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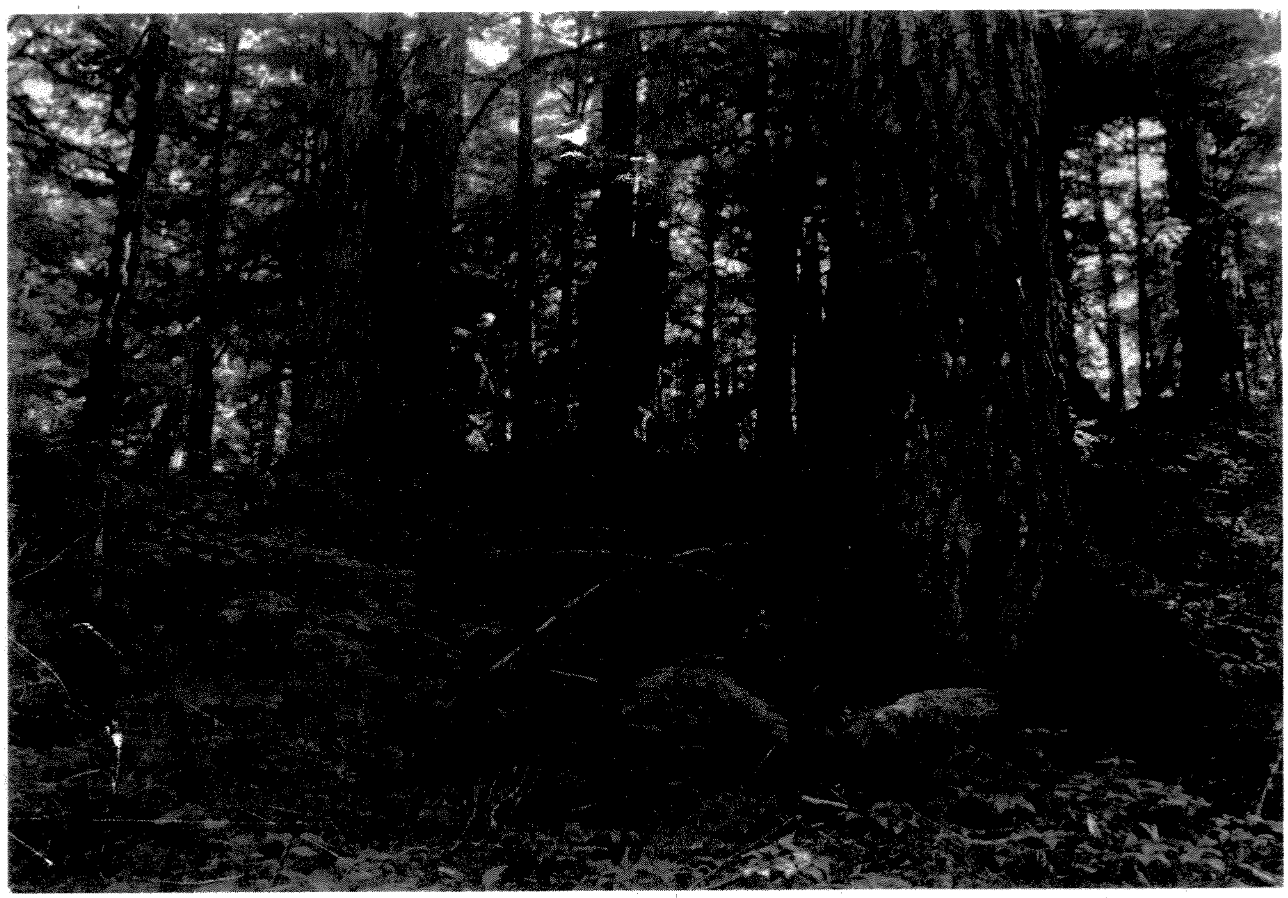
Forest Plant Association Management Guide

Ketchikan Area
Tongass National Forest



FOREST PLANT ASSOCIATION MANAGEMENT GUIDE
Ketchikan Area, Tongass National Forest

by

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PLANT ASSOCIATION LIST

TSHE Series - Western Hemlock

110 TSHE/VACCI	Western Hemlock/Blueberry
120 TSHE/VACCI/DRAU2	/Blueberry/Shield Fern
130 TSHE/VACCI/LYAM	/Blueberry/Skunk Cabbage
140 TSHE/VACCI-OPHO	/Blueberry-Devil's Club
150 TSHE/OPHO-RUSP	/Devil's Club-Salmonberry

TSHE-CHNO Series - Western Hemlock-Yellowcedar

210 TSHE-CHNO/VACCI	Western Hemlock-Yellowcedar/Blueberry
220 TSHE-CHNO/VACCI/LYAM	/Blueberry/Skunk Cabbage
250 TSHE-CHNO/VACCI-OPHO	/Blueberry-Devil's Club

PISI Series - Sitka Spruce

310 PISI/VACCI	Sitka Spruce/Blueberry
320 PISI/VACCI-OPHO	/Blueberry-Devil's Club
330 PISI/OPHO	/Devil's Club
335 PISI/OPHO-RUSP	/Devil's Club-Salmonberry
340 PISI/OPHO/LYAM	/Devil's Club/Skunk Cabbage
350 PISI/ALRU	/Red Alder
360 PISI/CANU	/Pacific Reedgrass
370 PISI/VACCI/LYAM	/Blueberry/Skunk Cabbage
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390 PISI-TSME/VACCI	-Mountain Hemlock/Blueberry
391 PISI-TSME/VACCI/CABI	-Mountain Hemlock/Blueberry/Marsh Marigold

MXD CON Series - Mixed Conifer

410 MXD CON/VACCI	Mixed Conifer/Blueberry
420 MXD CON/VACCI/LYAM	/Blueberry/Skunk Cabbage
430 MXD CON/VACCI/FACR	/Blueberry/Deer Cabbage
460 MXD CON/VACCI-GASH	/Blueberry-Salal
465 MXD CON/VACCI-GASH/FACR	/Blueberry-Salal/Deer Cabbage
470 MXD CON/GASH/LYAM	/Salal/Skunk Cabbage
480 MXD CON/GASH	/Salal
490 MXD CON/CLPY/FACR	/Copperbush/Deer Cabbage

TSME Series - Mountain Hemlock

510 TSME/VACCI	Mountain Hemlock/Blueberry
520 TSME/CLPY	/Copperbush
530 TSME/CASSI	/Cassiope

PICO Series - Shore Pine

610 PICO/EMNI	Shore Pine/Crowberry
630 PICO/CASI3	/Sitka Sedge
640 PICO/SCCA2	/Tufted Clubrush
650 PICO/GASH	/Salal

TSHE-THPL Series - Western Hemlock-Western Redcedar

710 TSHE-THPL/VACCI	Western Hemlock-Western Redcedar/Blueberry
720 TSHE-THPL/POMU	/Swordfern
730 TSHE-THPL/VACCI/LYAM	/Blueberry/Skunk Cabbage
750 TSHE-THPL/VACCI, WD	/Blueberry, Well Drained
760 TSHE-THPL/VACCI-GASH	/Blueberry-Salal
765 TSHE-THPL/VACCI-GASH/LYAM	/Blueberry-Salal/Skunk Cabbage
780 TSHE-THPL/GASH	/Salal

Total 41 Associations

FOREST PLANT ASSOCIATION KEYS

KEY TO VEGETATION SERIES, KETCHIKAN AREA

Text in bold provides an overview of the ecological zones. Follow the numbered couplets to determine the vegetation series. Individual keys for plant associations within each series immediately follow this key.

1. Mountain hemlock cover is at least 20 %.

Mountain Hemlock Ecological Zone
High elevation, cold temperatures

2. Sitka spruce cover is at least 10 %.

Sitka Spruce Ecological Zone (High Elevation Portion Only)
Soils characterized by disturbance: soil water movement

SITKA SPRUCE SERIES, High Elevation Associations (Chapter 9, part)

2. Sitka spruce cover is less than 10 %.

MOUNTAIN HEMLOCK SERIES (Chapter 8)

1. Mountain hemlock cover is less than 20 %.

3. Shore pine cover is at least 20%.

Cedar-Hemlock Ecological Zone
Generally poor soil drainage. Lowlands, rolling hills, benches. Includes Shore Pine, Mixed Conifer, and Western Hemlock-Western Redcedar Series (part).

SHORE PINE SERIES (Chapter 3).

3. Shore pine cover is less than 20%.

4. Sum of mountain hemlock overstory cover and understory cover is at least 3%.

MIXED CONIFER SERIES (Chapter 4)

4. Sum of mountain hemlock overstory cover and understory cover less than 3%.

5. Western redcedar cover is at least 10%.

WESTERN HEMLOCK-WESTERN REDCEDAR SERIES (Chapter 5)

5. Western redcedar cover is less than 10%.

Western Hemlock Ecological Zone
Generally well-drained hill- and mountainsides.
Includes Western Hemlock, Western Hemlock-Yellowcedar, and Western Hemlock-Western Redcedar Series (Part)

6. Yellowcedar cover is at least 10%.

WESTERN HEMLOCK-YELLOWCEDAR SERIES (Chapter 7)

6. Yellowcedar cover is less than 10%.

7. Sitka spruce cover is at least 15%.

Sitka Spruce Ecological Zone
Characterized by disturbance: Alluvial, beachfront, mass movement, or excessive soil water movement soils

SITKA SPRUCE SERIES (Chapter 9)

7. Sitka spruce cover is less than 15%.

WESTERN HEMLOCK SERIES (Chapter 6)

KEY TO SHORE PINE SERIES (600)

Barely forest, this series represents a transition from non-forest peatlands (muskegs) to open forest (Mixed Conifer). Mostly on lowlands and rolling hills below 1,000 feet elevation.

CODE

1. Tufted clubrush cover is at least 3%.

640 SHORE PINE/TUFTED CLUBRUSH

1. Tufted clubrush is less than 3%.

2. Sitka sedge (tall sedge) cover is at least 3%.

630 SHORE PINE/SITKA SEDGE

2. Sitka sedge cover is less than 3%.

3. Salal cover is at least 5%.

650 SHORE PINE/SALAL

3. Salal cover is less than 5%.

610 SHORE PINE/CROWBERRY

KEY TO MIXED CONIFER SERIES (CODE 400)

Covering vast acreages of the Ketchikan Area, this series forms the bulk of the Cedar-Hemlock Ecological Zone. Characterized by restricted soil drainage, mixed conifer is most common on lowlands and rolling hills, but can be found on hill- and mountainsides as well.

CODE

1. Copperbush cover is at least 3%.

490 MIXED CONIFER/COPPERBUSH/DEER CABBAGE

1. Copperbush cover is less than 3%.

2. Salal cover is at least 5%.

3. Deer cabbage cover is at least 2%.

465 MIXED CONIFER/BLUEBERRY-SALAL/DEER CABBAGE

3. Deer cabbage cover is less than 2%.

4. Skunk cabbage is at least 3%.

470 MIXED CONIFER/SALAL/SKUNK CABBAGE

4. Skunk cabbage is less than 3%.

5. Blueberry cover is at least 10%.

460 MIXED CONIFER/BLUEBERRY-SALAL

5. Blueberry cover is less than 10%.

480 MIXED CONIFER/SALAL

2. Salal cover is less than 5%.

6. Deer cabbage cover is at least 2%.

430 MIXED CONIFER/BLUEBERRY/DEER CABBAGE

6. Deer cabbage cover is less than 2%.

7. Skunk cabbage cover is at least 3%.

420 MIXED CONIFER/BLUEBERRY/SKUNK CABBAGE

7. Skunk cabbage cover is less than 3%.

410 MIXED CONIFER/BLUEBERRY

KEY TO WESTERN HEMLOCK-WESTERN REDCEDAR SERIES (700)

Transition from the Cedar-Hemlock to Western Hemlock Ecological Zone, on a variety of landforms up to 1,000 feet elevation.

CODE

1. Salal cover is 3% or greater.

    2. Skunk cabbage cover is 3% or greater.

765 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY-SALAL/SKUNK CABBAGE

    2. Skunk cabbage cover is less than 3%.

        3. Blueberry cover is 5% or greater.

760 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY-SALAL

        3. Blueberry cover is less than 5%.

780 WESTERN HEMLOCK-WESTERN REDCEDAR/SALAL

1. Salal cover is less than 3%.

    4. Swordfern cover is 3% or greater.

720 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY/SWORDFERN

    4. Swordfern cover is less than 3%.

        5. Skunk cabbage cover is 3% or greater.

730 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY/SKUNK CABBAGE

        5. Skunk cabbage cover is less than 3%.

            6. Combined cover of shield fern and devil's club is at least 5%.

750 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY, WELL-DRAINED VARIANT

            6. Combined cover of shield fern and devil's club is less than 5%.

710 WESTERN HEMLOCK-WESTERN REDCEDAR/BLUEBERRY

KEY TO WESTERN HEMLOCK SERIES (CODE 100)

Generally on well-drained hill- and mountainsides, this series comprises the bulk of the Western Hemlock Ecological Zone.

CODE

1. Devil's club cover is 10% or greater.

    2. Salmonberry cover is 10% or greater.

150 WESTERN HEMLOCK/DEVIL'S CLUB-SALMONBERRY

    2. Salmonberry cover is less than 10%.

140 WESTERN HEMLOCK/BLUEBERRY/DEVIL'S CLUB

1. Devil's club cover is less than 10%.

    3. Skunk cabbage cover is 3% or greater.

130 WESTERN HEMLOCK/BLUEBERRY/SKUNK CABBAGE

    3. Skunk cabbage cover is less than 3%.

        4. Spinulose shield fern cover is 2% or greater.

120 WESTERN HEMLOCK/BLUEBERRY/SHIELD FERN

        4. Spinulose shield fern cover is less than 2%.

110 WESTERN HEMLOCK/BLUEBERRY

KEY TO WESTERN HEMLOCK-YELLOWCEDAR SERIES (CODE 200)

Most common at higher elevations (1,000-1,500 feet) in the Western Hemlock Ecological Zone.

CODE

1. Devil's club cover is 5% or greater.

250 WESTERN HEMLOCK-YELLOWCEDAR/BLUEBERRY-DEVIL'S CLUB

1. Devil's club cover is less than 5%.

    2. Skunk cabbage cover is 3% or greater.

220 WESTERN HEMLOCK-YELLOWCEDAR/BLUEBERRY/SKUNK CABBAGE

    2. Skunk cabbage cover is less than 3%.

210 WESTERN HEMLOCK-YELLOWCEDAR/BLUEBERRY

KEY TO MOUNTAIN HEMLOCK SERIES (Code 500)

Generally above 1,500 feet elevation, on mountain shoulders and summits.

CODE

1. Combined cover of Cassiope species and Luetkea is at least 3 %.

530 MOUNTAIN HEMLOCK/CASSIOPE

1. Combined cover of Cassiope species and Luetkea is less than 3 %.

2. Copperbush cover is 15 % or greater.

520 MOUNTAIN HEMLOCK/COPPERBUSH

2. Copperbush is less than 15 percent.

510 MOUNTAIN HEMLOCK/BLUEBERRY

KEY TO SITKA SPRUCE SERIES (300)

Characterized by soil disturbance (riparian, soil mass movement, water moving laterally through soil profile). Associations 390-391 are usually above 1,500 feet; others are at low elevation in riparian zones.

CODE

1. Mountain hemlock cover is at least 20% (High Elevation Associations).

2. Marsh marigold cover is at least 3%.

391 SITKA SPRUCE-MOUNTAIN HEMLOCK/BLUEBERRY/MARSH MARIGOLD.

2. Marsh marigold cover is less than 3%.

390 SITKA SPRUCE-MOUNTAIN HEMLOCK/BLUEBERRY.

1. Mountain hemlock cover is less than 20%.

3. Red alder overstory cover is at least 10%.

350 SITKA SPRUCE/RED ALDER

3. Red alder overstory cover is less than 10%.

4. Devil's club cover is 10% or greater.

5. Salmonberry cover is at least 10%.

335 SITKA SPRUCE/DEVIL'S CLUB-SALMONBERRY

5. Salmonberry cover is less than 10%.

6. Skunk cabbage cover is 3% or greater.

340 SITKA SPRUCE/DEVIL'S CLUB/SKUNK CABBAGE

6. Skunk cabbage cover is less than 3%.

330 SITKA SPRUCE/DEVIL'S CLUB

4. Devil's club cover is less than 10%.

7. Salmonberry cover is at least 10%.

380 SITKA SPRUCE/SALMONBERRY

7. Salmonberry cover is less than 10%.

8. Devil's club cover is at least 5%.

320 SITKA SPRUCE/BLUEBERRY/DEVIL'S CLUB

8. Devil's club cover is less than 5%.

9. Skunk cabbage cover is 3% or greater.

370 SITKA SPRUCE/BLUEBERRY/SKUNK CABBAGE

9. Skunk cabbage cover is less than 3%.

10. Grass cover (primarily Pacific reedgrass) is at least 10%.

360 SITKA SPRUCE/PACIFIC REEDGRASS

10. Grass cover is less than 10%.

310 SITKA SPRUCE/BLUEBERRY

OVERVIEW: HOW TO USE THIS GUIDE

Plant association guides are under preparation throughout the Alaska Region. Specific objectives are to: 1) classify plant associations to provide an inventory of resources; 2) relate this to mapping, in order to meet a wide spectrum of planning needs; 3) collect data on soils, vegetation, and other attributes relevant to management; and 4) develop management implications for plant associations.

Accordingly, from 1986 to 1992 field data was gathered and analyzed. Data was collected on nearly 1,000 vegetation/timber/soils plots throughout the Ketchikan Area in order to develop the classification. Additionally, hundreds of second-growth transects were set up to provide information on vegetation response following disturbance. Transects have been used to partially field-verify the vegetation maps developed from soil maps; this process is ongoing. Finally, input from a wide range of resource specialists contributed to the revision of the 1989 preliminary text of this document. Consequently, management implications have been greatly expanded.

This user's guide is a result. It is designed to relay information efficiently to those in a wide range of resource disciplines. It is the product of substantial field work and data analysis. Perhaps more importantly, it is the product of years of on-the-ground integration and training with foresters, silviculturists, wildlife biologists, and others. We have designed it to address everyday resource management problems.

Nomenclature

Before discussing the text, a few notes on nomenclature are needed. To avoid endless renditions of long phrases, shortened versions have been used throughout. When capitalized, "Area" and "Region" refer to the Ketchikan Administrative Area and the Forest Service Alaska Region, respectively. In lower case, "area" refers to a specific location under discussion, and "region" to Southeast Alaska.

Plant association names are treated similarly. When the full name of an association or series is employed, it is capitalized. When shortened, lower case is used. A good example is that "Western Hemlock-Western Redcedar Series" and "redcedar series" refer to the same thing. In all cases we have sought to be clear in meaning.

The reader will note throughout the use of "generally," "usually," and other imprecise words. This is not to say ecology is a vague or careless science, but that it involves many factors-- including random occurrences. One can work with confidence using the generalizations, but should be aware that there can be exceptions. Ecology is a science of few absolutes.

Outline

CHAPTER 1 describes the **ENVIRONMENT** of Southeast Alaska. Those new to the region should start here. It will acquaint the reader with the geology, climate, soils, and vegetation of the Ketchikan Area. We also feel that long-time Alaska "sourdoughs" may find much of interest here.

CHAPTER 2, MANAGEMENT IMPLICATIONS is the next step. This chapter relates ecology to resource management problems, and is the natural starting point for specific issues. For example, a silviculturist might want information on cedar regeneration problems, or a wildlife biologist might want to learn which plant associations are most useful for canopy gap creation.

A range of issues are discussed. A brief overview of the issue (e.g., second-growth management) is presented, followed by instructions on how to use the plant association guide to collect information.

CHAPTERS 3 to 9 are the core chapters, those detailing **PLANT ASSOCIATIONS**. Each chapter begins with an overview of the vegetation series (group of plant associations with the same overstory). It is advised the reader begin here to get a grasp of the entire series before focusing on individual associations.

Each plant association write-up describes its vegetation, soils, and landforms. In describing quantity of vegetation, the terms constancy, fidelity, and abundance are used.

> *Constancy* refers to the frequency of species occurrence among sample plots. For example, if redcedar occurred in 2 of 10 sample plots for an association, its constancy is 2/10, or 20 percent.
>
> *Fidelity* relates to how frequently a plant occurs with a particular type of soil or other environmental factor. For example, skunk cabbage shows strong fidelity to deep, wet soils. Blueberry, in contrast, occurs across such a wide range of soils that it has poor fidelity. Usually plants with strong fidelity make good indicators. Skunk cabbage is a good indicator of deep, wet soils.
>
> *Abundance* is "how much" of the plant occurs on any given plot. In this case, values are reported as percent (areal) cover. This is simply an ocular (visual) estimate of how much area (in percent) was covered on individual sample plots by a particular species. It is reported as an average of occurrence on plots *where it occurred*. Therefore a species with 50 percent constancy and 4 percent average percent cover (abundance), averaged 4 percent cover on plots where it occurred and was entirely absent from half the plots.

Because soil drainage and elevation are two major environmental factors affecting plant associations, graphs are presented showing the drainage and elevation distribution of each association.

Typical soils for each association are listed. Soils listed are only those most typical or abundant. Similar associations are reported to avoid classification errors, and to give the reader a sense of where associations fit in the landscape.

A specific **Management Implications** section follows. This section will direct users to items of particular resource management interest: what expected timber volumes would be, how the association reponds to logging, implications for wildlife habitat, effects of road and trail construction, etc. Where data are available (mostly the Western Hemlock and Western Hemlock-Redcedar Series), specific second-growth vegetation response information is presented. Finally, representative field locations with relatively easy access are listed, so that users can find an example of the association or relate it to their own experiences.

CHAPTER 10 deals with vegetation **DIVERSITY**. Both vegetation and structure (tree size distribution) are evaluated for a selected range of plant associations. This information will be most useful for planners and those working with wildlife habitat models, but we encourage all to become familiar with it. Biodiversity is of increasing concern in resource management, and we seek to dispel the notion that it is a nebulous concept that cannot be quantified. Our capabilities in assessing biodiversity are changing almost daily, and we expect this section to be updated over time.

CHAPTER 11 deals with **MAPPING**. Our experience indicates that useful vegetation maps are critical in the use of plant associations for resource management. (We are indebted to silviculturist Bill Nightingale for stressing this.) Because individual plant associations cannot be mapped at scales we normally deal with (even a 10-acre unit is likely to contain a number of associations), they have been aggregated into groups refered to as ecological land units (ELUs). While we caution that the vegetation maps are still undergoing field verification, we feel that they will provide sound information for a variety of resource applications.

REFERENCES used in the text are then listed. We encourage users to pursue topics of interest. Second growth, for example, is a topic that has generated considerable literature, and we have only scratched the surface in this guide.

APPENDICES follow. Readers should become familiar with them. They have been designed to answer resource management questions such as: 1) What portions of this logging unit are forested wetland?; 2) What forage is available for deer in this association?; 3) What timber volumes can I expect on this map unit?, and so forth.

This guide is bound in a loose-leaf binder, because some of the information is likely to be updated over time. Also, unforeseen issues are likely to justify an addition to the guide.

Acknowledgments

Before closing this overview, I offer my thanks to many. A work of this nature, spanning six years of effort, requires the help of a lot of people. First and foremost are the field crews who collected data. In ten-week field seasons they had to master the complex art of describing vegetation, timber, and soils in the field. They have my deepest gratitude.

Next are my coauthors, Jon and Randy. Jon was the spearhead and guiding force of the Alaska Regional Ecology Program for 11 years, and now leaves us for ecology work in western Oregon. Both his technical and administrative skills are reflected in this work. He will be sorely missed.

Randy initiated this classification effort in 1986 and 1987. He left a solid foundation for me to build a classification on. He has exceptional skills at relating soils to vegetation, and the strength of this guide in that area is a result of his efforts.

Administratively I must thank the soils, fish, and wildlife units of the Ketchikan Area Ecosystems Staff, as well as the Timber Staff, who provided financial and technical support to this effort. We have worked well together to produce one of the most versatile and applied ecology programs anywhere. They have my sincere appreciation and hope that this relationship can continue.

Tracy Garrison, Maria Dudzak, Patti Krosse, Dennis Landwehr, and Mike Brown of the Ecosystems Staff provided valuable comments on Chapters 1 and 2. Tracy and Maria also added the references to Best Management Practices (BMPs).

I can't thank the Districts of the Ketchikan Area enough. They have been receptive to our work; further, they have sought to involve us in the management problems they face daily. I have been pleased and proud to work with Dave Johnson, Marla Dillman, Erich Grebner, Rick Hauver, Wally Greentree, Pat Tierney, Jake Cebula, Colleen Bentley, Kimberly Anderson, Annette Anderson, Glenn Pierce, Jeff High, Al Grundy, Jackie Canterbury, Cara Cupito, Jan Peloskey.... The list goes on and on.

Photography for this work was provided by Jackie Canterbury over two field seasons. She applied her professional skills to the task with vigor and interest. She also provided some wildlife interpretations to the text. I am very grateful.

Of no small significance is the technical help provided by Lucy Johnson, Betty McKelvy, Brad Smith, and Jan Albayalde. Respectively, they helped set text in Office Publisher, photocopied, provided instruction in data analysis, and set up the publishing at the Regional Office level. Line drawings of plants are from the field version of the Willamette National Forest plant association guide (Logan et al. 1987), and are gratefully acknowledged. Thanks to you all.

As this text goes to press, I have had the invaluable assistance of writer-editor Mary Carr. She applied her editing skills in superb fashion, working efficiently to get this done on time. It is no exaggeration to say it would not have been completed without her.

Gerald Lemke of our Geographic Informations Systems (GIS) group provided the ecosystem diagrams you see introducing each of the core chapters. These were provided in a timely fashion at almost the last minute. I am deeply grateful. Ralph Spear provided the Ketchikan Area map and helped me develop the maps described in Chapter 11.

When funding for publication was jeopardized, Gene Eide, timber staff officer on the Ketchikan Area, assured that the appropriate funds would be available. He has my sincere gratitude.

Finally there is Julie Concannon, who is adding strong landscape ecology skills to the Ketchikan ecology program and has contributed valuable edits on the manuscript, as well as useful suggestions on its design.

Ecosystem management isn't getting any easier. It is some comfort to know the above folks are tackling it. But it is up to you, the user of this guide, to fully implement the vision of Southeast Alaska as a unique place to live, make a living, and protect for our grandchildren.

Tom DeMeo
Ketchikan, December 1992

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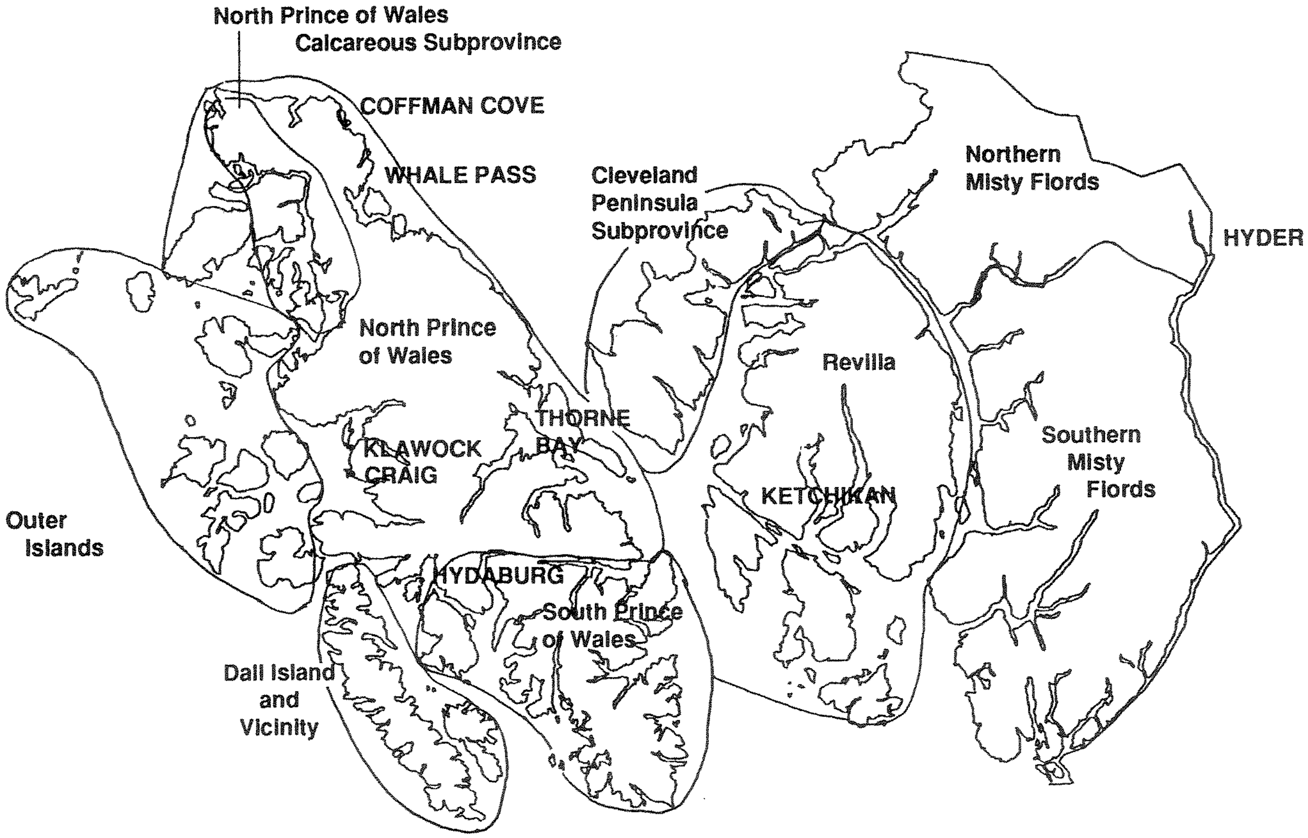
Schematic Map of Southern Southeast Alaska



Ecological Provinces of the Ketchikan Area, Tongass National Forest

1
ENVIRONMENT OF SOUTHERN SOUTHEAST ALASKA

Introduction

Forest ecosystems of Southeast Alaska have become the focus of intense scientific, management, and political interest. In order to deal with increasingly complex resource issues, managers must understand the factors influencing ecosystems, and the implications of altering those ecosystems by management. The objective of this chapter is to provide an overview of key factors influencing natural forest ecosystems in southern Southeast Alaska. Chapter 2 (Management Implications) provides a guide to understanding the effects of our activities on the landscape.

Geology

Southeast Alaska consists of the Alexander Archipelago, a chain of several large islands and thousands of smaller ones, coupled with a rugged mainland mountain chain (the Coast Range). Part of the Pacific Rim, Southeast is a product of plate tectonics. The Pacific Plate, moving in a northeastward direction, is in continual collision with the North American Plate. The resulting subduction and associated pressures lead to predominately igneous and metamorphic rocks forming the islands.

Although some volcanic activity has been extrusive (notably Mt. Edgecumbe in Sitka Sound), most magma remained underground. For example, substantial portions of the southern Southeast mainland (Misty Fiords) are underlain with igneous intrusive rocks, including diorite, granodiorite, and granite. Metamorphic activity from complex patterns of mountain building and faulting has resulted in abundant schist and phyllite.

In a few places, calcareous rocks predominate. These are limestone, marble, and calcareous graywackes, ancient marine deposits of calcareous zooplankton that have been uplifted. They are of vital management importance, for they form the parent material for some of the most productive soils on the Ketchikan Area. Limestone karst topography-- featuring sinkholes, caves, underground streams, and easily eroded and fractured bedrock-- is associated with hydrologic processes quite different from till areas (Ford and Williams 1989). Abundant caves, some quite large, also occur throughout karst areas. The Ketchikan Area (notably northwest Prince of Wales Island but also Dall Island and other locations) possesses significant cave resources that have yet to be fully described (Baichtal 1991).

Glaciation

Ten thousand years ago ice began receding from Southeast Alaska as the last great glacial epoch reached its end (Mann 1986, Arndt et al. 1987). Glaciers scoured the landscape and left behind enormous quantities of debris (till). The immense weight of the ice sheets compacted the till into masses virtually impermeable to water movement. In some cases, the till was more permeable, or was deposited in clusters of small hills (drumlins) over vast areas. Much of Honker Divide on Prince of Wales Island, for example, is composed of drumlin fields.

The legacy left by receding glaciers has profound management implications. Till deposits, if compacted, usually restrict soil drainage. This can lead to development of vast peatland (muskeg) areas, as well as other poorly drained soils associated with low site productivity.

Moreover, glaciation scraped some areas relatively clean (such as southern Prince of Wales Island) and endowed other areas with great deposits of loose till that have generated relatively productive soils (e.g., northern Prince of Wales Island). Northern Prince of Wales also was rounded and eroded by glaciation, resulting in relatively gentle topography. This topography, combined with productive, well drained mineral soils, has made it one of the most suitable logging areas in Southeast Alaska. Other areas that were not so severely eroded (Revillagigedo Island and the mainland) are characterized by rugged topography.

Glaciation also affected evolution of Southeast Alaska plants and animals. Ice masses altered species' ranges by blocking travel routes and by causing local extinctions. When the ice receded, deep fjords separated islands, leading to continued isolation of populations (Pielou 1991). This explains (for example) why wolves are now found on the southern islands of the Alexander Archipelago, and not on the northern, with the reverse true for brown bears.

Plant distribution was most affected by patterns of glaciated and non-glaciated areas. Areas that escaped glaciation served as refugia-- sources of plants and animals that could disperse later when the glaciers receded. These refugia serve as remnants of ancient flora from before the last period of glacial advance. The Queen Charlotte Islands (immediately south of the Area in British Columbia) provide the classic example of this, but the outer islands of the Ketchikan Area (Dall, Sumez, Baker, etc.) may also have functioned as refugia. This possibility is under investigation.

Soils

In poorly drained soils of Southeast Alaska, thick layers of organic matter accumulate, pH is generally low, and nutrients are unavailable. Soil drainage strongly influences plant growth. In southern Southeast Alaska, drainage is probably the single most important factor affecting site productivity (Cullen 1987). Productivity is defined here as the site's capability to produce biomass.

In peatlands (muskegs), where soils are anaerobic and cold for much of the year, decomposition rates are extremely slow. Other factors contributing to this process are: 1) the vegetation from which the organic matter is derived is low in nutrients; 2) organic matter forming the soil is strongly acidic; 3) a cool climate without temperature extremes inhibits decomposition; 4) fewer soil organisms are present in comparison with better-drained sites; and 5) there is a significant absence of fire, windthrow, and other disturbance on poorly drained sites. These organic soils are known as Histosols.

One notable exception to the pattern of organic soils as deep and poorly drained illustrates the importance of soil drainage in determining site productivity. Some shallow organic soils over bedrock (McGilvery series) on steep upper slopes are associated with fairly productive sites. On such sites, trees can grow well because overall drainage is good. In a dry climate, these sites would show low productivity because of droughty soil conditions. In Southeast Alaska, *availability* of water is seldom a problem; how the water *drains* is of vital significance.

Soils developed from alluvium, colluvium, or till are mineral soils. Alluvium is material deposited by stream or river flooding. Colluvium consists of rock fragments that break off from bedrock and move downhill over centuries.

Abundant rainfall leaches organic colloids from the organic layer on the surface to lower layers, called horizons. In some cases, a narrow, pale zone of leached material develops between the organic and mineral horizons. The resulting soils are called Spodosols, characterized by a spodic horizon. This horizon is an accumulation of organic material and aluminum oxides, with or without iron oxides. Below the spodic horizon, sequioxides and aluminum oxides form a mineral horizon, sometimes bright orange in color, and other times gray from parent material or accumulated organic colloids.

Presence of a spodic horizon suggests that drainage (at least at one time) was good. Spodosols on the Area range from somewhat poorly to well drained. Productivity of these soils largely depends on drainage and effective soil depth (Stephens et al. 1968, Farr and Ford 1988).

Soils developed from limestone appear to be especially productive. These soils are mostly well drained, because of highly fractured bedrock where subsurface drainage predominates. This bedrock type weathers more readily than other rock types in Southeast Alaska, and thus drains very freely. In fact, limestone in soils is often really a residue, not a breakdown product (White 1988). This susceptibility to weathering and subsequent soil texture created by weathered bedrock creates friable (loose) soils capable of supporting extensive root growth.

Entisols and Inceptisols are relatively young or frequently disturbed soils that lack the development of Spodosols. These soils commonly occur on landslide tracts and floodplains. On landslides, poor development and the continual degradation of unstable sites yield soils that lack adequate nutrients to support much tree growth. In contrast, in riparian areas characterized by floodplains, disturbance by flooding leaves rich, highly productive sediment deposits.

Riparian deposits are nutrient rich, and well aerated because the soil water continually cycles through the alluvium. Additionally, flood events and frequent fresh deposits of alluvium impede development of organic layers. The result is a relatively high soil pH with available nutrients. It is no surprise, therefore, that these sites can sometimes support spruce 8 feet in diameter and over 200 feet in height.

Climate

Climate is an environmental factor of prime importance in Southeast Alaska. Ideal conditions exist for rainfall-- the relatively warm, moisture-laden air currents associated with the North Pacific meet with cold continental air masses. This air rises, condenses, and falls as precipitation.

Topography assists this process. Many areas in Southeast are steep and dissected, so that warm air rises, cools, and falls sooner than in a flat region. Narrow channels (such as Ketchikan's Tongass Narrows) funnel air movement and concentrate the rainfall even further. With these conditions, Ketchikan's 162 inches of annual precipitation make it one of the rainiest communities on the North American continent (Alaska Climate Center 1986).

The forest of Southeast Alaska can therefore be considered a temperate rainforest. Unlike a tropical rainforest, evapotranspiration is low, further adding to the wet quality of the landscape (Alaback 1991). Thus, even areas with lower annual precipitation, such as Angoon (56 inches) or Juneau's Mendenhall Valley (60 inches) are effectively nearly as wet as Ketchikan (162 inches) or Prince of Wales Island (120 inches). Especially in fall and winter, little water evaporates into the air. Moreover, water that does evaporate often condenses and is recycled as fog drip from dense forest canopies (Hemstrom and Logan 1986).

With relatively warm ocean water encircling islands and working its way through a thousand bays and inlets, local climates (microclimates) are often much warmer than expected at this latitude. This warming effect has led to a forest landscape profoundly different than that of most of western North America. Elevation, while still a significant environmental factor, is largely overriden by rainfall and the ocean's warming effect. Its importance in determining vegetation patterns is therefore somewhat muted when compared with drier continental climates.

Aspect (the orientation of a site in relation to the sun) is most influential on vegetation at the point midway between the north pole and the equator (45 degrees N latitude). Consequently the Ketchikan Area (at 56 degrees N) is less affected by it. The sun angle is lower in the sky; a site is less likely to be affected by the direction it faces. Van Hees (1988) found no significant relationship between aspect and timber productivity in Southeast Alaska.

Growing Degree Days

Water, nutrients, light, and temperature are all important for plant growth. Each of these factors has a range where plant growth is optimized. With an average 300 cloudy days per year, light availability assumes critical importance (Alaback 1991). Growing season temperatures are known to significantly affect tree growth (Farr and Harris 1979). With cool temperatures year round (mean summer temperature <16 degrees C; mean winter temperature 2 degrees C), effective growing seasons are limited (Alaska Climate Center 1986).

The number of growing season days where a temperature sufficent to support plant growth is available is referred to as growing degree days. The Ketchikan Area represents a transition area where growing degree days are becoming critically limiting for a number of species. Western redcedar, Pacific yew, Pacific silver fir, salal, and swordfern are all notable examples of species at or near their northern limit on the Ketchikan Area. Other species, such as mountain hemlock, are abundant but show an erratic frequency of occurrence that stabilizes farther north.

Disturbance

Disturbance (as used in ecology) refers to environmental fluctuations and destructive events (Pickett and White 1985). Disturbance can be categorized spatially (at various scales across the landscape) or temporally (over time). Examples of spatial disturbances include a single tree blowing down, excessive water moving through a mountainside that triggers a landslide, or a fire that alters a broad landscape. Changes over time are referred to as succession. Examples include a lake gradually filling in with aquatic vegetation, alder seed revegetating a roadcut, or a series of vegetational changes following logging of a 100-acre unit. Succession is discussed in Chapter 2 (Management Implications).

In Southeast Alaska, the single most important natural disturbance factor is frequent, small-scale windthrow. While large-scale windthrow events do occur, it is the continual, year-to-year pattern of a few trees to a few acres blowing down that most affects our landscape (Harris 1989).

As trees blow down, they are replaced by new trees. Many of these were pre-existing in the forest understory. Western hemlock, the most abundant tree species on the Tongass National Forest, is particularly well adapted to tolerating years of shade and then responding to an opened canopy (Burns and Honkala 1990).

This continual small-scale disturbance and renewal pattern generates a shifting steady-state mosaic (Bormann and Likens 1979, Alaback 1988, Schoen et al. 1988, Franklin 1991). Comprehension of this forest pattern and its implications is critical to understanding effects of forest management in coastal Alaska.

Frequent small-scale windthrow provides woody debris as regeneration microsites for conifers (notably hemlock and spruce). On wet, cool, shady forest floors with thick surface organic layers, conifer seedlings compete poorly with mosses (Harmon 1986, Harmon and Franklin 1989). Instead, fallen trees and stumps provide better regeneration sites. This role is particularly critical in riparian zones, where frequent flooding events favor forbs and shrubs, to the detriment of tree seedling establishment.

Most understory forbs and shrubs in Southeast Alaska reproduce and expand their ranges vegetatively, not by seed dispersal (Alaback and Tappeiner 1991). When gaps are created by windthrow, these species (e.g., blueberry, bunchberry, five-leaved bramble, and trifoliate foamflower) invade the gaps by sending out rhizomes (runners).

Over time, windthrow rejuvenates the soil by churning surface layers and mixing them with lower horizons. Root wads torn up when trees blow down expose soil organic and mineral layers to sunlight, hastening nutrient release and retarding the accumulation of wet organic layers. Without this churning effect (as in a poorly drained mixed conifer stand), site productivity remains low.

Forest soils can also be disturbed by moving water or soil mass movement. This movement in streams or rivers has profound effects on adjacent forest, as does the forest on the stream.

Fluvial (moving water) processes in streams deposit fresh mineral material (alluvium) on adjacent floodplains at relatively frequent intervals. This deposition inhibits excessive organic matter accumulation and makes nutrients more available, similar to the effect of soil churning caused by windthrow in the upland forest. Floodplain soils are often of neutral or slightly acidic pH, in contrast to the strongly acidic soils of many upland sites (USDA Forest Service 1987).

Not all water movement is so obvious, however. Soil water can move down hillsides and mountainsides through soil profiles with a similar disturbance effect to that of riparian zones. Such sites are often characterized by devil's club or salmonberry, and are both highly productive and biologically diverse.

Soil mass movement is the final major category of natural disturbance affecting forests of Southeast Alaska. On very steep slopes, frequent sliding and instability is inherent, resulting in an early successional plant community of alder and salmonberry. Less steep slopes characterized by more climax forest communities can also slide, however. Degree of soil saturaton, soil type, slope gradient, and orientation of the soil to underlying bedrock are among the factors affecting landslide risk (Swanston 1985, Chatwin et al. 1991).

In contrast to ecosystems throughout much of the western United States and Canada, fire is not a major factor altering forests of Southeast Alaska. While there are notable local exceptions on the Area (Dall Head on Gravina Island and the Kasaan Peninsula of Prince of Wales Island, for example), the climate of the Alexander Archipelago is too consistently wet to support major fires. Even during dry summers, when fires begin they usually die out when they reach the humid understory conditions of old-growth stands.

Old Growth

The absence of fire as a major disturbance agent is a major reason why much of the pristine forest in Southeast Alaska is old growth. Catastrophic fire intervals of 200-300 years across much of the West (e.g., the 1988 Yellowstone fire) have resulted in a mosaic of older second-growth stands interspersed among old-growth stands. In contrast, older second-growth stands (age 100-200 years) greater than a few acres in size are relatively uncommon throughout the Tongass. Most of the Southeast Alaska forest landscape that has not been altered by man can therefore be considered old growth.

Old growth is best defined as a set of climax forest attributes rather than by age (Old-Growth Definition Task Group 1991). Old-growth stands contain a variety of tree diameters and canopy levels, show a diverse shrub and forb layer, and possess snags (dead trees) and woody debris. Specific amounts vary with habitat; for example, a western hemlock association will generally have much more woody debris than a mixed conifer type.

Summary

Appreciation of the above attributes of structure and composition and how they relate to ecosystem function is critical to forest management, especially if the New Perspectives/Ecosystem Management initiative is to be fully implemented. The relationship of old-growth attributes (and their alteration) to forest management is the thrust of this guide, and will be more fully explored in Chapter 2 (Management Implications), and subsequent chapters on plant associations.

2
MANAGEMENT IMPLICATIONS

Before discussing management implications we must cover a few basic ecological concepts. It will not be possible to apply the implications without them.

Ecological Concepts

Ecology is an integrated science, the study of interactions between organisms and their environments. In forest ecology, the disciplines of botany, soil science, geology, meteorology, and zoology are drawn on for information. Whereas many sciences seek to "take things apart" to study them, ecology seeks to put them together.

Forest management is becoming more complex than ever. Over the past 20 years in the National Forest system, foresters, wildlife biologists, planners, and other professionals have become increasingly challenged by ecosystems and our incomplete understanding of them. An understanding of how soils, vegetation, wildlife, and other factors work together has received new emphasis. The interdisciplinary approach to planning and problem-solving has become a routine requirement (if not always fully implemented).

Not only must managers today understand as much as possible about the forest environment, they need guidelines to reasonably predict response to changing these environments with logging, road-building, etc. In addition to these "traditional" uses of the forest, unforeseen resource demands continue to confront us. The use of Pacific yew bark for taxol, an anti-carcinogen, provides an excellent example of a formerly ignored species that became an inventory and management issue overnight. Managers were called on to map its distribution and make plans for its exploitation on a continued basis. Managers with a grasp of the yew's ecology-- or an ecologist's ear-- were well placed to deal with the issue.

This guide is intended to meet managers' needs for information on forest ecosystems and the implications of managing them. The plant association/habitat type concept provides a concise "package" of understanding that can be drawn on for interpretations.

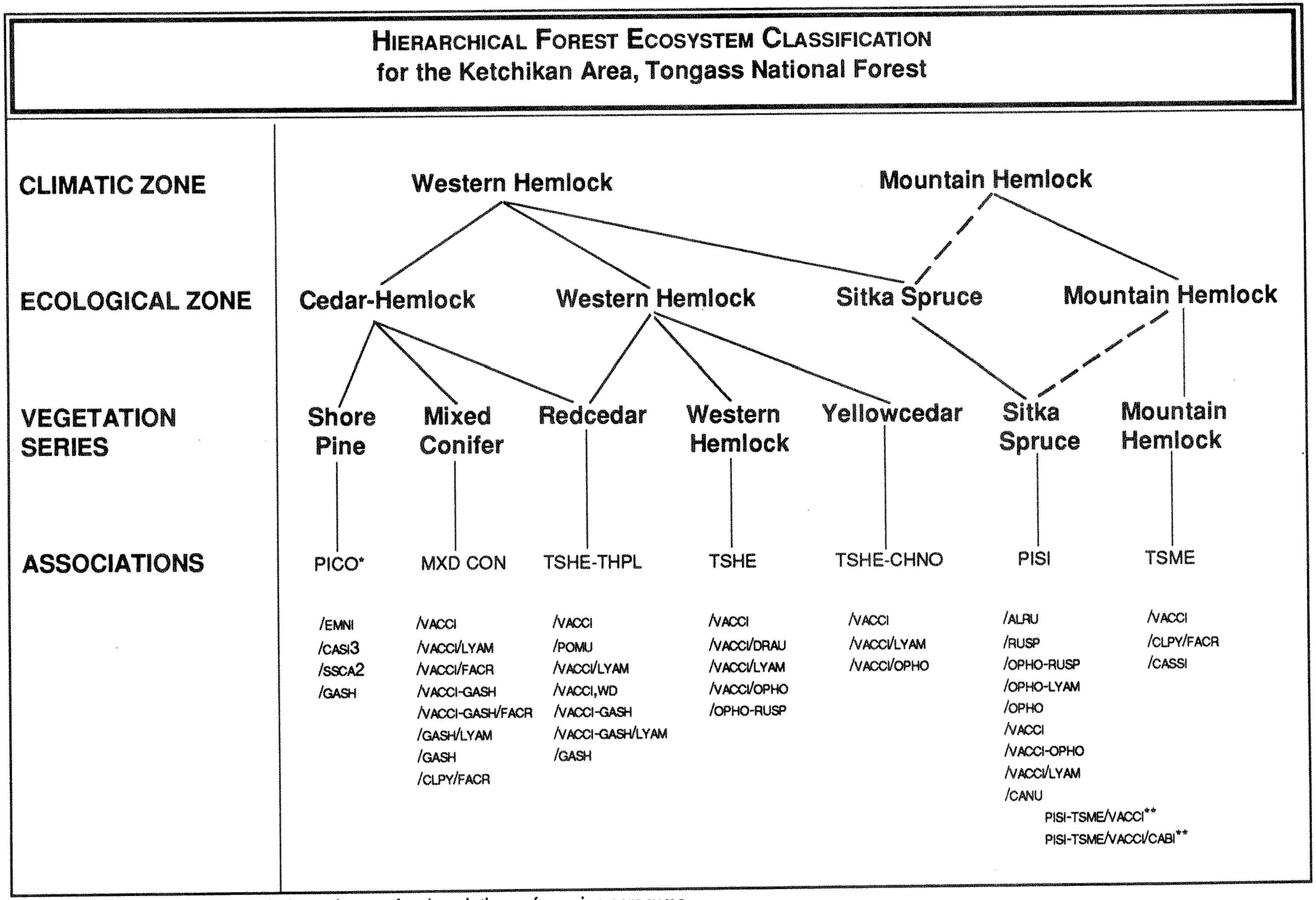
This chapter outlines vital concepts of forest ecology that should be understood in order to best employ the plant association and other chapters that follow.

Classification Concepts

Why Classify?

It wasn't so long ago that many believed the forest of Southeast Alaska was "all the same." It is true that excessive rainfall and a moderating influence of the ocean on temperatures make differences between forest associations less apparent than they would be in a dry climate. Field experience, however, has shown that differences can be substantial and that seemingly similar sites can respond quite differently to treatment. Those who ignore these differences run the risk of substantial management failures.

Figure 1



* See individual plant association write-ups for descriptions of species acronyms.

** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

Resource management is also becoming much more complex. For years nearly all logging on the Area focused on the Western Hemlock Series, but this is no longer true. Poorer sites of the Mixed Conifer and redcedar series are now logged. High elevation yellowcedar and mountain hemlock sites are now under consideration. Many of these associations require different logging systems and silvicultural prescriptions than those of the Western Hemlock Series. The days when a silviculturist can write "clearcut and thin at age 15" on nearly every unit prescription are numbered.

The proportionality clause of the Tongass Timber Reform Act (1990) and riparian buffer issues are other good reasons to define plant associations and their management implications.

Finally, planning efforts require that habitats (as well as soils, timber, visual aspects, etc.) must be classified. Neither environmental impact statements nor forest plans can be produced without thorough classifications.

Many land classification schemes have been developed based on climate, vegetation, landforms, soils, and geology, as well as combinations of these parameters. In developing a classification, two major decisions must be made: determining the objectives, and determining the appropriate scale.

A clear understanding of objectives is vital in obtaining and using resource information. This point cannot be stressed enough. Too often both data collection and management decisions are made without a clear view of why the action was taken. Data collection, classification, and interpretation can be expensive activities, and care should be taken that information will meet the needs of the user.

In designing classification schemes, however, the full range of possible issues and environmental parameters should be considered. Since the current vegetation classification effort began on the Tongass in 1981, a number of vegetation data needs-- notably for wetlands classification-- have come up that were not anticipated when the study began. Fortunately the data collection was designed to accommodate unforeseen issues, and met the need.

The key requirement for the scale of an effective classification is that it be hierarchical; that is, it should be arranged so that smaller units can be aggregated into larger ones to meet a wide variety of applications. Managers work at a variety of scales-- from a few acres on individual projects to many thousands of acres for planning analyses.

A classification scheme should also be designed to address environmental parameters-- soil drainage, windthrow, regeneration, and tree size classes, for example-- whether or not there is an immediate management need. Of course, not every item can be examined in detail, but the classification should be designed so that the information can be easily integrated after collection at a later date.

Overview of Classification for the Ketchikan Area

The biogeoclimatic classification employed in British Columbia (MacKinnon et al. 1992) provides a hierarchical framework to classify the environment. Large areas are delineated into smaller components based on environmental factors, primarily climate, followed by soil and vegetation.

A similar approach can be used for Southeast Alaska (although terminology and methods differ). First, broad **climatic zones** (Figure 1) are considered. Climatically, the forest of southern Southeast can be broken into a cold Mountain Hemlock and a warmer Western Hemlock zone.

Each zone can then be broken into broad landform/soil zones, known as ecological zones. **Ecological zones** consist of landform groups that are characterized by soil drainage and elevation. They cover broad areas of the landscape (typically hundreds of acres), and can be interspersed in complex patterns. The landscape of Southeast Alaska, in fact, is characterized by its heterogeneity.

The Western Hemlock Ecological Zone represents more productive sites with better soils. Generally, these are well-drained mineral soils. The Cedar-Hemlock Zone designates poorer sites with growth restricted by poor drainage or shallow soils. The Mountain Hemlock Zone designates the cold environment of the subalpine. The Sitka Spruce Zone is characterized by disturbance.

Vegetation series are the next layer in the hierarchy. These are plant associations grouped by overstory species. Note that the Western Hemlock-Redcedar Series represents a transition from the Cedar-Hemlock to the Western Hemlock Ecological Zone. The redcedar series covers a range of soil drainage and depth. More poorly drained and shallower soils supporting redcedar associations are in the Cedar-Hemlock Ecological Zone, and those with well drained and deeper soils are in the western hemlock zone.

Each series is then divided into its respective **plant associations**. Associations are designated by understory indicator plants. Plant indicators are used to indicate diagnostic environmental conditions and have been selected for their consistent correlation to the conditions. For example, devil's club is consistently present in habitats characterized by moving soil water. Skunk cabbage indicates deep, wet soils. Cassiope is found in cold environments, usually at high elevation. Other indicator plants are discussed in the specific associations where they occur.

Plant Associations/Habitat Types

This guide, like most Forest Service classification documents in the western United States, relies on plant associations. Plant associations are simply vegetation communities at the climax stage of succession. (Vegetation in earlier successional stages will be referred to as community types.)

Two problems are inherent in the preceding definition. One is that the climax stage of forest succession has eluded precise definition. For example, mature forests in the Pacific Northwest may be thought of as climax, even though they are (on average) severely altered by fire every 200-300 years. In Southeast Alaska, the problem is somewhat easier, because large catastrophic events like fire are uncommon.

The other problem is that use of plant associations assumes the environment can be split into discrete packages. In reality it is a continuum of one community grading into another (Whittaker 1960, 1965). Distributions of tree overstory abundance by elevation, for example, usually show an overlapping series of bell-shaped curves rather than sharp breaks between species.

Differentiation of plant associations on the Tongass is especially difficult because differences between communities are subtle. Warm air from the Pacific and excessive rainfall throughout tend to mask elevational, slope, and aspect differences.

Despite these problems, the plant association concept has proven immensely useful for understanding our forest environments and related management implications. A discrete "package" can be more easily understood than complex continua. The association is small enough to be easily seen on the ground. It is a fundamental building block that can be aggregated into larger units.

A related term is "habitat type," the preferred term in the inland Northwest (Pfister and Arno 1980). Strictly speaking, the habitat type refers to all components of a land surface capable of supporting the same climax plant association (Daubenmire 1978). Because soils and other data were collected along with vegetation for this classification in an integrated manner, we consider it a habitat type classification as well. For practical purposes in this work, the terms "plant association," "habitat type," and "habitat" will be used interchangably.

Gradients

Plant associations change over the landscape as elevation, slope, and drainage vary. These changes are called gradients.

An understanding of the critical role of gradients in explaining the observed variation will go a long way toward developing a classification and building a coherent view of the landscape. Through extensive field work and data analysis, it is evident that soil drainage and elevation are probably the two most important gradients in explaining occurrence of plant associations.

With excessive rainfall, vegetation is not water-limited in Southeast Alaska. Timber productivity, however, does correlate closely with soil drainage (Cullen 1987). Poorly drained sites show stunted trees of poor form. The most productive sites, while they may occasionally be saturated, are well drained. Moving water is oxygenated and facilitates nutrient uptake.

