Progress Report (January 2002-Final):
Investigating the Use of Prescribed Fire to Restore Wildlife Habitat in the South Fork Salmon River (SFSR) Sub-basin

Submitted by: Vicki Saab & Jon Dudley (Rocky Mountain Research Station, RMRS), and David Pilliod (Aldo Leopold Wilderness Research Institute).

Project Description: Fire has been an important ecological process in shaping forested landscapes and animal distributions in the SFSR sub-basin. Alterations in the structure and composition of forests in the sub-basin as a result of 60-70 years of fire suppression have also changed the structure of animal populations. Yet we do not have an understanding of the implications of fire exclusion on wildlife populations or their habitats. Objectives of the project are to use prescribed fire for three purposes: (1) restore fire to the ponderosa pine ecosystem; (2) reduce accumulation of fuels; and (3) improve wildlife and fish habitat. Effectiveness monitoring is conducted to quantitatively evaluate whether objectives of reducing fuels are met, and to assess effects of the potential fuel reductions on habitat and populations of focal wildlife species. The SFSR sub-basin provides habitat for both wildlife and fish TES species, including three Sensitive Species of woodpeckers (white-headed, black-backed and Lewis's woodpeckers) and four listed TES salmonid species. Little is known about how these species respond to prescribed fire treatments for ecosystem restoration, fire exclusion, or stand-replacing fire. The project will address information gaps by monitoring forest vegetation characteristics, woodpecker nesting densities and nest success, composition and abundance of songbirds, and abundance of two amphibian species (tailed frog & Idaho giant salamander) before and after prescribed fire treatments, and by comparing that data to existing information on bird and amphibian responses to stand-replacement fires. This project will help managers display trade-offs associated with different fire conditions (no fire, prescribed fire, and stand-replacing fire), identify potential conflicts in TES management, and assess potential benefits of habitat restoration. In November 2001, the Joint Fire Sciences Program awarded matching funds for three years to help continue this work and implement the protocol and design on forests in six other states across the western United States. The project implements the Forest Service Natural Resource Agenda by increasing prescribed fire and forest fuel treatments in a critical watershed (under "Watershed Health and Restoration"), and by working with state, local and other partners toward sustainable forest ecosystem management (under "Sustainable Forest Ecosystem Management").

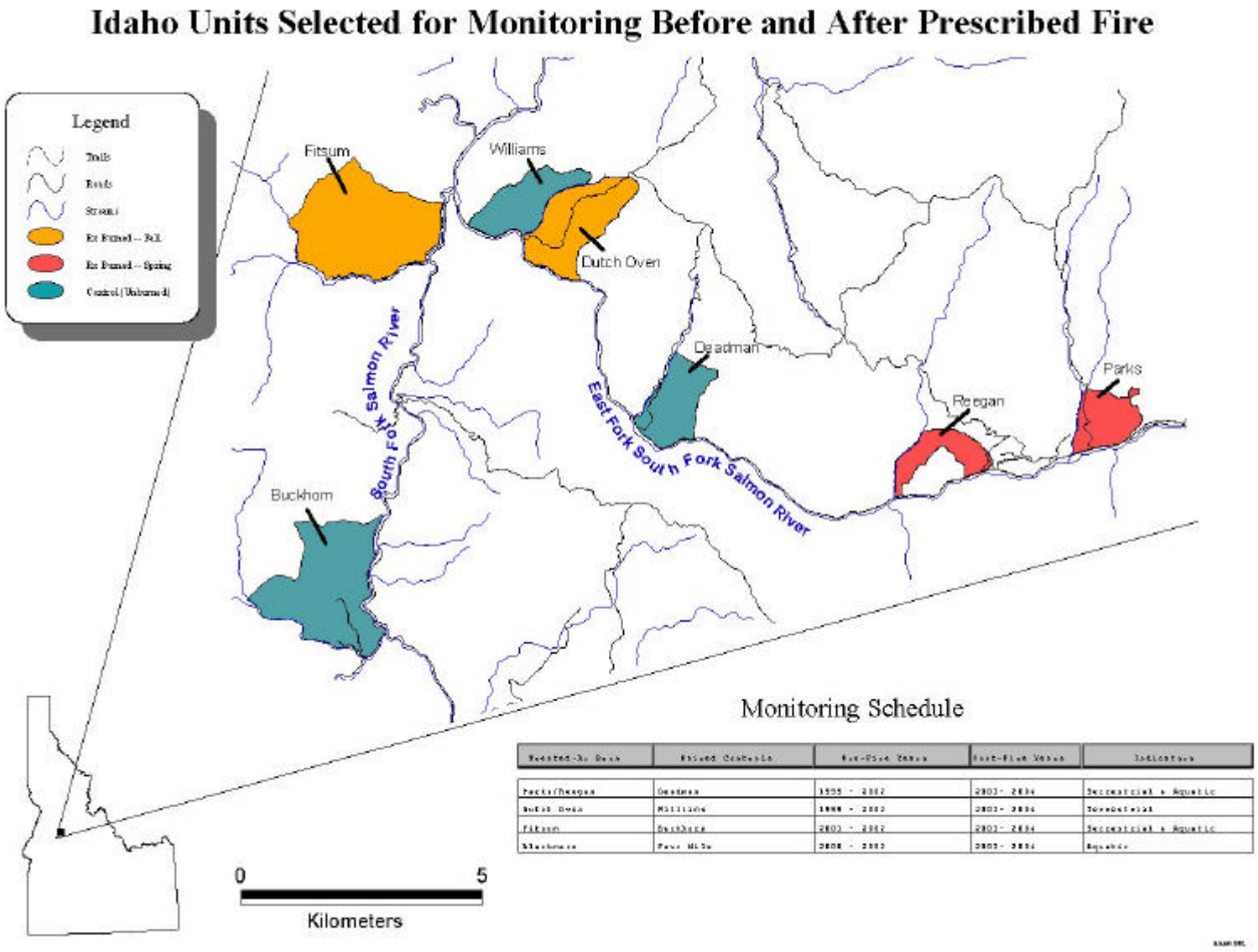
Partners: Payette NF (PNF), Rocky Mountain Research Station (RMRS), Forest Service Intermountain Region (R4) Fire Program and R-4 Partnership Enhancement Program (PEP), Pacific Northwest Research Station (PNW-Wenatchee Lab), Aldo Leopold Wilderness Research Institute (ALWRI) & University of Montana (U of M), Idaho Dept. of Fish & Game (IDFG), Rocky Mountain Elk Foundation (RMEF), University of Idaho (U of I), and Golden Eagle Audubon Society (GEAS) supported this project from 1999-2001. The following is a description of each partner's contribution. PNF fire program (Sam Hescock) and the R4 fire program (Dave Thomas) provide funding, field housing, transportation, and equipment. PNF is also integrating field information with Forest Service management needs. PNW provides funding for field crews and for purchasing equipment. RMRS is responsible for the design and supervision of the field studies, developing a monitoring plan, collecting and analyzing field data, providing field

