest sites**			**Suitable Woodlands**		
Category	*TPCC Code*	*Special Hab Indicator*	*Category*	*TPCC Code*	*Special Hab Indicator*	*Category*	*TPCC Code*	*Special Hab Indicator*
Permanent high water	FWNW	Wet meadows; bogs; swamps	Grass	NG	Meadows	Talus	RSW	Talus
Droughty soils	FSNW	Dry meadows	Rock	NR	Rock outcrops; rock garden			
Slope gradient	FGNW	Rock garden; rock outcrops	Water	NW	Ponds			

Table 2. Soil Survey categories and their associated data layers used as indicators for potential special habitats.

	Soil Physical Properties		
Data Layers:	Surface Texture	Organic Matter	Sand Content
Special Hab Indicators:	Rock outcrops; rock gardens	Bogs	Dunes
	Soil Quality Features		

Data Layers:	Drainage Class	Representative Slope	
Special Hab Indicators:	Meadows (wet, dry, mesic)	Rock garden; rock outcrop	
	Water Features		
Data Layers:	Depth to Water Table	Ponding Frequency Class	
Special Hab Indicators:	Meadows (wet, dry, mesic)	Wet meadows; bogs; swamps	
	Soil Chemical Properties		
Data Layers:	pH		
Special Hab Indicators:	Bogs		
	Land Classifications		
Data Layers:	Hydric Rating		
Special Hab Indicators:	Wet meadows; bogs; swamps		

Results and Discussion: To date 30 of 94 quads have undergone a full ocular survey, three of these were surveyed in phase III and were not included in Phase IV analyses. The ocular survey of the remaining 27 quads yielded 1844 total special habitats (graphed, fig.1, and pictured, fig. 2, below).

