United States
Department of
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Forest Service

Pacific Northwest
Research Station

General Technical
Report
PNW-GTR-XXX
Month Year

Stereo Photo Series for Quantifying Natural Fuels

Volume X: Sagebrush with Grass and Ponderosa Pine - Juniper Types in Central Montana

Roger D. Ottmar, Robert E. Vihnanek, and Clinton S. Wright

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ABSTRACT

Ottmar, Roger D.; Vihnanek, Robert E.; Wright, Clinton S. 2006. Stereo photo series for quantifying natural fuels. Volume X: Sagebrush with grass and ponderosa pine - juniper types in central Montana. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Two series of single and stereo photographs display a range of natural conditions and fuel loadings in sagebrush with grass and ponderosa pine - juniper types in central Montana. Each group of photos includes inventory information summarizing vegetation composition, structure, and loading; woody material loading and density by size class; forest floor depth and loading; and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, Missouri Breaks, mixed-conifer, ponderosa pine, *Pinus ponderosa*, creeping juniper, *Juniperus horizontalis*, Douglas-fir, *Pseudotsuga menziesii*, big sagebrush, *Artemisia tridentata.*

COOPERATORS

This publication was developed by the USDA Forest Service, Pacific Northwest Research Station, Fire and Environmental Research Applications team in cooperation with the Bureau of Land Management, Central Montana Zone Fire Management, with funding provided, in part, by the Joint Fire Science Program.

ACKNOWLEDGMENTS

Special recognition is due Vinita Shea, Jennifer Walker, and Karly Krausz, Bureau of Land Management, Lewistown Field Office; Brad Gillespie, Bureau of Land Management, Dillon Field Office; John Thompson, Bureau of Land Management, Butte Field Office; and Mitch Maycox, Bureau of Land Management, Medford Field Office. David Wright, Nicole Troyer, Geoffrey Seymour, Brian Maier, Ann McCauley, Frank Archuleta, Steve Duex, Jennifer Prince, Jennifer Byington, Erin Kenney, and Christine Pachecco, USDA Forest Service, Pacific Northwest Research Station, Pacific Wildland Fire Sciences Laboratory worked on this project in the field and in the laboratory.

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CONTENTS

WHAT IS THE NATURAL FUELS PHOTO SERIES?

The first phase of the natural fuels photo series was a collection of six volumes, each representing a region of the United States. Additional phases of the natural fuels photo series included new volumes (Volumes VII, VIII, IX and Hawaii) and supplemental volumes (Volumes IIa, Va, and VIa). Volume I included sites in mixed-conifer, western juniper, sagebrush, and grassland ecosystems in the interior Pacific Northwest. Volume II included sites in black and white spruce ecosystems in Alaska, and volume IIa included sites in hardwood ecosystems undergoing succession to spruce. Volume III included sites in lodgepole pine, quaking aspen, and gambel oak ecosystems in the Rocky Mountains. Volume IV included sites in pinyon-juniper, sagebrush, and chaparral ecosystems in the Southwest. Volume V included sites in red and white pine, northern tallgrass prairie, and mixed oak ecosystems in the Midwest, and volume Va included sites in jack pine ecosystems. Volume VI included sites in longleaf pine, pocosin, and marsh grass ecosystems in the Southeast, and volume VIa included sites in sand hill, sand pine scrub, and white pine invaded hardwood ecosystems. Volume VII included sites in Oregon white oak, California deciduous oak, and mixed-conifer with shrub ecosystems in Washington, Oregon and California. Volume VIII included sites in hardwood, pitch pine, and red spruce/balsam fir ecosystems in the Northeast. Volume IX included sites in oak-juniper ecosystems in southern Arizona and New Mexico. An un-numbered volume included grassland, shrubland, woodland, and forest ecosystems in Hawaii.

Generally, sites include wide-angle and stereo-pair photographs supplemented with information on living and dead fuels, vegetation, and stand structure and composition within the area visible in the photographs (fig. 1). This volume (Volume X) continues the natural fuels photo series and includes sites in sagebrush with grass, and ponderosa pine - juniper ecosystems in central Montana. The sites in this volume provide a basis for appraising and describing woody material, vegetation, and stand conditions in many sagebrush with grass and ponderosa pine - juniper ecosystems throughout Montana.

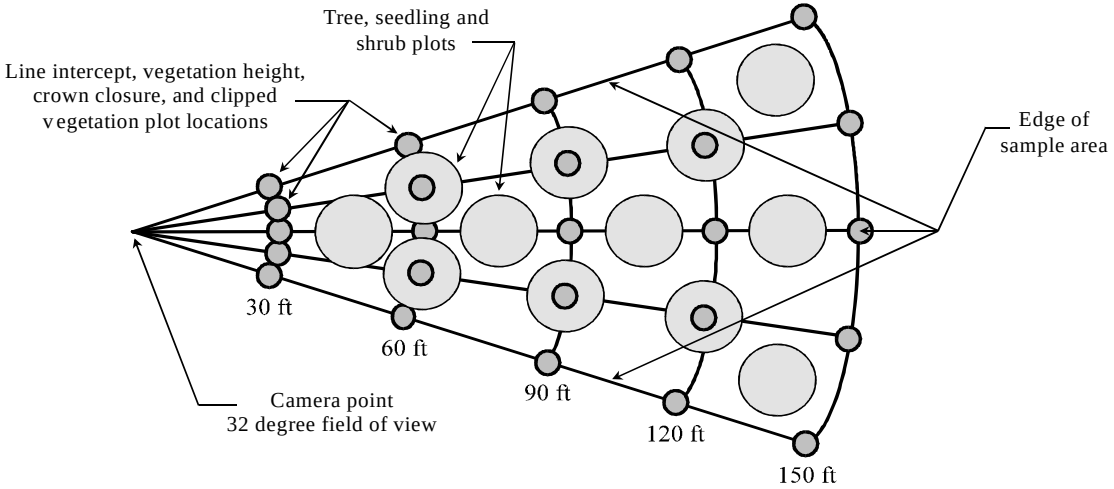

Figure 1--Photo series sample area layout. Forty random azimuth line transects (one at each point on the 30- and 150-foot arcs, and two at each point on the 60-, 90-, and 120-foot arcs) and 12 clipped vegetation plots (two to three per arc) were located within the sample area. Trees, shrubs and seedlings were inventoried on 12 systematically located sample plots.

WHY IS THE PHOTO SERIES NEEDED?

These photo series are land management tools that can be used to assess landscapes through appraisal of living and dead woody material and vegetation (i.e., fuels) and stand characteristics. Once an assessment has been completed, stand treatment options, such as prescribed fire or harvesting, can be planned and implemented to better achieve desired effects while minimizing negative impacts on other resources.

The photo series has application in several branches of natural resource science and management. Inventory data such as these can be used as inputs for evaluating animal and insect habitat, nutrient cycling, and microclimate, for example. Fire managers will find these data useful for predicting fuel consumption, smoke production, fire behavior, and fire effects during wildfires and prescribed fires. In addition, the photo series can be used to appraise carbon sequestration, an important factor in predictions of future climate, and to link remotely sensed signatures to live and dead fuels on the ground.

Ground inventory procedures that directly measure site conditions (e.g., fuel loading and arrangement, vegetation structure and composition, etc.) exist for most ecosystem types and are useful when a high degree of accuracy is required. Ground inventory is time consuming and expensive, however. Photo series can be used to make quick, easy, and inexpensive determinations of fuel quantities and stand conditions when less precise estimates are acceptable.

HOW WAS THE PHOTO SERIES DEVELOPED?

Sites photographed for the series in this volume were selected to represent a range of conditions in sagebrush with grass and ponderosa pine - juniper forest ecosystems in the Missouri Breaks region of central Montana. The sagebrush with grass sites represent a range of shrub coverage, species composition, and shrub size conditions and are ordered by total aboveground biomass. The ponderosa pine - juniper sites show a range of woodland and forested stand conditions and are ordered by tree density. Photographs were taken, and fuel loading, stand structure, and composition data were collected by using the procedures of Maxwell and Ward (1980) as a guide.

