

**USFS/BLM Interagency Special Status/Sensitive Species
Program**

**Greater Sage Grouse
Ecological Type and Habitat Mapping Project
(Pine Mountain and Desert Fringe)**

**Deschutes National Forest
FY09 Final Summary Report
April, 2010**



Figure_1. Sage Brush Communities on Pine Mountain

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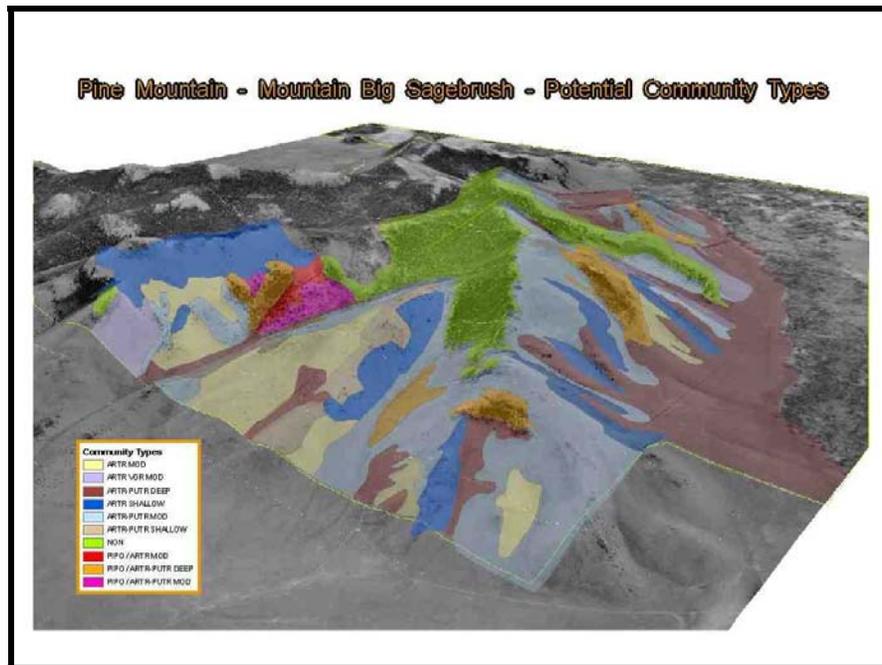
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Location: Pine Mountain and desert fringe areas of the Bend/Ft. Rock District within the Deschutes National Forest boundary, approximately 30 to 40 miles east of Bend, Oregon.

Habitat Type: Mountain Big Sagebrush (*Artemisia tridentata* spp. *vaseyana*) plant communities

Goal: Provide habitat mapping data to help evaluate potential management actions that could assist in meeting goals of the “Greater Sage-Grouse Conservation Assessment and Strategy for Oregon” for Sage Grouse on the Deschutes National Forest.



Figure_2. Draped projection of mapped ecological type map units on Pine Mountain

Summary: Sage Grouse (*Centrocercus urophasianus*) nesting, brood rearing/foraging and winter habitats were described and correlated to Ecological Types across approximately 13,105 acres of Mountain Big Sagebrush (*Artemisia tridentata* spp. *vaseyana*) communities previously classified as “xeric shrublands”. Physical soil and vegetation data was collected to develop and refine the Ecological Type map units at a finer scale than existing 4th order USFS Soil Resource Inventory (SRI) and 3rd order BLM Ecological Site Inventory (ESI) mapping in the area. The data has been assimilated into maps, spreadsheets and photographic hyperlinks stored in the corporate filing system to aid biologists and other resource specialists in future management of the Greater Sage Grouse on the Deschutes National Forest.

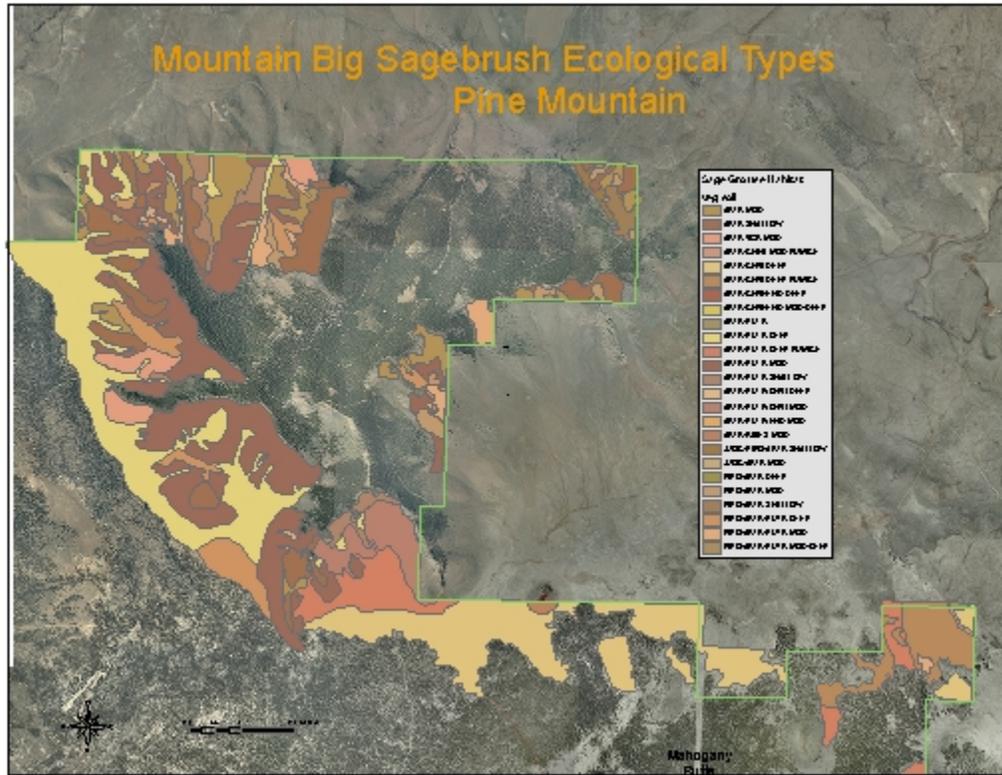
Project objectives for FY09:

- Compile a summary “stand alone” report describing the methodology and definitions of the ecological types mapped within the “xeric shrublands” plant association.
- Compile and store vegetative cover and composition data collected from ten permanent vegetative monitoring plots located within various ecological types.
- Hyperlink photographs taken within the ecological type polygons on Pine Mountain to the GIS point layer for future reference.
- Organize and store data collected during the course of the project in the corporate filing system.
- Correlate the age summaries of the dominant shrubs collected within ecological type polygon to an existing seral stage.
- Identify and summarize sage grouse nesting, brood-forage and winter habitat associated with the current seral stages of the ecological types mapped.