Fig. 1

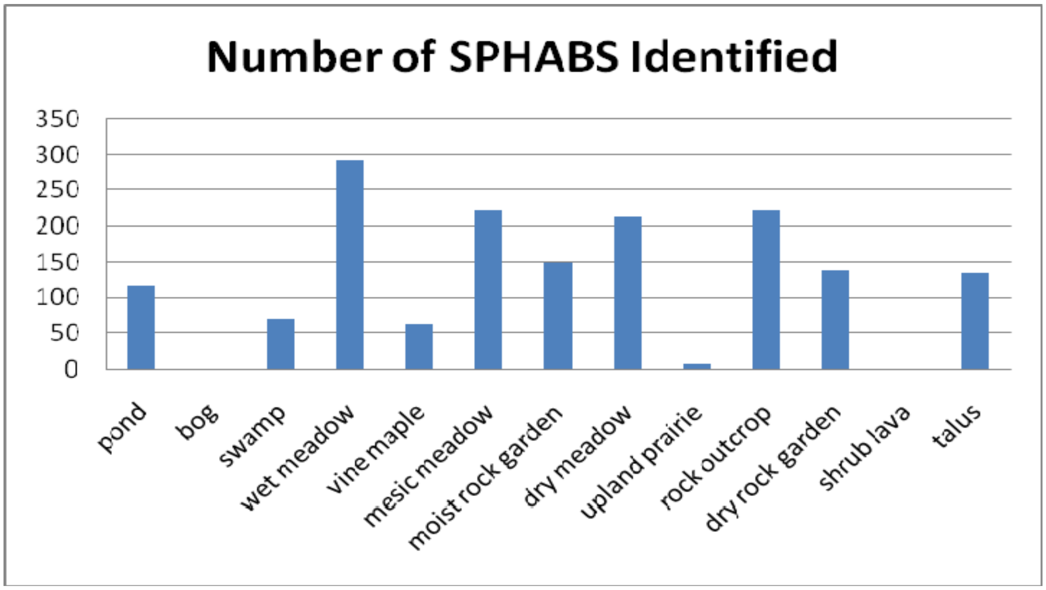
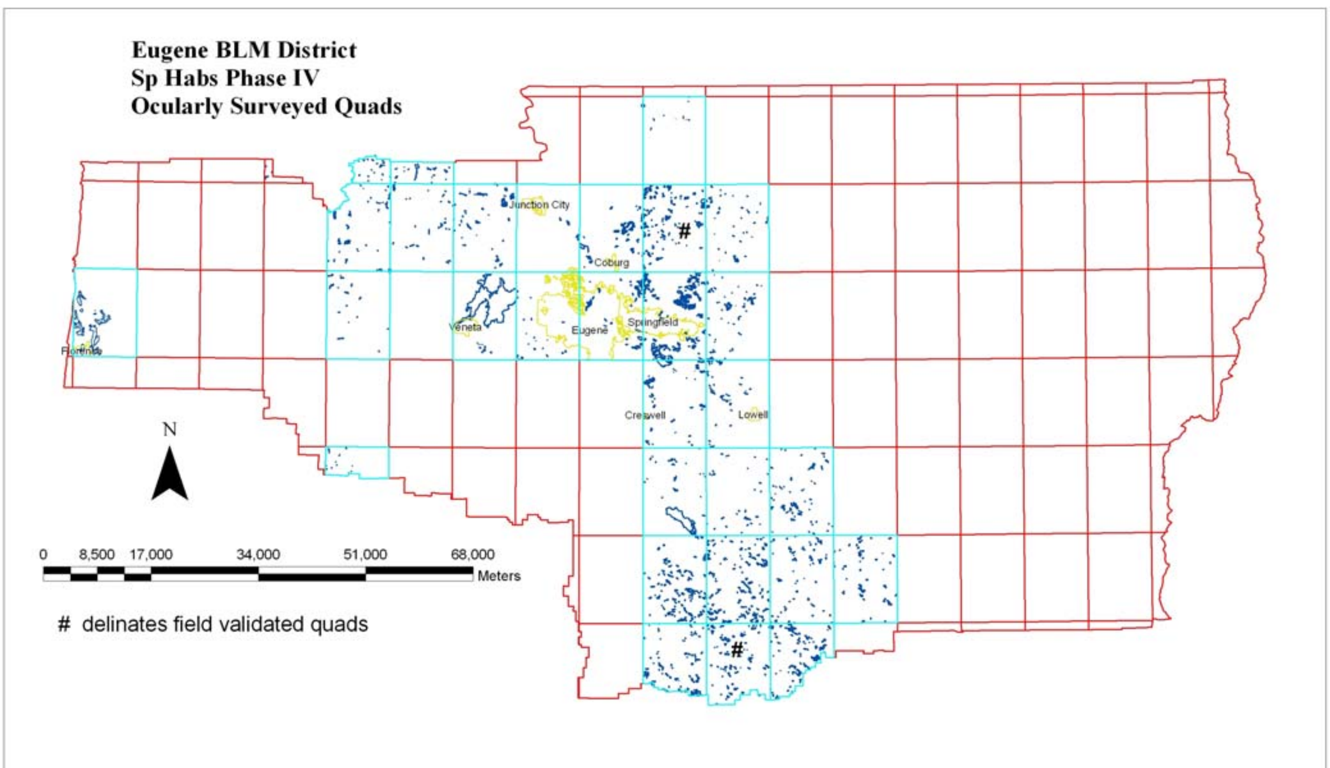

Number of SPHABS Identified
350
300
250
200
150
100
50
0
pond
bog
swamp
wet meadow
vine maple
mesic meadow
moist rock garden
dry meadow
upland prairie
rock outcrop
dry rock garden
shrub lava
talus

Fig. 2


Eugene BLM District
Sp Habs Phase IV
Ocularly Surveyed Quads
Junction City
Coburg
Veneta
Eugene
Springfield
Creswell
Lowell
N
0 8,500 17,000 34,000 51,000 68,000
Meters
delinates field validated quads