PHOTOGRAPHS

Stereo-pair photographs are included in this guide. The three-dimensional image obtained by viewing the photographs with a stereoscope will improve the ability of the land manager to appraise natural fuel, vegetation, and stand structure conditions. A larger wide-angle photograph has been included for additional comparisons. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide scale. The pole is 30 feet from the camera. The summary data relate to the field of view of the stereo-pair photographs but are based on measurements taken in the sample area only (see fig. 1). No sampling occurs in the foreground between the camera and the sign.

PHOTOGRAPH AND INFORMATION ARRANGEMENT

The photographs and accompanying data summaries are presented as single sites organized into two series. Each site is arranged to occupy two facing pages. The upper page contains a wide-angle (50mm) photograph and general site and stand information. For the ponderosa pine - juniper series, the upper page includes information on understory vegetation and dead and down woody material loading and density by size class. The lower page

includes the stereo-pair photographs and summaries of the overstory tree, sapling, and shrub structure and composition. The sagebrush with grass series also includes vegetation, litter and woody material loading by size class. The ponderosa pine - juniper series also includes forest floor information along with juniper biomass and structure information.

SITE AND STAND INFORMATION

The camera point of each site was located with a global positioning system (GPS) receiver using the WGS-84 datum. Aspect and slope were measured with a compass and clinometer, respectively. Ecological community classification (to the association level; NatureServe 2006), an indicator of current vegetation composition, was assigned for all sites. In addition, Society of American Foresters (SAF; Eyre 1980) and Society for Range Management (SRM; Shiflet 1994) cover type, indicators of current vegetation composition were assigned for all ponderosa pine - juniper and sagebrush with grass sites, respectively. Shrub, forb, and graminoid species coverage along with mineral soil exposure, was estimated by using line intercept transects (Canfield 1941). The listing of understory species was not meant to be a complete vegetation inventory and may represent only a portion of the actual species richness of the sampled areas.

For the ponderosa pine - juniper series, tree and seedling species present at a site are listed in order of abundance. Crown closure was measured with a forest densitometer (95 systematically located points). Tree and seedling composition and density were determined either by a total inventory of the sample area, or estimated by using twelve 0.005-acre circular plots; all trees less than 4.5 feet tall were considered seedlings.

UNDERSTORY VEGETATION

Graminoid and forb heights were measured at 25 points located systematically throughout the sample area; shrub height was calculated as an average of all shrubs measured in 12 systematically located 0.005-acre circular plots. Understory vegetation biomass was determined by sampling 12 square, clipped vegetation plots (10.76 square feet each) located systematically throughout the sample area (fig. 1). All live and dead understory vegetation (except *Juniperus* spp.) within each square plot were clipped at ground level, separated, and returned to the laboratory for oven drying. Understory vegetation and other collected material was oven dried at a minimum of 158°F for at least 48 hours before weighing and determination of area loading. Where present, *Prunus virginiana* was considered a shrub and measured in twelve 0.005-acre circular plots; biomass was calculated from a growth-form-based allometric equation (tall shrubs; Brown 1976).

FOREST FLOOR INFORMATION

For the ponderosa pine - juniper series, litter and duff depth were calculated as the average of measurements taken every 5 feet between the 30- and 150-foot arcs of the three center transects for a total of 75 measurements (fig. 1). The depth of the litter and duff was calculated as an average of the depth only where litter or duff was encountered during sampling (null values, or points where litter or duff were absent, are not included in the average). Therefore, the depths reported for litter and duff are not unit-wide averages, and do not necessarily sum to total depth. Loading was calculated from depth and bulk density values derived from field measurements or through collection of material in twelve 10.76 square foot plots.[1] Constancy, an indicator of how consistently the various forest floor components occur in the sample area, is expressed as a percentage of

the total number of measurements. The amount of exposed mineral soil at each site for the ponderosa pine - juniper series can be estimated by subtracting the constancy of the total forest floor from 100 percent. For the sagebrush with grass series, litter loading was determined through collection of material in twelve 10.76 square foot plots.

SELECTED SHRUB AND TREE SPECIES

For the sagebrush with grass series, individual plants of selected shrub and tree species were measured in circular plots or, if shrub density was low, in the entire sample area. Selected tree and shrub species included *Pseudotsuga menziesii*, *Juniperus scopulorum*, *Artemisia tridentata*, and *Sarcobatus vermiculatus*. The density and percentage of all stems that were dead is based on the number of plants rooted in circular plots ranging from 0.0001-acre to 0.005-acre each (or in the entire sample area if shrub density was low). Crown area was calculated from crown breadth (i.e., the average of the maximum crown diameter, and the widest point perpendicular to the maximum crown diameter). Basal diameter was measured above the root collar. Height is given as the average and maximum height of all sampled individuals of a given species. Cover was estimated using line intercept transects (Canfield 1941). *Pseudotsuga menziesii* biomass was estimated using a species-specific allometric equations (Brown 1978) and includes the mass of foliage and branches less than three inches diameter. Shrub biomass was determined by sampling 12 square clipped vegetation plots located systematically throughout the sample area.

WOODY MATERIAL

Measurement techniques used for inventorying dead and down woody material were patterned after the planar intersect method outlined by Brown (1974) and described by Maxwell and Ward (1980). Forty transects of random azimuth starting at 25 systematically located points within the sample area were used to determine woody material loading and density (fig. 1). Woody material data are reported by size classes that correspond to timelag fuel classes used in fire behavior modeling (see, for example, Burgan and Rothermel 1984).[2] Woody material in 10-hour, and 100-hour-and-larger size classes was tallied on transects that were 10 feet and 30 feet long, respectively. The decay class and the actual diameter at the point of intersection were measured for all pieces >3 inches in diameter. All woody material less than or equal to three inches in diameter was considered sound. Woody material loading and woody material density were calculated from relationships that use number of pieces intersected and transect length (and wood specific gravity for loading) developed by Brown (1974) and Safranyik and Linton (1987), respectively. Woody material loading in the 1-hour size class (and the 10-hour and 100-hour size classes for many of the sites) was determined by collecting, oven drying, and weighing all pieces in twelve 10.76-square-foot plots. When woody material >3 inches in diameter was scarce, a total inventory within the sample area was conducted to determine loading and density estimates. Measurements were taken to determine log volume, and wood specific gravities were applied to the volume to calculate loading.

SAPLINGS AND TREES

Overstory tree and sapling composition and density were determined either by a total inventory of the sample area, or were estimated by using twelve 0.005-acre circular plots located systematically throughout the sample area (fig. 1). Tree measurement data were summarized by diameter

[1]Forest floor bulk density values used for each material type appear under "Notes to Users" for each series.

[2]1-, 10-, 100- and 1000-hour timelag fuels are defined as woody material ≤0.25 inch, 0.26-1.0 inch, 1.1-3.0 inches, and >3.0 inches in diameter, respectively.

at breast height (d.b.h.)[3] size class and by tree status (live, dead, or all trees). The two most abundant tree species for each size class are listed with their relative density. Height to crown base (reported as ladder fuel height in previous photo series volumes) was defined as the height of the lowest, continuous live or dead branch material of the tree canopy, and height to live crown was defined as the height of the lowest continuous live branches of the tree canopy. Live crown mass (branchwood and foliage) was calculated from species- and size-specific allometric equations (Brown 1978, Jenkins et al. 2004). *Juniperus scopulorum* with a single-stemmed form was considered a tree.

JUNIPER BIOMASS

Juniperus scopulorum and *Juniperus horizontalis* in the Missouri Breaks region of central Montana have a diverse morphology, from prostrate shrub to tree form, and are reported to hybridize (Fassett 1944, 1945), making them difficult to identify to the species level. Therefore, all juniper with a multi-stemmed form were combined, regardless of species, and characterized by height class to distinguish between the low stature juniper form (≤ 3 ft tall) and the more upright form (> 3 ft tall). Biomass was collected in six systematically located 10.76 square foot plots for each height class represented at each site. All juniper vegetation that occupied the space defined by a vertical projection of the plot edges was clipped, separated into live and dead components, and weighed. A sub-sample of plots was further separated into size classes including foliage and live and dead fine twigs less than or equal to 0.25 inch, 0.26-1.0 inch twigs, and greater than 1.0 inch diameter stem and branch material. Biomass for each height class was calculated by multiplying the square footage occupied by each size/status class and the average loading per square foot for that size/status class for each site.

