CHARACTERIZATION OF RIPARIAN MANAGEMENT ZONES AND UPLAND MANAGEMENT AREAS WITH RESPECT TO WILDLIFE HABITAT

1989 FIELD REPORT

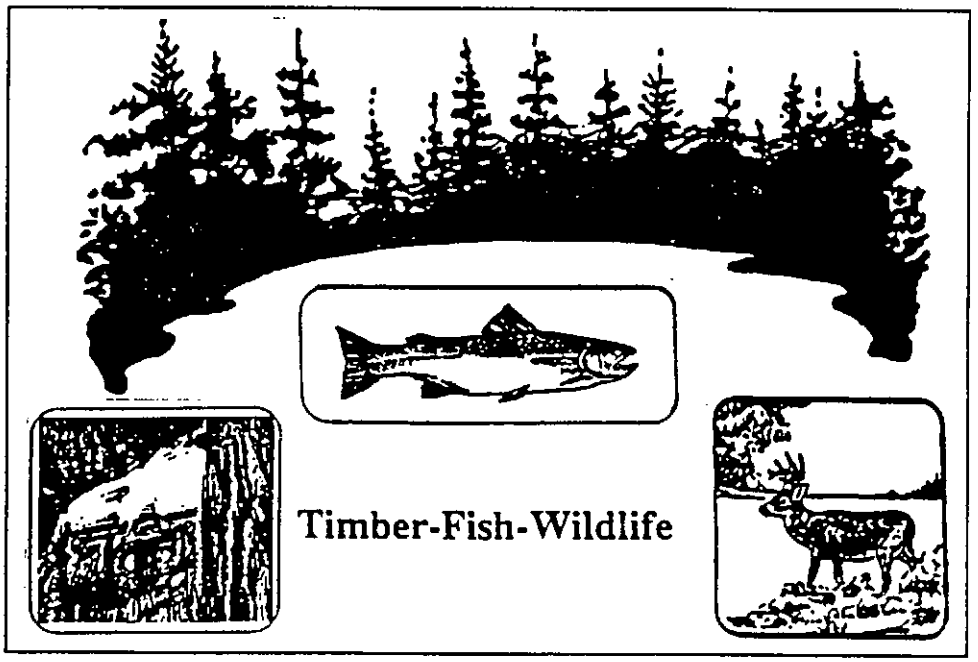
By

Washington Department of Wildlife
Habitat Management Division

October 1990

Washington Department of Wildlife
Habitat Management Division
Timber-Fish-Wildlife Project
TFW-003-90-003

1989 FIELD REPORT



Characterization of Riparian Management Zones and Upland Management Areas with Respect to Wildlife Habitat

October 1990

Washington Department of Wildlife

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1989 FIELD REPORT

CHARACTERIZATION OF

RIPARIAN MANAGEMENT ZONES

&

UPLAND MANAGEMENT AREAS

WITH RESPECT TO WILDLIFE HABITAT

Submitted to:
Washington Department of Natural Resources
Division of Forest Regulation and Assistance
1007 S. Washington St., Mail Stop EL-03
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Submitted By:
TFW Wildlife Steering Committee
under the direction of the
Cooperative Monitoring, Evaluation, and Research Committee

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This report summarizes the 1988 and 1989 field seasons of the Cooperative, Monitoring, Evaluation, and Research Committee research project #3 titled: "Characterization of Riparian Management Zones and Upland Management Areas with Respect to Wildlife Habitat". In December of 1990 it was decided by the Wildlife Steering Committee that a final report would not be produced for the 1989 field season. Instead of producing a final report a summary of the data collected is presented in this 1989 Field Report. The Wildlife Steering Committee has given their approval of the 1989 Field Report with limited editing.

Planning is currently taking place to produce a cumulative report summarizing data collected from 1988 to 1990. The 1988-90 cumulative report will be available in the Spring of 1991.

The opinions, findings, conclusions, or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of any participant in, or committee of, the Timber/Fish/Wildlife Agreement, the Washington Forest Practices Board, or the Washington Department of Natural Resources, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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ABSTRACT

In June of 1988 the Washington Department of Wildlife (WDW) entered into a research agreement with the the Washington Department of Natural Resources (DNR) in which WDW agreed to inventory Riparian Management Zones (RMZs) and Upland Management Areas (UMAs) throughout the state of Washington. The intent of the Wildlife Steering Committee when designing this project was to provide detailed information on RMZs and UMAs, but not to identify statistical or casual relationships. The objective was to quantify the physical and botanical characteristics of RMZs and UMAs with respect to wildlife habitat. This report summarizes the first (1988) and second (1989) years of a six-year study on state and private commercial forests in Washington. Three hundred and fifty-nine acres of RMZs located on 114 sites were sampled in 1988 and 1989. A total of 80 RMZs were located on industrial forestland, 21 on private non-industrial land, and 13 on state land. One hundred and twenty-six acres of UMAs located on 30 sites were sampled in 1988 and 1989. A total of 26 UMAs were located on industrial forest land, 2 on private non-industrial, and 2 on state lands. The UMAs sampled are a structurally diverse array of forest types ranging from wetlands to old-growth forests. Tabular reports presented were derived from data collected during the 1988 and 1989 field seasons. The 1988 field season lasted three months (Aug. - Oct.). The 1989 field season lasted six months (May - Oct.). Recommendations to improve sampling efficency and accuracy are provided at the end of this report.

INTRODUCTION

The Timber/Fish/Wildlife (TFW) Agreement (1987) requires the development of a monitoring, evaluation, and research program with cooperative decisions on priorities and associated costs. Results from research and monitoring will be used to make incremental changes in the forest practices regulations. This process is known as adaptive management and is a policy of the Forest Practices Board.

This project (Cooperative Monitoring, Evaluation, and Research Committee Project #3) was designed to provide detailed information on RMZs and UMAs. It is not designed to identify statistical or causal relationships between habitat and wildlife, nor does it attempt to measure compliance with the Forest Practices Act. It provides information for determining effectiveness of the TFW process in protecting riparian zones. The project quantifies the physical and botanical characteristics of RMZs and UMAs with respect to wildlife habitat.

Mean RMZ width and UMA acreages were derived from methods described in WDW's Field Procedures Handbook (Second Edition, 1990).

RMZs are defined in the Forest Practice Regulations, WAC 222 (1988) as a specified area alongside Type 1, 2, and 3 waters where specific measures are taken to protect water quality and fish and wildlife habitat. Riparian zones are among the most heavily used wildlife habitats in the forests of Washington (Thomas et al., 1979). They occur along rivers, streams, intermittent drainages, ponds, lakes, reservoirs, springs, and wetlands.

UMAs are areas of naturally occurring trees and vegetation or where specific silvicultural activities have been designed for wildlife management (Forest Practices Board Manual, 1988). UMAs are voluntary under the TFW agreement. They are intended to accommodate site-specific needs of landowners and wildlife. UMAs are intended to increase wildlife habitat diversity by providing conditions that would not normally occur in timber-harvested areas, such as shelter, corridors for travel, and security for other wildlife activities associated with harvest areas. The TFW intent was that UMAs would provide increased diversity through irregular scattering or dispersion of habitats for a broad spectrum of wildlife species.

This project provides an information base for more detailed studies on the value and use of RMZs and UMAs for wildlife. The Department of Ecology (Ed Rashin, 206-586-5291) in Olympia is currently conducting a study to monitor the effect RMZs have on water temperature regulation. Department of Ecology study sites are limited to Project #3's sample sites .

This is the second year of a six-year study.

STUDY AREA

This study was limited to commercial state and private forests of Washington. Most western Washington forests are located in the Sitka spruce (Picea sitchensis) and western hemlock (Tsuga heterophylla) zones. East of the Cascade crest the forests are located in the Douglas-fir (Pseudotsuga menziesii), Pacific silver fir (Abies amabilis), and subalpine fir (Abies lasiocarpa) zones. Franklin and Dyrness (1973) have published an excellent description of the physiography, geology, soils, and climate of this region.

METHODS

The Field Procedures Handbook Second Edition (WDW, 1990) outlines the sampling procedures used to quantify RMZs and UMAs.

Mean RMZ width and UMA acreages were derived from methods described in WDW's Field Procedures Handbook (Second Edition, 1990).

SITE SELECTION

Because sites were often selected as they became available, true stratified random sampling was not possible. To reduce bias in the site selection the following procedure was used:

Sites sampled were limited to harvested areas meeting the requirements of the TFW Agreement of February 1988. Sites meeting TFW standards, but which were harvested prior to February of 1988, were also sampled. The intent was to provide an unbiased, stratified, view of RMZs/UMAs as they occurred throughout the state of Washington. RMZs sampled were limited to those that occur on type 1, 2, and 3 waters.

Water types are defined as follows:

Type 1 waters are those waters inventoried as "shorelines of the state" under chapter 90.58 RCW. Type 2 waters are those waters diverted for domestic use by more than 100 persons, used by substantial numbers of anadromous or resident game fish for spawning, rearing or migration with a defined channel of more than 20 feet, and a gradient of less than four percent. Type 3 waters are those waters diverted for domestic use by more than 10 persons, used by substantial numbers of anadromous or resident game fish for spawning, rearing or migration with a defined channel of

more than five feet, a gradient of less than 12 percent, and are highly significant for protection of downstream water quality.

The Department of Revenue maintains a list of Forest Practices Applications (FPAs) on which timber tax has been paid. FPAs from this list were then collected from individual DNR Regional Offices. These FPAs were screened to select those which contain either RMZs or UMAs.

Concurrently, FPAs containing RMZs/UMAs were also requested from private landowners (industrial and non-industrial), and Washington Department of Wildlife regional biologists. Using these other sources allowed sampling of RMZs and UMAs that may not have been listed on original FPAs.

FPAs were mapped statewide to display RMZ and UMA locations. From this map, a sampling schedule was established. Emphasis was placed on sampling new areas, according to the annual schedule shown below, as required by contract.

Subsequent years' samples will include a mix of new and older RMZs and UMAs as follows:

Year 1 - (1988) 39 new areas sampled

Year 2 - (1989) 105 new areas sampled

Year 3 - new areas and 20% of 1st year areas

Year 4 - new areas and 20% of 2nd year areas

Year 5 - new areas, 20% of 1st year areas, and 20% of 3rd year areas

Year 6 - new areas, 20% of 2nd year areas, and 20% of 4th year areas

DATA ANALYSIS

Data were originally compiled in a SMARTWARE database (Informix Software, Version 3.1). They were then transferred to PARADOX (Borland, Version 3.0). All tabular summaries were created with Quattro Pro (Borland, Version 1.0). Graphics displayed in the Final Report were produced with Harvard Graphics (Software Publishing Corp., Version 2.12). The final report was produced in Ventura Publisher (Xerox, Version 2.0).

Data summaries were created by the following categorical break downs within the state: Eastern WA or Western WA as defined by the Washington Forest Practices Rules and Regulations (1988), water type (or UMA type) and substrate.

All sample site locations were recorded on 7.5-minute USGS quadrant maps. Sites were recorded on 15-minute maps when 7.5- minute maps were unavailable. A stereo pair of aerial photographs have been filed together with the original field forms, harvest unit maps, and the forest practice application. Maps and files are stored at the Department of Wildlife, Habitat Management Division, 600 Capitol Way N., Olympia, Washington, 98501-1091, (206) 753-3318.

All discussions within this report pertain to sites sampled during the 1988 and 1989 field seasons. Summaries provided are of data collected by Project #3.

RMZ/UMA SITE SUMMARY

Figure 1 maps sample site locations for the 1988/89 field seasons. During the 1988/89 field seasons 114 RMZs and 30 UMAs were sampled (Figure 2). The total acreage of RMZs sampled equaled 359 and the total acreage of UMAs equaled 126 (Figure 3).

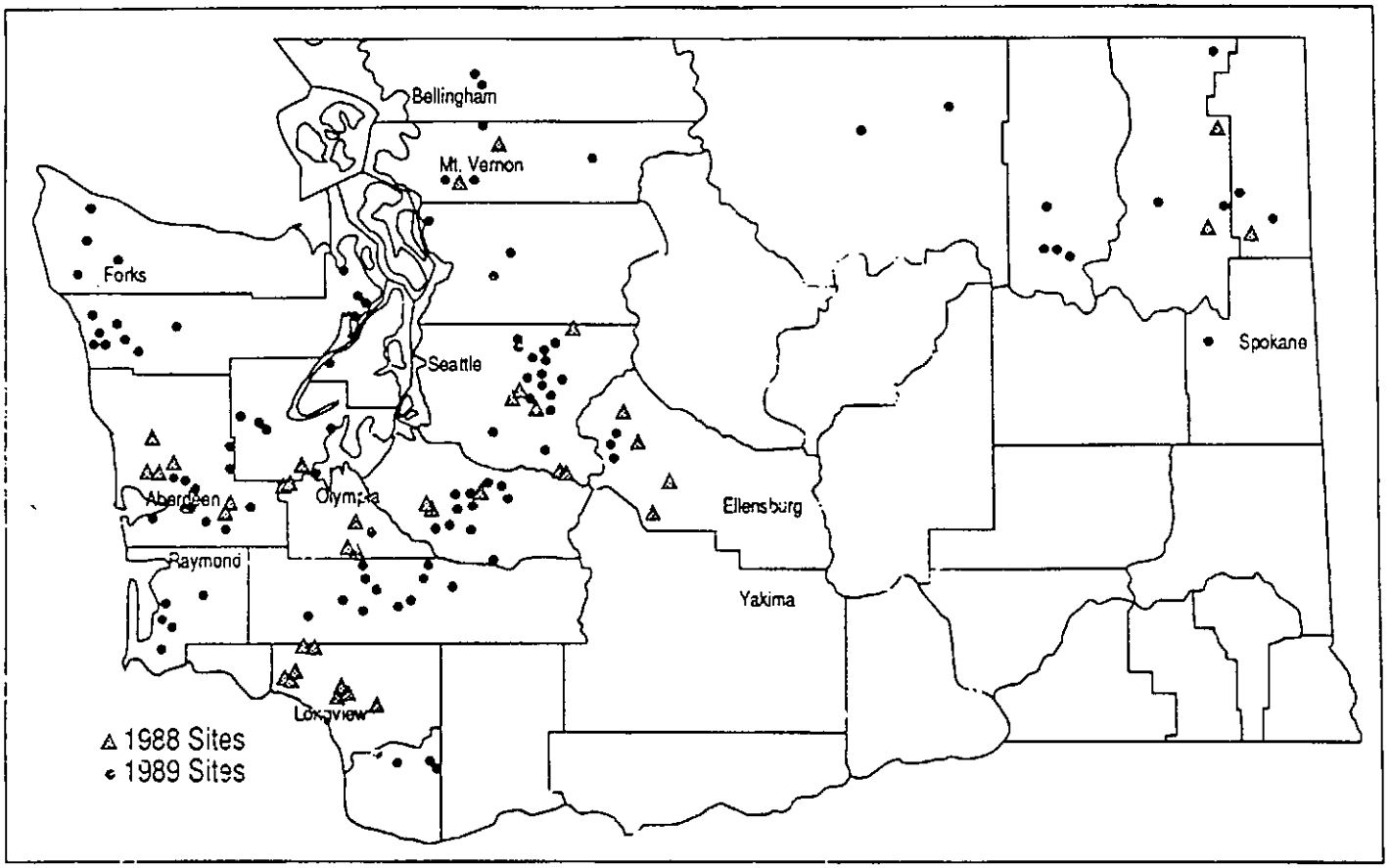

Figure 1. Map of RMZ and UMA sample sites.