Drainage is a good example of the concept that gradients are not necessarily continuous on the landscape. Poorly and well drained soils can occur all over the landscape in Southeast Alaska, affected more by restricting layers of bedrock or till than by slope or elevation.

Related to drainage is light availability, a secondary gradient of great importance in Southeast. With 300+ cloudy days per year, light is in short supply for plant growth. Open sites, with less dense canopy covers due to poor soil drainage, therefore have more light available for a variety of plant species. These sites tend to show higher diversity (see Chapter 10).

Elevation is an important gradient because of its relationship to temperature. At higher elevations, colder temperatures prevail. This relationship is not as straightforward as it is in ecosystems with continental climates and limited rainfall, but it "drives" ecosystem occurrence nonetheless. For species such as redcedar and salal that are at the northern limit of their ranges and are temperature-limited, elevation (and thus temperature) is especially important. On the Ketchikan Area, redcedar associations generally do not occur above 1000 feet elevation, and salal associations do not generally occur above 500 feet.

Management Implications

This section serves as a framework to deal with resource management issues most often encountered by managers. Following a brief summary of each issue, suggestions for specific uses of the guide are presented. This section offers a path to get started, not a comprehensive treatment of topics.

Timber and Silviculture

Timber volumes and species composition data are included in each plant association description. Graphics illustrating soil drainage, elevation, and landscape position will help guide choice of logging system, as well as provide implications for development of silvicultural prescriptions.

Information on vegetation response following logging is provided as well. Information for the Western Hemlock and redcedar series is most detailed. Extensive discussion on redcedar and yellowcedar silviculture is presented in their respective series chapters.

Chapter 11 details vegetation maps. Although not yet completely field-verified, they provide a useful tool for timber and silvicultural applications. Vegetation is mapped as influenced by soils and landforms (generating an ecological unit) (Allen 1987). Expected plant association groups and their percentages of each map unit are provided. The attribute tables and macros needed to generate these maps are in the Ketchikan Area GIS.

These maps are not intended to replace timber type maps, but to provide a useful complement to them. Undoubtedly they will be improved over time (e.g., providing separate map units by ecological province is a logical next step). Suggestions for improvements are welcome.

For More Information

Oliver and Larson (1990) provide a valuable text on forest stand development from a growth and yield viewpoint. Publications written for coastal British Columbia will generally apply here. Examples include Klinka et al. (1992), on the silviculture of mountain hemlock; Messier and Kimmins (1990, 1991), on silviculture of salal sites; Messier and Kimmins (1992), on redcedar regeneration; and Fyles et al. (1991), on effects of slash burning on soil characteristics. Excellent reviews of shrub and forb competition with seedlings can be found in Haeussler et al. (1990).

The work of Will Farr (e.g., Farr and Harris 1979, Farr and Ford 1988) provides valuable information on the relationship of timber productivity to varying site conditions. Taylor (1934), Meyer (1937), Barnes (1962), and van Hees (1988) are among those who have developed site index curves and regression equations to predict timber volumes.

Soil and Water Implications

Most soil and water issues related to logging concern potential soil mass movement and the maintenance of water quality. Regarding mass movement, see Swanston (1985) and Chatwin et al. (1991).

Water quality guidelines are contained in Best Management Practices (BMPs). BMPs are protection methods or practices designed to minimize or avoid adverse effects on soil and water quality that can result from logging or roadbuilding. BMP references related to management implications are made throughout this guide. They are intended to coordinate use of this guide with the Region 10 Soil and Water Quality Handbook (FSH 2509.22, Ch. 10), which provides direction for use of BMPs in the National Forests in Alaska. They are by no means the "last word" on the topics under discussion; refer to FSH 2509.22 for more complete explanations.

Wildlife

Most research in Southeast Alaska regarding wildlife has focused on Sitka black-tailed deer. Deer are important for subsistence as well as for sport-hunting, and research has been conducted on deer nutrition, home ranges, and winter thermal cover needs. Deer nutrition largely consists of blueberry (*Vaccinium* spp.) as a carbohydrate source and selected forbs as nutrient sources (Hanley et al. 1989, Rose 1990).

Deer, especially females (does), do not have large home ranges. Yeo and Peek (1992) report mean doe ranges of 113 acres (summer) and 80 acres (winter). While deer are usually considered habitat generalists (and thus usually adaptable to a wide range of conditions), Sitka black-tailed deer are near the limit of their range in Southeast Alaska and appear to be limited by winter thermal cover and its associated forage (Wallmo and Schoen 1979, Hanley and McKendrick 1985, Schoen et al. 1988). Winters are cold and very wet, presenting hypothermic conditions for mammals.

Interestingly, topography (proximity to saltwater) appears to be a better indicator of the value of deer winter range than does forest type (Hanley et al. 1989), although high-volume forest stands appear to have special value. Large limbs of old-growth hemlock collect snow, keeping the forest floor beneath them relatively clear and making forage available (Bunnell and Jones 1984).

Other species have received much less attention. For information on black bears, consult Kessler (1982). Fox (1983; Fox et al. 1989) researched mountain goat habitat. Information on songbird habitat requirements is remarkably meager, but Kessler (1979) and Kessler and Kogut (1985) provided some information for Prince of Wales Island. More recently, the Ebasco Environmental (1992) study detailed songbird use of old growth, second growth, and treated second growth.

For More Information

Each plant association write-up provides information on wildlife implications. Those for the Western Hemlock Series contain information on response of second-growth vegetation valuable for deer (blueberry and forbs). See also the second-growth section that follows for wildlife management implications.

Some deer research in British Columbia is relevant. In particular, the work of Nyberg et al. (1986) provides information especially useful for managers.

Snags

Maintenance of snags (standing dead trees) is increasingly recognized as an important part of forest management (Noble and Harrington 1978, Davis et al. 1983, Bull et al. 1990). In Southeast Alaska, spruce and hemlock are of far greater value to cavity nesters than red or yellowcedar, because the former have softer wood that is more easily excavated. Snag value also increases with snag diameter.

Leaving snags or green trees (as a source of future snags) in logging units is problematic. Safety regulations in Alaska restrict the retention of snags. Draft guidelines have been drawn up to detail conditions and situations where snags can be retained (Reserve Tree Guideline Committee 1992).

For More Information

Noble and Harrington (1978) is to date the best study of snags related to Southeast Alaska. The work of Evelyn Bull (Bull and Partridge 1986, Bull et al. 1990) is useful, particularly in developing snag inventories. Thomas (1979) provides a valuable primer in his classic text on wildlife habitat in the Blue Mountains of eastern Oregon and Washington. Some of the concepts will apply to Southeast Alaska. Cline et al. (1980) is also useful.

Wetlands

Because wetlands are transition areas between land and water, their definition and management are sometimes elusive. Federal regulations employ a three-parameter approach in defining wetlands. Vegetation, soil, and hydrology must all be hydric in order for a site to be considered wetland (Interagency Committee 1989).

Cowardin et al. (1979) is used throughout the country to classify wetlands. Because of the exceedingly wet nature of the Southeast Alaskan landscape, DeMeo and Loggy (1989) developed wetlands classification and mapping for the region. Maps are available in GIS. Users are cautioned that these maps were developed for forest planning, and that many applications at the project level will require field verification. U.S. Fish and Wildlife wetland maps are also available, but not all areas of Southeast have been mapped. In our opinion, Fish and Wildlife Service maps show greater detail in estuaries, but Forest Service maps are more accurate for forested areas. Further field verification has suggested that some wetland map units could be subdivided to increase accuracy.

Much of the Ketchikan Area is classified as wetlands. Most of the wetland area is peatlands (muskegs), or poorly drained forest (some associations in the Mixed Conifer and redcedar series). At this writing logging and associated roadbuilding is not prohibited on forested wetlands but must follow Best Management Practices.

For More Information

Each plant association write-up discusses wetland status and management implications. Wetland status is also listed in Appendix D.

A caution is in order. The wetland status of an individual plant association can differ from that of its associated soils and soil map units. For example, a hemlock-redcedar association can be non-wetland because its vegetation is non-wetland, but it can occur on wetland soils (e.g., Wadleigh). Also, some map units show borderline wetland character (e.g., Wadleigh and St. Nicholas). Actual wetland status may require field investigation. Refinements of wetland map units are called for, especially in borderline situations.

Succession

Succession is simply the change in a plant community over time. Primary succession results when a bare surface becomes colonized by plants. An example would be a lake filling in with sedges. Secondary succession follows significant alteration of the plant community. Examples might be an intense forest fire or clearcut logging.

The best-documented type of primary succession in Alaska is that following glacial retreat (Cooper 1937, Crocker and Major 1955). As this is not normally dealt with by managers on the Ketchikan Area, it will not be covered here.

More often, resource managers will deal with issues of secondary succession following logging. Alaback (1982, 1984) characterized these stages of stand development. The following description is limited to productive western hemlock sites, where most logging to date has been concentrated.

After clearcutting, a brief period (about 10 years) of forb expansion ensues. Among understory forbs, bunchberry typically responds the best to increased light following logging, but by age 12 begins to decline. Blueberry shows a similar vigorous response, passing old-growth cover levels by age 8 and remaining strong until about age 20.

From age 10 to 15 years, conifer response (hemlock and spruce) begins to surpass that of shrubs and forbs. Between age 15 and 30 years, the conifer canopy closes, shading out the understory. By age 30, understory plants are gone or severely diminished. A long depauperate stage begins (age 40 to over age 100 years in some cases) (Alaback 1982,1984). During this stage, overstory canopy cover remains high and stand structure (tree diameter and height distributions) are relatively uniform. Somewhere between age 100 and 200 years, depending on plant association, the canopy cover becomes more open, as trees blow down and gaps form.

Second-growth (young growth) stands that develop following clearcut logging have received intense interest by silviculturists, wildlife biologists, and other workers on the Tongass (e.g., Kessler 1979, Kessler 1982, Doerr and Sandburg 1986, Hanley et al. 1989, Ebasco Environmental 1992, Brown et al. 1992). Major issues have concerned site productivity, thinning to improve timber quality and useful yield, second-growth stand attributes in relation to wildlife use, changes in biodiversity as old growth is converted to young growth, and management techniques to alter second growth for potential wildlife benefit.

Second Growth Effects on Timber

Conversion of old growth to second growth on productive (mostly Western Hemlock Series) sites has the following effects on timber yield:

1) A wide range of diameter classes is changed to a uniform distribution.

2) Precommercial thinning at age 15-20 years is generally recommended, in order to allocate growth potential to fewer trees, thus increasing useful yield.

3) If precommercially thinned, total useful volume at rotation (age 100 years) will be greater than in old-growth stands. This is partly due to the reallocation of growth potential caused by thinning, and partly due to greatly reduced heartrot in second growth.

4) The proportion of spruce in second-growth hemlock stands generally increases. Increased light availability following clearcutting favors spruce seedling establishment, and soil scarification (even minor amounts) can benefit spruce (Burns and Honkala 1990).

5) Generally speaking, redcedar regeneration following clearcutting of redcedar stands is erratic on the Ketchikan Area, and yellowcedar regeneration following yellowcedar stands is almost non-existent.

For More Information

Each plant association write-up has an implications section with timber information, including expected volumes per acre, recommended yarding system to employ, and expected conifer regeneration. Because the Western Hemlock Series has (until recently) been the major focus of logging on the Tongass, the hemlock series chapter has especially detailed information on conifer response following logging.

Redcedar/yellowcedar silvicultural options are discussed in the introduction to their respective series chapters. For additional information, see Minore (1983) for redcedar and Hennon (1992) for yellowcedar.

Second Growth Effects on Wildlife

Alaback (1982, 1984) characterized secondary succession in Southeast Alaska, detailing understory biomass and compositional changes. He also explained the importance of the depauperate stage-- a long period of closed overstory with little understory other than mosses. On productive sites (e.g., the Western Hemlock Series) this stage is well underway by age 40, and can last well beyond age 100.

Second-growth structure differs from that of old growth as well. In contrast to the variety of tree diameters, canopy levels, and snags characteristic of old growth, young-growth stands following clearcutting often feature dense trees of similar diameter, are of one canopy layer, and lack snags. Heavy branches characteristic of old-growth hemlock are also absent.

In relation to wildlife habitat, these characteristics have generated considerable concern. A long depauperate stage means that forbs and shrubs important in Sitka black-tailed deer nutrition will be unavailable in these stands. Winter thermal cover is considered the most important factor limiting Sitka black-tailed deer populations in Southeast Alaska (Wallmo and Schoen 1980, Kirchhoff et al. 1983, Schoen and Kirchhoff 1990). Because young-growth canopies do not hold snow very well, they are considered poor winter thermal cover.

A lack of multiple shrub/tree layers in second growth generally means these stands are less valuable for some songbird species (Kessler 1979) Similarly, cavity-nesting birds and mammals depend on snags that may be notably absent in second growth (Noble and Harrington 1978, Bull et al. 1990).

To counter these effects, experimental second-growth treatments are under evaluation. Artificial canopy gaps have been created on the Area since 1988, with the objective of retaining light in the understory to maintain shrubs and forbs. Monitoring efforts since 1989 have suggested that the age and plant association of treated stands must be carefully considered. On productive sites, stands older than 15-20 years are probably past an age where understory forbs can benefit greatly from treatment (DeMeo et al. 1990). On plant associations designated with disturbance species (i.e., devil's club and salmonberry), salmonberry (of low deer forage value) expansion is likely following treatment.

Thinning is another potential option to allow light into the understory. Three strategies have thus far been attempted on the Area: 1) changing spacing of thinning to favor forage species (but maintain a grid pattern of residual trees); 2) thinning at variable spacing (i.e., residual trees are selected for size and species, not to maintain a grid, with the result that trees are randomly-spaced or in clumps); and 3) commercially thinning, i.e., thinning much later (age 60 years plus) in the stand's development, to favor forage.

No consensus has yet emerged on the best thinning spacing to favor wildlife. Similarly, variable-spaced thinning is too new a technique to draw conclusions. Because canopy gaps and conventional thinning would require repeated treatments to remain effective, however, variable-spaced thinning has the advantage of requiring only one entry. Variable-spaced thinning also is the technique that most clearly focuses on a desired future stand condition rather than short-term benefits. Given the immense amount of second growth on northern Prince of Wales appropriate for treatment, this may offer the best option.

For More Information

Each plant association write-up, particularly those for the hemlock and redcedar series, contains information on second-growth vegetation response. Information on Western Hemlock/Blueberry includes data on deer browsing of blueberry and slash as an impediment to deer movement. Appendix E lists abundances of forage available for deer in old growth.

A comprehensive literature review of second growth-wildlife relationships for the Ketchikan Area was prepared by Brown et al. (1992), and serves as a good starting point for further information.

Readers are cautioned that wildlife relationships are complex, and that there is danger in focusing on only one aspect of a species' requirements. For example, great effort could be put into maintaining deer forage in an area, only to discover that deer were not locally limited by forage, or it is available at the wrong time of year, etc. Take care to evaluate all aspects of a species' biology at different scales.

Alternate Harvesting Techniques

In recent years, alternatives to clearcutting have received increasing scrutiny, driven both by public pressures (Chief's June 4, 1992, letter) and increasing documentation of the reduced biodiversity associated with even-aged second-growth stands (Alaback 1982).

While clearcutting has many advantages for timber production (Burns 1983, Boughton 1990), at least in the short term, managing for both timber and wildlife must consider some problem areas:

1) Cedar silviculture is problematic, and to be successful will probably require a variety of techniques.

This issue is more fully discussed in the introductions to chapters 5 and 7, dealing with redcedar and yellowcedar associations, respectively. Data available suggest that clearcutting will not consistently regenerate these species. While there is no clear evidence that partial cutting will do so either, the autecology of these species suggests it may be more useful in maintaining cedars as a viable timber resource.

2) Clearcutting removes snags and potential snags from stands.

Snags and older/damaged live trees are critical for cavity-nesting birds and mammals (Bull et al. 1990, Davis et al. 1983). Additionally, snags provide a long-term nutrient source, habitat for fauna (insects, small mammals) and flora (fungi) that may play important roles in ecosystem function, and an eventual source of woody debris. These "biological legacies" are the means of perpetuating ecosystem attributes over time (Franklin and Waring 1980, Franklin 1989).

3) Low second-growth species and structural diversity can have potentially adverse affects on wildlife population viability.

This issue has been the focus of considerable interest and investigation on the Tongass. While it is difficult to conclusively state that second growth is adverse for wildlife, its attributes raise concerns.

As stated earlier, second-growth stands experience an extended depauperate stage where forbs used by deer are absent. Young second-growth stands provide poor winter thermal cover for deer and other species. Structurally, second growth lacks both horizontal and vertical diversity, i.e., the range of tree diameters and number of canopy layers is limited. Structural diversity is generally associated with higher populations of songbirds.

4) Important aspects of biodiversity are reduced or altered.

Because diversity has so many aspects, it is impossible to neatly quantify it as a single entity. Nevertheless, specific attributes of diversity can be quantified. In ecosystem management, the focus should be on what is most critical or limiting to ecosystem function rather than maximizing diversity per se.

Second-growth stands generated by logging across the landscape provide a good example of this. Staggered placement of logging units increases beta diversity (the differences between forest stands or patches). It can also fragment interior old-growth conditions, however. Contiguous old-growth conditions can be critical for some wildlife species (the northern spotted owl provides a famous example). Moreover, without sufficient patch size, old growth may not fully function as such, with potentially profound effects on wildlife movement, water runoff, seed dispersal, understory vegetation propagation, etc. Ecosystem function is far from fully understood, and its alteration could have potentially unforeseen effects.

Alternatives to clearcutting can be divided into three major options, by logging system and ecological zone: 1) shovel yarding on gentle slopes, 2) alternatives to highlead yarding on well-drained midslopes, and 3) helicopter logging on the steepest and highest elevation slopes.

Shovel yarding

Shovel yarding is restricted to slopes less than 20 percent. On the Ketchikan Area, this generally means poor sites in the Mixed Conifer or Western Hemlock-Western Redcedar Series, or the outer edges of riparian floodplains. At present the latter is a minor portion of the timber program on the Area.

This technique employs what is essentially a backhoe with an attachment to pick up logs. The machine moves about the unit on treads. Typically a mat of logs must be placed on the soil surface to avoid soil destruction.

With this system, individual trees can be harvested and yarded. Perhaps the greatest value of shovel yarding is that a selection system can be used for tree regeneration. Individual trees can be left to become part of the stand that follows. The value of this in retaining snags and future snags is obvious, but regenerating cedars by retaining smaller ones from the previous stand is also a great benefit. Cedars do not regenerate consistently in second-growth stands of Southeast Alaska, and planting seedlings may require rotations of 200 years or longer (see Chapters 5 and 7).

Alternatives on Midslopes

Hillslopes and mountain slopes have received the bulk of logging to date on the Ketchikan Area, and this is likely to remain so in the foreseeable future. Cable yarding is employed, and most cable systems used to date have been limited in ability to leave trees behind.

Leaving individual trees behind, except along the edges of units, will be difficult to attain even if a skyline system (offering the best suspension and lateral log movement capabilities) is employed. Instead, the best option may be to retain strips or clumps (forest islands) of trees. Leaving trees in clumps increases the possibility that at least some will remain windfirm over time. These clumps can serve to provide snags and snag recruitment, as well as sources of understory forbs and shrubs to "innoculate" the rest of the stand. If properly designed, strips of trees can serve as wildlife transit corridors.

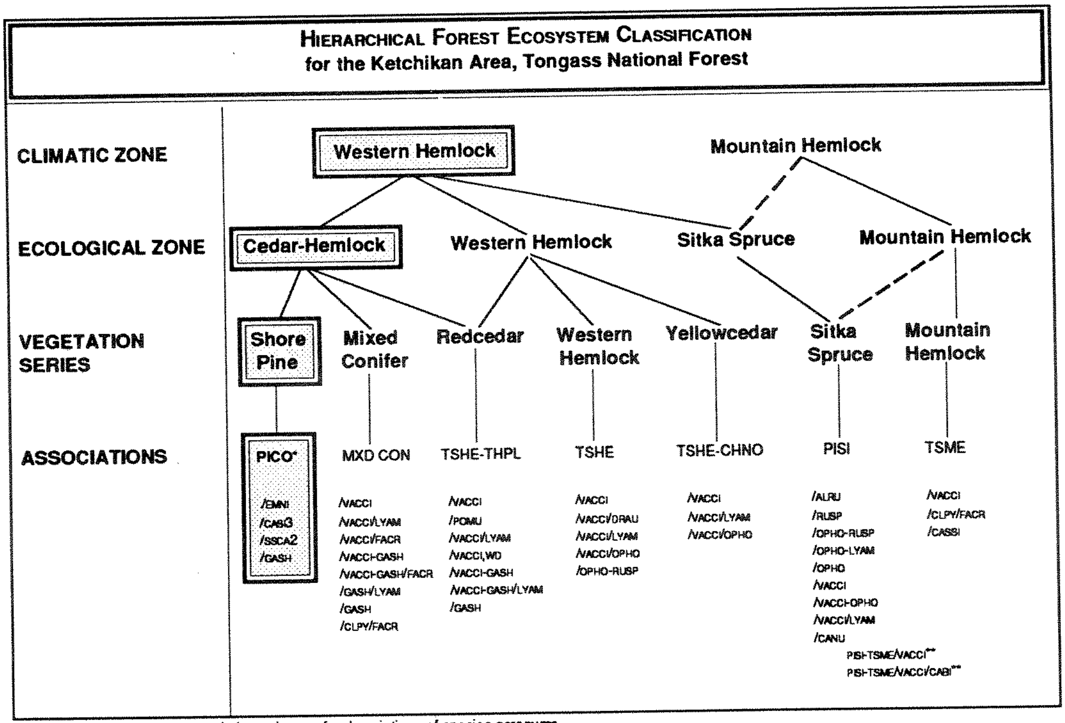
Helicopter Logging

While costs may be prohibitive unless spruce or cedars are a significant component of the stand, helicopter logging offers many resource benefits. As with shovel yarding, individual trees can be left. This is especially beneficial in managing yellowcedar, as the species is most abundant on upper slopes at 1,000-1,500 feet elevation (see Chapter 7). Helicopters are used to remove logs, so there is no need for road construction (although an existing road must be within one mile of the unit to serve as a log collection point). Because roads are not involved, many soil erosion and mass movement problems are avoided, and sites otherwise too steep can be logged.

For More Information

Hopwood's *Principles and Practices of New Forestry* (1991) provides an excellent primer on alternative forestry methods. Hunter's (1990) *Wildlife, Forests, and Forestry* is another valuable guide, written for field applications. Both are highly recommended as guides to implementing Ecosystem Management.

Shore Pine Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

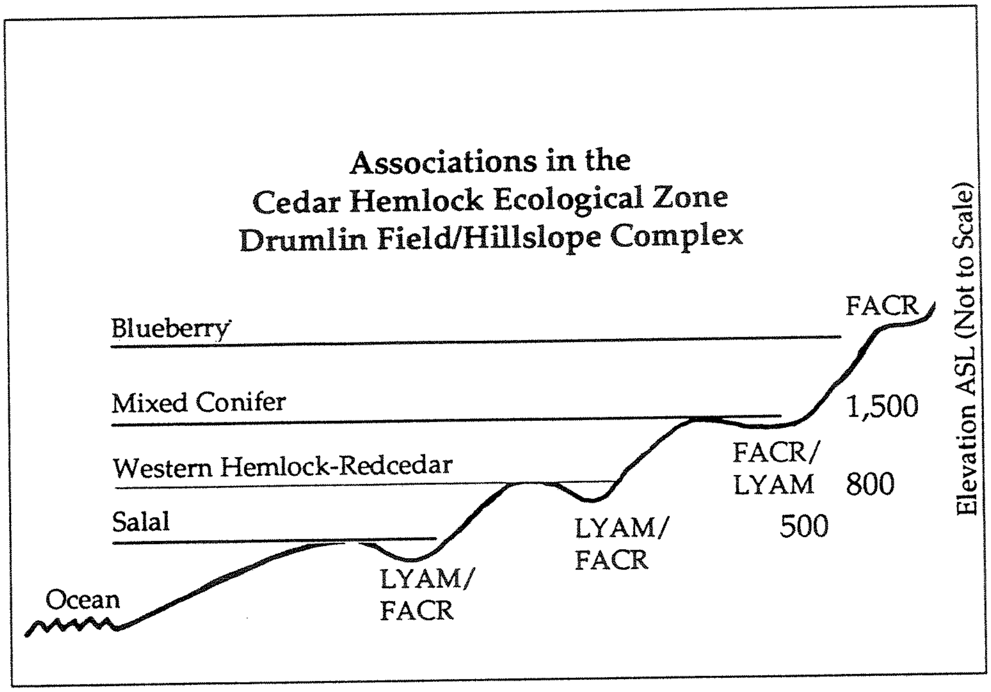


Fig. 2. The Shore Pine Series occupies poorly drained inclusions in the Cedar-Hemlock Ecological Zone. It cannot be mapped except at very small scales. It can occur anywhere on this diagram up to 1000 ft.

3
SHORE PINE SERIES

Cedar-Hemlock Ecological Zone

Shore pine (*Pinus contorta* var. *contorta*) represents the transition from open, poorly-drained mixed conifer to even less productive non-forest muskeg, and typically occurs as a ring or fringe around peatlands (muskegs). Shore pine stands are seldom very large; usually the transition from mixed conifer to muskeg occurs within 100 yards or less. The transition from mixed conifer to shore pine is very often diffuse and gradual, so that it can be difficult to distinguish between the two.

Shore pine plant associations are defined as those exhibiting at least 20 percent overstory shore pine cover. Because these sites barely support forest, minimum overstory height has been arbitrarily set at 25 feet. Cover less than this is considered muskeg. Stand height typically ranges to 50 feet, but occasionally can reach 75 feet.

Soils are always poorly drained, and are usually deep and organic (Histosols). Drainage is restricted by bedrock or till. These associations are most often found on gently sloping lowlands and benches, but can be found in nearly any slope position as long as sites are generally flat and drainage is restricted. Shore pine is temperature-limited, and generally does not occur above 1,500 feet elevation.

Disturbance from wind, moving water, or soil movement is rare in this habitat. Trees can be hundreds of years old, even though only a few inches in diameter. In the soil, decomposition rates are so slow that logs buried centuries ago are still intact when unearthed.

Shore pine habitats have the highest vascular plant species diversity among all forested associations. Although soil conditions are unfavorable, abundant microsites and light provide suitable niches for many species. Common understory plants include crowberry, three species of dwarf blueberries, Labrador tea, bog kalmia, sedges, and sphagnum moss.

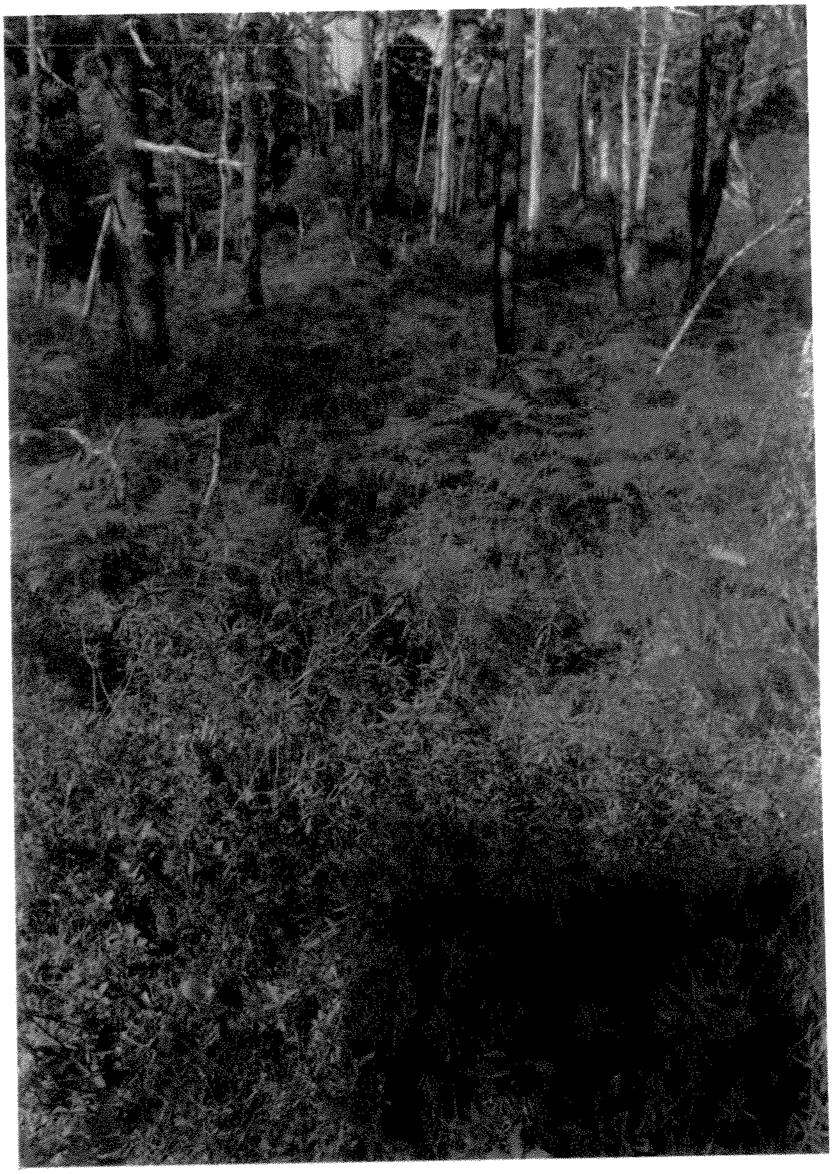
Shore pine stands contain non-commercial timber. Near human communities, the pines provide a source of Christmas trees. Recreationally they are of value for hunting and cross-country skiing.

Perhaps the greatest value of shore pine ecosystems is their hydrologic function in retaining water and regulating water flows. They act as "sponges" in the landscape, retaining high water flows and becoming a source of groundwater during dry periods. This regulating action is a critical landscape function whose value is incompletely understood.

Shore Pine/Crowberry

Pinus contorta/Empetrum nigrum

PICO/EMNI 610



Vegetation

Stands are very open and park-like, with an average overstory cover of 32 percent. Pine averages 24 percent cover. Yellowcedar was present in about half the sampled overstories and averaged 7 percent cover. Spruce, western and mountain hemlock, and redcedar may all be present in small amounts.

In the understory, yellowcedar is consistently present, and more commonly found than shore pine. Yellowcedar in the understory forms a diffuse, shrubby layer a few feet in height. Average understory cover is 26 percent for yellowcedar and 12 percent for shore pine.

The shrub layer is dominated by short, ericaceous plants. Crowberry is consistently present and averages 30 percent cover. Bog kalmia and Labrador tea are nearly always present. Dwarf *Vaccinium* species-- mountain cranberry, bog blueberry, bog cranberry, and dwarf blueberry-- are common.

Forb diversity is among the highest of forested plant associations (see Chapter 10). Bunchberry, not normally thought of as a bog species, is consistently present and averages 16 percent cover. This is probably due to the species' favorable response to high light availability.

In contrast to high species diversity, shore pine stands are structurally simple-- usually a few scattered trees of about the same diameter and height. Snags are not abundant, and those present are usually not attractive to cavity nesters. Shore pine grows exceedingly slowly; consequently, growth rings are tight and the wood is often very hard.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Shore pine	24%	100%	Crowberry	30%	91%
Yellowcedar	7	50	Bog kalmia	4	83
			Labrador tea	25	83
			Dwarf blueberry	11	91

Tree Understory			Forbs etc.		
Yellowcedar	26	100%	Bunchberry	16	91
Shore pine	12	75	Burnet	4	58
Redcedar	22	66	Sedges	20	50
Western hemlock	9	66			

Distribution and Environment

Shore pine associations represent the transition from mixed conifer stands to open peatlands (muskegs). They are common throughout the Ketchikan Area. Soils are always poorly or very poorly drained, and are typically deep and organic (Histosols) with very slow decomposition rates. Shore Pine/Crowberry occurs on gently sloping or flat lowlands, but can also be found on benches of hills and mountains. The key characteristic of this association is severely restricted soil drainage.

Most sampled stands were at less than 500 feet elevation, but shore pine sites can occur up to 1,500 feet if sites are suitable.

Typical Soils-- Shore Pine/Crowberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Lowlands, Benches	20,23,24,25,49
Kina	Organics	Lowlands	23,49,92,220,25

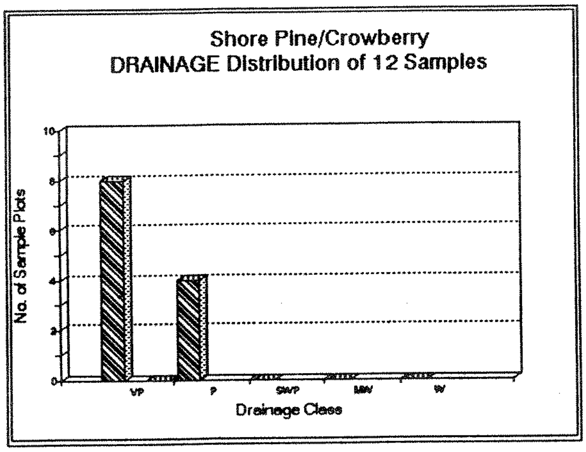


Fig. 3. Drainage Distribution of Shore Pine/Crowberry Sample Plots.

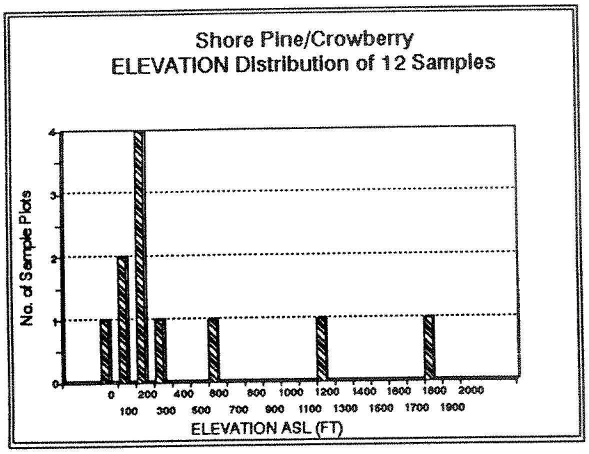


Fig. 4. Elevation Distribution of Shore Pine/Crowberry Sample Plots.

Similar Associations

Shore Pine/Crowberry is similar to other shore pine associations. Crowberry, in fact, is well represented throughout the shore pine series. Other associations are distinguished by their respective indicators. This association can be confused with poorer mixed conifer sites, but they will be distinguished by the presence of mountain hemlock and less than 20 perent overstory shore pine cover.

Management Implications

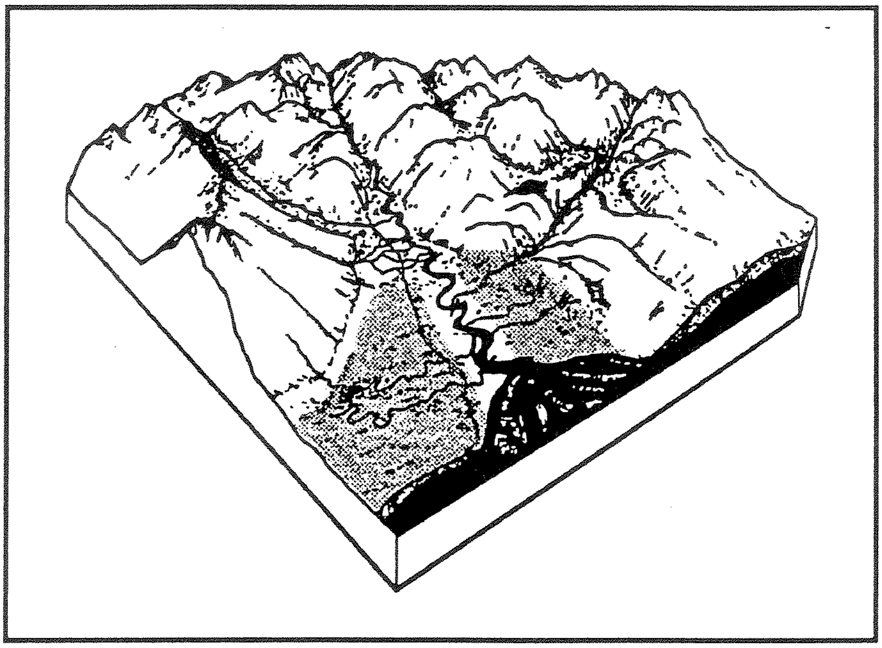
Timber is clearly non-commercial. Estimates generated from field data showed an average total volume of only 800 bd ft/ac. Incidental road construction has been observed to increase shore pine regeneration adjacent to roads in some cases.

Shore pine sites are clearly **wetlands** (DeMeo and Loggy 1989). Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Trail construction is expensive because of deep, wet soils, and requires planking (BMP 16.4). Shore pine sites provide **recreation** opportunities such as cross-country skiing, hunting, and gathering Christmas trees.

Representative Field Locations

In general, this association is found along the fringes of many scrub-shrub evergreen muskegs and is not difficult to find. Near Ketchikan, the National Forest entrance sign on the Ward Lake Road marks a good example of this association. On Prince of Wales Island, a superb example with relatively large trees can be found along the 2058 Road near Naukati. The Old Franks road extension (constructed in 1990-91) provides an example for the Craig District.



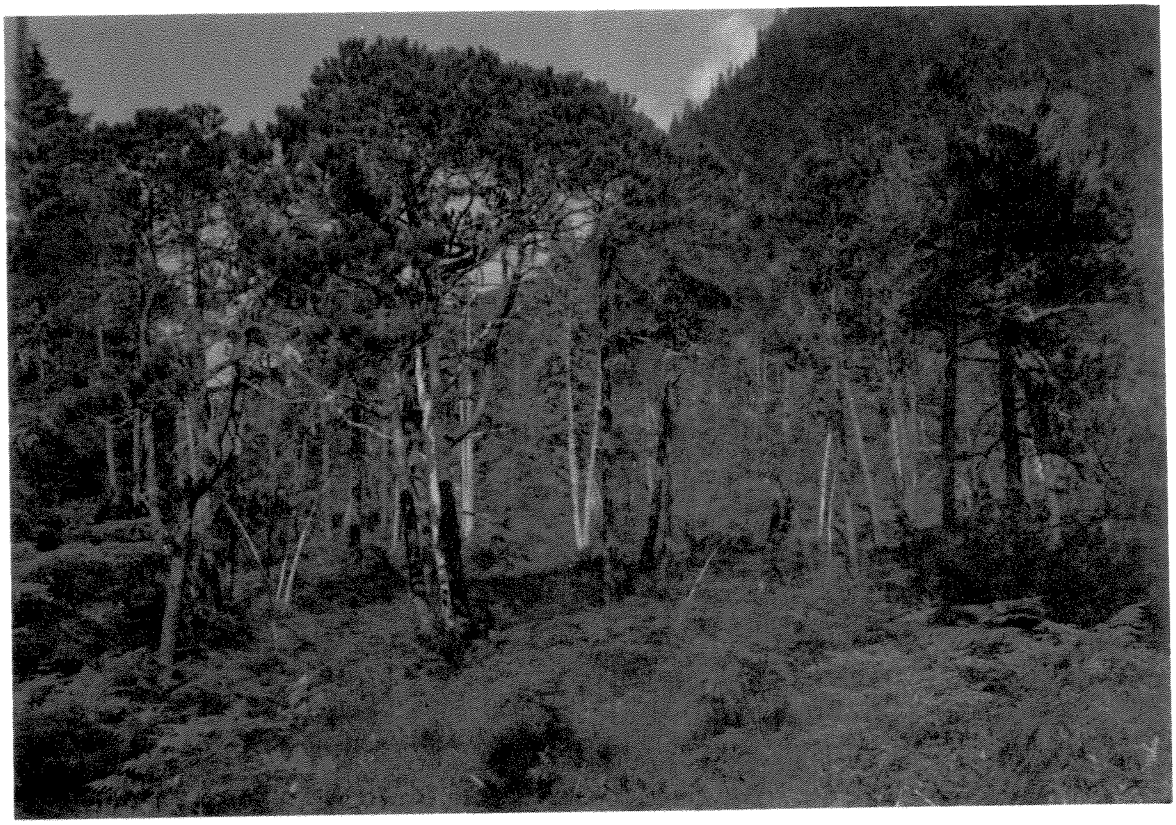
Most common landscape position(s) of the Shore Pine/Crowberry association.

VACA
Vaccinium caespitosum
Dwarf blueberry

Shore Pine/Sitka Sedge

Pinus contorta/Carex sitchensis

PICO/CASI3 630



Vegetation

Stands are very open and park-like, with an average overstory cover of 37 percent. Shore pine averages 30 percent cover. Sitka spruce and mountain hemlock were each present in about two thirds of sampled overstories. Yellowcedar was less common.

In the understory, shore pine was consistently present and averaged 6 percent cover. Yellowcedar was also common. Sitka spruce was consistently present in small amounts but showed evidence of stress.

Shrubs occur around drier mounds among tall sedge. The shrub layer is characterized by short, ericaceous plants. Crowberry is consistently present and averages 10 percent cover. Bog kalmia and Labrador tea are nearly always present. Dwarf *Vaccinium* species-- mountain cranberry, bog blueberry, bog cranberry, and dwarf blueberry-- are common.

Like other shore pine associations, forb diversity is very high (see Chapter 10). Bunchberry, not normally thought of as a bog species, is consistently present and averages 27 percent cover. This is probably due to the species' favorable response to high light availability.

Sitka sedge cover averages 18 percent and the plants average 2-3 feet tall. Other sedges are also often present. Sedges in this case indicate abundant water, but water that may be somewhat more aerated than in other shore pine associations. Frequently this association will occur in conjunction with old stream or river courses that have filled in. This may also explain the presence of Sitka spruce, usually associated with moving water. Sitka sedge is common behind beaver empoundment areas.

Although they have high species diversity, shore pine stands are structurally simple-- usually a few scattered trees of about the same diameter and height. Snags are not abundant, and those present are usually not attractive to cavity nesters. Shore pine grows exceedingly slowly; consequently, growth rings are tight and the wood is often very hard.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Shore pine	30%	100%	Crowberry	10%	100%
Yellowcedar	6	33	Bog kalmia	4	100
			Labrador tea	7	100
			Dwarf blueberry	50	100
Tree Understory			**Forbs etc.**		
Yellowcedar	47	67	Bunchberry	27	100
Shore pine	6	100	Sitka sedge	18	100
			Many-flowered sedge	25	66

Distribution and Environment

Only three stands were sampled. Like other shore pine associations, soils were poorly or very poorly drained, and typically deep and organic (Histosols). Shore Pine/Sitka Sedge occurs on gently sloping or flat lowlands, but can also be found on benches or small poorly drained inclusions in rolling hill country. Stands were sampled up to 1,100 feet.

Typical Soils-- Shore Pine/Sitka Sedge

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kina	Organics	Lowlands	23,49,92,220,25

Similar Associations

Shore Pine/Sitka Sedge is distinguished from other shore pine associations by a minimum 3 percent cover of tall Sitka sedge. In general, it is also more likely to have standing water over a higher proportion of the site. This association can be confused with poorer mixed conifer sites, but no other plant association has an abundance of tall sedge; a minimum of 20 percent shore pine in the overstory distinguishes it as a shore pine site.

Management Implications

Timber is clearly non-commercial. Sampled stands averaged 2,500 bd ft/ac. Shore pine sites are clearly **wetlands** (DeMeo and Loggy 1989). Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

These sites provide an important wetland function; coho salmon rearing habitat, beaver activity, and waterfowl nesting are commonly found here. These sites occupy a very small part of the landscape, and protection measures should be considered. Road construction and possible interruption of the groundwater hydrology is the greatest threat to these forest-bog ecosystems.

Trail construction is expensive because of deep, wet soils (BMP 16.4). Shore pine sites provide **recreation** opportunities such as cross-country skiing, hunting, and gathering Christmas trees.

Representative Field Locations

Near Ketchikan, the Ward Lake Road about a mile east of Ward Lake provides a small example. On Prince of Wales Island, try the 2058 Road near Naukati.

CASI3
Carex sitchensis
Sitka sedge

Shore Pine/Tufted Clubrush
Pinus contorta/Scirpus caespitosum
PICO/SCCA2 640

Vegetation

Stands are very open and park-like, with an average overstory cover of 29 percent. Shore pine averages 22 percent cover. Yellowcedar occurred in about 80 percent of sampled overstories, but averaged only 7 percent cover. Other overstory conifers can be considered incidental.

In the understory, both shore pine and yellowcedar are consistently present, but the latter is usually more abundant. Yellowcedar often forms a diffuse, shrubby layer a few feet in height. Average understory cover is 26 percent for yellowcedar and 17 percent for shore pine.

The shrub layer is dominated by short, ericaceous plants. Crowberry is always present and averages 36 percent cover. Bog kalmia and Labrador tea are consistently present. Dwarf *Vaccinium* species-- mountain cranberry, bog blueberry, bog cranberry, and dwarf blueberry-- are common.

Tufted clubrush designates the association and averages 22 percent cover. This short (about 6 inches height) grass-like plant produces a rug-like appearance and is especially abundant around the fringes of small ponds common to this association.

Forb diversity is among the highest of forested plant associations (see Chapter 10). Bunchberry, not normally thought of as a bog species, is consistently present and averages 13 percent cover. This is probably due to the species' favorable response to high light availability.

This association is limited in structure, with an average basal area of only 74 square feet per acre. Snags are not abundant, and those present are usually not attractive to cavity nesters. Shore pine grows exceedingly slowly; consequently, growth rings are tight and the wood is often very hard.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Shore pine	22%	100%	Crowberry	36%	100%
Yellowcedar	7	75	Bog kalmia	7	90
			Labrador tea	5	85
			Dwarf blueberry	18	100

Tree Understory			Forbs etc.		
Yellowcedar	26	87	Bunchberry	13	100
Shore pine	17	87	Skunk cabbage	2	62
			Sedges	17	50

Distribution and Environment

Soils are always poorly or very poorly drained, and are typically deep and organic (Histosols) with very slow decomposition rates. Shore Pine/Tufted Clubrush is nearly always found on gently-sloping or flat lowlands. Sampled stands were clustered around 100 and 1,000 feet in elevation (Fig. 6). Site productivity is very low, even for a shore pine association.

Typical Soils-- Shore Pine/Tufted Clubrush

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Lowlands, Benches	20,23,24,25,49
Kina	Organics	Lowlands	23,49,92,220,25

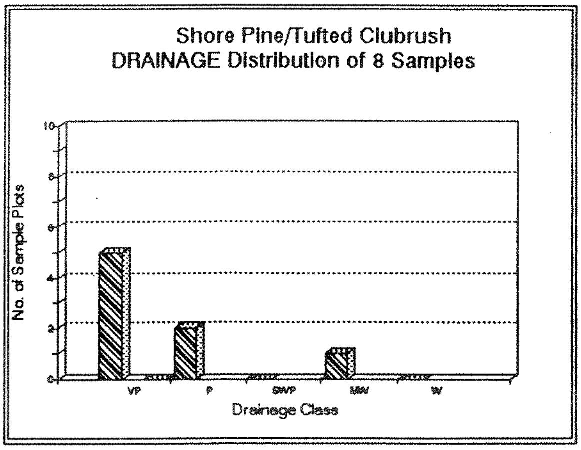


Fig. 5. Drainage Distribution of Shore Pine/Tufted Clubrush Sample Plots.

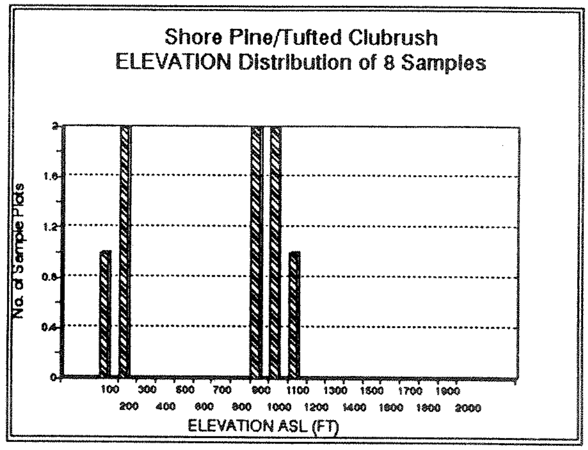


Fig. 6. Elevation Distribution of Shore Pine/Tufted Clubrush Sample Plots.

Similar Associations

Shore Pine/Tufted Clubrush is distinguished from other shore pine associations by the abundance of clubrush. Additionally, sites show very low productivity, with a mean stand height of less than 40 feet. This association is unlikely to be confused with mixed conifer sites, because abundance of conifers other than shore pine is severely limited.

Management Implications

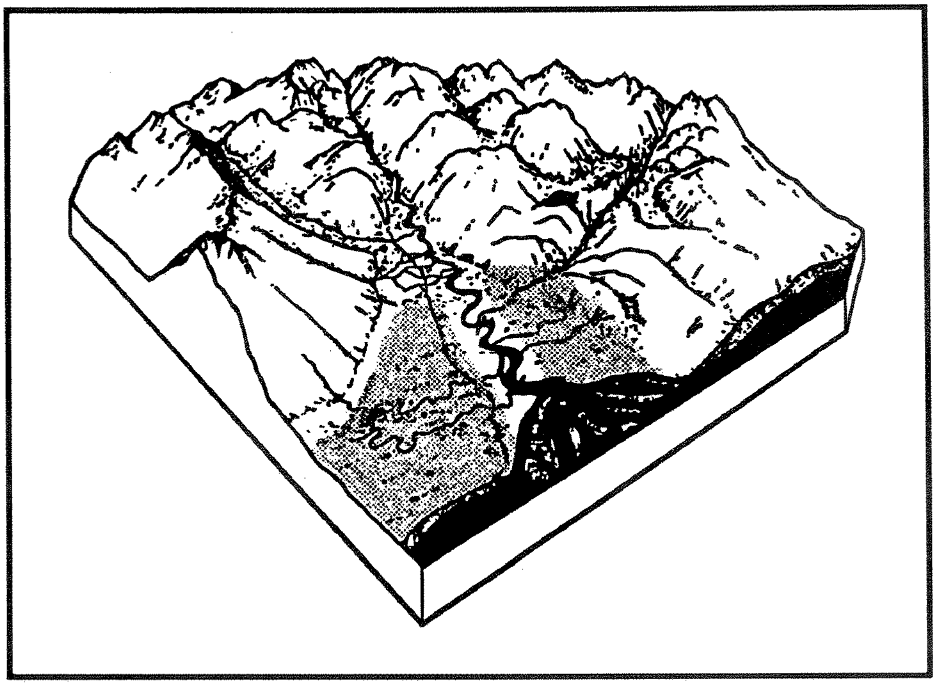
Timber is non-commercial. Sampled stands averaged 1,300 bd ft/ac. Incidental road construction has been observed to increase shore pine regeneration adjacent to roads in some cases.

Pine sites are **wetlands** (DeMeo and Loggy 1989). Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Trail construction is expensive because of deep, wet soils with low bearing stength. Planking will be required (BMP 16.4). Shore pine sites provide **recreation** opportunities such as cross-country skiing, hunting, and gathering Christmas trees.

Representative Field Locations

Good examples of this association are often found around 1,000 feet elevation. For Ketchikan, Lunch Creek at Mile 16 north will provide an example. On Prince of Wales Island, an example can be found along the Polk Inlet Road. Good examples can also be found in the Old Frank's drainage.



Most common landscape position(s) of the Shore Pine/Tufted Clubrush association.

VACA
Vaccinium caespitosum
Dwarf blueberry

Shore Pine/Salal

Pinus contorta/Gaultheria shallon

PICO/GASH 650

Vegetation

Stand overstory cover averages 34 percent, typical for the shore pine series. Shore pine averages 28 percent cover. Yellowcedar occurred in two thirds of sampled overstories but averaged only 4 percent cover. Redcedar, because of its association with salal, is better represented in this habitat than in any other shore pine association, but it occurred in less than half of sampled overstories. In Southeast Alaska, both redcedar and salal are light-limited and are therefore associated with open canopies.

In the understory, both shore pine and yellowcedar are consistently present, but the latter is usually more abundant. Yellowcedar often forms a diffuse, shrubby layer a few feet in height. Average understory cover is 36 percent for yellowcedar and 28 percent for shore pine. Redcedar is usually present and averages 15 percent cover.

Salal dominates the shrub layer, with an average of 37 percent cover. Crowberry is usually present and averages 21 percent cover. Bog kalmia is less common than in other shore pine associations, but Labrador tea is well-represented. Dwarf *Vaccinium* species-- mountain cranberry, bog blueberry, bog cranberry, and dwarf blueberry-- are common. Tall blueberry is consistently present, and rusty menziesia is common.

Because of the abundant light in old growth, forb diversity is among the highest of forested plant associations (see Chapter 10). Bunchberry, however, is less consistently present than in other associations of this series. Other common forb layer plants include fernleaf goldthread, skunk cabbage, and bracken fern. While bracken fern is not common in Southeast Alaska, it is frequently found in this association and like salal is another indication of high light availability.

Basal area averages 100 square feet per acre. Snags are not abundant, and those present are usually not attractive to cavity nesters. Shore pine grows exceedingly slowly; consequently, growth rings are tight and the wood is often very hard.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Shore pine	28%	100%	Salal	37%	100%
Yellowcedar	4	67	Bog kalmia	3	67
Redcedar	6	44	Labrador tea	26	89
			Crowberry	21	88
			Tall blueberry	9	88
Tree Understory			**Forbs etc.**		
Yellowcedar	36	89	Bunchberry	34	67
Shore pine	28	100	Skunk cabbage	5	78
Redcedar	15	89	Sedges	9	55

Distribution and Environment

Soils are always poorly or very poorly drained, and are typically deep and organic (Histosols) with very slow decomposition rates. All samples were found on gently sloping or flat lowlands. In contrast to other shore pine associations, Shore Pine/Salal sites are limited to about 500 feet in elevation. This is consistent with salal sites in other series. Salal is near its northern range limit on the Ketchikan Area, and is limited by light and temperature. Site productivity is very low, typical of shore pine associations.

Shore Pine/Salal sites can show some pit-and-mound topography development, and are more varied in microrelief than other shore pine associations. This, with light, probably explains the high diversity of plants.

Typical Soils-- Shore Pine/Salal

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Lowlands, Benches	20,23,24,25,49

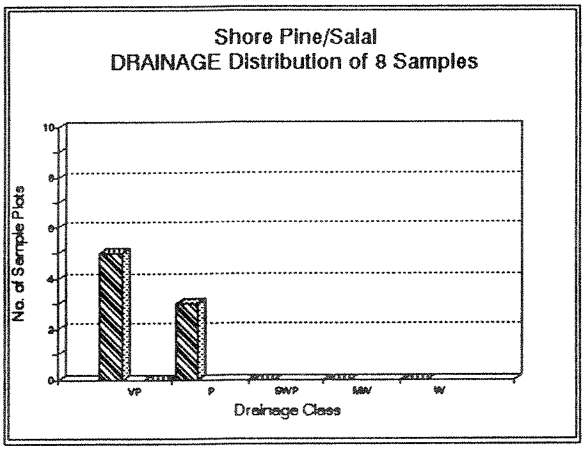


Fig. 7. Drainage Distribution of Shore Pine/Salal Sample Plots.

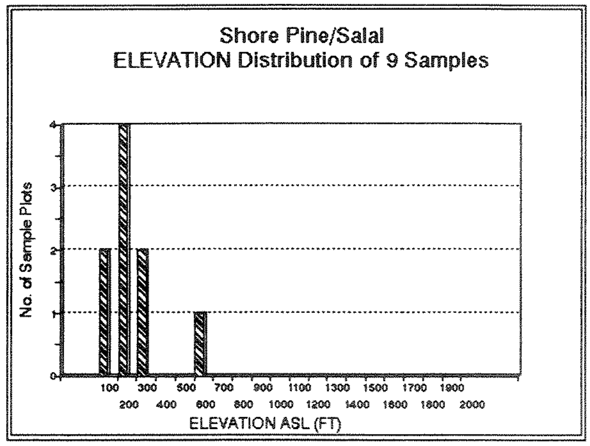


Fig. 8. Elevation Distribution of Shore Pine/Salal Sample Plots.

Similar Associations

Shore Pine/Salal is easily distinguished from other shore pine associations by a minimum of 3 percent salal cover. Distinguishing it from mixed conifer associations can be problematic, however, because the two grade into each other. Shore Pine/Salal is more like mixed conifer than other associations in the shore pine series. A minimum 20 percent shore pine in the overstory distinguishes this from other series.