equipment, and completing technical reports and publications. IDFG provides funding for field assistants and a GPS unit. R4 fire program (Dave Thomas) provides funding for vehicles and data collection. In 1999, RMEF provided funding to collect wildlife habitat measurements and PEP provided funding to survey woodpeckers and measure vegetation. In 1999 and 2000, U of I conducted amphibian surveys, collected aquatic insects, provided academic advising, field equipment, and overhead. In 2001, David Pilliod (ALWRI and U of M) became the lead for the amphibian and aquatic work. In 2000-2001, GEAS provided field assistants for part of each field season. Lisa Bate (contract biologist with the Pacific Northwest Research Station) provides assistance with the sampling design and analyses of the vegetation data. The project builds a sustainable partnership among agencies, research community, and conservation groups.

Study Site Selection

The study area is encompassed by the South Fork of the Salmon River Sub-basin on the PNF in Valley County, Idaho (Fig. 1). A common sampling design is shared for monitoring all indicators, including wildlife populations, and upland vegetation, and instream habitat characteristics. Areas identified for prescribed fire were at about 1000 acres (600 ha) in size, dominated by ponderosa pine cover types (i.e., working group strata identified by the PNF), between 3,500'-6,500' (1,060 m – 2,000 m), and with streams that provide habitat for amphibians. The 1000 acre units were selected in pairs. One of the paired units was selected for burning, while the other unit will remain unburned. This provides a design with a control plot that remains unburned, and a treated plot that is monitored before and after prescribed fire. During 1999, three paired units or replicates were selected for monitoring. The units were selected on the basis of prescribed fire opportunities/priorities that were identified by the Payette National Forest. We used maps produced by Brad Sanders (PNF) that identified the areas for restoration priority (spring followed by a fall application of prescribed fire) or maintenance priority (fall application of prescribed fire). From west to east, the paired units include Fit sum and Buckhorn, Williams and Dutchoven, and Deadman and Parks/Reegan (Fig. 1).

Fig. 1. Study area location.



Methods/Preliminary Results
Cavity-nesting Birds & Upland Vegetation

Pre-treatment data have been collected during May-September 1999-2001. Field season 1999 was a pilot effort in which we conducted an inventory of cavity-nesting birds, cursory nest surveys, and vegetation sampling. During 2000-2001, nest surveys, nest monitoring, point count surveys, and vegetation sampling were conducted at 6 sites in the study area (Fig. 1). Methods for nest surveys and monitoring are outlined in Dudley and Saab (in review). Seven point count stations per stratum (except Williams) were located in each site for surveying songbirds (Appendix 1). Point counts are conducted for 5 minutes and birds are recorded at 5 distance categories (0-25; 25-50; 50-75; 75-100; > 100). The program Distance will be used to analyze point count data (Buckland et al. 2000). A global positioning system (GPS) was used at each nest to determine topographical position, recorded as latitude and longitude (later converted to UTMs), and elevation accurate within 3 m.

Vegetation measurements were taken at stratified random locations and at nest sites. Random locations were stratified by cover type/structural stage as defined by the PNF working-group strata. At least 20 random samples per stratum will be measured in selected sites. These random stations are being used to describe the habitats available to birds for the analysis of habitat selection and to describe the vegetation before and after prescribed fire. A global positioning system (GPS) was used at each random location to determine topographical position, recorded as latitude/longitude (later converted to UTMs), and elevation accurate within 3 m. Tree and snag measurements follow methods outlined by Bate et al. (1999), and logs by Bate et al. (In press).

