A PRELIMINARY REPORT

EFFECTS OF TIMBER HARVEST ON SMALL MAMMALS AND AMPHIBIANS INHABITING OLD-GROWTH CONIFEROUS FORESTS ON THE CLEARWATER NATIONAL FOREST, IDAHO

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ABSTRACT

Small mammal and amphibian abundance and species richness were sampled in five contiguous old-growth stands of coniferous forest, five smaller fragments of old-growth stands, and five clearcut areas. Sampling techniques included pitfall trapping grids with drift fences and snap-trap transects. Pitfall trapping grids were sampled for 37 consecutive nights whereas snap-trapping was conducted for five consecutive nights. Results presented in this report are preliminary in that they provide a summary but not an analysis of the field data on small mammals, amphibians, and vegetation that were collected. Pitfall trapping grids with drift fences captured the greatest number of small mammal species (13) including five species of shrew, one pocket gopher species, and seven species of mice and voles. The greatest number of small mammal species and individuals were captured on clearcut areas. Masked, dusky, and vagrant shrews dominated the small mammal captures on pitfall trapping grids. Fewer species were captured on snap-trap transects (9), and the species composition was different from pitfall traps. Two species of chipmunk were captured on snap-trap transects and not in pitfall traps. Snap traps also captured relatively greater numbers of deer mice. There was little difference in the number of species or animals captured among the old-growth, fragment, and clearcut sampling sites with snap traps. Four species of amphibian were captured on pitfall trapping grids with drift fences. Although the greatest number of amphibians was captured on old-growth sites, the overall number of individual amphibians captured during this study was low. Only one rare, threatened, or endangered species - the pygmy shrew - was captured during the study. This study represents only the second documentation for the pygmy shrew in Idaho. A later report will contain statistical analyses, a more thorough discussion of the relevant literature on habitat relations of small mammals and amphibians, and a discussion of the effects of timber harvest on small mammal populations.

INTRODUCTION

The response of vertebrates to habitat fragmentation in old-growth forests of the Pacific Northwest has received considerable attention in recent years (Ruggiero et al. 1991). Yet, scant attention has been paid to the interior cedar-hemlock (*Thuja plicata - Tsuga sp.*) and mixed coniferous forests of eastern Washington, north-central and northern Idaho, and western Montana. Hoffman (1960) and Rickard (1960) sampled climax plant associations, including the cedar-hemlock association, for small mammals in eastern Washington and northern Idaho. Stout et al. (1971) reported on the abundance and diversity of small mammals in burned and adjacent unburned areas of mixed coniferous forest in northern Idaho. Finally, Scrivner and Smith (1984) investigated the relative abundance of four species of small mammals in successional stages of spruce-fir forests in north-central Idaho.

Although several studies have focused on the presence of amphibians in old-growth forests of the Pacific Northwest and the impact of timber harvest on these amphibians (e.g., Corn and Bury 1989, Welsh 1990), no studies have systematically surveyed amphibians in the interior cedar-hemlock forests. Nor have any studies investigated the impacts of timber harvest on amphibian species in these forests.

The purpose of this study was twofold: 1) examine small mammal and amphibian species richness and abundance in contiguous stands of old-growth forest, smaller fragmented stands of old-growth, and recently harvested stands on the Clearwater National Forest and 2) compare two trapping techniques for small mammals - pitfall traps with drift fences versus snap-trap transects. Concurrently, a separate study in the same area focused on the effects of forest fragmentation on bird communities (Hutto 1993).

STUDY AREA

Small mammals, amphibians, and vegetation were sampled at 15 sites on the Pierce and Lochsa Ranger Districts of the Clearwater National Forest, Idaho County, Idaho. The sampling sites were located in the Clearwater Mountains within the Lochsa and Middle Fork Clearwater River drainages in an area bounded by Eldorado Creek on FS Road 500 in the southwest, Deadman Creek in the southeast, and Mex Mountain and Frenchman Butte in the north (Figure 1). In general, the study area is a heavily roaded patchwork of timber harvest areas interspersed with stands of mixed coniferous old-growth forest. A Research Natural Area, the Four-bit Creek RNA (Wellner 1990), occurs within the boundaries of the study area.

Geologically, the area is underlain with Idaho Batholith granitics and associated gneisses (Wilson et al. 1983). Forest vegetation is dominated by western redcedar and Grand fir (*Abies grandis*) SAF cover types (Wellner 1990). Nearly all of the study area is classified as *Thuja plicata* habitat types (Cooper et al. 1991). Climate of the area is characteristic of an inland maritime regime with prolonged gentle rains, high humidity, and fog in spring and fall; deep snow pack at higher elevations in winter; and a warm, dry summer period. Most of the study area escaped burning by the catastrophic turn-of-the-century fires in the Lochsa and Selway drainages (Lichthardt and Moseley 1994).