USING THE PHOTO SERIES

The natural fuels photo series is a tool for quickly and inexpensively evaluating a variety of fuel and vegetation conditions. Because of its ease of use, however, care must be taken when evaluating field sites to compare only with photo series sites that are appropriate matches. It is acceptable, however, to use the data from more than one site from the photo series when evaluating a site in the field (e.g., woody material loading from one site in the photo series and tree density from another site in the photo series to best match the conditions of a given field site).

Make a visual inventory of the site by observing fuel and stand conditions within the field of view and comparing them with the stereo-pair photographs as follows, remembering that the data tables relate to the area behind the sign in the stereo-pair photographs:

- Observe each fuel and vegetation characteristic (e.g., 1.0 to 3.0-inch woody material loading).
- Select a photo series site (or sites) that nearly matches (or brackets) the observed characteristics.
- Obtain the quantitative value for the characteristic being estimated from the data summary accompanying the selected photo series site, or interpolate a value between sites.
- Repeat these steps for each size class or stand characteristic of interest.

[3]D.b.h. is measured 4.5 feet above the ground.

The total biomass or stand condition can then be calculated by summing the estimates. If a site being inventoried has areas with obvious differences in woody material or stand conditions, the user should make separate determinations for each area and then weight and cumulate the loading for the whole site.

Characteristics not distinguishable in the photographs are forest floor depth, loading, and bulk density, and proportions of sound and rotten woody material. If values for these characteristics are desired in the inventory, they must be derived from independent sampling or observations.

The 20 National Fire-Danger Rating System fuel models (Burgan 1988, Deeming et al. 1977) and the 13 original (Albini 1976) or 40 new (Scott and Burgan 2005) fire behavior fuel models are general and broadly applied. Each photo series encompasses a wider range of conditions, and individual sites represent fuel characteristics at greater resolution than can be gained by using fuel models; consequently, we chose not to assign one of these existing fuel models to individual sites in this photo series. The photo series was designed to provide sufficient fuel and vegetation data from which managers could generate their own customized fuel models.

METRIC CONVERSIONS

1 inch (in) = 2.54 centimeters	1 pound (lb) = 0.4536 kilogram	1 ton/acre = 0.2242 kilogram/square meter
1 foot (ft) = 0.3048 meter	1 ton = 907.2 kilograms	1 ton/acre = 2,241.7023 kilograms/hectare
1 square foot = 0.0929 square meter	(Degrees Fahrenheit - 32) × (5/9) = Degrees Celsius	1 ton·acre^{-1}·inch^{-1} = 8.8256 kilograms/cubic meter
1 acre (ac) = 4,046.9 square meters	1 pound/acre (lb/ac) = 1.1209 kilogram/hectare	1 ton·acre^{-1}·inch^{-1} = 8825.6 grams/cubic meter
1 acre = 0.4047 hectare	1 pound/acre = 1.1209 E-04 kilograms/square meter	1 ton·acre^{-1}·inch^{-1} = 8.8256E-03 grams/cubic centimeter

SPECIES LIST

Scientific and common species names are from NRCS (2006).

SCIENTIFIC NAME	COMMON NAME
TREES:	
Juniperus scopulorum Sarg.	Rocky Mountain juniper
Pinus ponderosa P. & C. Lawson	Ponderosa pine
Prunus virginiana L.	Chokecherry
Pseudotsuga menziesii (Mirbel) Franco	Douglas-fir
SHRUBS:	
Artemisia tridentata Nutt.	Big sagebrush
Artemisia ludoviciana Nutt.	White sagebrush
Chrysothamnus Nutt.	Rabbitbrush
Juniperus spp.	Juniper
Potentilla spp.	Cinquefoil
Rhus trilobata Nutt.	Skunkbush sumac
Ribes spp.	Currant
Rosa woodsii Lindl.	Wood's rose
Sarcobatus vermiculatus (Hook.) Torr.	Greasewood
Symphoricarpos albus (L.) Blake	Common snowberry
GRAMINOIDS:	
Bouteloua gracilis (Willd. Ex Kunth) Lag. Ex Griffith	Blue gramma grass
Bromus japonicus Thunb. ex Murr.	Japanese brome
Carex spp.	Sedge
Elymus albicans (Scrib. & J.G. Sm.) A. Love	Montana wheatgrass
Muhlenbergia spp.	Muhly
Nassella viridula (Trin.) Barkworth	Green needle grass
Pascopyrum smithii (Rydb.) A Love	Western wheatgrass
Poa secunda J. Presl	Sandberg bluegrass
Pseudoroegneria spicata (Pursh) A. Love	Bluebunch wheatgrass

SCIENTIFIC NAME	COMMON NAME
FORBS:	
Achillea millefolium L.	Common yarrow
Allium spp.	Onion
Anntennaria spp.	Pussytoes
Arabis spp.	Rockcress
Asteraceae	Aster
Brassica spp.	Mustard
Chenopodium spp.	Goosefoot
Cirsium spp.	Thistle
Collomia linearis Nutt.	Tiny trumpet
Comandra umbellate (L.) Nutt.	Bastard toadflax
Digitalis L. species	Foxglove
Fragaria spp.	Strawberry
Fragaria vesca L.	Woodland strawberry
Geum triflorum (Pursh)	Old man's whiskers/ prarie smoke
Halogeton glomeratus (Bieb.) C.A. Mey	Saltlover
Helianthus L.	Sunflower
Koeleria macrantha	Prairie junegrass
Lactuca spp.	Lettuce
Lepidium spp.	Pepperweed
Medicago sativa L.	Alfalfa
Melilotus officinalis (L.) Lam	Yellow sweetclover
Psoralea spp.	Scrufpea
Ratibida columnifera (Nutt.) Woot.& Standl.	Upright prarie coneflower
Solidago spp.	Goldenrod
Sphaeralcea coccinea (Nutt.) Rydb.	Scarlet globemallow
Taraxacum officinale G.H.Weber ex Wiggers	Common dandelion
Thermopsis Montana Nutt.	Mountain goldenbanner
Thlaspi arvense L.	Field pennycress
Tragopogon dubius Scop.	Yellow salsify
Vicia spp.	Vetch

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SAGEBRUSH WITH GRASS PHOTO SERIES

A SERIES OF 11 SITES
SG 01 THROUGH SG 11

NOTES TO USERS:

1. Sites in the this sagebrush with grass series are arranged in order of increasing total aboveground biomass
2. A list of scientific and common species names can be found on page 8.
3. Photographs were taken in July 2003, 2004, and 2005. Sampling was performed in July and August 2003, 2004, and August 2005.
4. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals. The pole is 30 feet from the camera.
5. Bulk density values used for calculating forest floor loading from depth:

Material type	Litter bulk density	Duff bulk density
	$tons \cdot acre^{-1} \cdot inch^{-1}$	$tons \cdot acre^{-1} \cdot inch^{-1}$
Ponderosa Pine	3.40	7.55
Juniper	4.98	12.01
Moss	2.84	12.10
Grass	0.30	6.39

6. Forest floor and woody material loading, and understory biomass are reported in tons per acre. The designation of "na" indicates cases where data are missing or "not available".
7. While this series predominantly covers sagebrush with grass types, two sites (SG03, SG05) are dominated by *Sarcobatus vermiculatus* (greasewood).