Management Implications

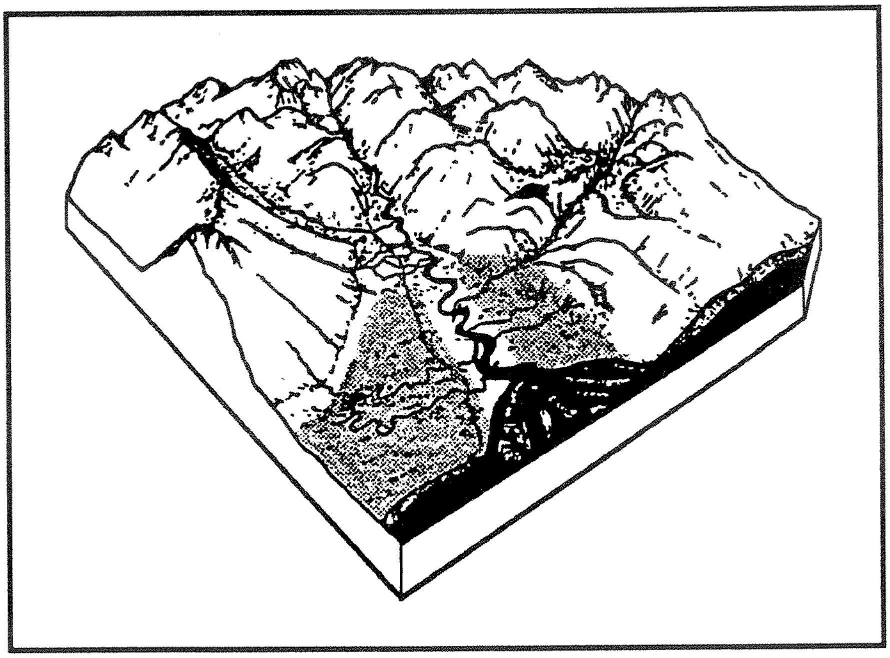
Timber is clearly non-commercial. Sampled stands averaged 4,100 bd ft/ac. Incidental road construction has been observed to increase shore pine regeneration adjacent to roads in some cases.

Shore pine sites are clearly **wetlands** (DeMeo and Loggy 1989). Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Trail construction is expensive because of deep, wet soils, and requires planking (BMP 16.4). Shore pine sites provide **recreation** opportunities such as cross-country skiing, hunting, and gathering Christmas trees.

Representative Field Locations

Near Ketchikan, examples can be found at the Deer Mountain Trailhead and along Lunch Creek at Mile 16 North. On Prince of Wales Island, look on lowlands near the southern inlets-- Moira Sound, Cholmondeley Sound, Kendrick Bay, etc.



Most common landscape position(s) of the Shore Pine/Salal association.

GASH
Gaultheria shallon
Salal

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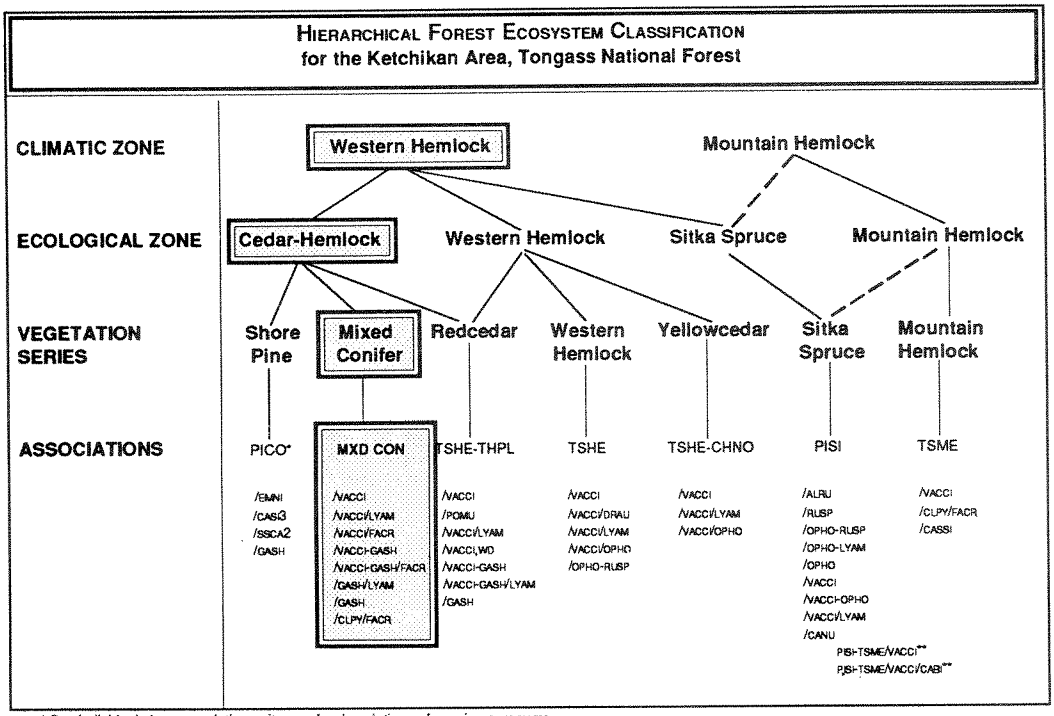
Mixed Conifer Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

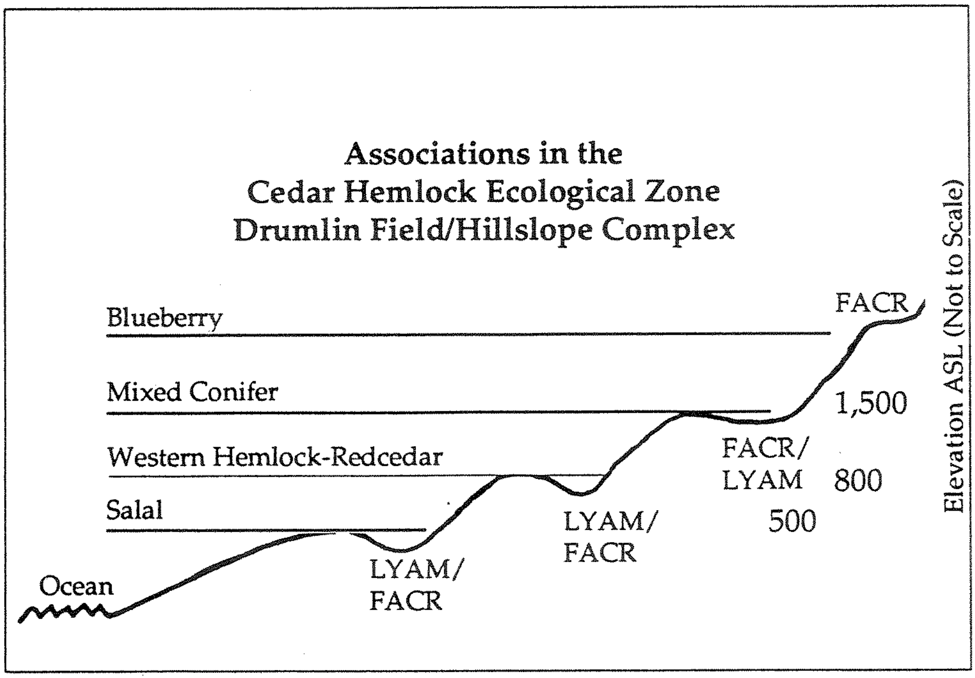


Fig. 9. Schematic of the Mixed Conifer series. It comprises the bulk of the Cedar-Hemlock Ecological Zone. Site productivity is limited by restricted drainage or shallow soils. LYAM = skunk cabbage, FACR = deer cabbage.

4
MIXED CONIFER SERIES

Cedar-Hemlock Ecological Zone

The Mixed Conifer Series occupies the bulk of the Cedar-Hemlock Ecological Zone. Covering vast acreages of the Ketchikan Area, mixed conifer associations are among the most common forested plant associations. Yellowcedar, western hemlock, mountain hemlock, and redcedar are all common components. Shore pine and Sitka spruce may also be present. No one conifer dominates; hence the name Mixed Conifer.

Presence of mountain hemlock (in small amounts) is used to define the series. In small amounts this conifer is associated with poor soil drainage; in excess of 20 percent cover it is clearly associated with the cold temperatures of the Mountain Hemlock Series.

At the landscape level, mixed conifer sites designate poor drainage and/or shallow soils. Intermediate between muskeg and the somewhat better-drained hemlock-redcedar series, they generally occupy more poorly drained and low elevation landforms. Mixed conifer vegetation occurs on gently sloping and flat lowlands, kettles and kames, and on glacial outburst floodplains. It is also common on the rolling hillcountry associated with glacial drumlins.

Mixed conifer associations are most common below 1,500 feet elevation, but can be found higher, near the cold mountain hemlock zone.

In structure, Mixed Conifer sites feature an open canopy; overstory cover seldom exceeds 45 percent. The understory usually features a dense shrub layer combined with stunted conifers. Stands are old and stunted in appearance. Poor productivity due to soil drainage and depth usually restricts tree height to no more than 60-70 feet. Trees are indeed old, and cedars in these associations often exceed 1,000 years in age. Snags are common and often represent 25 percent or more of the basal area, but most snags are cedar and are of little value as bird nesting sites.

Vegetation is clearly more diverse than on productive sites with more closed canopies (see Chapter 10). The open sites, while of poor soil status, receive more sunlight than more densely covered, productive forest. Hence there are more niches available for vascular plant species. Understory species are abundant, and the overstory can include any of the common conifers, frequently three or more.

Blowdown is uncommon in this series because the open nature of the stands allows wind to pass through easily. This augments the low site productivity, because lack of blowdown means that thick soil organic layers are not churned and broken up by windthrow. Hence organic matter accumulation, low soil pH, and low nutrient availability are further enhanced.

Timber values are low because of low site productivity and poor tree form in old growth. Ignored in the past, mixed conifer sites are now being considered for logging as more productive sites become locally scarce. Response to logging information is inadequate but suggests slow yet steady conifer regeneration.

Value for spring, summer, and fall deer range can be high because of the abundant skunk cabbage and other succulent forbs. Thermal value, however, is poor because of the open canopy.

Mixed conifer associations can be placed in three environmentally different groups based on understory: blueberry, salal, and deer cabbage/copperbush.

The blueberry group represents the best-drained and most productive sites in this series. Blueberry plant associations frequently occur on rolling hills or other somewhat better-drained landforms. The blueberry/skunk cabbage association often forms small inclusions on blueberry sites.

Salal sites are warmer in that they receive more growing degree days per year. Consequently they reach best development on the southern part of the Ketchikan Area, notably the southern Prince of Wales Island Physiographic Province. They often form a fringe along protected beaches in this and other areas.

Salal associations on the Ketchikan Area occupy quite different sites than do those of Oregon and Washington. Here they are on poorly drained, organic soils; farther south they compete on dry, shallow, excessively-drained soils.

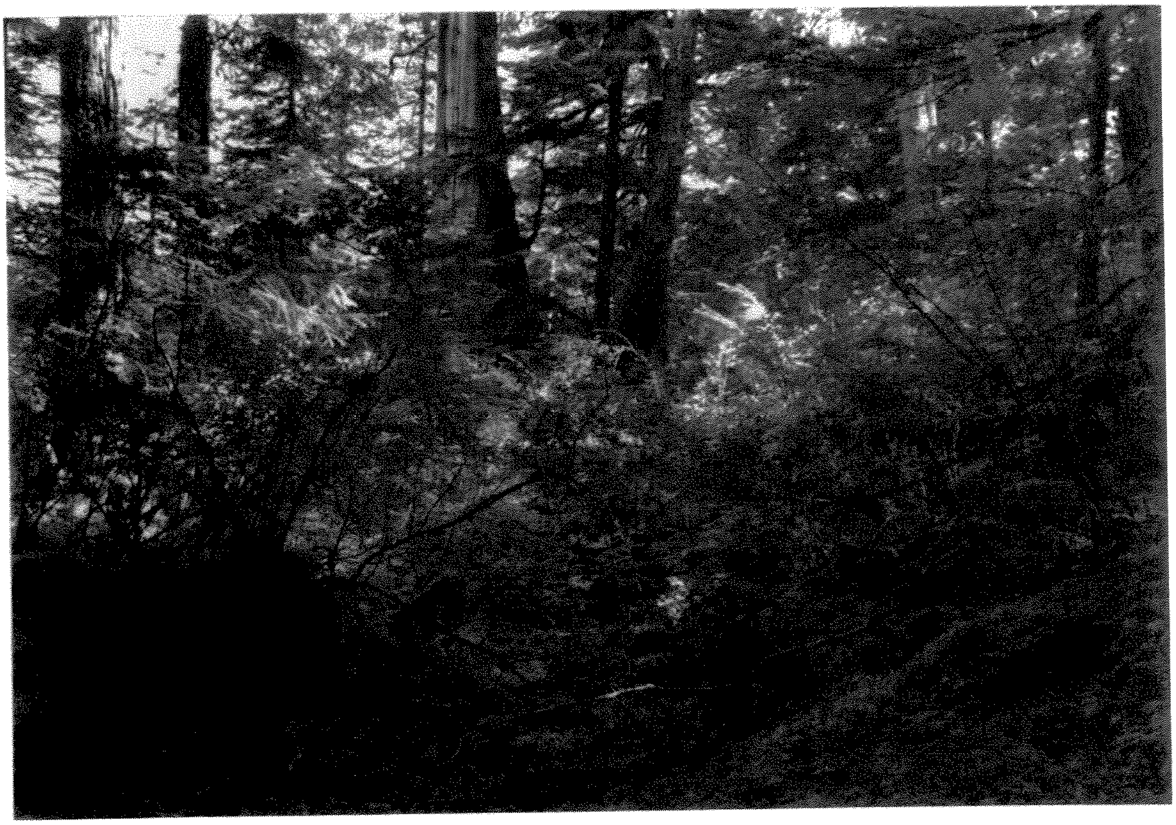
Occurrence of a number of burned Mixed Conifer stands is evidence that mixed conifer sites have become sufficiently dry in previous years. On these sites, the fires burned the surrounding muskegs but stopped at the edges of humid hemlock associations.

Deer cabbage and copperbush represent the coldest and most poorly drained sites of the series. Deer cabbage sites are found throughout a range of elevations. While the copperbush association can be found at low elevation, it best describes a higher elevation, almost subalpine type forming a transition to the Mountain Hemlock series. The copperbush association is more common farther north, where the environment is somewhat colder.

Mixed Conifer/Blueberry

Mixed Conifer/Vaccinium spp.

MXD CON/VACCI 410



Vegetation

Old-growth stands feature an open canopy. Mountain hemlock, yellowcedar, and western hemlock are all common in the overstory. Western redcedar was present in about half of the sampled overstories. The same general pattern was found for understory trees.

The shrub layer is dominated by blueberry. Often, blueberry is very thick and difficult to move through. Bunchberry, fernleaf goldthread, five-leaved bramble, and twayblade are common forbs. Deer fern was found in 90 percent of sampled stands.

Old-growth stands are structurally diverse and appear rough. Snags are abundant (24 percent of the basal area, on average) but are most frequently cedar snags, of little value to most wildlife species.

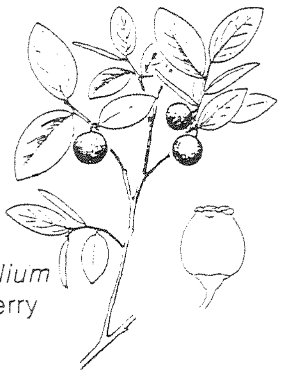
Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	8%	87%	Tall blueberry	37%	100%
Yellowcedar	18	84	Rusty menziesia	7	90
Western hemlock	18	81	Red huckleberry	2	62
Western redcedar	13	46			
Tree Understory			**Forbs, etc.**		
Mountain hemlock	7	87	Bunchberry	8	96
Yellowcedar	8	84	Deer fern	3	90
Western hemlock	11	90	Fernleaf goldthread	4	81
Western redcedar	5	59	Twayblade	1	78
			Five-leaved bramble	7	78

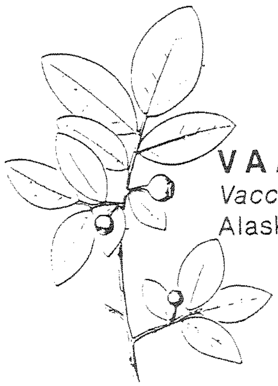
Distribution and Environment

Soils are generally organic and can be shallow or deep. Soil drainage is the most important environmental variable affecting this association-- 68 percent of sample plots were on poorly or somewhat poorly drained soils. Better-drained soils with this association are those limited by soil depth (Fig. 10).

Mixed Conifer/Blueberry occurs on a range of lowland, valley, hill, and mountain landforms. Typically it occurs in a fine-scale mosaic with other mixed conifer associations and will occupy somewhat better drained positions, such as on drumlins in a glacial outwash plain. On the Ketchikan Area, the association can be found at any elevation up to 1,500 feet, but seldom higher.



VAOV
Vaccinium ovalifolium
Oval-leaf huckleberry



VAAL
Vaccinium alaskaense
Alaska huckleberry

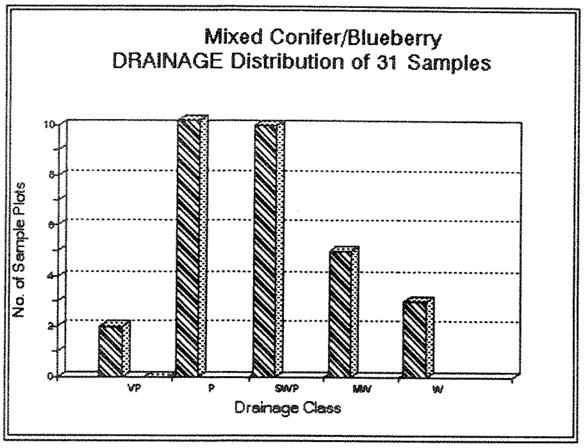


Fig. 10. Drainage Distribution of Mixed Conifer/Blueberry Sample Plots.

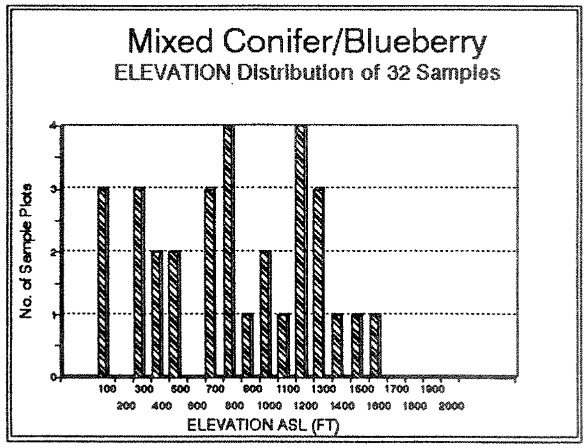


Fig. 11. Elevation Distribution of Mixed Conifer/Blueberry Sample Plots.

Typical Soils-- Mixed Conifer/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,24,25,51,550,25
Wadleigh	Compact Till	Lower Backslopes, Footslopes	31,252,320
McGilvery	Shallow Organic Over Bedrock	Mountain Slopes, Hill Slopes	33,62,79,540
Maybeso	Organics over Till	Footslopes	20,320,220,92

Similar Associations

At low elevation (less than 500 feet), Mixed Conifer/Blueberry is most like less productive Western Hemlock-Western Redcedar/Blueberry sites. The latter are somewhat more productive, show canopy closure greater than 45 percent, and are clearly designated by redcedar. At higher elevation (1,200-1,500 feet), mountain hemlock stands might be confused with this association, particularly when they include yellowcedar. Mountain hemlock stands, however, are clearly dominated by mountain hemlock (20 percent or more areal cover).

Management Implications

Mixed Conifer/Blueberry stands generally show low site productivity. **Timber** volume for Mixed Conifer/ Blueberry averages 17,200 bd ft/ac, corresponding to volume class 4. By species, 34 percent is combined western and mountain hemlocks, 41 percent is yellowcedar, 14 percent is redcedar, and 9 percent is Sitka spruce.

Shovel yarding may be an option on slopes less than 20 percent. Care should be taken to minimize soil disturbance, as mixed conifer is usually found on organic soils that lose structure when disturbed (BMP 13.7).

Regeneration information is limited, primarily because so few sites were logged until recently. However, the response of poorer hemlock-redcedar sites suggests that conifer growth response following logging will be slow. Many second-growth stands at age 15 will look like they had just been logged. When planning harvest, expect an extended rotation of up to 300 years. Natural regeneration stocking levels are generally adequate to meet National Forest Management Act (NFMA) requirements (BMP 13.19).

Augmenting cedar regeneration by planting is not recommended. Seedling survival is questionable and growth will be slow, resulting in a poor return on the high investment cost of planting. Retaining cedar as a stand component may best be achieved by using advance regeneration, including sapling, pole, and even mature-sized trees. The problem of yarding cables or shovel yarders interfering with residual trees is minimized because of the stands' open nature, but shovel yarders may need to move around more when residuals are left, increasing potential of soil damage (Landwehr, no date). Careful planning of logging systems is essential (BMPs 13.7, 13.15).

Prescribed-burned sites similar to Mixed Conifer/Blueberry on the Ketchikan Area show slow vegetation response. Depending on burn intensity, soil organic matter may be burned off, particularly on shallow soils. For these reasons, burning as site preparation is not recommended. Curiously, stands regenerated naturally by fire (e.g., sites on the Queen Charlotte Islands, Dog Island, Prince of Wales Island at Lancaster Cove, Dall Head on Gravina Island, etc.) show vigorous growth and much better form than old-growth mixed conifer. The mechanism for this response is not fully understood, but may be due to the break-up of organic matter accumulation and nutrient release following burning (BMPs 19.2, 13.19).

This association does not meet the criteria for **wetland** designation (Interagency Committee 1989, DeMeo and Loggy 1989), but is often in a matrix with wetland associations, typically mixed conifer with skunk cabbage or deer cabbage. Blueberry cover, however, is typically dense, and presents a high energy cost for deer movement.

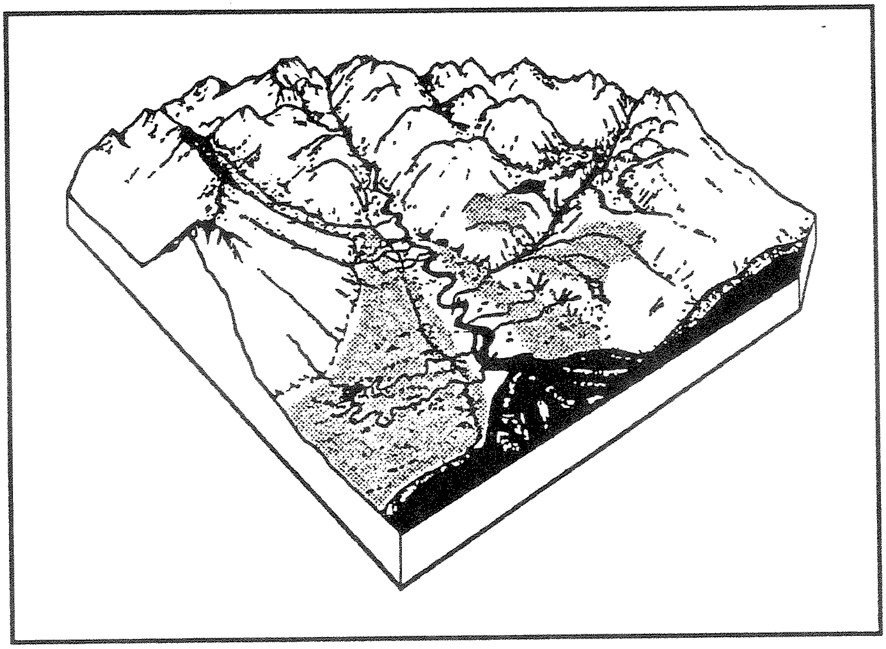
Mixed Conifer/Blueberry sites provide valuable **forage for Sitka black-tailed deer.** Bunchberry, five-leaved bramble, and fernleaf goldthread are all well represented in this association. Forage is most likely to be used in the spring, although it will be consumed in fall and even in winter if the weather is mild. Thermal cover value is low because of the open canopy.

Bird species diversity is not strongly correlated with this association. Snags are usually cedar and hard, so cavity nesters avoid them. **Bears** will use the blueberries generated in the understory.

Trail construction may require boardwalk, although gravel may be used if soils are shallow. **Road construction** will be easier on shallow soils but problematic on deep organic soils (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Mixed Conifer/Blueberry is easy to find, particular on landforms resulting from glacial action. Around Ketchikan, Harriet Hunt Lake provides examples on the Helm soil series. Near Thorne Bay, the section of Road 30 between Goose Creek and Control Lake Junction provides easy viewing of stands. Sealaska land north of Big Salt Lake near Klawock is within easy driving distance of Craig residents. Areas not yet cut there include examples of this association.



Most common landscape position(s) of the Mixed Conifer/Blueberry association.

Mixed Conifer/Blueberry/Skunk Cabbage

Mixed Conifer/Vaccinium spp./Lysichiton americanum

MXD CON/VACCI/LYAM 420

Vegetation

Stands are open and park-like, with overstory cover averaging 48 percent. Mountain hemlock, yellowcedar, and western hemlock are all common in the overstory. Western redcedar was present in about two thirds of sample plots. Sitka spruce and both hemlock species are very common in the understory. Yellowcedar is less well represented in the understory than in the overstory.

The shrub layer is dominated by blueberry species and rusty menziesia. Skunk cabbage, bunchberry, fernleaf goldthread, and five-leaved bramble are common forbs. Deer fern was found in 88 percent of sampled stands.

Old-growth stands are structurally diverse and appear rough. Snags are abundant (27 percent of the basal area, on average) but are most frequently cedar snags, of little value to most wildlife species.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	11%	88%	Tall blueberry	39%	97%
Yellowcedar	16	82	Rusty menziesia	10	100
Western hemlock	17	97	Red huckleberry	77	6
Western redcedar	12	68			

Tree Understory			Forbs, etc.		
Mountain hemlock	5	91	Bunchberry	9	88
Yellowcedar	6	68	Deer fern	4	88
Western hemlock	15	91	Fernleaf goldthread	8	94
Sitka spruce	3	71	Five-leaved bramble	7	97
Western redcedar	5	62			

Distribution and Environment

Mixed Conifer/Blueberry/Skunk Cabbage occurs in combination with Mixed Conifer/Blueberry and Mixed Conifer/Blueberry/Deer Cabbage. Consequently it seldom if ever reaches the size of a stand. The association occupies lower, more poorly-drained microsites in the matrix.

Restricted drainage characterizes this association, as it is found on poorly and very poorly drained soils. Trees in this association are often found growing atop boulders, old tree stumps, and other raised microsites, and thus may grow better than expected. Although this association is generally found on poorer soils than the Mixed Conifer/Blueberry association, its mean old-growth stand height (a good index of productivity) is nearly the same (70 feet vs. 73 feet for the blueberry association).

Mixed Conifer/Blueberry/Skunk Cabbage is most abundant below 1,000 feet elevation, but is well-represented up to 1,500 feet. As elevations increase and temperatures become cooler, this association is replaced by Mixed Conifer/Blueberry/Deer Cabbage.

Rolling hill country and infrequently dissected hillslopes provide the best examples of this association, but it is also well represented as inclusions on mountain slopes where soil drainage is restricted. It is found on lowlands and valleys also, but the poorest mixed conifer sites will feature salal and deer cabbage.

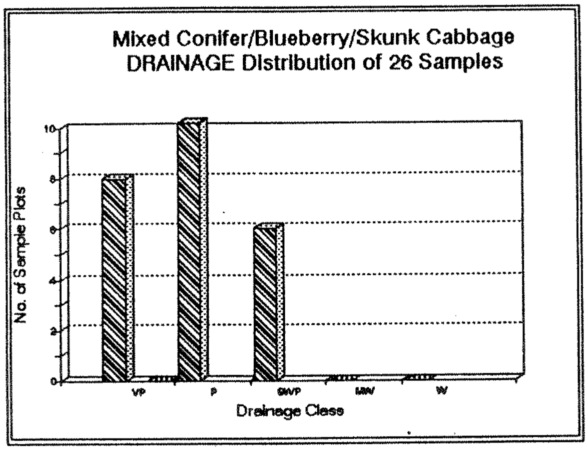


Fig. 12. Drainage Distribution of Mixed Conifer/Blueberry/Skunk Cabbage Plots

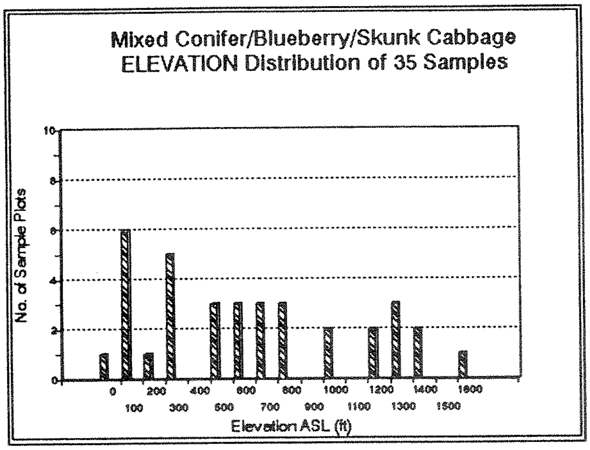


Fig. 13. Elevation Distribution of Mixed Conifer/Blueberry/Skunk Cabbage Plots

Typical Soils-- Mixed Conifer/Blueberry/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,24,25,550,
Wadleigh	Compact Till	Rolling Hills, Smooth Mtn Slopes	31,252,320
Kitkun	Organics	Backslopes, Footslopes	47,51,82
Maybeso	Organics over Till	Footslopes	20,320,220,92

Similar Associations

In structure and composition, this association is very similar to Mixed Conifer/Blueberry. It differs in featuring lower microsites with poorly drained soil. On a drainage gradient, it is similar to the mixed conifer association with deer cabbage, but that habitat is more poorly drained and tolerates colder sites. Distributions of the two associations show considerable overlap, however.

Management Implications

Timber volume for Mixed Conifer/Blueberry/Skunk Cabbage averages 15,000 bd ft/ac, corresponding to Volume Class 4. In sampled stands, 36 percent of this volume was combined western and mountain hemlocks, 33 percent was yellowcedar, and 18 percent was Sitka spruce. The remaining 20 percent was comprised of redcedar and shore pine.

Any logging system employed must minimize soil disturbance, as soils are wet and poorly structured, and hummocky microsites mean that many logs will get snagged along the ground if there is no deflection. Shovel yarding should not be used on this association (BMPs 13.2, 13.7).

Regeneration information is limited, but expect even slower response than in the Mixed Conifer/ Blueberry association. Extended rotation will be required. Planting sites with any species is not recommended. Natural regeneration is likely to be western hemlock (BMP 13.19).

This is a **wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989). It seldom if ever covers entire map units, and wetland map units containing this association will be matrices of wetland and non-wetland sites. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

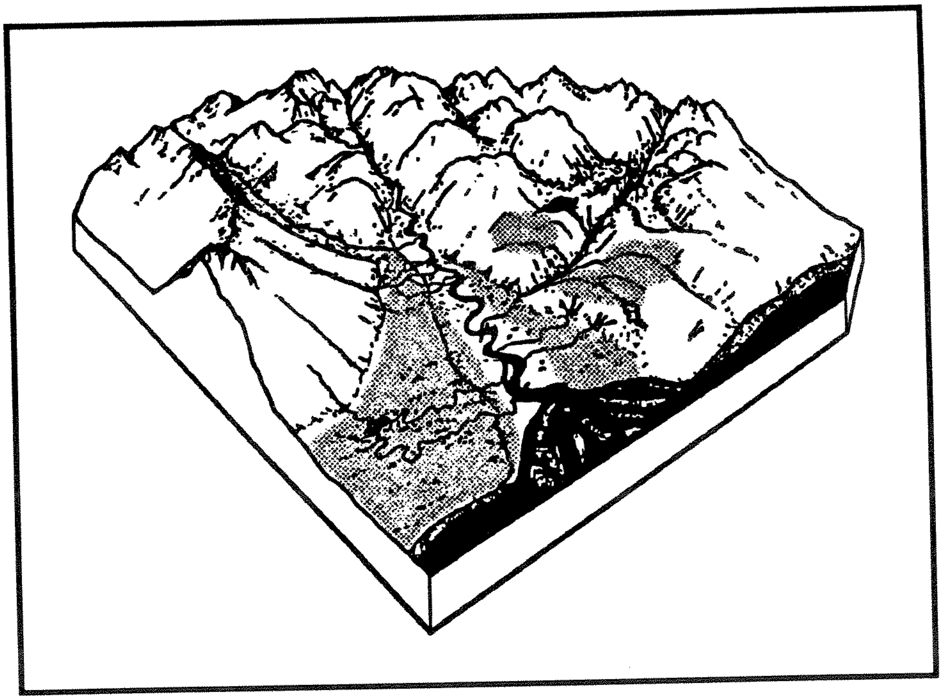
This association provides valuable **spring deer range** in Southeast Alaska, among the best when at low elevation. Skunk cabbage is one of the first plants to leaf out in the spring (as early as March) and is quickly consumed where deer are abundant. **Bears** dig up the tubers in both spring and fall. Deer thermal cover value is poor. **Bird** diversity is not strongly correlated with this association.

Culturally, Northwest Coast Natives used skunk cabbage to wrap and steam salmon. Cedars, of course, were the foundation of the culture; this association has moderate value for cedar bark but low value for totem poles and canoes (trees are generally too small).

Trail construction will be boardwalk. Road construction can usually accommodate this association on hillslopes and mountainslopes, where it forms small inclusions. On lowlands and in valleys, poor drainage will be more frequently encountered.

Representative Field Locations

The Brown Mountain Road near Ketchikan provides access to examples of this and other mixed conifer associations. Near Thorne Bay, the North Thorne River Road provides examples. On the Craig District, the higher elevations along the Polk Inlet Road are good sites to look for this association.

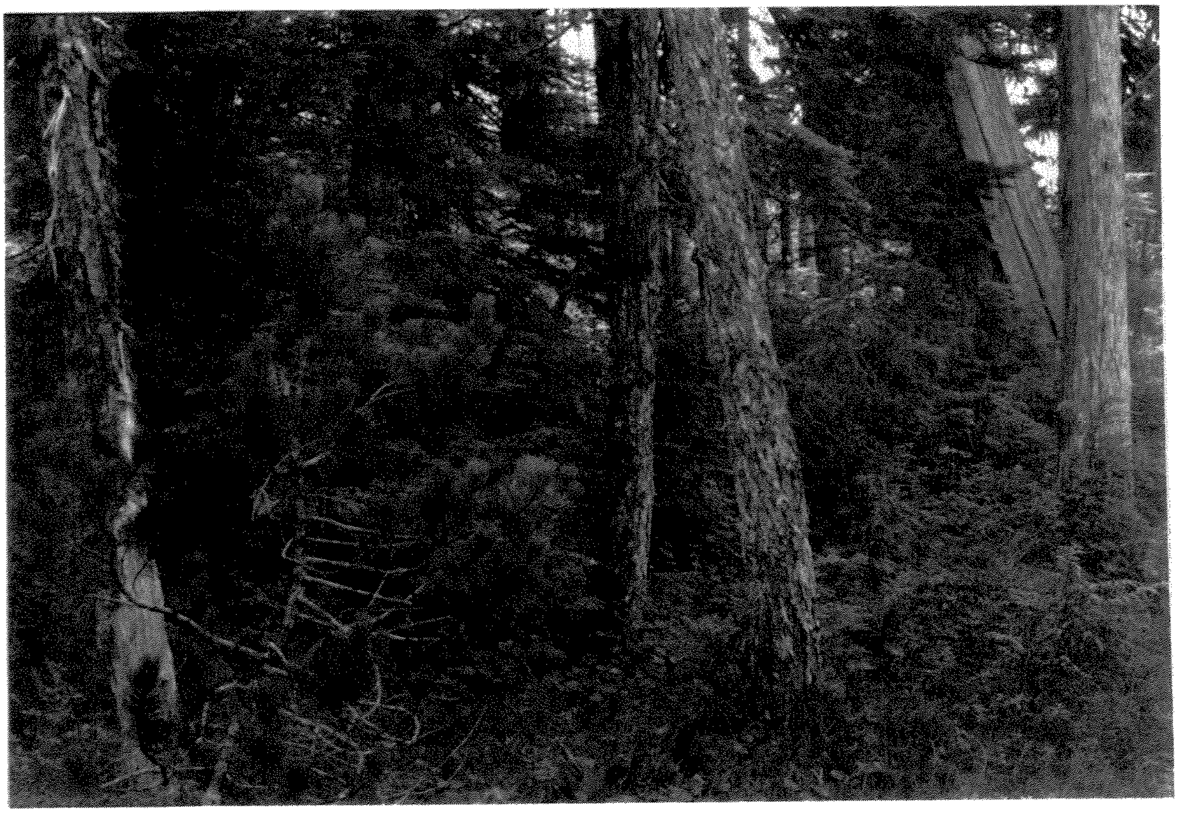


Most common landscape position(s) of the Mixed Conifer/Blueberry/Skunk Cabbage association.

Mixed Conifer/Blueberry/Deer Cabbage

Mixed Conifer/Vaccinium spp./Fauria crista-gallii

MXD CON/VACCI/FACR 430



Vegetation

Stands are very open, averaging 39 percent overstory cover. Yellowcedar and both hemlock species are common in the overstory. Western redcedar was present in about one fourth of the sampled stands, much less than in the more productive blueberry and blueberry/skunk cabbage associations. The same general pattern holds for the understory.

The shrub layer is dominated by blueberry and rusty menziesia. About one third of sampled stands included bog shrubs such as Labrador tea, crowberry, bog kalmia, etc.

Deer cabbage is a good indicator of cold, poorly-drained soils. Only 2 percent cover is required to identify this plant association. Skunk cabbage is also often present, but deer cabbage is given preference in the key because it designates sites with more limited productivity. Bunchberry, fernleaf goldthread, and five-leaved bramble are also common forbs.

Stand height averages 64 feet. Snags average 19 percent of basal area, but are most frequently cedar snags, of little value to most wildlife species.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	12%	91%	Tall blueberry	39%	100%
Yellowcedar	17	88	Rusty menziesia	10	100
Western hemlock	13	72			
Western redcedar	15	22			

Tree Understory			Forbs		
Mountain hemlock	11	94	Deer cabbage	15	100
Yellowcedar	12	88	Bunchberry	11	100
Western hemlock	10	88	Fernleaf goldthread	5	83
Western redcedar	6	27	Five-leaved bramble	4	75

Distribution and Environment

Like Mixed Conifer/Blueberry/Skunk Cabbage, this association occupies the lower relief in a matrix of better-drained mixed conifer associations, but it represents colder, poorer sites. In distribution, there is considerable overlap between this and the skunk cabbage association.

This association is distinctly associated with poorly and very poorly drained soils; moderately well drained samples in Fig. 14 represent adjacent higher relief, better-drained soils. Soils are generally deep and organic, although they are also often found on till-derived series with restricted drainage, such as the Wadleigh and Maybeso.

Mixed conifer with deer cabbage is best represented in rolling hill country and associated lowlands. On mountain slopes it occurs in poorly drained inclusions, particularly benches. Because it tolerates colder temperatures, it can also be found on mountain summits. This association is most abundant at 1,000-1,300 feet (Fig. 15), but can be found anywhere from sea level to 2,000 feet on the Ketchikan Area.

Typical Soils-- Mixed Conifer/Blueberry/Deer Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,23,24,49,86, 550,25
Kitkun	Organics	Backslopes, Footslopes	47,51,82

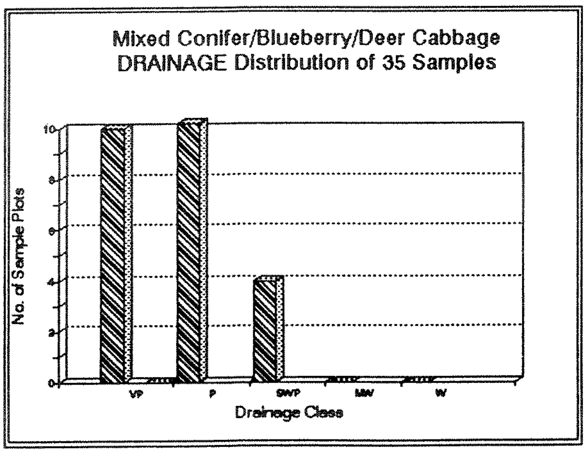


Fig. 14. Drainage Distribution of Mixed Conifer/Blueberry/Deer Cabbage Sample Plots

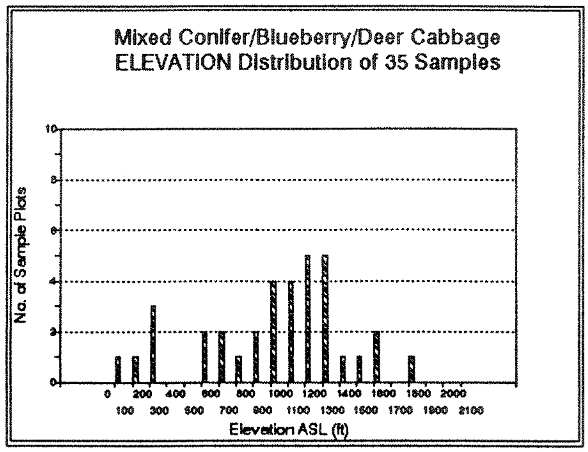


Fig. 15. Elevation Distribution of Mixed Conifer/Blueberry/Deer Cabbage Sample Plots

Similar Associations

Mixed Conifer/Blueberry/Deer Cabbage is similar to the skunk cabbage and salal-deer cabbage associations in the same series. It represents colder, more poorly drained sites than skunk cabbage sites. Sites with salal and deer cabbage are somewhat warmer in that they receive more sunlight at slightly higher temperatures over the course of a year. Differences can be subtle; this association overlaps significantly with the other two.

Management Implications

Timber value of this association is low, averaging 12,500 bd ft/ac (Volume Class 4). By species, 40 percent is combined western and mountain hemlocks, 34 percent is yellowcedar, and 12 percent is redcedar. The remaining 14 percent is comprised of Sitka spruce and shore pine.

Logging this association is questionable, as soils are very susceptible to damage. Because of poor drainage, shovel yarding is not an option. Slopes are often too gentle to get sufficient deflection when highlead is employed (BMPs 13.7, 13.9).

Conifer regeneration will be slow and limited. Natural regeneration will most likely be hemlock. Planting is not recommended; seedling establishment will be inhibited by poor drainage, and growth rates will be slow. Selection harvesting is an option, but could easily lead to high-grading, since stand timber value is low (BMP 13.19).

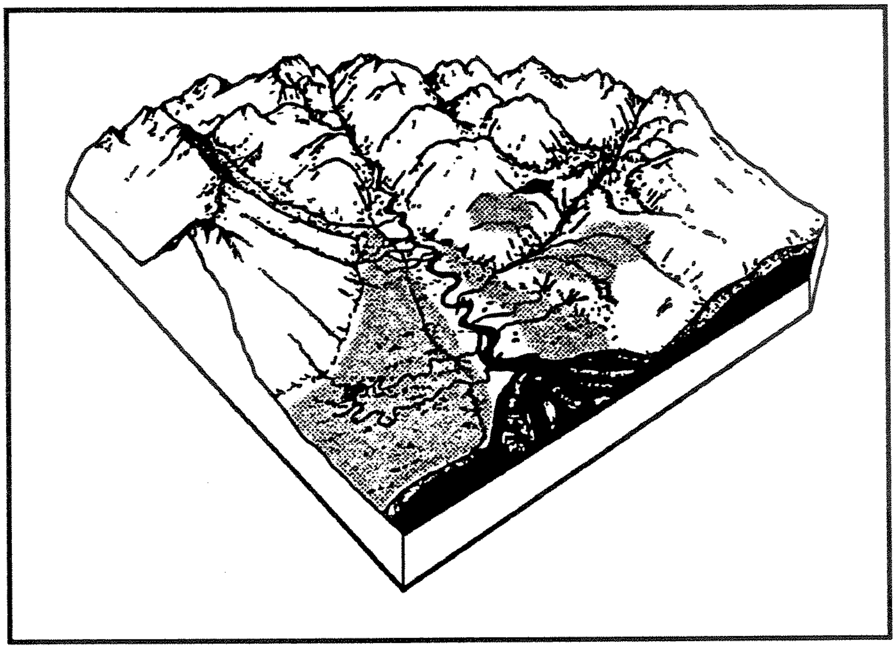
This is clearly a **wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989). Soil map units containing this association are likely to be more than 50 percent wetland. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Value as **spring deer range** is moderate, but the association provides high value summer and fall habitat. Although forbs are abundant, this association will on average experience later snowmelt than other mixed conifer associations. At higher elevations, deer cabbage sites may provide some summer range. Thermal cover value is very poor.

Trail construction should be avoided. Nearby higher relief microsites will provide better trail sites. If building on deer cabbage sites is necessary, use of boardwalk is required (BMPs 16.4, 14.2).

Representative Field Locations

Near Ketchikan, the Brown Mountain Road, Lunch Creek (Mile 16 north), and Harriet Hunt Lake all provide examples. For Thorne Bay, try the North Thorne Road. On the Craig District, examples will be found at higher elevations on the Polk Inlet Road.



Most common landscape position(s) of the Mixed Conifer/Blueberry/Deer Cabbage association.

Mixed Conifer/Blueberry-Salal

Mixed Conifer/Vaccinium spp.-Gaultheria shallon

MXD CON/VACCI-GASH 460

Vegetation

Yellowcedar and both hemlock species are well represented in the overstory. In contrast to mixed conifer associations without salal, redcedar is nearly always present and abundant in this association. Like salal, redcedar is temperature limited in Southeast Alaska and is not found north of Frederick Sound. Shore pine was found in about one third of sampled stands. Understory conifer occurrence and abundance reflects that of the overstory.

The shrub layer is dominated by salal and blueberry; red huckleberry and rusty menziesia are also common. At the south end of Prince of Wales Island, salal can reach 3-4 feet in height, but farther north 1-2 feet is more typical. Common forbs include bunchberry, skunk cabbage, and goldthread. Deer fern is usually present.

Stands are open but can be difficult to move through due to thick salal and blueberry. Snags are abundant (27 percent of basal area, on average) but are most frequently cedar snags, of little value to most wildlife species.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	7%	84%	Tall blueberry	19%	100%
Yellowcedar	11	92	Rusty menziesia	11	84
Western hemlock	8	84	Red huckleberry	5	72
Western redcedar	15	92	Salal	30	100
Tree Understory			**Forbs**		
Mountain hemlock	6	76	Bunchberry	10	96
Yellowcedar	15	80	Deer fern	6	84
Western hemlock	18	96	Fernleaf goldthread	2	76
Western redcedar	10	76			

Distribution and Environment

Salal growth in Southeast Alaska requires an open canopy, because the species is near the northern limit of its range and is light- and temperature limited. Open forested sites on the Ketchikan Area are generally associated with poorer soil drainage, so salal associations are typically found on wet, organic soils, particularly shallow ones.

Mixed Conifer/Blueberry-Salal occupies very poorly to somewhat poorly drained sites on gently sloping lowlands, rolling hills, and smooth hillslopes. In some areas it can form the beach fringe. Because it is light and temperature limited, it is closely tied to low elevations (80 percent of samples were collected at 500 feet or lower elevation), and is much more abundant on the southern part of the Ketchikan Area.

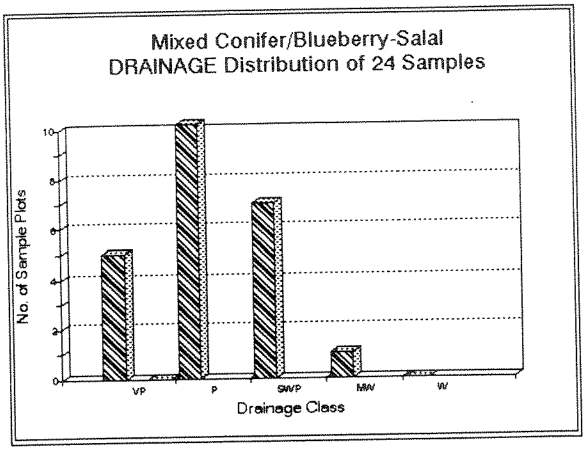


Fig. 16. Drainage Distribution of Mixed Conifer/Blueberry-Salal Sample Plots.

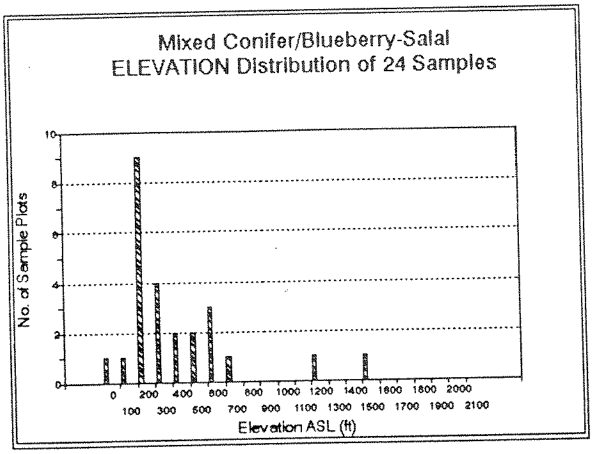


Fig. 17. Elevation Distribution of Mixed Conifer/Blueberry-Salal Sample Plots.

Typical Soils-- Mixed Conifer/Blueberry-Salal

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Lowlands	20,24,550
St. Nicholas	Colluvium	Footslopes, Benches	73,550
Karheen	Organics over Beach Sediments	Uplifted Beach	61,62

Similar Associations

The Mixed Conifer/Salal association is quite similar to this one, but in general is on even poorer, often shallower soils at higher elevations.

Management Implications

Timber volume for Mixed Conifer/Blueberry-Salal averages 10,900 bd ft/ac, corresponding to Volume Class 4. By species, 50 percent is yellowcedar, 24 percent is redcedar, and 20 percent is combined western and mountain hemlocks. Sitka spruce and shore pine make up the remaining 6 percent.

Shovel yarding may be an option on slopes less than 20 percent, except on deep organic soils like the Kaikli series. Care should be taken to minimize soil disturbance. On many sites the deflection needed to achieve this may be lacking.

No **regeneration** data for salal sites are available on the Ketchikan Area. Similar logged sites in the Queen Charlotte Islands indicate slow conifer regeneration response. Messier and Kimmins (1990), working in coastal British Columbia, showed that salal inhibited growth of planted redcedar and western hemlock in clearcuts. Soil nitrogen was largely immobilized up to eight years following logging. Salal competes strongly with conifer seedlings because of extensive underground rhizomes. Neither burning nor planting is recommended (BMP 13.19).

Mixed Conifer/Blueberry-Salal is not a **wetland** association (Interagency Commitee 1989, DeMeo and Loggy 1989). While the soil component is usually hydric (wetland) in character, the vegetation is not. This association, however, is often found in complexes with other salal associations that are wetlands (those designated by skunk cabbage and salal). Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

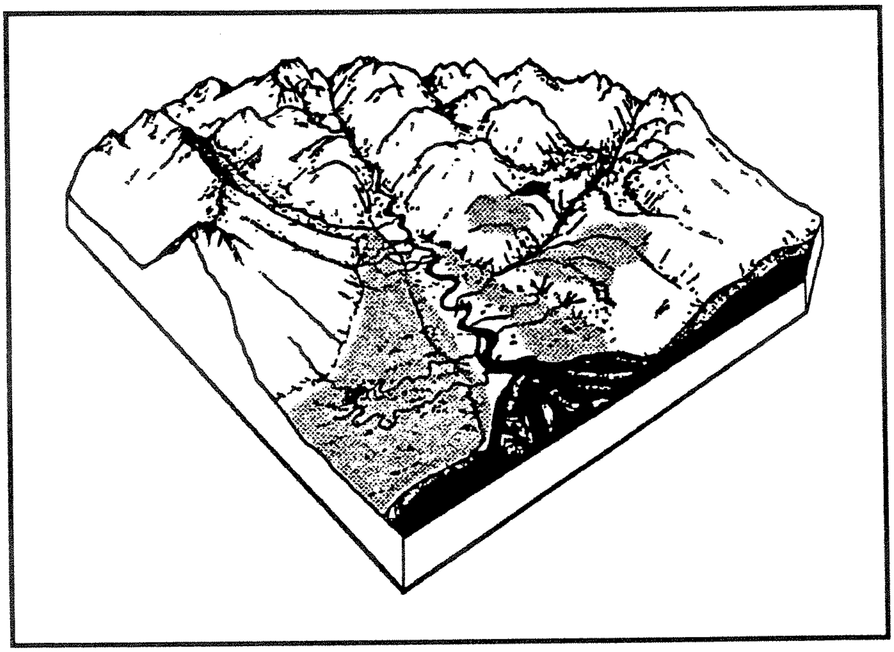
Salal associations generally provide moderate to poor **deer forage**. In contrast to Oregon and Washington, where salal provides significant forage for ungulates, it is little used by deer in Southeast Alaska. Thermal cover value is poor.

Culturally, salal berries are edible (but not tasty) and can be used to make jam that tastes quite similar to grape jelly.

Trail and road construction will involve dealing with organic soils (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

The trail leading to Coast Guard Beach north of Ketchikan provides examples of this and other salal associations. Nearly any inlet on Prince of Wales Island south of Kasaan Bay should have good examples near saltwater.



Most common landscape position(s) of the Mixed Conifer/Blueberry-Salal association.

Mixed Conifer/Blueberry-Salal/Deer Cabbage

Mixed Conifer/Vaccinium spp.-Gaultheria shallon/Fauria crista-galli
MXD CON/VACCI-GASH/FACR 465

Vegetation

Old-growth stands are very open, of low productivity, and represent a transition to shore pine associations or open peatlands (muskegs). Shore pine is the most consistently present overstory tree. Yellowcedar and mountain hemlock are very common. Redcedar was in about half the sampled stands. Western hemlock was only present in 40 percent of the stands sampled, an indication that site productivity is severely limited. Yellowcedar, mountain hemlock, and shore pine are all common understory species.

The shrub layer is dominated by salal, blueberry, and rusty menziesia. Bog shrubs such as Labrador tea, bog kalmia, etc., are commonly found. Deer cabbage identifies the forb layer; skunk cabbage, bunchberry, fernleaf goldthread, and deer fern are usually present. Sedges, wet site indicators, were present in 60 percent of sampled stands.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	7%	84%	Tall blueberry	8%	100%
Yellowcedar	11	84	Rusty menziesia	6	96
Western hemlock	3	40	Red huckleberry	2	64
Western redcedar	10	56	Salal	25	100
Shore pine	9	92			

Tree Understory			Forbs, etc.		
Mountain hemlock	10	96	Deer cabbage	10	100
Yellowcedar	12	88	Deer fern	4	80
Western hemlock	7	64	Fernleaf goldthread	2	76
Western redcedar	9	60	Bunchberry	7	92
			Sedges	14	60

Distribution and Environment

Mixed Conifer/Blueberry-Salal/Deer Cabbage is found on lowland and valley landforms, but is most common in rolling hill country and on smooth hillslopes. It can be found as poorly drained inclusions at lower elevations on mountainslopes. It can be found throughout the Area, but is most common on southern Prince of Wales Island and the shoreline of southern Revillagigedo Island.

Sites are poorly or somewhat poorly drained. As with the Mixed Conifer/Skunk Cabbage association, microsite topography can vary, with portions of better-drained raised relief on sites. This association is in complex with more consistently poorly drained sites, however. It is most abundant below 700 feet elevation.