Methods for ground, shrub, and canopy cover follow those described for BBIRD (Martin and Guepel 1993, Ralph et al. 1993) with some modifications. Sampling at each random location for snags, trees, and logs is measured within a 20 m x 100 m rectangular plot. Vegetation measurements for shrub densities, and tree canopy cover are measured in 5-m radius circular plots at the start of each rectangular sample plot. Plant species composition is recorded for all woody vegetation (Appendix 2). All snags and nest trees >1.4 m tall were measured. Nest tree measurements included nest height, cavity age, species that excavated the cavity, orientation of the cavity, stump(<1.4 m), log, or other (cf. Raphael and White 1984). Habitat characteristics and topographic measurements surrounding nest trees are sampled similar to the methods described for the random stations except four, 20 m x 50 m rectangular plots are centered at the nest tree.

Nests have been monitored for seven species of cavity-nesting birds (Table 1). The most common nesting species are Northern Flicker, Hairy Woodpecker, and Pileated Woodpecker. Only one Black-backed, and no White-headed or Lewis's woodpeckers were observed in the study sites. Black-backed woodpeckers were also observed foraging in prescribed burns to the east and south of Krassel Work Station. These three species are expected to respond favorably to vegetation changes after prescribed fire.

Seventy bird species were recorded during point count surveys in 200-2001(Appendix 1). Point counts were conducted to estimate the abundance and composition of songbirds at four sites

(Parks, Deadman, Dutchoven, Williams). Numbers of individuals by species were recorded within five-minute counts at distances of 0-50 m, 50-100 m, and > 100 m from the center of the point count station. Nine to 14 point count stations are established in each site and stations are located at least 200 m apart. Point count data will be analyzed to determine the sample sizes needed to obtain reasonable precision levels (20-30% of the true mean with a 90% confidence level) for ground- and shrub- nesting bird species. Based on this data analysis, numbers of point count stations will be increased over the 2000-2001 field seasons and stations will be established in Fitsum and Buckhorn.

Vegetation data were collected in two strata that correspond to the working group strata defined by the Payette National Forest. Stratum 1 was typically 10%--35% canopy, dominated by ponderosa pine. Stratum 2 was generally 35%--70% canopy, composed of mixed conifer tree species. Ground, shrub and canopy cover data were collected at all sites but we report data combined for all sites except Fit sum and Buckhorn (Tables 2-3, Fig. 2-3). Snag density estimates are reported for three sites (Tables 4, 5). Snag density estimates for >23 cm dbh had moderate precision compared to our pilot study in 1999. Precision was poor on estimates of snag densities for > 53 cm dbh (Table 5). Strikingly, snag densities are nearly doubled at nest sites compared to random sites. In 2002, our sampling effort will increase to improve data precision for large snags. Live tree densities are estimated for Dutchoven, Reegan, and Parks (Table 6). Log data were collected at all sites but we report data combined for all sites except Fit sum and Buckhorn (Tables 7-10, Fig. 4). Ground cover, shrub stem densities, canopy cover, snag densities, and live tree densities were typical higher in Stratum 1 compared to Stratum 2.

Table 1. Species and number of **nests** monitored between 1999-2001.

Species	1999	2000	2001	Total
Northern Flicker	5	9	15	29
Hairy Woodpecker	1	7	6	14
Pileated Woodpecker		2	3	5
Red-naped Sapsucker	1		2	3
Williamson's Sapsucker		1	1	2
Western Bluebird			2	2
Mountain Bluebird		1	1	2
Total	7	20	30	57

Table 2. Preliminary results on counts of **shrub stems** ($\leq$ 2.5 cm in diameter) measured in 5-m radius circular plots and percent canopy cover recorded at random locations during 1999-2000. Shrub species and tree species are listed Appendix 2. Stratum 1 stands are dominated by ponderosa pine; Stratum 2 is composed of mixed conifer trees.

Stratum	Avg. Shrub Count (± 1 S.E.)	Avg. % Canopy (± 1 S.E.)	Sample Size
1	65.7 ± 5.4	43.6 ± 1.5	164
2	99.4 ± 9.8	60.7 ± 1.6	127

Table 3. Preliminary pre-treatment results on percent **ground cover** measured in 5-m radius circular plots at random locations in five study sites during 1999-2001. Stratum 1 are stands dominated by ponderosa pine, while Stratum 2 is composed of mixed conifer trees. The vegetation component is shrub and herbaceous cover combined.

Stratum	Avg. Percent Ground Cover (± 1 S.E.)					Sample Size
	Shrub	Herbaceous	Bare Ground	Litter	Vegetation	
1	13.9 ± 1.3	7.3 ± 0.7	20.6 ± 2.1	78.7 ± 2.1	20.8 ± 1.4	133
2	13.0 ± 1.2	9.0 ± 0.8	12.8 ± 1.6	84.9 ± 1.7	21.5 ± 1.4	128

Effects of Prescribed and Wildland Fire on Aquatic Ecosystems in Western Forests
David S. Pilliod and P. Stephen Corn