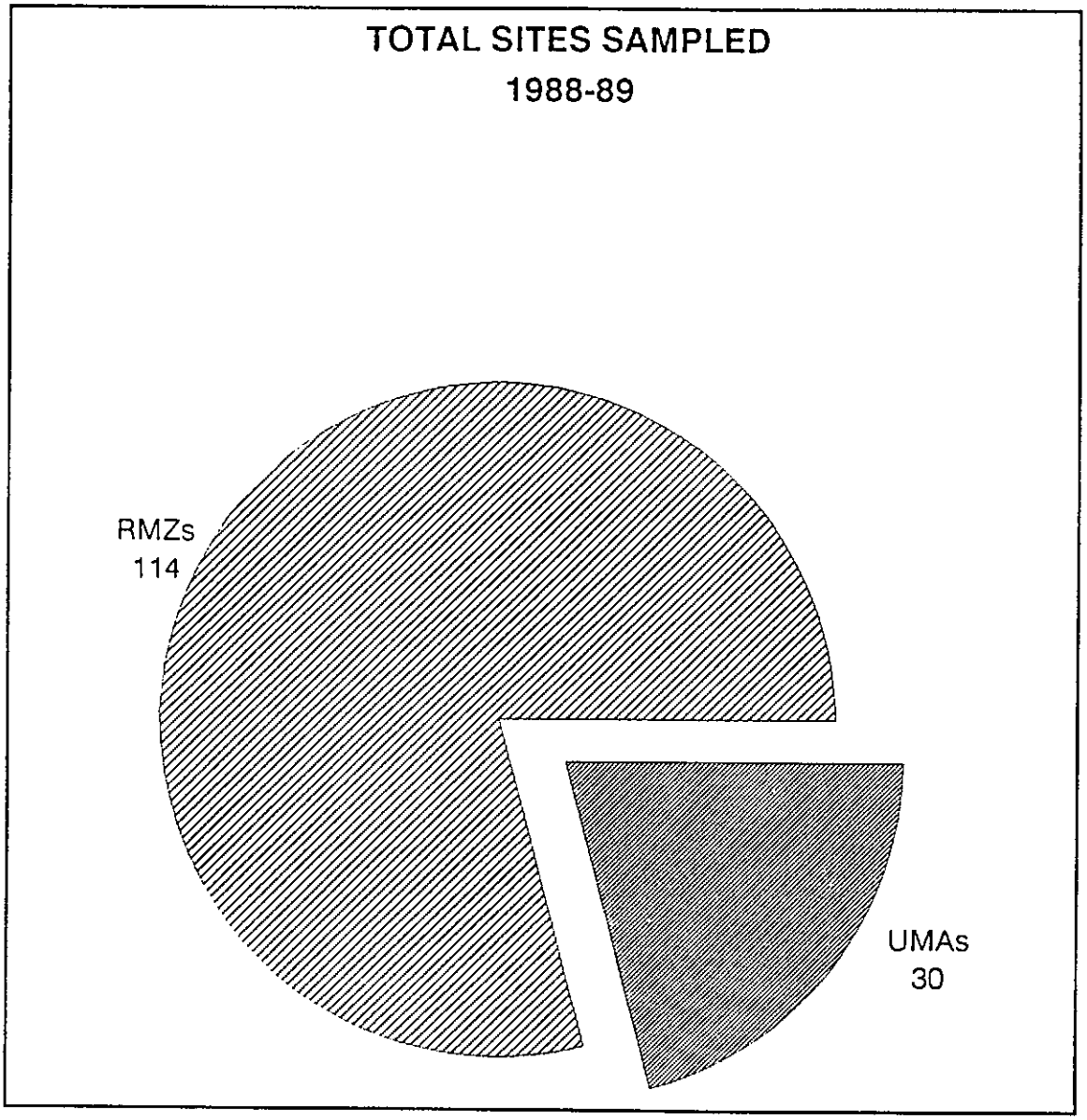

Figure 2. Total RMZ and UMA sites sampled 1988 and 1989.

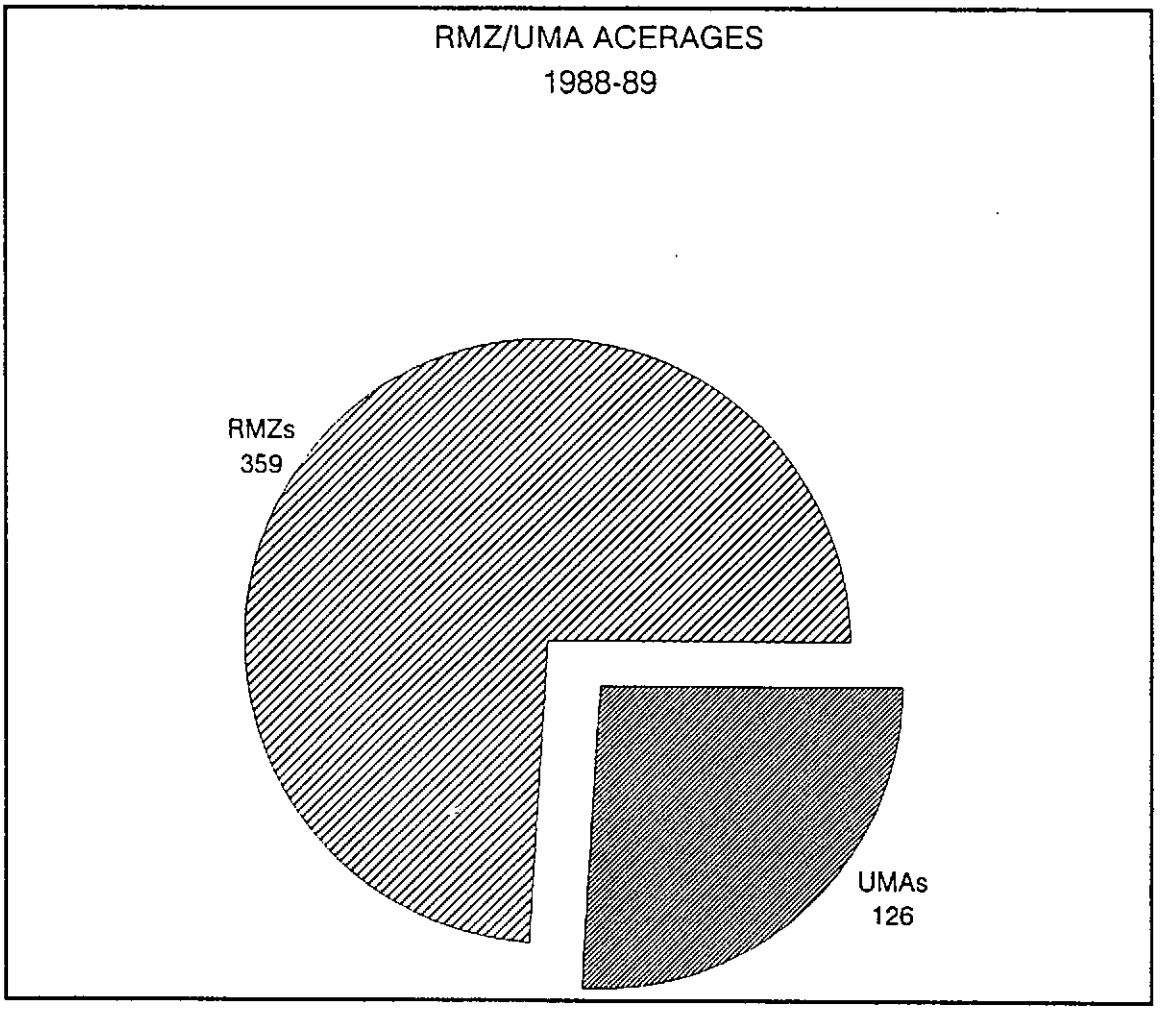

Figure 3. Total RMZ and UMA acres 1988 and 1989.

The majority of sample sites were located on private industrial land followed by private non-industrial, and state owned land (Figure 4).

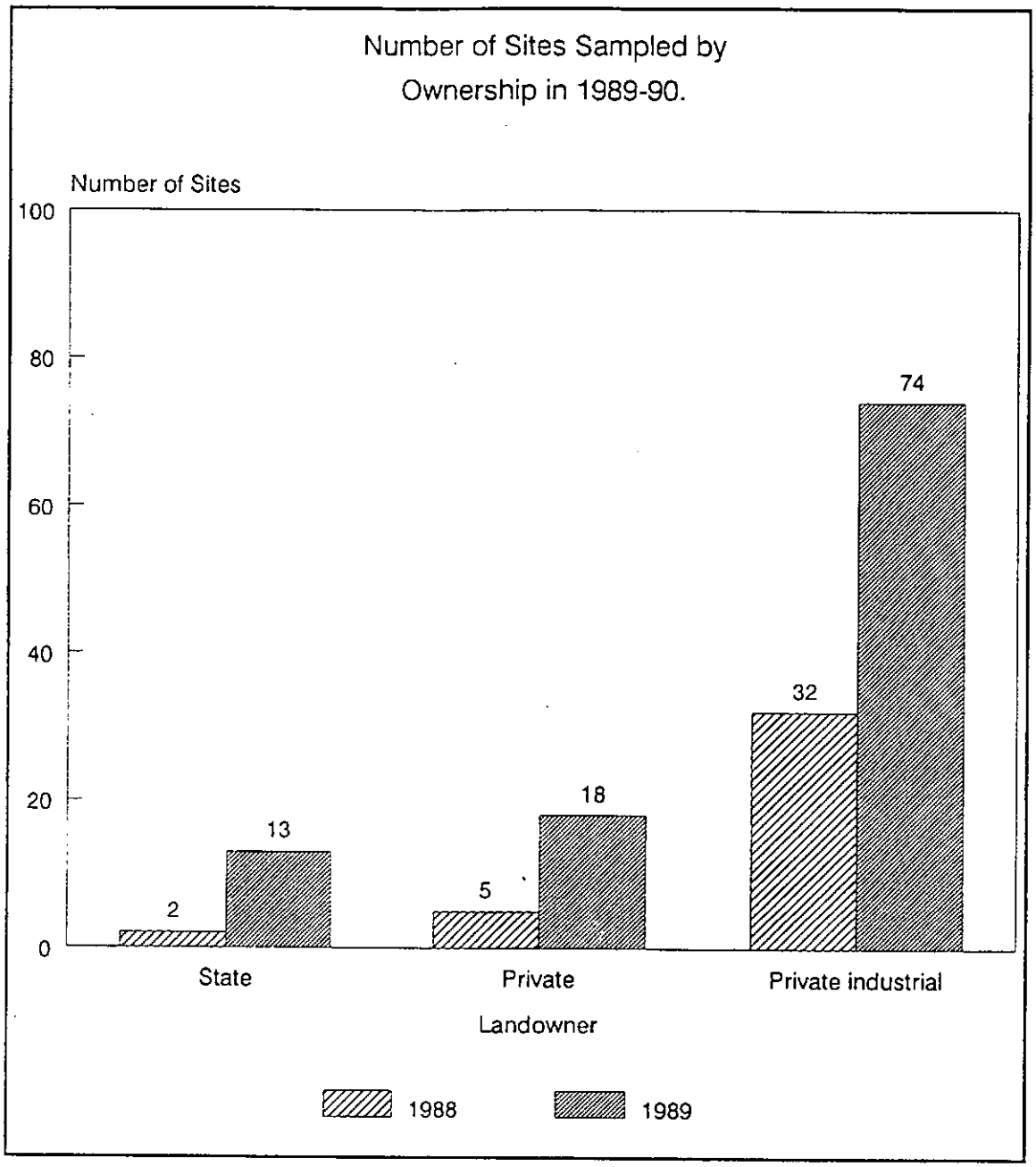

Figure 4. Total sites by owner code.

RMZ average widths are listed in Figure 5. These results are the mean widths of RMZs based on the project's criteria for measuring the physical and botanical characteristics of these sites. These averages should not be used for checking compliance with forest practices regulations.

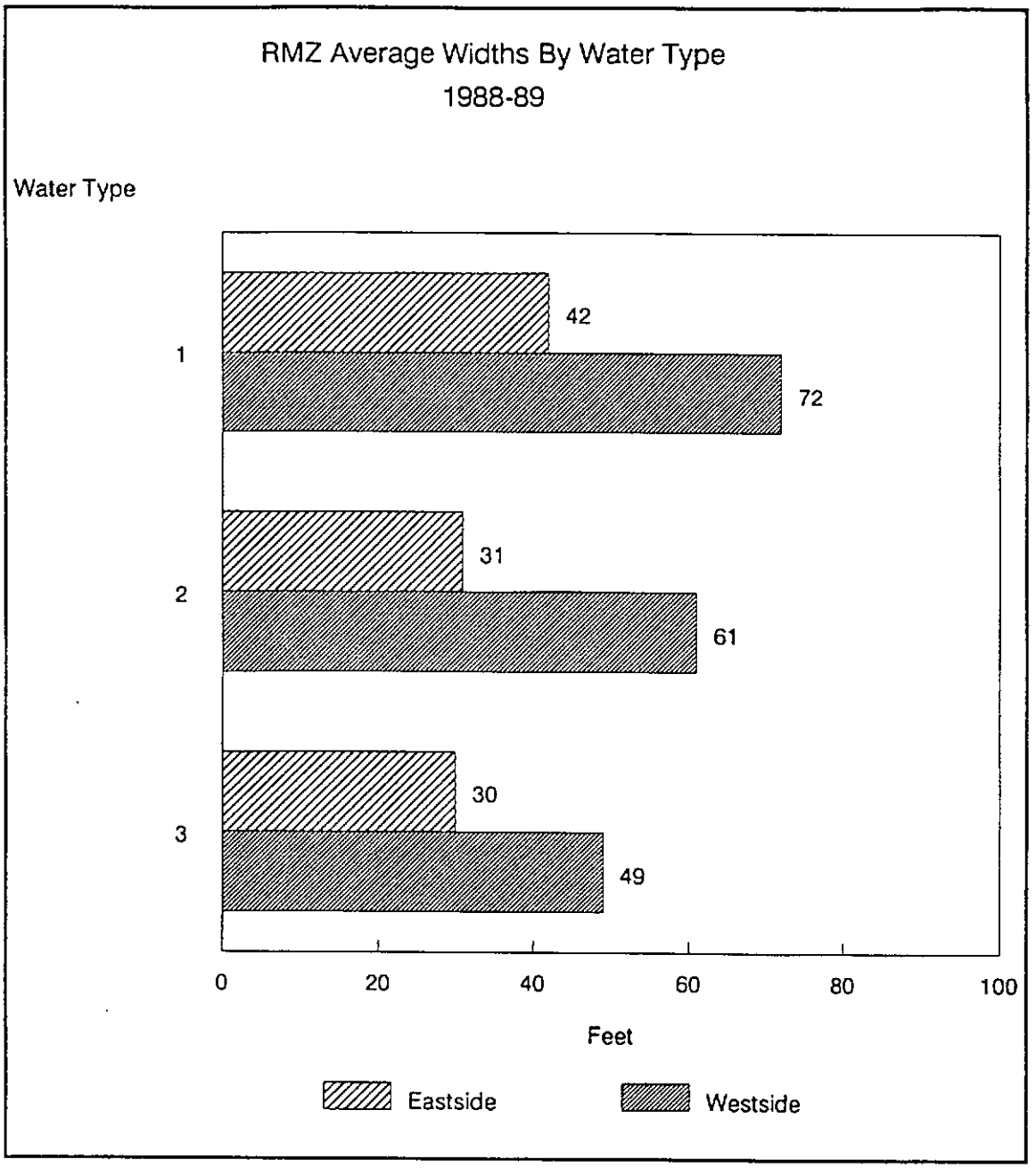

Figure 5. Average site width by water type 1988 and 1989.

Eastside average RMZ widths are estimated to average 30 feet due to the difficulty of defining RMZ boundaries within partial cut harvest units. When harvest boundaries were not easily identified the sampling effort concluded at 30 feet.

Figure 6. Break down of the total number of sites sampled within each category.

Lakes

Water Type	1	2	3
Eastside	1	1	
Westside	5	3	1

Boulder/Bedrock

Eastside			1
Westside	10	2	4

Gravel/Cobble

Eastside	1	1	11
Westside	11	12	50

Total Number of UMAs Within Each UMA Type By Side

UMA Type	Forested Wetland	Bog	Upland Forest
Eastside	1		2
Westside	7	2	18

RESULTS

RMZs

Three hundred and fifty-nine acres of RMZs located on 114 sites were sampled in 1988/89.

RMZs were broken down into 12 categories (for data analysis and display) in the following manner: first by their location within the state (eastside or westside), secondly by their water type (1,2,3), and lastly by the stream bed substrate (gravel/cobble or boulder/bedrock). On about five sites the entire RMZ identified on the Forest Practice Application was not sampled due to time limitations.

To be classified as a gravel/cobble substrate 50% of the dominant stones must be less than 10 inches in diameter. The substrate is classified as boulder/bedrock when more than 50% of the dominant stones are greater than 10 inches in diameter.

RMZ summaries are provided in the following order: Average number of large organic debris pieces per 100 feet, dominant shrub mean coverage and constancies, dominant herb mean coverage and constancies, mean coverage and constancy values for overstory canopy closure, total shrubs, forbs, and graminoids, live tree density, and lastly snag densities.

LARGE ORGANIC DEBRIS (LOD)

Table LOD-1. Eastside Boulder/Bedrock RMZ Average Number of Large Organic Debris Pieces Per Hundred Feet (Note: only water type 3 RMZs have been sampled within this category).

WATER TYPE	1	2	3
Average Number of LOD pieces/100 Feet	N.A.	N.A.	4
Number of Sites	N.A.	N.A.	1

Table LOD-2. Westside Boulder/Bedrock RMZ
Average Number of Large Organic Debris Pieces
Per Hundred Feet.

WATER TYPE	1	2	3
Average Number of LOD pieces/100 Feet	4	3	4
Number of Sites	10	1	4

Table LOD-3. Eastside Gravel/Cobble RMZ
Average Number of Large Organic Debris Pieces
Per Hundred Feet.

Water Type	1	2	3
Average Number of LOD pieces/100 Feet	1	2	4
Number of Sites	1	1	11

Table LOD-4. Westside Gravel/Cobble RMZ
Average Number of Large Organic Debris Pieces
Per Hundred Feet.