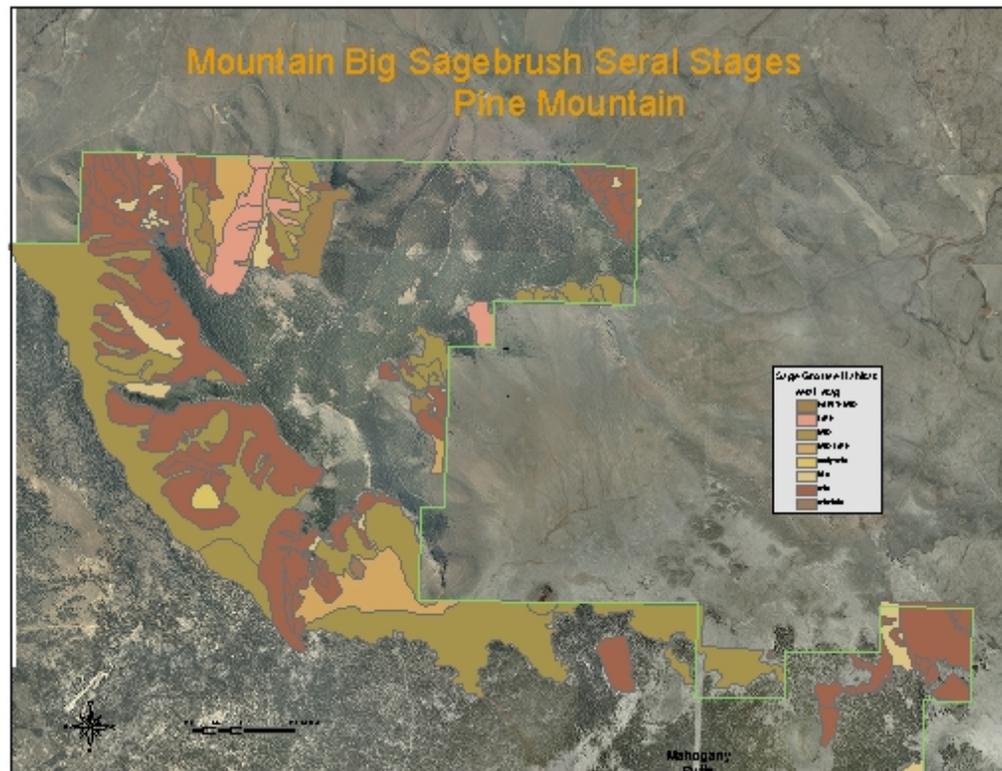
Map Products:

- Ecological Type, Seral Stage and Sage Grouse habitat type maps have been compiled in GIS for areas of Pine Mountain and the Desert Fringe on the Bend/Ft. Rock District.
- Ecological type map units are digitized into GIS after being delineated on 1:12,000 aerial photographs or hard copy maps with NAIP photography in the field (see **Figure_3**). Map units are subsets of sagebrush shrub plant associations and are based on definable soil and potential natural vegetative characteristics.
- Existing nesting, brood-forage and winter sage grouse habitat provided by the current seral stage of the ecological type map units are digitized in GIS. These habitat types are described in this report and are based on measured species composition and shrubs ages extrapolated across the mapping area.
- GPS point locations and photographic hyperlink references for 42 mapped polygons of ecological types and 8 permanent FIREMON vegetation plots located on Pine Mountain. Two additional FIREMON vegetation plots are located in the desert fringe area to the south of Pine Mountain.

Figure_3. Sagebrush Ecological types on Pine Mountain.



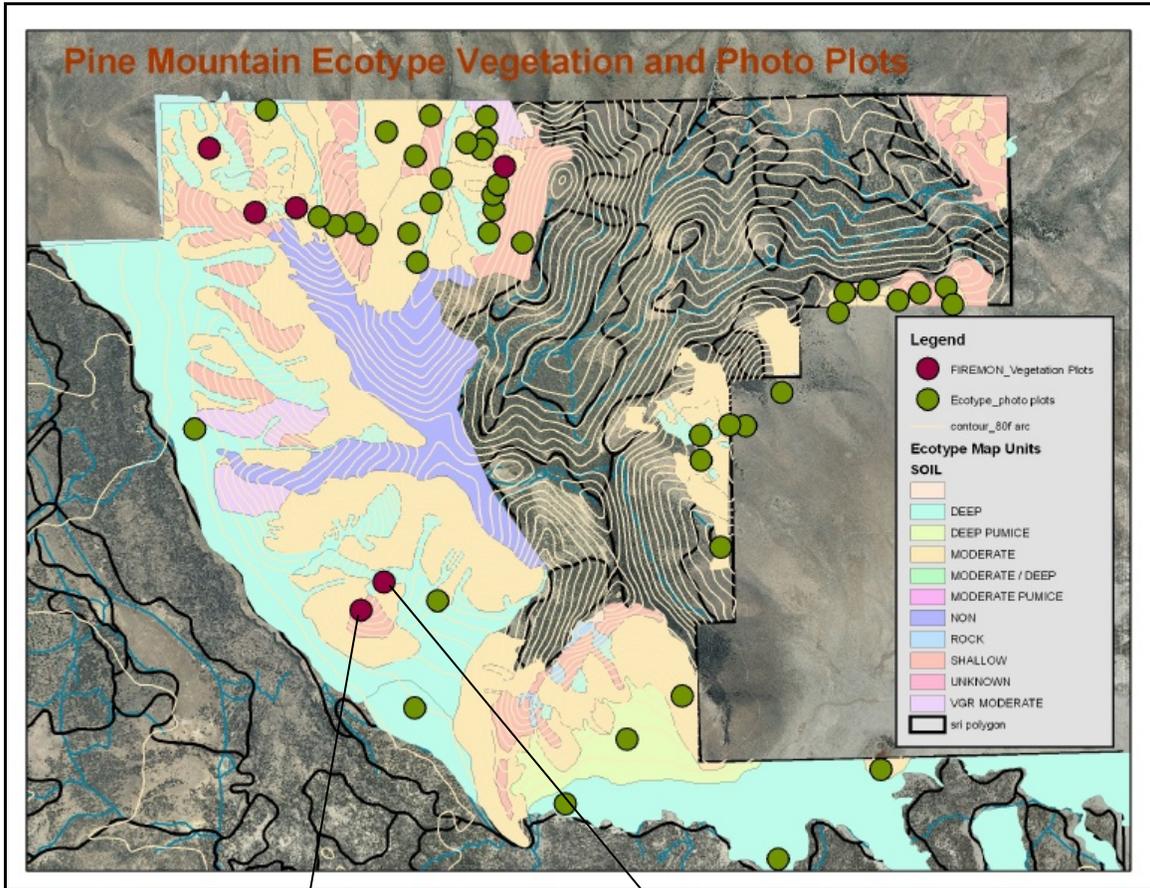
Figure_4. Current Seral Stages of Sagebrush habitats on Pine Mountain



Project Summary:

1. Mountain Big Sagebrush (*Artemisia tridentata* spp. *vaseyana*) ecological types were identified using observations of soil characteristics and concepts of potential natural vegetation to classify lands previously described in the Central Oregon Pumice Guide as “xeric shrublands” (USDA, 1988).
2. Thirteen ecological types were mapped across 10,498 acres on or near Pine Mountain and two ecological types were mapped on 2,607 acres along the desert fringe (**Figure_3** and **Figure_15**). A naming convention for the Ecological Types is based on the dominant vegetative plant association (ie. SHRUB/GRASS) and soil characteristics (_DEPTH + parent material). The Ecological Types identified during this project are displayed in **Table_1** on p. 8 of this report.
3. Sage Grouse habitat types (i.e. nesting, brood-forage and winter) were correlated with the mapped Ecological Type units. Field observations of known nesting sites identified in the Bureau of Land Management telemetry study conducted from 1988 to 1993 (USDI, 1994) were used to begin developing and describing map units. General descriptions of these habitat types also utilized previous classification efforts within the range of the Sage Grouse (Hagen, et al. 2007). Descriptions of the primary habitat types within the project area are summarized under the “Sage Grouse Habitat Types on Pine Mountain” section of this report beginning on p. 6.
4. The existing habitat function of each Ecological Type polygon mapped was determined based on the seral stage of the plant community, as measured in the field or extrapolated from similar ecological types. Since fire does not adhere to the boundaries of the mapped Ecological Types, the prominent habitat present within a mapped polygon was determined to be representative if there were multiple seral conditions observed as a result of fire disturbance. The acres of existing sage grouse habitat by ecological type are summarized in **Table_2**.
5. Nine permanent vegetative cover and species composition transect plots were installed under FIREMON protocols (Lutes, et al, 2006) during the extent of this project (**Figure_5**; **Appendix D**). Plots have GPS location coordinates and are monumented with capped iron rebar for re-location. Vegetative cover and species composition can be re-measured in the future to show change within the different ecological types, including nesting and brood rearing/foraging habitat on deep pumice, nesting habitats on varying depths of residual soils, and brood rearing/foraging habitats in different seral stages. An Excel spreadsheet database is on file in the project folder with transect vegetative data, shrub ages, GPS locations, and photographic references.
6. Forty-two shrub cover plots were located across a spectrum of Ecological Types on Pine Mountain to build a database to help define the range of characteristics for each type (**Figure_5**; **Appendix D**). Plots are located with GPS coordinates and photographic records in all four cardinal directions.

Figure_5. Location of FIREMON vegetation and Ecotype Cover plots on Pine Mountain with photographic GIS Hyperlinks.



Sage Grouse habitat types on Pine Mountain

Sage grouse habitat types defined by biologists and ecologists in the literature include nesting, brood rearing and winter habitats. All three habitat types were described as a part of this project after analysis of the BLM telemetry study showed Sage Grouse presence on Pine Mountain through all seasons during which these types of habitats would be utilized.

Nesting habitat was first observed in the field by locating nest site data collected during the BLM telemetry study. Six nest sites observed as active between 1988 and 1993 were visited on the slopes of Pine Mountain and characterized by a number of ecological factors, including plant association, aspect, slope, vegetative cover, species composition, soil parent material and soil depth. The plant associations and soil characteristics observed within the nesting habitat sites were used to begin developing Ecological Types across the Pine Mountain landscape. Field observations combined the composition, cover and size of shrubs, herbaceous forbs and grasses, with the physical soil characteristics on site to describe all three habitat types. Details for each habitat type are summarized below:

Winter Habitat: Mountain Big Sage_Bitterbrush (ARTRV_PUTR) plant associations with large structure and appreciable shrub heights capable of providing cover above accumulated snowpack (**Figure 6**). Measured individuals averaged 108 to 130 cm for PUTR and 69 cm for ARTRV. This habitat may also be provided by types located on windward slopes that do not accumulate snowpacks to appreciable depths and have slightly lower average shrub heights.



Figure 6. ARTRV_PUTR-moderate ecological type with structure and cover to provide winter habitat (left) and large PUTR and CHVI individuals (right)

Brood Rearing and Foraging Habitat: Primarily Mountain Big Sage (ARTRV) plant associations with lower shrub cover and more grass and forb components (**Figure_7**). Often found in ecological types with shallower soils or in early to mid-seral conditions following a fire disturbance.



Figure_7. ARTRV / FEID shallow ecological types on Pine Mountain providing brood rearing and foraging habitat.

Nesting Habitat: Mountain Big Sage_Bitterbrush (ARTRV_PUTR) and Mountain Big Sage / Idaho fescue (ARTRV / FEID) plant associations with appreciable live shrub cover, structural height and forb diversity (**Figure_8**). In general, nesting habitat was observed to be associated with shrub cover ranging from 10 to 30%, moderately deep soil consisting of residuum and older ash with 30% gravels and cobbles on the surface, and a somewhat diverse presence of herbaceous forb and grass species. Live shrub cover ranging from 17 to 39% was measured in the three ecological types sampled in this habitat. Average shrub heights of large individuals from the primary shrub species range from 42 to 81 cm for ARTRV and 78 to 108 cm for PUTR. Photographs and conditions observed for the nest site locations can be found in a report entitled “Pine Mountain Sage Grouse Nest Site Habitats” in the project file.



Figure_8. ARTRV-PUTR_moderate (left) and ARTRV_moderate (right) nesting habitat.

Ecological Types:

Approximately 13,105 acres of xeric shrublands on the slopes of Pine Mountain and desert fringe areas were field reconnoitered and delineated as ecological types using distinguishable breaks in the physical characteristics of the soil and vegetative plant associations. Ecological types were observed to be distinguishable at a finer scale across Pine Mountain than soil map units developed under 3rd order BLM Ecological Site Inventory (ESI) or 4th order USFS Soil Resource Inventory (SRI) mapping in the area.

The ecological type map units were delineated as distinct subsets of the eight sagebrush plant associations identified on Pine Mountain and the desert fringe. The types mapped on Pine Mountain are derived from two primary shrub/grass plant associations:

- *Mountain Big Sage - Bitterbrush / Idaho Fescue*



- *Mountain Big Sage / Idaho Fescue*



Two primary tree/shrub/grass plant associations from which Ecological Types were derived are also found on Pine Mountain:

- *Ponderosa pine / Mountain Big Sage - Bitterbrush / Idaho Fescue*
- *Ponderosa pine / Mountain Big Sage / Idaho Fescue.*

Associations that include *Green Rabbitbrush* were also identified along the southern slopes of Pine Mt. and the desert fringe areas. Two additional associations were identified in the desert fringe areas, both of which are located on deep deposits of Newberry pumice.