SG 01 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 32’ 16.8” W 108° 52’ 41.7”
Elevation: 2,996 ft Aspect: -- Slope: 0%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Poa secunda* (7), *Artemisia tridentata* (2), *Pascopyrum smithii* (2), *Achillea millefolium* (1), *Helianthus* spp. (1), *Sphaeralcea coccinea* (1), *Vicia americana* (1)

Exposed mineral soil (coverage): 58%

Total aboveground biomass: 0.52 tons/ac

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SELECTED SHRUB / TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	895	2	1.3	1.3	1.1	0.9	1.6	2	0.22

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	2	5	10
Avg height (ft)	0.9	0.5	0.5
Live biomass (tons/ac)	0.19	--	--
Dead biomass (tons/ac)	0.03	--	--
Total biomass (tons/ac)	0.22	0.05	0.11

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.04
≤ 0.25	0.02
0.26 - 1.0	0.08
1.1 - 3.0	0.00
Total	0.14

SG 02 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 38’ 15.4” W 108° 40’ 3.0”
Elevation: 2,791 ft Aspect: SW Slope: 5%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Agropyron spicatum* (28), *Melilotus officinalis* (10), *Bromus japonicus* (6), *Agropyron smithii* (5), *Sarcobatus vermiculatus* (3), *Artemisia tridentata* (2), *Trifolium* spp. (2), *Carex* spp. (2), *Achillea millefolium* (2), *Nassella* spp. (1), *Themopsis montana* (1), *Brassica* spp. (1)

Exposed mineral soil (coverage): 4%

Total aboveground biomass: 0.92 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	491	4	2.7	3.3	1.4	1.7	3.7	2	0.03
Juniperus spp.	36	0	3.7	5.3	3.2*	11	13	1	na

*Diameter at breast height

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	6	17	73
Avg height (ft)	1.6	1.4	1.2
Live biomass (tons/ac)	--	--	--
Dead biomass (tons/ac)	--	--	--
Total biomass (tons/ac)	0.03	0.07	0.60

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.19
≤ 0.25	0.01
0.26 - 1.0	0.03
1.1 - 3.0	0.00
Total	0.23

SG 03 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 37’ 72.5” W 108° 37’ 55.9”
Elevation: 2,293 ft Aspect: -- Slope: 0%

Association: Black greasewood / Basin big sagebrush shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Sarcobatus vermiculatus* (18), *Agropyron smithii* (5), *Muhlenburgia* spp. (5), *Opuntia polycanthia* (3), *Brassica* spp. (1)

Exposed mineral soil (coverage): 61%

Total aboveground biomass: 1.19 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Sarcobatus vermiculatus	3,740	0	1.9	2.9	na	1.8	3.4	18	0.67

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	19	1	16
Avg height (ft)	1.8	0.6	1.1
Live biomass (tons/ac)	--	--	--
Dead biomass (tons/ac)	--	--	--
Total biomass (tons/ac)	0.67	0.01	0.13

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.02
≤ 0.25	0.19
0.26 - 1.0	0.17
1.1 - 3.0	0.00
Total	0.38

SG 04 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 32’ 16.5” W 108° 52’ 41.6”
Elevation: 3,017 ft Aspect: -- Slope: 0%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (16), *Poa secunda* (3), *Pascopyrum smithii* (2), *Vicia americana* (1), *Nassella viridula* (1)

Exposed mineral soil (coverage): 32%

Total aboveground biomass: 1.27 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	10,527	5	0.7	0.4	1.1	0.7	1.8	16	0.90

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	16	1	7
Avg height (ft)	0.7	0.4	0.4
Live biomass (tons/ac)	0.70	--	--
Dead biomass (tons/ac)	0.20	--	--
Total biomass (tons/ac)	0.90	0.02	0.08

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.06
≤ 0.25	0.11
0.26 - 1.0	0.10
1.1 - 3.0	0.00
Total	0.27

SG 05 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 37’ 79.2” W 108° 37’ 39.4”
Elevation: 2,293 ft Aspect: -- Slope: 0%

Association: Black greasewood / Basin big sagebrush shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Agropyron smithii* (48), *Sarcobatus vermiculatus* (20), *Artemisia tridentata* (5) *Vicia* spp. (2), *Brassica* spp. (1)

Exposed mineral soil (coverage): 12%

Total aboveground biomass: 1.66 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	1,694	0	1.3	1.4	na	1.7	2.9	5	0.04
Sarcobatus vermiculatus	3,773	1	1.8	2.5	na	2.2	3.9	20	0.50

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	25	5	49
Avg height (ft)	2.5	0.7	1.4
Live biomass (tons/ac)	--	--	--
Dead biomass (tons/ac)	--	--	--
Total biomass (tons/ac)	0.54	0.13	0.65

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.03
≤ 0.25	0.13
0.26 - 1.0	0.16
1.1 - 3.0	0.02
Total	0.34

SG 06 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 33' 01.0" W 108° 49' 77.5"
Elevation: 2,870 ft Aspect: -- Slope: 2%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Pseudoregneria spicata* (40), *Artemisia tridentata* (11), *Pascopyrum smithii* (8), *Juniperus horizontalis* (7), *Rosa woodsii* (3), *Symphoricarpus albus* (2), *Rhus trilobata* (2), *Koeleria macrantha* (2), *Bromus japonicus* (2), *Achillea millifolium* (2), *Melilotus officinalis* (1)

Exposed mineral soil (coverage): 18%

Total aboveground biomass: 2.12 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	2,549	1	2.0	0.7	na	1.1	2.7	17	0.87
Juniperus horizontalis	na	na	na	na	na	na	na	7	0.20

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	24	3	53
Avg height (ft)	1.4	0.4	0.9
Live biomass (tons/ac)	1.04	--	--
Dead biomass (tons/ac)	0.03	--	--
Total biomass (tons/ac)	1.07	0.01	0.14

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.24
≤ 0.25	0.26
0.26 - 1.0	0.25
1.1 - 3.0	0.15
Total	0.90

SG 07 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 33’ 01.4” W 108° 49’ 48.3”
Elevation: 2,840 ft Aspect: NW Slope: 13%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (17)

Exposed mineral soil (coverage): 24%

Total aboveground biomass: 3.08 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	6,776	14	1.4	1.0	1.2	1.2	2.4	18	1.73

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	18	2	6
Avg height (ft)	1.5	na	0.6
Live biomass (tons/ac)	1.23	--	--
Dead biomass (tons/ac)	0.50	--	--
Total biomass (tons/ac)	1.73	0.01	0.25

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.39
≤ 0.25	0.23
0.26 - 1.0	0.47
1.1 - 3.0	0.00
Total	1.09

SG 08 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 47° 31’ 45.6” W 108° 52’ 33.2”
Elevation: 3,036 ft Aspect: -- Slope: 0%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (10), *Juniperus horizontalis* (6), *Agropyron smithii* (3), *Elymus albicans* (3), *Poa secunda* (2), *Medicago sativa* (1), *Sphaeralcea coccinea* (1), *Vicia americana* (1), *Comandra umbellate* (1)

Exposed mineral soil (coverage): --

Total aboveground biomass: 3.12 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	2,365	28	0.8	0.5	0.9	0.6	0.6	16	1.26
Juniperus horizantalis	7	na	na	na	na	na	na	6	1.20

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	22	4	8
Avg height (ft)	0.6	0.3	0.6
Live biomass (tons/ac)	1.64	--	--
Dead biomass (tons/ac)	0.82	--	--
Total biomass (tons/ac)	2.46	0.02	0.18

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.08
≤ 0.25	0.13
0.26 - 1.0	0.25
1.1 - 3.0	0.00
Total	0.46

SG 09 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 44° 54’ 37.0” W 113° 21’ 15.5”
Elevation: 7,560 ft Aspect: -- Slope: 0%

Association: Basin big sagebrush / Idaho fescue shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (63)

Exposed mineral soil (coverage): 6%

Total aboveground biomass: 5.17 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	12,660	8	1.5	2.7	1.3	2.0	2.6	63	3.21
Pseudotsuga menziesii	12	0	na	na	1.1*	8.2	9.0	na	0.04

*Diameter at breast height

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	63	6	37
Avg height (ft)	2.0	0.4	0.5
Live biomass (tons/ac)	2.08	--	--
Dead biomass (tons/ac)	1.13	--	--
Total biomass (tons/ac)	3.21	0.08	0.51

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	0.76
≤ 0.25	0.00
0.26 - 1.0	0.56
1.1 - 3.0	0.01
Total	1.33

SG 10 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 44° 55’ 01.0” W 113° 21’ 01.9”
Elevation: 7,345 ft Aspect: NE Slope: 8%

Association: Basin big sagebrush / Idaho fescue shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (53)

Exposed mineral soil (coverage): 6%

Total aboveground biomass: 7.89 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	8,103	9	1.8	1.7	1.3	1.7	2.6	53	4.91

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	53	7	23
Avg height (ft)	1.7	0.3	0.5
Live biomass (tons/ac)	2.83	--	--
Dead biomass (tons/ac)	2.08	--	--
Total biomass (tons/ac)	4.91	0.11	0.15

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	2.18
≤ 0.25	0.00
0.26 - 1.0	0.53
1.1 - 3.0	0.01
Total	2.72

SG 11 SAGEBRUSH WITH GRASS

SITE INFORMATION

Site location: N 45° 18’ 50.0” W 113° 01’ 39.5”
Elevation: 7,440 ft Aspect: SE Slope: 5%