Though this phase of the project only called for onscreen ocular delineation of polygons NWHI felt that some field verification was necessary for calibration and confidence purposes. To date only two of the 27 quads have undergone field verification. These quads contained a total of 229 special habitat polygons delineated through ocular survey. Of these 68 polygons (29%) were able to be verified on the ground. Verification revealed that 64 of the 68 polygons (94%) were actually special habitats. Of the 64 Polygons correctly identified as special habitats 59 (92%) were correctly identified to General habitat type, and 52 (81%) to specific habitat type. Tables comparing ocular assessment to field verification results can be found below. The lower percent accuracy in the tables reflects the inclusion of the four polygons deemed not to be special habitats.

Table 3. Error matrix for ocular assessment (columns) versus field validation (rows) for general habitat type. The diagonal total is the number of correctly classified covers. Overall accuracy is diagonal total dived by total number of sampled polygons. Individual habitat type accuracies were determined by dividing the diagonal cell (instances of correct id) by the column total (total instances of ocular ID).

General Habitat	Ocular assessment				% Accuracy
		dry	mesic	wet	
Field Verification	dry	45	0	0	90
	mesic	4	7	1	70
	wet	0	0	7	88
	not sp. Hab.	1	3		88

Table 4. Error matrix for ocular assessment (columns) versus field validation (rows) for specific habitat type. Seven specific habitat types were validated in the field. The diagonal total is the number of correctly classified covers. Overall accuracy is diagonal total dived by total number of sampled polygons. Individual habitat type accuracies were determined by dividing the diagonal cell (instances of correct id) by the column total (total instances of ocular ID).

	Ocular assesment									
	Specific Habitat	wet meadow	vine maple	mesic meadow	moist rock garden	dry meadow	rock outcrop	dry rock garden	talus	% Accuracy
Field Validation	wet meadow	5								63%
	vine maple	2								
	mesic meadow	1		1				1		20%
	rock garden			2	4			2	1	100%
	dry meadow					2			1	50%
	rock outcrop						14			100%
	dry rock garden					1		15		79%
	talus							1	11	100%
	Not sp. Hab.			3		1				Total Average =78%

With only 68 out of 1844 (3.5%) identified polygons verified, more field verification should be completed to increase the confidence of the data layer. A fifth phase could focus of field validation, targeting a variety of quads to ensure confidence of each specific habitat type. Though field validation has so far reinforced the ocular surveys the small amount of polygons sampled so far cannot provide a basis for statistically significant data. Certain habitats proved to be easier to identify via ocular survey then others, and additional power in the verification steps would reinforce the conclusions drawn about the special habitats identified in the first four phases. Some of the more difficult specific habitats to identify were outlined in the phase III discussion. Meadows, for example, had a higher instance of false identification then other habitats. This was due in large to the degraded states of many meadows near roads but also due improved forestry practices including green tree retention and irregular or small patch cuts as opposed to large easily identifiable clear cuts. These recently logged areas were almost entirely responsible for false identification of special habitats in phase IV. In contrast, rock outcroppings, which are relatively easy to identify using the curvature, DEM, and TPCC layers, may be under represented in size and quantity. Because many of these outcroppings are essentially vertical rock faces they appear much smaller from overhead NAIP imagery. This leads to their area being under calculated or rock outcroppings being potentially disregarded as under the minimum mapping unit of 1 ha.

One final form of possible bias results in our field verification techniques. Limited access, due to the scattered nature of special habitats, resulted in a revision of verification techniques during phase III to only those polygons visible from or nearby the road. While this stratified sample increased verification efficiency to acceptable levels, it may over represent the amount of human impact of special habitats. While extensive road systems cover much of each quad, they still only allowed ‘drive up’ access to 29% of polygons. The ease of access to these sites likely resulted in more instances of human degradation or entirely human created habitats such as quarries and old logging landings that have succeeded into meadows. It follows that the more remote polygons are likely more pristine.