The study area is approximately 11 km wide from east to west and 5 km in length from north to south. Elevation of sampling sites ranged from 1097 m to 1494 m (3600′ - 4900′). Approximate locations of sampling sites are provided in Table 1. Appendix A gives detailed directions for locating sampling sites.

METHODS

Sampling sites were selected by placing acetate overlays on a aerial photograph of the study area (Mex Mountain and the timber harvest area south to the Lochsa River) and drawing boundaries around polygons of 1) clearcuts, 2) fragments of old-growth forest (areas < 300 acres (121 ha)) surrounded on most sides by clearcuts, and 3) non-fragmented old-growth areas (> 300 acres). Five polygons of each of three treatment types above were randomly selected for sampling for a total of 15 sampling sites. These 15 sites consisted of five clearcut sites (CC2, CC4, CC6, CC12, CC14), five sites containing fragments of old-growth forest (FG8, FG9, FG14, FG16, FG17) and five sites containing more contiguous old-growth forest (OG1, OG2, OG5, OG6, OG7). All sites were selected in conjunction with a concurrent study of habitat use by forest birds (Hutto 1993) so that there would be as much overlap as possible between sampling sites for birds, small mammals, and amphibians. One sampling site (OG5) was located within the boundaries of Four-bit Creek RNA.

At each site, sampling grids for small mammals and amphibians were established 100-300 m from the nearest road and as close to the center of the polygon as possible. A sampling grid for small mammals and amphibians consisted of two arrays of pitfall traps with drift fences with the centers of the two arrays being 25 m apart (Bury and Corn 1987, Corn and Bury 1990). A single array contained six pitfall traps with a single trap located at each end of three 5-meter long drift fences. The drift fences were arranged like three spokes of a wheel, each 120° apart. Thus, there were 12 pitfall traps per sampling site and a total of 180 traps in the study area. Drift fences were made of 50-cm tall aluminum valley roofing metal buried approximately 20 cm in the ground. A pitfall trap consisted of two No. 10 tin cans held

together with duct tape and buried so that the top end of the two-can unit was flush with the ground.

In addition to the pitfall trapping arrays, two parallel snap-trap transects, each 25 m apart, were established at four of the five sampling sites for each of the three treatments for a total of 12 sites sampled with snap traps. These transects were established 150 m from the center of one of the pitfall trapping arrays. These transects were located in areas subjectively determined to be most similar in vegetation composition and structure to vegetation surrounding the pitfall arrays. Each transect was 110 m in length and consisted of 12 trap stations each spaced 10 m apart. Each trap station consisted of two Museum Special snap traps. Prior to trapping, traps were baited but not set to catch, for one night. Snap traps were baited with a mixture of peanut butter and rolled oats. Snap-trap transects were located at the following sampling sites: CC2, CC6, CC12, CC14; FG9, FG14, FG16, FG17; OG2, OG5, OG6, OG7 (Figure 1).

For each animal trapped in a pitfall or snap trap, the following information was recorded in the field: date, site name, trap station, trap night, species (if possible), sex, sexual condition (for small mammals: juvenile vs. adult), weight, and length (SVL for amphibians, total length for small mammals). With the exception of easily identified and common species like the deer mouse (*Peromyscus maniculatus*), each small mammal was placed in an individually marked plastic bag, frozen as soon as possible, and transported to the Department of Biological Sciences at the University of Idaho (Moscow) or the College of Idaho (Caldwell) for specimen preparation and identification. Amphibian specimens were individually marked with leg tags and stored in 10% solutions of formalin for transport to the Museum of Natural History at Idaho State University (Pocatello).

Because it was not possible to trap all 15 sites concurrently, the trapping sites were split into two groups. Group I (OG1, FG16, FG17, CC2, CC12, CC14) of the pitfall arrays was trapped for 37 trap nights from July 31 - September 5. Group II (OG2, OG5, OG6, OG7, FG8, FG9, FG14, CC4, CC6) of the pitfall arrays also was trapped for 37 trap nights from August 11 - September 17. Trapping was conducted on snap-trap transects for 5 consecutive days during the first 5 days of trapping on pitfall trap arrays. Pitfall traps were checked daily for the first 5 days of trapping, then every 3 days for the next 3 trapping sessions, and then every 5 or 7 days for the remainder of the trapping period.