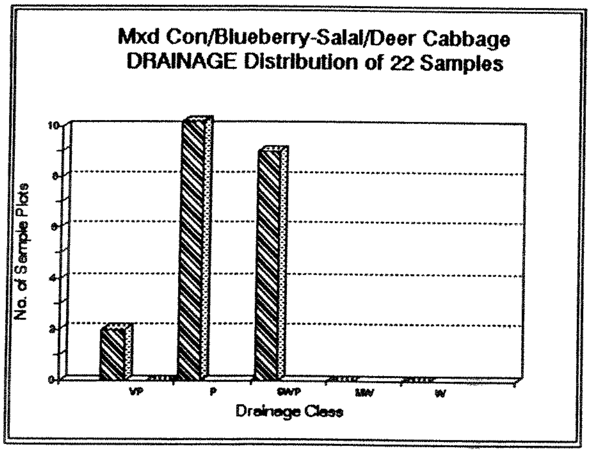


Fig. 18. Drainage Distribution of Mixed Conifer/Blueberry-Salal/Deer Cabbage

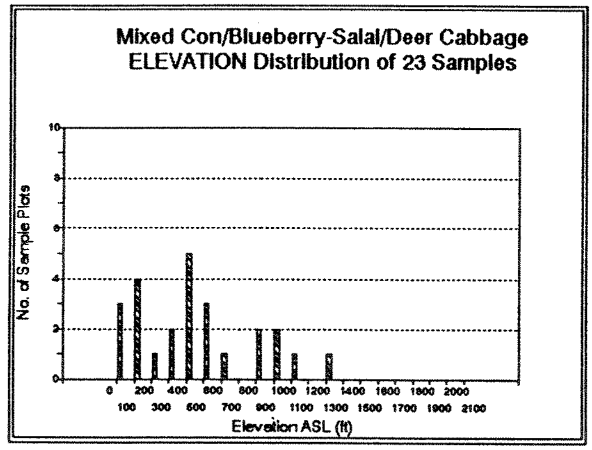


Fig. 19. Elevation Distribution of Mixed Conifer/Blueberry-Salal/Deer Cabbage

Typical Soils-- Mixed Conifer/Blueberry-Salal/Deer Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,23,24,49,25
Kitkun	Organics	Hillslopes, Footslopes	47,51,82
Maybeso	Organics over Till	Footslopes	20,320,220,92

Similar Associations

This association is most similar to Mixed Conifer/Blueberry/Skunk Cabbage. Salal is present in this association because of a somewhat warmer environment (more sunlight at a higher average temperature over time). Despite this apparent advantage, mixed conifer with salal and deer cabbage is a much less productive environment than mixed conifer with deer cabbage alone (mean old-growth stand heights of 44 feet vs. 64 feet.) In Southeast Alaska, the price of an open forest canopy (with more sunlight on average) is often poorer soils that do not allow conifers to form a closed canopy.

Management Implications

Timber volume for Mixed Conifer/Blueberry-Salal/Deer Cabbage averages 4,800 bd ft/ac, and is clearly non-commercial. By species, 32 percent of estimated volume is shore pine, 22 percent is yellowcedar, and 41 percent is redcedar. The remaining 5 percent is made up of combined western and mountain hemlocks and shore pine. Poor productivity and wet, poorly structured soils preclude all but incidental logging of these sites.

Regeneration is undocumented but can be expected to be very slow. If logged, plan on an extended rotation of 200 years or more. Messier and Kimmins (1990), working in coastal British Columbia, showed that salal inhibited growth of planted redcedar and western hemlock in clearcuts. Soil nitrogen was largely immobilized up to eight years following logging. Salal competes strongly with conifer seedlings because of extensive underground rhizomes. Expect modest shore pine and Sitka spruce to seed in on some logged sites. Whether this is caused by increased light or altered hydrology is unclear (BMP 13.19).

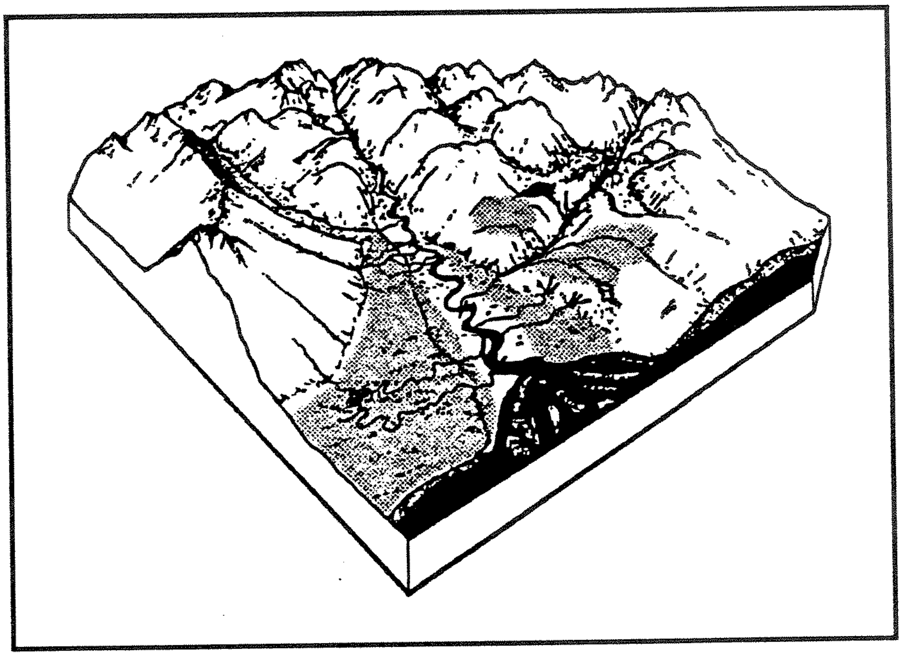
This is a **wetland** association (Interagency Commitee 1989, DeMeo and Loggy 1989). Map units containing this association are likely to be greater than 50 percent wetland. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

This association provides **deer spring range** of moderate value. Thermal cover value is poor.

Trail and road construction will be affected by poorly drained organic soils. On the Maybeso series, a highly erosive till layer will inhibit excavation (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Near Ketchikan, try the trail leading down to Coast Guard Beach (accessed by the South Point Higgins Road). On the Ketchikan District, the road south of Shoal Cove camp will provide examples. On the Craig District, the Soda Springs Trail illustrates this and other salal associations. The North Thorne River Road's junction with the E Spur provides a good example near Thorne Bay.



Most common landscape position(s) of the Mixed Conifer/Blueberry-Salal/Deer Cabbage association.

Mixed Conifer/Salal/Skunk Cabbage

Mixed Conifer/Gaultheria shallon/Lysichiton americanum

MXD CON/GASH/LYAM 470

Vegetation

Stands are very open, averaging 30 percent overstory cover. Both cedar and both hemlock species are common in the overstory. In the understory, the same pattern follows, except that redcedar is present in only about half the stands.

The shrub layer is dominated by salal (29 percent average cover), but tall blueberry, red huckleberry, and rusty menziesia are nearly always present.

Skunk cabbage and bunchberry were present in all sampled stands. Other common understory species include grasses, sedges, club mosses, and deer fern.

Stand structure is very open. Even small trees can be very old. Snags average 28 percent of the basal area.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	13%	71%	Tall blueberry	7%	85%
Yellowcedar	12	85	Rusty menziesia	5	85
Western hemlock	8	85	Red huckleberry	5	85
Western redcedar	8	71	Salal	29	100%
Tree Understory			**Forbs**		
Mountain hemlock	8	85	Skunk cabbage	11	100
Yellowcedar	6	71	Bunchberry	4	100
Western hemlock	18	85	Grasses	15	85
Western redcedar	7	57	Deer fern	7	85

Distribution and Environment

Mixed Conifer/Salal/Skunk Cabbage is not a common association. Only seven sample plots were encountered out of about 200 for the Mixed Conifer Series. No samples of this association were found north of mid-Prince of Wales Island, and none were found far from saltwater. It appears most abundant on the Outer Islands, the southeastern bays of Prince of Wales, and the Revilla Island coastline as far north as Ketchikan.

Sample plots showed about equal distribution among poorly, somewhat poorly, and moderately well drained soils. As with other mixed conifer associations, this may reflect the complex microsite composition of most sites, with raised relief alternating with depressions. All sample plots were located at less than 1,000 feet elevation.

Mixed Conifer/Salal/Skunk Cabbage is best represented on rolling hill country and infrequently dissected footslopes of restricted drainage (notably the Maybeso soil series). It also occurs on small, poorly drained inclusions on hillslopes and mountainslopes.

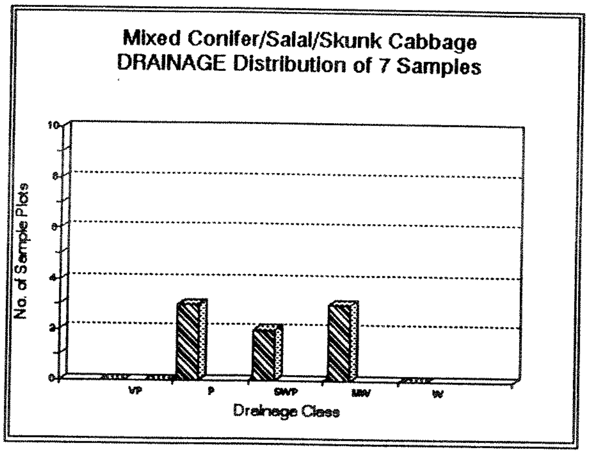


Fig. 20. Drainage Distribution of Mixed Conifer/Salal/Skunk Cabbage Plots.

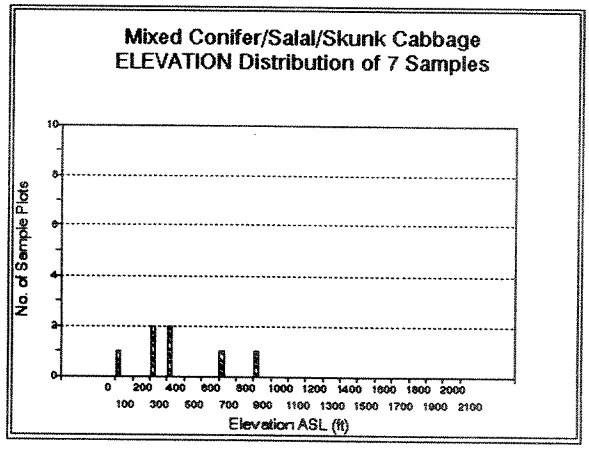


Fig. 21. Elevation Distribution of Mixed Conifer/Salal Skunk cabbage Plots.

Typical Soils-- Mixed Conifer/Salal/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,24,25,49
Kitkun	Organics	Hillslopes, Backslopes	47,51,82
Maybeso	Organics over Till	Footslopes	20,320,220,92

Similar Associations

This association is most similar to mixed conifer associations with skunk cabbage, deer cabbage, and salal and deer cabbage. It indicates an environment that is better-drained and warmer than those designated by deer cabbage. Presence of salal is further indication of this.

Management Implications

Site productivity is poor. Mean old-growth stand height is 74 feet. **Timber** volume for Mixed Conifer/Salal/Skunk Cabbage averages 9,600 bd ft/ac, corresponding to Volume Class 4. By species, 37 percent is redcedar, 34 percent is yellowcedar, and 26 percent is combined western and mountain hemlocks. Shore pine and Sitka spruce comprise the remaining 3 percent.

This association might be incidentally logged in combination with other mixed conifer or redcedar associations. Shovel yarding should be avoided. BMPs 13.7 and 13.9 apply to these sites.

Expect very slow **conifer regeneration.** Messier and Kimmins (1990), working in coastal British Columbia, showed that salal inhibited growth of planted redcedar and western hemlock in clearcuts. Soil nitrogen was largely immobilized up to eight years following logging. Salal competes strongly with conifer seedlings because of extensive underground rhizomes (Haeussler et al. 1990). Conifer regeneration that does occur is likely to be western hemlock.

This is a **wetland** association; in fact, the soils rated the most hydric among all forested plant associations evaluated by DeMeo and Loggy (1989). It frequently occurs with other salal associations, both wetland and not. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Deer forage and thermal cover values are low. Deer use skunk cabbage in the spring. **Bears** will dig up skunk cabbage tubers and use buttress-rooted hemlocks as denning sites. High **bird** diversity is not strongly correlated with this association.

Poorly drained microsites will increase **trail construction** costs, and the hummocky nature of sites will probably necessitate boardwalk construction. **Road construction** may be more costly due to deep organic soils (Kaikli and Kitkun series) or erosive till (Maybeso series) (BMPs 14.2, 14.3, 16.4).

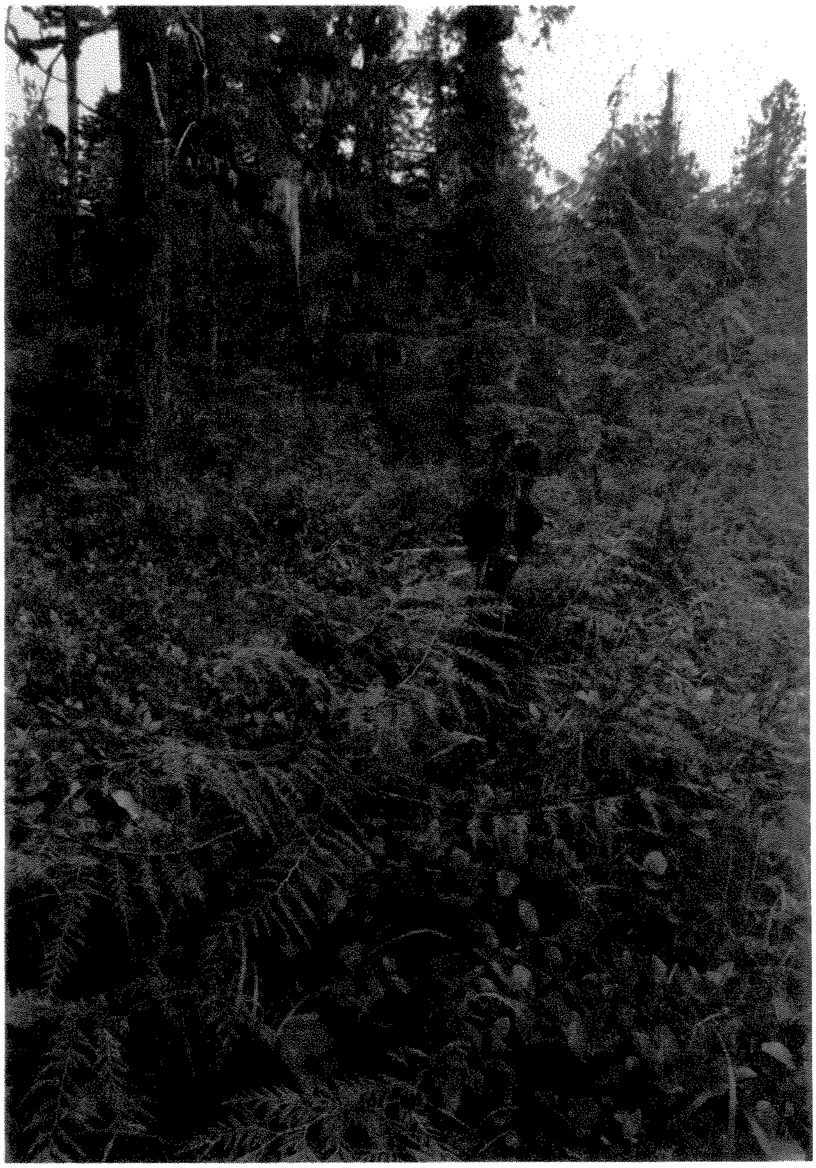
Representative Field Locations

Near Ketchikan, the Coast Guard beach trail and Mahoney Lake on George Inlet will provide examples. On Prince of Wales Island, one site near the Harris River was sampled. All other known locations are remote.

Mixed Conifer/Salal

Mixed Conifer/Gaultheria shallon

MXD CON/GASH 480



Vegetation

Old-growth stands are very open, averaging 38 percent overstory cover. Both cedar species and western hemlock are well represented in the overstory. Mountain hemlock was present in only two thirds of sampled overstories, unlike most mixed conifer associations, where the figure exceeds 80 percent. Correspondingly, redcedar is more common in this association than any in the mixed conifer series, indicating a relatively warm environment. Pacific yew, while uncommon on the Ketchikan Area, is associated with this plant association when it occurs near salt water. The same pattern holds for the understory, except that yellowcedar is less often found here than in the overstory.

The shrub layer is dominated by salal. Tall blueberry averages a mere 3 percent and rusty menziesia 4 percent. Probably because of dense salal cover or because of deer, no forb species averages greater than 4 percent cover. Forbs occurring in more than half the samples include skunk cabbage (small amounts), bunchberry, and deerberry. Deer fern is common.

Stand structure is open, and snags comprise 22 percent of basal area. On the southern part of the Ketchikan Area, the salal layer can reach 3-4 feet in height, making movement through these stands difficult.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	5%	66%	Tall blueberry	3%	88%
Yellowcedar	15	81	Rusty menziesia	4	92
Western hemlock	9	81	Red huckleberry	2	70
Western redcedar	14	88	Salal	37	100
Tree Understory			**Forbs, etc.**		
Mountain hemlock	5	70	Bunchberry	3	77
Yellowcedar	12	66	Skunk cabbage	2	55
Western hemlock	14	81	Deerberry	1	55
Western redcedar	12	88	Grasses	4	62

Distribution and Environment

Mixed conifer/salal occurs on gently sloping lowlands, rolling hills, and smooth hill- and mountainslopes. Samples are remarkably well distributed below 1,000 feet (Fig. 23), but scarce above that elevation.

Soils were mostly poorly or somewhat poorly drained. Soils supporting this association are often shallow (less than 20 inches deep). Productivity is limited by soil drainage, or soil depth (especially on better-drained sites), or both. In a few instances this association can be found on karst topography, usually associated with high productivity. In these cases, however, soil development has been very limited, and productivity is restricted by soil depth.

Typical Soils-- Mixed Conifer/Salal

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,24,25,51,550, 25
Helm	Phyllitic/Residuum/Colluvium	Mountain and Hill Slopes	4
St. Nicholas	Colluvium	Mountain Slopes, Hill Slopes	33,35,550
Wadleigh	Compact Till	Lower Backslopes, Footslopes	320,31

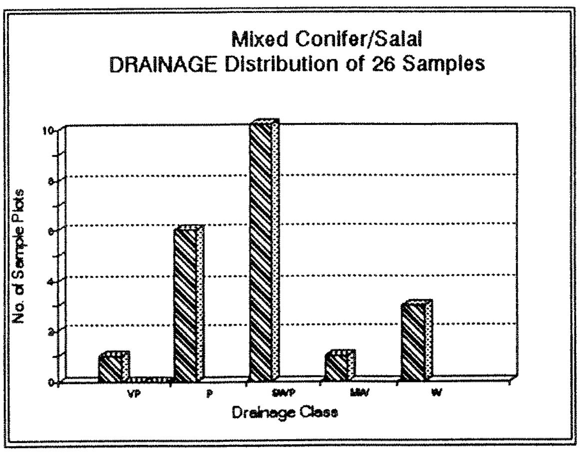


Fig. 22. Drainage Distribution of Mixed Conifer/Salal Sample Plots.

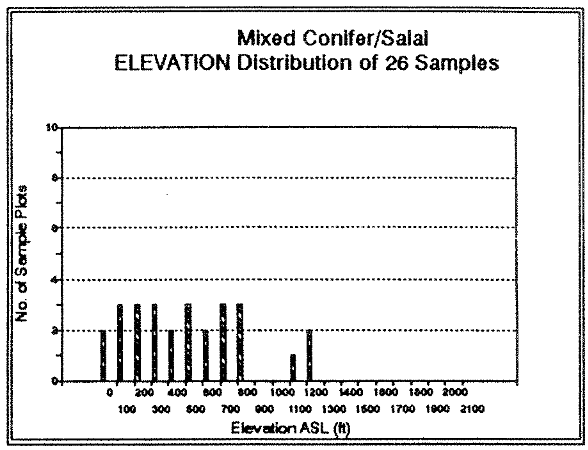


Fig. 23. Elevation Distribution of Mixed Conifer/Salal Sample Plots.

Similar Associations

This association is similar to Mixed Conifer/Blueberry-Salal, but salal more clearly dominates here because of warmer overall temperatures (greater growing-degree days during the growing season). Mixed Conifer/Salal is one of the least diverse associations in terms of plant species richness in the Mixed Conifer Series, probably because of salal dominance of the understory.

Management Implications

Timber volume for Mixed Conifer/Salal averages 12,200 bd ft/ac, corresponding to Volume Class 4. By species, 39 percent is yellowcedar, 28 percent is redcedar, and 26 percent is combined western and mountain hemlocks. Sitka spruce and shore pine comprise the remaining 7 percent. Site productivity is low, so this association is unlikely to be logged, except when it occurs as an inclusion in more productive associations.

Conifer regeneration data for Southeast Alaska are lacking, but expect regeneration to be slow. Salal may expand following overstory removal. Messier and Kimmins (1990), working in coastal British Columbia, showed that salal inhibited growth of planted redcedar and western hemlock in clearcuts. Soil nitrogen was largely immobilized up to eight years following logging. Salal competes strongly with conifer seedlings because of extensive underground rhizomes. Planting is not recommended because of poor soils and salal competition. Partial harvesting may be an option. If clearcutting is chosen, expect an extended rotation of 200 years or more (BMP 13.19).

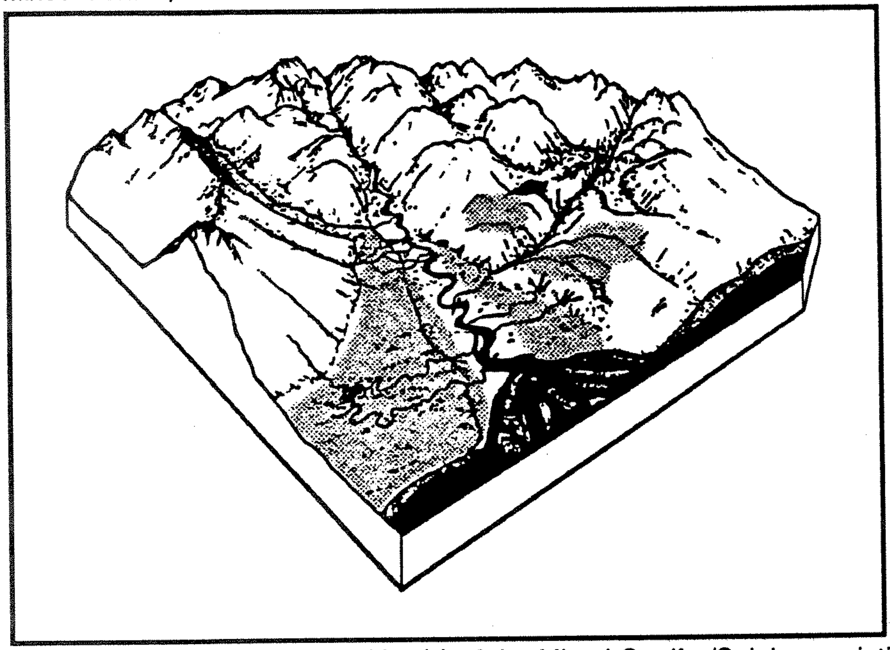
This is not a **wetland** association (Interagency Commitee 1989, DeMeo and Loggy 1989), but may often be found in combination with salal associations that are wetlands. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Deer **forage value** is moderate to very low due to the abundance of salal and lack of blueberry. Thermal cover value is low.

Trail construction techniques suitable for shallow organic soils should be considered. Smooth mountainslopes and hillslopes associated with this type mean midslope roads may be feasible. Full bench construction will typically be required on these sites (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

The Coast Guard Beach trail near Ketchikan provides a good example of this association. On Prince of Wales Island, any of the bays south of Kasaan Bay should feature this association. On the Thorne Bay District, the Rio Roberts tributary to the Thorne River (proposed Research Natural Area) will include Mixed Conifer/Salal on its associated drumlin field.

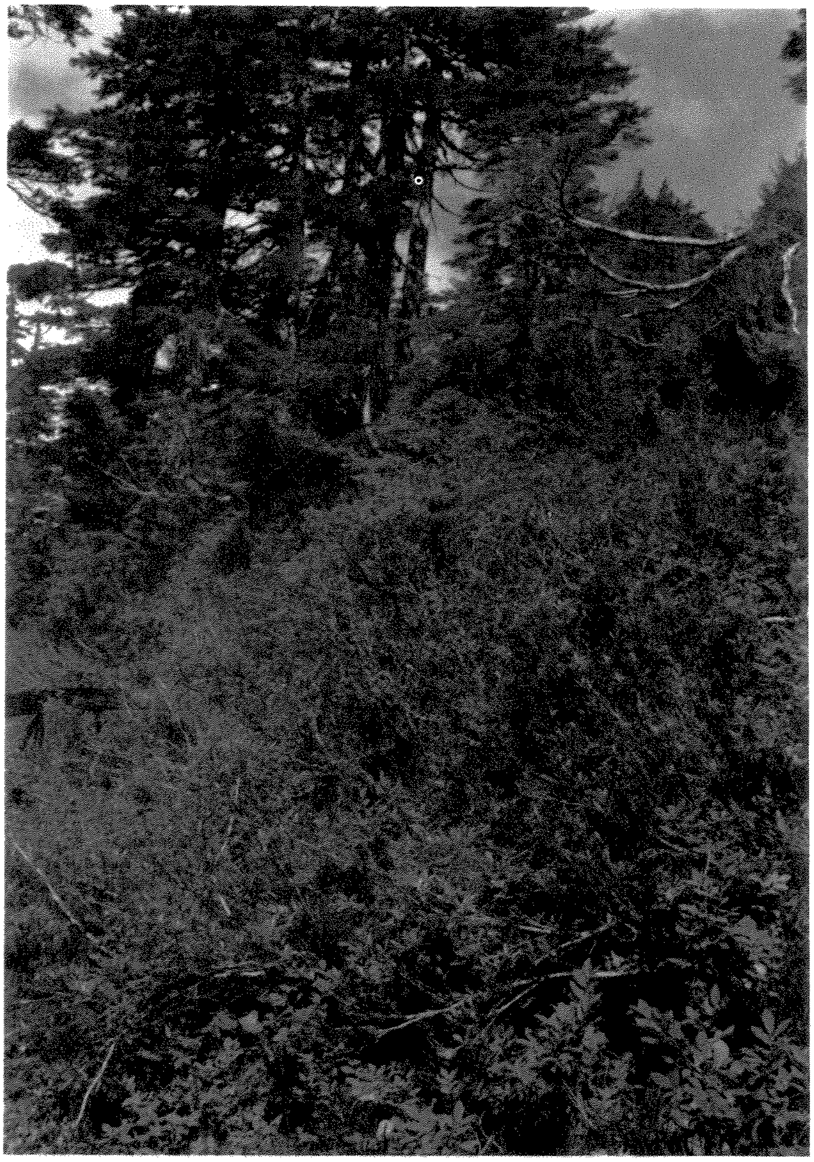


Most common landscape position(s) of the Mixed Conifer/Salal association.

Mixed Conifer/Copperbush/Deer Cabbage

Mixed Conifer/Cladothamnus pyrolaeflorus/Fauria crista-galli

MXD CON/CLPY/FACR 490



Vegetation

Old-growth stands are very open and park-like. Mountain hemlock and yellowcedar are common in the overstory. Western hemlock and redcedar are less common because of the colder environment. The same general dominance pattern holds for understory trees.

The shrub layer is designated by copperbush, although tall blueberry shows much greater cover. Rusty menziesia is also common. Low shrubs (bog laurel, bog blueberries, etc.) characteristic of the muskeg environment can be scattered throughout.

Deer cabbage designates the understory, averaging 10 percent cover. Bunchberry, skunk cabbage, five-leaved bramble, and goldthread are also common.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	9%	100%	Copperbush	12%	100%
Yellowcedar	14	87	Tall blueberry	31	93
Western hemlock	6	62	Rusty menziesia	5	93
Western redcedar	10	43			
Tree Understory			**Forbs**		
Mountain hemlock	10	100	Bunchberry	8	93
Yellowcedar	13	87	Deer fern	3	87
Western hemlock	5	68	Fernleaf goldthread	11	87
Western redcedar	3	31	Deer cabbage	14	87
			Five-leaved bramble	6	75

Distribution and Environment

Mixed Conifer/Copperbush/Deer Cabbage represents colder conditions found typically at higher elevation. As such it can form a transition to the Mountain Hemlock Series.

Accordingly, this association is most common from 1,000 to 1,800 feet, although it can also be found as low as 400 feet elevation. It is best represented on a variety of mountainslope landforms, including the lower portions of mountain summits.

Sites are a complex of depressions with deer cabbage and raised areas with copperbush. Soil drainage is highly variable depending on the microsite in which the soil is located.

Typical Soils-- Mixed Conifer/Copperbush/Deer Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Benches on Mountain Slopes	23,24,49,25
Kitkun	Organics	Hillslopes, Backslopes	47,51,82

Similar Associations

Mixed Conifer/Copperbush/Deer Cabbage is similar to the mixed conifer association with blueberry and deer cabbage, as well as the Mountain Hemlock/Copperbush association. It represents a point between the two on a temperature gradient. This corresponds closely to an elevation gradient as well, as follows:

Association	*Most Abundant At*
Mixed Conifer/Blueberry/Deer Cabbage	1,000-1,300 feet
Mixed Conifer/Copperbush/Deer Cabbage	1,400-1,800 feet
Mountain Hemlock/Copperbush	1,500-3,000 feet

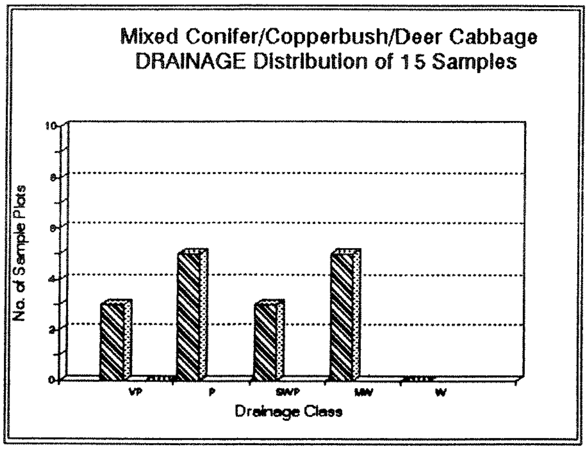


Fig. 24. Drainage Distribution of Mixed Conifer/Copperbush/Deer Cabbage Sample Plots.

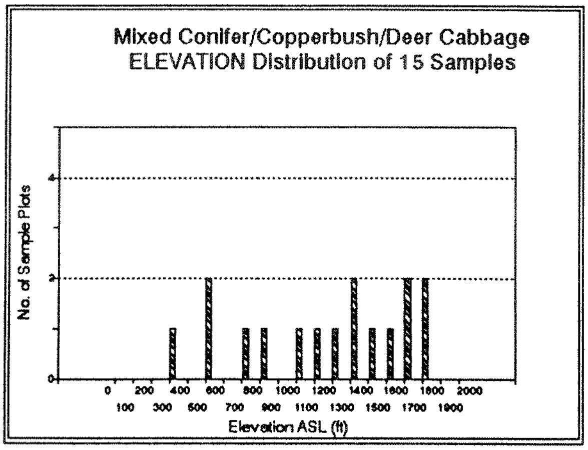


Fig. 25. Elevation Distribution of Mixed Conifer/Copperbush/Deer Cabbage Sample Plots

Management Implications

Site productivity is low, hampered by cold temperatures and (in most cases) poor drainage. **Timber** volume for Mixed Conifer/Copperbush/Deer Cabbage averages 9,300 bd ft/ac, corresponding to Volume Class 4. By species, 45 percent is yellowcedar, 24 percent is redcedar, and 23 percent is combined western and mountain hemlocks. The remaining 8 percent is comprised of Sitka spruce and shore pine. Productivity is poor and sites are unlikely to be logged, except incidentally.

Expect very slow **conifer regeneration**, often hampered by poorly drained soils and cold conditions, including late snow melt (BMP 13.19).

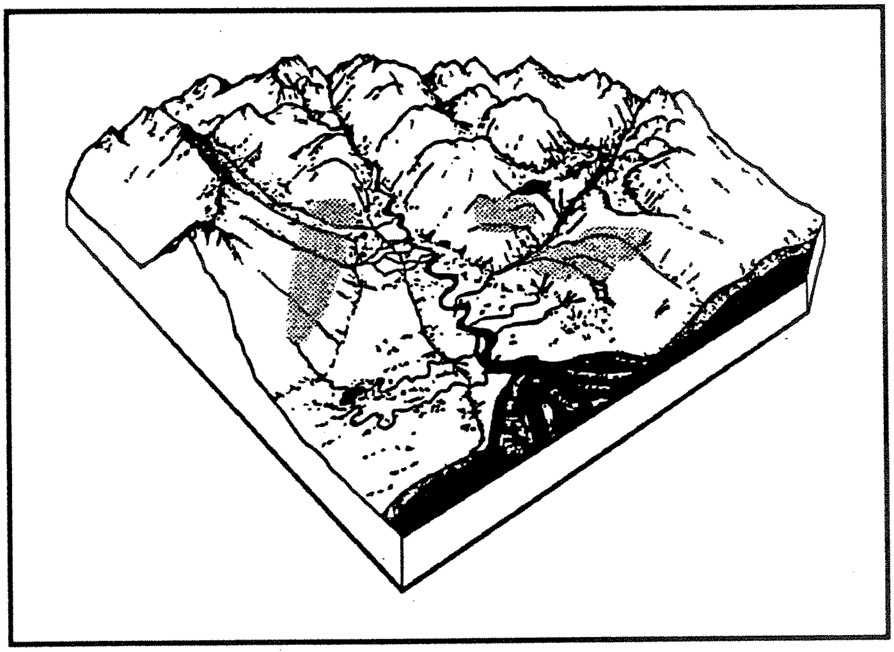
This association meets the criteria for **wetland** designation (Interagency Committee 1989, DeMeo and Loggy 1989). It is likely to occur as small inclusions in better-drained mapped units. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Mixed Conifer/Copperbush/Deer Cabbage provides good summer range for **Sitka black-tailed deer**. Thermal cover value is poor.

Trail and road construction will need allow for wet, poorly-drained soils, sometimes on steeper slopes (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Near Ketchikan, the second overlook on the Deer Mountain Trail provides an example. (The trail in general covers well the gradient from western hemlock to mountain hemlock.) The end of the Brown Mountain Road might also provide a location. On Prince of Wales Island, Cable Creek and Red Bay Mountain are sample sites for the Craig and Thorne Bay Districts, respectively.



Most common landscape position(s) of the Mixed Conifer/Copperbush/Deer Cabbage association.

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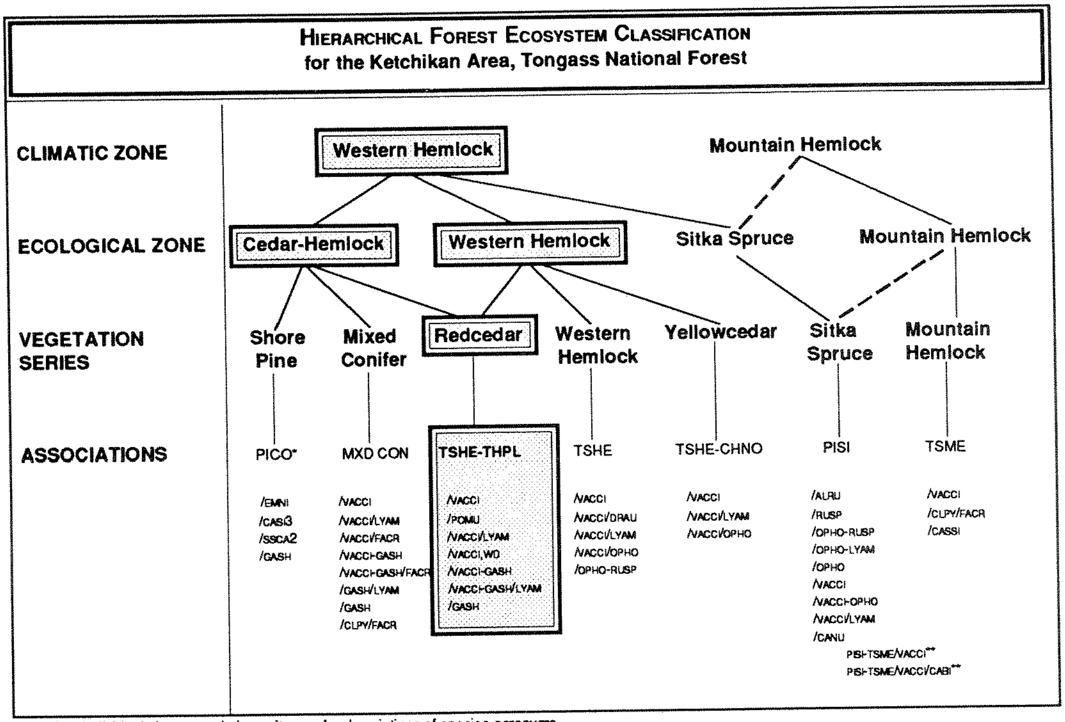
Western Hemlock-Western Redcedar Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

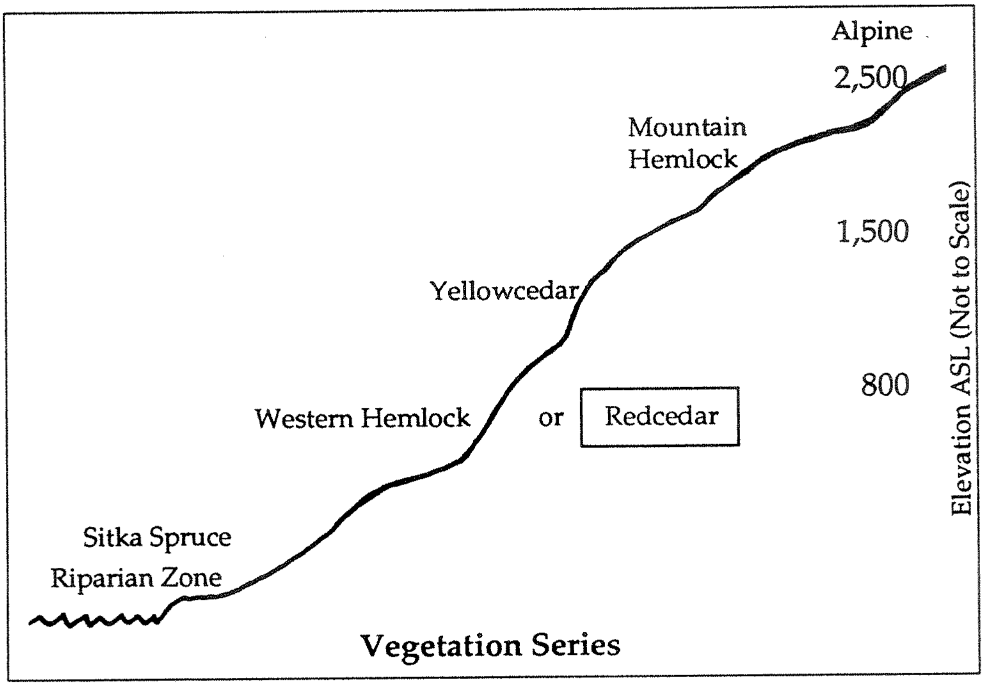


Fig. 26. Schematic of the Western Hemlock-Western Redcedar series. On more productive sites its distribution is similar to that of the Western Hemlock Series, except that it is infrequent above 800 feet elevation.

5
WESTERN HEMLOCK-WESTERN REDCEDAR SERIES
Transition

This series represents the transition from the cedar-hemlock to the western hemlock ecological zones (see Fig. 1). Moving from the former to the latter, sites become more productive. Western Hemlock-Western Redcedar (hereafter refered to as "redcedar" for simplicity) sites in the cedar hemlock zone include those with salal, as well as some blueberry sites. On this "low end" of the transition, productivity is restricted by poorer drainage, and also by shallow soils in some cases. This is particularly true of salal sites.

More productive sites in this series are characterized by blueberry understories. In many cases these sites differ little from western hemlock associations in composition and structure (see Chapter 10). Presence of redcedar seems almost incidental.

Distribution of redcedar associations on the Ketchikan Area is largely explained by three factors: 1) soil drainage, 2) temperature/light (growing degree days), and 3) redcedar seeding characteristics.

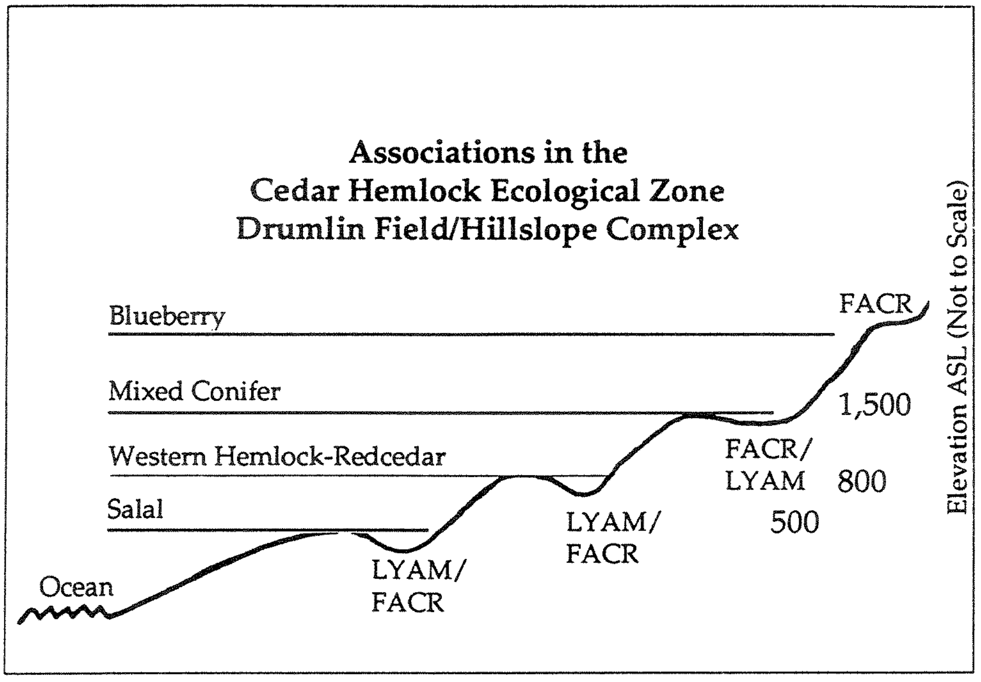


Fig. 27. Schematic of the Western Hemlock-Western Redcedar Series on more poorly drained sites. It represents the transition from the Cedar Hemlock to Western Hemlock Ecological Zones. LYAM = Skunk cabbage, FACR = Deer cabbage.

While redcedar associations cover the full range of drainage classes, they typically occur in soils that are somewhat poorly to well drained. Poorer drainage allows redcedar to compete with other conifers. Redcedar is associated with a survival type of growth strategy rather than a competitive strategy.

Because redcedar is near the northern limit of its range, it is limited by temperature and light. Redcedar associations, therefore, seldom occur much above 900 feet elevation, and are most abundant below 500 feet. At higher elevations, redcedar is replaced by yellowcedar, which can better stand colder temperatures. This hypothesis has been tested throughout the Area. The elevational limit is rather consistent, varying perhaps 100-200 feet based on aspect or other factors.

Seeding characteristics provide a third explanation for redcedar distribution. Redcedar seeds germinate best on disturbed mineral soil (Minore 1983, Burns and Honkala 1990), but spruce and alder are better adapted to competing on these sites in Southeast Alaska. On better sites-- where spruce and western hemlock outcompete redcedar in terms of seedling establishment-- redcedar establishment is more dependent on chance events such as good cone crops, scarcity of spruce/alder, or presence of scarified soil.

Forest structure in redcedar associations varies considerably. Structure is least complex on salal sites and most complex on well drained blueberry sites. This probably relates to rates of disturbance, with blowdown less frequent on salal sites and more frequent on better-drained sites.

Similarly, associated landforms vary widely. The less productive sites are most often associated with rolling hill country and drumlin fields. More productive sites are similar to those of the western hemlock series: mountain and hillsides.

Timber values range from moderate to high. Redcedar stands are typically Volume Class 5 (20-30 MBF/acre), but will vary from classes 4 through 6 (20-50 MBF).

Western Hemlock-Western Redcedar sites provide valuable wildlife habitat. Less productive sites, especially those with skunk cabbage, provide important spring range. More productive sites with bigger trees provide critical winter thermal cover, especially because redcedar sites are frequently near saltwater.

Redcedar was and is an important factor in Northwest Coast Native life. Houses, canoes, totem poles, and even clothing were made from the tree. Trees on the Ketchikan Area are in general smaller and of poorer form than redcedar to the south. The wood is in great demand, both for Native and western uses. Management to produce and retain quantities of high quality redcedar should therefore be a high priority.

Redcedar Silviculture

Redcedar is intermediate in shade tolerance between western hemlock and yellowcedar. It germinates best in sunlight on mineral soil. One study showed about twice as much seedling mortality under a dense overwood as under partial shade (seed trees) (Minore 1983). Regeneration is easily inhibited by leaf litter and debris covering seedlings.

Although redcedar germinates well on mineral soil, there are a host of other species in Southeast Alaska that compete better on disturbed soil. Salmonberry and alder are examples, but spruce is also more suited to this environment. This may explain why redcedar establishes itself erratically here from seed. In second-growth study plots on the Area, redcedar regeneration has been found to vary widely.

Another factor limiting regeneration success is deer browsing on seedlings. The difficulty of getting young cedar started in the Queen Charlotte Islands, for example, is well known. Deer are an exotic species there, introduced about 1910. The result has been an abundant deer population that has wiped out most of the forest understory in many cases.

If redcedar is to be reestablished by planting, bareroot seedlings are recommended. Success with containerized seedlings has been reported on the Stikine Area, however. It is important to get the seedlings from storage to planting site as quickly as possible, because redcedar seedlings break dormancy in about one week. The tree is also reported to regenerate well from cuttings.

A close spacing in planting (4-5 feet apart) is recommended to avoid the strong bole taper characterisic of the species. Precommercial thinning is recommended at age 30.

Silvicultural Strategies

Through literature review and discussion with District personnel on the Ketchikan Area, five major silvicultural strategies (or combinations of them) have emerged:

1. *Current Practice*. Redcedar is regenerated by seed/advanced regeneration through clearcutting, in mixture with hemlock and spruce. Redcedar may be favored, along with spruce, at precommercial thinning (typically at age 15-20). Stand rotation age is projected at 100 years.

   The problem with this approach is that spruce and hemlock will be of merchantable size at age 100, but redcedar will still be pole-sized. The dilemma then will be whether to retain redcedar in the stand, at the risk of logging damage and blowdown, or harvest it at an unmarketable size. If the latter option is chosen, there is no point in retaining it in the original stand.

2. *Plant Entire Site With Redcedar*. Maintaining a pure stand of redcedar in Southeast Alaska will be difficult due to competition from hemlock and spruce. The tight spacing will make planting cost high. Also, slower growth of the tree will mean a longer rotation. When compared with hemlock and spruce, which regenerate more readily and grow faster, redcedar is unlikely to be chosen.

3. *Partial Cutting Techniques*. With this option, undersize trees are left at the time of harvest. (If so, a 12-inch diameter limit is recommended.) Problems include potential blowdown, as well as damage to residuals from the yarding process. One suggestion at Thorne Bay was to leave residuals along the unit edge and along stream buffers, where trees would be left anyway.

   In addition to leaving individual trees, leaving groups of trees (forest islands) would be a variant of this option. Redcedar could be a target species in the leave islands. This option fits in well with the New Perspectives agenda. It would have the advantage of using established trees, removing the risks of relying on seed or planting. Leaving a clump of trees might ensure that at least one would survive blowdown.

4. *Interplant with Red Alder*. Following clearcutting, redcedar could be planted at the expected final spacing, with red alder planted between redcedar trees. The alder would be expected to grow quickly, filling in the gaps between trees, and shading the stems of redcedar, preventing epicormic sprouting. The alder would die out at age 40-80 years, leaving the redcedar free to grow. As alder dies out, hemlock and spruce might seed in, but all trees would be ready for harvest at age 200 years. This approach would have the added benefit of additions to soil nitrogen from the

alder. It has not yet been tested. Getting both redcedar and alder to survive initial planting could be the biggest obstacle to success.

5. *Write It Off* (on individual sites). This option considers redcedar a non-renewable resource in Southeast Alaska. It is at the northern limit of its range here, and thus does not grow or compete well with other, more manageable species. The investment to regenerate it is extremely high. With this option, the redcedar resource would be considered finite; areas with timber-quality cedar would be reserved and slowly "mined" over time.

Western Hemlock-Western Redcedar/Blueberry

Tsuga heterophylla-Thuja plicata/Vaccinium spp.

TSHE-THPL/VACCI 710

Vegetation

Canopies are relatively closed, with a mean cover of 59 percent. This is shared between western hemlock and western redcedar, with an average of 33 percent and 25 percent cover, respectively. Other conifers are minor components.

The understory is dominated by western hemlock. The species is nearly always present and averages 20 percent cover. Redcedar is usually present and averages 6 percent cover. Other conifers may be present, usually in small amounts.

The shrub layer is clearly dominated by blueberry (mean 28 percent cover), and stands can be thick and difficult to move through. This is particularly true on southern aspects near saltwater. Rusty menziesia is consistently present, and red huckleberry is common. Common forbs are bunchberry, twayblade, trifoliate foamflower, five-leaved bramble, and rosy twisted stalk. Deer and oak fern are the most common ferns.

Stands are moderately productive, and stand height averages 107 feet. Snags are about 10 percent of the basal area. Hemlock snags are valuable for wildlife, but redcedar snags are resistant to decay, and less useful for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	33%	100%	Tall blueberry	28%	100%
Western redcedar	25	100	Rusty menziesia	6	100
			Red huckleberry	3	76

Tree Understory			Forbs		
Western hemlock	20	100	Bunchberry	6	82
Western redcedar	6	74	Five-leaved bramble	5	82
			Twayblade	1	72
			Twisted stalk	2	72
			Goldthread	4	74

Distribution and Environment

Western Hemlock-Western Redcedar/Blueberry is clearly associated with rolling hill country and other hill landforms, but can also be found on mountainsides. Soils are most often moderately well drained. Elevation ranges from 0 to 1,000 feet, with very few samples taken at higher elevation (Fig. 29). The association is most abundant below 500 feet elevation.

Soils vary widely, from the shallow but well drained McGilvery to deeper Spodosols of the Karta and Kupreanof series. The table below represents only a portion of the more typical map units.

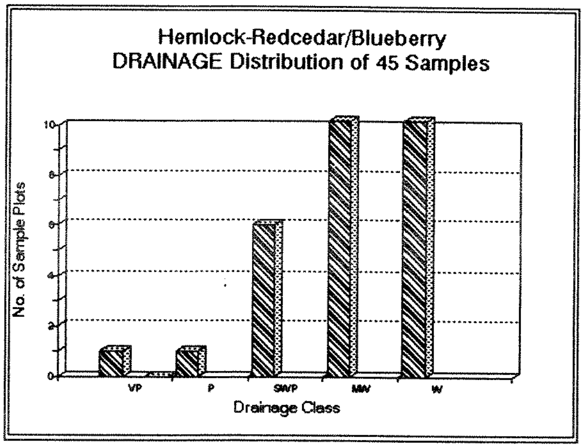


Fig. 28. Drainage Distribution of Redcedar/Blueberry Sample Plots.

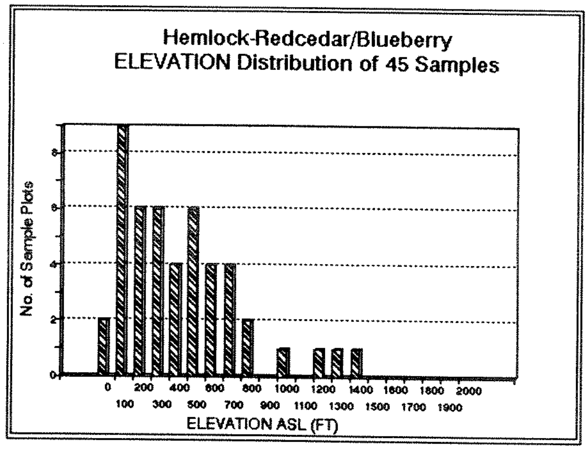


Fig. 29. Elevation Distribution of Redcedar/Blueberry Sample Plots.

Typical Soils-- Western Hemlock-Western Redcedar/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Remedios	Colluvium	Footslopes, Backslopes	11
Kupreanof	Colluvium	Sideslopes, Moraines	74,75,76
Tokeen	Granitic Colluvium	Convex Backslopes	54,540
Karta	Compact Till	Mountain, Hill Slopes	30,50,331,351

Similar Associations

This association is very similar to Western Hemlock/Blueberry and occurs on many of the same soils and landforms. It is distinguished by a minimum of 10 percent redcedar in the overstory. Redcedar/blueberry is also more clearly associated with rolling hill country than with the variety of hill and mountain landforms associated with Western Hemlock/Blueberry. This association is closer to the Western Hemlock Ecological Zone than the Cedar-Hemlock Ecological Zone.

Management Implications

Timber value of this association is generally moderate to high, averaging 34,300 bd ft/ac (Volume Class 6). By species, 40 percent is western hemlock, 43 percent is redcedar, 10 percent is yellowcedar, and 7 percent is Sitka spruce.

Shovel yarding may be an option on better-drained sites of up to 20 percent slope, but most sites will require cable **logging**. Suspension requirements will vary more with soil than with vegetation in this case (BMPs 13.2, 13.7, 13.9).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerate prolifically on undisturbed soil surface organic horizons (Ruth and Harris 1979, Burns and Honkala 1990). (BMP 13.19).

Redcedar regeneration is problematic. Advanced regeneration will usually be limited, because of the relatively small amount of redcedar in the understory (see above table). Regeneration from seeding will be sporadic, due to competition from hemlock and irregularity of seed crops (BMP 13.19).

Fig. 30 clearly shows the dynamic response of western hemlock following logging of redcedar associations. Note that redcedar response is modest, even 25 years following logging.

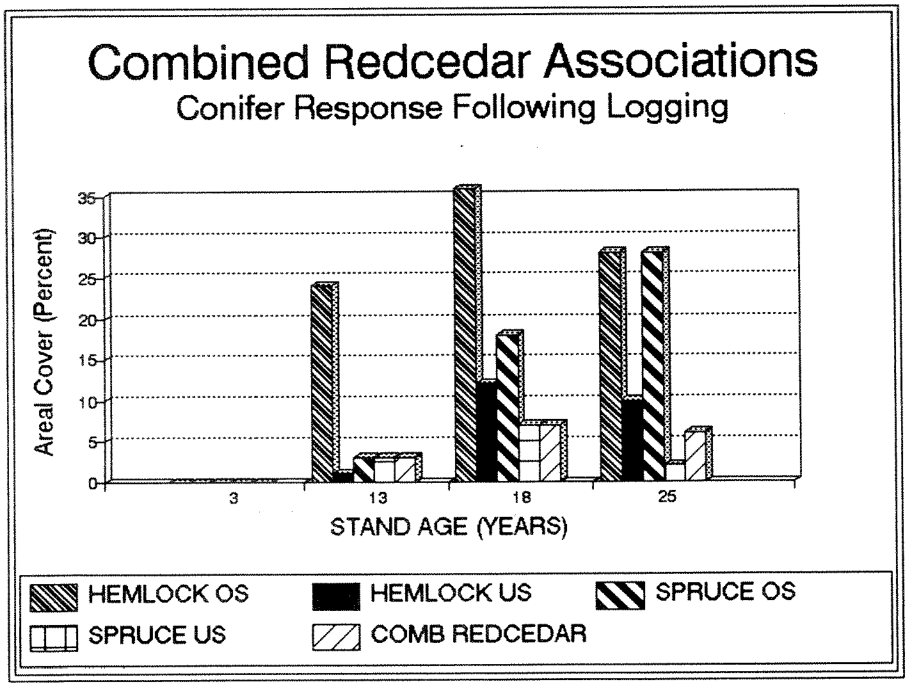


Fig. 30. Combined Western Hemlock-Western Redcedar Associations: Conifer Response Following Logging.

Planting of redcedar to improve stocking may be advisable, but only on more productive sites. Planting redcedar on more poorly drained sites is not advised, because of the slow growth rates to be expected.

As Fig. 31 shows, response of deer forage species following logging is more modest than that on western hemlock sites. Blueberry cover from age 18 to 25 is less in redcedar associations than in Western Hemlock/Shield Fern at age 13. Slow conifer response on redcedar sites, however, means that forage will persist longer. Canopy gaps or wildlife thinning treatments can be delayed until age 20 or later on redcedar sites.