Water type	1	2	3
Average Number of LOD pieces/100 Feet	4	7	6
Number of Sites	11	9	50

Westside gravel/cobble streams appeared to contain more pieces of LOD per 100 feet than similar eastside streams. Only one eastside boulder/bedrock stream was sampled (water type 3). This stream contained the same average pieces of LOD per hundred feet as westside type 3 streams. On both sides of the state, and within both substrate types, LOD was more frequently found in type 3 streams. LOD was least frequently found within type 1 streams.

VEGETATION AND OTHER STRIP VARIABLES

Data were collected on the two dominant shrubs and herbs, total shrubs, forbs and graminiods (grass), downed wood 1 to 3 (decay class 1 = recent fallen, decay class 3 = rotten), water, rock, and soil. Mean coverage and constancy values were calucu-lated for these variables.

Canopy is defined as the percent of closed canopy above the sample plot. Coverage is defined as the percentage of ground, when viewed from above the subplot, the variable covers within the sample plot. Sample plots are 5x10 feet. Constancy is defined as the degree of presence a variable has within sample plots. Subplot coverage and constancy values are given in percent.

RMZ shrubs and herbs are listed in order by their constancy values. Shrub tables 1 through 27 and herb tables 1 through 24 list the 20 most frequently encountered shrubs or forbs. When fewer than 20 shrubs or forbs are listed, this implies that fewer than 20 were encountered within that specific category. **Values are given in percent. An * means the value was less than 1%.**

When the total site number and subplot numbers do not match between categories it is due to a portion the sites having been sampled in 1988 (sites 1-39) before those variables were being collected, or that particular data point was overlooked in the field. The latter explanation accounts for less than 1% of the occurences.

DOMINANT SHRUB MEAN COVERAGE AND CONSTANCIES

Table SHRUB-1. Eastside lake RMZs, water type 1, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 58). ** value was less than 1.0* *note: values are in percent*

Shrub Name	Coverage	Constancy
snowberry	24	66
not present		16
bearberry	1	10
Douglas fir	*	2
water birch	*	2
russet buffaloberry	*	2
rose spp.	*	2
bristly Nootka rose	*	2

Table SHRUB-2. Eastside lake RMZs, water type 2, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 37).

Shrub Name	Coverage	Constancy
not present		22
mallow ninebark	7	16
snowberry	4	14
ocean-spray	3	14
thimbleberry	1	11
hardhack	1	8
rose spp.	*	5
black hawthorne	*	3
baldhip rose	*	3
willow spp.	*	3
Douglas maple	1	3

Snowberry, bearberry, and mallow ninebark were the most frequently encountered dominant shrubs within eastside, water type 1 and 2, lake RMZs. It was not uncommon for shrubs to be lacking completely (i.e., not present).

Table SHRUB-3. Eastside lake RMZs, water type 1, dominant shrub #2 mean subplot coverage and constancy (total sites = 1, total subplots = 58). * *value was less than 1.0*
note: values are given in percent

Shrub Name	Coverage	Constancy
bearberry	1	12
russet buffaloberry	*	10
Douglas fir	*	5
snowberry	*	5
bristly Nootka rose	*	3
prickly currant	*	3
serviceberry	*	3
currant spp.	*	3
water birch	*	2
baldhip rose	*	2
huckleberry spp.	*	2
hardhack	*	2

Bearberry and russet buffaloberry were the most common sub-dominant shrubs within eastside, water type 1, lake RMZs.

Table SHRUB-4. Westside lakes, water type 1, dominant shrub #1 mean subplot cover age and constancy (total sites = 5, total subplots = 192). * *value was less than 1.0 note: values are in percent*

Shrub Name	Coverage	Constancy
salmonberry	13	28
salal	15	19
red huckleberry	1	9
not present		6
devil's club	2	6
Alaskan huckleberry	1	6
rusty menziesia	1	5
trailing blackberry	2	5
vine maple	3	5
Oregon grape	1	3
Indian plum	*	2
hardhack	1	2
ocean-spray	*	1
hazelnut	*	1
red-osier dogwood	*	1
baldhip rose	*	1
western hemlock	*	1
black cottonwood	*	1
stink currant	*	1

Table SHRUB-5. Westside lakes, water type 2, dominant shrub #1 mean subplot coverage and constancy (total sites = 3, total subplots = 129).

Shrub Name	Coverage	Constancy
salal	18	35
hardhack	6	12
salmonberry	8	12
trailing blackberry	2	12
Cascade Oregon grape	3	8
red huckleberry	1	6
Pacific ninebark	2	3
not present		2
evergreen huckleberry	*	2
rose spp.	*	2
snowberry	*	2
ocean-spray	*	1
red elderberry	*	1
Douglas fir	*	1
hazelnut	*	1

Table SHRUB-6. Westside lakes, water type 3, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 72).

Shrub Name	Coverage	Constancy
salal	38	68
hardhack	25	32

Salmonberry, salal, and hardhack were the most commonly encountered dominant shrubs within westside, water type 1, 2, and 3 lake RMZs.

Table SHRUB-7. Westside lake RMZs, water type 1, dominant shrub #2 mean subplot coverage and constancy (total sites = 4, total subplots = 143). * *value was less than 1.0*
note: values are in percent

Shrub Name	Coverage	Constancy
not present		21
salmonberry	1	10
trailing blackberry	*	8
red huckleberry	*	8
rusty menziesia	*	7
Alaska huckleberry	*	7
Cascade Oregon grape	*	6
salal	1	4
Pacific ninebark	*	4
western hemlock	*	4
vine maple	*	4
hardhack	*	4
devil's club	*	3
serviceberry	*	2
oceanspray	*	2
Utah honeysuckle	*	1
red-osier dogwood	*	1
western red cedar	*	1
Indian plum	*	1
stink currant	*	1

Table SHRUB-8. Westside lake RMZs, water type 2, dominant shrub #2 mean subplot coverage and constancy (total sites = 2, total subplots = 67).

Shrub Name	Coverage	Constancy
not present		28
trailing blackberry	2	18
salal	1	13
red huckleberry	1	10
hardhack	2	9
Cascade Oregon grape	*	5
evergreen huckleberry	*	5
Pacific ninebark	2	3
baldhip rose	*	3
salmonberry	*	3
western hemlock	*	2
alder spp.	*	2

Table SHRUB-9. Westside Lake RMZs, water type 3, dominant shrub #2 mean subplot coverage and constancy (total sites = 1, total subplots = 73).

Shrub Name	Coverage	Constancy
not present		59
hardhack	2	18
salal	1	12
red huckleberry	*	3
trailing blackberry	*	3
western crabapple	1	3
unknown	*	1
western hemlock	*	1

Thirty-six percent of the time presence of a sub-dominant shrub in westside, water type 1, 2, and 3, lake RMZs was lacking. Salal, hardhack, salmonberry, and trailing blackberry were the most frequently encountered sub-dominant shrubs.

Table SHRUB-10. Eastside, boulder/bedrock, water type 3, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 157). * *value was less than 1.0* *note: values are in percent*

Shrub Name	Coverage	Constancy
big huckleberry	6	24
alder spp.	16	22
devil's club	5	13
rusty menziesia	5	12
willow spp.	7	8
stink currant	1	8
thimbleberry	2	5
salmonberry	1	3
mountain ash	*	3
prickly currant	*	1
pachistima	*	1
vine maple	*	1
not present		1

One eastside, boulder/bedrock, water type 1 RMZ was sampled in 1988. The most common dominant shrubs were big huckleberry, alder species and devil's club.

Table SHRUB-11. Westside, boulder/bedrock, water type 1, dominant shrub #1 mean subplot coverage and constancy (total sites = 7, total subplots = 522). * *value was less than 1.0* *note: values are in percent*

Shrub Name	Coverage	Constancy
salmonberry	20	40
vine maple	16	25
not present		7
Alaska huckleberry	1	4
red huckleberry	*	4
salal	1	3
stink currant	*	3
trailing blackberry	*	3
red elderberry	*	2
devil's club	*	2
rusty menziesia	*	1
Pacific ninebark	*	1
Cascade Oregon grape	*	1
snowberry	*	1
Indian plum	*	1
red-osier dogwood	*	1
thimbleberry	*	1
hazelnut	*	1
western hemlock	*	1
western red cedar	*	1

Table SHRUB-12. Westside, boulder/bedrock, water type 2, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 95).

Shrub Name	Coverage	Constancy
not present		23
red huckleberry	1	12
salal	4	12
Cascade Oregon grape	3	11
Alaska huckleberry	1	7
oceanspray	2	7
devil's club	1	6
vine maple	3	6
salmonberry	3	5
trailing blackberry	*	3
pachistima	*	2
big huckleberry	*	2
stink currant	*	1
baldhip rose	*	1
red elderberry	*	1

Table SHRUB-13. Westside, boulder/bedrock, water type 3, dominant shrub #1 mean subplot coverage and constancy (total sites = 2, total subplots = 115).

Shrub Name	Coverage	Constancy
salmonberry	25	44
not present		17
red huckleberry	1	7
salal	1	6
vine maple	2	5
trailing blackberry	*	5
stink currant	1	4
oceanspray	*	4
Cascade Oregon grape	*	3
western hemlock	*	2
devil's club	*	2
Indian plum	*	1
thimbleberry	*	1

Sixteen percent of the time presence of shrubs in westside, water type 1, 2, and 3, boulder/bedrock RMZs were lacking. When shrubs were encountered they were most frequently salmonberry, vine maple, red huckleberry and salal.

Table SHRUB-14. Westside, boulder/bedrock, water type 1, dominant shrub #2 mean subplot coverage and constancy (total sites = 7, total subplots = 334). * *value was less than 1.0* *note: values are in percent*

Shrub name	Coverage	Constancy
not present		37
salmonberry	2	11
red huckleberry	1	8
stink currant	*	6
vine maple	*	6
salal	*	4
trailing blackberry	*	4
red elderberry	*	3
Alaska huckleberry	*	3
thimbleberry	*	3
devil's club	*	2
Indian plum	*	2
prickly currant	*	1
baldhip rose	*	1
western red cedar	*	1
snowberry	*	1
Pacific ninebark	*	1
western hemlock	*	1
Cascade Oregon grape	*	1
rusty menziesia	*	1

Table SHRUB-15. Westside, boulder/bedrock, water type 2, dominant shrub #2 mean subplot coverage and constancy (total sites = 1, total subplots = 51).

Shrub name	Coverage	Constancy
not present		49
salmonberry	*	8
pachistima	*	8
devil's club	2	8
Alaska huckleberry	*	6
red huckleberry	*	6
stink currant	*	6
Cascade Oregon grape	*	2
vine maple	1	2
salal	*	2
western hemlock	*	2
red elderberry	*	2

Table SHRUB-16. Westside, boulder/bedrock, water type 3, dominant shrub #2 mean subplot coverage and constancy (total sites = 2, total subplots = 83).

Shrub name	Coverage	Constancy
not present		53
stink currant	1	8
trailing blackberry	*	6
salmonberrry	*	5
salal	*	5
western hemlock	*	4
red huckleberry	*	4
devil's club	1	4
vine maple	*	2
prickly currant	*	2
willow spp.	*	1
Cascade Oregon grape	*	1
twinflower	*	1
douglas fir	*	1
big huckleberry	*	1
red elderberry	*	1

Sub-dominant shrubs were lacking in westside, boulder/bedrock, water type 1, 2, and 3 RMZs. When shrubs were found they most frequently were salmonberry, stink currant, pachistima, and devil's club.

Table SHRUB-17. Eastside, gravel/cobble, water type 1, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 44). * *value was less than 1.0 note: values are in percent*

Shrub Name	Coverage	Constancy
snowberry	25	43
alder spp.	26	32
red-osier dogwood	4	5
mallow ninebark	*	2
mockorange	*	2
serviceberry	*	2
shiny leaf spirea	*	2
unknown	*	2
bittercherry	*	2
willow spp.	*	2
Douglas maple	13	2
not present		2

Table SHRUB-18. Eastside, gravel/cobble, water type 2, dominant shrub #1 mean coverage and constancy (total sites = 1, total subplots = 87).

Shrub Name	Coverage	Constancy
snowberry	13	28
willow spp.	4	18
red-osier dogwood	10	16
alder spp.	7	10
not present		8
baldhip rose	*	5
black hawthorne	*	3
rose spp.	*	2
mockorange	*	2
ocean-spray	*	2
Douglas maple	*	1
Cascade Oregon grape	*	1

Table SHRUB-19. Eastside, gravel/cobble, water type 3, dominant shrub #1 mean subplot coverage and constancy (total sites = 11, total subplots = 701).

Shrub Name	Coverage	Constancy
snowberry	8	18
alder spp.	9	17
red-osier dogwood	4	8
not present		8
vine maple	3	7
Douglas maple	3	6
thimbleberry	2	5
hazelnut	2	4
stink currant	*	3
prickly currant	*	3
pachistima	*	2
mockorange	1	2
devil's club	*	2
black hawthorne	*	2
baldhip rose	*	1
serviceberry	*	1
salmonberry	*	1
Cascade Oregon grape	*	1
Oregon grape	*	1
big huckleberry	*	1

Snowberry, alder species, willow species and red osier dogwood were the most frequently encountered dominant shrubs within eastside, gravel/cobble, water type 1, 2, and 3 RMZs.

Table SHRUB-20. Eastside, gravel/cobble, water type 1, dominant shrub #2 mean subplot coverage and constancy (total sites = 1, total subplots = 44). * *value was less than 1.0 note: values are in percent*

Shrub Name	Coverage	Constancy
snowberry	5	23
serviceberry	3	14
not present		9
poison-ivy	1	7
mockorange	1	7
alder spp.	3	7
bristly Nootka rose	1	5
unknown	*	5
ocean-spray	*	5
red-osier dogwood	1	5
willow spp.	*	2
Oregon grape	*	2
Douglas fir	*	2
bittercherry	1	2
thimbleberry	*	2
mallow ninebark	*	2

Table SHRUB-21. Eastside, gravel/cobble, water type 3, dominant shrub #2 mean subplot coverage and constancy (total sites = 7, total subplots = 425).

Shrub Name	Coverage	Constancy
snowberry	5	18
not present		17
thimbleberry	2	9
red-osier dogwood	1	7
Douglas maple	1	7
prickly currant	*	6
alder spp.	1	5
pachistima	1	5
mockorange	1	4
serviceberry	*	3
rose spp.	*	3
shiny leaf spirea	*	3
hazelnut	*	2
bristly Nootka rose	*	2
twinflower	*	1
mallow ninebark	*	1
blackcap	*	1
Oregon grape	*	1
rubus spp.	*	1
unknown	*	1

Snowberry, serviceberry and thimbleberry were the most frequently encountered sub-dominant shrub species within eastside, gravel/cobble, water type 1 and 3 RMZs. Water type 3 RMZs had a high percentage of subplots lacking in a sub-dominant shrub species.

Table SHRUB-22. Westside, gravel/cobble, water type 1, dominant shrub #1 mean subplot coverage and constancy (total sites = 10, total subplots = 892). * *value was less than 1.0* *note: values are in percent*

Shrub Name	Coverage	Constancy
salmonberry	14	22
vine maple	15	20
red-osier dogwood	7	9
not present		9
Pacific ninebark	4	5
Alaska huckleberry	1	5
red huckleberry	*	3
red elderberry	*	3
Cascade Oregon grape	*	3
salal	1	2
Indian plum	1	2
trailing blackberry	*	2
rusty menziesia	*	2
alder spp.	*	1
mallow ninebark	*	1
devil's club	*	1
snowberry	*	1
big huckleberry	*	1
willow spp.	*	1
pachistima	*	1

Table SHRUB-23. Westside, gravel/cobble, water type 2, dominant shrub #1 mean subplot coverage and constancy (total sites = 8, total subplots = 704).

Shrub Name	Coverage	Constancy
salmonberry	31	48
salal	7	12
vine maple	7	11
red huckleberry	*	4
not present		4
trailing blackberry	1	4
Alaska huckleberry	1	3
devil's club	1	3
rusty menziesia	*	1
Pacific ninebark	*	1
cascara	*	1
hardhack	*	1
mallow ninebark	*	1
Indian plum	*	1
red elderberry	*	1
stink currant	*	1
black twinberry	*	1
Cascade Oregon grape	*	1
Utah honeysuckle	*	1
thimbleberry	*	1

Table SHRUB-24. Westside, gravel/cobble, water type 3, dominant shrub #1 mean sub-plot coverage and constancy (total sites = 39, total subplots = 3306).

Shrub Name	Coverage	Constancy
salmonberry	17	34
vine maple	12	18
salal	4	9
not present		9
trailing blackberry	1	4
devil's club	1	4
red elderberry	*	4
stink currant	1	4
red huckleberry	*	3
Cascade Oregon grape	*	2
red-osier dogwood	1	2
Alaska huckleberry	*	2
rusty menziesia	*	1
Indian plum	*	1
cascara	*	1
blackcap	*	1
Pacific ninebark	*	1
western hemlock	*	1
black twin-berry	*	1
big huckleberry	*	1

Salmonberry, salal and vine maple were the most common dominant shrub species within westside, gravel/cobble, water type 1, 2, and 3 RMZs.