Vegetation sampling was conducted during October 1991 and generally followed the sampling methodology outlined in the Timber Management Data Handbook (USFS 1991). Forms completed during field sampling included Card 1 (Basic Stand Data), Card 2

Tree Data Form), Card 9 (Cover Plot Data), Card 4 (Fire Data), and Form PC (Plant Composition Database - ECODATA). At each sampling site, one of the two pitfall trapping arrays was randomly selected for vegetation sampling. A fixed radius plot (.01 ac (.004 ha)) was used to sample trees less than the breakpoint DBH of 5.1 in (12.9 cm). Trees greater in size than the breakpoint DBH were sampled on variable radius plots. Habitat type, slope, aspect, and topographic position were recorded for all sampling sites. A 50-ft (15.2 m) transect was used to collect fire data. Downed woody material > 3-in (7.6 cm) diameter and depth of duff were sampled on these transects.

Percent cover data were collected on .05-ac (.02-ha) plots and all plant species covering > 1 % of the plot were sampled. Cover data were recorded for the following variables: bareground, gravel, rock, duff/litter, basal area of trees, downed wood, water, and moss/lichen; foliar canopy cover of all trees, seedlings, saplings, pole, and 4 sizes of trees; canopy cover of all shrubs, medium-sized shrubs, and tall shrubs, and; grasses, forbs, and ferns. Only selected vegetation variables are reported in the results. All vegetation data collected are on file at the Idaho Conservation Data Center and the Clearwater National Forest.

RESULTS

Vegetation

Vegetation data were collected on three of five old-growth sampling sites. Habitat types were classified as *Tsuga heterophylla-Asarum caudatum* (OG2), *Thuja plicata-Gymnocarpium dryopteris* (OG5), and *T. plicata-A. caudatum* (OG6). On fragmented stands of old growth, the habitat types were classified as *T. plicata-G. dryopteris* (FG8), *T. plicata-A. caudatum* (FG9,FG14, FG17) and *T. plicata-A. caudatum-Taxum brevifolia* (FG16).

Englemann spruce (*Picea engelmannii*) and grand fir (*Abies grandis*) dominated the canopy on OG2, whereas western redcedar and Pacific Yew were dominant on sampling sites OG5 and OG6. Western redcedar and grand fir were the co-dominants on all the fragmented (FG) old-growth stands. The primary cover of clearcuts was shrubs, forbs, and small trees such as Rocky Mountain maple (*Acer glabrum*), snowberry (*Symphoricarpos albus*), chokecherry (*Prunus emarginata*), ceanothus (*Ceanothus velutinus*), pachistima (*Pachistima myrsinites*), thimbleberry (*Rubus parviflorus*), elderberry (*Sambucus racemosa*), and shield fern (*Dryopteris filix-mas*).

Average diameter of trees was 33 in (83.8 cm) (range: 24-42 in) in old-growth stands and 26 in (66 cm) (range:19-36 in) for stands of fragmented old growth (Table 2). There were virtually no measureable trees in clearcuts. Depth of duff averaged approximately 33 in (83.8 cm) for old-growth stands, 20 in (50.8 cm) for the fragments, and 5 in (12.7 cm) (range: 0-25 in) for clearcuts.

The amount of bareground in sampling plots was similar for old-growth and clearcut sampling sites (X = 21.6 % and 22 %, respecitively), but somewhat lower for fragment sampling sites (11%) (Table 2). Tree cover averaged about 60 % for old-growth sites, 74 % for fragmented old-growth sites, and about 16 % for clearcut sites. Cover by moss was restricted primarily to old-growth stands where it averaged 11 %. Shrub cover was highest in clearcut sites where it averaged 33 % (range: 10-50 %), and substantially lower in fragmented and contiguous old-growth stands. Grass cover exhibited a similar trend but averaged only about 9 % cover in clearcut sampling sites. Finally, percent cover by forbs was similar across all 3 sampling types.

Small Mammmals and Amphibians

The masked shrew (*Sorex cinereus*), vagrant shrew (*S. vagrans*), and southern red-backed vole (*Clethrionomys gapperi*) were the primary small mammal species captured in pitfall traps within old-growth stands (Table 3). Three species - the water shrew (*S. palustris*), montane vole (*Microtus montanus*), and long-tailed vole (*M. longicaudus*) - were captured in very low numbers. Although four species of amphibians were captured, none were abundant. In fact, only 26 individual amphibians were captured compared to 159 small mammals.

The masked and vagrant shrew also dominated the capture of small mammals on the fragmented old-growth stands (Table 4). Three additional species not captured in the old-growth stands - the pygmy shrew (*S. hoyi*), water vole (*Microtus richardsonius*), and heather vole (*Phenacomys intermedius*) - were captured in the fragmented stands in low numbers. One less amphibian species and substantially fewer individual amphibians were captured in the fragmented stands compared to the old-growth stands.

The largest number of small mammal species and the greatest number of individuals were captured in pitfall traps on clearcut areas (Table 5). However, three species (water shrew, pygmy shrew, montane vole) were represented by only one capture each. As on the old-growth and fragmented stands, masked and vagrant shrews dominated the captures of small mammals. Only one amphibian species, the long-tailed salamander (*Ambystoma macrodactylum*), was captured in clearcut areas.