- *Mountain Big Sage - Rabbitbrush / Carex rossii*



- *Mountain Big Sage - Bitterbrush / Carex rossii*

The ecological type map units were delineated within the eight sagebrush plant associations identified on Pine Mountain and the desert fringe using identifiable soil characteristics (profile depth, parent material and surface rock content) that influence the composition, structure, and rate of growth of vegetation on site. A total of fifteen ecological types were defined within Sage Grouse habitats on Pine Mountain and the Desert Fringe areas (**Table_1**). The Ecological Type naming convention derived for the project includes a soil depth modifier added to the primary shrub / grass components of the plant association. Soil depths were stratified as deep (>20”), moderate (10 to 20”) and shallow (<10”) profiles. Additional information on the soil characteristics identified during field work can be found in the FY05, FY06 and FY07 project summary reports in the project file.

Table_1. Sagebrush plant associations and ecological types on Pine Mountain and desert fringe

Ecological Types		
Primary vegetative component	Plant Association	Soil modifier*
Ponderosa Pine	PIPO / ARTRV-PUTR	deep
“	“	moderate
“	“	shallow
“	PIPO / ARTRV	moderate
Mountain Big Sage	ARTRV-PUTR / FEID	deep
“	“	moderate
“	“	shallow
“	ARTRV / FEID	moderate
“	“	Vgr moderate
“	“	shallow
“	ARTRV-CHVI / FEID	deep
“	ARTRV-PUTR-CHVI / FEID	moderate
“	“	deep
“	ARTRV-CHVI / CARO	deep pumice
“	ARTRV-PUTR / CARO	deep pumice

* Soil depths were stratified as deep (>20”), moderate (10 to 20”) and shallow (<10”) profiles.

Existing Habitat Types provided by the Ecological Types

Each of the sagebrush Ecological Types delineated on Pine Mountain or desert fringe areas has the potential to provide one or all of the sage grouse habitats at some point along the vegetative path of seral succession. A given ecological type is likely to progress from foraging → brood rearing → nesting → winter habitat through vegetative succession following disturbance. It should be noted that the extent and timing of fire and grazing disturbances can push the habitat type back along the successional pathway. The range of habitat types provided by an Ecological Type is influenced primarily by the physical soil and landscape characteristics on site. Less productive sites may only be able to provide foraging/brood rearing habitat due to limitations on moisture availability and vegetative growth on the site.

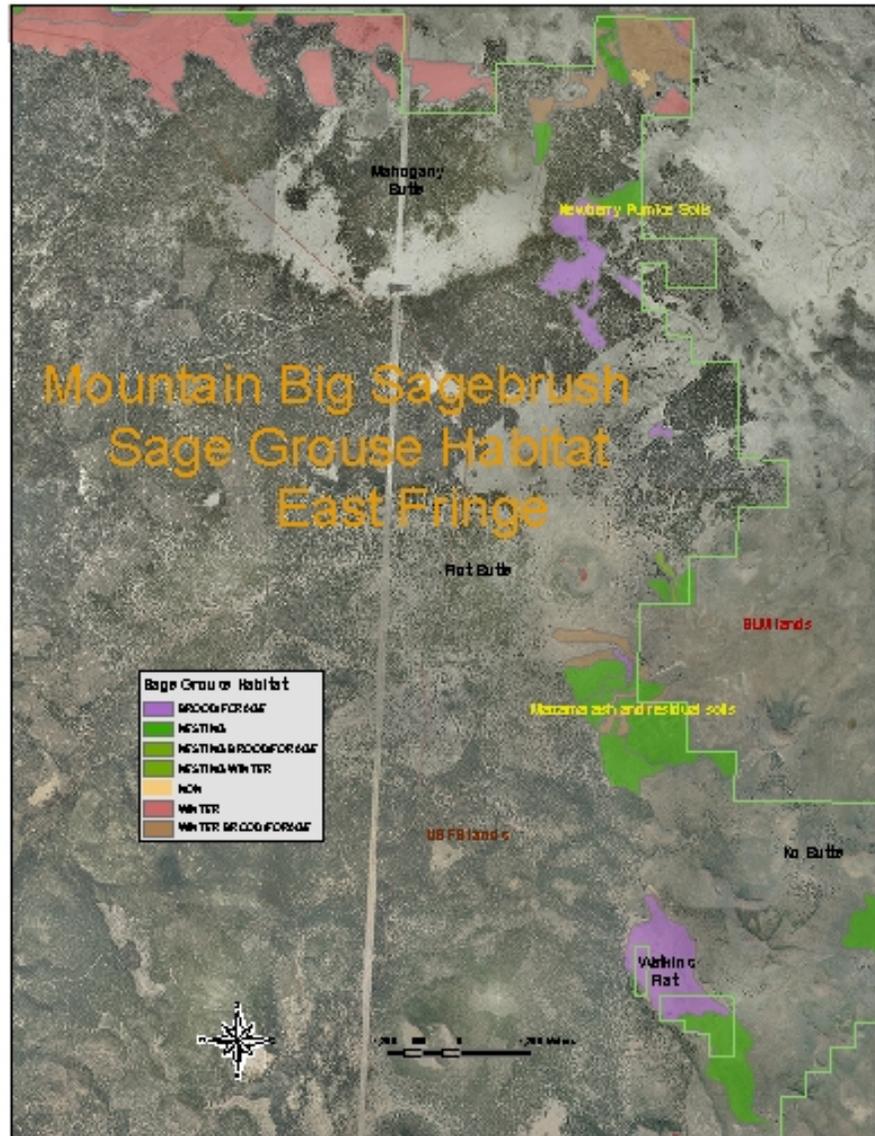
The mapped extent of the three habitat types are summarized in **Table_2** and displayed for the eastern fringe area in **Figure_9**. Vegetative cover, composition and shrub heights from formally sampled habitats were utilized as a guide to extrapolate a current habitat type to each ecological type map unit in which data was not collected. A representative habitat type was attributed for each ecological type map unit where breaks in seral stages were not obvious or where the predominant habitat type was not uniform across the entire map unit.

Table_2. Potential and existing habitat types provided by Sagebrush Ecological Types on Pine Mountain and desert fringe areas.

Ecological Type	Potential Habitat Types	Existing Habitat Types (acres)
PIPO / ARTRV_PUTR deep	Non / Nesting / Winter*	492 / 289 / 10
PIPO / ARTRV_PUTR mod	Non / Nesting / Winter*	329 / 36 / 36
PIPO / ARTRV_PUTR shallow	Non / Nesting / Winter*	68 / 0 / 0
PIPO / ARTRV mod	Non / Brood-forage / Nesting / Winter*	85 / 36 / 16 / 68
ARTRV_PUTR deep	Winter / nesting	2,128 / 45
ARTRV_PUTR mod	Brood-forage / Nesting / Winter	316 / 2,502 / 342
ARTRV_PUTR shallow	Brood-forage / Nesting	170 / 84
ARTRV_PUTR_CHVI moderate	Brood-forage	315
ARTRV_PUTR_CHVI deep	Brood-forage	104
ARTRV / FEID mod	Brood-forage / Nesting	69 / 560
ARTRV / FEID vgr mod	Brood-forage / Nesting	187 / 56
ARTRV / FEID shallow	Brood-forage / Nesting	720 / 119
ARTRV_CHVI / FEID deep	Winter / Nesting / Brood -forage	1,848 / 28 / 432
ARTRV_CHVI / CARO deep pumice	Brood -forage	326
ARTRV_PUTR / CARO deep pumice	Nesting / Brood -forage	205 / 0

*Ecological types with a PIPO component may be able to function as sage grouse habitat following a fire disturbance after snags fall to the ground and before seeded conifers become large enough to provide raptor perches.