This section is a progress report for research activities conducted in 2001 on the effects of fire on aquatic ecosystems by the Aldo Leopold Wilderness Research Institute and the University of Montana. The goal of this study is to quantify and compare the ecological consequences of three fire conditions (unburned forests, prescribed understory fires, stand-replacement fires) on stream ecosystems using a variety of biotic and abiotic indicators. This project is a combination of two studies; one funded by the Region 1 and 4 National Fire Plan Adaptive Management and Monitoring Program (R1/4 NFP), and another by the Joint Fire Sciences Program (JFS) and conducted in collaboration with the USGS Forest and Rangeland Ecosystem Science Center (FRESC) in Corvallis, Oregon. The project is scheduled to begin in 2002, but we were able to use some limited alternative funding in 2001 to conduct a pilot study which focused on developing and refining appropriate methodology, locating study areas, and collecting baseline information on amphibians. We sampled 13 streams between 9 July and 26 August 2001 on the Payette National Forest, Idaho. Seven of these streams were located in the Frank Church-River of No Return Wilderness in watersheds that burned, at varying intensities, in the Diamond Peak Fire of 2000. Six streams were located in the South Fork Salmon Sub-basin, an area that has not burned for 60-70 years due to human fire suppression and other conditions. In 432 transects sampled (transects = 1 m x stream width), we captured a total of 560 tadpoles and 21 juvenile or adult tailed frogs (*Ascaphus montanus*), and 33 larvae and 1 juvenile Idaho giant salamander (*Dicamptodon aterrimus*). Densities of tailed frog tadpoles and giant salamander larvae in study streams ranged from 0 - 1.33 and 0 - 0.11 individuals per m^2, respectively. Biomass of tailed frog tadpoles and giant salamander larvae in study streams ranged from 0 – 1.45 and 0 – 2.53 g/m^2, respectively. Based on preliminary analyses of these limited data, streams in burned watersheds tended to have less cover, higher water temperatures, more sediment, and lower densities and biomass of tailed frogs compared to populations in unburned watersheds. Idaho giant salamanders only occurred in four streams and may not be included in further analyses. Future research will include sampling additional streams in previously sampled drainages and in the Bitterroot River drainage, sampling burned and unburned reaches within a stream, evaluating differences in burn severity among watersheds, sampling for macroinvertebrates and periphyton, and monitoring watersheds before and after prescription burning in the South Fork Salmon sub-basin.

Table 4. Preliminary pre-treatment results on estimates of **snag densities** during 1999-2001 for snags > 23 cm (9") dbh, >1.4 m (3.5') tall, and all decay classes. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

Deadpan		Plot Size (m)	Avg. Snags/acre (SE)	Avg. Snags/hectare (± 90 % bound)	SE	Sample size (n)
Nest tree	Stratum 1	10 x 100	7.0 (1.9)	17.5 (8.2)	4.9	8
	Stratum 2	10 x 100	7.6 (1.5)	19 (6.3)	3.8	10
	Landscape		**7.3 (1.2)**	18.3 (5.04)	3.02	18
Random	Stratum 1	10 x 100	1.7 (0.8)	4.29 (3.38)	2.0	7
	Stratum 2	50 x 10	5.7 (1.9)	14.28 (8.16)	4.9	14
	Landscape		**3.9 (1.1)**	9.86 (4.78)	2.86	21

Dutchoven		Plot Size	Avg. Snags/acre (SE)	Avg. Snags/hectare (± 90 % bound)	SE	Sample size (n)
Nest tree	Stratum 1	50 x 10	5.2 (1.4)	12.9 (5.8)	3.5	32
	Stratum 2	100 x 20	10 (1.4)	25 (5.9)	3.5	4
	Landscape		**6.0 (1.2)**	15.1 (4.87)	2.92	36
Random	Stratum 1	100 x 10	1.9 (0.8)	4.72 (3.49)	2.1	36
	Stratum 2	100 x 10	5.8 (1.0)	14.5 (4.3)	2.6	20
	Landscape		**2.6 (0.7)**	6.47 (2.94)	1.76	56

Parks		Plot Size	Avg. Snags/acre (SE)	Avg. Snags/hectare (± 90 % bound)	SE	Sample size (n)
Nest tree	Stratum 1	10 x 100	7.0 (1.5)	17.5 (6.2)	3.7	16
	Stratum 2	10 x 50	13.0 (3.4)	32.7 (13.99)	8.4	22
	Landscape		**10.9 (2.2)**	27.3 (9.22)	5.52	38
Random	Stratum 1	10 x 100	4 (1.0)	10 (4.29)	2.6	17
	Stratum 2	10 x 50	6.3 (1.8)	15.8 (7.38)	4.4	33
	Landscape		**5.5 (1.2)**	13.71 (4.95)	2.96	50

Table 5. Preliminary pre-treatment results on estimates of **snag densities** during 1999-2001 for snags > 53 cm (21") dbh, >1.4 m (3.5') tall, and all decay classes. Stratum 1 stands are dominated by ponderosa pine; stratum 2 is composed of mixed conifer trees.