Association: Basin big sagebrush / Western wheatgrass shrubland

SRM cover type: Basin big sagebrush

Species (% cover): *Artemisia tridentata* (37)

Exposed mineral soil (coverage): 1%

Total aboveground biomass: 8.23 tons/ac

SELECTED SHRUB AND TREE SPECIES

	Density (plants/ac)	Dead (% of plants)	Avg crown breadth (ft)	Avg crown area (ft2)	Avg basal diameter (in)	Avg height (ft)	Max height (ft)	Coverage (percentage)	Biomass (tons/ac)
Artemisia tridentata	10,888	2	1.9	2.2	1.4	2.4	4.1	37	4.18

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Coverage (percent)	37	25	14
Avg height (ft)	2.4	0.6	0.4
Live biomass (tons/ac)	2.04	--	--
Dead biomass (tons/ac)	2.14	--	--
Total biomass (tons/ac)	4.18	0.15	0.20

LITTER AND WOODY MATERIAL

	Loading (tons/ac)
Diameter (in)	Total
Litter	2.59
≤ 0.25	0.00
0.26 - 1.0	1.09
1.1 - 3.0	0.02
Total	3.70

PONDEROSA PINE - JUNIPER
PHOTO SERIES

A SERIES OF 12 SITES
PPJ 01 THROUGH PPJ 12

NOTES TO USERS:

1. Sites are arranged in order of increasing tree density
2. A list of scientific and common species names can be found on page 8.
3. Photographs were taken in July 2003, 2004, and 2005. Sampling was performed in July and August 2003, 2004, and August 2005.
4. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals. The pole is 30 feet from the camera.
5. Bulk density values used for calculating forest floor loading from depth:

Material type	Litter bulk density	Duff bulk density
	tons·acre^{-1}·inch^{-1}	*tons·acre^{-1}·inch^{-1}*
Ponderosa pine	3.40	7.55
Juniper	4.98	12.01
Moss	2.84	12.10
Grass	0.30	6.39

6. Forest floor and woody material loading, and understory biomass are reported in tons per acre. Trace coverage of understory species, percentage of seedling stems, or woody material loading is indicated either as "trace" or as "t." The designation of "na" indicates cases where data are missing or "not available".
7. A distinction is made between rotten and sound woody material for pieces larger than 3 inches in diameter.
8. Depth values reported for surface material, duff, and total forest floor are not unit-wide averages (null values, or points where litter or duff are absent, are not included in average), and, as such, the total forest floor depth is not the sum of surface material and duff depths
9. Juniper biomass for each height class was calculated by multiplying the square footage occupied by each size/status class and the average loading per square foot.

PPJ 01 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 75.2" W 108º 52' 26.8"
Elevation: 3,025 ft Aspect: -- Slope: 5%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 2%

Seedlings (% of stems): None
Density: 0/ac

Understory (% cover): *Juniperus* spp. (33), *Stipa viridula* (6), *Artemesia tridentata* (2), *Agropyron smithii* (2), *Symphoricarpos albus* (2), *Rosa woodsii* (1), *Rhus trilobata* (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	10	1	43
Height (ft)	1.1	0.5	3.1
Biomass (tons/ac)	0.06	0.01	2.50

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.31	--	0.31
0.26 - 1.0	0.36	--	0.36
1.1 - 3.0	0.20	--	0.20
> 3.0	0.00 (0)	0.00 (0)	0.00 (0)
Total	0.87	0.00	0.87

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	--	--	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	0	0	7	0	7
Live	0	0	7	0	7
Dead	0	0	0	0	0
Avg d.b.h. (in)	--	--	11.6	--	11.6
Live	--	--	11.6	--	11.6
Dead	--	--	--	--	--
Avg height (ft)	--	--	30.0	--	30.0
Live	--	--	30.0	--	30.0
Dead	--	--	--	--	--
Avg height to crown base (ft)	--	--	5.5	--	5.5
Live	--	--	5.5	--	5.5
Dead	--	--	--	--	--
Avg height to live crown (ft)	--	--	6.0	--	6.0
Live crown mass (tons/ac)	0.00	0.00	0.76	0.00	0.76

JUNIPER BIOMASS

Loading (tons/ac)		Size class (height) ≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.81	0.00	0.81
	0.26 - 1.0"	1.02	0.00	1.02
	> 1.0 "	0.19	0.00	0.19
	Subtotal	2.02	0.00	2.02
Dead:	≤ 0.25"	0.20	0.00	0.20
	0.26 - 1.0"	0.70	0.00	0.70
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.90	0.00	0.90
All:	≤ 0.25"	1.01	0.00	1.01
	0.26 - 1.0"	1.09	0.00	1.09
	> 1.0 "	0.19	0.00	0.19
Grand Total		2.29	0.00	2.29

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.3	0.50	53
Duff	0.0	0.00	0
Total	0.3	0.50	53

PPJ 02 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 44.0" W 108º 52' 16.6"
Elevation: 3,031 ft Aspect: -- Slope: 0%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Juniperus scopulorum* (94), *Pinus ponderosa* (6)
Crown closure: 1%

Seedlings (% of stems): None
Density: 0/ac

Understory (% cover): *Juniperus* spp. (15), *Agropyron smithii* (11), *Artemesia tridentata* (8), *Bromus japonicus* (2)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	15	4	23
Height (ft)	0.7	0.5	0.8
Biomass (tons/ac)	0.13	0.03	3.08

WOODY MATERIAL

Diameter (in)	Loading in tons/ac (Density in pieces/ac)		
	Sound	Rotten	Total
≤ 0.25	0.11	--	0.11
0.26 - 1.0	0.09	--	0.09
1.1 - 3.0	0.00	--	0.00
> 3.0	0.00 (0)	0.00 (0)	0.00 (0)
Total	0.20	0.00	0.20

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Juniperus scopulorum* (100)	*Pinus ponderosa* (50)	--	--	*Pinus ponderosa* (50)
Second most common species (percentage of stems)	--	*Juniperus scopulorum* (50)	--	--	*Juniperus scopulorum* (50)
Tree density (stems/ac)	116	14	0	0	14
Live	72	14	0	0	14
Dead	43	0	0	0	0
Avg d.b.h. (in)	1.1	6.4	--	--	6.4
Live	1.1	6.4	--	--	6.4
Dead	1.2	--	--	--	--
Avg height (ft)	6.4	12.0	--	--	12.0
Live	6.7	12.0	--	--	12.0
Dead	5.8	--	--	--	--
Avg height to crown base (ft)	1.4	2.0	--	--	2.0
Live	0.9	2.0	--	--	2.0
Dead	2.4	--	--	--	--
Avg height to live crown (ft)	1.4	3.0	--	--	3.0
Live crown mass (tons/ac)	1.90	0.90	0.00	0.00	0.90

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.33	0.31	0.64
	0.26 - 1.0"	0.22	0.25	0.47
	> 1.0 "	0.18	0.29	0.47
	Subtotal	0.73	0.85	1.58
Dead:	≤ 0.25"	0.01	0.01	0.02
	0.26 - 1.0"	0.01	<0.01	0.01
	> 1.0 "	0.00	0.01	0.01
	Subtotal	0.02	<0.01	0.04
All:	≤ 0.25"	0.34	0.32	0.66
	0.26 - 1.0"	0.23	0.25	0.48
	> 1.0 "	0.18	0.30	0.48
Grand Total		0.75	0.87	1.62

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.5	0.30	17
Duff	0.7	0.83	11
Total	0.9	1.13	19

PPJ 03 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 37.9" W 108º 52' 54.9"
Elevation: 3,063 ft Aspect: -- Slope: < 5%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 15%

Seedlings (% of stems): *Juniperus scopulorum* (96), *Pinus ponderosa* (4)
Density: 181/ac

Understory (% cover): *Juniperus* spp. (75), *Rosa woodsii* (11), *Agropyron smithii* (3), *Aster* spp. (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	6	4	91
Height (ft)	0.7	0.6	1.0
Biomass (tons/ac)	0.07	0.03	5.92

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.28	--	0.28
0.26 - 1.0	0.63	--	0.63
1.1 - 3.0	0.00	--	0.00
> 3.0	0.00 (0)	0.00 (0)	0.00 (0)
Total	0.91	0.00	0.91