Figure_9. East Fringe Area Existing Habitat Types.



The majority of ecological types mapped during this process were observed to currently provide nesting and/or winter habitat (**Table_3**). The observed percentage (59%) appears to be largely the result of fire suppression in the area that has allowed many plant communities to progress to a mid- to late seral condition. Measured cover of shrubs on transects collected within nesting habitat utilized during the 1988-1993 telemetry study is at or above levels documented for nesting habitat across the range of sage grouse. Few nesting sites have been found in shrub communities with cover values above 30% (Hagen, 2007). The higher shrub cover measured in nesting habitat on Pine Mountain may limit the growth and maintenance of grasses and herbaceous forbs utilized in sage grouse diets and subsequently affect the use of this habitat.

Table_3. Summary of Habitat types mapped as Sage Grouse habitat

Habitat type	% of area mapped
NON	13
BROOD/FORAGE	18
NESTING	32
WINTER	27
NESTING BROOD/FORAGE	2
NON/NESTING	2
WINTER BROOD/FORAGE	5

Seral Conditions within Ecological Types: The current seral stage assigned to each Ecological Type map unit is based on measured ages of shrubs or extrapolated from similar ecological types in the area. Shrub age data collected by destructively sampling three ARTRV and PUTR species within 42 ecological type map unit polygons on Pine Mountain indicates that the majority of “xeric shrublands” on Pine Mountain are currently in a mid to late-mid seral stage. **Table_4** summarizes the current seral stage (measured or estimated) of all ecological types mapped for this project.

Table_4. Seral Stages of mapped Ecological Types

Seral stage	Ecological Type Map Units		
	% w/data	% extrapolated	Total (%)
EARLY-MID	2	0	2
MID	33	41	74
MID-LATE	6	4	10
LATE	5	9	14

Areas of late seral conditions exist primarily within the ARTRV_PUTR ecological types. The oldest ARTRV and PUTR individuals measured were 58 and 84 years, respectively. A GPS photo point was established and a series of photographs were taken for each ecological type polygon visited for shrub age sampling. Six site photographs are hyperlinked to a point layer created in GIS for each ecological type polygon in which data was collected. An Excel spreadsheet of the shrub age data and GPS locations is in the project file and is summarized in **Table_5**:

Table_5: Mountain sagebrush and bitterbrush age data

Summary of shrub ages in 42 ecological type sample plots			
	ARTRV	PUTR	All
Mean	24.1	37.9	31.0
Median	23.0	36.0	25.0
Mode	14.0	47.0	14.0
Max	58.0	84.0	-
Min	5.0	5.0	-

Specific Nest Habitat Vegetation data: Pine Mountain vegetation plots PM_4, 6 and 7 are located on three nest site habitats identified by the BLM telemetry study (USDI, 1994). These sites may also function as brood rearing habitat, depending on the presence of forbs, grasses and insects utilized for food. Shrub ages, heights and cover values measured in these plots are representative of late seral conditions that have not burned for thirty or forty plus years. ARTRV shrub ages measured in three plots located in nesting habitat averaged 22 and 41 years in an ARTRV_moderate ecological type (plots PM_4 and PM_7), and 28 years in an ARTRV-PUTR_moderate ecological type (plot PM_6). PUTR individuals from PM_6 were 35 and 80 years of age.

Average shrub height in PM_6 (**Figure_10**) was 81.6 cm for ARTRV and 107.7 for PUTR individuals, conditions that likely represent the latest seral conditions of the three nest sites.

The two nest site habitats in ARTRV_moderate ecological types currently express mid-seral (PM_4) and late seral (PM_7) conditions and have an average ARTRV shrub height of 42 and 74 cm, respectively. Shrub heights on site do not necessarily correlate with age however, which is likely due to variability in site productivity and the micro-site soil conditions within an ecological type. Measured live shrub cover densities within nest site habitats range from 17 to 30%. CHVI was a variable component of all three ecological types sampled in nest site habitat, ranging from 0.7 to 2.7% cover.



Figure_10. Permanent vegetation plot PM_6 with large ARTRV and PUTR individuals expressing late seral conditions.

Fire Disturbance

Ecological types located within prescribed burn or recent wildfire areas on Pine Mountain or along the desert fringe provide the youngest seral stages within the areas mapped. The rate at which an ecological type can provide brood rearing/foraging, nesting or winter habitat following a fire disturbance appears to be directly proportional to the depth and moisture holding capacity of the soil profile on site. Shrub cover of ecological types located within a 1979 prescribed burn on Pine Mountain (**Figure_11**) is extensive enough to be at or close to values measured in types considered to be nesting habitat. These measurements indicate a rate of recovery for ARTRV_shallow and ARTRV-PUTR_moderate ecological types of approximately 25 to 30 years to provide nesting habitat, and 15 to 25 years to obtain brood rearing habitat.



Figure 11. ARTRV_shallow (PM_2 left) and ARTRV-PUTR_moderate (PM_3 right) ecological types providing brood-forage and nesting habitat characteristics, respectively, 27 years after 1979 prescribed burn.

A recent wildfire in August, 2005 on Pine Mountain burned through an ARTRV / FEID_shallow ecological type and re-vegetated rapidly with bunchgrass and lupine species (**Figure 12**). The site is adjacent to plot PM_2 installed in 2005 and will show rates of shrub response for this ecological type during early and mid-seral stages.



Figure 12. 2005 wildfire (left) on ARTRV_shallow ecological type with 2006 recovery dominated by lupine and bunchgrasses (right).

Summary of Habitat provided by Sagebrush Ecological Types

ARTRV moderate and **ARTRV_PUTR moderate** ecological types appear to provide the most extensive nesting habitat on Pine Mountain (560 and 1,655 acres, respectively).

- This is 24% (2,215 of the 9,419 acres) of identified habitat mapped on Pine Mountain.
- These types also provide the most extensive nesting habitat identified in the desert fringe habitat south of Plot Butte.
- The **ARTRV_PUTR moderate** ecological type sampled within the 1979 prescribed burn (vegetative plot PM_3) is currently dominated in size and number by ARTRV individuals but has a significant component of PUTR developing beneath the ARTRV individuals. The PUTR component may comprise a greater percentage of shrub cover and develop a larger size found in nesting habitat as the type moves into late seral conditions.

ARTRV_PUTR deep pumice type provides the shrub characteristics of known nesting habitat, but does not have the fescue and forb diversity.