Snap-trap transects captured two small mammal species, the yellow-pine chipmunk (*Tamias amoenus*) and red-tailed chipmunk (*T. ruficaudus*), that were not captured in pitfall traps (Table 6). Most of these chipmunks were captured in clearcut areas. In addition, a large number of deer mice (*Peromyscus maniculatus*) were captured in all three treatments (OG, FG, CC) on snap-trap transects compared to only a few in pitfall traps. Snap-traps also captured substantial numbers of red-backed voles in old-growth and fragmented stands.

Although a few shrews were captured in snap traps, pitfall traps were more effective at capturing shrews (Table 7). In general, snap traps captured slightly fewer species than pitfall traps. No vole (*Microtus*) species or pocket gophers (*Thomomys talpoides*) were captured in snap traps. As mentioned above, chipmunks were only captured in snap traps.

Overall, only four species of amphibians - the long-tailed salamander, the Idaho giant salamander (*Dicamptodon aterrimus*), the tailed frog (*Ascaphus truei*), and the spotted frog (*Rana pretiosa*) - were captured during this study (Table 8). Most of these captures were in old-growth stands, and all of the species were captured in relatively low numbers.

Only one rare, threatened, or endangered species (Moseley and Groves 1992) was captured during this study. The pygmy shrew (*S. hoyi*) is a state species of special concern and a BLM sensitive species. Prior to this study, the pygmy shrew had only been recorded in one other locale in Idaho (Foresman 1986). In this study, one pygmy shrew was captured in a clearcut area and three were captured in fragments of old-growth forest.

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Table 1. Location of 15 sampling sites on Clearwater National Forest, Idaho County, Idaho, 1991.

Site Name	Nearest Stream	Township, Range and Section	UTM Easting, Northing	Harvest Date (Stand Size)
Old Growth 1 (OG1)	Deadman Creek	T34NR6ES10SW4	610082, 5127981	
Old Growth 2 (OG2)	Frenchman Creek	T34NR7ES2SE4SW4	611757, 5129404	
Old Growth 5 (OG5)	Four-bit Creek	T34NR6ES13NW4	603855, 5126843	
Old Growth 6 (OG6)	Eldorado Creek	T34NR6ES23NW4	602172, 5125485	
Old Growth 7 (OG7)	Deadman Creek	T34NR7ES14SE4SE4	612817, 5126318	
Fragment 8 (FG8)	Dollar Creek	T34NR7ES7NE4NW4	605606, 5128979	
Fragment 9 (FG9)	Two-bit Creek	T34NR7ES7 center	605495, 5128246	
Fragment 14 (FG14)	Canyon Creek	T34NR7ES28NW4NE4	609102, 5124284	
Fragment 16 (FG16)	Glade Creek	T34NR7ES22SE4	611179, 5124874	
Fragment 17 (FG17)	Deadman Creek	T34NR7ES23NW4SE4	612224, 5124959	
Clearcut 2 (CC2)	Deadman Creek	T34NR7ES23NW4SE4	610006, 5129181	1967 (87 ac)
Clearcut 4 (CC4)	Dollar Creek	T34NR7ES5SW4SW4	606343, 5129214	1970 (153 ac)
Clearcut 6 (CC6)	Dollar Creek	T34NR7ES7 center	605028, 5128287	1970 (74 ac)
Clearcut 12 (CC12)	Canyon Creek	T34NR7ES28NE4NE4	609288, 5124320	1979 (54 ac)
Clearcut 14 (CC14)	Glade Creek	T34NR7ES22SW4NE4	610562, 5125392	1979 (35 ac)

Table 2. Summary of vegetation measurements in old-growth stands (OG), clearcut stands (CC), and fragments of old-growth (FG) on the Clearwater National Forest, 1991. Slope is measured in degrees, DBH and Duff in inches and the remaining cover measures represent % cover by ocular measures.

Site	Slope	Aspect	DBH	Duff	Baregrd	Treecov	Mosscov	Shrubcov	Grasscov	Forbcov
OG2	27	N	24	35	50	59	3	5	2	15
OG5	12	NE	33	30	5	60	20	10	1	20
OG6	23	NW	42	35	10	65	10	10	1	20
AVG-OG	20.6		33	33.3	21.6	61.3	11	8.3	1.3	18.3
CC2	10	SW	2	0	40	8	0	50	8	20
CC4	28	N	0	25	15	20	10	35	1	15
CC6	35	W	2	0	20	25	5	10	30	30
CC12	6	NW	1	0	25	25	5	30	2	20
CC14	6	W	0	0	10	1	0	40	3	30
AVG-CC	17		1	5	22	15.8	4	33	8.8	23
FG8	25	NW	28	20	5	70	2	5	0	25
FG9	8	SW	19	5	15	80	5	10	0	15
FG14	15	W	26	0	10	90	1	1	0	10
FG16	14	SW	22	60	15	80	0	7	0	20
FG17	23	E	36	15	10	50	2	15	0	40
AVG-FG	17		26	20	11	74	2	7.6	0	18

Table 3. Numbers of small mammals and amphibians captured on pitfall trapping grids in old-growth stands on the Clearwater National Forest during 37 consecutive nights of trapping per grid from July-September, 1991.