Table SHRUB-25. Westside, gravel/cobble, water type 1, dominant shrub #2 mean sub-plot coverage and constancy (total sites = 10, total subplots = 832). * *value was less than 1.0* *note: values are in percent*

Shrub Name	Coverage	Constancy
not present		22
salmonberry	4	14
vine maple	2	9
Indian plum	1	5
red elderberry	*	5
devil's club	1	5
red-osier dogwood	1	4
trailing blackberry	*	4
Cascade Oregon grape	*	3
snowberry	*	3
Pacific ninebark	*	3
rusty menziesia	*	3
red huckleberry	*	3
stink currant	*	2
Alaska huckleberry	*	2
big huckleberry	*	1
salal	*	1
twinflower	*	1
baldhip rose	*	1
western hemlock	*	

Table SHRUB-26. Westside, gravel/cobble, water type 2, dominant shrub #2 mean subplot coverage and constancy (total sites = 8, total subplots = 412).

Shrub Name	Coverage	Constancy
not present		29
salmonberry	3	17
Alaska huckleberry	1	9
red huckleberry	*	9
salal	*	7
vine maple	1	6
trailing blackberry	*	3
rusty menziesia	*	2
devil's club	*	2
red elderberry	*	2
western hemlock	*	2
stink currant	*	2
Pacific ninebark	*	2
blackcap	*	1
Cascade Oregon grape	*	1
hardhack	*	1
big huckleberry	*	1
Utah honeysuckle	*	1
red alder	*	1
alder spp.	*	1

Table SHRUB-27. Westside, gravel/cobble, water type 3, dominant shrub #2 mean sub-plot coverage and constancy (total sites = 39, total subplots = 2733).

Shrub Name	Coverage	Constancy
not present		35
salmonberry	2	13
stink currant	1	7
vine maple	1	6
red elderberry	*	5
devil's club	1	5
red huckleberry	*	5
trailing blackberry	*	5
salal	*	3
Alaska huckleberry	*	3
Cascade Oregon grape	*	2
western hemlock	*	2
Indian plum	*	1
rusty menziesia	*	1
red-osier dogwood	*	1
big huckleberry	*	1
cascara	*	1
Pacific ninebark	*	1
blackcap	*	1
thimbleberry	*	1

Twenty-nine percent of the time westside, gravel/cobble, water type 1, 2, and 3 RMZs sampled lacked sub-dominant shrubs. When sub-dominant shrubs were present they were most frequently salmonberry, Alaskan huckleberry, vine maple and stink currant.

DOMINANT HERB MEAN COVERAGE AND CONSTANCIES

Table HERB-1. Eastside lakes, water type 1, dominant herb #1 mean subplot coverage and constancy (total sites = 1, total subplots = 58). * *value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
grass	31	69
pinegrass	3	5
horsetail	2	5
soft rush	*	4
rush	1	4
aster	*	2
lady-fern	*	2
Carex	*	2
Canada thistle	1	2
daisy	1	2
white flowered hawkweed	*	2
starry solomon	*	2
unknown	1	2

The most common dominant herbs within eastside, water type 1, lake RMZs were grass species, pine grass, and horsetails.

Table HERB-2. Eastside lakes, water type 1, dominant herb #2 mean subplot coverage and constancy (total sites = 1, total subplots = 58). * *value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
common yarrow	1	24
grass	2	14
unknown	1	10
not present		7
strawberry	*	7
thistle spp.	*	5
daisy	*	5
Carex	*	4
Canada thistle	*	4
soft rush	*	4
lupin	*	4
starry solomon	*	4
aster	*	2
fireweed	*	2
rush spp.	*	2
Mountain sweet root	*	2
buttercup	*	2
dock	1	2

The most commonly encountered sub-dominant herbs within eastside, water type 1, lake RMZs were common yarrow, grass species, and unknown species.

Table HERB-3. Westside lakes, water type 1, dominant herb #1 mean subplot coverage and constancy (total sites = 4, total subplots = 143). * *value was less than 1.0 note: values are given in percent*

Herb Name	Coverage	Constancy
swordfern	4	28
not present		23
lady-fern	1	10
wood-fern	*	9
deer-fern	*	8
bracken-fern	*	7
false lily of the valley	*	3
piggyback plant	2	3
goatsbeard	*	1
bunchberry dogwood	*	1
sweetscented bedstraw	*	1
carex spp.	*	1
rattlesnake plantain	*	1
grass	*	1
candy flower	*	1
licorice-fern	*	1
coolwort foamflower	*	1
western starflower	*	1
common cat-tail	*	1

Table HERB-4. Westside lakes, water type 2, dominant herb #1 mean subplot coverage and constancy (total sites = 2, total subplots = 67).

Herb Name	Coverage	Constancy
swordfern	13	46
not present		19
bracken-fern	1	11
tansy	*	6
deer-fern	*	5
vanilla leaf	1	3
wild ginger	*	2
lady-fern	*	2
carex spp.	*	2
fireweed	*	2
sweetscented bedstraw	*	2
grass	*	2
unknown	*	2

Table HERB-5. Westside lakes, water type 3, dominant herb #1 mean subplot coverage and constancy (total sites = 1, total subplots = 73).

Herb Name	Coverage	Constancy
not present		38
carex spp.	10	37
bracken-fern	1	19
grass	1	3
lady-fern	*	1
false lily of the valley	*	1

Swordfern and carex species were the most frequently encountered dominant herbs within westside, water type 1, 2, and 3, lake RMZs. The absence of herbs altogther was also common.

Table HERB-6. Westside lakes, water type 1, dominant herb #2, mean subplot coverage and constancy (total sites = 4, total subplots = 143). * *value was less than 1.0*
note: values are given in percent

Herb Name	Coverage	Constancy
not present		57
deer-fern	*	9
lady-fern	*	7
wood-fern	*	5
swordfern	*	5
bunchberry dogwood	*	2
false lily of the valley	*	2
goatsbeard	*	1
oak-fern	*	1
licorice-fern	*	1
bracken-fern	*	1
maidenhair-fern	*	1
fireweed	*	1
sweetscented bedstraw	*	1
grass	*	1
skunk cabbage	*	1
stag's horn moss	*	1
Cooleye's hedgenettle	*	1
dandelion	*	1
western starflower	*	1

Table HERB-7. Westside lakes, water type 2, dominant herb #2, mean subplot coverage and constancy (total sites = 2, total subplots = 67).

Herb Name	Coverage	Constancy
not present		46
grass	*	11
bracken-fern	*	9
false lily of the valley	*	6
swordfern	*	6
wild ginger	*	5
lady-fern	*	5
tansy	*	5
vanilla leaf	*	2
deer-fern	*	2
fireweed	*	2
sweetscented bedstraw	*	2
white flowered hawkweed	*	2
Cooleye's hedgenettle	*	2

Table HERB-8. Westside lakes, water type 3, dominant herb #2, mean subplot coverage and constancy (total sites = 1, subplots = 73).

Herb Name	Coverage	Constancy
not present		71
false lily of the valley	*	18
western starflower	*	6
unknown	*	4
carex spp.	*	1

The majority of the time there was not a sub-dominant herb within westside, water type 1, 2, and 3, lake RMZs. When herbs were found they most frequently were grass species, false lilly of the valley, and deer-fern.

Table HERB-9. Westside, boulder/bedrock, water type 1, dominant herb #1 mean subplot coverage and constancy (total sites = 7, total subplots = 334). * *value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
swordfern	17	44
Oregon oxalis	7	19
piggyback plant	1	4
grass	*	4
waterleaf	2	4
not present		3
lady-fern	1	3
deer-fern	*	3
coolwort foamflower	1	3
Scouler's corydalis	*	2
skunk cabbage	*	1
bunchberry dogwood	*	1
wood-fern	*	1
cow parsnip	*	1
wall lettuce	*	1
bracken-fern	*	1
Cooleye's hedgenettle	*	1
goatsbeard	*	1
daisy	*	1
coltsfoot	*	1

Table HERB-10. Westside, boulder/bedrock, water type 2, dominant herb #1 mean subplot coverage and constancy (total sites = 2, total subplots = 51).

Herb Name	Coverage	Constancy
swordfern	34	75
not present		10
deer-fern	*	4
unknown	*	4
lady-fern	*	2
Scouler's corydalis	1	2
oak-fern	*	2
candy flower	*	2

Table HERB-11. Westside, boulder/bedrock, water type 3, dominant herb #1 mean subplot coverage and constancy (total sites = 2, total subplots = 83).

Herb Name	Coverage	Constancy
swordfern	20	54
piggyback plant	16	28
not present		4
deer-fern	*	4
bracken-fern	2	4
grass	*	1
candy flower	*	1
tansy	*	1
fringecup	*	1
trillium	*	1
unknown	*	1

The most commonly encountered dominant herbs within westside, boulder/bedrock, water type 1, 2, and 3, RMZs were swordfern, piggyback plant, and Oregon oxalis.

Table HERB-12. Westside, boulder/bedrock, water type 1, dominant herb #2 mean subplot coverage and constancy (total sites = 10, total subplots = 334). * *value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
not present		21
swordfern	1	12
Oregon oxalis	1	10
piggyback plant	1	9
grass	*	6
lady-fern	*	5
wood-fern	*	5
deer fern	*	4
waterleaf	*	3
coolwort foamflower	*	3
skunk cabbage	*	2
licorice-fern	*	2
sweetscented bedstraw	*	2
stinging nettle	*	2
horsetail	*	2
goatsbeard	*	1
false lilly of the valley	*	1
Scouler's corydalis	*	1
alumroot	*	1
unknown	*	1

Table HERB-13. Westside, boulder/bedrock, water type 2, dominant herb #2 mean subplot coverage and constancy (total sites = 1, total subplots = 51).

Herb Name	Coverage	Constancy
not present		26
deer-fern	1	18
trillium	*	12
wood-fern	*	10
lady-fern	*	8
Scouler's corydalis	*	8
swordfern	*	6
goatsbeard	*	4
unknown	*	4

Table HERB-14. Westside, boulder/bedrock, water type 3, dominant herb #2 mean subplot coverage and constancy (total sites = 2, total subplots = 83).

Herb Name	Coverage	Constancy
lady-fern	2	17
not present		16
swordfern	1	13
deer-fern	*	8
Scouler's corydalis	1	7
bracken-fern	*	7
dwarf nightshade	*	5
piggyback plant	1	5
sweetscented bedstraw	*	4
maidenhair-fern	*	2
grass	*	2
unknown	*	2
Columbia brome	*	1
wood-fern	*	1
horsetail	*	1
waterleaf	*	1
candyflower	*	1
licorice-fern	*	1
coolwort foamflower	*	1

Within westside, boulder/bedrock, water type 1, 2, and 3, RMZs it was not uncommon to find subdominant herbs lacking. When sub-dominant herbs were present they were most frequently swordfern, lady-fern, and deer-fern.

Table HERB-15. Eastside, gravel/cobble, water type 1, dominant herb #1 mean subplot coverage and constancy (total sites = 1, total subplots = 44). * *value was less than 1.0*
note: values are given in percent

Herb Name	Coverage	Constancy
grass	26	39
horsetail	5	25
not present		16
showy aster	*	2
strawberry spp.	*	2
northern bedstraw	*	2
cow parsnip	*	2
soft rush	*	2
lupin spp.	*	2
canarygrass	1	2
claspleaf twistedstalk	*	2

Table HERB-16. Eastside, gravel/cobble, water type 3, dominant herb #1 mean subplot coverage and constancy (total sites = 6, total subplots = 425).

Herb Name	Coverage	Constancy
grass	10	19
coolwort foamflower	3	9
wild sasparilla	2	8
meadowrue	*	5
canarygrass	3	5
beadlily	*	5
starry solomon-plume	*	5
stinging nettle	1	5
not present		5
sweetscented bedstraw	1	4
horsetail	1	3
claspleaf twistedstald	*	3
unknown	*	2
bunchberry dogwood	*	2
dwarf nightshade	*	2
heart-leaf arnica	*	1
bromus spp.	1	1
mountain sweet-root	*	1
lady-fern	*	1
thistle spp.	*	1

Within eastside, gravel/cobble, water type 1 and 3, RMZs the most commonly encountered dominant herbs were grass species, horsetail, and coolwort foamflower.

Table HERB-17. Eastside, gravel/cobble, water type 1, dominant herb #2 mean subplot coverage and constancy (total sites = 1, total subplots = 44). * *value was less than 1.0*
note: values are given in percent

Herb Name	Coverage	Constancy
horsetail	8	30
not present		21
grass	4	14
sweetscented bedstraw	*	7
heart-leaf arnica	*	7
unknown	*	7
fireweed	*	5
pinegrass	*	2
broadpetal strawberry	*	2
rush spp.	*	2
bracken fern	*	2
pioneer violet	*	2

Table HERB-18. Eastside, gravel/cobble, water type 3, dominant herb #2 mean subplot coverage and constancy (total sites = 11, total subplots = 426).

Herb Name	Coverage	Constancy
not present		12
grass	1	9
beadlily	*	8
coolwort foamflower	*	6
unknown	*	6
starry solomon-plume	*	5
meadowrue	*	5
stinging nettle	*	5
western yarrow	*	4
sweetscented bedstraw	*	4
wild sasparilla	*	4
claspleaf twistedstalk	*	3
dwarf nightshade	*	3
horsetail	*	2
lady-fern	*	2
bunchberry dogwood	*	2
meadow goldenrod	*	2
broadpetal stawberry	*	1
silky lupine	*	1
mountain sweetroot	*	1

Within eastside, gravel/cobble, water type 1 and 3, grass species, beadlily and sweetscented bedstraw were the most commonly encountered sub-dominant herbs. RMZs Within water type 3 RMZs sub-dominant forbs were lacking.

Table HERB-19. Westside, gravel/cobble, water type 1, dominant herb #1 mean subplot coverage and constancy (total sites = 10, total subplots = 828). * *value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
swordfern	12	27
piggyback plant	8	17
canarygrass	5	7
Oregon oxalis	3	7
bunchberry dogwood	*	5
lady-fern	1	5
not present		3
carex spp.	2	3
Scouler's corydalis	1	3
grass	*	2
bracken-fern	*	2
ground ivy	1	2
stinging nettle	1	2
inside-out-flower	*	2
beadlily	*	1
wood-fern	*	1
false lily of the valley	*	1
unknown	*	1
fireweed	*	1
vanilla leaf	*	1

Table HERB-20. Westside, gravel/cobble, water type 2, dominant herb #1 mean subplot coverage and constancy (total sites = 8, total subplots = 413).

Herb Name	Coverage	Constancy
swordfern	7	25
deer-fern	1	16
Oregon oxalis	5	11
piggyback plant	5	11
lady-fern	1	10
grass	2	4
false lily of the valley	*	2
not present		2
carex spp.	1	2
alumroot	*	2
water parsley	1	2
buttercup	*	2
small fruited bullrush	1	2
coolwort foamflower	*	2
canarygrass	*	2
skunkcabbage	*	1
Colleye's hedgenettle	*	1
stinging nettle	*	1
horsetail	*	1
ground ivy	*	1

Table HERB-21. Westside, gravel cobble, water type 3, dominant herb #1 mean subplot coverage and constancy (total sites = 40, total subplots = 2734).

Herb Name	Coverage	Constancy
swordfern	13	29
piggyback plant	8	14
Oregon oxalis	6	12
lady-fern	2	6
deer-fern	*	5
canarygrass	3	5
grass	1	3
small fruited bulrush	2	3
carex spp.	1	2
skunk cabbage	*	2
buttercup	1	2
stinging nettle	*	2
bleeding heart	*	2
not present		1
waterleaf	*	1
false lily of the valley	*	1
sweetscented bedstraw	*	1
Scouler's corydalis	*	1
water parsley	*	1
candy flower	*	1

Within westside, gravel/cobble, water type 1, 2, and 3, RMZs the most common dominant herbs were swordfern, piggyback plant, Oregon oxalis and deer-fern.

Table HERB-22. Westside, gravel/cobble, water type 1, dominant herb #2 mean sub-plot coverage and constancy (total sites = 10, total subplots = 828). **value was less than 1.0* *note: values are given in percent*

Herb Name	Coverage	Constancy
not present		12
swordfern	1	9
lady-fern	1	8
piggyback plant	1	7
Oregon oxalis	2	7
grass	*	6
wood-fern	*	5
false lily of the valley	*	4
stinging nettle	*	4
carex spp.	*	3
Scouler's corydalis	*	3
bunchberry dogwood	*	2
sweetscented bedstraw	*	2
beadlily	*	2
horsetail	*	2
bleeding heart	*	2
bracken-fern	*	2
candy flower	*	2
vanilla leaf	*	1

Table HERB-23. Westside, gravel/cobble, water type 2, dominant herb #2 mean subplot coverage and constancy (total sites = 8, total subplots = 412).