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Juniperus scopulorum* (96)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	*Pinus ponderosa* (4)	--	--	--	--
Tree density (stems/ac)	181	7	7	0	14
Live	181	7	7	0	14
Dead	0	0	0	0	0
Avg d.b.h. (in)	2.1	8.5	10.8	--	9.7
Live	2.1	8.5	10.8	--	9.7
Dead	--	--	--	--	--
Avg height (ft)	8.2	22.0	28.0	--	25.0
Live	8.2	22.0	28.0	--	25.0
Dead	--	--	--	--	--
Avg height to crown base (ft)	2.5	3.0	3.0	--	3.0
Live	2.5	3.0	3.0	--	3.0
Dead	--	--	--	--	--
Avg height to live crown (ft)	4.9	5.0	5.0	--	5.0
Live crown mass (tons/ac)	5.10	0.40	0.70	0.00	1.10

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	1.23	0.48	1.71
	0.26 - 1.0"	0.87	0.60	1.47
	> 1.0 "	0.55	0.90	1.45
	Subtotal	2.65	1.98	4.63
Dead:	≤ 0.25"	0.45	0.12	0.57
	0.26 - 1.0"	0.12	0.15	0.27
	> 1.0 "	0.00	0.29	0.29
	Subtotal	0.57	0.56	1.13
All:	≤ 0.25"	1.68	0.60	2.28
	0.26 - 1.0"	0.98	0.74	1.72
	> 1.0 "	0.55	1.20	1.75
Grand Total		3.21	2.54	5.75

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.4	1.23	61
Duff	0.6	2.40	49
Total	0.7	3.63	84

PPJ 04 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 36.4" W 108º 52' 50.6"
Elevation: 3,035 ft Aspect: N Slope: 9%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 10%

Seedlings (% of stems): None
Density: 0/ac

Understory (% cover): *Juniperus* spp. (13), *Artemesia tridentata* (8), *Agropyron smithii* (4), *Stipa viridula* (4)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	13	3	21
Height (ft)	0.6	0.6	0.9
Biomass (tons/ac)	0.18	0.01	1.80

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.05	--	0.05
0.26 - 1.0	0.10	--	0.10
1.1 - 3.0	0.00	--	0.00
> 3.0	0.09 (14)	0.03 (7)	0.12 (21)
Total	0.24	0.03	027

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	7	36	14	0	50
Live	7	36	14	0	50
Dead	0	0	0	0	0
Avg d.b.h. (in)	1.3	6.4	11.3	--	7.8
Live	1.3	6.4	11.3	--	7.8
Dead	--	--	--	--	--
Avg height (ft)	7.0	21.2	27.5	--	23.0
Live	7.0	21.2	27.5	--	23.0
Dead	--	--	--	--	
Avg height to crown base (ft)	3.0	4.0	6.0	--	4.6
Live	3.0	4.0	6.0	--	4.6
Dead	--	--	--	--	--
Avg height to live crown (ft)	3.0	5.0	6.0	--	5.3
Live crown mass (tons/ac)	0.10	1.10	1.40	0.00	2.60

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.65	0.00	0.65
	0.26 - 1.0"	0.27	0.00	0.27
	> 1.0 "	0.03	0.00	0.03
	Subtotal	0.95	0.00	0.95
Dead:	≤ 0.25"	0.14	0.00	0.14
	0.26 - 1.0"	0.01	0.00	0.01
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.15	0.00	0.15
All:	≤ 0.25"	0.79	0.00	0.79
	0.26 - 1.0"	0.28	0.00	0.28
	> 1.0 "	0.03	0.00	0.03
Grand Total		1.10	0.00	1.10

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	--	0.06	--
Duff	--	--	--
Total	--	0.06	--

PPJ 05 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 33' 1.8" W 108º 49' 80.7"
Elevation: 2,851 ft Aspect: N Slope: 18%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Juniperus scopulorum* (81), *Pseudotsuga menziesii* (13), *Pinus ponderosa* (6)
Crown closure: 35%

Seedlings (% of stems): None
Density: 0/ac

Understory (% cover): *Juniperus* spp. (87), *Agropyron spicatum* (11), *Symphoricarpus albus* (6), *Rosa woodsii* (3), *Rhus trilobata* (2), *Solidago sparsiflora* (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	13	1	98
Height (ft)	1.0	1.0	3.2
Biomass (tons/ac)	0.03	0.03	3.35

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.39	--	0.39
0.26 - 1.0	0.18	--	0.18
1.1 - 3.0	0.45	--	0.45
> 3.0	0.16 (10)	0.05 (5)	0.21 (15)
Total	1.18	0.05	1.23

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Juniperus scopulorum* (92)	*Pseudotsuga menzeisii* (44)	--	--	*Pseudotsuga menzeisii* (44)
Second most common species (percentage of stems)	*Pseudotsuga menzeisii* (5)	*Juniperus scopulorum* (33)	--	--	*Juniperus scopulorum* (33)
Tree density (stems/ac)	274	65	0	0	65
Live	245	65	0	0	65
Dead	29	0	0	0	0
Avg d.b.h. (in)	1.9	6.4	--	--	6.4
Live	2.0	6.4	--	--	6.4
Dead	1.7	--	--	--	--
Avg height (ft)	9.6	20.0	--	--	20.0
Live	9.6	20.0	--	--	20.0
Dead	9.0	--	--	--	--
Avg height to crown base (ft)	0.3	0.6	--	--	0.6
Live	0.2	0.6	--	--	0.6
Dead	0.6	--	--	--	--
Avg height to live crown (ft)	1.2	2.1	--	--	2.1
Live crown mass (tons/ac)	1.70	2.10	0.00	0.00	2.10

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.76	0.88	1.64
	0.26 - 1.0"	0.45	0.69	1.14
	> 1.0 "	0.27	0.28	0.55
	Subtotal	1.48	1.85	3.33
Dead:	≤ 0.25"	<0.01	<0.01	<0.01
	0.26 - 1.0"	<0.01	<0.01	<0.01
	> 1.0 "	0.00	0.00	0.00
	Subtotal	<0.01	<0.01	<0.01
All:	≤ 0.25"	0.76	0.88	1.64
	0.26 - 1.0"	0.45	0.69	1.14
	> 1.0 "	0.27	0.28	0.55
Grand Total		1.48	1.85	3.33

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.5	1.65	87
Duff	0.6	2.16	39
Total	0.7	3.81	87

PPJ 06 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 39.6" W 108º 52' 49.2"
Elevation: 3,027 ft Aspect: -- Slope: 5%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 37%

Seedlings (% of stems): None
Density: 0/ac

Understory (% cover): *Juniperus* spp. (79), *Rosa woodsii* (13), *Carex* spp. (6), *Achillea millefolium* (2)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	10	5	100
Height (ft)	0.7	0.6	1.2
Biomass (tons/ac)	0.06	0.14	3.44

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.05	--	0.05
0.26 - 1.0	0.15	--	0.15
1.1 - 3.0	0.16	--	0.16
> 3.0	0.00 (0)	0.00 (0)	0.00 (0)
Total	0.36	0.00	0.36

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	--	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	0	29	43	7	79
Live	0	29	43	7	79
Dead	0	0	0	0	0
Avg d.b.h. (in)	--	6.2	12.4	17.5	10.6
Live	--	6.2	12.4	17.5	10.6
Dead	--	--	--	--	--
Avg height (ft)	--	21.0	23.5	37.0	28.7
Live	--	21.0	23.5	37.0	28.7
Dead	--	--	--	--	--
Avg height to crown base (ft)	--	3.0	5.8	9.0	5.1
Live	--	3.0	5.8	9.0	5.1
Dead	--	--	--	--	--
Avg height to live crown (ft)	--	6.5	9.0	9.0	8.1
Live crown mass (tons/ac)	0.00	0.90	5.40	1.80	8.10

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.75	0.15	0.90
	0.26 - 1.0"	0.76	0.18	0.94
	> 1.0 "	0.83	0.61	1.45
	Subtotal	2.34	0.94	3.29
Dead:	≤ 0.25"	0.20	0.13	0.34
	0.26 - 1.0"	0.61	0.33	0.94
	> 1.0 "	0.19	0.28	0.47
	Subtotal	1.00	0.74	1.75
All:	≤ 0.25"	0.96	0.28	1.24
	0.26 - 1.0"	1.37	0.51	1.88
	> 1.0 "	1.02	0.89	1.91
Grand Total		3.35	1.68	5.03