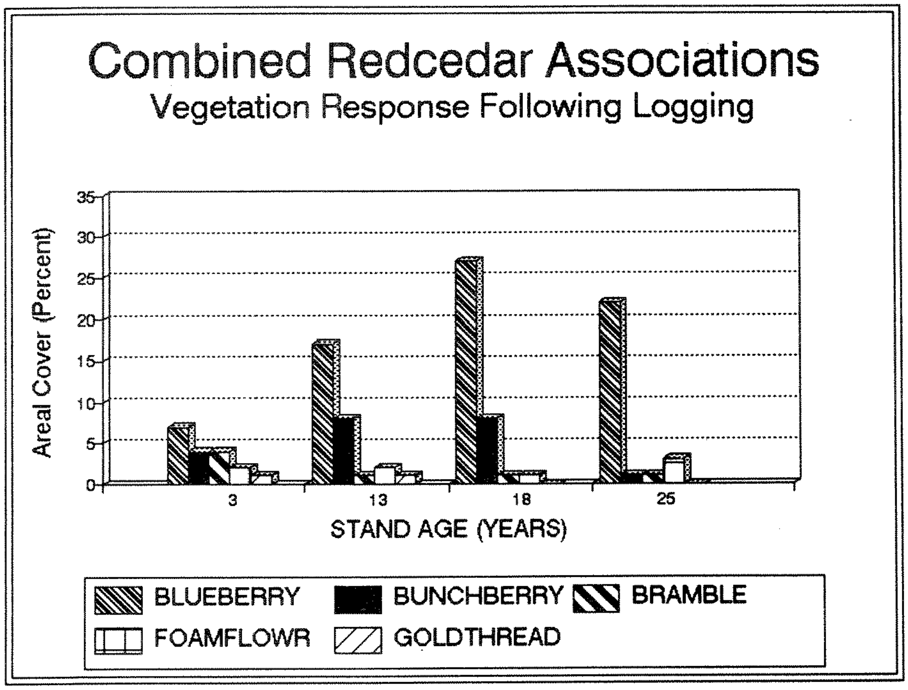


Fig. 31. Combined Redcedar Associations: Vegetation Response Following Logging.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), but is often in association with redcedar/blueberry/skunk cabbage, a wetland association. The latter often occupies toeslopes or uplifted beaches adjacent to this association.

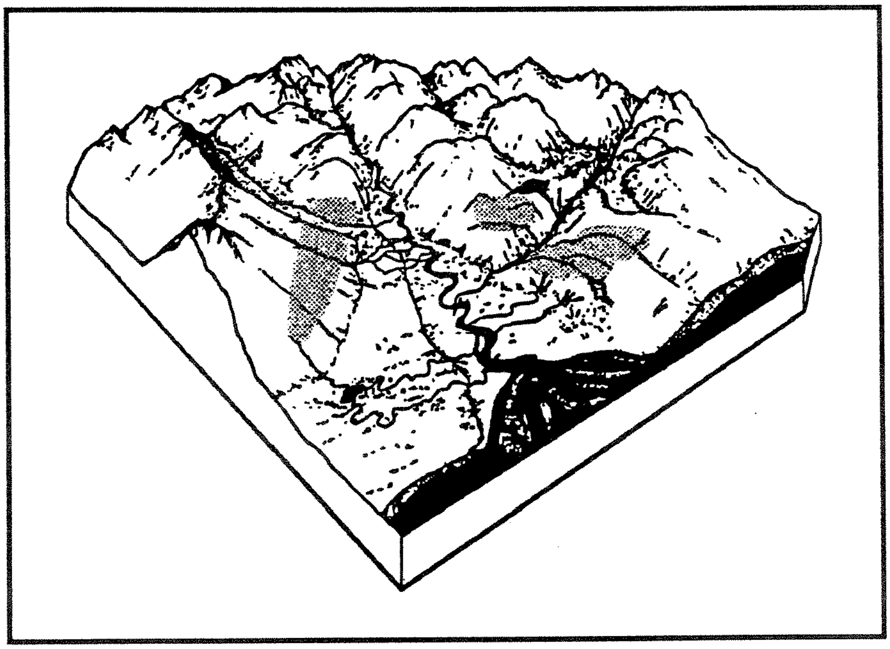
Value for **deer** forage is high. Redcedar sites on gentle slopes near saltwater often provide prime spring range. This association also can provide large trees for winter thermal cover.

Trail and road construction are usually easy, but will vary with landform (BMPs 14.2, 14.3, 16.4).

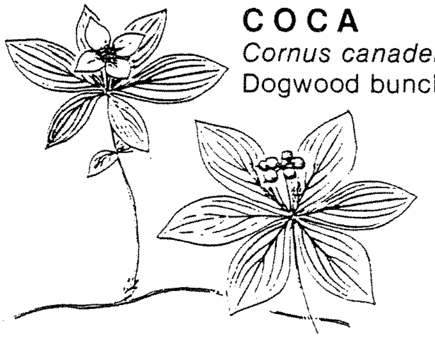
Representative Field Locations

Near Ketchikan, the Perseverance Trail provides a good example, located about a half mile up the trail on the right side. Lunch Creek at Mile 16 North provides another example.

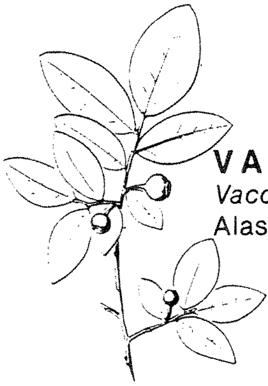
On Prince of Wales Island, the association is widespread. On the Thorne Bay District, the Goose Creek Area provides examples. The logging road network south of Polk Inlet has examples for the Craig District.



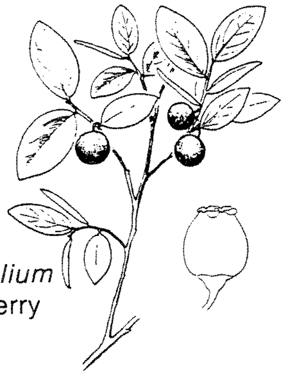
Most common landscape position(s) of the Western Hemlock-Western Recedar/Blueberry association.



COCA
Cornus canadensis
Dogwood bunchberry



VAAL
Vaccinium alaskaense
Alaska huckleberry



VAOV
Vaccinium ovalifolium
Oval-leaf huckleberry

Western Hemlock-Western Redcedar/Swordfern

Tsuga heterophylla-Thuja plicata/Polysticum munitum

TSHE-THPL/POMU 720

Vegetation

Canopies are relatively closed, with a mean cover of 64 percent. This association is mostly comprised of western hemlock and western redcedar, with an average of 41 percent and 22 percent cover, respectively. Sitka spruce is often present and averages 6 percent cover.

The understory is dominated by western hemlock, with an average of 34 percent cover. Redcedar is usually present but averages only 5 percent cover. Other conifers may be present, usually in small amounts.

The shrub layer is clearly dominated by blueberry (mean 12 percent cover) and rusty menziesia (mean 6 percent cover), but the shrub layer in general is less prominent than in other redcedar associations. Salmonberry and devil's club are usually present in small amounts.

As with the shrub layer, forbs are somewhat less abundant than other associations in this series. Twayblade, twisted stalk, foamflower, and deerberry are the most common forbs, but none of them exceeds 75 percent constancy, and total forb cover averages only 14 percent. Swordfern designates the association and averages 9 percent cover. Swordfern is at the northern limit of its range, and like redcedar, is temperature limited.

Stands are moderately productive. Stand height averages 103 feet. Snags average 20 percent of basal area. Hemlock snags are valuable for wildlife, but redcedar snags are resistant to decay, and less useful for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	41%	100%	Tall blueberry	12%	100
Western redcedar	22	100	Rusty menziesia	6	100
Sitka spruce	6	60	Red huckleberry	4	73
Tree Understory			**Forbs**		
Western hemlock	34	100	Bunchberry	7	66
Western redcedar	5	73	Swordfern	9	100
Sitka spruce	1	60	Foamflower	2	73
			Twisted stalk	2	73
			Deerberry	3	73

Distribution and Environment

Western Hemlock-Western Redcedar/Swordfern is typically associated with well drained rock outcrops in rolling hill country. It can also occur on mountain landforms. The association is most abundant around 400 feet elevation, and seldom if ever exceeds 800 feet. It is most common on steep slopes with cliffs, but can be found on gentle slopes as well.

Productivity is moderate, and limited by soil depth. Soils are typically shallow, well drained Spodosols, often in a mosaic with a shallow Histosol (McGilvery).

Typical Soils-- Western Hemlock-Western Redcedar/Swordfern

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tolstoi	Colluvium	Hillslopes, Mountainslopes	35,50,53,351,528
Traitors	Colluvium	Hillslopes, Mountainslopes	2,6
Tokeen	Granitic Colluvium	Convex Backslopes	54,540

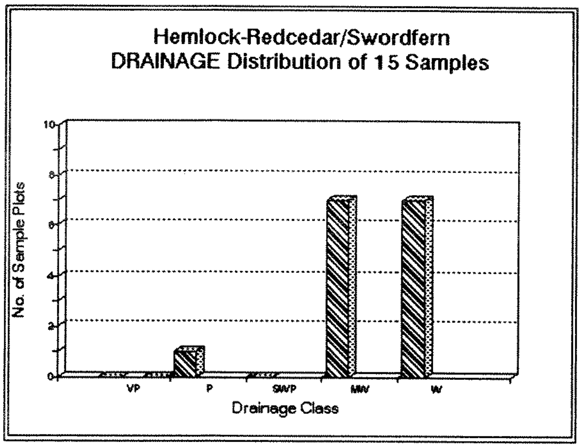


Fig. 32. Drainage Distribution of Redcedar/Swordfern Sample Plots.

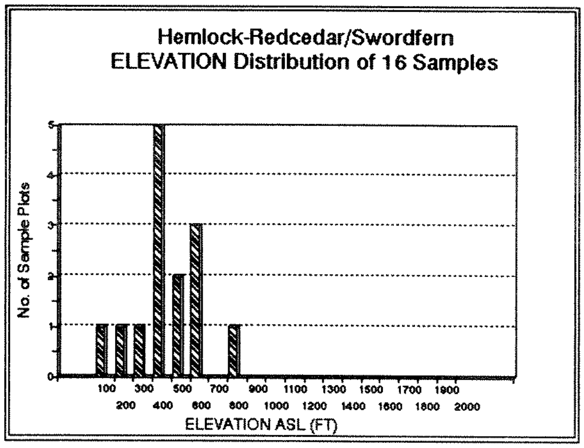


Fig. 33. Elevation Distribution of Redcedar/Swordfern Sample Plots.

Similar Associations

This association is tied to a unique combination of environmental factors-- rock outcrops at lower elevations. Swordfern abundance should easily distinguish this from other associations. Some western hemlock sites with devil's club also have swordfern, but absence of redcedar should separate those from redcedar/swordfern.

Management Implications

Timber value of this association is generally moderate to high, averaging 32,100 bd ft/ac (Volume Class 6). By species, 62 percent is western hemlock, 28 percent is redcedar, and 10 percent is Sitka spruce.

Rock outcrops and cliffs present obstacles to **logging** these sites. Yarding systems must be chosen carefully to avoid blind leads and logs catching on outcrops. Attaining log suspension is often difficult, because swordfern sites can be situated in rolling, broken topography (BMPs 13.2, 13.9).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerating prolifically on undisturbed soil surface organic horizons (Ruth and Harris 1979, Burns and Honkala 1990).

Redcedar regeneration is problematic. Advanced regeneration will usually be limited, because of the relatively small amount of redcedar in the understory (see above table). Regeneration from seeding will be sporadic, due to competition from hemlock and irregularity from seed crops. Documented response to disturbance for this association is lacking. Redcedar response could be somewhat better than in redcedar/blueberry because of the small-scale disturbance associated with this association (BMP 13.19).

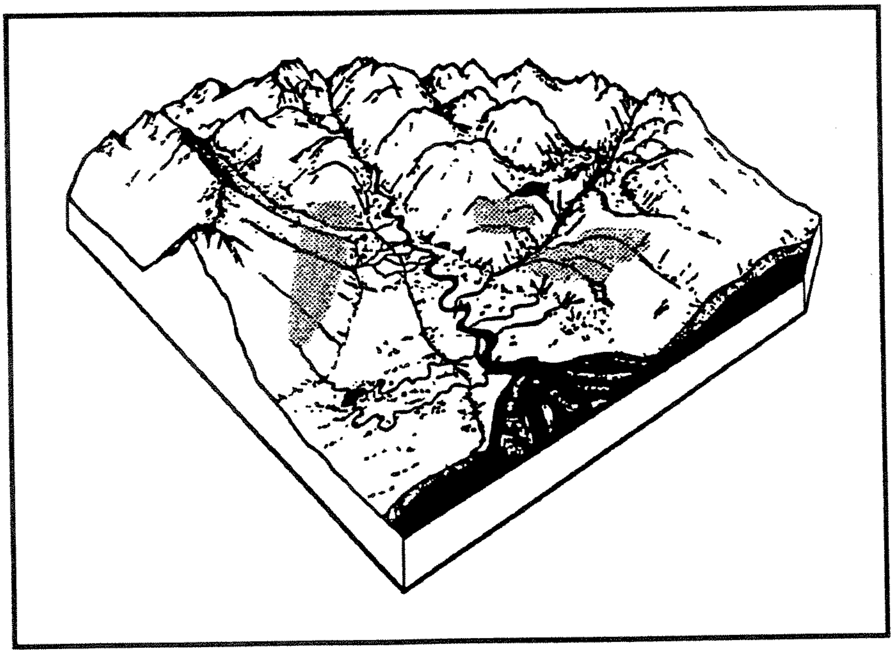
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) because sites are well drained. It is usually not found in association with wetlands.

Value as **deer habitat** is moderate. Forage value is lower than with other redcedar associations. Winter thermal cover value is moderate, but rock outcrops could deter deer from using sites.

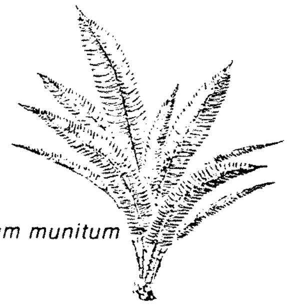
Trail and road construction are problematic because of rock cliffs and outcrops (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

There are no examples easily accessible from Ketchikan. This association is abundant along the southern bays and inlets of Prince of Wales Island. Excellent examples can be found at Nutkwa Lagoon and near Lancaster Cove. On the Thorne Bay District, the limestone region from Naukati to El Capitan provides abundant examples. Redcedar associations are common on shallow soil (Sarkar series) derived from limestone.



Most common landscape position(s) of the Western Hemlock-Western Redcedar/Swordfern association.

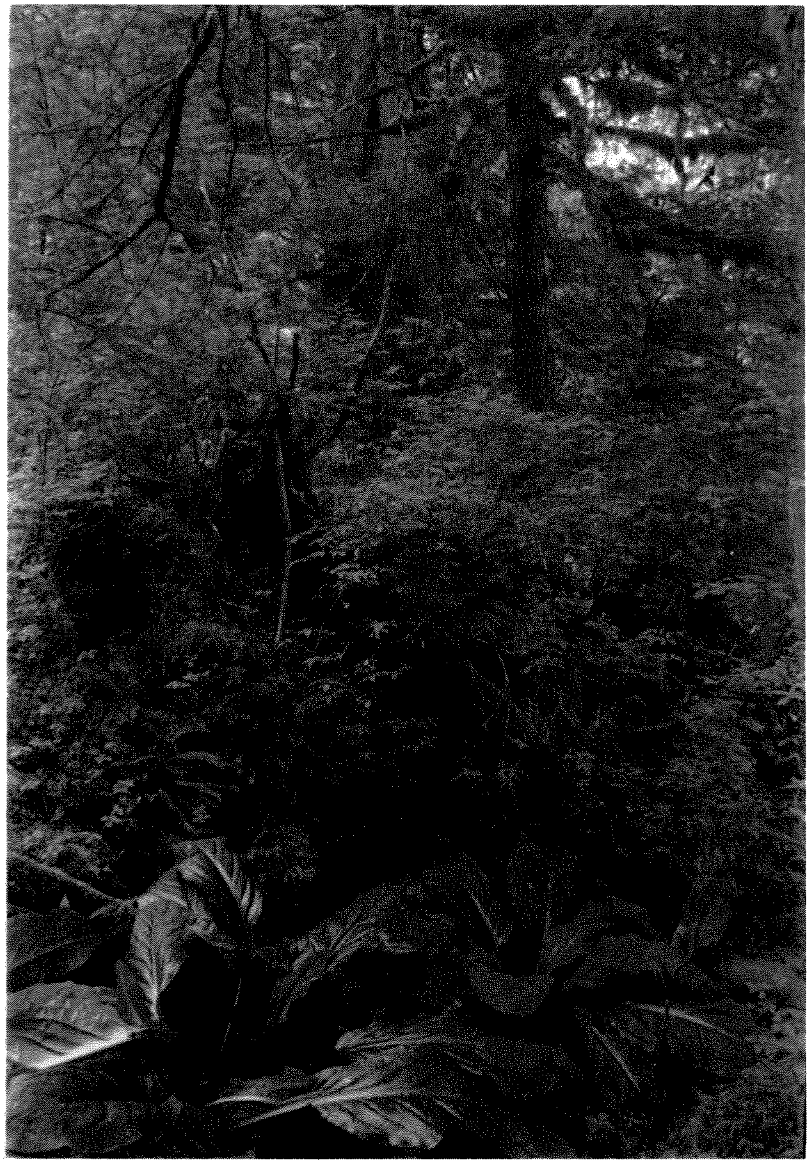


POMU
Polystichum munitum
Swordfern

Western Hemlock-Western Redcedar/Blueberry/Skunk Cabbage

Tsuga heterophylla-Thuja plicata/Vaccinium spp./Lysichitum americanum

TSHE-THPL/VACCI/LYAM 730



Vegetation

Canopies are relatively closed, with a mean cover of 55 percent. This is shared equally between western hemlock and western redcedar, with an average of 26 percent cover each. Strong redcedar presence in the overstory is evidence that this association is less productive than redcedar/blueberry, because redcedar competes more successfully on poorer sites. Sitka spruce occurred in 58 percent of sampled overstories, and averaged 8 percent cover.

The understory is dominated by western hemlock with 21 percent cover. Redcedar averages 5 percent cover and is usually present. Sitka spruce is usually present in small amounts.

The shrub layer is dominated by blueberry (mean 33 percent cover), and rusty menziesia (14 percent cover). Red huckleberry is common but in small amounts, which is typical for this species. Skunk cabbage designates the understory, with an average 15 percent cover, a high amount for this species. Bunchberry, twayblade, foamflower, and five-leaved bramble are other common forbs.

Stands are moderately productive, and stand height averages 95 feet. Snags are about 20 percent of basal area. Hemlock snags are valuable for wildlife, but redcedar snags are resistant to decay, and less useful for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	26%	100%	Tall blueberry	33%	100%
Western redcedar	26	100	Rusty menziesia	14	97
Sitka spruce	8	58	Red huckleberry	4	77

Tree Understory			Forbs		
Western hemlock	21	100	Bunchberry	8	88
Western redcedar	5	72	Five-leaved bramble	4	80
			Twayblade	1	72
			Skunk cabbage	15	100
			Goldthread	5	50

Distribution and Environment

Western Hemlock-Western Redcedar/Blueberry/Skunk Cabbage is clearly associated with low elevation sites, but on a variety of landforms. Hill landforms are the most common, but lowlands, mountainslopes, and associated valleys are common. Soil drainage varies but is most commonly somewhat poorly drained.

This association can occur as small inclusions in a matrix of better-drained redcedar and western hemlock associations, but can also occur as a significant portion of the rolling hills/lowlands landscape. As with other skunk cabbage associations, sites are often composed of complex pit-and-mound topography.

Typical Soils-- Western Hemlock-Western Redcedar/Blueberry/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kaikli	Organics	Rolling Hills, Benches	20,24,51,550
Wadleigh	Compact Till	Lower Backslopes, Footslopes	31,320
Maybeso	Organics Over Till	Footslopes	20,320
Meares	Till	Footslopes, Rolling Hills	5

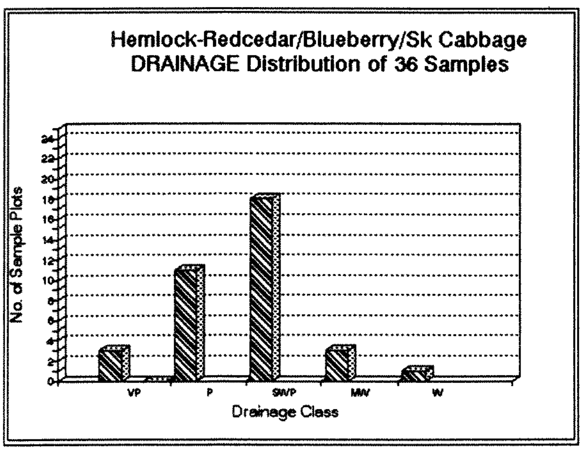


Fig. 34. Drainage Distribution of Redcedar/Blueberry/Skunk Cabbage Plots.

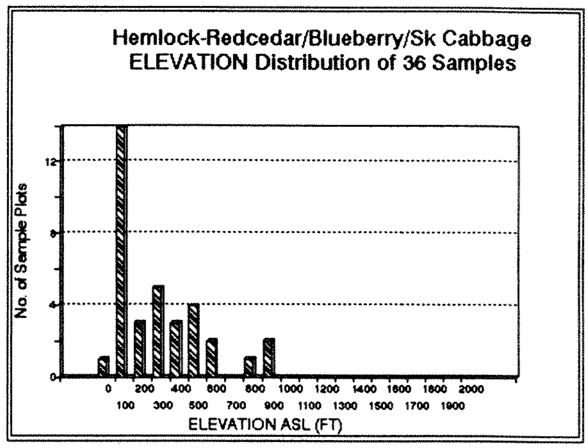


Fig. 35. Elevation Distribution of Redcedar/Blueberry/Skunk Cabbage Plots.

Similar Associations

This association is similar to both Western Hemlock and Mixed Conifer associations with skunk cabbage. It is more productive than Mixed Conifer/Skunk Cabbage and is more clearly dominated by hemlock and redcedar. It is distinguished from Western Hemlock with skunk cabbage by 10 percent overstory redcedar.

Management Implications

Timber value of this association is generally moderate, averaging 27,300 bd ft/ac (Volume Class 5). Sampled stand volumes ranged from 9,900 to 44,300 bd ft/ac. By species, 39 percent is western hemlock and 49 percent is western redcedar, with 6 percent each for yellowcedar and Sitka spruce.

Shovel yarding may not be an option because of easily disturbed, poorly drained soils. Use of other **yarding systems** should seek to minimize soil disturbance, but this will be difficult on many sites because of gentle slopes (BMPs 13.7, 13.2).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerating prolifically on undisturbed soil surface organic horizons (Ruth and Harris 1979, Burns and Honkala 1990).

Redcedar regeneration is problematic. Advanced regeneration will usually be limited, because of the relatively small amount of redcedar in the understory (see above table). Regeneration from seeding will be sporadic, due to competition from hemlock and irregularity from seed crops (BMP 13.19).

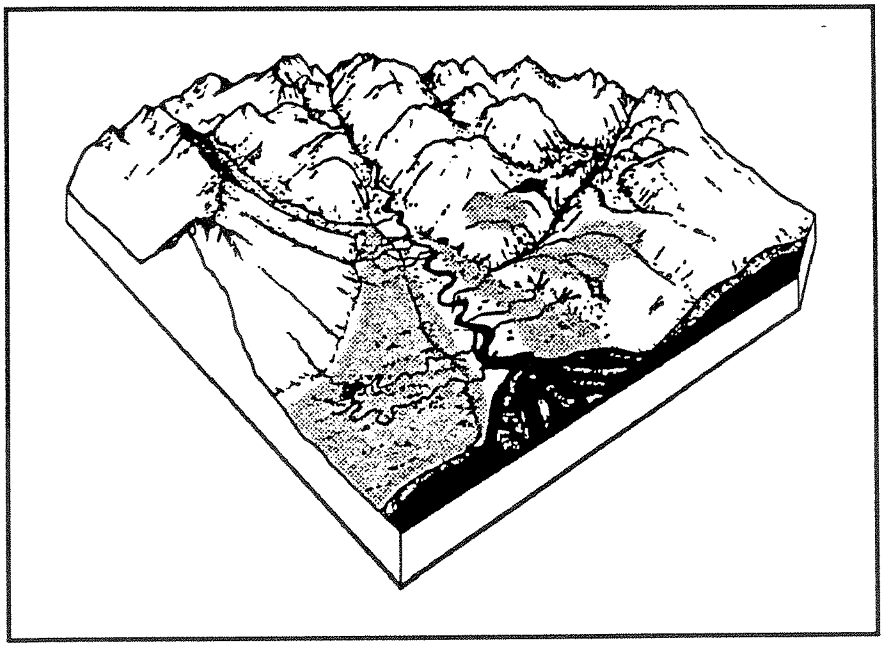
This is a **wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and can occur in a landscape matrix with both wetland and non-wetland associations. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Deer **forage value** is high, especially as spring range. Skunk cabbage provides some of the first leafy material available to deer in the spring. Skunk cabbage sites are of moderate value for winter thermal cover. **Bears** dig up and eat skunk cabbage tubers.

Trail and road construction may be inhibited by deep organic soils.

Representative Field Locations

Lunch Creek at Mile 16 North will provide an example for Ketchikan residents. On Prince of Wales Island, the Goose Creek area near Thorne Bay (especially the proposed Dart Timber Sale) illustrates the association well.



Most common landscape position(s) of the Western Hemlock-Western Redcedar/Blueberry/Skunk Cabbage association.

Western Hemlock-Western Redcedar/Blueberry, Well-Drained Variant

Tsuga heterophylla-Thuja plicata/Vaccinium spp., Well-Drained

TSHE-THPL/VACCI,WD 750

Vegetation

Canopies are relatively closed, with a mean cover of 64 percent. This is shared between western hemlock and western redcedar, with an average of 41 percent and 17 percent cover, respectively. Sitka spruce occurred in 75 percent of sampled overstories and averaged 10 percent cover.

The understory is dominated by western hemlock. The species is nearly always present and averages 35 percent cover. Redcedar is usually present and averages 5 percent cover. Other conifers may be present, usually in small amounts.

The shrub layer is characterized by blueberry (mean 29 percent cover) and devil's club (mean 7 percent cover). Rusty menziesia is nearly always present and averages 4 percent cover.

Common forbs are bunchberry, trifoliate foamflower, five-leaved bramble, and rosy twisted stalk. Ferns are varied and abundant; deer, oak, shield, and lady fern all are usually present.

Some combination of devil's club and shield fern, totalling at least 5 percent, is always present. In fact, this could be called a devil's club association, but the species is sometimes present in only trace amounts.

Redcedar/Blueberry, Well-Drained sites are the most productive in the hemlock-redcedar series. Stand height averages 120 feet. Snags represent 15 percent of the basal area. Western hemlock snags provide valuable habitat for cavity nesters, but redcedar snags are resistant to decay.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	41%	100%	Tall blueberry	29%	100%
Western redcedar	17	100	Rusty menziesia	4	100
Sitka spruce	10	75	Devil's club	7	100

Tree Understory	.		Forbs		
Western hemlock	35	91	Bunchberry	7	83
Western redcedar	5	83	Five-leaved bramble	6	83
Sitka spruce	2	66	Trifoliate foamflower	3	91
			Twisted stalk	1	91

Distribution and Environment

Western Hemlock-Western Redcedar/Blueberry, Well-Drained is associated with well drained, productive sites on mountainslopes, footslopes, and hills. Elevations of samples range from 200 to 800 feet and rarely higher.

Water moving through the soil profile is characteristic of this association. Soil disturbance in this form is indicated by devil's club, foamflower, lady fern and other species.

Typical Soils-- Western Hemlock-Western Redcedar/Blueberry, Well-Drained

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Kupreanof	Colluvium	Sideslopes	74,75,76
McGilvery	Shallow Organic Over Bedrock	Mountain and Hillslopes	6,28,40,75,528,540
Sarkar	Residuum/ Colluvium	Mountain and Hillslopes	40,442

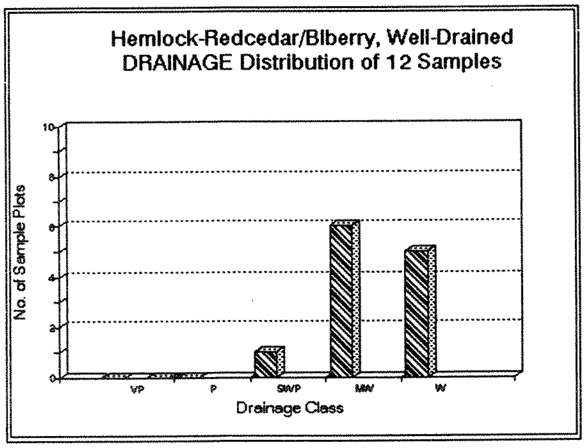


Fig. 36. Drainage Distribution of Redcedar/Blueberry, WD Sample Plots.

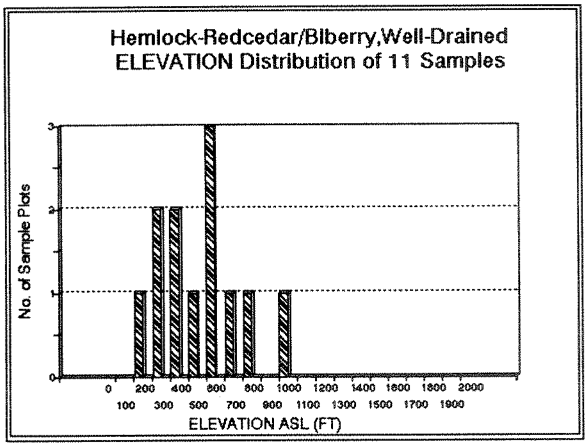


Fig. 37. Elevation Distribution of Redcedar/Blueberry, WD Sample Plots.

Similar Associations

In vegetation, this habitat is similar to both hemlock/devil's club and hemlock/shield fern. It occupies similar sites as these productive hemlock associations, but it is distinguished from them by a minimum 10 percent overstory cedar cover. It is distinguished from other redcedar associations by combined devil's club and shield fern cover of at least 5 percent. It is also more productive than most redcedar sites.

Management Implications

Timber value of this association is generally high, averaging 35,900 bd ft/ac (Volume Class 6). By species, 59 percent is western hemlock, 29 percent is western redcedar, and 12 percent is Sitka spruce.

Cable yarding is appropriate, and some soil disturbance may be tolerated. Excessive soil disturbance will favor salmonberry invasion. Sheet erosion can be followed by expansion of lady fern (BMPs 13.2, 13.9).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Response should be similar to that of western hemlock/shield fern. Redcedar regeneration will be erratic, and will be inhibited by dense hemlock regeneration (BMP 13.19).

Of all the redcedar associations, this well-drained variant is the one likely to be most worthy of planting redcedar. Sites are productive and trees will grow relatively rapidly. If this option is selected, planting should follow harvest as promptly as possible. Planting should use a close spacing (Minore 1983); otherwise trees will develop with a strong taper (BMP 13.19).

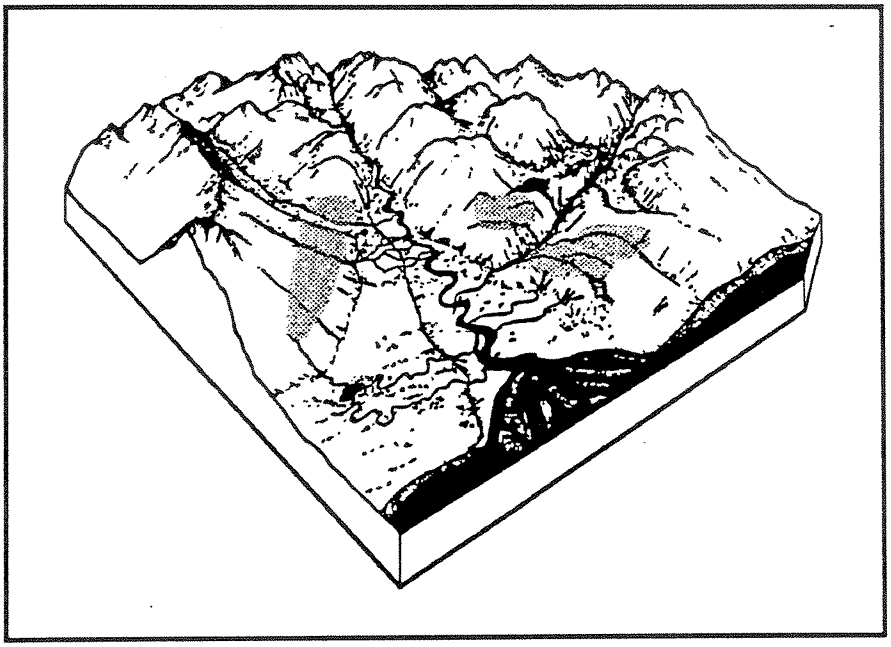
Growing redcedar to rotation age involves a number of difficulties. Strong hemlock competition can be expected throughout the life of the stand. If a 100-year rotation of mixed cedar and hemlock is desired, redcedar will be too small when hemlock is ready for harvest. If hemlock were removed at that time and redcedar retained, cedars would be susceptible to blowdown, because the windbreak effect of adjacent trees would be lost.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is unlikely to be found in association with wetland habitats.

Trail and road construction is feasible, but more problematic on frequently dissected slopes. On those sites bridges and culverts are more likely to be required. Care should be taken to minimize surface disturbance, as this habitat is moderately susceptible to surface erosion (BMPs 14.2, 14.3, 13.5, 16.4).

Representative Field Locations

In the Ketchikan vicinity, look for this association near the end of the Perseverance Trail. On Prince of Wales Island, the Thorne Bay bypass road provides good examples of redcedar sites.

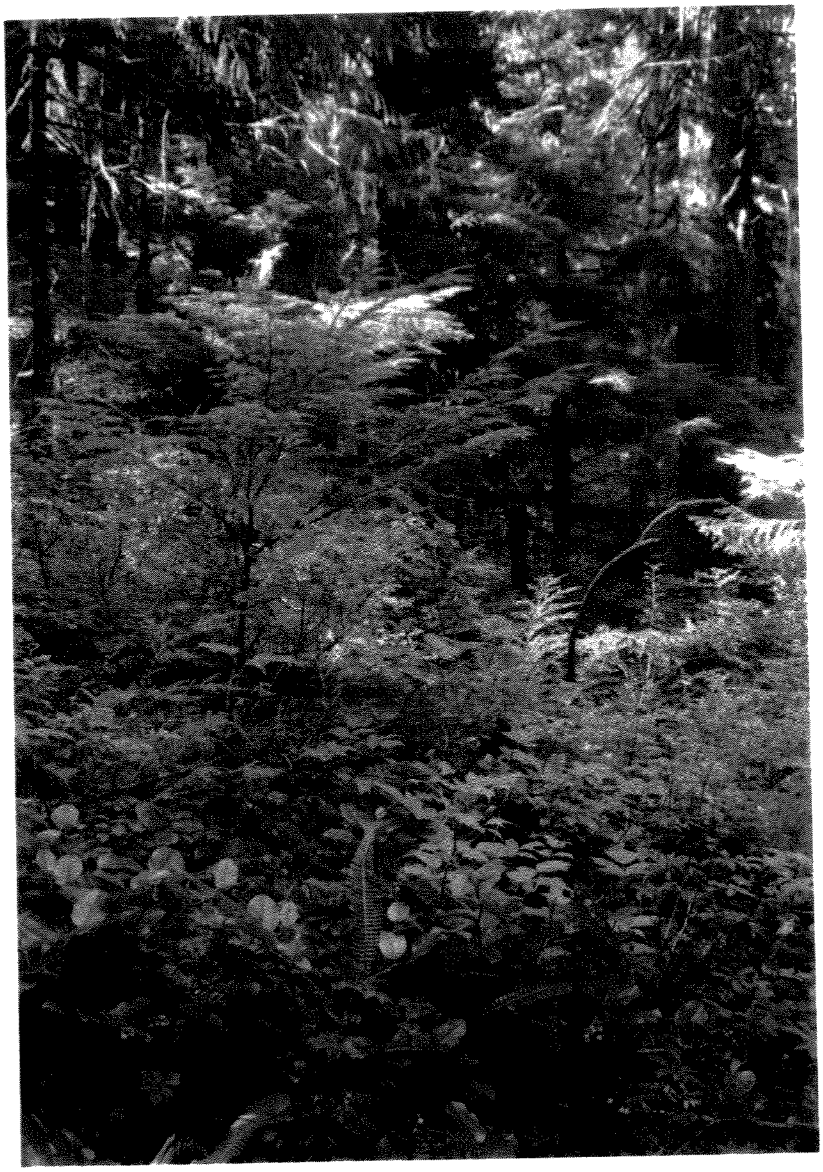


Most common landscape position(s) of the Western Hemlock-Western Redcedar/Blueberry, Well-Drained association

Western Hemlock-Western Redcedar/Blueberry-Salal

Tsuga heterophylla-Thuja plicata/Vaccinium spp./Gaultheria shallon

TSHE-THPL/VACCI-GASH 760



Vegetation

Canopy cover averages 53 percent. Redcedar is well represented in the overstory, with 26 percent average cover. Western hemlock averages 22 percent. Sitka spruce and yellowcedar each appeared in about half the stands samples, and averaged 4 and 9 percent cover, respectively.

The understory is dominated by western hemlock, with 29 percent cover. Redcedar is nearly always present and averages 13 percent cover. Other species are minor components.

The shrub layer is dominated by salal (mean 29 percent cover) and blueberry (mean 20 percent cover). Rusty menziesia and red huckleberry are nearly always present in smaller amounts (averaging 9 and 8 percent respectively).

Common forbs are bunchberry, twayblade, foamflower, and deerberry. Skunk cabbage was present in half the sampled stands. Deer fern is the most common fern.

Stands are of low to moderate productivity, with an average stand height of 83 feet. Snags comprise about 40 percent of basal area. Hemlock snags are soft and thus valuable for cavity nesters; cedar snags are hard, resisting decay and excavation by birds and mammals.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	22%	100%	Tall blueberry	20%	100%
Western redcedar	26	100	Rusty menziesia	9	89
			Salal	29	100

Tree Understory			Forbs		
Western hemlock	29	100	Bunchberry	5	94
Western redcedar	13	94	Five-leaved bramble	3	63
			Twayblade	1	84
			Foamflower	1	78
			Deerberry	3	73

Distribution and Environment

Within the redcedar series, this association represents the transition from better-drained, more productive blueberry sites, to less productive sites limited by soil drainage or depth. Western Hemlock-Western Redcedar/Blueberry-Salal is clearly associated with rolling hill country, but can occur on mountains as well. Elevation is typically around 300 feet (Fig. 39), but can range up to 800 feet.

Soils are most often somewhat poorly or moderately well drained. Shallow soils, such as the McGilvery series, are common. This association sometimes occurs on deep, well drained Spodosols.

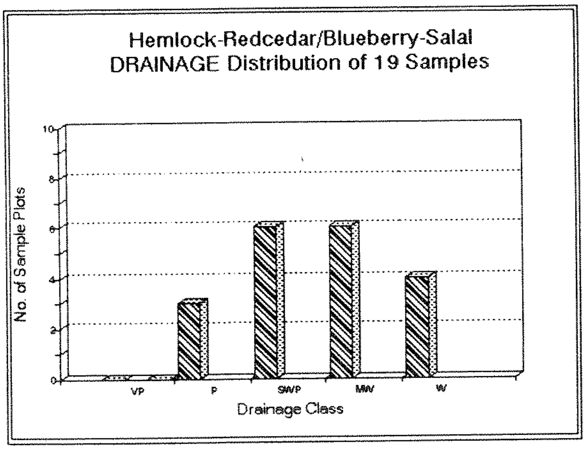


Fig. 38. Drainage Distribution of Redcedar/Blueberry-Salal Sample Plots.

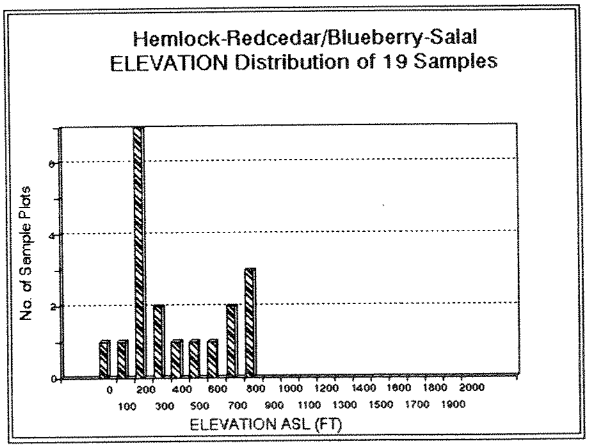


Fig. 39. Elevation Distribution of Redcedar/Blueberry-Salal Sample Plots.

Typical Soils-- Western Hemlock-Western Redcedar/Blueberry-Salal

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Wadleigh	Compact Till	Rolling Hills, Hill/Mountain Slopes	331,320,31
St. Nicholas	Colluvium	Mountain Slopes, Hill Slopes	32,33,550
Helm/Granitic Phase	Residuum/Colluvium	Mountain Slopes	19
McGilvery	Shallow Organic Over Bedrock	Mountain Slopes, Hill Slopes	28,29,33,62

Similar Associations

This association is similar to blueberry and salal sites in the redcedar series, but is distinguished by a roughly equal mix of blueberry and salal. It might be confused with mixed conifer associations with salal, but those usually have mountain hemlock present. Redcedar sites are usually clearly dominated by a western hemlock/redcedar mix in the overstory, and are more productive than mixed conifer sites.

Management Implications

Timber value of this association is generally low to moderate, averaging 21,800 bd ft/ac (Volume Class 5). By species, 68 percent is redcedar, 22 percent is western hemlock, 7 percent is yellowcedar, and 3 percent is Sitka spruce.

Because of shallow soils, shovel yarding may not be appropriate, though it could be an option on better-drained sites of less than 20 percent slope. Cable **logging** systems may not be able to attain sufficient deflection to avoid soil disturbance, since this association frequently occurs on gentle slopes in rolling hill country, presenting a host of blind leads and other logging obstacles (BMPS 13.2, 13.7, 13.9).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerate prolifically on undisturbed soil surface organic horizons (Ruth and Harris 1979, Burns and Honkala 1990). Regeneration may be inhibited by salal on (Haeussler et al. 1990). Messier and Kimmins (1990), working in coastal British Columbia, found that growth of planted redcedar and western hemlock was inhibited by salal. Soil nitrogen was largely immobilzed up to eight years following logging on salal sites. Salal is a strong competitor for nutrients because of extensive rhizomes and fine roots.

Redcedar regeneration is problematic, although more advanced redcedar regeneration is present than in other redcedar associations. Response will be slower on poorer sites supporting this association. Very little data exists to document response on salal sites (BMP 13.19).

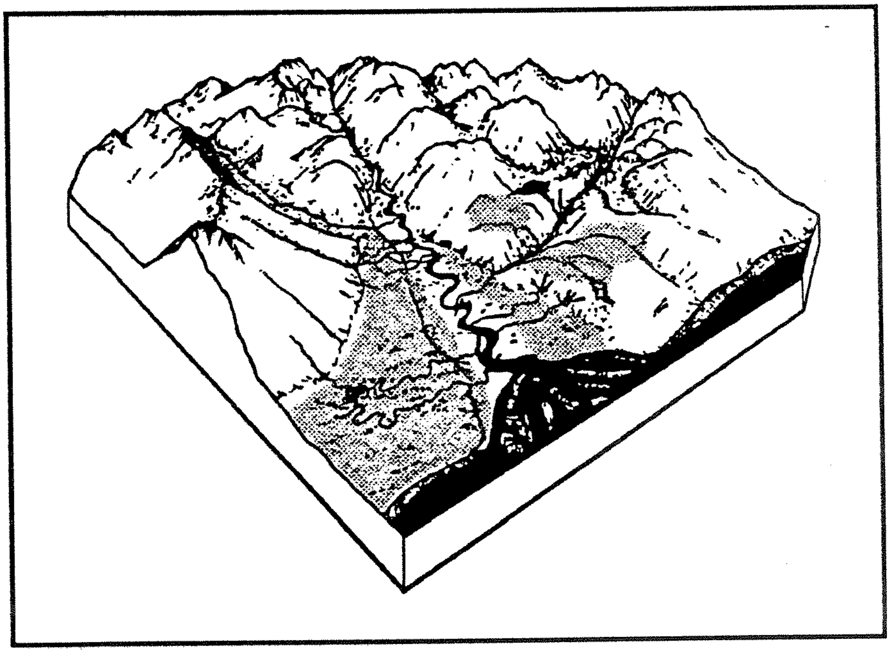
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), but may occur in soil map units with inclusions of wetlands. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Value for **deer** forage is moderate. Blueberry and nutritious forbs are available, but salal is undesirable despite its use by ungulates in British Columbia, Oregon, and Washington (Brown 1961, Bailey 1966, Nyberg et al. 1986). Winter thermal cover is of low to moderate value.

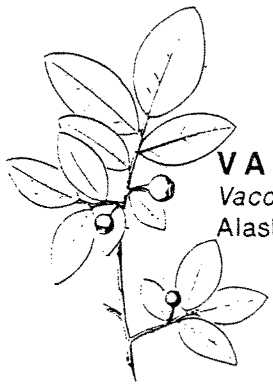
Trail and road construction are relatively easy, but may need to contend with uneven topography and shallow or wet soils. Esthetically, salal sites are attractive locations for hiking and nature interpretation (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Perseverance Trail and the trail leading to Coast Guard Beach near Ketchikan both provide examples of this association. The proposed Dart Sale in the Goose Creek area near Thorne Bay is a well documented (Tierney 1990) example of redcedar associations with salal. On the Craig District, try the Soda Springs Trail on the Hydaburg Road.

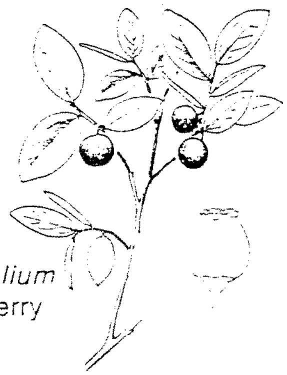


Most common landscape position(s) of the Western Hemlock-Western Redcedar/Blueberry-Salal association.



VAAL
Vaccinium alaskaense
Alaska huckleberry

GASH
Gaultheria shallon
Salal



VAOV
Vaccinium ovalifolium
Oval-leaf huckleberry

Western Hemlock-Western Redcedar/Blueberry-Salal/Skunk Cabbage

Tsuga heterophylla-Thuja plicata/Vaccinium spp.-Gaultheria shallon
Lysichitum americanum

TSHE-THPL/VACCI-GASH/LYAM 765

Vegetation

Canopy cover averages 50 percent. Redcedar is well represented in the overstory, with 27 percent average cover. Western hemlock averages 18 percent. Sitka spruce was present in half the sampled overstories, and averaged 5 percent cover where present.

The understory is dominated by western hemlock, with 19 percent cover. Redcedar is usually present and averages 8 percent cover.

The shrub layer is clearly dominated by salal, with 36 percent mean cover. Blueberry and rusty menziesia were present in all samples, and averaged 9 percent cover each.

Skunk cabbage designates the association, and averages 12 percent cover-- high abundance for this species. Other common forbs are bunchberry, twayblade, five-leaved bramble, twisted stalk, and deerberry. Deerberry is particularly common along along beachfronts.

Stands are of low to moderate productivity, with an average stand height of 87 feet. Snags comprise about 20 percent of basal area. Hemlock snags are soft and thus valuable for cavity nesters. Cedar snags are hard, resisting decay and excavation by birds and mammals.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	18%	100%	Tall blueberry	9%	100%
Western redcedar	27	100	Rusty menziesia	9	100
			Salal	36	100

Tree Understory			Forbs		
Western hemlock	19	100	Bunchberry	7	92
Western redcedar	8	85	Five-leaved bramble	4	71
			Skunk cabbage	12	100
			Twisted stalk	2	71
			Deerberry	2	71

Distribution and Environment

This series occurs in combination with other redcedar associations with salal on lowland, valley, and hill landforms. Individual sites are often small in area and represent a mosaic of depressions and raised areas resulting from windthrow or the inherently uneven topography of glacial drumlin fields. Because of the many microsites this association can occupy, it is evenly distributed in elevation up to 500 feet. Cooler temperatures above this elevation normally prohibit its occurrence.

Soils are most often somewhat poorly or moderately well drained. Skunk cabbage is associated with deeper, poorly drained soils, but these sites are often a mosaic of deep and more poorly drained sites.

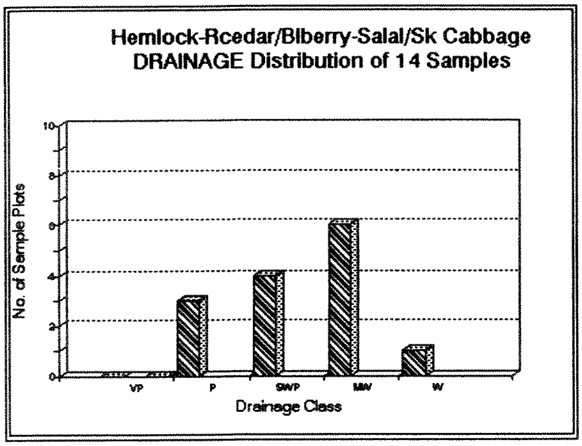


Fig. 40. Drainage Distribution of Redcedar/Blueberry-Salal/ Skunk Cabbage Plots.

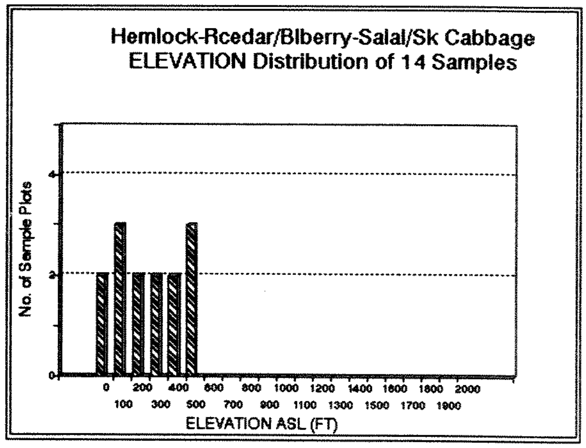


Fig. 41. Elevation Distribution of Redcedar/Blueberry-Salal/ Skunk Cabbage Plots.

Typical Soils-- Western Hemlock-Western Redcedar/Blueberry-Salal/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Wadleigh	Compact Till	Rolling Hills, Outwash Plains	320,31
St. Nicholas	Colluvium	Hill Slopes	32,33,35,550
Tokeen	Residuum/Colluvium	Hill Slopes	54,540

Similar Associations

This association is similar to blueberry and salal sites in the redcedar series, but is distinguished by abundant skunk cabbage. It might be confused with mixed conifer associations with salal and skunk cabbage, but those usually have mountain hemlock present. Redcedar sites are usually clearly dominated by a western hemlock/redcedar mix in the overstory, and are more productive than those of the mixed conifer sites.

Management Implications

Timber value of this association is generally moderate, averaging 28,100 bd ft/ac (Volume Class 5). By species, 59 percent is redcedar, 20 percent is western hemlock, 16 percent is Sitka spruce, and 15 percent is yellowcedar.

Because of wet soils and uneven topography, shovel yarding is not recommended. Cable **logging** systems may not be able to attain sufficient deflection to avoid soil disturbance, as this association frequently occurs on gentle slopes in rolling hill country or valleys, presenting a host of blind leads and other logging obstacles. BMPS 13.2, 13.7, 13.9, and 13.19 apply to these sites.

Conifer regeneration is likely to be western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerating prolifically on undisturbed soil surface organic horizons (Ruth and Harris 1979, Burns and Honkala 1990). Abundant salal may inhibit regeneration on better-drained sites, but should respond slowly on more poorly-drained sites. (Haeussler et al. 1990).

Redcedar regeneration is problematic, although more advanced redcedar regeneration is present than in other redcedar associations. Response is likely to be slow. Messier and Kimmins (1990), working in coastal British Columbia, found that growth of planted redcedar and western hemlock was inhibited by salal. Soil nitrogen was largely immobilzed up to eight years following logging on salal sites. Salal is a strong competitor for nutrients because of extensive rhizomes and fine roots.

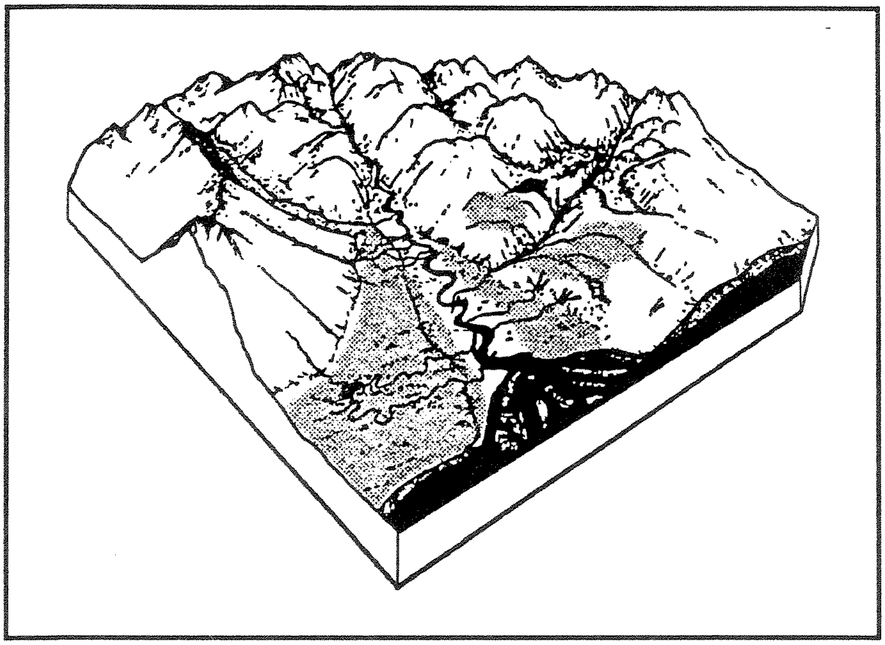
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), although it often occurs in association with wetlands in wetland map units. Care should be taken when management activities occur in wetland areas (BMP 12.5, 13.15).

Redcedar/Blueberry-Salal/Skunk Cabbage sites provide excellent **spring deer range** because of abundant skunk cabbage and associated forbs. Value for winter range, however, is poor. The canopy is open, and the strongly tapered redcedar with elongated crowns of these sites are ill-equipped to hold heavy winter snow.

Trail and road construction are difficult because of uneven topography and pockets of deep, poorly-drained soil. Avoid construction where possible. Boardwalk will probably be required when constructing trails (BMPs 14.2, 14.3, 16.4, 12.5).

Representative Field Locations

Perseverance Trail and the trail leading to Coast Guard Beach near Ketchikan both provide examples of this association. The proposed Dart Sale in the Goose Creek area near Thorne Bay is a well documented (Tierney 1990) example of redcedar associations with salal. On the Craig District, try the Soda Springs Trail on the Hydaburg Road.



Most common landscape position(s) of the Western Hemlock-Western Redcedar/Blueberry-Salal/Skunk Cabbage association.

Western Hemlock-Western Redcedar/Salal

Tsuga heterophylla-Thuja plicata/Gaultheria shallon

TSHE-THPL/GASH 780

Vegetation

Canopy cover averages 52 percent. Redcedar is well-represented in the overstory, with 29 percent average cover. Western hemlock averages 18 percent. Other species are infrequent.

The understory is dominated by western hemlock, with 25 percent cover. Redcedar is nearly always present and averages 10 percent cover. Other species are minor components.

The shrub layer is dominated by salal (mean 33 percent cover). Blueberry, red huckleberry, and rusty menziesia are all common but not abundant when present. Forbs are much reduced compared with other salal associations. No forb species exceeds 71 percent constancy, and individual forb species seldom occur in more than trace amounts. Deer fern is the most common fern and averages 14 percent cover.

Stands are of low productivity, with an average stand height of 77 feet. Snags comprise about 15 percent of basal area, but most are hard redcedar snags, of little value to wildlife.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock Western redcedar	18% 29	100% 100	Tall blueberry Rusty menziesia Salal	3% 5 33	80% 95 100

Tree Understory			Forbs		
Western hemlock Western redcedar	25 10	100 95	Bunchberry Trifoliate foamflower Twayblade Deerberry	2 1 1 2	57 71 57 66

Distribution and Environment

Of all forest associations with salal, this is the one most dominated by the species. Its presence indicates a relatively high amount of available light, and in southern Southeast Alaska, this means open sites limited by poor drainage or shallow soils. On the Ketchikan Area, redcedar/salal reaches its best expression on southern Prince of Wales and associated islands-- the area with the greatest number of growing degree days in Southeast.

Because of cooler temperatures limiting salal, this association is most abundant below 500 feet elevation, although it has been recorded as high as 900 feet. It is clearly associated with rolling hill country but can sometimes occur on other hill, valley, and mountain landforms.