Herb Name	Coverage	Constancy
not present		16
Oregon oxalis	1	10
swordfern	*	8
grass	1	8
piggyback plant	1	8
lady-fern	*	7
deer-fern	*	7
false lily of the valley	*	5
water parsley	*	3
carex spp.	*	3
sweetdscented bedstraw	*	3
coolwort foamflower	*	3
skunk cabbage	*	2
wood-fern	*	2
alumroot	*	2
pioneer violet	*	2
licorice-fern	*	1
buttercup	*	1
Cooleye's hedgenettle	*	1
unknown	*	1

Table HERB-24. Westside, gravel/cobble, water type 3, dominant herb #2 mean sub-plot coverage and constancy (total sites = 39, total subplots = 2732).

Herb Name	Coverage	Constancy
lady-fern	2	12
swordfern	1	10
not present		9
piggyback plant	1	8
Oregon oxalis	1	7
grass	1	5
deer-fern	*	5
false lily of the valley	*	4
sweetscented bedstraw	*	3
skunk cabbage	*	3
stinging nettle	*	3
bleeding heart	*	3
candy flower	*	2
water parsely	*	2
unknown	*	2
Cooleye's hedgenettle	*	2
waterleaf	*	2
Scouler's corydalis	*	1
wood-fern	*	1
horsetail	*	1

Within westside, gravel/cobble, water type 1, 2, and 3, RMZs the most frequently encountered sub-dominant herbs were swordfern, lady-fern, and Oregon oxalis. On water type 1 RMZs sub-dominant herbs were most frequently lacking.

MEAN COVERAGE AND CONSTANCY VALUES FOR OVERSTORY CANOPY, TOTAL SHRUBS, FORBS, AND GRAMINOIDS.

The following tables display the total overstory canopy closure, total shrub coverage, total forb coverage, and total grass coverage within the subplots. Site and subplot numbers are provided. Total subplot numbers were used to detemine the mean coverages.

For example: Table COVER-1 is read as... within eastside, lakeside, water type 1 RMZs the mean subplot canopy coverage was 55%, mean total shrub coverage and constancies were 38% and 83% respectively, mean total forb coverage and constancies were 27% and 93% respectively, and mean total grass coverage was 60% and 100% respectively. Where N.A. appears in the column indicates that there were no sites sampled within the defined category.

Lakeside RMZs

Table COVER-1. Eastside Lake RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs, and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	55%	76%	N.A.
Shrubs	38/83	36/78	N.A.
Forbs	27/93	26/95	N.A.
Grass	60/100	16/46	N.A.
Number of sites	1	1	N.A.
Number of subplots	58	37	N.A.

Table COVER-2. Westside Lake RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs, and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	90%	80%	47%
Shrubs	59/94	61/98	69/93
Forbs	31/82	30/81	9/44
Grass	14/17	19/40	28/39
Number of sites	5	3	1
Number of subplots	191	129	75

Subplot overstory canopy closure for eastside lake RMZs appeared less than westside lake RMZs. Shrub canopy coverage and frequency appeared greater within westside lake RMZs. Forb canopy coverage appeared higher within westside lake RMZs, yet forb frequency was lower than those found in eastside sites. Grass canopy coverage was higher within type 1 lake RMZs on the eastside and similar between state sides on type 2 lakes. Grass frequency was higher in eastside lake RMZs.

Boulder/bedrock RMZs

Table COVER-3. Eastside, Boulder/Bedrock, RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	N.A.	N.A.	61%
Shrubs	N.A.	N.A.	58/98
Forbs	N.A.	N.A.	32/88
Grass	N.A.	N.A.	6/17
Number of sites	N.A.	N.A.	1
Number of subplots	N.A.	N.A.	157

Table COVER-4. Westside, Boulder/Bedrock, RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	87%	93%	88%
Shrubs	59/92	40/77	53/83
Forbs	51/97	33/90	47/97
Grass	8/37	7/19	5/30
Number of sites	10	2	4
Number of sub-plots	522	96	115

No type 3 streams were sampled on the east side of the state. Means for westside type 1 and 2 streams can be found in table COVER-3 and table COVER 4. Within type 3 streams the westside had greater overstory canopy closure and greater forb canopy closure. Shrub and grass canopy coverage was nearly equivalent between westside and eastside sites. Aside from grasses occuring twice as often in westside sites the frequencies of these variables were similar.

Gravel/cobble RMZs

Table COVER-5. Eastside, Gravel/Cobble, RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	69%	72%	74%
Shrubs	81/98	50/92	59/92
Forbs	28/89	16/32	37/93
Grass	56/77	36/75	32/63
Number of sites	1	1	11
Number of sub-plots	44	87	701

Table COVER-6. Westside, Gravel/Cobble, RMZ Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminoids. Note: Coverage values given are in percent

WATER TYPE	1	2	3
Canopy	87%	82%	82%
Shrubs	73/88	67/96	59/90
Forbs	52/93	44/97	59/97
Grass	25/48	23/49	27/53
Number of sites	11	12	50
Number of sub-plots	916	704	3,309

Overstory canopy closure and forb coverage was greater in westside RMZs. Grass coverage was greater within eastside RMZs than within westside RMZs. Shrub coverage on westside type 1 streams was lower than eastside yet higher than the eastside on type 2 waters. Shrub coverage was similar within RMZs on type 3 streams. Grass and shrubs were more frequently found within eastside RMZs. Forbs were more frequently found within westside RMZs.

MEAN COVERAGE AND CONSTANCY VALUES FOR WATER, ROCK, SOIL, ORGANIC GROUND COVER (OGC), DOWNED WOOD 1 (DW1), DOWNED WOOD 2 (DW2), & DOWNED WOOD 3 (DW3).

The following tables display the coverage and constancy values for total water, rock, soil, and organic ground cover. The number of subplots sampled is provided in parenthesis next to the water type.

Water coverage is based on open water. Rock coverage is based on exposed rock, and soil coverage is based on exposed soil. Organic ground cover includes litter, duff, mosses, lichens, and fungi. Organic ground cover does not include the downed wood coverage.

Downed wood classes are based on the amount of decay the log exhibits. Downded wood 1 logs are recently fallen trees with tight bark. Downed wood 2 logs are beginning to decay on the outside, but still have a solid center. Downed wood 3 logs are decayed throughout.

Lakes

	Eastside			Westside		
Water Type	1 (58)	2 (37)	3	1 (191)	2 (129)	3 (75)
Water	0/0	0/0	N.A.	13/4	6/3	0/0
Rock	18/31	3/8	N.A.	4/9	3/2	3/1
Soil	8/33	3/22	N.A.	8/6	13/5	15/1
OGC	87/98	93/100	N.A.	92/99	96/99	97/89

	Eastside			Westside		
Water Type	1 (58)	2 (37)	3	1 (191)	2 (129)	3 (75)
DW1	3/2	7/38	N.A.	25/13	8/14	3/1
DW2	11/26	7/30	N.A.	9/22	7/23	5/7
DW3	8/38	13/27	N.A.	17/39	9/25	15/40

Boulder/bedrock

		Eastside			Westside	
Water Type	1	2	3 (157)	1 (522)	2 (95)	3 (116)
Water	N.A.	N.A.	4/6	9/3	3/1	9/5
Rock	N.A.	N.A.	15/33	18/31	24/27	6/32
Soil	N.A.	N.A.	20/24	8/22	11/19	16/18
OGC	N.A.	N.A.	81/98	86/99	87/99	92/99
		Eastside			**Westside**	
Water Type	1	2	3 (157)	1 (522)	2 (95)	3 (116)
DW1	N.A.	N.A.	10/31	8/13	9/2	10/22
DW2	N.A.	N.A.	10/31	19/26	11/20	7/25
DW3	N.A.	N.A.	13/20	17/31	19/40	7/28

Gravel/cobble

		Eastside			Westside	
Water Type	1 (44)	2 (87)	3 (701)	1 (914)	2 (704)	3 (3306)
Water	3/2	3/1	7/8	15/4	7/8	15/8
Rock	23/30	26/62	5/14	18/9	10/4	9/7
Soil	25/18	19/61	11/21	10/9	10/14	9/14
OGC	82/96	68/99	86/99	93/96	93/99	93/99
		Eastside			**Westside**	
Water Type	1 (44)	2 (87)	3 (701)	1 (914)	2 (704)	3 (3306)
DW1	3/2	7/15	11/19	12/7	11/17	10/14
DW2	12/9	4/12	11/26	11/16	11/14	12/20
DW3	14/14	10/12	13/37	18/24	17/39	15/27

LIVE TREE DENSITY

Tree diameter was measured in the following four inch size class intervals:

Size Class	Diameter in inches
1	0.0 - 3.9
2	4.0 - 7.9
3	8.0 - 11.9
4	12.0 - 15.9
5	16.0 - 19.9
6	20.0 - 23.9
7	24+

Data were analyzed to determine the number of trees per acre and per 1000 feet within each size class. Size class analysis occurred on sizes 1-7, 2-7, 3-7, 4-7. When the last size class shown is 3-7, there were no trees larger than 11.9 inches in diameter within the defined category.

For example: Table TREE-1 is read as... there was a mean of seven conifers greater than 12.0 inches in diameter per 1000 feet within eastside lakes, water type 1. In this example a mean of seven trees per 1000 feet equates to a mean of eight trees (greater than 12.0 inches in diameter) per acre.

Trees analyzed as live fit one of the following criteria: live tree - undamaged, live tree - 1/3 to 1/2 of the top broken, live tree - dead top. Minimum height was 4.5 feet. All trees were grouped together by size class and category.

Trees were defined as either hardwood or conifer. The number of sites sampled and the total number of strips within these sites have been provided in the tables.

Strip count is not the total number of strips within the sampled RMZs, but instead is the total number of strips, in that category of RMZs, containing trees of the defined size class range. The total number of strips sampled within each RMZ category is not shown.

Trees/1000 feet and trees/per acre were calculated by dividing by the total number of trees (within the size class range) by the strip count.

The number of strips and sites decreased when trees no longer met the minimum size requirements. For example in Table TREE-9 (water type 3) the number of sites with trees in size classes 1-7 equals 9. The number of sites with trees in size classes 4-7 equals 7. This means there were two eastside gravel/cobble RMZs without trees larger than 12.0 inches in diameter. Strip count decreased from 135 to 87. Again, this means that 135 strips had at least one conifer within them, but only 87 strips had at least one conifer over 12.0 inches in diameter.

Lakeside Mean Tree Densities

Table TREE-1. Eastside Lake RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	40	43	1	12
	2-7	29	31	1	12
	3-7	15	16	1	12
	4-7	8	7	1	10
2	1-7	51	42	1	10
	2-7	43	36	1	10
	3-7	24	20	1	10
	4-7	12	10	1	8

Table TREE-2. Eastside Lake RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	7	8	1	4
	2-7	1	1	1	1
2	1-7	9	7	1	6
	2-7	8	6	1	5
	3-7	3	2	1	2

Table TREE-3. Westside Lake RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	42	41	5	26
	2-7	21	23	5	26
	3-7	11	13	5	25
	4-7	7	7	5	22
2	1-7	13	41	3	7
	2-7	9	15	3	6
	3-7	5	9	3	6
	4-7	3	6	3	6
3	1-7	25	30	1	9
	2-7	18	22	1	9
	3-7	8	10	1	8
	4-7	2	3	1	5

Table TREE-4. Westside Lake RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	37	88	5	18
	2-7	25	61	5	18
	3-7	17	44	5	16
	4-7	11	30	5	15
2	1-7	50	67	3	20
	2-7	42	54	3	20
	3-7	23	30	3	19
	4-7	7	10	3	15
3	1-7	13	15	1	10
	2-7	12	14	1	9
	3-7	5	6	1	6
	4-7	1	2	1	4

Statewide, type 1 lake RMZs contained similar amounts of conifers per 1000 feet and per acre. Conifer size in type 1 RMZs was similar on both sides of the state. Hardwood composition within water type 1 RMZs was considerably higher on the westside of the state. Conifers composition, within water type 2 RMZs, was higher in eastside sites. Tree size was larger in eastside RMZs. Hardwoods were more prevalent and larger in westside, type 2 RMZs.

Boulder/bedrock Mean Tree Densities

Table TREE-5. Eastside Boulder/Bedrock RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
3	1-7	27	18	1	42
	2-7	24	17	1	41
	3-7	12	8	1	33
	4-7	6	4	1	26

Table TREE-6. Eastside Boulder/Bedrock RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
3	1-7	2	1	1	8
	2-7	2	1	1	8
	3-7	1	1	1	7
	4-7	1	1	1	4

Table TREE-7. Westside Boulder/Bedrock RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	30	54	10	54
	2-7	14	25	10	53
	3-7	7	13	10	47
	4-7	5	8	10	43
2	1-7	56	116	2	14
	2-7	42	85	2	13
	3-7	23	47	2	13
	4-7	12	8	2	11
3	1-7	60	41	4	24
	2-7	25	19	4	23
	3-7	11	10	4	19
	4-7	4	4	3	12

Table TREE-8. Westside Boulder/Bedrock RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	42	68	10	78
	2-7	24	38	10	78
	3-7	14	21	10	70
	4-7	9	14	10	65
2	1-7	19	31	2	14
	2-7	14	23	2	14
	3-7	9	17	2	13
	4-7	5	10	2	12
3	1-7	54	42	4	26
	2-7	28	25	4	26
	3-7	16	16	4	21
	4-7	10	12	4	19

Westside, water type 3, boulder/bedrock RMZs had higher densities of hardwoods per acre and per 1000 feet. The composition of conifers between the two sides of the state were relatively equal. Within westside water type 1 RMZs hardwoods dominated over conifers. On water type 2 RMZs conifers dominated the hardwoods.

Gravel/cobble Mean Tree Densities

Table TREE-9. Eastside Gravel/Cobble RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	12	10	1	8
	2-7	10	8	1	8
	3-7	6	5	1	8
	4-7	4	4	1	8
2	1-7	9	5	1	9
	2-7	8	4	1	9
	3-7	4	3	1	8
	4-7	3	2	1	8
3	1-7	51	26	9	135
	2-7	20	14	9	129
	3-7	10	7	9	110
	4-7	7	5	7	87

Table TREE-10. Eastside Gravel/Cobble RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	10	8	1	7
	2-7	5	4	1	6
	3-7	3	3	1	4
	4-7	2	2	1	4
2	1-7	43	25	1	18
	2-7	30	17	1	18
	3-7	5	3	1	12
	4-7	3	2	1	7
3	1-7	29	25	11	115
	2-7	11	10	11	89
	3-7	4	4	11	71
	4-7	3	2	10	54

Table TREE-11. Westside Gravel/Cobble RMZ Mean Tree Density - Conifers

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	36	57	11	84
	2-7	12	19	11	76
	3-7	7	11	10	66
	4-7	4	7	10	60
2	1-7	35	40	9	77
	2-7	13	17	9	74
	3-7	9	11	9	66
	4-7	6	8	9	59
3	1-7	22	33	49	357
	2-7	11	16	47	332
	3-7	6	9	47	291
	4-7	4	6	46	243

Table TREE-12. Westside Gravel/Cobble RMZ Mean Tree Density - Hardwoods

WATER TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	35	81	11	115
	2-7	21	60	11	111
	3-7	16	42	11	106
	4-7	9	25	11	95
2	1-7	33	33	12	131
	2-7	27	27	11	120
	3-7	19	19	11	113
	4-7	12	13	11	107
3	1-7	31	60	50	495
	2-7	20	26	50	470
	3-7	14	17	50	431
	4-7	9	11	48	387

Westside, water type 1, gravel/cobble RMZs contained more conifers and hardwoods per acre than their eastside counterparts. Westside water type 2 RMZs contained more conifers per 1000 feet, and per acre than did their eastside counterparts, but fewer hardwoods. Westside water type 3 RMZs contained fewer conifers and more hardwoods per acre than similar eastside sites.

SNAG DENSITY

Snags were defined in the following manner: recent dead (needles or leaves dead, yet still on the tree), dead tree - tight bark, or dead tree - loose bark. Minimum height was 4.5 feet. There was no minimum size requirement for snags. All snags were grouped together by size class and category.

Lakeside Mean Snag Densities

Table SNAG-1. Eastside Lake RMZ Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
2	1-7	6	5	1	5
	2-7	5	4	1	5
	3-7	2	1	1	3
	4-7	1	1	1	1

Table SNAG-2. Eastside Lake RMZ Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	7	8	1	11
	2-7	4	5	1	9
	3-7	2	2	1	5
	4-7	2	2	1	4
2	1-7	3	3	1	4
	2-7	3	3	1	4
	3-7	1	1	1	2

Table SNAG-3. Westside Lake RMZ Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	5	5	4	15
	2-7	3	3	4	15
	3-7	3	3	3	13
	4-7	3	4	2	10
2	1-7	3	4	2	5
	2-7	1	2	2	3
	3-7	1	2	1	2
	4-7	1	1	1	1
3	1-7	18	21	1	9
	2-7	9	11	1	9
	3-7	2	3	1	6
	4-7	1	1	1	4

Table SNAG-4. Westside Lake RMZ Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	5	16	4	12
	2-7	5	15	3	9
	3-7	4	12	2	6
	4-7	2	5	2	4
2	1-7	11	14	3	17
	2-7	10	13	3	16
	3-7	5	6	3	13
	4-7	1	5	2	4
3	1-7	11	13	1	8
	2-7	7	8	1	7
	3-7	3	4	1	7
	4-7	2	5	2	4

Westside, water type 1, lake RMZs contained more hardwood snags per acre than conifers. Eastside, water type 2, RMZs contained more conifer, and similar hardwood snags per acre, than their westside counterparts. Westside, water type 3 RMZs contained more conifer snags per acre than hardwoods.