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.8	2.10	93
Duff	1.4	5.82	59
Total	1.6	7.92	93

PPJ 07 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 35' 33.5" W 108º 42' 46.4"
Elevation: 2,660 ft Aspect: NW Slope: 45%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pseudotsuga menziesii* (59), *Juniperus scopulorum* (38), *Pinus ponderosa* (38)
Crown closure: 74%

Seedlings (% of stems): *Pseudotsuga menziesii* (91), *Juniperus* spp. (9)
Density: 872/ac

Understory (% cover): *Prunus virginiana* (15), *Juniperus* spp. (12), *Achillea millefolium* (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	23	1	18
Height (ft)	0.5	0.5	0.9
Biomass (tons/ac)	0.04	<0.01	0.19

WOODY MATERIAL

Diameter (in)	Loading in tons/ac (Density in pieces/ac)		
	Sound	Rotten	Total
≤ 0.25	0.27	--	0.27
0.26 - 1.0	0.86	--	0.86
1.1 - 3.0	0.74	--	0.74
> 3.0	0.38 (19)	0.56 (34)	0.94 (53)
Total	2.25	0.56	2.81

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (54)	*Pinus ponderosa* (83)	*Pseudotsuga menzeisii* (50)	--	*Pseudotsuga menzeisii* (75)
Second most common species (percentage of stems)	*Juniperus scopulorum* (46)	*Juniperus scopulorum* (17)	*Pinus ponderosa* (50)	--	*Pinus ponderosa* (13)
Tree density (stems/ac)	347	87	29	0	116
Live	246	87	29	0	116
Dead	101	0	0	0	0
Avg d.b.h. (in)	2.2	5.5	10.6	--	6.8
Live	2.0	5.5	10.6	--	6.8
Dead	2.4	--	--	--	--
Avg height (ft)	12.2	26.6	34.8	--	28.6
Live	12.8	26.6	34.8	--	28.6
Dead	10.8	--	--	--	--
Avg height to crown base (ft)	1.7	3.4	9.8	--	5.0
Live	1.7	3.4	9.8	--	5.0
Dead	1.9	--	--	--	--
Avg height to live crown (ft)	5.6	10.1	16.5	--	11.7
Live crown mass (tons/ac)	5.90	3.00	2.40	0.00	5.40

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.02	0.00	0.02
	0.26 - 1.0"	0.01	0.00	0.01
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.03	0.00	0.03
Dead:	≤ 0.25"	<0.01	0.00	<0.01
	0.26 - 1.0"	0.00	0.00	0.00
	> 1.0 "	0.00	0.00	0.00
	Subtotal	<0.01	0.00	<0.01
All:	≤ 0.25"	<0.01	0.00	<0.01
	0.26 - 1.0"	0.01	0.00	0.01
	> 1.0 "	0.00	0.00	0.00
Grand Total		0.03	0.00	0.03

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.5	1.58	95
Duff	0.9	7.93	76
Total	1.2	9.51	95

PPJ 08 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 06' 58.0" W 108º 35' 43.9"
Elevation: 3,206 ft Aspect: -- Slope: 5%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 38%

Seedlings (% of stems): *Pinus ponderosa* (100)
Density: 14/ac

Understory (% cover): *Juniperus* spp. (13), *Carex* spp. (4), *Collomia lineris* (1), *Achillea millefolium* (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	7	3	13
Height (ft)	0.5	0.4	0.7
Biomass (tons/ac)	0.04	0.02	0.48

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.12	--	0.12
0.26 - 1.0	0.35	--	0.35
1.1 - 3.0	0.45	--	0.45
> 3.0	0.07 (10)	0.32 (5)	0.39 (15)
Total	0.99	0.32	1.31

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	94	94	65	0	159
Live	65	87	58	0	144
Dead	29	7	7	0	15
Avg d.b.h. (in)	5.6	7.0	10.3	--	8.4
Live	5.6	7.1	10.0	--	8.3
Dead	5.5	5.8	12.9	--	9.4
Avg height (ft)	18.8	27.4	32.1	--	29.3
Live	18.8	28.5	32.5	--	30.1
Dead	17.8	14.0	29.0	--	21.5
Avg height to crown base (ft)	5.5	7.3	8.1	--	7.7
Live	5.5	7.3	8.4	--	7.7
Dead	5.4	8.0	6.0	--	7.0
Avg height to live crown (ft)	10	13.9	14.5	--	14.2
Live crown mass (tons/ac)	1.00	3.40	4.50	0.00	7.90

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.33	0.00	0.33
	0.26 - 1.0"	0.19	0.00	0.19
	> 1.0 "	0.09	0.00	0.09
	Subtotal	0.40	0.00	0.40
Dead:	≤ 0.25"	0.01	0.00	0.01
	0.26 - 1.0"	0.00	0.00	0.00
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.01	0.00	0.01
All:	≤ 0.25"	0.34	0.00	0.34
	0.26 - 1.0"	0.19	0.00	0.19
	> 1.0 "	0.09	0.00	0.09
Grand Total		0.62	0.00	0.62

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.7	1.88	85
Duff	0.8	4.76	85
Total	1.3	6.64	93

PPJ 09 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 50.3" W 108º 52' 30.3"
Elevation: 2,979 ft Aspect: N Slope: 10%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (92), *Juniperus scopulorum* (6), *Pseudotsuga menziesii* (2)
Crown closure: 56%

Seedlings (% of stems): *Pinus ponderosa* (97), *Pseudotsuga menziesii* (2)
Density: 339/ac

Understory (% cover): *Juniperus* spp. (32), *Carex* spp. (19), *Antennaria* spp. (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	28	2	32
Height (ft)	0.5	0.5	1.0
Biomass (tons/ac)	0.09	0.01	3.74

WOODY MATERIAL

Diameter (in)	Loading in tons/ac (Density in pieces/ac)		
	Sound	Rotten	Total
≤ 0.25	0.15	--	0.15
0.26 - 1.0	0.32	--	0.32
1.1 - 3.0	0.35	--	0.35
> 3.0	0.68 (34)	2.07 (63)	2.75 (97)
Total	1.5	2.07	3.57

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (89)	*Pinus ponderosa* (96)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (97)
Second most common species (percentage of stems)	*Juniperus scopulorum* (9)	*Pseudotsuga menzeisii* (4)	--	--	*Pseudotsuga menzeisii* (3)
Tree density (stems/ac)	462	181	101	0	282
Live	419	167	101	0	280
Dead	43	14	0	0	2
Avg d.b.h. (in)	1.1	6.9	11.3	--	8.5
Live	1.0	7.0	11.3	--	8.6
Dead	1.8	5.6	--	--	5.6
Avg height (ft)	8.1	29.2	41.7	--	33.7
Live	7.9	30.3	41.7	--	34.6
Dead	10.2	16.5	--	--	16.5
Avg height to crown base (ft)	1.8	10.3	14.8	--	11.9
Live	1.7	10.8	14.8	--	12.3
Dead	2.5	4.0	--	--	4.0
Avg height to live crown (ft)	2.9	12.7	20.4	--	15.6
Live crown mass (tons/ac)	0.10	0.90	1.40	0.00	2.30

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.33	0.00	0.33
	0.26 - 1.0"	0.21	0.00	0.21
	> 1.0 "	0.20	0.00	0.20
	Subtotal	0.74	0.00	0.74
Dead:	≤ 0.25"	0.01	0.00	0.01
	0.26 - 1.0"	0.01	0.00	0.01
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.02	0.00	0.02
All:	≤ 0.25"	0.34	0.00	0.34
	0.26 - 1.0"	0.22	0.00	0.22
	> 1.0 "	0.20	0.00	0.20
Grand Total		0.76	0.00	0.76

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.7	2.14	96
Duff	1.3	9.83	92
Total	1.9	11.97	99

PPJ 10 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 31' 39.3" W 108º 52' 49.3"
Elevation: 3,029 ft Aspect: -- Slope: 10%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (98), *Juniperus scopulorum* (2)
Crown closure: 67%

Seedlings (% of stems): *Pinus ponderosa* (94), *Pseudotsuga menziesii* (6)
Density: 116/ac