Deadman		Plot size (m)	Avg. Snags/acre (SE)	Mean density (± 90 % bound)	SE	Sample size (n)	Percent precision
Nest tree	Stratum 1	50 x 10	5.0 (1.2)	12.5 (5.17)	3.1	16	41
	Stratum 2	100 x 10	3.6 (1.5)	9 (6.27)	3.8	7	70
	Landscape		**4.2 (1.0)**	10.55 (4.17)	2.5	23	40
Random	Stratum 1	100 x 20	0.9 (0.6)	2.15 (2.48)	1.5	7	116
	Stratum 2	100 x 10	1.1 (0.7)	2.86 (3.08)	1.8	7	108
	Landscape		**1.0 (0.5)**	2.54 (2.03)	1.2	14	80

Dutchoven		Plot size (m)	Avg. Snags/acre (SE)	Mean density (± 90 % bound)	SE	Sample size (n)	Percent precision
Nest tree	Stratum 1	50 x 10	4.1 (1.1)	10.32 (4.61)	2.8	31	45
	Stratum 2	100 x 10	8.0 (1.6)	20 (6.81)	4.1	4	34
	Landscape		**4.8 (0.95)**	12.06 (3.97)	2.38	35	33
Random	Stratum 1	50 x 10	0.8 (0.3)	1.94 (1.17)	0.7	72	60
	Stratum 2	50 x 10	2.0 (0.7)	5 (2.87)	1.7	40	57
	Landscape		**1.0 (0.3)**	2.49 (1.08)	0.65	112	43

Parks		Plot size (m)	Avg. Snags/acre (SE)	Mean density (± 90 % bound)	SE	Sample size (n)	Percent precision
Nest tree	Stratum 1	50 x 10	4.0 (1.2)	10 (5)	3	30	50
	Stratum 2	50 x 10	4.4 (1.4)	10.9 (5.7)	3.4	22	52
	Landscape		**4.2 (0.96)**	10.58 (4.05)	2.42	52	38
Random	Stratum 1	50 x 20	0.8 (0.3)	2.06 (1.37)	0.8	34	67
	Stratum 2	100 x 10	0.9 (0.6)	2.35 (2.69)	1.6	17	114
	Landscape		**0.9 (0.4)**	2.25 (1.78)	1.07	51	79

Table 6. Preliminary results on estimates of **live tree** densities during 1999 for trees > 23 cm (9") dbh, >1.4 m (3.5') tall. Numbers in the Stratum column are the working group strata defined by the Payette National Forest, followed by the percent canopy and cover type of Pipo (ponderosa pine) or mixed conifer. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

SITE	STRATUM	PLOT SIZE	AVG. TREES/ACRE (± 1 S.E.)	AVG. TREES/HECTARE (± 1 S.E.)	SAMPLE SIZE
Dutch Oven	925, 941; 10-35% Canopy; Pipo	20 x 100 m	20.4 ± 3.19	50.50 ± 7.89	20
Dutch Oven	324, 924; 35-50% Canopy; Mixed Con	10 x 100 m	43.6 ± 7.2	107.6 ± 17.9	14
Dutch Oven	Landscape		24.6 ± 2.9	60.73 ± 7.17	34
Reagan	925, 941; 10-35% Canopy; Pipo	20 x 100 m	34.6 ± 3.1	85.50 ± 7.68	10
Reagan	824; 10-35% Canopy; Mixed Con	10 x 100 m	54.7 ± 4.3	135.0 ± 10.6	6
Reagan	Landscape		45.7 ± 2.74	112.9 ± 6.76	16
Parks	925, 941; 10-35% Canopy; Pipo	10 x 100 m	45.7 ± 3.8	113.0 ± 9.47	10
Parks	724, 824; 35-70% Canopy; Mixed Con	10 x 100 m	70.4 ± 7.0	174.0 ± 17.3	10
Parks	Landscape		61.6 ± 4.69	152.26 ± 11.59	20

Table 7. Preliminary pretreatment results on estimates of **log densities** during 1999-2000 for logs with large end diameter (LED) ≥ 8 cm (3.15"), > 0.1 m (3.94") length, and decay sound/hard or rotten. Numbers in the Stratum column are the working group strata defined by the Payette National Forest, followed by the percent canopy and cover type of Pipo (ponderosa pine) or mixed conifer. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

SITE	STRATUM	PLOT SIZE	AVG. LOGS/ACRE (± 1 S.E.)	AVG. LOGS/HECTARE (± 1 S.E.)	SAMPLE SIZE
Deadman	925, 941; 10-35% Canopy; Pipo	4 x 12.5 m	20.3 ± 6.3	50.0 ± 15.5	56
Deadman	324, 924; 35-50% Canopy; Mixed Con	4 x 50 m	39.0 ± 8.7	96.4 ± 21.5	28
Deadman	Landscape		30.7 ± 5.6	75.7 ± 13.8	84
Parks	925, 941; 10-35% Canopy; Pipo	4 x 12.5 m	35.7 ± 6.4	88.2 ± 15.9	136
Parks	724, 824; 35-70% Canopy; Mixed Con	4 x 12.5 m	46.5 ± 8.0	114.7 ± 19.9	136
Parks	Landscape		42.7 ± 5.6	105.4 ± 13.9	272

Table 8. Preliminary pretreatment results on estimates of **log volumes** during 1999-2000 for logs with large end diameter (LED) ≥ 8 cm (3.15"), > 0.1 m (3.94") length, and decay sound/hard or rotten. Numbers in the Stratum column are the working group strata defined by the Payette National Forest, followed by the percent canopy and cover type of Pipo (ponderosa pine) or mixed conifer. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