Species	OG1	OG2	OG5	OG6	OG7	Total
MAMMALS						
Sorex cinereus	10	20	2	3	7	42
Sorex vagrans	12	13	3	5	1	34
Sorex monticolus	3	2	3		2	10
Sorex palustris	1					1
Sorex species	6	18	5	3	1	33
Thomomys talpoides	3	2				5
Clethrionomys gapperi	18	5	4		2	29
Microtus montanus	1		1		1	3
Microtus longicaudus			1		1	2
Total number of animals	54	60	19	11	15	159
Total number of species	7	5	6	3	6	8
AMPHIBIANS						
Ambystoma macrodactylum		4	4		1	9
Dicamptodon aterrimus				1		1
Ascaphus truei		9		2	3	14
Rana pretiosa				2		2
Total number of animals	0	13	4	5	4	26
Total number of species	0	2	1	3	2	4

Table 4. Numbers of small mammals and amphibians captured on pitfall trapping grids in old-growth fragments on the Clearwater National Forest during 37 consecutive nights of trapping per grid from July-September, 1991.

Species	FG8	FG9	FG14	FG16	FG17	Total
MAMMALS			T34N R7E S28	T34N R7E S22		
Sorex cinereus	5	8	2	4	8	27
Sorex vagrans	6	2	3	11	4	26
Sorex monticolus		2	1	8	2	13
Sorex hoyi			(1)	(2)		3
Sorex species		1		2	5	8
Thomomys talpoides		1		1	2	4
Peromyscus maniculatus					1	1
Clethrionomys gapperi	5	1	1	1	1	9
Microtus montanus	2					2
Microtus richardsonius				1		1
Phenacomys intermedius	(2)	(1)				3
Total number of animals	20	16	8	30	23	97
Total number of species	5	6	5	7	6	10
AMPHIBIANS						
Ambystoma macrodactylum	4	1				5
Ascaphus truei	1				1	2
Rana pretiosa					1	1
Total number of animals	5	1	0	0	2	8
Total number of species	2	1	0	0	2	3

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Table 5. Numbers of small mammals and amphibians captured on pitfall trapping grids in clearcuts on the Clearwater National Forest during 37 consecutive nights of trapping per grid from July-September, 1991.

Species	CC2	CC4	CC6	CC12	CC14	Total
MAMMALS						
Sorex cinereus	1	10	5	7	7	30
Sorex vagrans	10	7	11	11	14	53
Sorex monticolus	3	3	2	4	1	13
Sorex palustris				1		1
Sorex hoyi	(1)					1
Sorex species	26	7	6	7	2	48
Thomomys talpoides	3				4	7
Peromyscus maniculatus		1	1		1	3
Clethrionomys gapperi	1	5				6
Microtus montanus				1		1
Microtus longicaudus	1		1	3		5
Microtus species			1			1
Phenacomys intermedius	♀12 (1)	♀13 (6)		♀12 (3)	♀12 (3)	13
Zapus princeps	3			3		6
Total Number of Animals	50	39	27	40	30	187
Total Number of Species	9	6	6	8	6	12
AMPHIBIANS						
Ambystoma macrodactylum		1	1	3		5

← ♀♀1

← ♀12 & ♀13

Table 6. Number of small mammals captured on snap-trap transects in old growth (OG) stands, fragments of old growth stands (FG), and clearcuts (CC) during five consective nights of trapping per transect on the Clearwater National Forest, July-August, 1991.

Site	SOCI[1]	SOVA	SOMO	SOSP	TAAM	TARU	TASP	PEMA	CLGA	PHIN	ZAPR	Total[2]
OG2						1	1	25	11			38/3
OG5	1	1				1		9	16			28/5
OG6	2		2	1				5	2			12/4
OG7	1					1	1	10	15		1	29/5
Total	4	1	2	1		3	2	49	44		1	107/7
FG9	2	1	2	1				9	16	1	1	33/7
FG14	1	1				2	1	9	8			22/5
FG16		1				3	4	15	6			29/4
FG17	1	1						13	7			22/4
Total	4	4	2	1		5	5	46	37	1	1	106/8
CC2				1	2	17		14	1		3	38/5
CC6					1	1	5	10			3	20/4
CC12	1					2		16			1	20/4
CC14					1			34				35/2
Total	1			1	4	25	5	74	1		7	113/7
Grand Total	9	5	4	2	4	33	17	169	82	1	9	335/9