Understory (% cover): *Juniperus* spp. (54), *Carex* spp. (4), *Symphoricarpus albus* (3), *Solidago* spp. (2)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	12	6	59
Height (ft)	0.7	0.4	1.0
Biomass (tons/ac)	0.06	0.02	2.58

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.04	--	0.04
0.26 - 1.0	0.36	--	0.36
1.1 - 3.0	0.29	--	0.29
> 3.0	0.10 (10)	1.38 (19)	1.48 (29)
Total	0.79	1.38	2.17

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (96)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	*Juniperus scopulorum* (4)	--	--	--	--
Tree density (stems/ac)	173	209	94	0	303
Live	159	209	94	0	303
Dead	14	0	0	0	0
Avg d.b.h. (in)	2.9	5.8	12.4	--	7.8
Live	2.9	5.8	12.4	--	7.8
Dead	2.6	--	--	--	--
Avg height (ft)	9.9	26.5	42.5	--	31.4
Live	10.0	26.5	42.5	--	31.4
Dead	9.0	--	--	--	--
Avg height to crown base (ft)	2.6	9.9	9.9	--	7.4
Live	2.5	9.9	9.9	--	7.4
Dead	3.3	--	--	--	--
Avg height to live crown (ft)	3.9	11.3	17.8	--	13.3
Live crown mass (tons/ac)	1.10	5.50	11.40	0.00	16.90

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.65	0.00	0.65
	0.26 - 1.0"	0.63	0.00	0.63
	> 1.0 "	0.39	0.00	0.39
	Subtotal	1.67	0.00	1.67
Dead:	≤ 0.25"	0.05	0.00	0.05
	0.26 - 1.0"	0.08	0.00	0.08
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.13	0.00	0.13
All:	≤ 0.25"	0.70	0.00	0.70
	0.26 - 1.0"	0.71	0.00	0.71
	> 1.0 "	0.39	0.00	0.39
Grand Total		1.80	0.00	1.80

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	1.2	4.04	96
Duff	1.5	11.07	85
Total	2.6	15.11	96

PPJ 11 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 06' 57.9" W 108º 35' 27.6"
Elevation: 3,312 ft Aspect: -- Slope: 5%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 40%

Seedlings (% of stems): *Pinus ponderosa* (100)
Density: 219/ac

Understory (% cover): *Juniperus* spp. (28), *Collomia linearis* (2)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	1	2	28
Height (ft)	0.7	0.3	0.4
Biomass (tons/ac)	<0.01	<0.01	0.50

WOODY MATERIAL

Diameter (in)	Loading in tons/ac (Density in pieces/ac)		
	Sound	Rotten	Total
≤ 0.25	0.22	--	0.22
0.26 - 1.0	0.59	--	0.59
1.1 - 3.0	0.86	--	0.86
> 3.0	0.25 (11)	0.55 (46)	0.80 (57)
Total	1.92	0.55	2.47

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	823	289	36	0	325
Live	700	267	36	0	303
Dead	123	22	0	0	22
Avg d.b.h. (in)	2.0	5.8	11.1	--	6.4
Live	1.9	5.8	11.1	--	6.4
Dead	2.0	5.4	--	--	5.4
Avg height (ft)	9.4	21.9	35.0	--	23.3
Live	9.4	22.8	35.0	--	24.3
Dead	9.2	10.0	--	--	10.0
Avg height to crown base (ft)	2.8	7.3	10.0	--	7.6
Live	2.8	7.3	10.0	--	7.6
Dead	2.3	7.0	--	--	7.0
Avg height to live crown (ft)	4.0	11.7	15.0	--	12.1
Live crown mass (tons/ac)	2.50	7.00	3.50	0.00	10.50

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.45	0.00	0.45
	0.26 - 1.0"	0.04	0.00	0.04
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.49	0.00	0.49
Dead:	≤ 0.25"	0.00	0.00	0.00
	0.26 - 1.0"	0.00	0.00	0.00
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00
All:	≤ 0.25"	0.46	0.00	0.46
	0.26 - 1.0"	0.00	0.00	0.00
	> 1.0 "	0.00	0.00	0.00
Grand Total		0.50	0.00	0.50

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.7	2.20	96
Duff	0.8	5.15	84
Total	1.4	7.35	96

PPJ 12 PONDEROSA PINE - JUNIPER

SITE AND STAND INFORMATION

Site location: N 47º 07' 00.0" W 108º 35' 32.3"
Elevation: 3,303 ft Aspect: -- Slope: 2%

Association: Ponderosa pine/ Rocky Mountain juniper woodland
SAF cover type: Interior ponderosa pine

Trees (% of stems): *Pinus ponderosa* (100)
Crown closure: 56%

Seedlings (% of stems): *Pinus ponderosa* (100)
Density: 72/ac

Understory (% cover): *Juniperus* spp. (9), *Collomia linearis* (1)

UNDERSTORY VEGETATION

	Lifeform		
	Graminoid	Forb	Shrub
Coverage (percent)	1	1	9
Height (ft)	0.5	0.2	0.6
Biomass (tons/ac)	0.01	<0.01	0.19

WOODY MATERIAL

	Loading in tons/ac (Density in pieces/ac)		
Diameter (in)	Sound	Rotten	Total
≤ 0.25	0.24	--	0.24
0.26 - 1.0	0.37	--	0.37
1.1 - 3.0	0.33	--	0.33
> 3.0	1.06 (19)	0.00 (0)	1.06 (19)
Total	2.00	0.00	2.00

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	Saplings (≤ 4")	4 - 9"	9 - 16"	> 16"	> 4"
Most common species (percentage of stems)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	*Pinus ponderosa* (100)	--	*Pinus ponderosa* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	130	332	15	0	347
Live	108	325	15	0	340
Dead	22	7	0	0	7
Avg d.b.h. (in)	3.0	6.9	12.0	--	7.1
Live	3.1	6.9	12.0	--	7.1
Dead	2.6	4.4	--	--	4.4
Avg height (ft)	12.7	26.7	34.5	--	27.0
Live	13.3	27.0	34.5	--	27.3
Dead	9.7	13.0	--	--	13.0
Avg height to crown base (ft)	4.6	6.5	7.5	--	6.5
Live	4.7	6.5	7.5	--	6.6
Dead	4.3	6.0	--	--	6.0
Avg height to live crown (ft)	6.9	13.8	18.0	--	14.0
Live crown mass (tons/ac)	0.90	12.20	1.70	0.00	13.80

JUNIPER BIOMASS

		Size class (height)		
Loading (tons/ac)		≤ 3 ft	> 3 ft	> 0 ft
Live: Foliage	& ≤ 0.25"	0.18	0.00	0.18
	0.26 - 1.0"	0.02	0.00	0.02
	> 1.0 "	0.00	0.00	0.00
	Subtotal	0.20	0.00	0.20
Dead:	≤ 0.25"	<0.01	0.00	<0.01
	0.26 - 1.0"	<0.01	0.00	<0.01
	> 1.0 "	0.00	0.00	0.00
	Subtotal	<0.01	0.00	<0.01
All:	≤ 0.25"	0.18	0.00	0.18
	0.26 - 1.0"	0.02	0.00	0.02
	> 1.0 "	0.00	0.00	0.00
Grand Total		0.20	0.00	0.20

FOREST FLOOR

	Depth (in)	Loading (tons/ac)	Constancy (%)
Litter	0.7	2.42	100
Duff	0.7	4.55	92
Total	1.3	6.97	100

Ottmar, Roger D.; Vihnanek, Robert E.; Wright, Clinton S. 2006. Stereo photo series for quantifying natural fuels. Volume X: Sagebrush with Grass and Ponderosa Pine - Juniper types in central Montana. Gen. Tech. Rep. PNW-GTR-XXX . Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 59 p.

Two series of single and stereo photographs display a range of natural conditions and fuel loadings in sagebrush with grass and ponderosa pine - juniper types in central Montana. Each group of photos includes inventory information summarizing vegetation composition, structure, and loading; woody material loading by size class; forest floor depth and loading; and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, Missouri Breaks, mixed-conifer, ponderosa pine, *Pinus ponderosa*, creeping juniper, *Juniperus horizontalis*, Douglas-fir, *Pseudotsuga menziesii*, big sagebrush, *Artemisia tridentata.*