SITE	STRATUM	PLOT SIZE	AVG. FT^3/ACRE (± 1 S.E.)	AVG. M^3/HECTARE (± 1 S.E.)	SAMPLE SIZE
Deadpan	925, 941; 10-35% Canopy; Pipo	4 x 50 m	897.4 ± 321.5	62.8 ± 22.5	28
Deadpan	324, 924; 35-50% Canopy; Mixed Con	4 x 12.5 m	934.6 ± 270.1	65.4 ± 18.9	56
Deadpan	Landscape		918.8 ± 206.6	64.3 ± 14.5	84
Parks	925, 941; 10-35% Canopy; Pipo	4 x 12.5 m	828.8 ± 252.9	58.0 ± 17.7	136
Parks	724, 824; 35-70% Canopy; Mixed Con	4 x 12.5 m	478.7 ± 87.2	33.5 ± 6.1	136
Parks	Landscape		603.0 ± 106.0	42.2 ± 7.4	272

Table 9. Preliminary pretreatment results on estimates of **percent log cover** during 1999-2000 for logs with large end diameter (LED) ≥ 8 cm (3.15"), > 0.1 m (3.94") length, and decay sound/hard or rotten. Numbers in the Stratum column are the working group strata defined by the Payette National Forest, followed by the percent canopy and cover type of Pipo (ponderosa pine) or mixed conifer. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

SITE	STRATUM	PLOT SIZE	AVG. PERCENT COVER (± 1 S.E.)	SAMPLE SIZE
Deadpan	925, 941; 10-35% Canopy; Pipo	4 x 12.5 m	1.22 ± 0.39	56
Deadpan	324, 924; 35-50% Canopy; Mixed Con	4 x 12.5 m	2.46 ± 0.61	56
Deadpan	Landscape		1.91 ± 0.39	112
Parks	925, 941; 10-35% Canopy; Pipo	4 x 12.5 m	1.63 ± 0.37	136
Parks	724, 824; 35-70% Canopy; Mixed Con	4 x 12.5 m	1.48 ± 0.23	136
Parks	Landscape		1.53 ± 0.20	272

Table 10. Preliminary pretreatment results on estimates of **log lengths** during 1999-2000 for logs with large end diameter (LED) ≥ 8 cm (3.15"), > 0.1 m (3.94") length, and decay sound/hard or rotten. Numbers in the Stratum column are the working group strata defined by the Payette National Forest, followed by the percent canopy and cover type of Pipo (ponderosa pine) or mixed conifer. Stratum 1 stands are dominated by ponderosa pine, while stratum 2 is composed of mixed conifer trees.

SITE	STRATUM	AVG. LENGTH (FT) (± 1 S.E.)	AVG. LENGTH (M) (± 1 S.E.)	SAMPLE SIZE
Deadpan	925, 941; 10-35% Canopy; Pipo	54.8 ± 11.7	16.7 ± 3.6	24
Deadpan	324, 924; 35-50% Canopy; Mixed Con	40.7 ± 4.2	12.4 ± 1.3	58
Deadpan	Landscape	44.6 ± 4.6	13.6 ± 1.4	82
Parks	925, 941; 10-35% Canopy; Pipo	35.4 ± 3.6	10.8 ± 1.1	103
Parks	724, 824; 35-70% Canopy; Mixed Con	31.8 ± 2.5	9.7 ± 0.8	141
Parks	Landscape	33.5 ± 2.1	10.2 ± 0.6	244

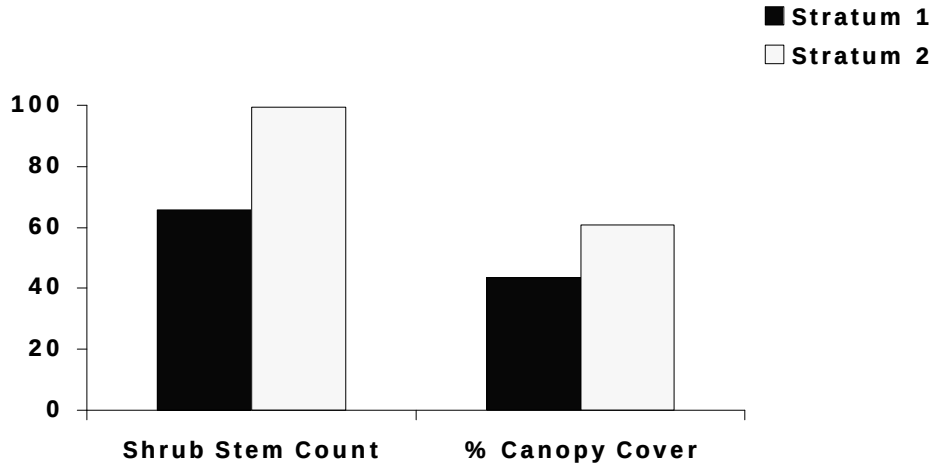


Fig. 2. Preliminary pre-treatment results on counts of shrub stems (≤ 2.5 cm in diameter) measured in 5-m radius circular plots and percent canopy cover recorded at random in five study sites during 1999-2000. Shrub species and tree species are listed Appendix 2. Stratum 1 stands are dominated by ponderosa pine, while Stratum 2 is composed on mixed conifer trees.