[1] Species acronyms are defined as follows: SOCI=Sorex cinereus, SOVA=Sorex vagrans, SOMO=Sorex monticolus, SOSP=Sorex species, TAAM= Tamias amoenus, TARU=Tamias ruficaudus, TASP=Tamias species, PEMA= Peromyscus maniculatus, CLGA=Clethrionomys gapperi, PHIN=Phenacomys intermedius, ZAPR=Zapus princeps

[2] Total Number of Animals/Total Number of Species

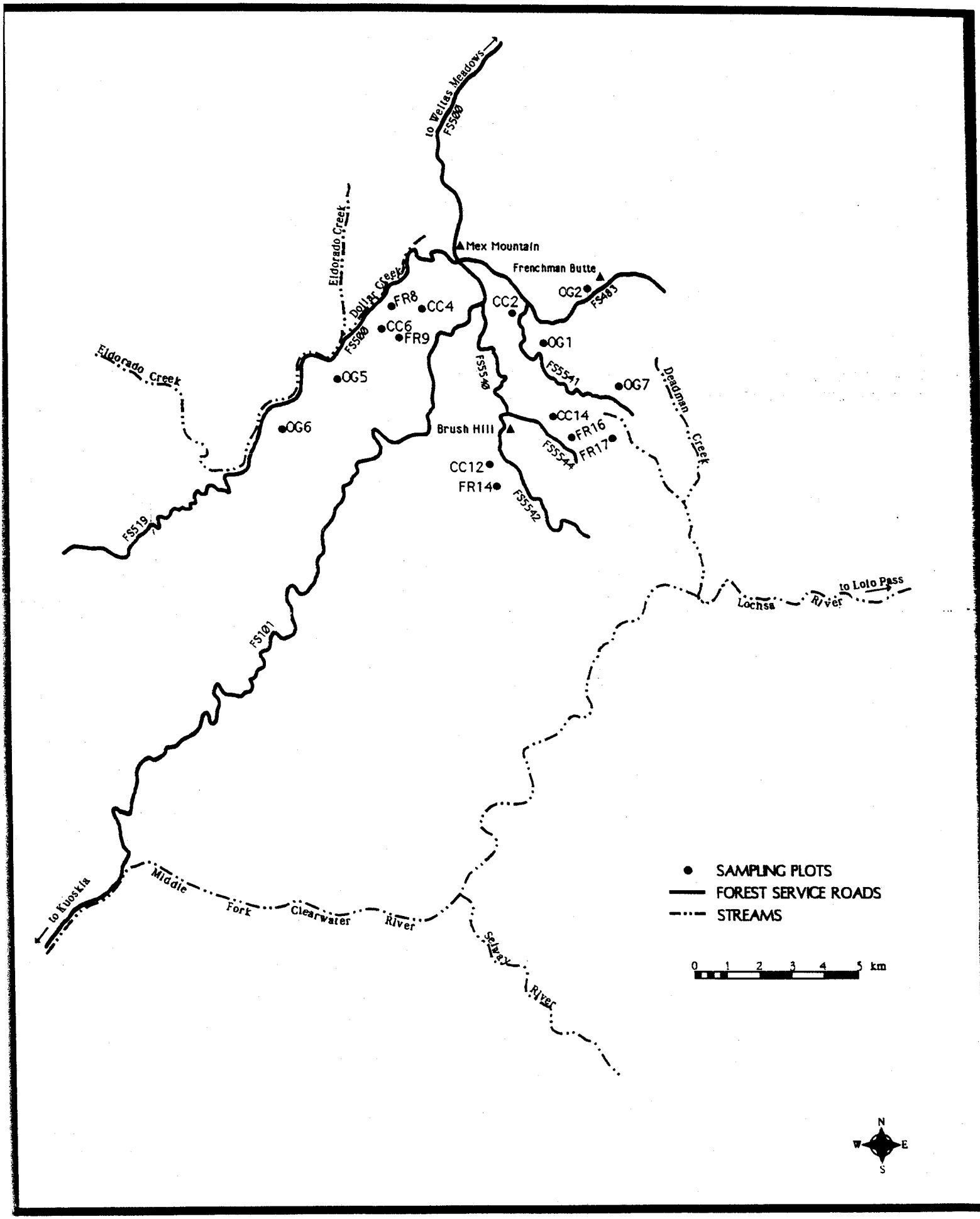
Table 7. Number of small mammals captured on pitfall trapping grids and snap trap transects in old growth stands (OG), fragments of old growth (FG), and clearcuts (CC) on the Clearwater National Forest, 1991. Because of differences in trap technique, numbers of small mammals captured by pitfalls versus snap traps are not directly comparable.