Soil drainage varies widely, from poorly to well drained sites (Fig. 42). Soil series vary more widely than other redcedar associations with salal. Those listed below are only the most common.

Typical Soils-- Western Hemlock-Western Redcedar/Salal

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tolstoi	Colluvium/ Residuum	Hill and Mountain Slopes	35, 53, 528,351
Traitors	Colluvium	Mountain Slopes, Hill Slopes	2,6
Tokeen	Residuum/Colluvium	Mountain Slopes	54,540

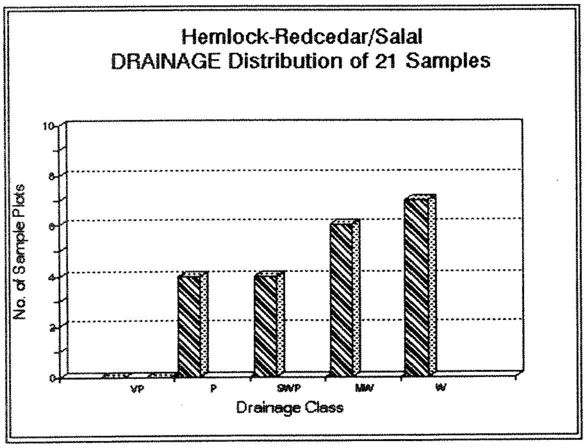


Fig. 42. Drainage Distribution of Redcedar/Salal Sample Plots.

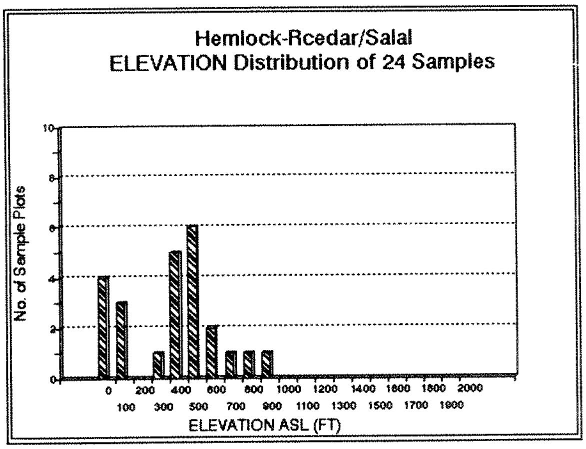


Fig. 43. Elevation Distribution of Redcedar/Salal Sample Plots

Similar Associations

This association should be easy to distinguish by its clear abundance of redcedar and salal. Ecologically, it is most similar to redcedar/ blueberry-salal. Mixed conifer associations with salal are more open, less productive, and usually show at least some mountain hemlock present.

Management Implications

Timber value of this association is moderate, averaging 27,700 bd ft/ac (Volume Class 5). By species, 53 percent is redcedar, 31 percent is western hemlock, 10 percent is yellowcedar, and 6 percent is Sitka spruce.

Because of shallow soils, shovel yarding may not be appropriate. It is an option on better-drained sites of less than 20 percent slope. Cable **logging** systems may not be able to attain sufficient deflection to avoid soil disturbance, as this association frequently occurs on gentle slopes in rolling hill country, presenting a host of blind leads and other logging obstacles (BMPs 13.2, 13.7, 13.9).

Conifer regeneration is likely to be severely inhibited by salal, especially on southern Prince of Wales Island, where the shrub can reach 4 feet in height. Messier and Kimmins (1990), working in coastal British Columbia, found that growth of planted redcedar and western hemlock was inhibited by salal. Soil nitrogen was largely immobilzed up to eight years following logging on salal sites. Salal is a strong competitor for nutrients because of extensive rhizomes and fine roots. Conifer regeneration that does succeed is likely to be western hemlock (BMP 13.9).

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), but it may occur in soil map units with inclusions of wetlands. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

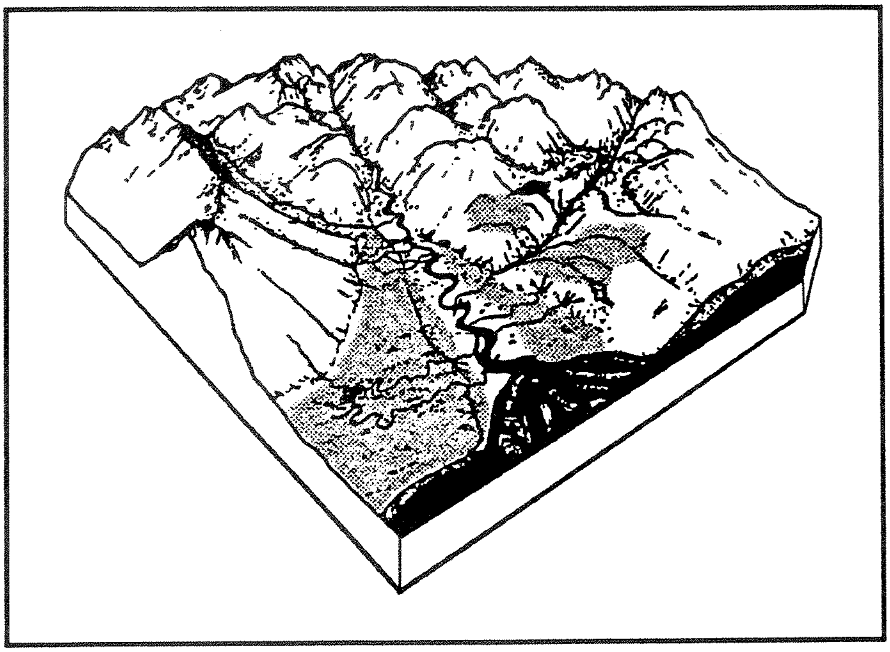
Value for **deer** forage and cover is low. Desirable forbs are notably low in abundance. Salal is undesirable, despite its use by ungulates in Oregon and Washington (Brown 1961, Bailey 1966).

Trail and road construction are relatively easy, but may need to contend with uneven topography and shallow soils (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Perseverance Trail and the trail leading to Coast Guard Beach near Ketchikan both provide examples of this association. The proposed Dart Sale in the Goose Creek area near Thorne Bay is a well documented (Tierney 1990) example of redcedar associations with salal. On the Craig District, try the Soda Springs Trail on the Hydaburg Road.

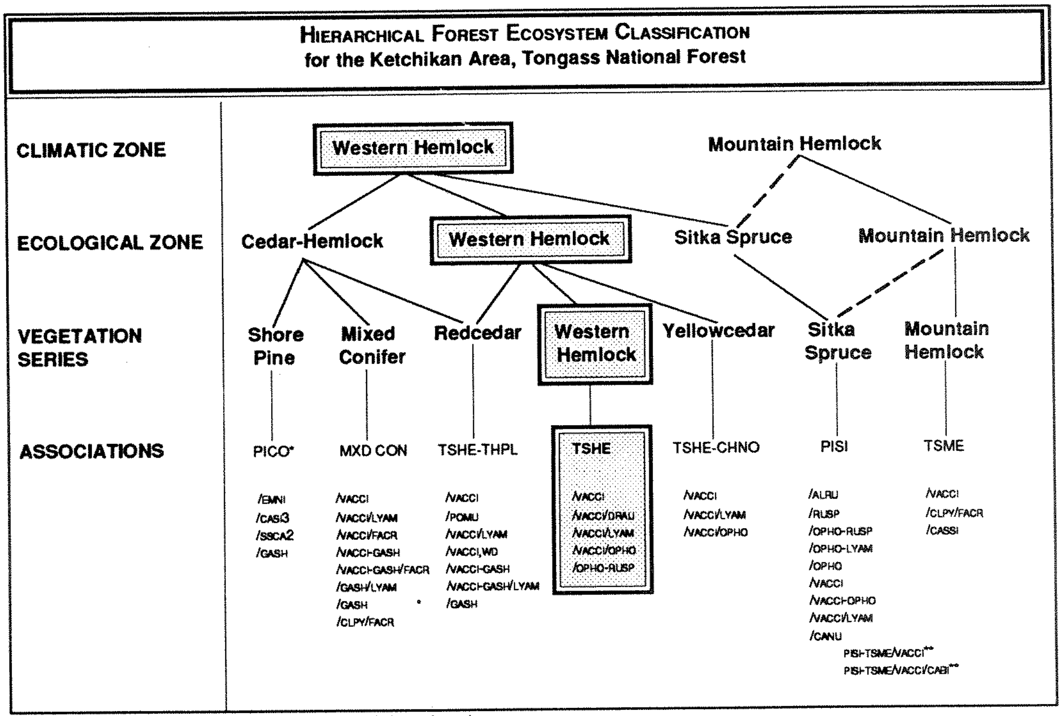
The best expression of this association, however, is along bays and inlets of southern Prince of Wales and associated islands, where growing-degree days are the greatest.



Most common landscape position(s) of the Western Hemlock-Western Redcedar/Salal association.

GASH
Gaultheria shallon
Salal

Western Hemlock Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

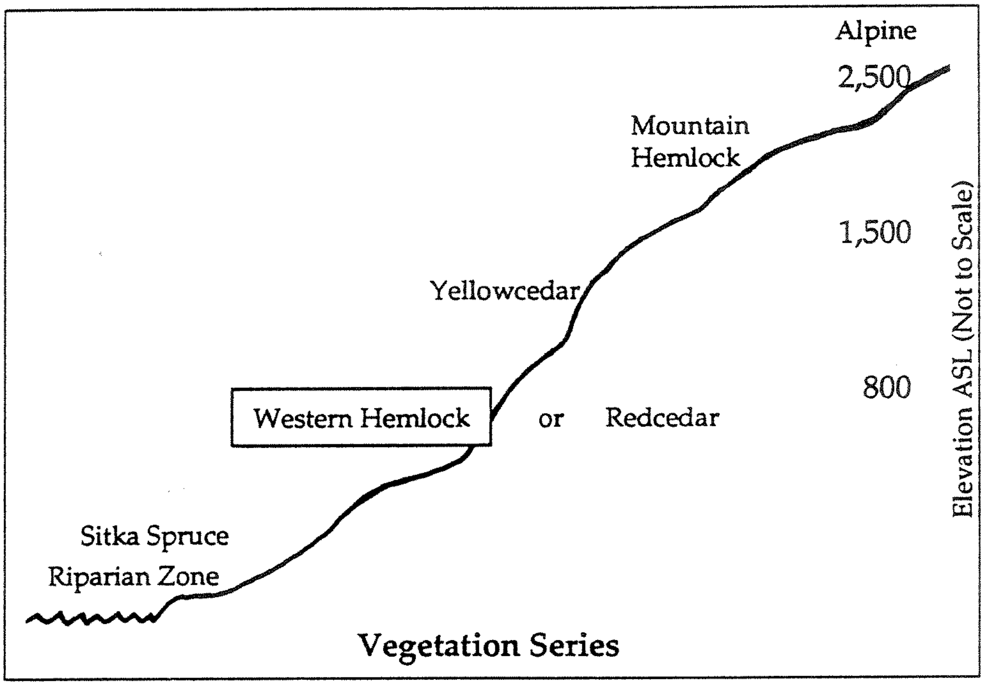


Fig. 44. Schematic of the Western Hemlock Series. It comprises the bulk of the Western Hemlock Ecological Zone, and has been the focus of logging on the Ketchikan Area since the 1950s.

6
WESTERN HEMLOCK SERIES

Western Hemlock Ecological Zone

The Western Hemlock Vegetation Series occupies the bulk of the Western Hemlock Ecological Zone. On low elevation, productive sites, Western Hemlock-Western Redcedar associations will overlap with this series. Western Hemlock-Yellowcedar will also occur in this ecological zone, particularly at higher elevation. At the highest elevations (around 2,000 feet), a transition is made to the Mountain Hemlock Ecological Zone.

Western hemlock sites are generally productive. Soil drainage varies from somewhat poorly to well drained, with better-drained sites the norm. Typical sites are on hill and mountain sideslopes and footslopes, but western hemlock associations are also common within riparian zones and on uplifted beaches.

Western hemlock associations range from saltwater to around 2,000 feet. Around 1,000 feet, they begin to be replaced by yellowcedar associations because of cooler temperatures.

In structure, climax western hemlock stands represent classic old-growth conditions. A range of tree diameters is complemented with numerous soft snags ideal for cavity-nesting wildlife. Heavy limbs on the tallest trees intercept snow well, providing good thermal cover for Sitka black-tailed deer. Woody debris is abundant on the forest floor.

The shrub layer is characterized by blueberry, well represented but not as abundant as on more open sites in the hemlock-redcedar series. On sites more closely tied to soil disturbance, such as those adjacent to V-notches, devil's club and salmonberry are more abundant.

In the forb layer, bunchberry, goldthread, five-leaved bramble, and trifoliate foamflower are well represented. Skunk cabbage designates the association that forms small, poorly drained inclusions within a better-drained matrix. Ferns are abundant, and shield fern is used to designate a highly productive association in this series.

Small-scale windthrow is frequent in this series and serves to regenerate the forest. When one or a few trees blow down, a gap is created, letting in light that encourages shrub, tree, and forb development (Hocker 1990). Root wads are torn from the soil, creating a churning effect that over the centuries acts as a form of cultivation. Some authors have hypothesized that lack of windthrow in stands will eventually lead to increased soil organic matter accumulation and poorer drainage. Whether this would occur or not is uncertain, but it is important to realize that windthrow is an integral, vital part of ecosystem function (Harris 1989).

Woody debris is likewise important, as most conifer regeneration occurs on nurse logs and stumps (Harmon and Franklin 1989). Debris is also a long-term nutrient source and supports mycorrhizal fungi, vital to tree nutrient uptake (Hunter 1990).

Western hemlock sites have been the focus of logging on the Ketchikan Area since the inception of the Long-Term Sale in 1954. Consequently, a large pool of second-growth stands less than 35 years old can be drawn on to provide silvicultural response information. Typically, abundant natural western hemlock regeneration follows logging of these sites. Canopies often close by age 15-20, and by age 30 understory vegetation begins to die out. Because these sites are valuable for timber, thousands of acres have been thinned, particularly within the past ten years.

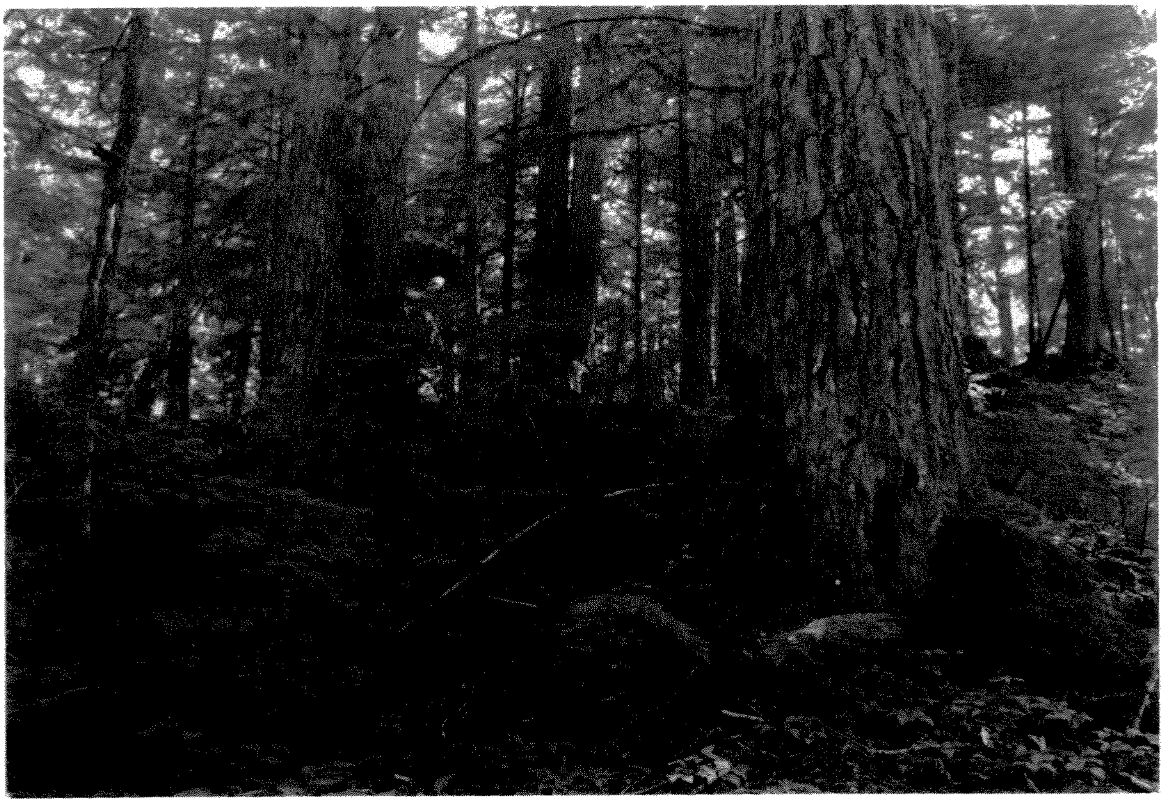
After age 30, a depauperate stage (Alaback 1982) follows. Unpublished data collected by DeMeo and others in 1992 shows that this condition lasts at least until age 200. Because this has significant implications for availability of deer forage, second-growth evaluation has received great attention (Alaback 1982, 1984; Kessler 1982, Hanley 1991, Ebasco Environmental 1992, among others). To assist silviculturists, wildlife biologists, and others in developing stand prescriptions, we include second-growth vegetation summaries in selected association write-ups. They were derived from data on 150 sample transects on northern and central Prince of Wales Island.

While the focus of logging may now be shifting to less productive sites, western hemlock stands will receive increased attention as they become locally scarce. Desirable timber, high quality deer winter range, abundant soft snags for cavity nesters, high esthetic and recreational value, and structural diversity are only a few of the reasons why managers will need to become increasingly sophisticated in dealing with the Western Hemlock Series.

Western Hemlock/Blueberry

Tsuga heterophylla/Vaccinium spp.

TSHE/VACCI 110



Vegetation

Canopy cover averages 59 percent. Structure in this association features a range of diameters, snags, and woody debris. Western hemlock designates the overstory and averages 54 percent. Sitka spruce was found in 58 percent of sampled overstories and is an indicator of small-scale disturbance (usually individual tree windthrow) in this series. Redcedar may be a minor component. The understory follows a similar pattern.

The shrub layer is characterized by blueberry; cover averages 38 percent. Rusty menziesia usually is present, and red huckleberry is present in small amounts. The forb layer is characterized by bunchberry and five-leaved bramble, with twisted stalk, goldthread, foamflower, and twayblade occurring less frequent. The presence of blueberry and forbs is sometimes reduced by high deer populations or intense winter use, as may occur on the southern end of the Cleveland Peninsula.

Snags comprise 15 percent of basal area, and are usually hemlock or spruce. These species make valuable snags, because their wood is relatively soft and allows excavation by cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	54%	100%	Tall blueberry	38%	100%
Sitka spruce	7	58	Rusty menziesia	7	87
Western redcedar	5	23	Red huckleberry	5	58
Tree Understory			**Forbs etc.**		
Western hemlock	22	96	Bunchberry	5	84
Sitka spruce	2	57	Deer fern	4	79
Western redcedar	3	15	Fernleaf goldthread	4	55
			Twayblade	1	58
			Five-leaved bramble	6	79

Distribution and Environment

Sites are generally well drained valley sidewalls and footslopes, although this association is also common on floodplains and uplifted beaches. The range of soils associated with Western Hemlock/Blueberry is tremendous-- no less than 24 soils series-- but it reaches best development on deep, well drained Spodosols.

Western Hemlock/Blueberry is found from saltwater to 1,700 feet. Above 1,000 feet, it is increasingly replaced by yellowcedar associations due to a cooler microclimate.

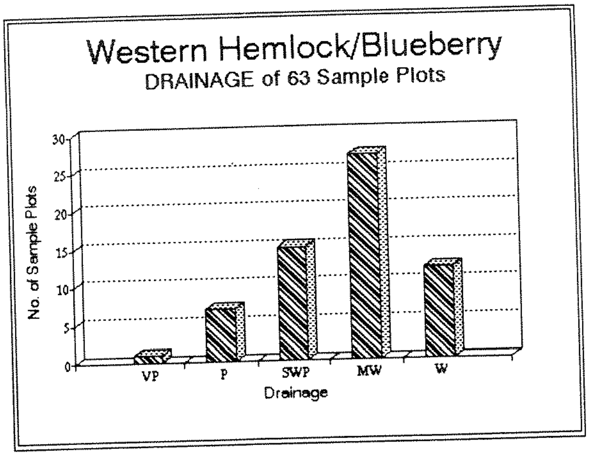


Fig. 45. Drainage Distribution of Western Hemlock/Blueberry Sample Plots

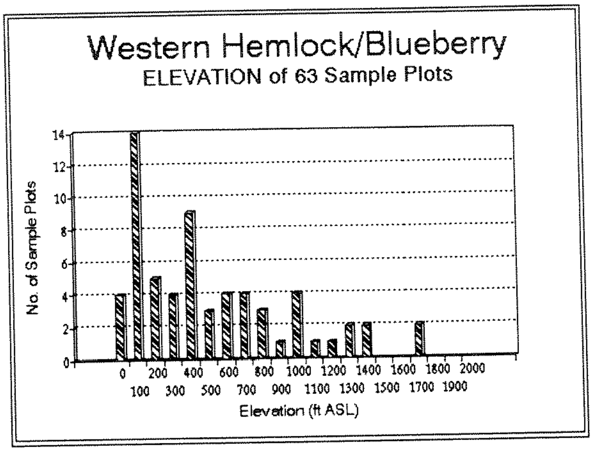


Fig. 46. Elevation Distribution of Western Hemlock/Blueberry Sample PLots

Typical Soils-- Western Hemlock/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Remedios	Colluvium	Footslopes, Backslopes	11
Vixen	Phyllite/Schist Colluvium/Residuum	Backslopes, Footslopes	1,3
Kupreanof	Colluvium	Sideslopes, Moraines	74,75,76
Tokeen	Granitic Colluvium	Convex Backslopes	54,540

Similar Associations

Western Hemlock/Blueberry is very similar to Western Hemlock/Blueberry/Shield Fern, and for many applications they can be considered the same. The latter shows at least 2 percent shield fern cover, and on average designates somewhat more productive sites.

Western Hemlock-Redcedar/Blueberry on more productive sites is also very similar to hemlock/blueberry, but shows at least 10 percent redcedar overstory cover. Redcedar on these sites may be the result of a random event, such as a seed crop and climatic conditions favoring redcedar establishment centuries ago. In all other respects these stands will be hemlock/blueberry stands. Most other redcedar associations occur on sites with restricted drainage or soil depth.

Management Implications

Timber value of this association is generally high, averaging 32,400 board feet per acre (Volume Class 6). By species, 82 percent is western hemlock, 12 percent is Sitka spruce, and 6 percent is combined cedars.

Because this association occurs on a wide variety of mountain and hill landforms, logging system may be more influenced by landforms and soils than by vegetation. Shovel, cable, and helicopter systems are all options, depending on topography. Shovel yarding may be an option on better-drained sites up to 20 percent slope. Western hemlock/blueberry frequently occurs on heavily dissected mountain slopes. These sites preclude midslope roads and may require more landings to avoid V-notches. Smooth slopes allow greater flexibility (BMPs 13.2, 13.7, 13.9, 13.10, 13.16, 14.2, 14.3).

Conifer regeneration is likely to be abundant, both from advanced regeneration and from seeding in. Spruce will form an increased proportion of second-growth stands because of increased light availability and surface soil scarification.

As Fig. 47 illustrates, three years following logging there is little vegetation response. By age 13, however, vigorous conifers and shrubs are competing for dominance. A similar pattern is seen at age 20. Somewhere between the age of 20 and 50, conifers clearly dominate the stand. According to Alaback (1982,1984) this is around age 30.

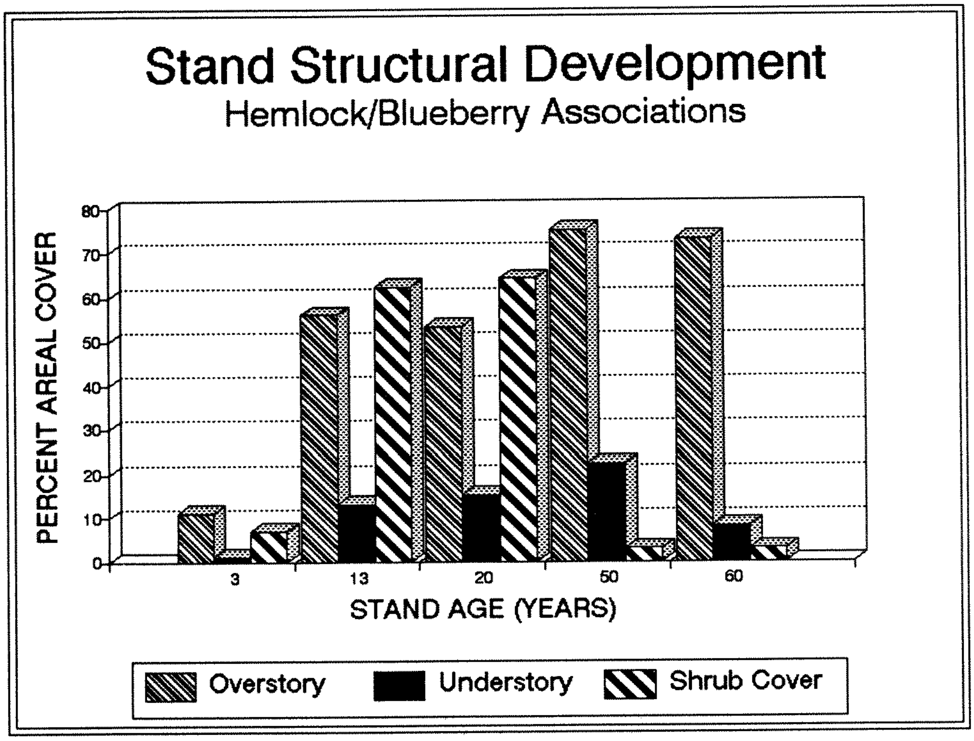


Fig. 47. Stand Structural Development Over Time for Western Hemlock Associations Characterized by Blueberry. Samples were taken from northern Prince of Wales Island.

Fig. 48 shows the clear dominance of western hemlock over other conifer species following logging. Response of other species is static, at least up to age 20. As shown in Fig. 54 (next association), precommercial thinning around age 20 increased Sitka spruce cover to an average 22 percent, compared with 12 percent in unthinned stands. Hemlock cover decreased from an average 48 percent to an average 37 percent.

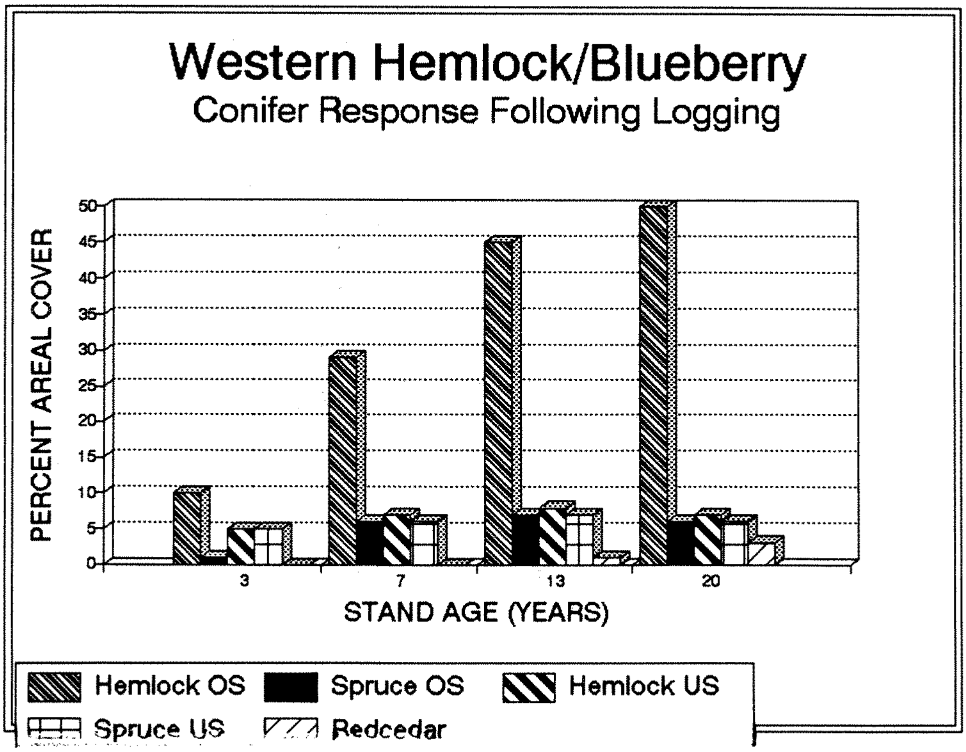


Fig. 48. Western Hemlock/Blueberry: Conifer Response Following Logging. Samples were taken on northern Prince of Wales Island.

Vigorous hemlock competition is a concern in nearly any treatment applied to hemlock/blueberry sites. Because the species is so well adapted to growing on undisturbed organic soils, it will often fill in gaps created by thinning or canopy gap creation (Alaback 1984).

Fig. 49 shows response of important deer forage species following logging. By age 8, blueberry cover has surpassed that of preharvest old-growth levels, and maintains a high level of cover, at least until age 20. Bunchberry response is likewise strong, but begins to decline by age 12 and has notably declined by age 20. This suggests canopy gaps or thinning for the benefit of deer should occur early-- perhaps as early as age 10-- in this association.

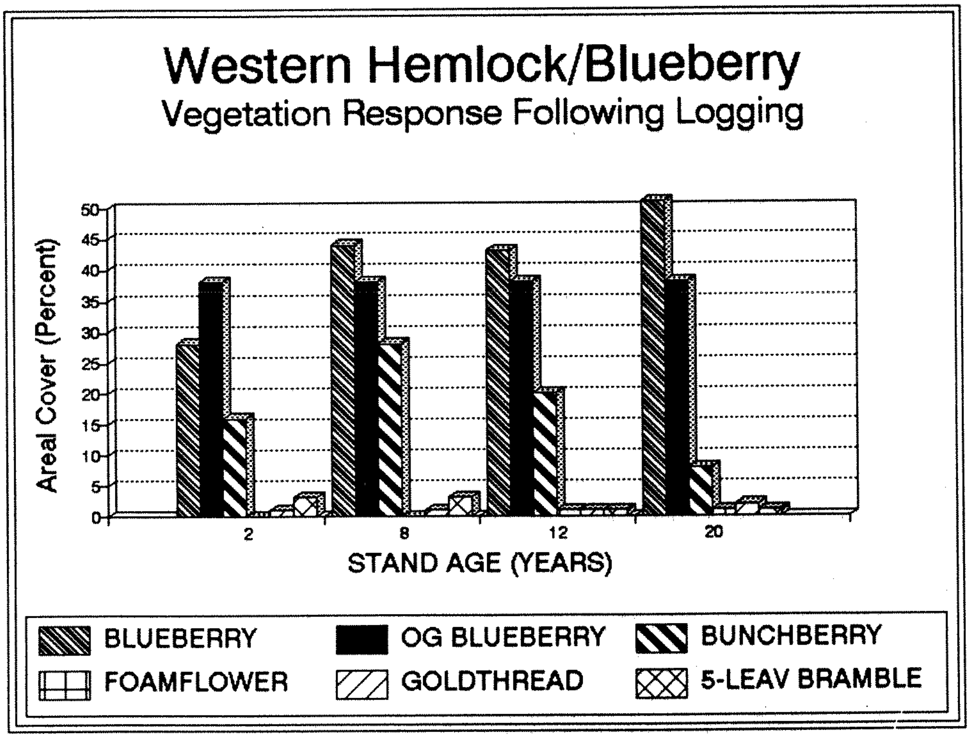


Fig. 49. Western Hemlock/Blueberry: Vegetation Response Following Logging. (OG = Old Growth)

Deer appear to have little use for second-growth hemlock stands as a source of forage (Fig. 50; see also Hanley 1991, Ebasco Environmental 1992, Brown et al. 1992). To offset this problem, thinning at wider spacings (e.g., 16' X 16' in contrast to the timber production (12' X 12' spacing) has been recommended, but Hanley et al. (1989) documented that forb production (the most important component of deer forage) was not significantly affected by thinning intensity. Unpublished data collected by DeMeo and others has shown that thinning can generate increased forb levels, but that these levels begin to decline four years following treatment.

Cutting canopy gaps in dense second growth is another mitigation measure under experimentation. Results have been mixed. DeMeo et al. (1990) showed that gaps cut in stands past the age of canopy closure were of little benefit in encouraging blueberry or forbs, although deer browsing did increase on gap edges. Subsequent work by DeMeo and others has shown that gaps created in younger stands (average age 17 years) can generate higher forb levels, but data are only available for two years following treatment.

Regarding songbirds, the Ebasco Environmental Study (1992) showed no significant difference in number of bird species between old growth, untreated second growth, thinned second growth, and second growth with gaps. Some individual bird species were favored by specific treatments, however.

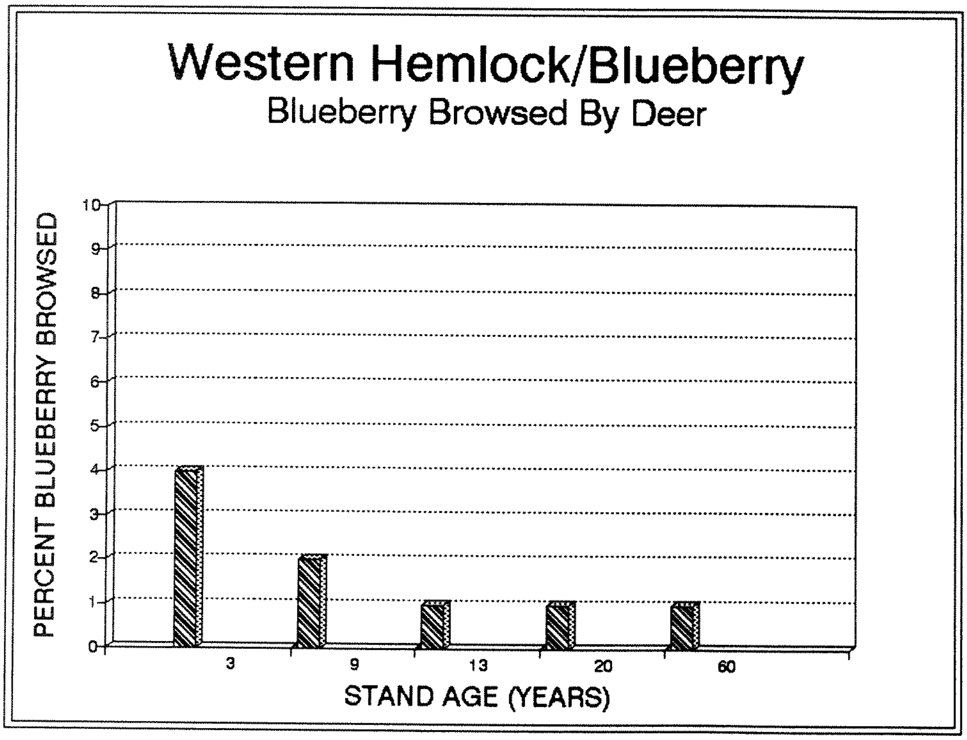


Fig. 50. Blueberry Browsed by Deer in Second-Growth Hemlock/Blueberry Stands. Data collected on northern Prince of Wales Island.

Any consideration of second-growth manipulation for deer should consider their forage needs, seasonal use patterns, and the surrounding landscape's capacity to meet winter thermal cover and escape terrain. The guiding principle in second-growth alteration should be to work toward a desired future condition of diverse stand structure and composition. Short-term benefits have proven elusive.

Fig. 51 shows slash cover of a depth 18 inches or greater. This depth was shown by Mankowski and Peek (1989) as the height where deer movement was inhibited. The value shown for age 20 is following precommercial thinning. Note that this treatment increases slash levels to about those following logging (age 3). Slash as a deer movement impediment is a serious consideration in any second-growth treatment for wildlife.

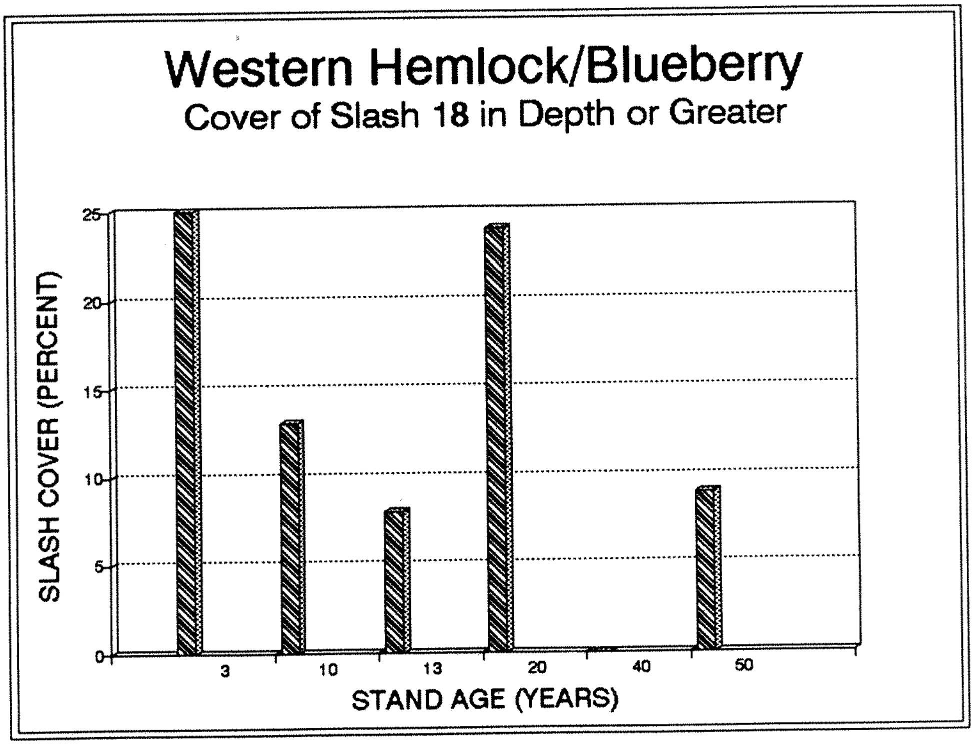


Fig. 51. Western Hemlock/Blueberry: Slash of 18 Inches Depth or Greater as an Impediment to Deer Movement.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and is generally in map units that are mostly non-wetland. However, it may be sometimes found in a matrix of h[illegible]mlock/blueberry/skunk cabbage, a wetland association. Care should be taken when management activities [illegible] in wetland areas (BMPs 12.5, 13.15).

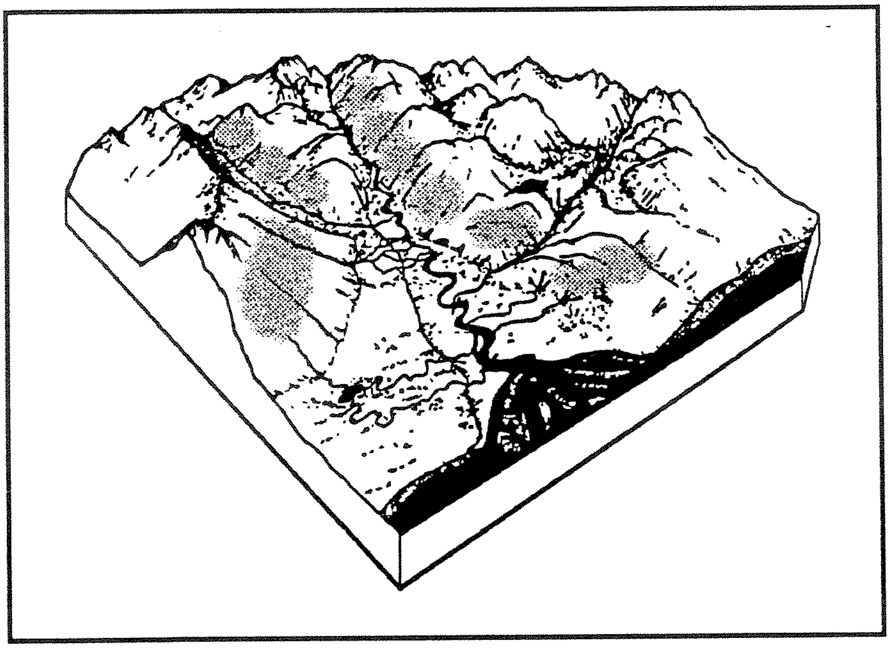
Value for **deer** forage is high. Although biomass of desirable shrubs/forbs may be less than in mixed conifer or redcedar associations, the nutritive value and palatability is high. This is because shrubs and forbs grown under a largely closed canopy have less light available to produce tannins and other defensive chemicals unpalatable to deer (Van Horne et al. 1988, Hanley et al. 1989).

Winter range value at low elevation is also high. Large limbs on old-growth hemlock intercept snow, leaving the forest floor relatively clean of snow (Kirchhoff and Schoen 1987). Deer can therefore find forage plants throughout the winter. Thermal value is high because of the relatively closed canopy.

Trail construction is relatively easy. As with logging systems, **road construction** will depend more on soils and landforms than vegetation (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

Near Ketchikan, the trail around Ward Lake provides examples of this association, as well as a good illustration of small-scale windthrow effects. Near Thorne Bay, try uncut portions of the North Thorne or Goose Creek valleys. For the Craig District, there is a good example just west of the USDA Forest Service Polk Inlet camp.

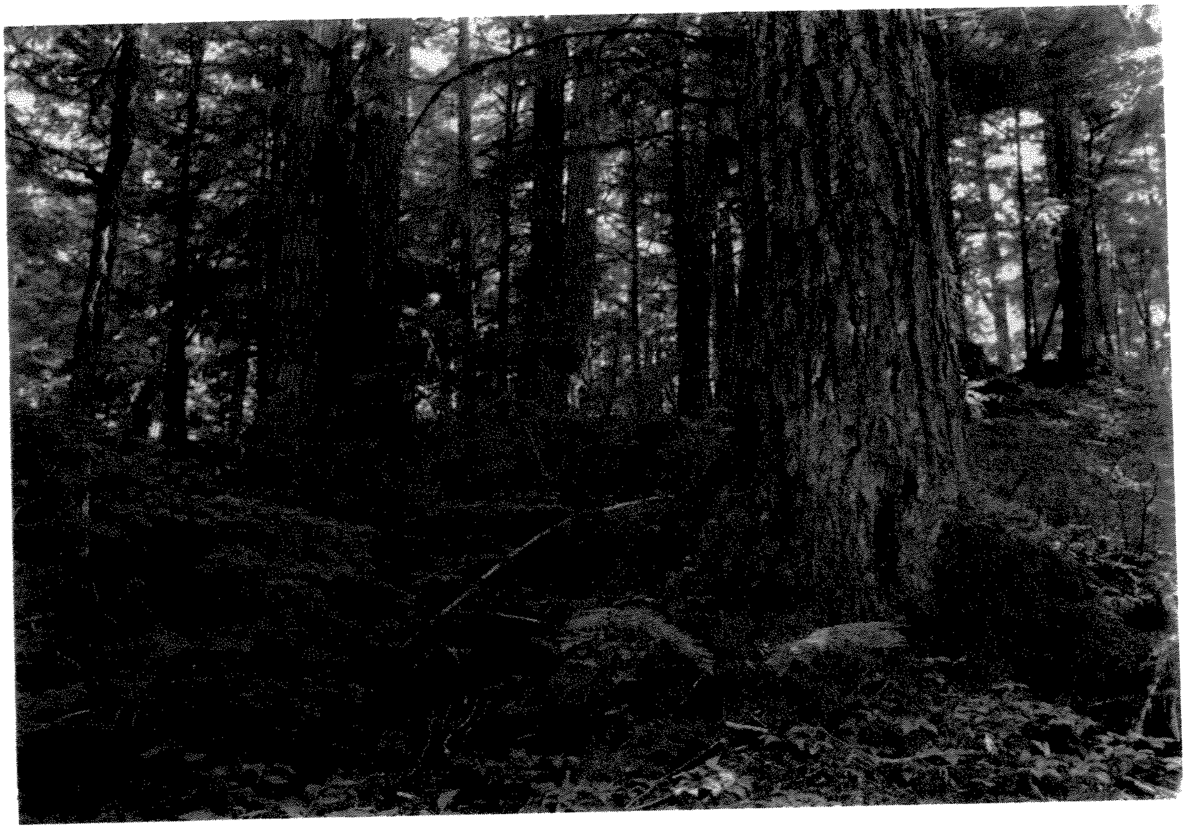


Most common landscape position(s) of the Western Hemlock/Blueberry association.

Western Hemlock/Blueberry/Shield Fern

Tsuga heterophylla/Vaccinium Spp./Dryopteris austriaca

TSHE/VACCI/DRAU 120



Vegetation

Canopy cover averages 66 percent. Structure in this association features a range of diameters, snags, and woody debris. Western hemlock designates the overstory, averaging 64 percent. Sitka spruce was found in 41 percent of sampled overstories and is an indicator of small-scale disturbance (individual tree windthrow, etc.) in this series. The understory follows a similar pattern.

The shrub layer is characterized by blueberry; cover averages 34 percent. Rusty menziesia, red huckleberry, and devil's club are often present in small amounts (average 3 percent cover each).

The forb layer is characterized by bunchberry and five-leaved bramble, with twisted stalk, goldthread, foamflower, and twayblade occurring less frequently. The presence of blueberry and forbs is sometimes reduced by high deer populations or intense winter use, as may occur on the southern end of the Cleveland Peninsula.

Shield fern (*Dryopteris austriaca*) is used as the indicator for this association, separating it from Western Hemlock/Blueberry. This fern indicates well-drained, relatively nutrient rich sites in Southeast Alaska. (Klinka et al. (1989) list its nutrient status as "moderate" in British Columbia.)

Snags comprise 15 percent of basal area, and are usually hemlock or spruce. These species make valuable snags, because their wood is relatively soft and allows excavation by cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock Sitka spruce Western redcedar	64% 6 4	100% 41 7	Tall blueberry Rusty menziesia Red huckleberry	34% 3 3	100% 71 67
Tree Understory			**Forbs etc.**		
Western hemlock Sitka spruce Western redcedar	25 2 2	100 48 7	Bunchberry Five-leaved bramble Fernleaf goldthread Shield fern	7 8 6 6	83 82 61 100

Distribution and Environment

Sites are well drained valley sidewalls and footslopes, hillslopes, and mountain slopes. This association is also common on floodplains and uplifted beaches. Soils are characteristically deep Spodosols, but this habitat can occur on any soil that is well-drained, regardless of soil depth or parent material. The great majority of sample plots showed moderately well drained or well drained soil (Fig. 52).

Western Hemlock/Blueberry/Shield Fern is found from saltwater to above 2,000 feet, but occurrence becomes scarce above 1,000 feet. Above this elevation, the environment becomes colder, and thus less likely to support so productive a habitat.

Typical Soils-- Western Hemlock/Blueberry/Shield Fern

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Remedios	Colluvium	Footslopes, Backslopes	11
Vixen	Phyllite/Schist Colluvium/Residuum	Backslopes, Footslopes	1,3
Kupreanof	Colluvium, Till	Sideslopes, Moraines	74,75,76
Tokeen	Granitic Colluvium	Convex Backslopes	54,540

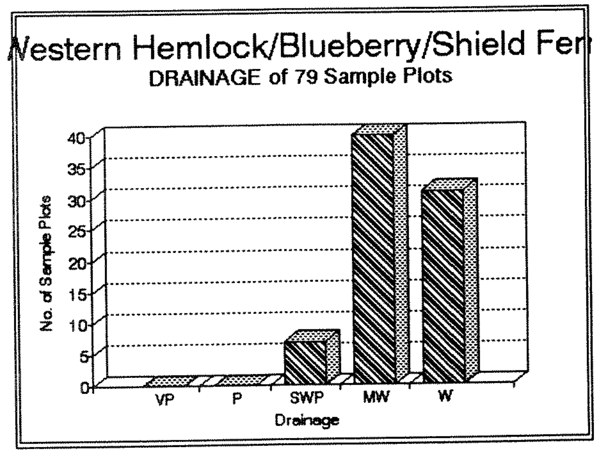


Fig. 52. Drainage Distribution of Western Hemlock/Blueberry/Shield Fern Plots

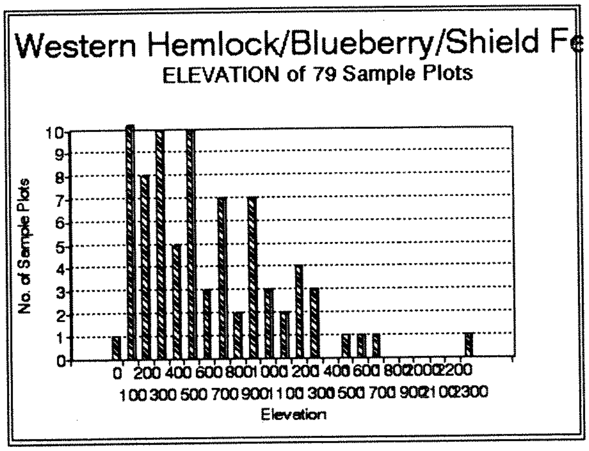


Fig. 53. Elevation Distribution of Western Hemlock/Blueberry/Shield Fern Plots

Similar Associations

Western Hemlock/Blueberry/Shield Fern is very similar to Western Hemlock/Blueberry, and for many applications they can be considered the same. They occur on the same landforms and soils, although the shield fern association is more closely tied to better-drained soils.

The well-drained variant of Western Hemlock-Redcedar/Blueberry is also very similar to hemlock/blueberry/shield fern, but shows at least 10 percent redcedar overstory cover. Redcedar on these sites may be the result of a random event, such as a seed crop and climatic conditions favoring redcedar establishment centuries ago. In all other respects these stands will be hemlock/blueberry stands. Most other redcedar associations occur on sites with restricted drainage or soil depth.

Management Implications

Timber value of this association is very high, averaging 43,400 bd ft/ac (Volume Class 6). For this reason it has been a focus of logging over the last 30 years. Among 20 randomly sampled stands, volume class ranged from 5 to 7 (20,000 to 50,000 bd ft/ac). By species, 84 percent is western hemlock, 13 percent is Sitka spruce, and 3 percent is western redcedar.

Because this association occurs on a wide variety of mountain and hill landforms, logging system choice will be more influenced by landforms than by a vegetative assessment. Shovel yarding may be an option on better-drained sites up to 20 percent slope. Western Hemlock/Blueberry/Shield Fern frequently occurs on heavily dissected mountain slopes. These sites preclude midslope roads and may require more landings to avoid V-notches. Smooth slopes allow greater flexibility (BMPs 13.2, 13.7, 13.9, 13.16).

Conifer regeneration is likely to be abundant, both from advanced regeneration and from seeding in. Spruce will form an increased proportion of second-growth stands because of increased light availability and surface soil scarification. Growth rates should be rapid. If timber production is the management objective, thinning should occur no later than age 25 (BMP 13.19).

Most of the silvicultural information presented for Western Hemlock/Blueberry applies here as well. In the shield fern association, hemlock dominance in young second growth is even more pronounced than in the blueberry association. Data presented for age 21 are for precommercially thinned stands. By thinning, the ratio of hemlock/spruce cover is reduced from 5:1 to about 3:2 (Fig. 54).

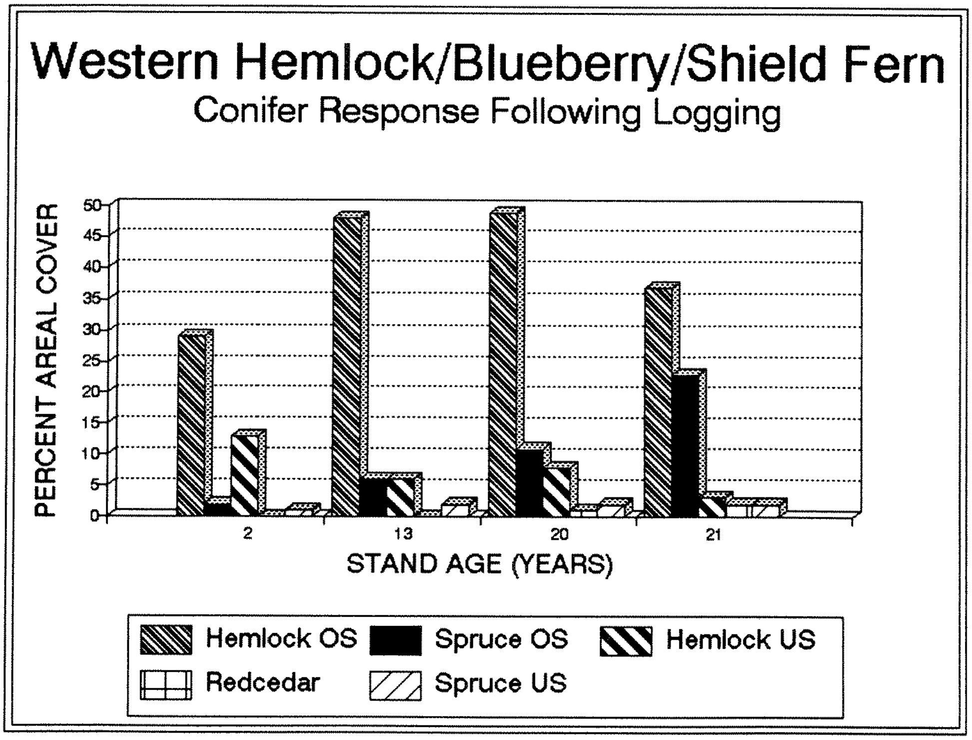


Fig. 54. Western Hemlock/Blueberry/Shield Fern: Conifer Response Following Logging. Data collected on northern Prince of Wales Island. Data for age 21 represent stands precommercially-thinned 3-5 yrs following treatment.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is generally associated with non-wetland map units.

Value for **deer** forage is high. Although biomass of desirable shrubs/forbs may be less than in mixed conifer or redcedar associations, the nutritive value and palatability is high. This is because shrubs and forbs grown under a largely closed canopy have less light available to produce tannins and other defensive chemicals unpalatable to deer (Van Horne et al. 1988, Hanley et al. 1989).

As Figs. 55 and 56 illustrate, response of blueberry and bunchberry (major deer forage species) to logging is initially strong. By age 13, levels of these two species are greater than in old growth. At age 20, blueberry cover is still significant, but bunchberry has dwindled to a trace. Age 21 on the figure indicates cover levels 3-5 years following precommercial thinning; note that blueberry responds favorably to thinning, but bunchberry (and other forbs) show no response. This suggests thinning for deer forage might be best targeted for ages 13-15; age 20 is clearly too late.