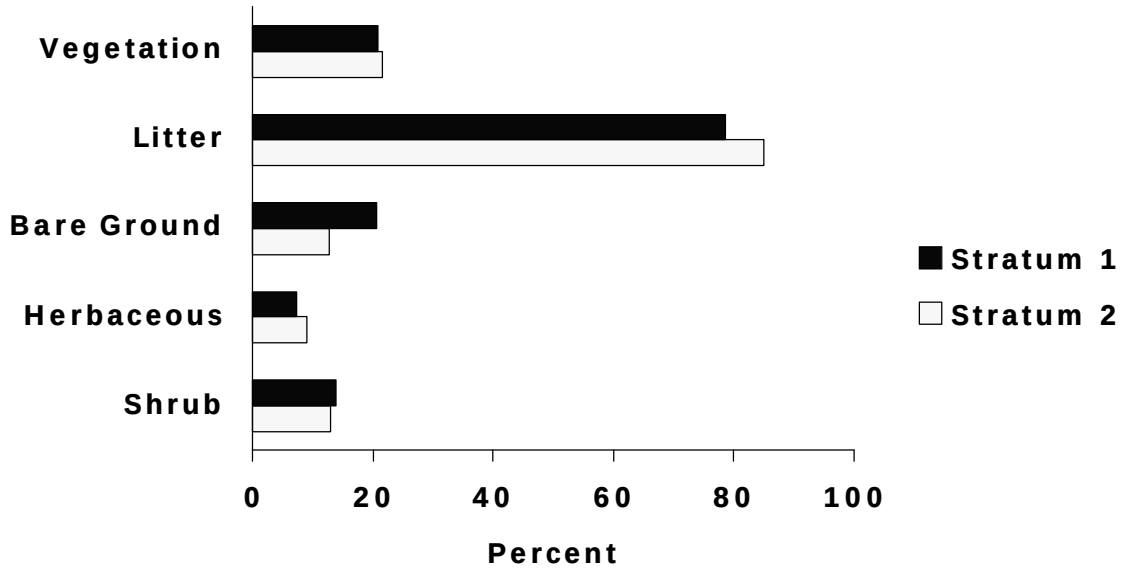


Fig. 3. Preliminary pretreatment results on percent ground cover measured in 5-m radius circular plots at five study sites during 1999-2000. Stratum 1 are stands dominated by ponderosa pine, while Stratum 2 is composed of mixed conifer trees. The vegetation component includes shrub and herbaceous cover combined.

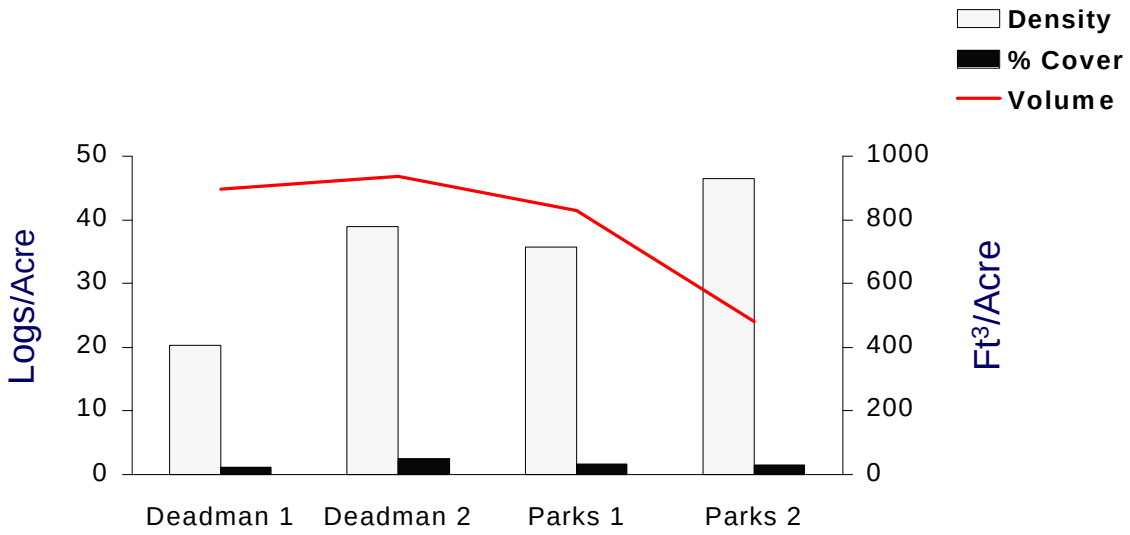


Fig. 4. Preliminary pre-treatment results on estimates of log densities, volumes, and percent cover during 1999-2000 at Deadman and Parks Creek sites. Data are for logs with large end diameter (LED) $\geq$ 8 cm (3.15”), > 0.1 m (3.94”) length, and decay sound/hard or rotten. Numbers following site names indicate stratum number. Stands designated as Stratum 1 are dominated by ponderosa pine, while stratum 2 stands are those composed of mixed conifer trees.

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Appendix 1. Common and scientific names of birds recorded during point count surveys in the South Fork Salmon study areas during 1999-2000.