- This type is likely more important as cover in winter months or for protected movement during brood rearing and foraging activities.

ARTRV_PUTR deep and **ARTRV_CHVI deep** ecological types appear to provide primarily winter habitat

- This is 42% (3,917 of the 9,419 acres) of identified habitat mapped on Pine Mountain.
- Although they generally have the shrub cover and structure found in nesting habitat, they have a lesser diversity and composition of herbaceous forbs than the ARTRV_PUTR moderate ecological type and may not be utilized for nesting.
- ARTRV_PUTR moderate types also have the potential to grow shrub heights capable of providing cover and food sources above winter snowpack accumulations.

ARTRV shallow ecological types appear to provide primarily brood habitat on Pine Mountain.

- This is 8% (720 out of 9,419 acres) of identified habitat mapped.
- Some of these community types have pockets of deeper soil that can support groups of ARTRV_PUTR or ARTRV individuals dense and large enough to provide nesting habitat (119 acres).
- The ARTRV deep pumice basin landform type along the desert fringe also appears to provide the characteristics of this type of habitat.

The **ARTRV_PUTR_CHVI moderate** ecological type mapped on the southern slopes of Pine Mountain was prescribed burned in 1980 and has the highest percent cover of CHVI of all types mapped in the project area.

The **ARTRV_CHVI / CARO deep pumice** and the **ARTRV_PUTR / CARO deep pumice** types have the shrub cover and structure of brood rearing/foraging and nesting habitat, respectively, although the grass and forb diversity is noticeably lower than in comparable shrub / FEID types on finer ash. Forb species present in the Newberry pumice include *Achillea millefolia*, *Eriogonum umbellatum*, *Castilleja chlorotica* and *Phlox gracilis*.

PIPO / ARTRV_PUTR ecological types may or may not provide nesting or brood-forage habitat depending on the size and extent of the conifer component present in the existing seral stage.

Desert Fringe Habitat:

Approximately 2,600 acres of xeric shrublands located along the desert fringe were typed according to unique soil characteristics and plant compositions observed on the ground (**Figure_16**). Although limited physical evidence of sage grouse use was noted (i.e. - sage grouse scat), lek sites on BLM lands to the east are proximate enough to provide birds to these fringe areas. Documented use of an ARTRV_PUTR / FEID moderate ecological type south of Ko Butte by sage grouse was observed from the presence of sage grouse feces in this area (**Figure_13**). In addition, the ecological types mapped along the desert fringe primarily express late-mid seral conditions that provide the composition and cover of shrubs and herbaceous vegetation found in suitable nesting or brood-rearing sage grouse habitat.



Figure_13. Sage grouse scat observed in fringe ARTRV_PUTR / FEID ecological type south of Ko Butte

The desert “fringe” areas along the eastern Forest boundary and the northeastern slopes of Pine Mountain appear to be dynamic in their expression of conifer cover as a result of fire frequency and behavior. Although the extent to which conifer encroachment on sage grouse habitat has occurred above that found under pre-fire suppression conditions is not entirely clear, the presence of occasional relict PIPO stumps, snags and down wood were observed throughout these areas and indicates the historic presence of conifers under a natural fire disturbance regime.

The consumption of vegetation along the eastern desert fringe by the Aspen wildfire in 1959, indicates that the majority of acres throughout the fringe area are able to carry wildfire and generate early seral conditions lacking in conifer cover. The return of PIPO in the areas burned by the Aspen fire was enhanced by aggressive reforestation that included mechanical terracing and may or may not accurately express the natural density or rate of return of this species in an unregulated fire regime. Many fringe areas likely provide sage grouse habitat during early and mid seral conditions following fire disturbance. These areas may cycle out of useable habitat after conifers are established and until fire returns to the site.

Conifer encroachment: Some areas adjacent to fringe habitat mapped by this project appear capable of providing sage grouse habitat but have a small component of conifer cover that may or may not affect use by sage grouse (**Figure_14**). Although some



Figure_14. ARTRV / CHVI deep ecological type (foreground) with scattered PIPO on convex slopes in an adjacent ARTRV_PUTR type (rear middleground).

biological observations assume that the presence of trees as raptor perches limits the utility of habitat by sage grouse, the extent to which this occurs is not clear, especially since a telemetry study nest site on Pine Mountain was bordered by PIPO individuals.

In addition, the aggressive reforestation of fringe habitat burned by the Aspen fire in 1959, including machine terracing, may have affected the amount of sage grouse habitat currently expressed along the desert fringe due to the physical presence of planted individuals and their subsequent natural regeneration. As a result, the dynamic habitat conditions of fringe areas may provide a greater number of acres of habitat than was mapped or identified by this project. It appears that total acres of Sage Grouse habitat could be enhanced in the fringe areas by active management of coniferous vegetation through mechanical or fire treatments. Fringe sagebrush habitats were not found to have been impacted by either mowing or prescribed burns at the time of field surveys,