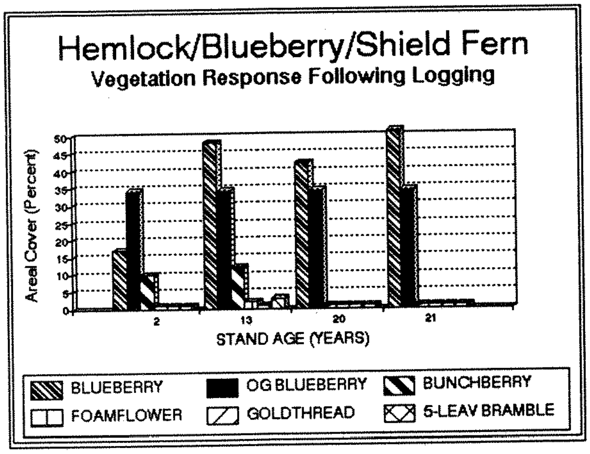


Fig. 55. Hemlock/Shield Fern: Vegetation Response Following Logging

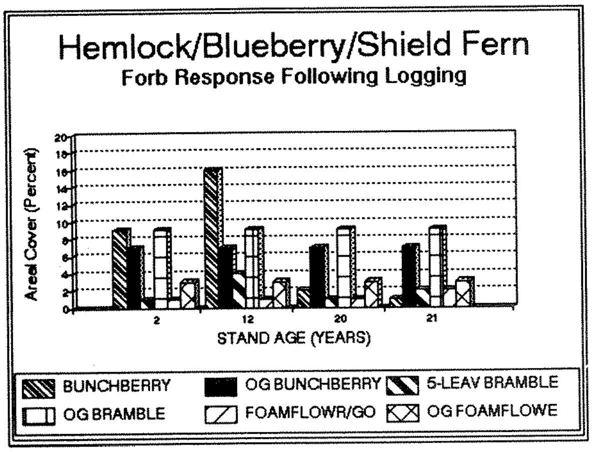


Fig. 56 . Hemlock/Shield Fern: Forb Response Following Logging

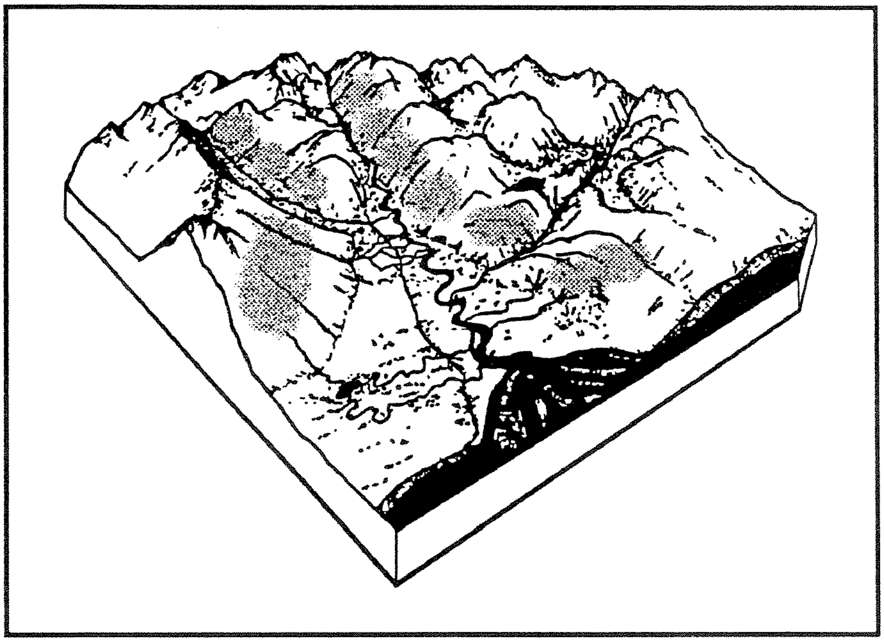
Winter range value at low elevation is probably the highest of any forest plant association. Large limbs on old-growth hemlock intercept snow, leaving the forest floor relatively clean of snow. Deer can therefore find forage plants throughout the winter. Thermal value is high because of the relatively closed canopy.

Trail construction is relatively easy. As with logging systems, **road construction** will depend more on soils and landforms than on vegetation, although this association should be generally easy to work with.

Representative Field Locations

Near Ketchikan, a good example of this association is found near the Perseverance Trailhead. This stand has a relatively high proportion of spruce, the result of past windthrow events on shallow soil.

Near Thorne Bay, try uncut portions of the North Thorne valley. For the Craig District, there is a superb example 10.3 miles down the Polk Inlet Road from its junction with the Hydaburg road. This stand is in the process of being designated a permanent reference stand.



Most common landscape position(s) of the Western Hemlock/Blueberry/Shield Fern association.

Western Hemlock/Blueberry/Skunk Cabbage

Tsuga heterophylla/Vaccinium spp./Lysichitum americanum

TSHE/VACCI/LYAM 130

Vegetation

Canopy cover averages 58 percent. Stand height averages 111 feet. Structure in this association features a range of diameters, snags, and woody debris. Western hemlock designates the overstory and averages 54 percent. Sitka spruce was found in 73 percent of sampled overstories and is an indicator of small-scale disturbance (individual tree windthrow, etc.) in this series. Redcedar may be a minor component. The understory follows a similar pattern.

The shrub layer is characterized by blueberry; cover averages 41 percent. Rusty menziesia is nearly always present (mean cover 8 percent). Red huckleberry occurred in 52 percent of sample plots. The forb layer is designated by a minimum 3 percent cover of skunk cabbage. Bunchberry and five-leaved bramble are common.

Snags comprise 12 percent of the basal area, and are usually hemlock or spruce. These species make valuable snags, because their wood is relatively soft and allows excavation by cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	54%	100%	Tall blueberry	41%	100%
Sitka spruce	6	73	Rusty menziesia	8	97
Western redcedar	5	13	Red huckleberry	3	52
Tree Understory			**Forbs**		
Western hemlock	22	94	Skunk Cabbage	11	100
Sitka spruce	2	73	Five-leaved bramble	6	81
Western redcedar	2	10	Fernleaf goldthread	4	65
			Twayblade	1	71

Distribution and Environment

The Western Hemlock/Blueberry/Skunk Cabbage association represents inclusions of more poorly drained soil in a matrix of well-drained soil that also supports the Hemlock/Blueberry and Hemlock/Blueberry/Shield Fern associations. Western Hemlock/Blueberry/Skunk Cabbage can also be found in association with the mixed conifer and hemlock-redcedar series on a variety of landforms. It is characteristic of footslopes, benches, and other areas of water collection. It is also common on uplifted beaches. This association is most often poorly or somewhat poorly drained (Fig. 57).

The inclusions themselves are a complex of poorly drained depressions and hummocks supporting trees. This pit-and-mound topography results from centuries of windthrow and soil churning. Trees grow on the tops of stumps, logs, and toppled rootwads. Over time this woody debris decomposes and becomes soil.

Western Hemlock/Blueberry/Skunk Cabbage is found from saltwater to 1,500 feet elevation, but it is uncommon above 500 feet elevation (Fig. 58). Distribution of skunk cabbage is limited by colder temperatures at higher elevation.

Typical Soils-- Western Hemlock/Blueberry/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Wadleigh	Compact Till	Lower Backslopes, Footslopes	331,320,31
Maybeso	Organics over Till	Footslopes	20,320
Karheen	Organics over Beach sediments	Uplifted Beaches	61,62

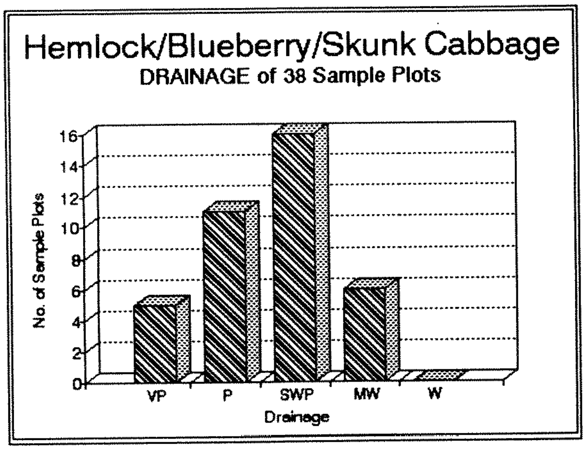


Fig. 57. Drainage Distribution of Western Hemlock/Blueberry/Skunk Cabbage Plots

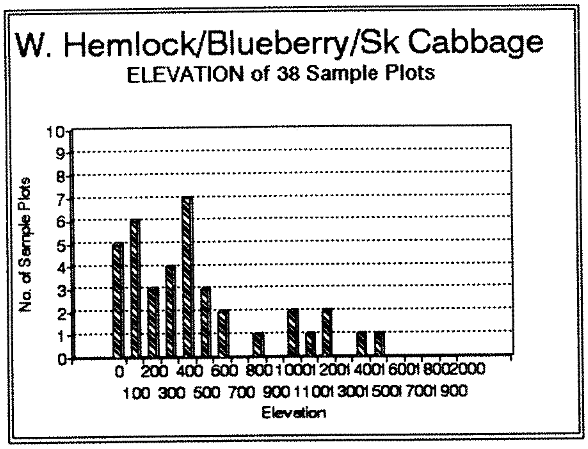


Fig. 58. Elevation Distribution of Western Hemlock/Blueberry/Skunk Cabbage Plots

Similar Associations

Western Hemlock/Blueberry/Skunk Cabbage is similar to Western Hemlock/Blueberry in structure and composition. It is also commonly found in combination with mixed conifer and hemlock-redcedar, but is more productive and lacks the cedar abundance associated with these sites.

Management Implications

Timber value of this association ranges widely (17,300 to 63,400 bd ft/ac among 20 random samples). Mean volume is 34,000 bd ft/ac (Volume Class 6). By species, 70 percent is western hemlock, 27 percent is Sitka spruce, and 3 percent is combined cedars.

At least partial suspension is desirable on this association, because its poorly drained depressions are easily damaged by dragging logs. Western Hemlock/Blueberry/Skunk Cabbage sites should not be shovel yarded (BMPs 13.7, 13.9, 13.15).

Conifer regeneration is likely to be abundant, both from advanced regeneration and from seeding in. Response will be somewhat slower than in the blueberry and shield fern associations. On poorer sites, extended rotations may be necessary. Planting is neither necessary nor recommended (BMP 13.19).

Response data is inadequate to generate graphs like those presented for the blueberry and shield fern associations.

This is a **wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and occurs frequently in both wetland and non-wetland map units. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

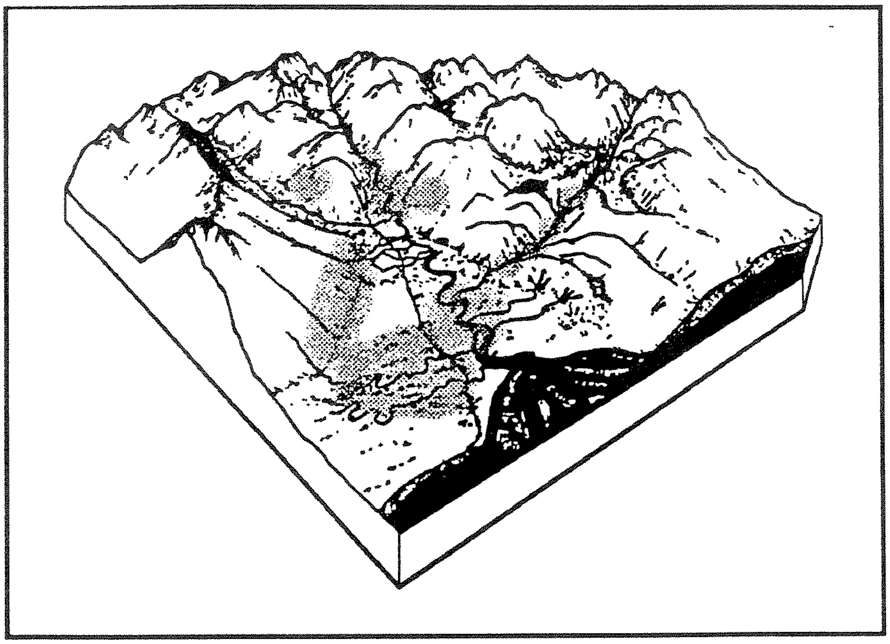
Value for **deer** forage is high. In the spring, skunk cabbage provides important forage before other plants leaf out. **Bears** feed on the tubers throughout spring and summer, but especially at the end of the summer, to store up energy for winter hibernation.

Winter range value at low elevation is also high. Large limbs on old-growth hemlock intercept snow, leaving the forest floor relatively clean of snow. Deer can therefore find forage plants throughout the winter. Thermal value is high because of the relatively closed canopy.

Trail construction should avoid poorly drained depressions with skunk cabbage. If construction is unavoidable, boardwalk will be necessary. **Road construction** should be acceptable if skunk cabbage patches are not extensive. (BMPs 14.2, 14.3, 16.4).)

Representative Field Locations

Near Ketchikan, the hillside near the Perseverance Trailhead provides an example of small inclusions of this association. Near Thorne Bay, try uncut portions of the Goose Creek Valley. For the Craig District, there is a good example at the foot of the proposed reference stand mentioned in the shield fern association section.

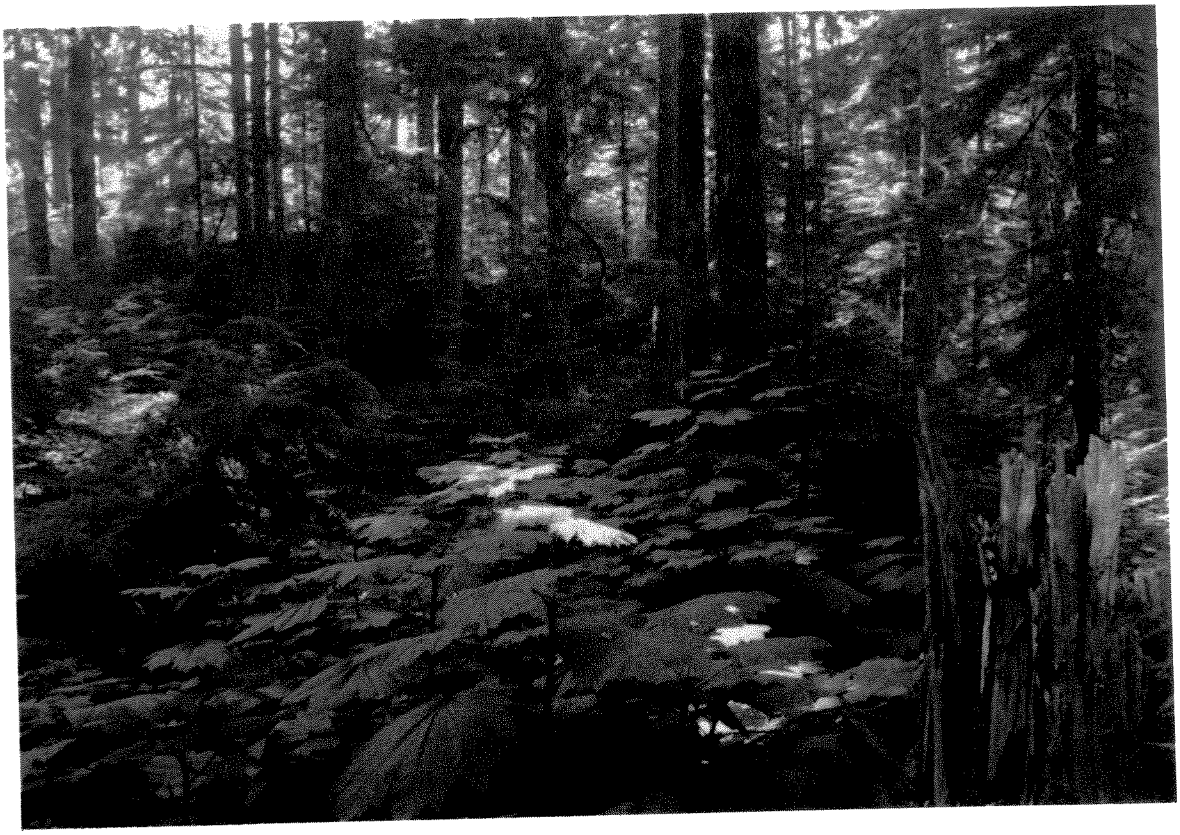


Most common landscape position(s) of the Western Hemlock/blueberry/Skunk Cabbage association.

Western Hemlock/Blueberry-Devil's Club

Tsuga heterophylla/Vaccinium Spp./*Oplophanax horridum*

TSHE/VACCI/OPHO 140



Vegetation

Canopy cover averages 60 percent. Structure in this association features a range of diameters, snags and woody debris. Western hemlock designates the overstory and averages 58 percent. Sitka spruce is more common than in other western hemlock associations, both in the overstory and in the understory. Spruce abundance is related to the soil disturbance characterized by this association. Other conifer species are uncommon.

The shrub layer is designated by devil's club (average 25 percent cover). Blueberry is nearly always present and averages 24 percent cover. Salmonberry (a disturbance species like devil's club) and rusty menziesia are also common.

The forb layer is characterized by bunchberry, five-leaved bramble, and trifoliate foamflower. Foamflower indicates nutrient-rich, aerated soil where water moves freely through the profile. Twisted stalk and goldthread occurred on about two thirds of sample plots.

Snags comprise 18 percent of basal area, and are usually hemlock or spruce. These species make valuable snags, because their wood is relatively soft and allows excavation by cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	58%	100%	Tall blueberry	24%	96%
Sitka spruce	5	57	Rusty menziesia	5	65
			Salmonberry	3	76
			Devil's club	25	100
Tree Understory			**Forbs**		
Western hemlock	24	100	Bunchberry	8	88
Sitka spruce	2	69	Five-leaved bramble	7	92
Western redcedar	1	11	Trifoliate foamflower	6	92

Distribution and Environment

Hemlock/Blueberry-Devil's Club is associated with a variety of valley, hill, and mountain landforms, but in all cases is characterized by lateral subsurface water movement. For this reason it is most common along V-notches and on steep slopes (greater than 60 percent). Devil's club is associated with nitrogen-rich soils (Klinka et al. 1989).

Soil usually drains moderately well or better. This association is found evenly up to 1,000 feet (Fig. 60), but is uncommon at greater elevations.

Karst topography, because of its subsurface water movement and productive soils, is ideal for hemlock/devil's club. Soil pH is relatively high (more basic) and nutrients are available. Consequently this association is abundant on karst.

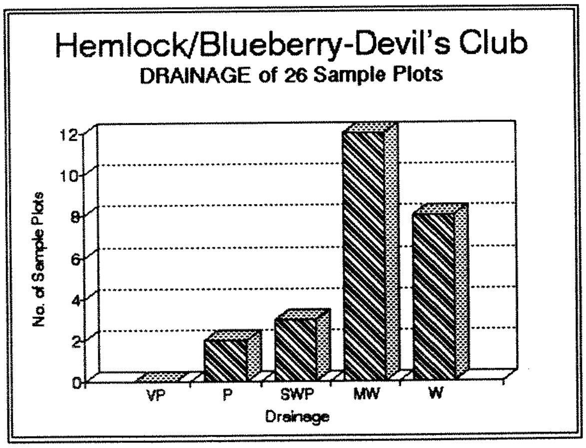


Fig. 59. Drainage Distribution of Western Hemlock/Blueberry-Devil's Club Sample Plots

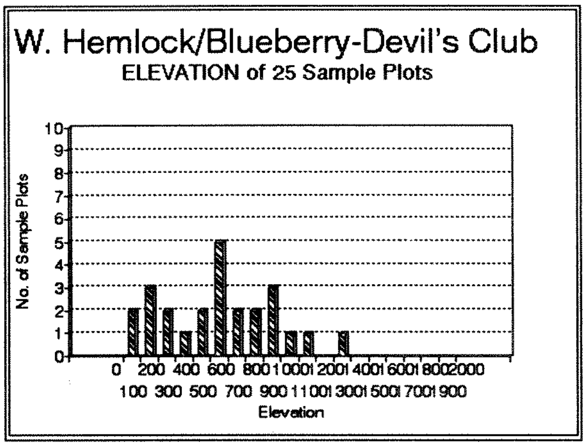


Fig. 60. Elevation Distribution of Western Hemlock/Blueberry-Devil's Club Sample Plots.

Typical Soils-- Western Hemlock/Blueberry-Devil's Club

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tolstoi	Colluvium/ Residuum	Wide range of slopes	50,53,528,351
Ulloa	Limestone Colluvium/Residuum	Sideslopes and Ridges	442
Kupreanof	Colluvium	Sideslopes	74,75,76
Tokeen	Granitic Colluvium	Convex Backslopes	54,540

Similar Associations

Western Hemlock/Blueberry-Devil's Club shows similarities to Sitka spruce associations with devil's club, but the latter are more closely associated with riparian landforms. While it can occur on floodplains, Hemlock/Devil's Club is generally associated with upland landforms.

This association is also similar to the well-drained variant of Hemlock-Redcedar/Blueberry, but the latter has at least 10 percent overstory redcedar. Both associations occur on the same range of landforms and elevations. Hemlock-Yellowcedar/Blueberry-Devil's Club is similar, but is designated by at least 10 percent overstory yellowcedar and is most common around 1,000 feet.

Management Implications

Timber value of this association is generally high, averaging 43,700 bd ft/ac (Volume Class 6). By species, 81 percent is western hemlock and 19 percent is Sitka spruce. Other conifers are minor components.

Because associations designated by devil's club are associated with water moving laterally through soils and steep or heavily dissected slopes, this association serves as a "red flag" for potential mass movement or soil erosion problems. **Logging** and **road construction** should therefore proceed with great caution on these sites, or be evaluated on a case-by-case basis. If logging will occur, full or at least partial suspension is desirable to avoid surface disturbance. Road construction can involve culverts and even bridge construction on these sites, so it is wise to consider alternative road location (BMPs 13.5, 13.9, 13.16, 14.2, 14.3).

As Fig. 61 shows, the shrub layer competes vigorously following logging. At age 12, shrub cover is about twice as great as that of overstory conifers. At age 19, conifers show nearly equal abundance, and at age 40 shrubs are clearly diminished. Depending on severity of logging disturbance, and the natural soil disturbance regime, shrub dominance may persist longer.

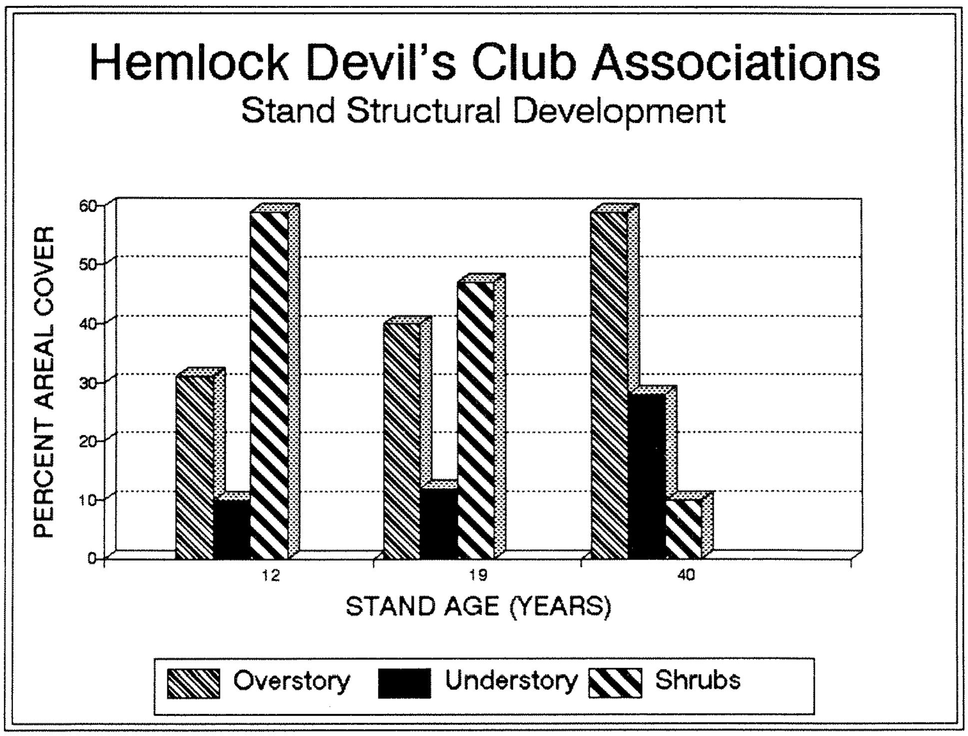


Fig. 61. Stand Structural Development of Hemlock/Devil's Club Associations Following Logging.

Because of delayed **conifer response**, precommercial thinning of hemlock/devil's club sites can in many cases be delayed to age 25 or later, although more information for stands aged 20-40 is needed (BMP 13.19).

As with other hemlock associations, hemlock dominates other conifers in the tree strata. Note, however, that initially spruce response is roughly equal to that of hemlock (Fig. 62, data for age 8). Note also that total tree overstory cover at age 13 is only about 30 percent, because shrubs are a major portion of the stand at this age.

Comparison of shrub response (Fig. 63) following logging is instructive. Blueberry foliage expands to greater than old-growth levels, at least until age 18. Salmonberry increases dramatically, but by age 18 has begun to decline. Devil's club declines following logging, probably because it is adversely affected by reduced humidity and higher evapotranspiration characteristic of clearcuts.

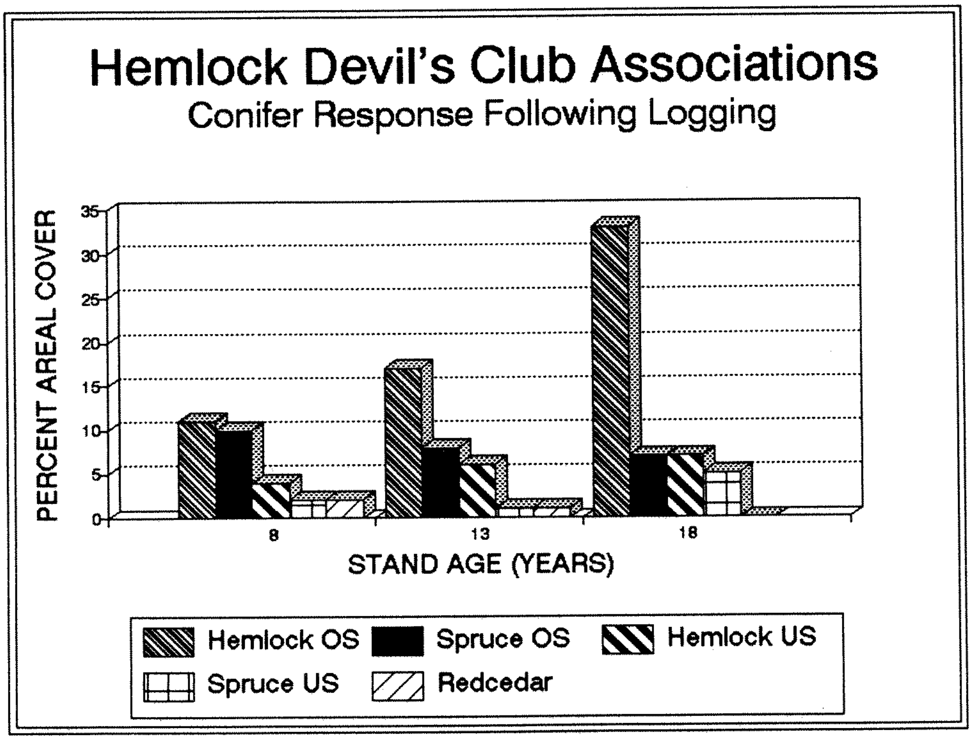


Fig. 62. Hemlock/Devil's Club Associations: Conifer Response Following Logging.

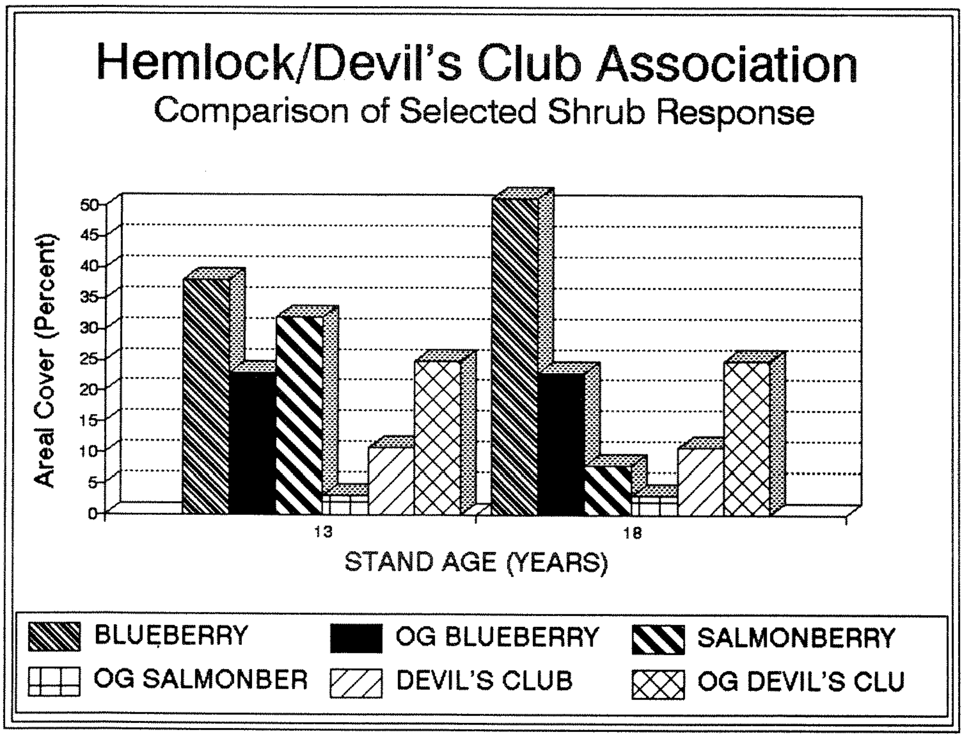


Fig. 63. Hemlock/Devil's Club Associations: Comparison of Selected Shrub Response.

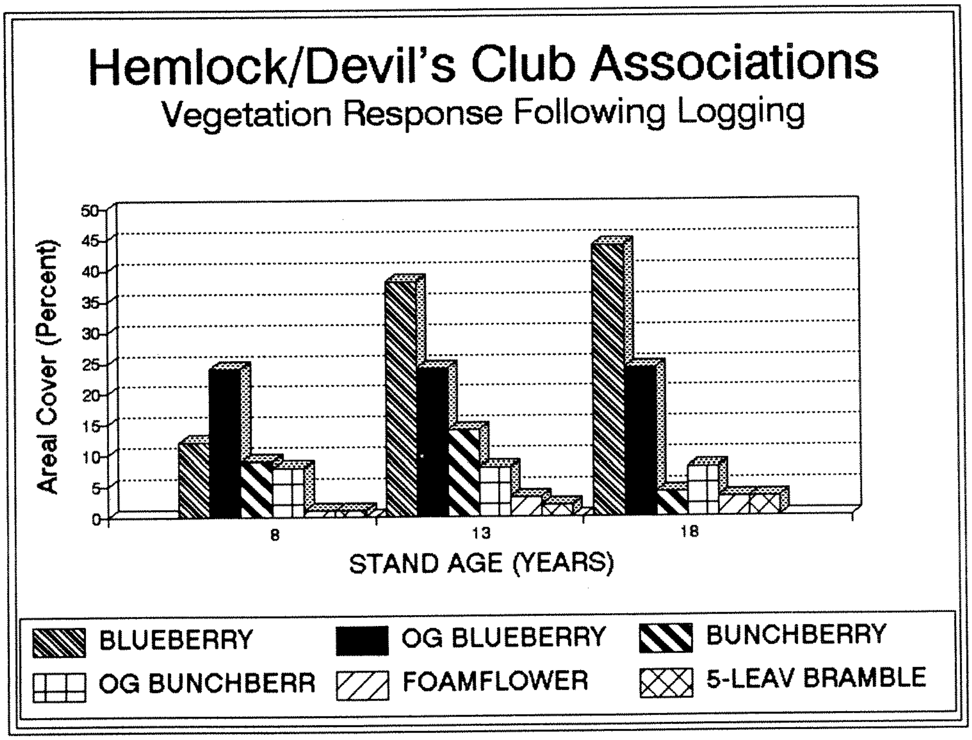


Fig. 64. Hemlock/Devil's Club Associations: Vegetation Response Following Logging. (OG = Old Growth)

Fig. 64 illustrates vegetation response following logging, with a focus on species valuable as deer forage. Blueberry cover surpasses that of old growth by age 13, and continues to show a strong response at age 18. Bunchberry response is also strong at age 13, but declines by age 18. Response of other desirable forbs is negligible.

Salmonberry, even when present in small amounts, is a strong competitor when the canopy is opened. Rootstocks can sprout vigorously and growth rates are rapid. Salmonberry also appears to be less nutrient-limited than devil's club (Haeussler et al. 1990, Klinka et al. 1989).

Because of strong salmonberry competition following logging and relatively weak forb response, this association is not a good one to target for thinning, canopy gaps, or other **wildlife** treatments. As old growth, this association provides good thermal cover and winter range for deer. Forage value overall is moderate to high. Although not a preferred browse species, deer will eat devil's club leaves (somehow without harm). Bears eat the red berries that mature in late summer.

As Fig. 65 illustrates, stands precommercially thinned (data for age 20) show marked increases in slash levels over those at age 11.

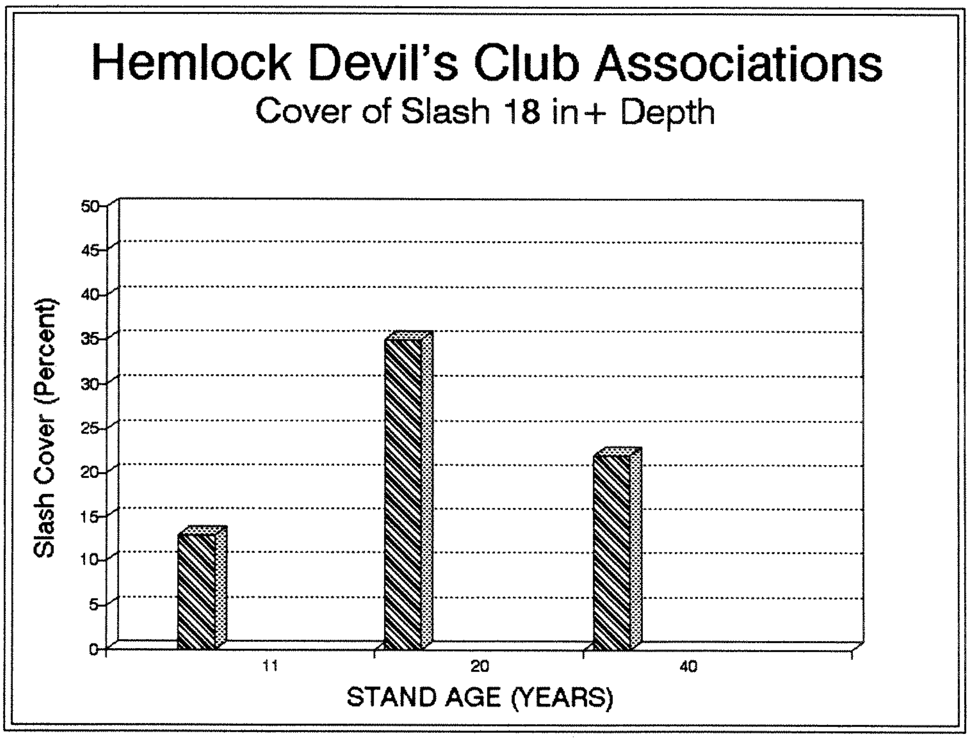


Fig. 65. Hemlock/Devil's Club Associations: Cover of Slash 18 Inches or Greater in Depth.

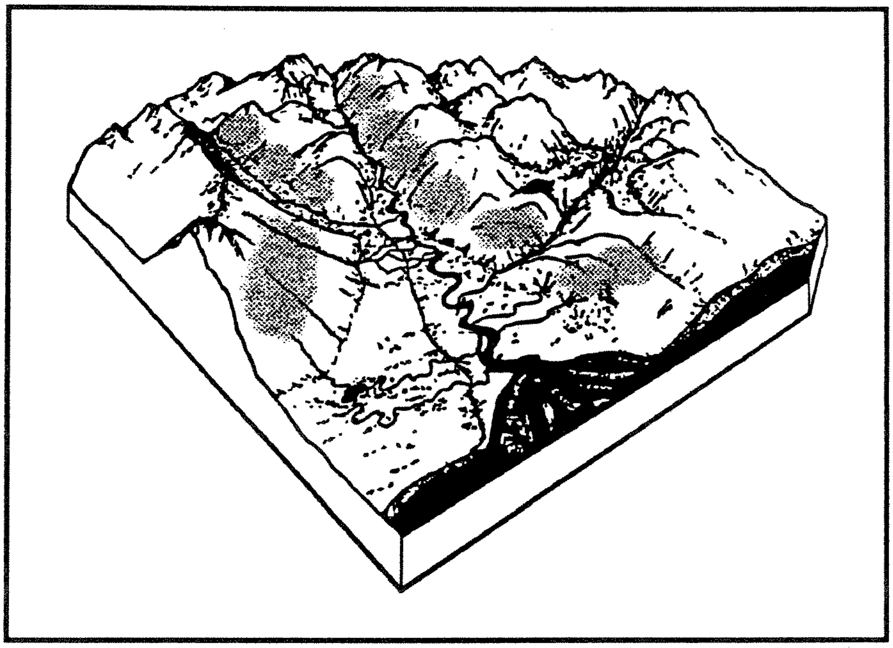
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and is seldom in association with wetland associations.

Trail construction will encounter the problems described for road construction above. V-notches or patches of devil's club should be avoided, or will require bridges (BMPs 13.16, 14.2, 14.3, 16.4).

Culturally, the Tlingits used the inner bark of devil's club for a variety of ailments including headaches, constipation, and cancer. The best plants are said to be those over small streams running into saltwater.

Representative Field Locations

Near Ketchikan, the trail around Ward Lake provides examples, as does the Deer Mountain Trail. Near Thorne Bay, try uncut portions of the North Thorne valley. For the Craig District, there is a good example just west of the Polk Inlet camp.

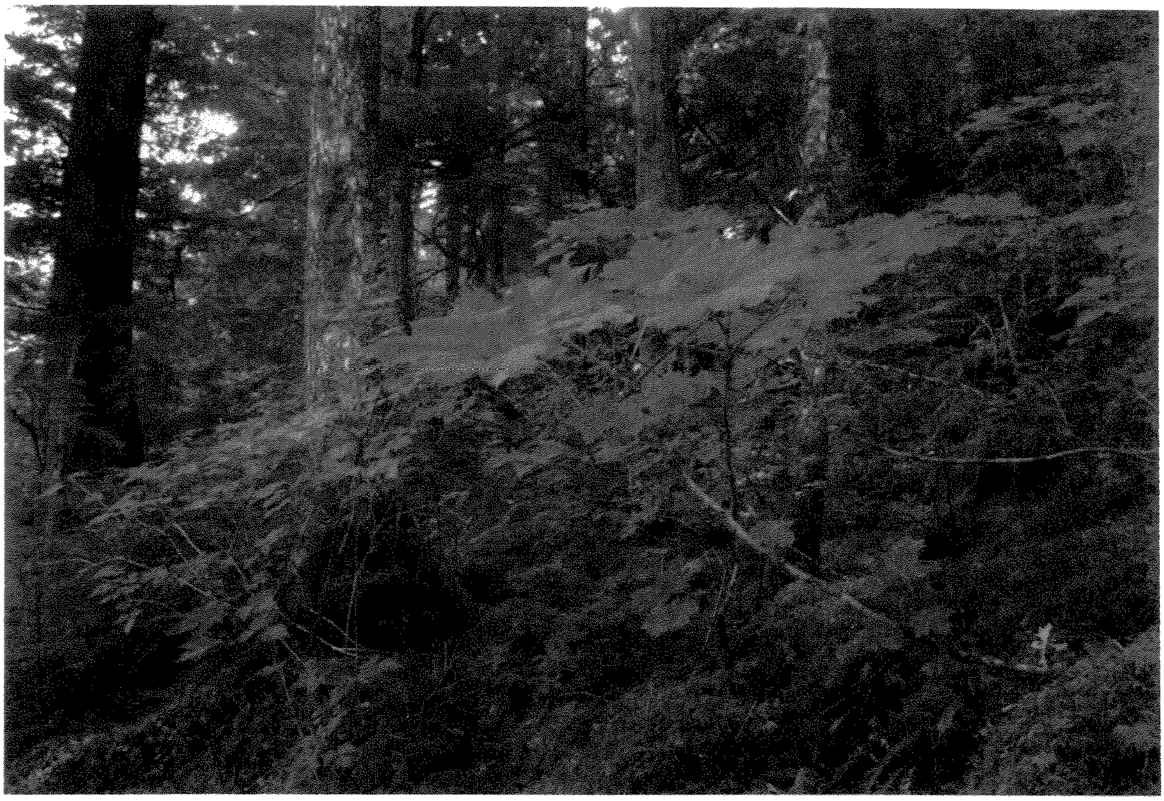


Most common landscape position(s) of the Western Hemlock/Blueberry-Devil's Club association.

Western Hemlock/Devil's Club-Salmonberry

Tsuga heterophylla/Oplopanax horridum-Rubus spectabilis

TSHE/OPHO-RUSP 150



Vegetation

Canopy closure averages 58 percent. Structure features a range of diameters, snags and woody debris. Western hemlock designates the overstory and averages 55 percent. Sitka spruce was found in 44 percent of sampled overstories and is an indicator of small-scale disturbance (individual tree windthrow, etc.) in this series. Redcedar may be a minor component. The understory follows a roughly similar pattern.

The shrub layer is characterized by salmonberry and devil's club. Rusty menziesia and blueberry are also usually present. The forb layer is characterized by bunchberry, five-leaved bramble, and twisted stalk. Shield fern is nearly always present, and averages 6 percent.

Snags comprise 17 percent of basal area but were present in only two thirds of sampled stands. Structurally, this association experiences frequent disturbance from windthrow or water action.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock Sitka spruce Western redcedar	55% 7 6	100% 44 11	Salmonberry Devil's club Blueberry Rusty menziesia	19% 20 30 6	100% 100 88 77

Tree Understory			Forbs etc.		
Western hemlock Sitka spruce Western redcedar	15 1 1	100 66 11	Bunchberry Five-leaved bramble Twisted stalk Shield fern	8 14 2 6	88 77 77 100

Distribution and Environment

Normally, Western Hemlock/Devil's Club-Salmonberry is limited to V-notches and other landforms associated with significant disturbance. It is most often found on frequently dissected mountainslopes and broken slopes. Soils are usually moderately well or well drained. Limited data suggests elevations up to 1,500 feet. Devil's club and salmonberry are indicators of subsurface lateral water movement throughout the growing season. They also indicate nutrient-rich soils, although salmonberry is less dependent on high nutrient levels than is devil's club (Haeussler et al. 1990, Klinka et al. 1989).

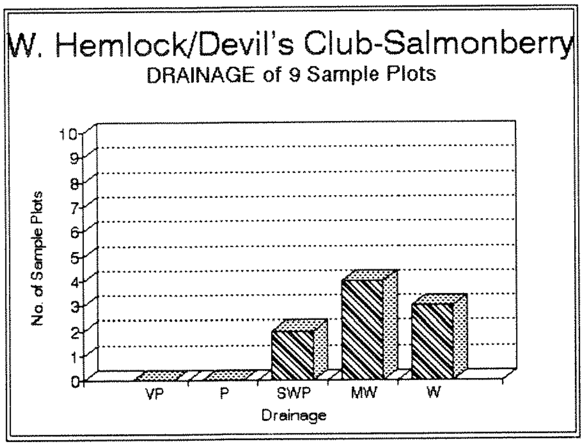


Fig. 66. Drainage Distribution of Western Hemlock/Devil's Club-Salmonberry Sample Plots

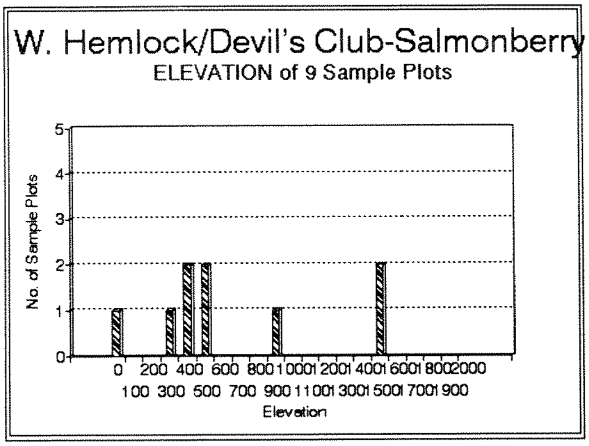


Fig. 67. Elevation Distribution of Western Hemlock/Devil's Club-Salmonberry Sample Plots

Typical Soils-- Western Hemlock/Devil's Club-Salmonberry

Soil Series	Parent Material	Most Common Landform	Soil Map Units
Remedios	Colluvium	Footslopes, Backslopes	11
Vixen	Phyllite/Schist Colluvium/Residuum	Backslopes, Footslopes	1,3
Tolstoi	Colluvium	Wide range of slopes	35,50,53,351,528

Similar Associations

Western Hemlock/Devil's Club-Salmonberry is similar to Hemlock/Blueberry-Devil's Club, but is distinguished by a minimum 10 percent salmonberry cover. Because it is tied to sites with strong soil disturbance regimes from wind and water movement, its range of sites is more limited than Hemlock/Blueberry-Devil's Club. Sites with more severe disturbance are likely to be characterized by spruce.

Management Implications

Timber volumes among eight samples ranged from 21,800 to 54,700 bd ft/ac, with an average of 34,700 bd ft/ac (Volume Class 6). By species, 76 percent is western hemlock and 23 percent is Sitka spruce. Volume of other species is negligible.

Because this habitat is characterized by soil disturbance and landforms like V-notches and steep slopes, logging should be avoided.

Conifer regeneration is likely to be delayed by abundant salmonberry response (Haeussler et al. 1990). Because of the competitive vigor of this shrub, planting is not recommended. Thinning can be delayed until age 25 or perhaps avoided entirely, due to the patchy nature of young growth hemlock/devil's club-salmonberry. The graphs presented for Hemlock/Blueberry-Devil's Club will generally also apply to this association (BMP 13.19).

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and is usually found in complex with other non-wetland associations.

Value for **deer** forage is low. Topography associated with this habitat is of low value as winter range. **Bears** eat salmonberries.

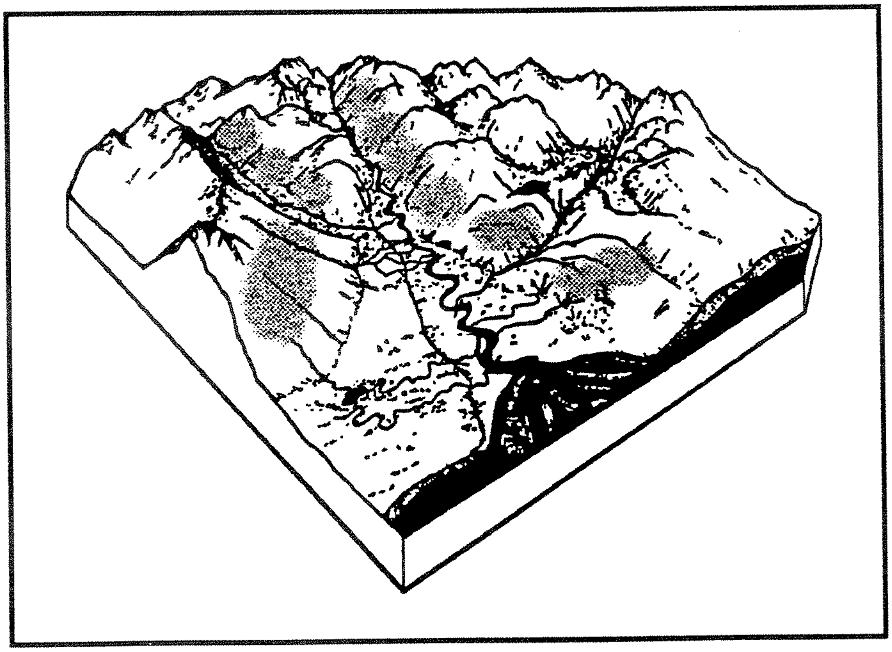
Hydrologically, this association can play an important role in preventing soil erosion on steep sites. When sites are disturbed by windthrow or landslide, salmonberry can quickly recolonize the site and hold the soil.

Trail and road construction is problematic because of rugged topography and erosive soils. Avoid these sites where possible (BMPs 13.5, 14.2, 14.3, 16.4).

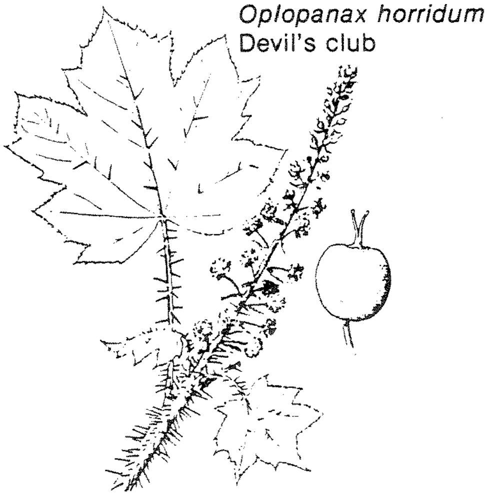
Culturally, salmonberries are eagerly sought for eating and for jam. The Tlingits pressed the berries into cakes, dried them, and stored them for winter use. They are a valuable source of vitamin C.

Representative Field Locations

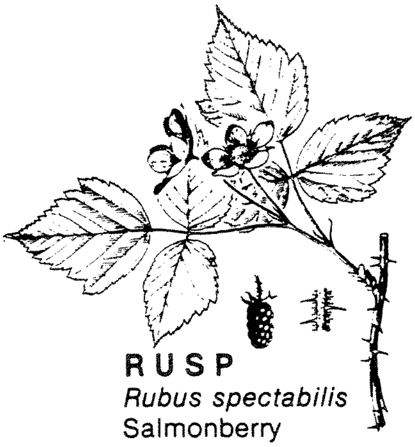
Near Ketchikan, the Deer Mountain Trail provides examples. Specific locations on Prince of Wales Island with easy road access are not known, but look along V-notches or on karst topography.



Most common landscape position(s) of the Western Hemlock/Devil's Club-Salmonberry association.



OPHO
Oplopanax horridum
Devil's club



RUSP
Rubus spectabilis
Salmonberry

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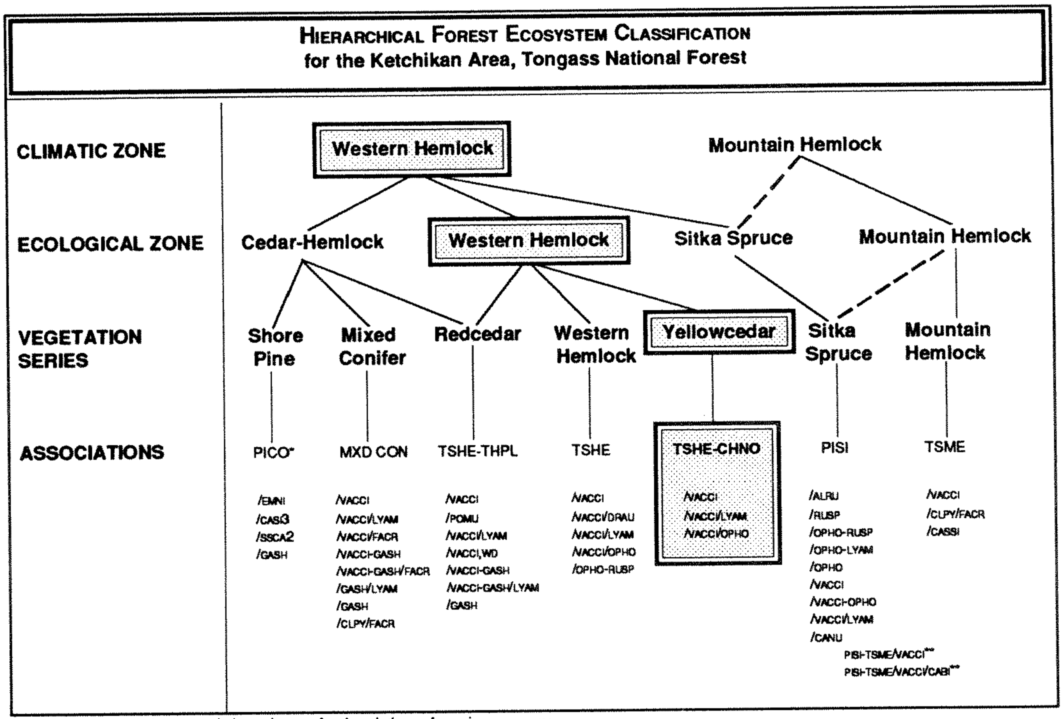
Western Hemlock–YellowcedarSeries



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

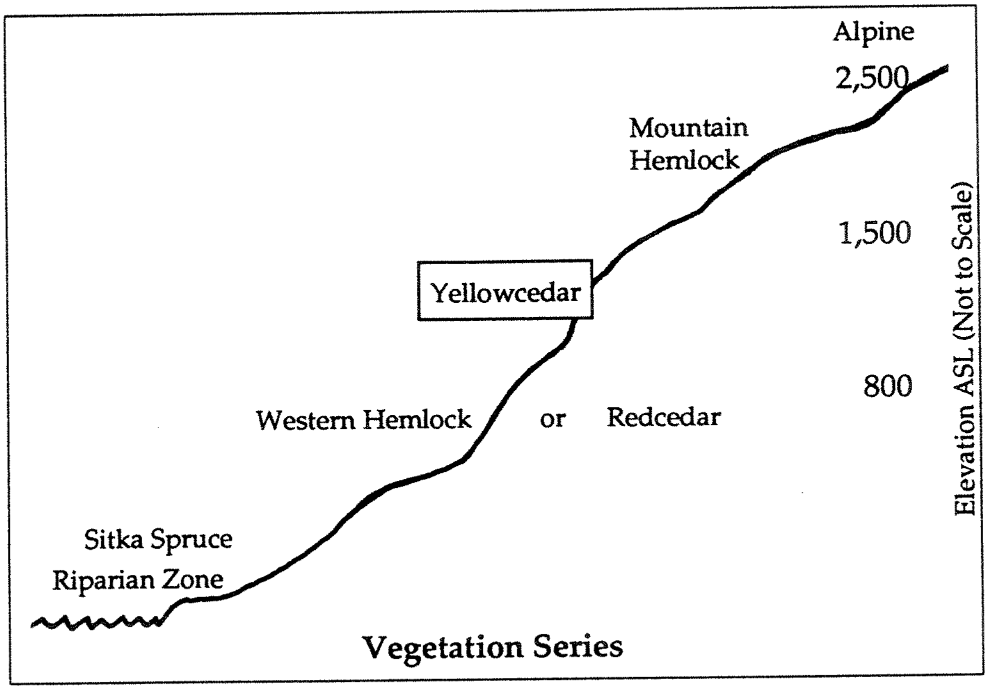


Fig. 68. Schematic of yellowcedar associations. On the Ketchikan Area, they occur most frequently in the upper portion of the Western Hemlock Ecological Zone.

7
WESTERN HEMLOCK-YELLOWCEDAR SERIES
Western Hemlock Zone

The Western Hemlock-Yellowcedar Series is a subset of the Western Hemlock Ecological Zone. It occurs throughout this zone, but is most abundant at around 1,000 feet elevation on somewhat poorly to moderately well drained slopes.

Yellowcedar distribution can be difficult to predict because of its regeneration requirements. Although it germinates best on exposed mineral soil, other tree species (alder, spruce, and redcedar, in that order) are stronger competitors (Minore 1983). Complicating this is the poor seeding abilities of yellowcedar. Good seed crops are attained about once every seven years (Hennon 1992).

The result is that there can be a distinct random element in the occurrence of this series. Sites that would otherwise support hemlock-yellowcedar may be found with hemlock or hemlock-redcedar associations instead.

Nonetheless, Western Hemlock-Yellowcedar can be thought of as occupying the upper edge of the Western Hemlock Ecological Zone, from 1,000 to 2,000 feet. Above that elevation, mountain hemlock (and high elevation mixed conifer on more poorly drained sites) will predominate. The transition is often gradual, complicated by the climatic effect of proximity to saltwater.

In structure, hemlock-yellowcedar stands are much like western hemlock stands. The canopy can be more open, and the tree size class distribution is less weighted toward larger trees than in the Western Hemlock Series. Windthrow, snag, and woody debris characteristics are similar to those of the Western Hemlock Series. Yellowcedar snags, however, are resistant to decay; because of this slow cedar decay, snag density and abundance can be expected to be higher.

The shrub layer is characterized by blueberry. Rusty menziesia is also common. Upper elevation V-notches with yellowcedar will be characterized by devil's club, but the shrub is not as abundant as in other series.

The forb layer is similar to that of other associations in the Western Hemlock Ecological Zone. Bunchberry, goldthread, five-leaved bramble, and trifoliate foamflower are well represented. Skunk cabbage designates an association forming small, poorly drained inclusions within a better-drained matrix. Deer fern is the most common fern.

Yellowcedar provides a valuable wood, the highest in value of all timber species on the Tongass National Forest. Traditionally, Northwest Coast Natives used the species for carving canoe paddles, totems, and other objects. Like redcedar, the bark can be used for basket making.

Today, the species is highly valued on the Japanese market. Its wood qualities are similar to that of hinoki cedar, a closely related species now depleted in Japan. Yellowcedar is now used in construction of temples and other high-value uses.

Regenerating yellowcedar is even more problematic than redcedar. In 1991, a conference was held in Sitka, Alaska to address this important resource issue (Hennon 1992). Like redcedar, yellowcedar germinates best on exposed mineral soil, but is the poorest competitor for establishment on these sites among local conifer species. Regeneration is further hampered by long periods between good seed years, and by a cold stratification requirement of one year (Hennon 1992). Once established, the species is slow–growing.See the individual yellowcedar association sections that follow for details on silvicultural options.