Final Products: Final maps of the special habitats in digital form are still being finalized and will be submitted as GIS coverages along with metadata. A final report further detailing the findings and conclusions will also be included with the final digital coverages

Attachment 1

Non-forested Special Habitat Habitats

(source: Willamette National Forest Management Guide, J. Lippert)

General Habitat Type	Specific Habitat	Plant Association
Wet Habitats	Pond	
	Bog	
	Swamp	Skunk cabbage swamp
		Swamp
		Seep/spring
	Wet (sedge) meadow	Douglas spirea - bog blueberry/sedge
		Sedge - panicled bulrush
		Sedge - twinflower - marsh marigold
		Spirea - willow/sedge
		Inflated sedge-Columbia sedge
	Vine Maple (Talus)	
Mesic Habitats	Mesic meadows	Blueberry - alpine spirea/grass
		False hellebore - common cowparsnip
		Coneflower - bracken
		Tufted hairgrass
		Shrub fields
		Aspen stands

	Moist rock garden	
Dry Habitats	Dry meadows	Blue wildrye-brome
		Common vetch - peregrine fleabane
		Thimbleberry/pokeweed fleeceflower
		Wooly eriophyllum - varileaf phacelia
		Beargrass - red fescue
		Coneflower - Arrow-leafed groundsel/grass
		Shrub fields
	Upland Prairie	
	Rock outcrop	
	Dry rock garden	Rock garden (flat, xeric)
		Rock garden (steep, xeric)
		Pinemat manzanita-Common juniper
	Shrub lava	
	Talus	

Attachment 2

Wet Habitats - Riparian Reserves

Key environmental factors for wet habitats include hydrology (water table, water quality, and water temperature), solar exposure, air temperature, humidity and organic matter.

(1) Pond (lacustrine/palustrine wetland): This habitat is a body of standing water and its associated edge of water-tolerant vegetation. The pond may be permanent or seasonal. Associated plants include water lilies and 3-leafed buckbean in open water, and sedges, cattails and willows in marshy areas in the pond floodplain (see Table 2a for scientific names of associated plants). Key environmental factors necessary for maintenance of ponds may be seen in Table 2b. For wildlife, the habitat of concern consists of the pond and adjacent forest cover which will moderate climate and provide a long-term supply of large dead standing and down wood in and adjacent to the pond. Wood adjacent to the pond provides hiding cover for larger animals using the pond for feeding, watering and breeding. The pond itself acts as an attraction to and breeding site for flying insects and bats which feed upon them. Table 2c lists wildlife dependent on this habitat and structural components of the habitat necessary for wildlife use. This habitat is highly susceptible to disturbance by logging and road building activities. Trails cause low levels of disturbance.

(2) Bog (palustrine wetland): A bog is a permanently wet area dominated by Sphagnum and other acid-tolerant plants. Many other plant species such as tofieldia, sedge, bog blueberry, spirea, bog orchid, sundews and kalmia are common (see Table 2a for scientific names). Key environmental factors associated with bogs are the same as ponds (Table 2b). Wildlife habitat is composed of the bog and adjacent forest. Carrs may be found on the edges of bogs and are considered part of the special habitat. Cover is found in the canopy, aquatic vegetation and down logs, and nesting and roosting sites are found in large live and dead trees. Wildlife associated with bogs are listed in Table 2c.

Bogs are rare on the Willamette National Forest. They are highly susceptible to disturbance by logging and road building. Grazing by cattle causes high disturbance. It is recommended that trails be located around the periphery of the riparian area rather than through it.

(3) Swamp (palustrine wetland): A swamp is a permanently wet area, often shaded by the canopy. There are three habitat types within this community:

(a) Skunk cabbage - usually small in area and covered by the canopy, these areas are dominated by a single species.

(b) Swamp - these habitats are larger in area, open and often associated with western red cedar. Plants which inhabit the area include vine maple, alder, skunk cabbage, devil's club, water hemlock and speedwell (Table 2a).