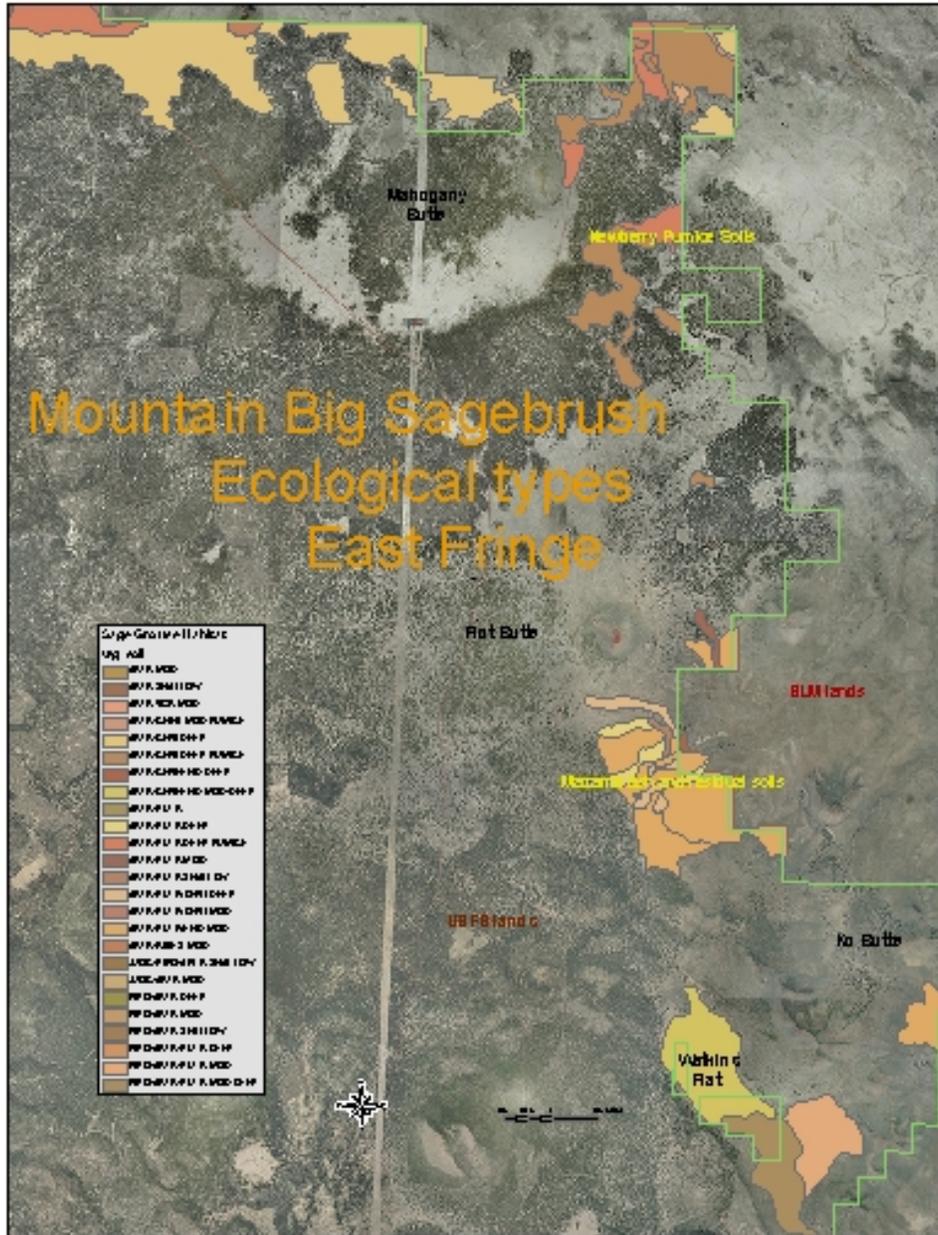
Fringe Ecological Types: The influence of a deep layer of Newberry pumice was observed in the northern portions of fringe habitat near Mahogany Butte down to Plot Butte. Ecological types mapped in Newberry pumice have little or no composition of Idaho fescue and contain Ross sedge (**Figure 15**). These include an ARTRV_CHVI / CARO deep pumice located in a basin landform and an ARTRV_PUTR / CARO deep pumice located on a convex “dunal” landform. Vegetative plots within an ARTRV / CARO deep pumice type and an ARTR_PUTR / CARO deep pumice type describe existing structural characteristics and composition of shrubs and herbaceous vegetation in ecological types with mid to late seral nesting (PM_10) or brood rearing/foraging (PM_9) habitat.



Figure 15. Plot PM_9 located on an ARTRV / deep pumice ecological type in a desert fringe basin (left) with surface pumice composition (right).

Fringe Habitat Field Notes: Approximately 2,600 acres along the eastern boundary of the Deschutes National Forest that are contiguous with sagebrush communities located on adjacent BLM land were observed to be capable of providing sage grouse habitat and mapped as ecological types (**Figure_16**).

Figure_16. Fringe Habitat Ecological Types



The coarse textured Newberry pumice appears to affect the grass and forb composition of the vegetation community by altering the seasonal storage and release of available moisture on site. Idaho fescue disappears nearly completely within an area influenced by Newberry pumice parent material from north of Mahogany Butte south to Plot Butte. Fescue is replaced by Ross sedge (*Carex rossii*) and Squirrel tail (*Elymus elymoides* ssp. *elymoides*) in the communities sampled on the Newberry pumice material northeast of Mahogany Butte (combining for 2% and 7% cover in PM_9 and PM_10, respectively). Forb species present in the Newberry pumice include *Achillea millefolium*, *Eriogonum umbellatum*, *Castilleja chlorotica* and *Phlox gracilis*.

Approximately 530 acres mapped on flat terrain along the southern edge of the Kotzman basin (T21S, R15E & R16E, sections 13-15, 16-18) are located within the deposits of Newberry pumice and express an ARTRV / CARO deep pumice ecological type. Soil depth, pumice content, particle size stratification and landform were observed to be the primary characteristics influencing ecological types on these sites (**Figure_17**). The ARTRV / CARO ecological type is primarily identified as winter sage grouse habitat, but may be able to provide brood/foraging or even nesting habitat similar to BLM sites in the Kotzman and Millican basins.



Figure_17. ARTRV / CARO ecological type on Newberry pumice deposits (left) and deep soil profile showing coarse pumice over finer ash (right).

Post-deposit dynamics of the Newberry pumice deposits appear to have an influence on the ecological type expressed in this area. Basin locations generally have uniform stratification of coarser material at the surface, while lava ridge or dunal convex landforms have accumulated fines mixed in with the coarse material in the surface horizons (**Figure_18**).



Figure_18. Surface features of basin (left) and convex (right) dunal landforms in the area of Newberry pumice influence.

Basin landform locations appear to be “blowout” areas that lose fines during wind storms and the convex landforms appear to be “depositional” areas where fines are mixed with the coarse pumice in the surface horizons (**Figure_19**). The convex depositional areas have a PUTR shrub component added to them and are typed as ARTRV_PUTR / CARO where the Newberry pumice is present. This type contains the shrub characteristics of nesting habitat.



Figure_19. Soil horizons of a ‘dunal’ landform showing mixed surface (left), coarse sublayer (center) and buried older fine ash (right).

Shrub composition is dominated by ARTRV and PUTR within the Newberry pumice, with pure ARTRV composition in basin landforms and ARTRV_PUTR associations on the convex 'dunal' locations. Prickly phlox (*Leptodactylon pungens*) is present in the shrub communities located on basin landforms, while gray rabbit brush (*Chrysothamnus nauseosus*) is present in both basin and convex landform locations. CHVI appears likely to gain cover following disturbance.

The perennial bunchgrass component represented by Idaho fescue (*Festuca idahoensis*) is prevalent in most ecological types sampled on Pine Mountain and desert fringe areas south of Plot Butte. Cover data measurements from the permanent vegetation plots show an average of 41% cover of FEID in the three nest site samples and 31% in the two samples from the 1979 prescribed burn.

Ecological types mapped near Plot Butte, Ko Butte and in Watkins Flat are similar to those on Pine Mountain due to the return of finer ash on the surface, lava rock fragments on the surface and within the profile and residual subsurface soils. The ARTRV_PUTR shrub community contains Idaho Fescue (FEID) and forbs found in the Pine Mountain ecological types and appear support sagebrush communities with characteristics capable of providing habitat for sage grouse. (**Figure_20**).



Figure_20. Fringe ARTRV_PUTR / FEID_moderate ecological type south of Ko Butte considered nesting habitat.

Most of the types mapped in areas along the desert fringe were observed to have varying presence and densities of Ponderosa pine (PIPO) seedlings, saplings, young to mid-aged, and mature conifers in proximity to them. The extensive Aspen Flat fire in 1959 was aggressively reforested along the desert fringe and created many areas that are now stocked with young to mid-aged individuals. This stock has naturally seeded additional individuals over this time. The dynamic cycles of vegetation conditions in fringe habitat may allow for active management of coniferous vegetation through mechanical or fire treatments to enhance Sage grouse habitat in some areas.