Boulder/bedrock Snag Densities

Table SNAG-5. Eastside, Boulder/Bedrock Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
3	1-7	4	3	1	17
	2-7	4	3	1	17
	3-7	2	2	1	15
	4-7	1	1	1	10

Table SNAG-6. Eastside, Boulder/Bedrock Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
3	1-7	1	1	1	2
	2-7	1	1	1	2
	3-7	1	1	1	2
	4-7	1	1	1	2

Table SNAG-7. Westside, Boulder/Bedrock Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	4	7	9	19
	2-7	2	3	9	18
	3-7	1	2	7	12
	4-7	1	2	6	11
2	1-7	12	26	2	9
	2-7	7	14	2	9
	3-7	2	3	2	6
	4-7	1	1	2	4
3	1-7	11	8	3	13
	2-7	4	3	3	9
	3-7	2	1	3	5
	4-7	1	1	2	3

Table SNAG-8. Westside, Boulder/Bedrock Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	4	7	10	35
	2-7	2	3	10	27
	3-7	1	2	10	17
	4-7	1	1	6	8
2	1-7	2	3	2	7
	2-7	2	3	2	6
	3-7	2	3	2	6
	4-7	2	2	2	6
3	1-7	5	4	4	13
	2-7	3	2	4	9
	3-7	2	2	4	5
	4-7	1	1	3	4

Westside, boulder/bedrock, water type 1, RMZs contained an equal ratio (per acre) of conifer to hardwood snags. Westside, type 2, RMZs contained more conifer snags per acre than hardwoods. Westside, type 3, RMZs contained more conifer and hardwood snags per acre than did their counterpart eastside sites. Westside and eastside, type 3, RMZs contained more conifer snags than hardwoods per acre.

Gravel/cobble Mean Snag Densities

Table SNAG-9. Eastside, Gravel/Cobble Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	1	1	1	1
2	1-7	3	4	1	6
	2-7	3	2	1	6
	3-7	1	2	1	5
	4-7	1	1	1	2
3	1-7	3	2	9	46
	2-7	1	1	8	32
	3-7	1	1	6	17
	4-7	1	1	6	14

Table SNAG-10. Eastside, Gravel/Cobble Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	1	1	1	2
	2-7	1	1	1	1
	3-7	1	1	1	1
	4-7	1	1	1	1
2	1-7	3	2	1	5
	2-7	2	1	1	5
	3-7	1	1	1	3
	4-7	1	1	1	1
3	1-7	7	6	8	50
	2-7	4	4	8	42
	3-7	2	2	5	23
	4-7	1	1	5	13

Table SNAG-11. Westside, Gravel/Cobble Mean Snag Density - Conifers

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	3	5	9	33
	2-7	1	2	7	23
	3-7	1	1	4	11
	4-7	1	2	3	9
2	1-7	3	4	9	42
	2-7	2	2	9	34
	3-7	1	2	8	25
	4-7	1	1	6	18
3	1-7	2	5	43	153
	2-7	2	3	42	132
	3-7	1	2	35	80
	4-7	1	2	26	57

Table SNAG-12. Westside, Gravel/Cobble Mean Snag Density - Hardwoods

WATER TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
1	1-7	4	18	10	60
	2-7	3	10	10	54
	3-7	1	2	6	28
	4-7	1	1	5	13
2	1-7	5	5	9	56
	2-7	4	4	9	49
	3-7	2	2	8	28
	4-7	1	1	8	16
3	1-7	5	7	43	250
	2-7	3	4	40	212
	3-7	2	2	35	122
	4-7	1	1	30	67

Westside, gravel/cobble, water type 1, RMZs contained more conifer, and fewer hardwood snags per acre, than eastside sites within the same category. Westside, water type 2, RMZs contained similar numbers of conifer snags, and more hardwood snags per acre, than do eastside, water type 2 RMZs. Within water type 3 RMZs there were similar numbers of conifer snags per acre between state sides, and more hardwood snags per acre in eastside RMZs. Hardwood snags dominated within all water types on both sides of the state.

UMAs

One hundred and twenty-six acres of UMAs located on 30 sites were sampled in 1988/89. UMAs were stratified by their dominant vegetative characteristics. The structure of the UMAs sampled in 1988/89 was a diverse array of forest types ranging from wetlands to old-growth forests.

UMAs are categorized by their physical characteristics. Three categories were developed: forested wetland, upland forest, and bogs. No bog UMAs were sampled on the eastside of the state.

VEGETATION AND OTHER STIRP VARIABLES

Data were collected on the two dominant shrubs and herbs, total shrubs, herbs and graminiods (grass), downed wood 1 to 3 (decay class 1 = recent fallen, decay class 3 = rotten), water, rock, and soil. Mean coverage and constancy were caluculated on these variables

Canopy is defined as the percent of closed canopy above the sample plot. Coverage is defined as the percentage of ground, when viewed from above the subplot, the variable covers within the sample plot. Sample plots are 5x10 feet. Constancy is defined as the degree of presence a variable has within sample plots. Subplot coverage and constancy values are given in percent.

UMA shrubs and herbs are listed in order by their constancy values. Shrub tables 28 through 37 and herb tables 25 through 34 list the 20 most frequently encountered shrubs or forbs. When fewer than 20 shrubs or forbs are listed, this implies that fewer than 20 were encountered within that specific category.

When the total site number and subplot numbers do not match between categories it is because a portion of the sites, the first 39, were sampled in 1988 before those variables were being collected or that particular data point was overlooked in the field. The latter explanation accounts for less than 1% of the occurances.

Values are given in percent. An * means the value was less than 1%.

DOMINANT SHRUB MEAN COVERAGE AND CONSTANCIES

Table SHRUB-28. Eastside UMAs, forested wetlands, dominant shrub #1 mean subplot coverage and constancy (total sites = 1, total subplots = 174).

Shrub Name	Coverage	Constancy
hardhack	9	21
snowberry	5	20
alder spp.	5	13
quaking aspen	*	10
not present		8
unknown	4	8
red-osier dogwood	1	6
prickly currant	*	4
devil's club	1	2
black hawthorne	1	2
western red cedar	*	2
thimbleberry	*	2
stink currant	*	1
baldhip rose	*	1
Oregon grape	*	1
serviceberry	*	1
Douglas maple	*	1

Within Eastside, forested wetland , UMAs the most commonly encountered dominant shrubs were hardhack, snowberry and alder species.

Table SHRUB-29. Eastside UMAs, upland forest, dominant shrub #1 mean subplot coverage and constancy (total sites = 2, total subplots = 197).

Shrub Name	Covcrage	Constancy
mallow ninebark	19	27
not present		15
subalpine fir	*	10
low huckleberry	2	10
pachistima	1	8
twinflower	1	6
big huckleberry	1	6
baldhip rose	*	6
Utah honeysuckle	*	4
Douglas fir	*	4
common prince's pine	*	3
Oregon grape	*	3
unknown	*	1
grand fir	*	1

Within eastside, upland forest, UMAs the most common dominant shrubs (when present) were mallow ninebark and subalpine fir. The absence of a dominant shrub was recorded 15% of the time.

Table SHRUB-30. Eastside UMA, forested wetland, dominiant shrub #2 mean subplot coverage and constancy (total sites = 1, total subplots = 174).

Shrub Name	Coverage	Constancy
not present		29
hardhack	2	11
quaking aspen	*	11
alder spp.	1	9
unknown	1	8
prickly currant	*	7
snowberry	1	6
red-osier dogwood	1	6
serviceberry	*	3
baldhip rose	*	3
thimbleberry	*	2
salmonberry	*	1
western red cedar	*	1
rubus spp.	*	1
Douglas maple	*	1
Oregon grape	*	1
rose spp.	*	1
devil's club	*	1
grand fir	*	1

Within eastside, forested wetland, UMAs a sub-dominant shrub was most frequently lacking. When sub-dominant shrubs were present they were most frequently hardhack and quaking aspen.

Table SHRUB-31. Eastside UMA, upland forest, dominant shrub #2 mean subplot coverage and constancy (total sites = 2, total subplots = 197).

Shrub Name	Coverage	Constancy
not present		28
snowberry	1	10
common prince's pine	*	9
pachistima	1	8
shiny leaf spirea	2	7
subalpine fir	*	7
big huckleberry	*	6
baldhip rose	*	6
low huckleberry	*	5
Douglas fir	*	5
Utah honeysuckle	*	5
Oregon grape	*	3
twinflower	*	3
Douglas fir	*	1
serviceberry	*	1
mallow ninebark	*	1

Within eastside, upland forest, UMAs sub-dominant shrub most frequently were lacking. When sub-dominant shrubs were encountered they were most frequently snowberry and common prince's pine.

Table SHRUB-32. Westside UMA, bogs, dominant shrub #1 mean subplot coverage and constancy (total sites = 2, total subplots = 273).

Shrub Name	Coverage	Constancy
salal	18	28
smooth Labrador-tea	16	22
western crabapple	13	17
hardhack	12	14
vine maple	7	8
swamp laurel	4	7
cascara	1	2
western hemlock	*	1
red huckleberry	*	1
not present		1

Within westside, bog, UMAs the most common dominant shrubs were salal, smooth Labrador-tea, and western crabapple.

Table SHRUB-33. Westside UMA, forested wetlands, dominant shrub #1 mean subplot coverage and constancy (total sites = 6, total subplots = 581).

Shrub Name	Coverage	Constancy
salmonberry	11	29
not present		21
vine maple	6	9
western crabapple	7	8
salal	3	6
red huckleberry	1	6
trailing blackberry	1	5
rusty menziesia	*	4
Alaska huckleberry	1	4
blackcap	*	1
big huckleberry	*	1
twinflower	*	1
red alder	*	1
western hemlock	*	1
red elderberry	*	1
devil's club	*	1
black twin-berry	*	1
cascara	*	1
Sitka spruce	*	1
sticky currant	*	1

Within westside, forested wetland, UMAs the most frequently encountered dominant shrubs were salmonberry and vine maple. Shrubs were lacking 21% of the time.

Table SHRUB-34. Westside UMA, upland forest, dominant shrub #1 mean subplot coverage and constancy (total sites = 11, total subplots = 1462).

Shrub Name	Coverage	Constancy
vine maple	13	20
salmonberry	5	12
trailing blackberry	3	8
not present		7
salal	2	7
Cascade Oregon grape	2	6
red huckleberry	1	6
hazelnut	2	5
big huckleberry	1	4
rusty menziesia	1	4
devil's club	1	2
red elderberry	*	2
baldhip rose	*	2
red-osier dogwood	1	1
ocean-spray	*	1
dwarf bramble	*	1
western hemlock	*	1
serviceberrry	*	1
western red cedar	*	1
Himalayan blackberry	*	1

Within westside, upland forest, UMAs the most frequently encountered dominant shrubs were vine maple, salmonberry, and trailing blackberry.

Table SHRUB-35. Westside UMA, bog, dominant shrub #2 mean subplot coverage and constancy (total sites = 2, total subplot = 275).

Shrub Name	Coverage	Constancy
salal	11	25
western crabapple	6	15
hardhack	4	13
not present		12
swamp laurel	2	10
smooth Labrador-tea	2	10
vine maple	1	6
rusty menziesia	*	4
red huckleberry	*	2
salmonberry	*	2
cascara	*	1
western hemlock	*	1
Alaska huckleberry	*	1
Sitka spruce	*	1

Within westside, bog, UMAs the most commonly encountered sub-dominant shrubs were salal, western crabapple, and hardhack.

Table SHRUB-36. Westside UMA, forested wetlands, dominant shrub #2 mean subplot coverage and constancy (total sites = 6, total subplot = 551).

Shrub Name	Coverage	Constancy
not present		48
salmonberry	2	10
salal	2	9
red huckleberry	*	5
Alaska huckleberry	1	5
red huckleberry	*	5
rusty menziesia	*	4
trailing blackberry	*	3
western hemlock	*	3
vine maple	*	2
devil's club	*	1
stink currant	*	1
western crabapple	*	1
blackcap	*	1
Sitka spruce	*	1
big huckleberry	*	1
cascara	*	1
Pacific ninebark	*	1
hardhack	*	1
twinflower	*	1

Within westside, forested wetland, UMAs sub-dominant shrubs were predominantly lacking. When sub-dominant shrubs were present they most frequently were salmonberry and salal.

Table SHRUB-37. Westside UMA, upland forests, dominant shrub #2 mean subplot coverage and constancy (total sites = 11, total subplot = 886).

Shrub Name	Coverage	Constancy
not present		26
salmonberry	1	12
red huckleberry	*	7
Cascade Oregon grape	1	7
trailing blackberry	*	5
vine maple	1	5
rusty menziesia	*	5
salal	*	4
big huckleberry	*	4
red elderberry	*	3
western hemlock	*	2
common prince's pine	*	2
pachistima	*	2
Himalayan blackberry	*	2
baldhip rose	*	2
hazelnut	*	1
devil's club	*	1
dwarf bramble	*	1
unknown	*	1
thimbleberry	*	1

Within westside, upland forests, UMAs sub-dominant shrubs were generally lacking. When sub-dominant shrubs were found they most commonly were salmonberry and red huckleberry.

Dominant herb Mean Coverage and Constancies

Table HERB-25. Eastside UMAs, forested wetlands, dominant herb #1 mean subplot coverage and constancy (total sites = 1, total subplots = 197).

Herb Name	Coverage	Constancy
lady-fern	22	47
grass	7	13
arrowleaf groundsel	2	8
unknown	1	7
wild sasparilla	3	5
starry solomon-plume	1	4
dwarf nightshade	*	3
wild ginger	*	2
carex spp.	*	2
bracken-fern	*	2
starry solomon-plume	*	2
not present		1
pathfinder	*	1
waterleaf	*	1
mint spp.	*	1
bigroot	*	1
arrowleaf coltsfoot	*	1
alpine pyrola	*	1
false bugbane	*	1

Within eastside, forested wetland, UMAs the most frequently encountered dominant herbs were lady-fern, grass, and arrowleaf groundsel.

Table HERB-26. Eastside UMAs, upland forests, dominant herb #1 mean subplot coverage and constancy (total sites = 2, total subplots = 197).

Herb Name	Coverage	Constancy
pinegrass	9	22
not present		17
round-leafed violet	*	16
sidebells pyrola	*	9
bluebunch wheatgrass	3	5
northwest sedge	*	5
meadowrue	1	5
white flowered hawkweed	*	4
starry solomon-plume	*	4
aster spp.	1	3
mint spp.	*	2
broadleaf lupine	*	2
unknown	*	2
Idaho fescue	*	1
grass	*	1
western yarrow	*	1
pathfinder	*	1
lady-fern	*	1
elk sedge	*	1
beadlilly	*	1

Within eastside, upland forest, UMAs the most frequently encountered dominant herbs were pinegrass and roundleaf violet. Dominant herbs were not present in 17% of the subplots.

Table HERB-27. Eastside UMA, forested wetland, dominant herb #2 mean subplot coverage and constancy (total sites = 2, total subplots = 174).

Herb Name	Coverage	Constancy
lady-fern	3	20
starry solomon-plume	1	15
arrowleaf groundsel	1	12
wild sasparilla	1	6
grass	1	6
unknown	*	6
dwarf nightshade	*	6
wild ginger	*	5
sweetscented bedstraw	*	4
waterleaf	*	4
claspleaf twistedstalk	*	4
horsetail	*	2
carex spp.	*	2
mint spp.	*	2
not present		2
false bugbane	*	2
pathfinder	*	1
bluegrass spp.	*	1
alpine pyrola	*	1
pyrola spp.	*	1

Within eastside, forested wetland, UMAs the sub-dominant herbs most commonly encountered were lady-fern, starry solomon-plume, and arrowleaf groundsel.

Table HERB-28. Eastside UMA, upland forest, dominant herb #2 mean subplot coverage and constancy (total sites = 2, total subplots = 197).

Herb Name	Coverage	Constancy
not present		37
broadleaf lupine	1	11
round-leafed violet	*	11
pinegrass	*	5
starry solomon-plume	*	5
broadpetal strawberry	*	3
bunchgrass spp.	1	3
bigleaf sandwort	*	3
alumroot spp.	*	3
western yarrow	*	2
bunchberry dogwood	*	2
white flowered hawkweed	*	2
mint spp.	*	2
grass	*	2
unknown	*	2
heart-leaf arnica	*	1
woods strawberry	*	1
rattlesnake plantain	*	1
sidebells pyrola	*	1
meadowrue	*	1

Within eastside, upland forest, UMAs the sub-dominant herbs most commonly found were broadleaf lupine and round-leafed violet. Sub-dominant herbs were not found in 37% of the subplots.