(c) Seep, Spring- an area where the water table is at the soil surface.

Key environmental factors are similar to other wet habitats (Table 2b). Wildlife habitat is composed of the swamp and adjacent forest. Cover is found in the canopy and down logs.

Swamps are highly susceptible to environmental change as a result of logging and road building in the vicinity.

(4) Sedge Meadows (palustrine wetlands): There are four sedge meadow types identified in the PAMG. All are fens in which the ground usually does not dry out for part of the year:

(a) Douglas spirea - bog blueberry/sedge (PAMG, p. 139). This plant community has a water table above or just below the soil. Soil has a high organic content.

(b) Sedge - panicled bulrush (PAMG, p. 149) This plant community is wet throughout the growing season. It is often found adjacent to streams. Beaver dams may have caused a high water table. Soils in these areas have a high organic content.

(c) Sedge - twinflower - marsh marigold (PAMG, p. 151). In this plant community the water table is at or above the surface. These areas are often used heavily by deer and elk for forage.

(d) Spirea - willow/sedge (PAMG, p. 157). This plant community has the water table within 10 inches of the surface. It is flat and has a deep organic soil horizon. Deer and elk often use these areas for forage and wallows.

(e) Inflated sedge-Columbia sedge (not in PAMG). This plant association is found surrounding lakes and ponds along the crest of the Cascades.

Key environmental factors are similar to other wet habitat types (Table 2b). The habitat for wildlife includes the meadow and its edge, which is often transitional shrubs (carr), plus mature forest. Many types of wildlife use wet meadows (Table 2c).

Wet meadows are common on the Willamette NF. Susceptibility to disturbance by logging, road building and grazing is high; vegetation disturbance caused by trails may be low though soil profiles are generally unsuited for sustained trail use.

(5) Vine Maple (Talus) - This plant community (PAMG, p. 165) may be loosely identified as a wet shrub field, as water is near the surface. Water determines patterns of plant colonization and shading can have a substantial effect on humidity levels (Table 2b). Wildlife use is high; the habitat of special concern is the shrub field and a portion of the edge for cover for large animals. Wildlife use is high (Table 2c).

Susceptibility of the community to disturbance is low.

(6) Forested Devil's Club: There are two forested devil's club types identified in the PAMG. These types are included here rather than as Rare Forested Plant Associations (see Table 2d) since their distribution is controlled by wet cool microsite conditions, related to environmental factors characterizing other more riparian sites such as swamps, wet shrub fields, and associated riparian types. While most Rare Forested Plant Associations identified as special habitats will become part of MA-9d, the Forested Devil's Club types (Western hemlock/devil's club and Pacific silver fir/devil's club) will be assigned to MA-15.

(a)Pacific silver fir/ devil's club (PAMG, p. 70). This forested plant association is typically found on northerly aspects between elevations of 3300-5200 feet, on lower slopes, benches, seeps and wet areas. It is sometimes associated with avalanche tracks.

(b)Western hemlock/ devil's club (PAMG, p. 98). This forested plant association is found on northerly slopes from 1500-3780 feet in elevation. It is characterized by abundant water and impeded drainage which leads to swampy conditions. Sites are usually small (less than 1 acre), and can be distributed as stringers along drainages. Skunk cabbage may be present in areas of organic, anaerobic soils.

Key environmental factors are water quality and quantity. Wet soils are especially prone to compaction. Soils are usually saturated through the summer. Herbaceous forage and thermal cover provide habitat for abundant wildlife species. These types may provide key amphibian habitats, particularly if associated with seeps.

Susceptibility to disturbance through soil compaction is high.

Mesic Habitats

(7) Mesic meadows: There are two mesic meadow types identified in the PAMG. These types are wet into mid-summer:

(a)Blueberry - alpine spirea/grass (PAMG, p. 133). This plant community is found above 4,000' elevation, between forest and more moist plant associations surrounding water bodies. Because of the elevation, regeneration capacity may be limited after disturbance. These areas may be shaded for part of the day or at least sheltered by adjacent timber stands. Deer and elk often use these areas for browse.