	Pitfall Traps			Total		Snap Traps		
Species	OG	FG	CC	Pitfall	Snap	OG	FG	CC
Sorex cinereus	42	27	30	99	9	4	4	1
Sorex vagrans	34	26	53	113	5	1	4	
Sorex monticolus	10	13	13	36	4	2	2	
Sorex palustris	1		1	2	0			
Sorex hoyi		3	1	4	0			
Sorex species	33	8	48	89	3	1	1	1
Tamias amoenus				0	4			4
Tamias ruficaudus				0	33	3	5	25
Tamias species				0	12	2	5	5
Thomomys talpoides	5	4	7	16	0			
Peromyscus maniculatus		1	3	4	169	49	46	74
Clethrionomys gapperi	29	9	6	44	82	44	37	1
Microtus montanus	3	2	1	6	0			
Microtus longicaudus	2		5	7	0			
Microtus richardsonius		1		1	0			
Microtus species			1	1	0			
Phenacomys intermedius		3	13	16	1		1	
Zapus princeps			6	6	9	1	1	7
Total Number of Small Mammals	159	97	187	443	326	107	106	113
Total Number of Species	8	10	12	13	9	7	8	7

Table 8. Number of amphibians captured in pitfall trapping grids in old growth stands (OG), fragments of old growth (FG), and clearcuts (CC) on the Clearwater National Forest, 1991, during 37 consecutive nights of trapping per grid.

Species	Old Growth	Fragments	Clearcuts	Total
Ambystoma macrodactylum	9	5	5	19
Dicamptodon aterrimus	1			1
Ascaphus truei	14	2		16
Rana pretiosa	2	1		3
Number of Animals	26	8	5	39
Number of Species	4	3	1	

Figure 1. Map of the study area on the Pierce and Lochsa Ranger Districts, Clearwater National Forest.


to Weitas Meadows
FS5600
Eldorado Creek
Mex Mountain
Frenchman Butte
Dollar Creek
FR8
CC4
CC2
OG2
FS483
FS5600
CC6
FR9
OG1
Eldorado Creek
FS5540
FS5541
OG7
OG5
Deadman Creek
CC14
OG6
Brush Hill
FR16
FS5541
FR17
CC12
FR14
FS5542
FS19
FS101
to Lolo Pass
Lochsa River
to Kooskia
Middle Fork Clearwater River
Selway River
SAMPLING PLOTS
FOREST SERVICE ROADS
STREAMS
0 1 2 3 4 5 km
N
W
E
S

APPENDIX A

CLEARWATER NATIONAL FOREST - DIRECTIONS TO PITFALL TRAPPING SITES

FRAGMENTS 16 AND 17, CLEARCUT 14

Gate to Canyon Junction (0.8 Mile). Take road 101. Go 1.1 mile to the junction of 101 and road 445. Take 445. Go 1.0 mile to the junction of roads 445 and 5540.

CC14

Take road 5540 (to the left) and continue for 2.5 miles to the junction with 5544. Take road 5544 and go 1.0 mile to CC14. There's a pullout on the right side of the road with a stump marked with orange paint. The points are up the skid road that runs at roughly 65 degrees. The trapping plots are ca. 100 meters from the main road.

FR16 - point south of the road

From CC14 continue on road 5544 0.7 mile to FR16. Marked tree is on the left side of the road on a medium-sized cedar, just before a small stream. (You can park a little further on at pullout on right). Point 1 and FR16 plots are at 220 degrees on the south side of the road.

FR17 - point 3

From CC14 go 0.4 mile to the junction of roads 5544 and 5544H. Take 5544H (to the left). At 0.1 mile you will reach the junction with 5544J. Continue on 5544H (to the right) for 0.3 mile to FR17. Point near the road is marked on right side of road. Point 1 is 100 meters at 180 degrees. Distance to the road marker for point 2 is 0.1 mile (ca 200 meters pacing) at 90 degrees. Road marker for point 3 is about 200 meters further, and trapping plots are 100 meters off road at 160 degrees.

OLD GROWTH 5 - GROVES AND OLD GROWTH 6 - POINT 2

Gate to Canyon Junction (0.8 mile). Take road 500 and drive 3.9 miles to beginning of Eldorado Creek Road (524). There are 9 points along the road, marked on trees on the left side of the road.

OG5 - GROVES

Continue on road 500 0.6 mile to reach road marker for OG5 (this is 4.5 miles from Canyon Junction). Marked tree is on the left side of the road at the bend/pulloff. Bird transect runs at 120 degrees across the meadow, then up the hill. To get to the site where the plots are set up, go to the road marker for OG5 (pink and blue flagging). Some pink flagging to the right of this begins this begins the trail markers for OG5 - GROVES. Go at approximately 195 degrees, cross creek (log provided for this), across meadow along creek, and up a steep slope to the top of a bench. Site is about 200 - 300 meters from the bottom of the slope. First trapping plot is on top of the bench; second plot

is about 25 to 30 meters further and to the right (the way is flagged).