Table HERB-29. Westside UMA, bogs, dominant herb #1 mean subplot coverage and constancy (total sites = 2, total subplots = 276).

Herb Name	Coverage	Constancy
false lily of the valley	4	18
beargrass	9	17
bracken-fern	7	12
not present		12
skunk cabbage	4	11
unknown	3	8
carex spp.	6	8
deer-fern	*	4
swordfern	1	4
rush spp.	1	2
trillium	*	1
western starflower	*	1

Within westside, bog, UMAs the most frequently encountered dominant herbs were false lily of the valley, beargrass, and bracken-fern.

Table HERB-30. Westside UMA, forested wetland, dominant herb #1 mean subplot coverage and constancy (total sites = 6, total subplots = 552).

Herb Name	Coverage	Constancy
skunk cabbage	6	14
carex spp.	6	12
swordfern	4	11
water parsely	4	9
buttercup	7	9
small fruited bulrush	6	9
lady-fern	3	8
not present		8
grass	4	6
false lily of the valley	*	4
piggyback plant	2	3
Oregon oxalis	*	2
deer-fern	*	1
Canada thistle	*	1
licorice-fern	*	1
beadlily	*	1
fireweed	*	1
soft rush	*	1
candy flower	*	1
trillium	*	1

Within westside, forested wetland, UMAs the most common dominant herbs were skunk cabbage, carex species, and swordfern.

Table HERB-31. Westside UMA, upland forest, dominant herb #1 mean subplot coverage and constancy (total sites = 11, total subplots = 886).

Herb Name	Coverage	Constancy
swordfern	6	21
not present		12
beargrass	2	10
grass	4	9
Oregon oxalis	2	6
piggyback plant	2	6
deer-fern	*	5
lady-fern	*	4
unknown	1	4
vanilla leaf	*	3
western starflower	*	3
bleeding heart	*	2
candy flower	*	2
Cooleye's hedgenettle	*	2
dwarf nightshade	*	2
bracken-fern	*	1
inside-out-flower	*	1
false lily of the valley	*	1
sweetscented bedstraw	*	1
penstemon spp.	*	1

Within westside, upland forest, UMAs the most frequently found dominant herbs were swordfern and beargrass. Herbs were not present 12% of the time.

Table HERB-32. Westside UMA, bogs, dominant herb #2 mean subplot coverage and constancy (total sites = 6, total subplots = 273).

Herb Name	Coverage	Constancy
not present		39
bracken-fern	2	16
false lily of the valley	2	15
rush spp.	1	4
deer-fern	*	3
unknown	*	3
beargrass	*	3
carex spp.	*	2
skunk cabbage	*	2
trillium	*	2
bunchberry dogwood	*	2
swordfern	*	2
western starflower	*	2
sedge spp.	*	1
sundew	*	1
grass	*	1
water parsely	*	1
buttercup	*	1
lady-fern	*	1
fireweed	*	1

Within westside, bog, UMAs sub-dominant herbs were most often lacking. When sub-dominant herbs were present they were most frequently bracken-fern and false lily of the valley.

Table HERB-33. Westside UMA, forested wetlands, dominant herb #2 mean subplot coverage and constancy (total sites = 2, total subplots = 550).

Herb Name	Coverage	Constancy
not present		16
lady-fern	2	15
water parsely	3	12
skunk cabbage	2	9
false lily of the valley	1	8
grass	3	7
buttercup	2	5
carex spp.	1	4
swordfern	*	4
small fruited bulrush	2	3
unknown	*	3
piggyback plant	*	2
stinging nettle	*	2
Cooleye's hedgenettle	*	2
sweetscented bedstraw	*	1
leafy miterwort	*	1
licorice-fern	*	1
pioneer violet	*	1
deer-fern	*	1
bleeding heart	*	1

Within westside, forested wetland, UMAs sub-dominant herbs were most frequently lacking. When they were persent they were most commonly lady-fern and water parsley.

Table HERB-34. Westside UMA, upland forests, dominant herb #2 mean subplot coverage and constancy (total sites = 11, total subplots = 886).

Herb Name	Coverage	Constancy
not present		33
swordfern	*	9
lady-fern	*	7
grass	*	6
unknown	*	5
Oregon oxalis	*	4
piggyback plant	*	4
dwarf nightshade	*	3
bleeding heart	*	2
deer-fern	*	2
false lily of the valley	*	2
coolwort foam flower	*	2
vanilla leaf	*	1
inside-out-flower	*	1
bracken-fern	*	1
arrowleaf groundsel	*	1
sweetscented bedstraw	*	1
candy flower	*	1
buttercup	*	1
wood-fern	*	1

Within westside, upland forest, UMAs subdominant herbs were most frequently lacking. When they were present they were most frequently swordfern and lady-fern.

The following tables display total overstory canopy closure, total shrub coverage, total forb coverage, and total grass coverage within subplots. Site and subplot numbers are provided due to the variance of site size. Total subplot number was used to detemine the mean coverages.

MEAN COVERAGE AND CONSTANCIES FOR OVERSTORY CANOPY CLOSURE, TOTAL SHRUBS, FORBS, AND GRAMINOIDS

Table UMACOVER-1. Eastside UMA Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminiods. *Note: Coverage values given are in percent*

UMA TYPE	Forested Wetland	Upland Forest
Canopy	91%	77%
Shrubs	45/93	42/89
Forbs	56/99	20/80
Grass	24/74	38/48
Number of sites	1	2
Number of sub-plots	174	197

Table UMACOVER-2. Westside UMA Mean Coverage/Constancy for Subplot Canopy, Total Shrubs, Forbs and Graminiods. *Note: Coverage values given are in percent*

UMA TYPE	Forested Wetland	Upland Forest	Bog
Canopy	85%	90%	52%
Shrubs	52/78	56/92	83/99
Forbs	56/90	37/85	44/85
Grass	49/59	19/34	53/22
Number of sites	7	18	2
Number of sub-plots	579	1,465	268

Overstory subplot canopy coverage was greater in westside forested wetland UMAs than in similar eastside forested wetlands. Overstory canopy closure was higher in eastside upland forests than in westside upland forests. Shrub and grass coverages and constancies were higher within westside forested wetlands and upland forests than in similar eastside sites. Forb coverage and constancy were nearly equal between the westside and eastside forested wetland and upland UMAs.

Westside bog coverages and constancies can be found in Table UMACOVER-2.

MEAN COVERAGE AND CONSTANCY VALUES FOR WATER, ROCK, SOIL, ORGANIC GROUND COVER (OGC), DOWNED WOOD 1 (DW1), DOWNED WOOD 2 (DW2), & DOWNED WOOD 3 (DW3).

The following tables display the coverage and constancy values for total water, rock, soil, and organic ground cover. The number of subplots sampled is provided in parenthesis next to the UMA type.

Water coverage is based on open water. Rock coverage is based on exposed rock, and soil coverage is based on exposed soil. Organic ground cover includes litter, duff, mosses, lichens, and fungi. Organic ground cover does not include the downed wood coverage.

Downed wood classes are based on the amount of decay the log exhibits. Downded wood 1 logs are recently fallen trees with tight bark. Downed wood 2 logs are beginning to decay on the outside, but still have a solid center. Downed wood 3 logs are decayed throughout.

UMAs

		Eastside			Westside	
UMA Type	B	FW (174)	UF (197)	B (268)	FW (579)	UF (1465)
Water	N.A.	10/10	0/0	3/1	17/13	15/6
Rock	N.A.	0/0	15/22	21/3	6/1	26/22
Soil	N.A.	11/21	10/13	20/6	7/16	11/15
OGC	N.A.	93/100	93/100	96/99	93/99	91/99
		Eastside			**Westside**	
UMA Type	B	FW (174)	UF (197)	B (268)	FW (579)	UF (1465
DW1	N.A.	10/8	7/9	9/1	9/6	11/10
DW2	N.A.	8/14	10/50	15/5	10/13	10/18
DW3	N.A.	7/12	6/21	20/31	19/36	14/29

LIVE TREE DENSITY

Tree diameter was measured in the following four inch size class intervals:

Size Class	Diameter in inches
1	0.0 - 3.9
2	4.0 - 7.9
3	8.0 - 11.9
4	12.0 - 15.9
5	16.0 - 19.9
6	20.0 - 23.9
7	24 +

Data were analyzed to determine the number of trees per acre and per 1000 feet within each of their size classes. Size class analysis occurred on sizes 1-7, 2-7, 3-7, 4-7. When the last size class to be shown is 3-7 it is implied that there are no trees larger than 11.9 inches in diameter within the defined category.

To be analyzed as a live tree one of the following criteria was met: live tree - undamaged, live tree - 1/3 to 1/2 of the top broken, live tree - dead top. Minimum height was 4.5 feet. There was no minimum diameter size requirement. All trees were grouped together by size class and category.

Live tree data follows:

UMA-1. Eastside, Forested Wetland UMA Mean Tree Density - Conifers

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT.	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	34	112	1	11
	2-7	12	41	1	11
	3-7	5	16	1	9
	4-7	2	7	1	8

Table UMA-2. Eastside, Forested Wetland UMA Mean Tree Density - Hardwoods

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	30	100	1	12
	2-7	22	73	1	12
	3-7	19	61	1	12
	4-7	13	44	1	12

Eastside, forested wetland, UMAs had similar numbers of hardwoods and conifers per acre. Although the number of conifers are nearly equal to the number of hardwoods there were more hardwoods over size class 4.

Table UMA-3. Eastside, Upland Forest UMA Mean Tree Density - Conifers

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	96	383	2	11
	2-7	63	255	2	11
	3-7	27	108	2	11
	4-7	5	19	2	9

Table UMA-4. Eastside, Upland Forest UMA Mean Tree Density - Hardwoods

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	18	69	2	10
	2-7	16	62	2	10
	3-7	10	40	2	10
	4-7	7	25	2	7

Eastside, upland forest, UMAs had more conifers per acre than hardwoods. The conifers also were larger.

Table UMA-5. Westside, Forested Wetland UMA Mean Tree Density - Conifers

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	31	110	7	35
	2-7	14	70	7	34
	3-7	8	44	7	31
	4-7	5	24	7	27

Table UMA-6. Westside, Forested Wetland UMA Mean Tree Density - Hardwoods

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	45	135	7	36
	2-7	28	94	7	34
	3-7	11	44	7	31
	4-7	5	19	6	28

Westside, forested wetland, UMAs were dominated by hardwoods. The majority of the trees within these sites were below 12 inches in diameter.

Table UMA-7. Westside, Upland Forest UMA Mean Tree Density - Conifers

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	34	132	16	73
	2-7	18	70	16	70
	3-7	11	43	15	59
	4-7	6	26	15	51

Table UMA-8. Westside, Upland Forest UMA Mean Tree Density - Hardwoods

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	49	189	17	85
	2-7	30	130	16	83
	3-7	18	70	16	80
	4-7	9	39	15	75

Westside, upland forest, UMAs had a higher concentration of hardwoods per acre than conifers.

Table UMA-9. Westside, Bog UMA Mean Tree Density - Conifers

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
B	1-7	29	566	2	11
	2-7	8	110	2	11
	3-7	3	22	2	11
	4-7	2	6	2	8

Table UMA-10. Westside, Bog UMA Mean Tree Density - Hardwoods

UMA TYPE	SIZE CLASS	TREES/ ACRE	TREES/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
B	1-7	86	335	2	12
	2-7	4	15	2	8
	3-7	1	7	1	6
	4-7	1	1	1	2

Westside, bog, UMAs contained a greater number of hardwoods per acre than conifers. Over 80% of these hardwoods were below four inches in diameter. High tree densities within bog UMAs is attributed to the ring of trees left around the actual bog post harvest.

SNAG DENSITY

Snags were defined in the following manner: recent dead (needles or leaves dead, yet still on the tree), dead tree - tight bark, or dead tree - loose bark. Minimum height was 4.5 feet. There was no minimum diameter size requirement. All snags were grouped together by size class and category.

Table UMA-11. Eastside, Forested Wetland UMA Mean Snag Density - Conifers

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	1	5	1	6
	2-7	1	3	1	5
	3-7	1	1	1	3

Table UMA-12. Eastside, Forested Wetland UMA Mean Snag Density - Hardwoods

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	5	17	1	8
	2-7	5	15	1	8
	3-7	3	9	1	5
	4-7	1	1	1	3

Eastside, forested wetland, UMAs contained more hardwood snags per acre than conifer snags.

Table UMA-13. Eastside, Upland Forest UMA Mean Snag Density - Conifers

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	36	145	2	11
	2-7	24	97	2	11
	3-7	5	19	2	10
	4-7	1	2	2	4

Table UMA-14. Eastside, Upland Forest UMA Mean Snag Density - Hardwoods

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	9	33	2	9
	2-7	8	28	2	8
	3-7	2	14	1	3
	4-7	1	3	1	2

Eastside, upland forest, UMAs contained more conifer snags per acre than hardwood snags.

Table UMA-15. Westside, Forested Wetland UMA Mean Snag Density - Conifers

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	4	24	4	15
	2-7	3	19	4	14
	3-7	1	8	4	11
	4-7	1	7	3	8

Table UMA-16. Westside, Forested Wetland UMA Mean Snag Density - Hardwoods

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
FW	1-7	5	25	6	19
	2-7	3	15	6	15
	3-7	1	6	4	8
	4-7	1	3	1	4

Westside, forested wetland, UMAs contained a similar number of hardwood snags per acre as conifer snags per acre.

Table UMA-17. Westside, Upland Forest UMA Mean Snag Density - Conifers

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	7	25	14	41
	2-7	2	11	14	35
	3-7	1	7	12	24
	4-7	1	4	10	20

Table UMA-18. Westside, Upland Forest UMA Mean Snag Density - Hardwoods

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
UF	1-7	4	22	16	65
	2-7	3	16	16	59
	3-7	1	8	10	33
	4-7	1	4	11	22

Westside, upland forest, UMAs contained more conifer snags per acre than hardwood snags.

Table UMA-19. Westside, Bog UMA Mean Snag Density - Conifers

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
B	1-7	1	3	2	3
	2-7	1	2	2	2

Table UMA-20. Westside, Bog UMA Mean Snag Density - Hardwoods

UMA TYPE	SIZE CLASS	SNAGS/ ACRE	SNAGS/ 1000 FT	NUMBER OF SITES	NUMBER OF STRIPS
B	1-7	4	22	16	65
	2-7	3	16	16	59
	3-7	1	8	10	33
	4-7	1	4	11	22

Westside, bog, UMAs contained more hardwood snags per acre than conifer snags.

RECOMMENDATIONS

Site Selection

To make the process of site selection more efficient, a master list of FPAs containing either RMZs/UMAS shall be requested from the DNR Forest Practice Rules and Regulations office in Olympia. Included on this list will be: FPA number, the number of UMAs, UMA acreage, water types of RMZs, length of RMZs, Township, Range, and section number, owners first and last name, and the owners phone number. Individual FPAs can then be requested from the DNR regional offices. This will eliminate the need to visit each region's office individually.

Sampling Methods

Record blowdowns in the tree data by the species, diameter at breast height, and with a "B". Record only those blowdowns that, when standing, were within the macroplot.

Record RMZ/UMA length measured by the following formula:

(# of strips sampled X 250 ft.) - 250 ft.

Strips are 250 ft. apart with strip # 1 begining at zero feet, therefore the subtraction of 250 ft. Using this formula provides a more accurate representation of RMZ/UMA length sampled.

Record the distance to the nearest road in 50 foot intervals as opposed to the nearest foot.

On the east side of the state, end the sampling effort at 30 feet when the harvest boundary, due to selective cuts, is not easily identified. Where harvest unit boundary can be identified, end the sampling effort at that point.

For UMAs, record the distance to the nearest type 1, 2, 3, or 4 water in feet.

Plant Association Community Classification System

Currently Forest Service Plant Association Keys are used to characterize sampled sites. The majority of these keys were written for areas of higher elevation than we sample with little emphasis was given to riparian areas. Similar keys can be created from our data base for the lower elevation riparian zones we sampled by conducting a statistical cluster analysis to our data. These new keys could be tailored for riparian area classification. The new keys would be more accurate when applied to this project.