Common name	Scientific name
Bald Eagle	*Haliaeetus leucocephalus*
Sharp-shinned Hawk	*Accipiter striatus*
*Cooper's Hawk	*Accipiter cooperii*
*Red-tailed Hawk	*Buteo jamaicensis*
*American Kestrel	*Falco spaverius*
Chukar	*Alectoris chukar*
*Blue Grouse	*Dendragapus obscurus*
Ruffed Grouse	*Bonasa umbellus*
Mourning Dove	*Zenaida macroura*
*Flammulated owl	*Otus flammeolus*
*Great-horned Owl	*Bubo virginianus*
*Northern Pygmy-Owl	*Glaucidium gnoma*
*Common Nighthawk	*Chordeiles minor*
Vaux's Swift	*Chaetura vauxi*
*Calliope Hummingbird	*Stellula calliope*
Belted Kingfisher	*Ceryle alcyon*
*Red-naped Sapsucker	*Sphyrapicus nuchalis*
*Williamson's Sapsucker	*Sphyrapicus thyroideus*
*Hairy Woodpecker	*Picoides villosus*
White-headed Woodpecker	*Picoides albolarvatus*
Three-toed Woodpecker	*Picoides tridactylus*
*Northern Flicker	*Colaptes auratus*
*Pileated Woodpecker	*Dryocopus pileatus*
Olive-sided Flycatcher	*Contopus borealis*
Western Wood-Peewee	*Contopus sordidulus*
*Hammond's Flycatcher	*Empidonax hammondii*
*Dusky Flycatcher	*Empidonax oberholseri*
Cordilleran Flycatcher	*Empidonax occidentalis*
Gray Jay	*Perisoreus canadensis*
Stellar's Jay	*Cyanocitta stelleri*
Clark's Nutcracker	*Nucifraga columbiana*
Common Raven	*Corvus corax*
*Mountain Chickadee	*Parus gambeli*
*Red-breasted Nuthatch	*Sitta Canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
*Brown Creeper	*Certhia Americana*
*Rock Wren	*Salpinctes obsoletus*
*House Wren	*Troglodytes aedon*
*Winter Wren	*Troglodytes troglodytes*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*

*Western Bluebird	*Sialia mexicana*
*Mountain Bluebird	*Sialia currucoides*
*Townsend's Solitaire	*Myadestes townsendi*
Swainson's Thrush	*Catharus ustulatus*
*Hermit Thrush	*Catharus guttatus*
*American Robin	*Turdus migratorius*
Cedar Waxwing	*Bombycilla cedrorum*
Cassin's Vireo	*Vireo cassinii*
Warbling Vireo	*Vireo gilvus*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapila*
*Yellow-rumped Warbler	*Dendroica coronata*
Townsend's Warbler	*Dendroica townsendi*
*MacGillivray's Warbler	*Oporornis tolmiei*
Wilson's Warbler	*Wilsonia pusilla*
*Western Tanager	*Piranga ludoviciana*
Lazuli Bunting	*Passerina amoena*
Spotted Towhee	*Pipilo maculatus*
*Chipping Sparrow	*Spizella passerina*
Brewer's Sparrow	*Spizella breweri*
Song Sparrow	*Melospiza melodia*
*Dark-eyed Junco	*Junco hyemalis*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Red Crossbill	*Loxia curvirostra*
Cassin's Finch	*Carpodacus cassinii*
Pine Siskin	*Carduelis pinus*
Evening Grosbeak	*Coccothraustes vespertinus*

*Confirmed nesting within the study areas.

Appendix 2. Common and scientific names of woody vegetation recorded within the South Fork Salmon study areas during 1999-2000.

Common name	Scientific name
Grand Fir	*Abies grandis*
Subalpine Fir	*Abies lasiocarpa*
Rocky Mountain Maple	*Acer glabrum*
Mountain Alder	*Alnus incana*
Sitka Alder	*Alnus sinuata*
Western Serviceberry	*Amelanchier alnifolia*
Bearberry, Kinnikinnick	*Arctostaphylos uva-ursi*
Creeping Oregongrape	*Berberis repens*
Mountain Balm	*Ceanothus velutinus*
Curleaf Mountain-Mahogany	*Cercocarpus ledifolius*
Red-osier Dogwood	*Cornus stolonifera*
Black Hawthorn	*Crataegus douglasii*
Utah Honeysuckle	*Lonicera utahensis*
Fool's Huckleberry	*Menziesia ferruginea*
Mock Orange	*Philadelphus lewisii*
Mallow Ninebark	*Physocarpus malvaceus*
Lodgepole Pine	*Pinus contorta*
Engelman Spruce	*Picea engelmannii*
Ponderosa Pine	*Pinus ponderosa*
Quaking-aspen	*Populus tremuloides*
Bittercherry	*Prunus emarginata*
Common Chokecherry	*Prunus virginiana*
Douglas-fir	*Pseudotsuga menziesii*
Bitterbrush	*Purshia tridentate*
Squaw Currant	*Ribes cereum*
Swamp Gooseberry	*Ribes lacustre*
Sticky Currant	*Ribes viscosissimum*
Currant	*Ribes spp.*
Baldhip Rose	*Rosa gymnocarpa*
Wood's Rose	*Rosa woodsii*
Rose	*Rosa spp.*
Thimbleberry	*Rubus parviflorus*
Elderberry	*Sambucus cerulea*
Scouler Willow	*Salix scouleriana*
Salix	*Salix spp.*
Buffaloberry	*Shepherdia Canadensis*
Mountain Ash	*Sorbus scopulina*
White Spirea	*Spirea betulifolia*
Common Snowberry	*Symphoricarpos albus*
Mountain Snowberry	*Symphoricarpos oreophilus*
Snowberry	*Symphoricarpos spp.*
Big Huckleberry	*Vaccinium membranaceum*