OG6 - point 2

Continue on road 500 for 2.0 miles to closed road (5123) that branches off to the right. The road marker for OG6 is 0.1 mile further on the left side of the road. Cross Eldorado Creek using logs. Transect runs at 120 degrees for the first 2 points. Follow flags uphill -- trapping plots are at point 2.

CLEARCUT 4 - POINT 4

Gate to Canyon Junction (0.8 mile). Take road 500 and go 0.7 mile to junction with road 5039 which takes off to the left (the road number is not marked in the field, only on the map). Take 5039 for 0.6 mile to the junction of roads 5039 and 5109. Continue on 5039 (staying to the left) and go 0.6 mile to point 1 of CC4. From point 1 go 200 meters along the road to the road marker for point 2. Point 2 is 50 meters at 140 degrees. Road marker for point 3 is 200 meters from point 2; point 3 is 10 meters at 120 degrees. Distance from point 3 to road marker for point 4 is 325 meters. Point 4 is ca 12 meters off the road to the right. The plots are on the ridge to the left of the road, probably less than 10 meters from the road.

OLD GROWTH 1 - POINT 2 AND OLD GROWTH 2 - POINT 2

From the gate (to Mex Mountain) take road 483 and go 1.4 miles to the junction with road 5541.

OG1

Take road 5541 and go 0.8 mile to road marker for OG1 (the road marker is a bunch of medium-sized conifers on the left side of the road). The transect runs at roughly 84 degrees. Trapping plots are at point 2.

OG2

From the Junction of roads 483 and 5541, continue on 483 (to the left) for 1.3 miles to the junction with 5549. Continue on 483 and go 0.3 mile to the road marker for OG2. Marker is on the left side of the road on an old tree that has a very old "X" slashed in it, and old blaze facing the road (painted orange) and an old section marker. The transect runs at 90 degrees. Trapping plots are at point 2.

CLEARCUT 6, FRAGMENT 8 AND FRAGMENT 9

FR8

Gate to Canyon Junction (0.8 mile). At Canyon Junction take road 500. Go 2.9 miles to junction with road 1542. Take 1542 (to the left). At 0.2 miles there is a junction, stay to the right. 0.1 mile from this junction there is a road marker for FR8 at bend on the left side of the road. The only point for FR8 is 100 meters

at 150 degrees.

CC6

Continue for 0.8 mile to road marker for CC6 on the right side of the road. The only point and trapping plots are ca 7.0 meters at 243 degrees.

FR9

Continue for 0.4 mile to road marker for FR9 on the left side of the road, 25 meters in from the road. From the road marker go 110 meters at 358 degrees to reach the point and trapping plots.

CLEARCUT 2

From the gate (to Mex Mountain) take road 483 to the left and go 1.4 miles to point 1 for CC2. This point is on the road, marked on the left side. Point 2 is 200 meters ahead, on the road, marked on the right side of the road. The road marker for point 3 is 200 meters from point 2. This is at mile post "2" on the right side of the road. Point 3 is 54 meters at 234 degrees. Go approximately 200 meters to the road marker for point 4. Point 4 and trapping plots are 100 meters at 230 degrees.

FRAGMENT 14 - POINT 1 AND CLEARCUT 12 - -POINT 2

Gate to Canyon Junction (0.8 mile). Take road 101 to junction of 101 and 445. Take road 445 (straight). Go to junction with road 5540 (2.1 miles from Canyon Junction). Take 5540 and go for 3 miles to FR12 (tree marked with number 7) point 1 and trapping plots are at 60 degrees.

FR13

CC12 is 0.5 mile from the junction of roads 5542G and 5542, along 5542. Road marker for CC12 is 90 meters in on closed road. Marker is a painted log in a large slash pile on the right, with a hanging structure on the left. Go 160 meters further to FR14 - point 1 road marker. This is at an earth barrier across the road. Point 2 and trapping plots are 200 meters further on the road.

OLD GROWTH 7

From the gate (to Mex Mountain) take road 483 for 1.4 mile to the junction with road 5541. take road 5541 for 4.5 miles to a big turnout above a clearcut on the right side of the road. Road marker for OG7 is ca 0.1 mile further down the road on the left side of the road; a tree is blazed at the top of the roadcut. It is easiest to go in closer to the pullout. From the blazed tree walk up the ridge at 310 degrees for ca 300 to 350 meters. First trapping plot is on the ridge; second plot is below and to the right of the first plot.