(b)False hellebore - common cowparsnip (PAMG, p. 141). This plant associations typically has the water table deeper than 8 inches from the surface. Soil has a moderate organic content. Deer and elk use these areas for foraging.

(c)Coneflower - bracken fern - (not yet described in PAMG). This is another mesic meadow type; the herbaceous layer is composed almost entirely of the 2 co-dominant species. Diversity is low. (Table 2a).

(d) Tufted hairgrass- (not yet described in PAMG). Meadows dominated by tufted hairgrass are common at higher elevations along the crest of the Cascades. These sites receive most of their water from snowmelt and remain moist throughout most of the growing season.

Key environmental factors to habitat maintenance include hydrology, degree of solar exposure and insolation (Table 2b). Wildlife habitat includes the meadow, shrubby edge and adjacent timber (Table 2c).

Susceptibility to disturbance is moderate to high.

(8) Moist Rock Garden - This plant community is found on steep slopes with wet seepy conditions through mid-July (PAMG, p. 145). Plant species include those which require both hydric and xeric conditions, depending on the microenvironment. The canopy usually shades a large percentage of these areas.

Key environmental factors include hydrology, because drainage patterns are key to plant species distribution, and solar exposure. Effects of increased exposure to the sun include higher evapotranspiration rates during the early growing season. Some amphibians utilize this habitat exclusively.

Susceptibility to disturbance is moderate, but higher if the adjacent cover is removed or if the hydrologic pattern is changed.

(9) Sitka Alder - This plant community occurs in steep rocky headwalls at elevations above 3,900 feet (PAMG, p. 155). The vegetation is maintained by water via snowpack and streams. These are often high elk use areas where hiding and thermal cover are important.

Occasion for impact has been low.

(10) Caves - Caves are true cavern or cavelike overhangs with historic, current or potential wildlife habitat and accompanying environmental characteristics (Table 3b). Abandoned mine shafts may qualify when they provide potential habitat for cave-dwelling species. The wildlife habitat of concern is the cave and surrounding forest that provides cover and wind regulation for animals using the site. Caves that may provide bat hibernacula or breeding sites are of special concern. Operating restrictions may be required around these caves during breeding and hibernating periods. Other wildlife using caves are listed in Table 2c.

Susceptibility to any disturbance is high. (Note that caves with archaeological features may fall under FW-267 to FW-270. All caves fall under FW-O27 to FW-033 and ROD standards and guidelines on pp C-43 and D-10)

(11) Mineral Deposits - This habitat includes elk salt licks and pigeon springs. Wildlife use is high. Habitats of special concern are the spring or licks plus adjacent perches and/or cover needed for safe use of the sites (Table 2c).

Susceptibility to disturbance of any kind is high.

Dry Habitats

(12) Dry Meadows - The PAMG identifies five dry meadow types. Most habitats are south to southwest facing slopes where water is available only early in the season:

a) Blue wildrye-brome (PAMG, p. 135). This plant community is found on dry ridgetops, sheltered by timber.

b) Common vetch - peregrine fleabane - blue wildrye (PAMG, p. 137). This plant community is found on south-facing slopes in well-drained soil. These areas are dry by late spring.

c) Thimbleberry/pokeweed fleeceflower (PAMG, p. 161). This plant community is found at high elevations in dry, exposed areas.

d) Wooly eriophyllum - varileaf phacelia (PAMG, p. 167). This plant community is found on severe, south-facing slopes with deep snow-packs. These areas are dry by mid-summer. Soil development is minimal.

e) Beargrass - red fescue (PAMG, p. 131). This plant community is found in cold, dry areas, usually mountaintops. These areas are prone to erosion due to the properties of pumice and parent rock.

f) Coneflower - Arrow-leafed groundsel/grass (not yet identified in PAMG) This plant community receives water early in the growing season. Soil is well-drained.

g) Sand blowouts (not yet identified in the PAMG). This plant association is found on the crest of the Cascades. The substrate is volcanic sand which limits the number of species able to tolerate these sites. Water permeability is high and blowing sand causes continual disturbance.