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APPENDIX A

LIST OF ABBREVIATIONS SCIENTIFIC AND COMMON NAMES OF TREES AND SHRUBS

TREES

CODE	SCIENTIFIC NAME	COMMON NAME
ABAM	Abies amabilis	Pacific silver fir
ABGR	Abies grandis	grand fir
ABLA2	Abies lasiocarpa	subalpine fir
ABPR	Abies procera	noble fir
ACMA	Acer macrophyllum	bigleaf maple
ALRU	Alnus rubra	red alder
ARM	Arbutus menziesii	Pacific madrone
BEGL	Betula occidentalis	water birch
BEPA	Betula papyrifera	paper birch
CONU	Cornus nuttallii	Pacific dogwood
FRLA	Fraxinus latifolia	Oregon ash
LAOC	Larix occidentalis	Western larch
PIEN	Picea engelmannii	Englemann spruce
PISI	Picea sitchensis	Sitka sprue
PICO	Pinus contorta	lodgepole pine
PIMO	Pinus monticola	western white pine
PIPO	Pinus ponderosa	ponderosa pine
POTR	Populus tremuloides	quaking aspen
POTR2	Populus trichocarpa	black cottonwood
PREM	Prunus emarginata	bitter cherry
PSME	Pseudotsuga menziesii	Douglas-fir
SALIX	Salix spp.	willow
TABR	Taxus brevifolia	Pacific yew
THPL	Thuja plicata	western red cedar
TSHE	Tsuga heterophylla	western hemlock
TSME	Tsuga mertensiana	mountain hemlock

SHRUBS

CODE	SCIENTIFIC NAME	COMMON NAME
ACCI	Acer circinatum	vine maple
ACGLD	Acer glabrum	Douglas maple var. douglasii
ALIN	Alnus incana	mountain alder
ALNUS	Alnus spp.	alder
ALSI	Alnus sinuata	Sitka alder
AMAL	Amalanchier alnifolia	serviceberry
ARUV	Arctostaphylos uva-ursi	bearberry
BENE	Berberis nervosa	Cascade Ore grape
BERE	Berberis repens	Oregon grape
CEVE	Ceanothus velutinus	snowbrush ceanothus
CHUM	Chimaphyla umbellata	common prince's-pine
CONU	Cornus nuttallii	pacific dogwood
COST	Cornus stolonifera	red-osier dogwood
COCO2	Corylus cornuta	hazelnut
CRDO	Crataegus douglasii	black hawthorn
CYSC	Cytisus scoparius	Scot's broom
GASH	Gaultheria shallon	salal
HODI	Holodiscus discolor	ocean-spray
HOLLY	Ilex spp.	holly
KAOC	Kalmia occidentalis	swamp laurel
LEGL	Ledum glandulosum	smooth Labrador-tea
LIBOL	Linnaea borealis	twinflower var. longiflora
LONIC	Lonicera spp.	honeysuckle
LOIN	Lonicera involucrata	black twin-berry
LOUT2	Lonicera utahensis	Utah honeysuckle
MEFE	Menziesia ferruginea	rusty menziesia
OECE	Oemleria cerasiformis	Indian plum
OPHO	Oplopanax horridum	devil's club
PAMY	Pachistima myrsinities	pachistima
PHLE2	Philadelphus lewisii	mockorange
PHCA3	Physocarpus capitatus	Pacific ninebark
PHMA	Physocarpus malvaceus	mallow ninebark
PREM	Prunus emarginata	bittercherry
PRVI	Prunus virginiana	common chokecherry
PYFU	Pyrus fusca	western crabapple
RHPU	Rhamnus purshiana	cascara
RHAL	Rhododendron albiflorum	white rhododendron
RHDI	Rhus diversiloba	poison-ivy
RIBES	Ribes spp.	currant

RIBR	Ribes bracteosum	stink currant
RICE	Ribes cereum	wax currant
RILA	Ribes lacustre	prickly currant
RIVI	Ribes viscosissimum	sticky currant
ROSA	Rosa spp.	rose
ROGY	Rosa gymnocarpa	baldhip rose
RONUH	Rosa nutcana var. hispida	bristly Nootka rose
ROWO	Rosa woodsii	Wood's rose
RUBUS	Rubus spp.	rubus
RUDI	Rubus discolor	Himalayan blackberry
RULA	Rubus lasiococcus	dwarf bramble
RULE	Rubus leucodermis	blackcap
RUPA	Rubus parviflorus	westrn thimbleberry
RUSP	Rubus spectabilis	salmonberry
RUURU	Rubus ursinus	trailing blackberry
SALIX	Salix spp.	Willow
SASC	Salix scouleriana	Scouler willow
SACE	Sambucus cerulea	blue elderberry
SARA	Sambucus racemosa	red elderberry
SHCA	Shepherdia canadensis	russet buffaloberry
SOSC2	Sorbus scopulina	mountain ash
SPBEL	Spirea betulifolia	shiny leaf spirea var. lucinda
SPDO	Spirea douglasii	hardhack
SYAL	Symphoricarpos albus	common snowberry
SYMOH	Symphoricarpos mollis	creeping snowberry var. hesperius
VACCI	Vaccinium spp.	huckleberry
VAAL	Vacciniun alaskaense	Alaska huckleberry
VAME	Vaccinium membranaceum	big huckleberry
VAMY	Vaccinium myrtillus	low huckleberry
VAOV2	Vaccinium ovatum	evergreen huckleberry
VAPA	Vaccinium parvifolium	red huckleberry
VASC	Vaccinium scoparium	grouse huckleberry

HERBS

CODE	SCIENTIFIC NAME	COMMON NAME
ACMI	Achillea millefolium	common yarrow
ACRU	Actaea rubra	baneberry
ACTR	Achyls triphylla	vanilla leaf
ADBI	Adenocaulon bicolor	pathfinder
ADPE	Adiantum pedatum	maidenhair fern
AGUR	Agastache urticifolia	nettle-leaf horse-mint
AGSP	Agropyron spicatum	bluebunch wheatgrass
ANMA	Anaphalis margaritacea	pearly-everlasting
ARNU3	Aralia nudicaulis	wild sasparilla
ARMA3	Arenaria macrophylla	bigleaf sandwort
ARCO	Arnica cordifolia	heart-leaf arnica
ARSY	Aruncus sylvester	goatsbeard
ASCA3	Asarum caudatum	wild ginger
ASTER	Aster spp.	Aster
ASCO	Aster conspicuus	showy aster
ATFI	Athyrium filix-femina	lady-fern
BLSP	Blechnum spicant	deerfern
BROMU	Bromus spp.	brome
BRBR	Bromus brizaeformis	rattle grass
BRVU	Bromus vulgaris	Columbia brome
CARO	Campanula rotudifolia	harebell
CARU	Calamagrostis rubescens	pinegrass
CAREX	Carex spp.	carex
CACO	Carex concinnoides	northwest sedge
CAGE	Carex geyeri	elk sedge
CASTI	Castilleja spp.	Indian-paintbrush
CIAR	Cirsium arvense	Canada thistle
CIRSI	Cirsium spp.	thistle
CIVU	Cirsium vulgare	bull thistle
CLCOL	Clematis columbiana	Columbia clematis
CLUN	Clintonia uniflora	beadlily
COCA	Cornus canadensis	bunchberry dogwood
COSC	Corydalis scouleri	Scouler's corydalis
CYMO	Cypripedium montanum	mountain lady's-slipper
DAGL	Dactylis glomerata	orchard-grass
DELPH	Delphinium spp.	larkspur
DIFO	Dicentra formosa	bleeding heart
DIPU	Digitalis purpurea	foxglove
DIHO	Disporum hookeri	Hooker fairy-bell

DITR	Disporum trachycarpum	wartberry fairy-bell
DRRO	Drosera rotundifolia	sundew
DRAU2	Dryopteris austriaca	wood-fern
EPAN	Epilobium angustifolium	fireweed
ERIGE	Erigeron spp.	daisy
EQUIS	Equisetum spp.	horsetail
EQAR	Equisetum arvense	common horsetail
FEID	Festuca idahoensis	Idaho fescue
FRAGA	Fragaria spp.	strawberry
FRVE	Fragaria vesca	woods strawberry
FRVI	Fragaria virginiana	broadpetal strawberry
GABO	Galium boreale	northern bedstraw
GATR	Galium triflorum	sweetscented bedstraw
GEVI	Geranium viscosissimum	sticky purple geranium
GEUM	Geum macrophyllum	Oregon avens
GLHE	Glecoma hederacea	ground ivy
GOOB	Goodyera oblongifolia	western rattlesnake plaintain
GYDR	Gymnocarpium dryopteris	oakfern
HELA	Heracleum lanatum	cow-parsnip
HEMI	Heuchera micrantha	alumroot
HEUCH	Heuchera spp.	alumroot
HIAL	Hieracium albiflorum	white-flowered hawkweed
HYTE	Hydrophyllum tenuipes	waterleaf
JUNUC	Juncus spp.	rush
JUEFE	Juncus effusus	soft rush
LACTU	Lactuca spp.	lettuce
LAMU	Lactuca muralis	wall lettuce
LOMAT	Lomatium spp.	biscuit-root
LUPIN	Lupinus spp.	lupine
LULAS	Lupinus latifolius	broadleaf lupine
LUSEA	Lupinus sericeus	silky lupine
LUZSP	Luzula spp.	woodrush
LYCL	Lycopodium clavatum	stag's horn moss
LYAM	Lysichitum americanum	skunk cabbage
MADI2	Maianthemnum dilatatum	false lilly of the valley
MAOR	Marah oreganus	bigroot
MELI	Melampyrum lineare	cow-wheat
MECI	Mentha citrata	bergamot mint
MENTH	Mentha spp.	mint
MILE	Mimulus lewisii	Lewis' monkey-flower
MIGU	Mimulus guttatus	yellow monkey-flower

MICA3	Mitella caulescens	leafy mitrewort
MOSI	Montia sibirica	miner's lettuce
OESA	Oenanthe sarmentosa	water-parsley
OSCH	Osmorhiza chilensis	mountain sweet-root
OXOR	Oxalis oregana	Oregon oxalis
PEBRA	Pedicularis bracteosa	bracted lousewort
PEFR	Petasites frigidus	coltsfoot
PENST	Penstemon spp.	beardtongue
PESA	Petasites sagittatus	arrowleaf coltsfoot
PHAR	Phalaris arundinacea	canarygrass
PLRE	Pleuropogon refractus	nodding semaphoregrass
POGL	Polypodium glycyrrhiza	licorice-fern
POMU	Polystichum munitum	swordfern
POA	Poa spp.	bluegrass
PRVU	Prunella vulgaris	self-heal
PTAQ	Pteridium aquilinum	bracken fern
PYAS	Pyrola asarifolia	alpine pyrola
PYPI	Pyrola picta	white vein pyrola
PYSE	Pyrola secunda	sidebells pyrola
RANUN	Ranunculus spp.	buttercup
RUMEX	Rumex spp.	dock
SAAC	Satureja acinos	savory
SCMI	Scirpus microcarpus	small-fruited bulrush
SESP	Sedum spathulifolium	broadleaf stonecrop
SEJA	Senecio jacobaea	tansy ragwort
SETR	Senecio triangularis	arrowleaf groundsel
SODU2	Solanum dulcamara	climbing nightshade
SOCA	Solidago canadensis	meadow goldenrod
SMRA	Smilacina racemosa	western Solomon-plume
SMST	Smilacina stellata	starry solomon-plume
STCO4	Stachys cooleyae	Cooley's betony
STAM	Streptopus amplexifolius	claspleaf twistedstalk
STRO	Streptopus rosea	rosey twisted-stalk
TARAX	Taraxacum spp.	dandelion
TAOF	Taraxacum officinale	common dandelion
TEGR	Tellima grandiflora	fringecup
THOC	Thalictrum occidentale	meadowrue
TITR	Tiarella trifoliata	coolwort foamflower
TOME	Tolmiea menziesii	piggyback plant
TRCA3	Trautvetteria caroliniensis	false bugbane
TRLA2	Trientalis latifolia	western starflower
TRIFO	Trifolium spp.	clover

TROV	Trillium ovatum	trillium
TYLA	Typha latifolia	common cat-tail
VAHE	Vancouveria hexandra	inside-out-flower
VECA	Veratrum californicum	California false hellebore
VIOLA	Viola spp.	violet
VIGL	Viola glabrella	pioneer violet
VIOR2	Viola orbiculata	round-leaved violet
URDI	Urtica dioica	stinging nettle
XETE	Xerophyllum tenax	beargrass

APPENDIX B

KEY CONTACTS: SOURCE FOR FOREST PRACTICE INFORMATION

DEPARTMENT OF NATURAL RESOURCES

REGION	NAME	TITLE	TELEPHONE
CEN	John Baarspul	FP Regional Coordinator	(206) 753-3410
CEN	Debie Boyd	FP Admin Asst	(206) 753-3410
NE	Bob Anderson	FP Regional Coordinator	(509) 684-5201
NE	Bob Hartley	Deer Park FP Forester	(509) 684-5201
NE	Al Lang	Chewelah FP Forester	(509) 684-5201
NE	Diana Hoffman	FP Admin Asst	(509) 684-5201
NE	Mel Kuipers	Republic FP Forester	(509) 684-5201
NE	Don Strand	Colville FP Forester	(509) 684-5201
NW	Dave Dietzman	FP Regional Coordinator	(206) 856-0083
NW	Diane Paustain	FP Admin Asst	(206) 856-0083
OLY	Russ Holt	Sequim FP Forester	(206) 374-6131
OLY	Dan Christensen	Ozette FP Forester	(206) 374-6131
OLY	Wayne Radcliff	Quinalt FP Forester	(206) 288-2448
OLY	Jackie Simmons	FP Admin Asst	(206) 374-6131
OLY	Jack Zaccardo	FP Regional Coordinator	(206) 374-6131
SPS	Diane Andersen	FP Admin Asst	(206) 825-1631
SPS	Ben Cleveland	FP Regional Coordinator	(206) 825-1631
SE	Don Aden	South Half FP Forester	(509) 962-1006
SE	Linda Hazlett	FP Admin Asst	(509) 925-6131
SE	Len Riggin	North Half FP Forester	(509) 962-1006
SE	Ben Startt	FP Regional Coordinator	(509) 925-6131
SW	Llyod Handlos	FP Regional Coordinator	(206) 577-2025
SW	Shirley Shea	FP Admin Asst	(206) 577-2025

WEYERHAEUSER

REGION	NAME	TITLE	TELEPHONE
CEN	John Helm	Area Forester	(206) 748-8661
CEN	Ken Lentz	District Engineer	(206) 748-1167
CEN	Kieth Metcalf	District Engineer	(206) 942-2442
CEN	Tim Shere	District Engineer	(206) 942-2442
CEN	Warren Sorenson	District Engineer	(206) 748-8661
OLY	Don Jordan	District Engineer	(206) 532-7110
SPS	Steve Anderson	TFW Industry Coord.	(206) 888-2511
SPS	Mike Bradley	Area Forester	(206) 825-5715
SW	John Keatly	TFW Industry Coord.	(206) 425-2150

SW	Jim Booher	District Engineer	(206) 425-2150

PLUM CREEK

REGION	NAME	TITLE	TELEPHONE
NE	Dwight Opp	Timberlands Superint.	(509) 447-3686
SPS	Gary Johnson	Timberlands Superint.	(206) 825-5596
SE	Pete Heide	Timberlands Superint.	(509) 649-2218
SE	Steve Griswold	Forester	(509) 649-2218
SW	Roger Wimer	Production Superint.	(206) 636-2650

OTHER INDUSTRY

REGION	NAME	COMPANY	TELEPHONE
CEN	Al Cain	Campbell Group	(206) 532-7331
CEN	John Ensinger	Menesha	(206) 754-1711
CEN	Bob Schwarz	Murray Pacific	(206) 492-5981
NE	Steve Tveit	Boise Cascade	(509) 738-6421
NE	Wayne Vaagen	Vaagen Bros.	(509) 684-5071
NW	Dave Chaimberlain	Georgia Pacific	(206) 733-4410
NW	Pete Poeschol	Poeschol & Schultz	(206) 659-5666
NW	Bill Rawlins	Crown Pacific	(206) 826-3951
NW	Norm Schaaf	Crown Pacific	(206) 826-3951
OLY	Frank Phillips	ITT Rayonier	(206) 374-6565
SPS	Craig Beals	Champion International	(206) 879-5311
SPS	Vaughn Webb	Pope Resources	(206) 297-3341
SPS	Mike Masman	PBMCO Land Trust	(206) 624-5810
SPS	Dave Baxtrum	Simpson Timber	(206) 426-3381
SE	Jeff Davies	Boise Cascade	(206) 925-5341
SE	Bill Hatch	Boise Cascade	(509) 773-4343
SE	Bill Howard	Boise Cascade	(509) 453-3131
SE	Jeff Jones	Boise Cascade	(509) 925-5341
SE	Bob McGruder	Boise Cascade	(509) 925-5341
SW	Marc Norberg	International Paper	(206) 423-2110
SW	Monte Martinsen	Longview Fibre	(206) 425-1550

DEPARTMENT OF WILDLIFE

REGION	NAME	TITLE	TELEPHONE
I	John Whalen	TFW Biologist	(509) 456-4082
II	John Rohrer	TFW Biologist	(509) 754-4624
III	Bill Weiler	TFW Biologist	(509) 575-2740
IV	Dana Base	TFW Biologist	(509) 629-2488
V	Bob Bicknell	TFW Biologist	(206) 274-9814
VI	Gloria Mitchell	TFW Biologist	(206) 753-2600

HQ	Andy Carlson	TFW Biologist	(206) 753-3318
HQ	John Mankowski	TFW Program Manager	(206) 753-3318
HQ	Pete Haug	Systems Biologist	(206) 753-3318

DEPARTMENT OF REVENUE

NAME	TITLE	TELEPHONE
Joyce Fouts	Systems Analyst	(206) 753-5573