The observation of PIPO along the desert fringe appears to reflect a dynamic system in which the presence, age and density of conifers fluctuates with fire disturbances. Although the majority of existing conifers are young to mid-aged individuals, seedlings are currently dispersed throughout many areas. Relict ponderosa pine stumps and coarse woody boles on the ground indicate a variable historical presence of conifers as an established seed source along the desert fringe areas (**Figure_21**).



Figure_21. ARTV_PUTR / FEID ecological type located south of Plot Butte on finer ash soil with scattered PIPO.

References

Hagen, C., 2005. Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: *A Plan to Maintain and Enhance Populations and Habitat*. Oregon Department of Fish and Wildlife, Salem, OR., USA.

Hagen, C.A., Connelly, J.W. & Schroeder, M.A. 2007: A meta-analysis of greater sage-grouse *Centrocercus urophasianus* nesting and brood-rearing habitats. - *Wildl. Biol.* 13 (Suppl. 1): 42-50.

Lutes, Duncan C.; Keane, Robert E.; Caratti, John F.; Key, Carl H.; Benson, Nathan C.; Sutherland, Steve; Gangi, Larry J. 2006. FIREMON: Fire effects monitoring and inventory system. Gen. Tech. Rep. RMRS-GTR-164-CD. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 1 CD.

Miller, R. et al. 2001. Pre and Post Settlement Fire Regimes in Mountain Big Sagebrush Steppe and Aspen: The Northwest Great Basin. Unpublished Final Report 2001 to the National Interagency Fire Center.

USDA Forest Service, 1988. Plant Associations of the Central Oregon Pumice Zone.

USDI Bureau of Land Management, 1994. Sage Grouse in the High Desert of Central Oregon: Results of a Study, 1988-1993.

Appendix A: Pine Mountain Sage Grouse Nest Site Habitats

(A full report of all six nest site habitats is located in the project file)

Site # 1 (Telemetry Nest site #13114)

N 43° 49' 11.8" W 120° 58' 01.2" ~5,015 ft



- ARTR-PUTR/FEID community on northeasterly, 25% slope. Some CHVI present.
- Vegetative cover estimated at 50 to 60% total (ocular estimate of ~35% shrub cover including 20% PUTR and 15% ARTR).
- Sage individuals averaging 20 to 25" in height and are spreading with few dead branches.
- Herbaceous and grass vegetation includes interspersed forbs and grasses, including castelleja, calochortus, yarrow, sandberg bluegrass, bluebunch wheatgrass (<1%), aster campestris (western meadowstar), eriogonum heracleoides, silene douglasii, and boraginaceae lithospermum.
- Soil: relatively shallow (10 to 15") profile consisting of older ash/residuum with gravels and cobbles on the surface. Gravels present down through profile. Mollic colors.

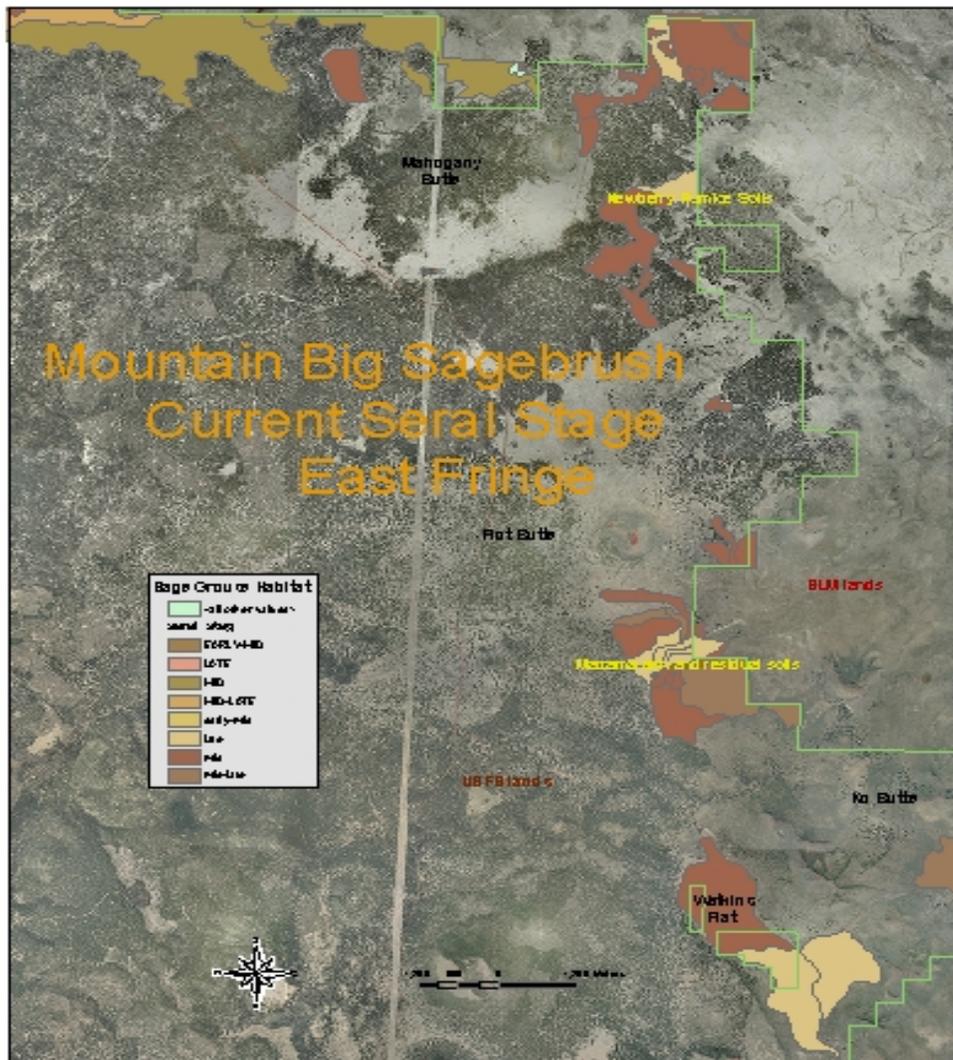
Appendix B

Electronic copies of annual summary reports (FY05, 06 & 07) and other data collected or compiled for the Sage Grouse mapping project are filed on the Forest Service network server. This includes maps, photographs, permanent vegetative plot data and GIS data. The file pathway for this material is on the S:/ drive:

S:/r06/des/bfr/program/wildlife/Species_Info/Western_sage_grouse.

Appendix C

Mountain Big Sagebrush Current Seral Stage for desert fringe areas of the Bend/Ft. Rock Ranger District.



Note: Polygons with capital letter attributes have collected age data; polygons with lower case attributes have had their seral stage extrapolated from similar types within the mapping area.