Environmental concerns for dry meadows center around changes in hydrology and solar exposure and exclusion of fire (Table 2b). Wildlife use in the area is often high; the meadow-shrub transition (if present) and adjacent mature forest, which supplies a long-term supply of snags and cover, provide important wildlife habitat. Elk and great gray owls may be of special concern. Where elk are important users, a more substantial area, possibly on one side of the meadow, should be buffered to provide cover for a herd. In areas with high potential for great gray owls, a large forested buffer is necessary for nesting habitat. Pocket gophers may play an active part in maintenance of these habitats by continually disturbing the soil. Other wildlife species which use dry meadows are listed in Table 3c. The blue wildrye-brome and common vetch-peregrine fleabane probably have the highest wildlife use.

Sensitivity to disturbance in the beargrass-red fescue plant association is low. The four other types are moderately to highly sensitive to disturbance, including grazing and roadbuilding, because of susceptibility to erosion and competition by weedy or exotic plants.

(13) Rock Outcrop - Rock outcrops are of two types: monoliths, which emerge from the surrounding canopy, and rock piles, which do not. Both are dry with little plant cover. Monoliths are potential habitat for many types of raptor; the rock itself and some surrounding mature forest, which can provide cover and perches, are probably necessary for wildlife habitat.

Rock outcrops are common on the Willamette NF. Though quarrying has damaged or destroyed many rock outcrops, susceptibility to other kinds of disturbance is generally low. (Note: raptor use of monoliths may fall under FW-133 and cultural use of rock piles may fall under FW-267).

(14) Dry Rock Gardens - The PAMG identifies two types of dry rock garden which are often found on southerly-facing slopes with shallow soil. Plant species are adapted to dry soil conditions. The third type, Pinemat manzanita-Common juniper, is not described in the PAMG.

a)Rock garden (flat, xeric)- PAMG, p. 143. This plant community and geomorphic conditions is usually found on the tops of exposed rocky ridges. Soil development is minimal.

b)Rock garden (steep, xeric)- PAMG, p. 147. This plant community and geomorphic conditions are often protected from wind and sun by an adjacent forest canopy.

c)Pinemat manzanita-Common juniper- (not included in PAMG). This plant community is found predominantly on ridgetops or south- and east-facing slopes in scree or poorly developed soil between rock outcrops. Snow dominates the moisture regime.

Environmental factors important for maintenance of these habitats include changes to the hydrologic timing and pattern and exposure because reduced cover could increase evaporation during the growing season.

Susceptibility to disturbance by logging and road construction is moderate. Quarrying would cause a high level of disturbance.

(15) Shrub Lava - This condition consists of shrub fields growing on lava beds at mid to high elevations on the Forest. These are harsh areas which dry out rapidly after snowmelt. Wildlife use and environmental sensitivity are low.

(16) Talus - Scattered plants of this community occur on dry talus slopes (PAMG, p. 159). Because flowing water is deep or absent, flowering plant diversity is low. There may be a diverse assemblage of moss and lichens. The emergence of subsurface water at the base of these slopes may allow development of a forest cover and mossy growth. Adjacent forest cover and hydrology are important for wildlife habitat in this part of the site (Table 2b). Wildlife species, particularly amphibians and snakes, may use these areas.

Susceptibility to disturbance is low in the talus, but moderate at the toe of the slope.

(17) Vine Maple (Rocky Soil) - This plant community (PAMG, p. 163) is found on all aspects and has a seasonal water supply which dries up by early summer. There is a small (1-2 inch) organic layer in the soil. The canopy typically shades these areas. Wildlife use is mostly by songbirds, and these areas are often susceptibility to disturbance.