An additional concern in managing yellowcedar is the documented decline in the species (Hennon et al. 1990a, Hennon et al. 1990b). Although reasons for this decline remain elusive, Hennon et al. (1990a) have advanced an hypothesis concerning winter snow cover. At higher elevations (1,000–2,000feet), where yellowcedar associations are most abundant, winter snow has insulated the sensitive surface roots of the species and prevented damage. With milder winters since 1900, this insulating protection has been more frequently absent, making roots susceptible to damage from cold snaps during other-wise mild winters.

Research and monitoring are needed not only to assess the cause of yellowcedar decline, but also to develop silvicultural methods to perpetuate it in managed landscapes.

Western Hemlock-Yellowcedar/Blueberry

Tsuga heterophylla-Chamaecyparis nootkatensis/Vaccinium spp.

TSHE-CHNO/VACCI 210

Vegetation

Canopies are relatively closed, with a mean cover of 63 percent. This is shared between western hemlock and yellowcedar, with an average of 35 percent and 24 percent cover, respectively. Other conifers are minor components.

Western hemlock is usually present in the understory and averages 19 percent cover. Yellowcedar is somewhat less common and averages 4 percent cover. Other conifers were recorded during sampling, but each occurred less than half the time.

The shrub layer is clearly dominated by blueberry (mean 40 percent cover), and stands can be thick and difficult to move through. Rusty menziesia is nearly always present and averages 10 percent cover--high for this species. Red huckleberry and devil's club occurred each in 61 percent of sampled stands.

The forb layer is similar to that of western hemlock and the more productive redcedar associations, with five-leaved bramble, bunchberry, goldthread, twisted stalk, foamflower, and twayblade all common. Deer and oak fern are the most common ferns.

Stands are moderately productive. Stand height averages 100 feet. Snags average 17 percent of basal area. Hemlock snags are valuable for wildlife, but yellowcedar snags are resistant to decay, and less useful for cavity nesters.

Characteristic Species

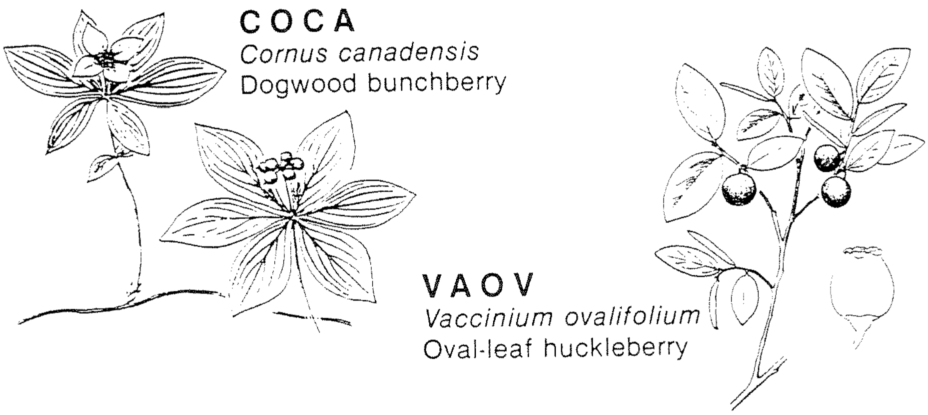
Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	35%	100%	Tall blueberry	40%	100%
Yellowcedar	24	100	Rusty menziesia	10	96

Tree Understory			Forbs		
Western hemlock	19	88	Bunchberry	8	96
Yellowcedar	4	80	Five-leavedbramble	7	100
			Twayblade	2	80
			Twisted stalk	2	88
			Goldthread	8	92

Distribution and Environment

Western Hemlock-Yellowcedar/Blueberryis typically found on rolling hills, upper mountainslopes, and benches. Because yellowcedar competes best on sites with cooler temperatures (on the Ketchikan Area), most samples were clustered around 1,000 feet elevation (Fig. 70). Yellowcedar/blueberry sites were found from near saltwater to 1,600 feet elevation, however.

Soils are typically somewhat poorly or moderately well drained. Productivity can be limited by soil depth as well as drainage, although not as severely as in the mixed conifer or "low end" of hemlock-redcedar. This association has been recorded on a wide variety of soils. Clearly, temperature (as influenced by elevation) and other factors influence distribution of this association. Soils shown in the table that follows are only a sampling of those possible.



Typical Soils--Western Hemlock-Yellowcedar/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Helm/Granitic Phase	Residuum, Colluvium	Mountain Slopes	19,63
Meares	Till	Footslopes, Rolling Hills	5
Mitkof	Colluvium, Till	Mountain/Hillslopes Till Plains	78
Waterfall	Colluvium	Hillslopes, Toeslopes	7

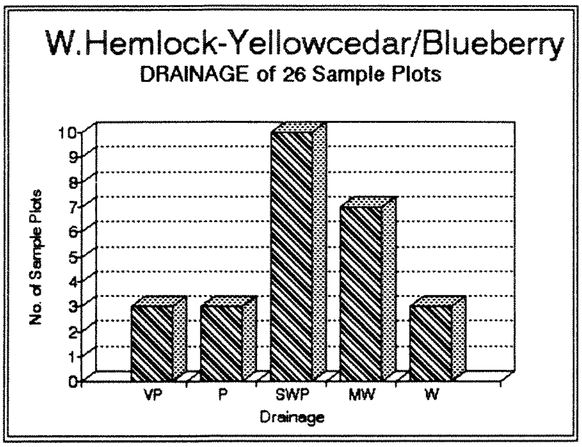


Fig. 69. Drainage Distribution of Yellowcedar/Blueberry Sample Plots.

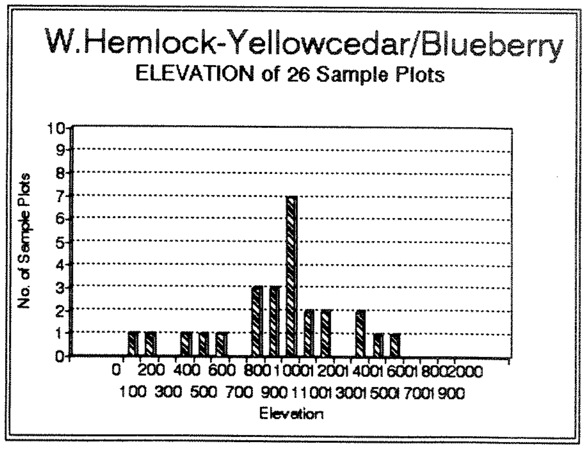


Fig. 70. Elevation Distribution of Yellowcedar/Blueberry Sample Plots.

Similar Associations

This association is similar to redcedar/blueberry in structure and site affinity. It is distinguished from other series by 10 percent yellowcedar overstory cover. Where both redcedar and yellowcedar show at least 10 percent cover, consider the plant association redcedar. Redcedar denotes warmer conditions (and more growing-degreedays) than yellowcedar, and is considered to designate a more limited environment. Yellowcedar stands are separated from mixed conifer by general absence of mountain hemlock, and greater site productivity.

Management Implications

Timber value of this association is generally moderate to high, averaging 31,600 bd ft/ac (Volume Class 6). Data from twenty sampled stands generated estimates from 5,400 to 61,600 bd ft/ac. By species, 41 percent of the mean total volume is western hemlock and 49 percent is yellowcedar. The remaining 10 percent is composed of Sitka spruce and redcedar. When the yellowcedar market is strong, these sites will support timber of considerable value.

Shovel yarding may be an option on better-drained sites of up to 20 percent slope, but most sites will require cable **logging**. Suspension requirements will vary with landform. This association often occurs on broken mountainslopes or benches, landforms that can present blind leads and other obstacles to cable logging. On upper slopes, soil stability may be a concern (BMPs 13.2, 13.7, 13.9, 13.5).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerate prolifically on undisturbed soil surface organic horizons (Burns and Honkala 1990) (BMP 13.19).

Yellowcedar regeneration presents even more problems than that of redcedar. Second-growth sample plots on northern Prince of Wales Island showed very little yellowcedar regeneration (DeMeo 1991). Sites on the Stikine Area have shown more success (Hennon 1992); lack of redcedar competition may be a factor.

Regeneration options for yellowcedar were discussed at a conference in Sitka, Alaska, in 1991. As reported by Hennon (1992), they are:

1. *Harvest timing.* Conduct timber harvest at a time to coincide with a heavy cone crop of yellowcedar. When possible, conduct harvest over snow to protect advanced regeneration of yellowcedar.

2. *Group selection.* Harvest that results in small openings (< 2 acres) might encourage regeneration by seedfall from perimeter trees. One advantage is the potential to enhance sites for other resources (e.g., wildlife). Disadvantages include costs, possible windthrow losses, and a probable increase in hemlock regeneration. This method may cause too little soil disturbance and create insufficient light to be effective for yellowcedar. The size of the opening might influence success.

3. *Individual tree selection.* As in group selection, this may not result in adequate soil disturbance or increased light to improve regeneration for yellowcedar. It will probably favor hemlock regeneration. Other disadvantages include high costs and the perception of high-grading. An advantage may be the opportunity to leave smaller yellowcedar trees (e.g., pole-size).

4. *Seed tree harvest.* Leave scattered individual yellowcedar trees on a unit while harvesting to ensure seed source. This method has low cost and the advantage of improving visuals and structural diversity of the harvested unit. Also, opportunities exist for genetic improvement, since trees with superior traits can serve as the seed source. There is some concern about blowdown, but trees need only remain standing for several years to contribute to regeneration. It may even be advantageous if some or most seed trees should blow down after several years. Because the crowns of yellowcedar are sparse, these trees are less likely to blow down than Sitka spruce or western hemlock.

5. *Shelterwood harvest.* Similar to method (4) above, but with more trees remaining to protect regenerating trees from drought and frost. In general, however, regenerating yellowcedar does not need protection in the cool moist environment of Southeast Alaska. A protective canopy would probably reduce growth by yellowcedar seedlings due to less light and soil warming, and may favor competition by western hemlock. It may also decrease snow on the ground in winter, and thus encourage deer use in the area, resulting in increased browse on yellowcedar seedlings.

6. *Cedar groups or 'islands'* left in clearcuts. Again, this is similar to seed tree harvest, but with this method, seed trees are left in groups or "islands" in the unit. This may have advantages of wind-firmness and preserving wildlife habitat, but would be less effective in distributing seed across the unit.

7. *Clearcut and planting.* This is one technique in which we already have some experience. Advantages are that planting yellowcedar can be successful on most sites (given sufficient effort), spacing can be controlled, site preparation can be used, new sites (where yellowcedar did not previously grow) can be established, and there is the potential to control genetic quality. Disadvantages are the efforts associated with seed and cone collection and storage, expense of producing and planting seedlings, and potential for increased damage to seedlings caused by animals (over natural regeneration).

8. *Clearcut and no planting.* The size of clearcuts may influence natural regeneration of yellowcedar. Smaller cutting units with relatively greater perimeter/area ratios might receive more seed from adjacent old-growth cedar. More yellowcedar can be left along perimeters by careful unit layout. Advantages include adequate light, low cost, and no need for site preparation. Disadvantages include unpredictable levels of natural regeneration (including virtually no yellowcedar) and little genetic control. The relatively short dispersal distance of yellowcedar seed should be considered if perimeter yellowcedar is relied upon as a seed source.

9. *Burning.* As site preparation, burning increases the ease of planting and thinning, reduces competition by hemlock and other vegetation, reduces hemlock dwarf mistletoe, and increases light, temperature, and nutrients for seedlings. Limited data suggests that planted yellowcedar seedlings perform very well on burned sites. Disadvantages of burning are cost, limited experience with burning techniques on the Tongass, killing of advanced regeneration of yellowcedar and Sitka spruce, and unknown long-term effects on soil nutrients. Limited data suggest burning may increase deer browse on yellowcedar seedlings.

10. *Other site preparation and yarding.* YUM (yarding of unmerchantable material), tractor, and shovel-yarding, as well as various slash treatments, can affect soil disturbance, slash levels, and soil surface temperatures. These factors could have both positive and negative effects on naturally regenerated or planted yellowcedar. Limited data from trials at Anita Bay suggest that deer browsing on planted yellowcedar seedlings is reduced in areas of heavy slash. Harvesting over snow, as mentioned in method (1), could preserve yellowcedar advanced regeneration where present (for example, on wet, poorly drained sites).

11. *Favor yellowcedar during thinning.* Most Districts on the Tongass already employ this method. Saplings of yellowcedar (and redcedar) have high priority for selection as leave trees during precommercial thinning (often around age 15). This method requires yellowcedar saplings on the site, and if natural regeneration is counted on, the number of saplings often is low. Another disadvantage is that yellowcedar retained for crop trees may mature much later than spruce and hemlock on the same site, resulting in immature trees when the site is cut again at age 100.

12. *Utilize natural regeneration on low-volume sites*. Natural regeneration, usually in the form of vegetative layering, is common on sites with relatively poor drainage. As these sites receive more harvesting, this method may be used to encourage more cedar in the next stand. Harvest methods to optimize use of natural regeneration on these sites remain poorly understood.

For other information on yellowcedar ecology and silviculture, see Current Knowledge of Ecology and Silviculture of Yellow-cedarin Southeast Alaska: Information Exchanged at Sitka, Alaska, November 1991, by Paul Hennon of the Juneau Forest Science Lab (Hennon 1992). The above 12 points are taken from this document.

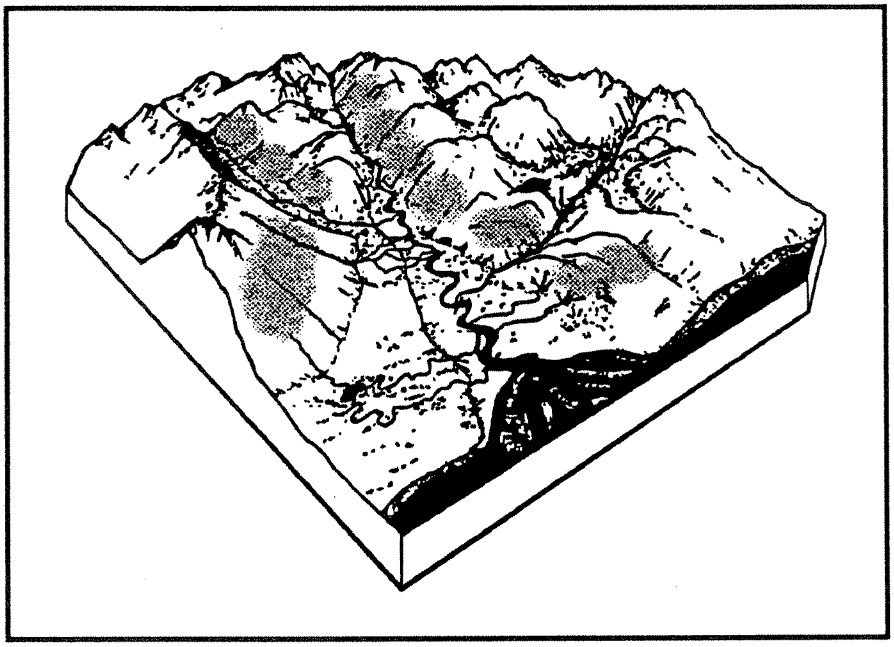
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and can be associated with either wetland or non-wetland map units.

Value for **deer** forage is high. While thermal value is also high, deer are less likely to use yellowcedar sites in winter because they occur most often around 1,000 feet elevation.

Trail and road construction are relatively easy, except on steep upper slopes. Construction should be avoided on these sites (BMP 14.2, 14.3, 16.4).

Representative Field Locations

The ridge on the east side of Lower Silvis Lake provides an excellent example of yellowcedar/blueberry on the Helm/Granitic Phase soil series. On Prince of Wales Island, most of the southern part of the island features soils--Helm/Granitic, Mitkof, and Meares, for example--that are likely to support this association. On the Thorne Bay District, try upper slopes in the North Thorne drainage.



Most common landscape position(s) of the Western Hemlock-Yellowcedar/Blueberry association

Western Hemlock-Yellowcedar/Blueberry/Skunk Cabbage

Tsuga heterophylla-Chamaecyparis nootkatensis/Vaccinium spp.
Lysichitum americanum
TSHE-CHNO/VACCI/LYAM 220

Vegetation

Canopies are relatively closed, with a mean cover of 70 percent. This is shared between western hemlock and yellowcedar, with an average of 38 percent and 24 percent cover, respectively. Sitka spruce was found in 60 percent of sampled overstories, with a mean cover of 9 percent. The presence of spruce may reflect windthrow disturbance; upturned root wads can expose mineral soil to facilitate spruce regeneration.

In the understory, western hemlock is the most common and abundant species, but less so than other red- and yellowcedar sites. Yellowcedar occurred in only half of sampled understories, and averaged 8 percent cover.

The shrub layer is clearly dominated by blueberry (mean 36 percent cover). Rusty menziesia is usually present and averages 9 percent cover. Other shrubs are notably less common.

Skunk cabbage designates this association, and averages 8 percent cover. Common forbs include bunchberry, five-leaved bramble, goldthread, twayblade, and foamflower. Goldthread shows 12 percent cover, an exceptionally high level for this species.

Stands show low-moderate productivity. Stand height averages 81 feet. Snags average 25 percent of basal area. Hemlock snags are valuable for cavity nesters, but cedar snags are resistant to decay, and thus less useful.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	38%	100%	Tall blueberry	36%	100%
Yellowcedar	24	100	Rusty menziesia	9	90
Sitka spruce	9	60	Red huckleberry	4	50

Tree Understory			Forbs		
Western hemlock	15	90	Bunchberry	8	90
Yellowcedar	8	50	Five-leaved bramble	6	90
			Skunk Cabbage	8	100
			Foamflower	6	70
			Goldthread	12	80

Distribution and Environment

Western Hemlock-Yellowcedar/Blueberry/Skunk Cabbage represents inclusions within other associations of the Yellowcedar and Western Hemlock Series. It is found on a variety of hill, valley, and mountain landforms. Elevations range up to 1,200 feet. Soils are most often somewhat poorly drained. Soil series can vary widely.

Like other skunk cabbage associations, yellowcedar/skunk cabbage shows high microsite diversity. Pit-and-mound topography is typical, the result of windthrow and soil movement over centuries of time. Soils are therefore often a mosaic of deep, poorly drained organics and better drained soils on hummocks. Tree regeneration on logs and stumps is common, and trees often have buttress roots.

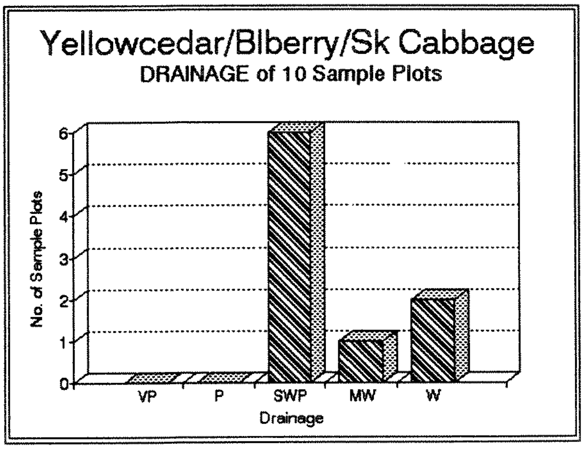


Fig. 71. Drainage Distribution of Yellowcedar/Skunk Cabbage Sample Plots.

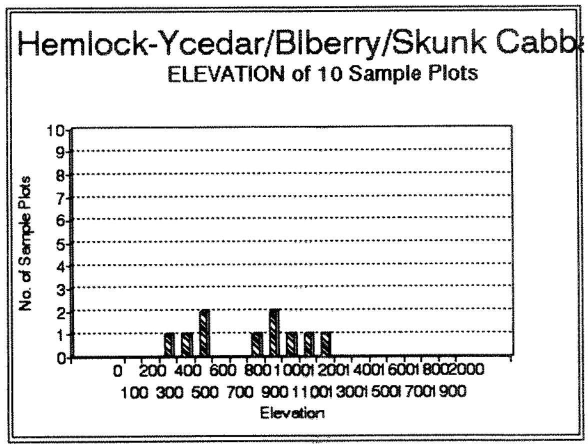


Fig. 72. Elevation Distribution of Yellowcedar/Skunk Cabbage Sample Plots.

Typical Soils-- Western Hemlock-Yellowcedar/Blueberry/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Meares	Till	Footslopes, Rolling Hills	5
Mitkof	Colluvium, Till	Mountain/Hillslopes Till Plains	78
Waterfall	Colluvium	Hillslopes, Toeslopes	7

Similar Associations

This association is distinguished from other series by a minimum 10 percent yellowcedar cover in the overstory, and a general absence of mountain hemlock. In structure and function, it is very similar to redcedar/skunk cabbage, but occurs at higher elevation (500-1,000 feet) more frequently than the redcedar association.

Management Implications

Timber value of this association is generally moderate, averaging 28,200 bd ft/ac (Volume Class 5). By species, 46 percent is western hemlock and 44 percent is yellowcedar. Sitka spruce volume in sampled stands was 10 percent. Timber value will largely fluctuate with the yellowcedar market.

Shovel yarding is not acceptable because of inclusions of deep, organic soil. **Logging** using a cable system is effective if sufficient deflection can be achieved. Because this association frequently occurs on benches or broken hillslopes, this may not be possible (BMPs 13.2, 13.7, 13.9).

Conifer regeneration is likely to be abundant western hemlock, both from regenerating prolifically on undisturbed soil surface organic horizons (Burns and Honkala 1990), as well as from advanced regeneration from previous stands (BMP 13.19).

Yellowcedar regeneration is very problematic. Advanced regeneration will usually be limited, because of inconsistent presence of yellowcedar in the understory (see above table). Regeneration from seeding will be sporadic, due to competition from hemlock and irregularity from seed crops.

For additional discussion, see the Western Hemlock-Yellowcedar/Blueberry section.

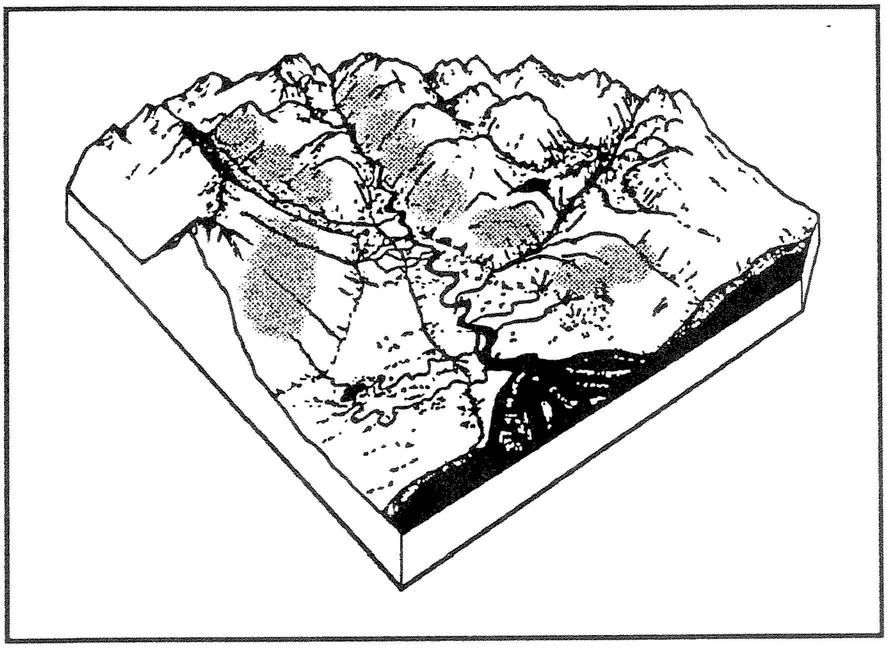
This is a **borderline wetland association** (Interagency Committee 1989, DeMeo and Loggy 1989). Field inspection is necessary to determine wetland status. The association can occur in both wetland and non-wetland map units (BMPs 14.2, 14.3, 16.4). Expect a wetland on lowlands and rolling hills, and a non-wetland on hillsides.

Value for **deer forage** is high, especially in the spring. Emerging skunk cabbage provides some of the first palatable forage. Thermal cover value is likewise high, but this value may be negated at the higher elevations common for this association. **Bears** dig up and eat skunk cabbage tubers, and use trees with buttress roots for denning sites.

Trail and road construction will be hampered by pockets of deep, poorly drained soil, as well as by pit-and-mound topography.

Representative Field Locations

Yellowcedar/Skunk Cabbage may be found along the road leading up to Lower Silvis Lake, south of Ketchikan. On Prince of Wales Island, it has been documented at Klawock Lake. In general, look for it on benches from 500 to 1,500 feet.



Most common landscape position(s) of the Western Hemlock–Yellowcedar/Blueberry/SkunkCabbage association.

Western Hemlock-Yellowcedar/Blueberry-Devil's Club

Tsuga heterophylla-Chamaecyparis nootkatensis/Vaccinium spp.- Oplopanax horridum

TSHE-CHNO/VACCI-OPHO 250

Vegetation

Canopies are relatively closed, with a mean cover of 69 percent. This is shared between western hemlock and yellowcedar, with an average of 39 percent and 24 percent cover, respectively. Sitka spruce, an indicator of soil disturbance, occurred in two thirds of sampled stands and averaged 13 percent cover.

Western hemlock is the most abundant tree species in the understory, with 12 percent cover. Yellowcedar is usually present and averages 6 percent cover. Other conifers occupy small portions of areal cover.

The shrub layer is characterized by blueberry (mean 45 percent cover) and devil's club (mean 10 percent cover). Rusty menziesia is always present and averages 15 percent cover. Forbs are abundant, and include bunchberry, five-leaved bramble, goldthread, and rosy twisted stalk. Oak and shield fern are the most common ferns.

Stands are moderately to highly productive. Stand height averages 110 feet. Snags average 19 percent of basal area. Hemlock snags are valuable for wildlife, but yellowcedar snags are resistant to decay, and less useful for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Cover	Mean Constancy
Western hemlock Yellowcedar	39% 24	100% 100	Tall blueberry Rusty menziesia Devil's club	45% 15 10	100% 100 100
Tree Understory			**Forbs**		
Western hemlock Yellowcedar	12 6	100 83	Bunchberry Five-leavedbramble Goldthread	12 20 10	100 100 100

Distribution and Environment

Western Hemlock-Yellowcedar/Blueberry-Devil'sClub occurs on a variety of valley, hill, and mountain landforms. It is most characteristic on upper portions of heavily dissected mountain slopes. As with other devil's club associations, it is typical along V-notches.Assessments of elevation are hampered by low sample size (Fig. 74). The upper elevational limit is around 1,500 feet.

Soils are poorly and somewhat poorly drained. Better-drainedsoils in similar slope positions would most likely be Western Hemlock/Blueberry-Devil'sClub.

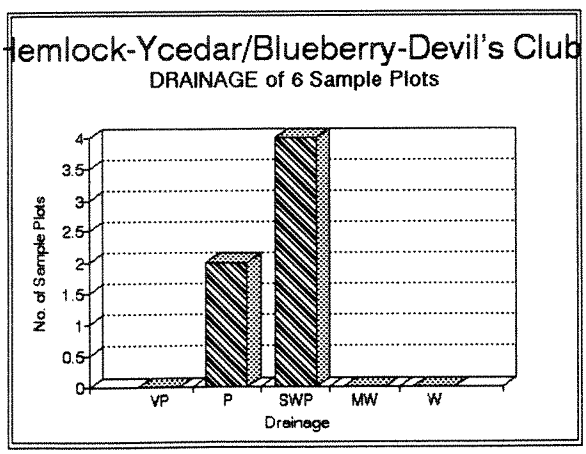


Fig. 73. Drainage distribution of Yellowcedar/Blueberry- Devil's Club Sample Plots

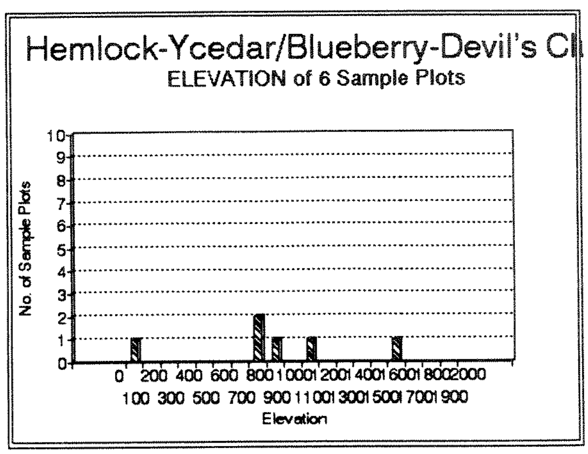


Fig. 74. Elevation Distribution of Yellowcedar/Blueberry- Devil's Club Sample Plots

Typical Soils--Western Hemlock-Yellowcedar/Blueberry-Devil's Club

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Meares	Till	Footslopes, Rolling Hills	5
Mitkof	Colluvium, Ablation Till	Mountain/Hillslopes	78

Similar Associations

This is not a common association. It is most like other associations in the yellowcedar series, but is distinguished by presence of devil's club. Overstory presence of a minimum 10 percent yellowcedar cover distinguishes this from other series. On upper slope positions this association will approach the mountain hemlock zone.

Management Implications

Timber value of this association is often high, averaging 39,600 bd ft/ac (Volume Class 6) in six sampled stands. By species, 36 percent is western hemlock, 38 percent is yellowcedar, 24 percent is Sitka spruce, and 2 percent is redcedar.

These sites will require cable **logging**. On upper slopes, soil stability may be a concern. Surface erosion is rarely a concern in Southeast Alaska because of thick organic soil layers. The dominant form of erosion concern is mass wasting (BMPs 13.2, 13.7, 13.9, 13.5).

Conifer regeneration is likely to be abundant western hemlock, both from advanced regeneration and from seeding in. Hemlock is well adapted to regenerating prolifically on undisturbed soil surface organic horizons (BMP 13.19).

Yellowcedar regeneration is problematic. Advanced regeneration will usually be limited, because of the relatively small amount of yellowcedar in the understory (see above table). Regeneration from seeding will be sporadic, due to competition from hemlock and irregularity from seed crops.

Blueberry and rusty menziesia are likely to expand following logging. Devil's club will decline (DeMeo 1991). Forb abundance is likely to increase up to age 10–15and decline precipitously thereafter. See the Yellowcedar/Blueberry section for more detail on silvicultural options.

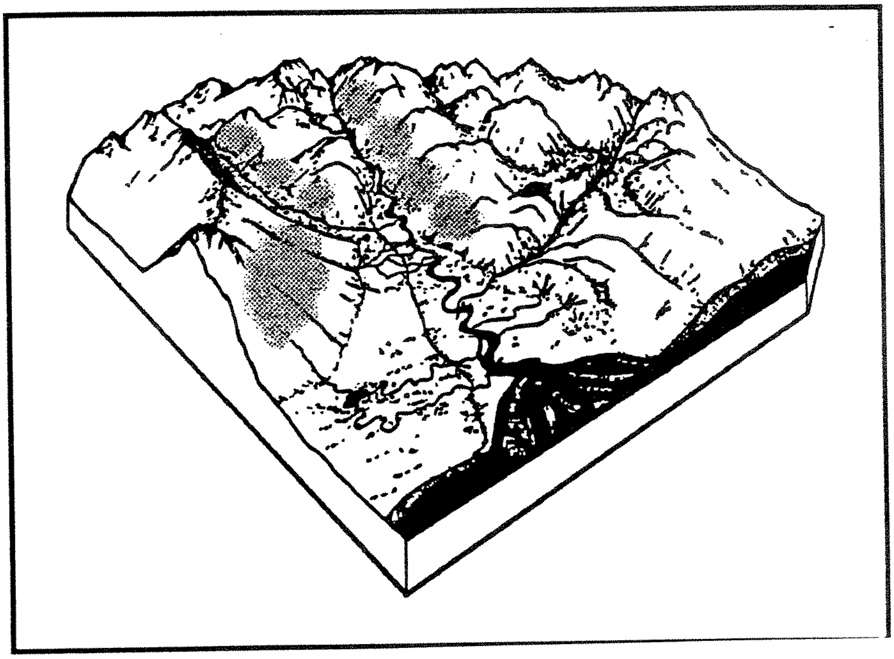
Value for **deer forage** is very high, especially for nutritious forbs like bunchberry, five–leavedbramble, and goldthread. Winter thermal value on low elevation sites is also high.

This is a **non–wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is usually associated with non–wetlandmap units.

Trail and road construction should be avoided because of the association with V-notches and unstable soils. (Road construction is not generally avoided because of wetness, but because of instability.) (BMPs 14.2, 14.3, 14.7, 16.4, 13.16, 13.5.)

Representative Field Locations

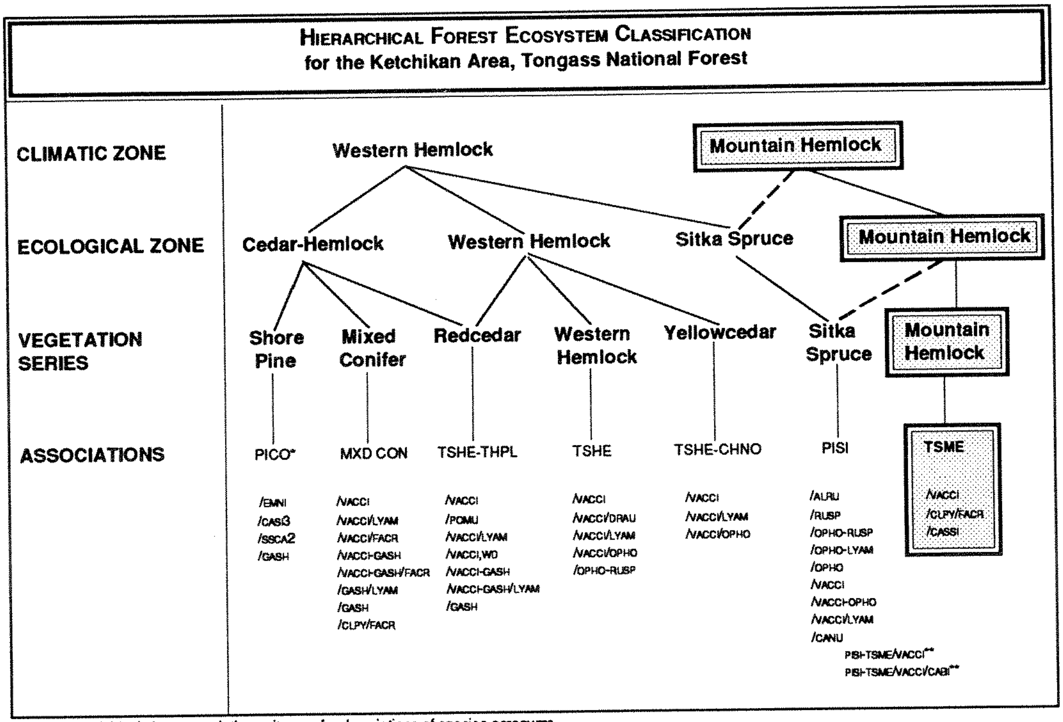
Near Ketchikan, this association has been documented near Harriet Hunt Lake. Other known locations require helicopter access.



Most common landscape position(s) of the Western Hemlock-Yellowcedar/Blueberry-Devil's Club association.

OPHO
Oplopanax horridum
Devil's club

Mountain Hemlock Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

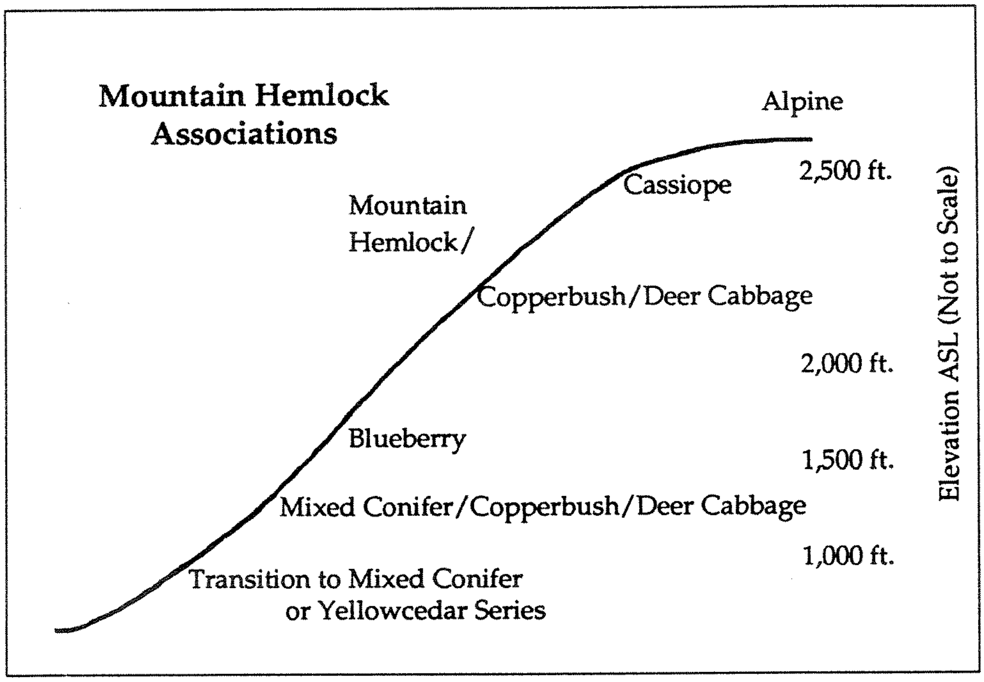


Fig. 75. Schematic of mountain hemlock associations. Sitka spruce-mountain hemlock associations (Chapter 9) can also occur among these associations.

8
MOUNTAIN HEMLOCK SERIES

Mountain Hemlock Ecological Zone

The Mountain Hemlock series (and ecological zone) delineates the subalpine zone-- a transition from productive mountain slopes to the treeless alpine. As such it is widespread, especially on the mainland.

In a word, "cold" describes this series. Elevations typically range from 1,500 to 3,000 feet. Landforms are upper mountain slopes and mountain summits. Productivity is limited by cold temperatures, short growing seasons, and late snow melt.

In structure, stands are usually open and park-like, but sometimes approach a closed canopy. Lower boles of trees are often "pistol-butted" from heavy snow loads and soil creep.

Soils are typically shallow and can be both mineral and organic with weak development. Soil drainage varies widely but is generally moderately well- or well-drained.

Understory vegetation is diverse because of the high light environment. With increasing elevation, the shrub layer in this series is designated by tall blueberry, copperbush, and alpine shrubs. The latter group features small, evergreen heathers such as *Cassiope*, *Luetkea*, and mountain heather. Forbs include deer cabbage, false hellebore, Sitka valerian, and lupine.

Landslides, avalanches, and other soil movement are common. Some stands become mosaics of raised areas and depressions. Blowdown is significant in the Mountain Hemlock/Blueberry association. In fact, older even-aged stands of this association (generated by windthrow or landslide) are fairly common. Windthrow is much less common in the copperbush and cassiope associations, where trees are less tall and stands more open.

The *Cassiope* association approaches the alpine (treeless) zone. Alpine trees and shrubs are often stunted and gnarled in appearance because of wind influence. (This is refered to as **krummholz**, or crooked wood.)

Timber value is low to moderate. At the lower end of the elevation range (1,500-2,000 feet) yellowcedar is often well represented. These stands are similar to the Mixed Conifer Series. Farther north on the Tongass, these sites represent the bulk of mixed conifer, as conditions are colder at lower elevations there.

Until recently, logging in this series was incidental. A mountain hemlock patch might be interspersed with mixed conifer at lower elevations. Now, however, somewhat more productive mountain hemlock sites around 1,500-2,000 feet are being logged. These sites will receive increased attention as lower elevation timber becomes locally scarce or is reserved for deer winter range.

If logged, expect slow conifer regeneration response. Cold soil temperatures and short growing seasons will inhibit seedling growth.

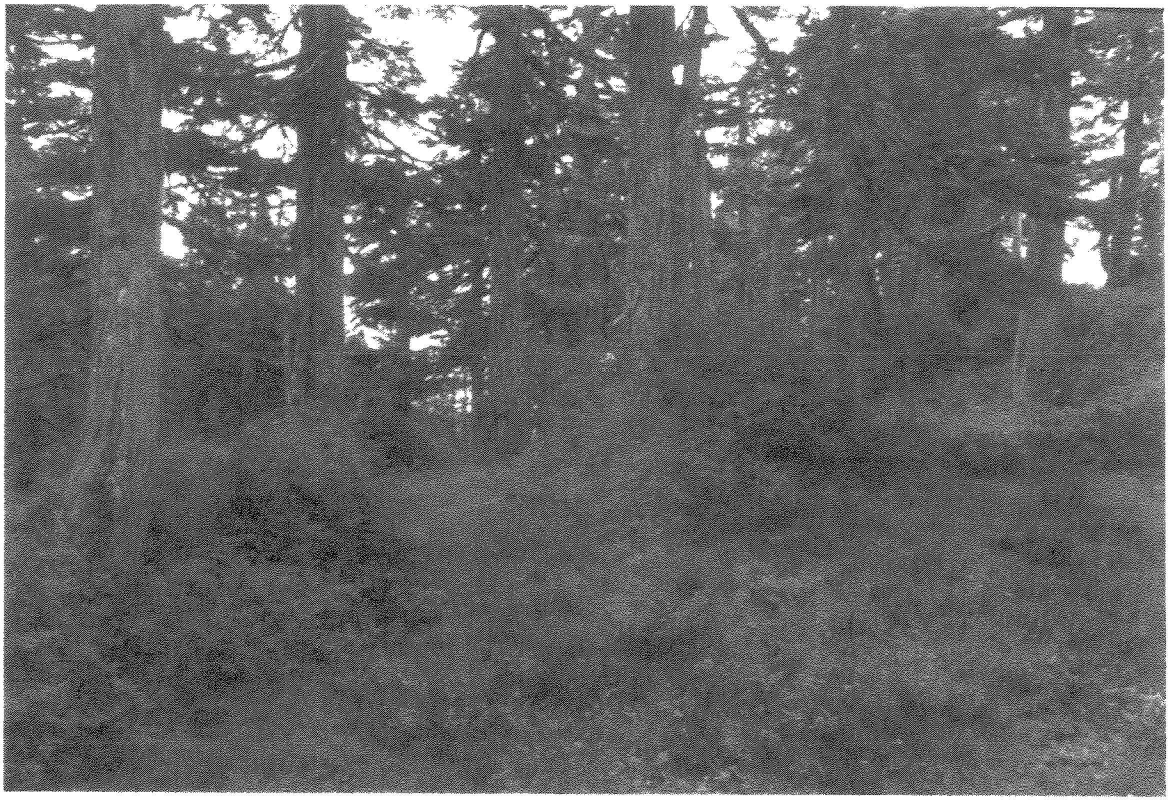
Sitka spruce is sometimes seen in this ecological zone in areas of soil disturbance (primarily along streams and V-notches), in two associations. Because soil disturbance describes the Sitka Spruce Series, these associations are detailed in that section of the guide.

Three associations comprise the Mountain Hemlock series. In order of increasing elevation, they are: blueberry, copperbush/deer cabbage, and *Cassiope*. The blueberry association has a wide distribution within this ecological zone and represents the most productive sites in the series. The copperbush is a microsite complex composed of elevated areas with copperbush and slumped, poorly-drained areas with deer cabbage. Copperbush is often located on snow avalanche areas. *Cassiope* is the last forested habitat before treeless alpine is reached. Stands are open and feature evergreen heathers such as *Cassiope*, and *Luetkea*, mountain heather. Esthetically these stands are very appealing, and excellent places to develop recreational trails. A sunny summer day in Mountain Hemlock/Cassiope near 3,000 feet can be a "Sound of Music" experience.

Mountain Hemlock/Blueberry

Tsuga mertensiana/Vaccinium spp.

TSME/VACCI 510



Vegetation

Stands are open and park-like. Overstory cover averages 54 percent, most of which is mountain hemlock, with cover averaging 36 percent cover. Western hemlock was present in two thirds of sampled stands. Yellowcedar often is present, especially in the lower end of the elevational distribution. Sitka spruce also often is present and indicates disturbance, such as moving water, windthrow, and mass wasting. The same general pattern is true for the understory, although average covers are lower, probably because of the difficulty of tree establishment on cold soils and a short growing season.

The shrub layer is dominated by blueberry, with 47 percent average cover. Rusty menziesia usually is present. Salmonberry and devil's club, good indicators of soil disturbance or water moving through the soil profile, were present in about one third of sampled stands.

Five-leaved bramble and goldthread are the most common forbs, although twisted stalk, false hellebore, bunchberry, deer cabbage, marsh marigold, and foamflower are often present. Deer fern is usually present.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	36%	100%	Tall blueberry	47%	100%
Yellowcedar	15	52	Rusty menziesia	9	86
Western hemlock	14	69			
Sitka spruce	5	54			
Tree Understory			**Forbs**		
Mountain hemlock	13	92	Bunchberry	8	69
Yellowcedar	7	52	Deer fern	7	83
Western hemlock	9	88	Fernleaf goldthread	8	84
Sitka spruce	2	67	Five-leaved bramble	11	90

Distribution and Environment

Cold temperatures characterize this and other mountain hemlock associations. This limits productivity, even though soils are usually fairly well-drained (Fig. 76). Soil temperatures will remain nearly the same year round-- just a few degrees above freezing. Soil depth is shallow, less than 20 inches in both mineral and organic soils.

Mountain Hemlock/Blueberry is found on upper mountain slopes that are smooth or shallowly dissected. This association is also found on hill and valley landforms (25 percent of sampled stands), but these are more like mixed conifer stands and should be managed accordingly. Most common elevations were from 1,000 to 1,300 feet and 1,800-2,500 feet (Fig. 77).

Typical Soils-- Mountain Hemlock/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tokeen	Colluvium and Residuum	Upper Mountain Slopes	540
Tolstoi	Colluvium	Upper Mountain Slopes	53,35,528,351
McGilvery	Organic Over Bedrock	Mountain Slopes	6,28,33,40,528,540

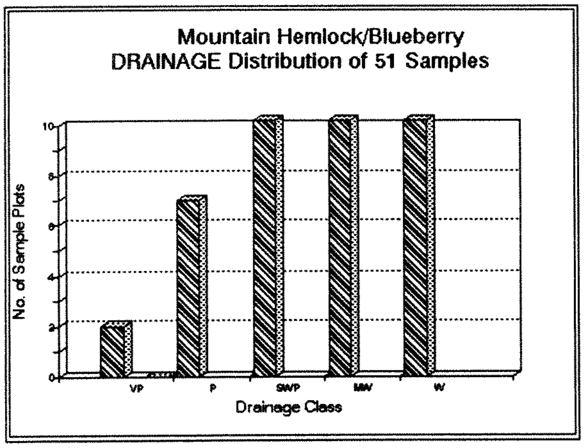


Fig. 76. Drainage Distribution of Mountain Hemlock/Blueberry Sample Plots.

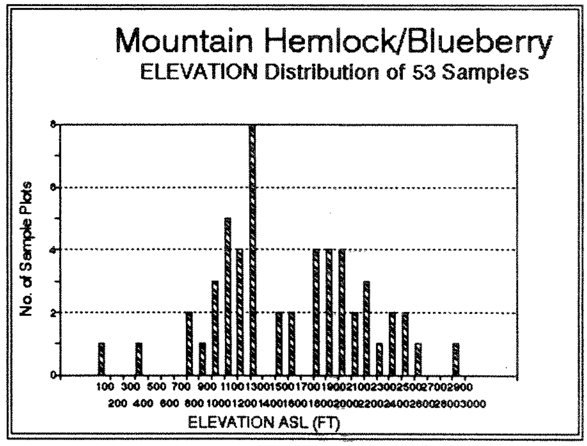


Fig. 77. Elevation Distribution of Mountain Hemlock/Blueberry Sample Plots.

Similar Associations

Mountain Hemlock/Blueberry might be confused with Mixed Conifer/Blueberry, particularly at elevations around 1,000 feet where they commonly occur together. Mountain Hemlock is delineated by 20 percent or more mountain hemlock overstory cover, more than is common in mixed conifer.

This association can occur in a mosaic with the Mountain Hemlock/Copperbush and Cassiope associations. In this case, the blueberry association will usually occupy the most productive sites with the highest relief.

Management Implications

Timber volume for Mountain Hemlock/Blueberry averages 28,600 bd ft/ac, corresponding to Volume Class 5. Data from ten stands was used to generate a range of volumes from 12,500 to 63,000 bd ft/ac. By species, 70 percent is mountain hemlock (or small amounts of western hemlock), 21 percent is yellowcedar, and 9 percent is western hemlock. Although seldom logged in the past, this association is receiving increased attention, particularly in plans for northern Revillagigedo Island.

Logging systems should minimize soil disturbance. Achieving deflection may be facilitated by steep slopes (BMPs 13.2, 13.9).

Regeneration information is lacking, but expect conifers to respond slowly. Planting is not recommended. Advanced regeneration must be relied on if these sites are logged (BMPs 13.19, 13.9).

Mountain Hemlock/Blueberry provides valuable **summer deer range** from late June until about September 1, with a peak in August. Forbs are nutrient rich and highly palatable at this time. After the first snowfall, deer move to lower elevations.

All associations in the mountain hemlock series are designated **non-wetland** (Interagency Committee 1989, DeMeo and Loggy 1989). When found around 1,000 feet, this association can be found in combination with mixed conifer associations that are wetlands.

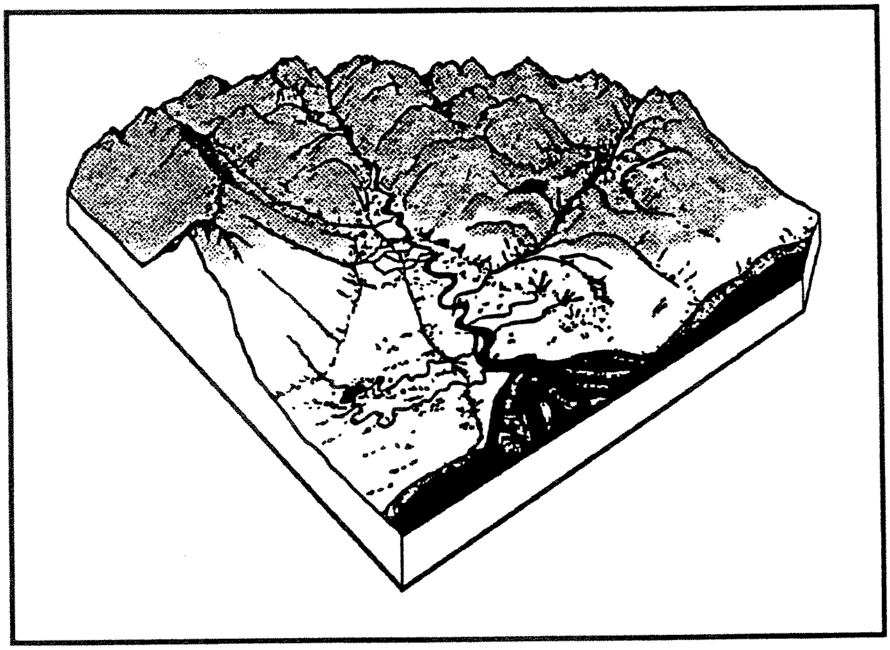
Trail construction is feasible and will usually not require boardwalk. Because slopes are usually smooth, road construction is feasible, but surface erosion will need mitigation (BMPs 14.2, 14.3, 14.7, 16.4).

Representative Locations

Access to mountain hemlock stands usually requires a helicopter or a long walk uphill. Near Ketchikan, a relatively easy walk is the Deer Mountain Trail. Mountain Hemlock stands start showing up around 2,000 feet and are best expressed at 2,500 feet.

On the Thorne Bay District, the Wolf Pup spur road near Coffman Cove provides examples of this association in matrix with mixed conifer associations at about 2,000 feet. In this area, logged examples can also be found, something of great monitoring and research value.

On the Craig District, a short walk uphill from the Polk Inlet West Ridge road at Unit 650-100 will provide examples.

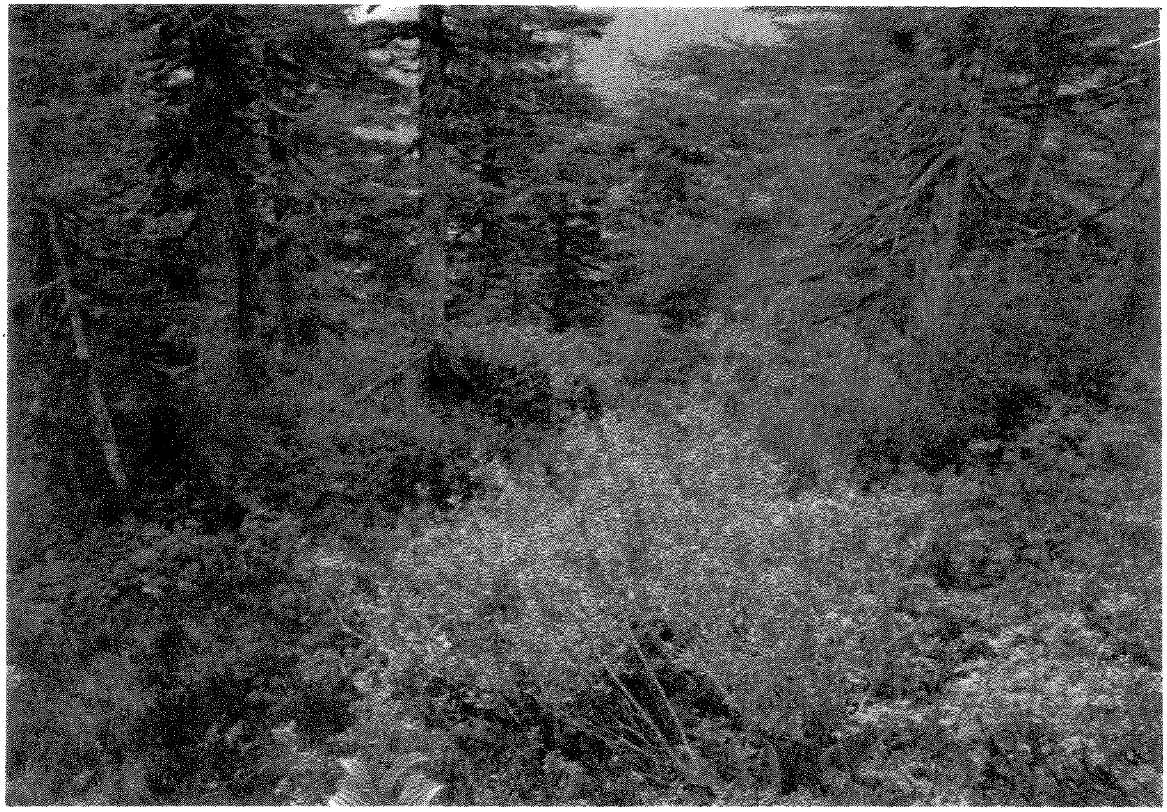


Most common landscape position(s) of the Mountain Hemlock/Blueberry association.

Mountain Hemlock/Copperbush

Tsuga mertensiana/Cladothamnus pyrolaeflorus

TSME/CLPY 520



Vegetation

Stands are open and park-like. Mountain hemlock clearly designates the overstory. Yellowcedar occurs about 60 percent of the time. Western hemlock occurred in only about one third of sampled overstories, a sign that the environment is becoming too cold for that species.

The shrub layer is designated by copperbush (average 14 percent cover), although tall blueberry is actually more abundant (average 37 percent cover) and just as common. Rusty menziesia is also common.

Deer cabbage is common in the forb layer, and averages 8 percent cover. It is closely tied to the small, poorly drained microsites characteristic of this association. Other common forbs include five-leaved bramble, fernleaf goldthread, twisted stalk, and false hellebore. Deer fern is nearly always present.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	33%	100%	Tall blueberry	37%	100%
Yellowcedar	13	61	Rusty menziesia	7	94
Sitka spruce	5	44	Copperbush	14	100

Tree Understory			Forbs, etc.		
Mountain hemlock	11	88	Deer cabbage	8	77
Yellowcedar	11	61	Deer fern	5	94
Sitka spruce	3	50	Fernleaf goldthread	7	83
			False hellebore	3	83
			Five-leaved bramble	10	88

Distribution and Environment

Mountain Hemlock/Copperbush represents an intermediate temperature position between the blueberry and *Cassiope* associations in this series. It is most commonly found between 1,500 and 3,000 feet on upper and high mountain slopes. Soils drain from poorly to moderately well, reflecting the complex microsite nature of the association. Raised relief areas (with copperbush) alternate with depressions (with deer cabbage) in a mosaic generated by slumping and other mass soil movement.

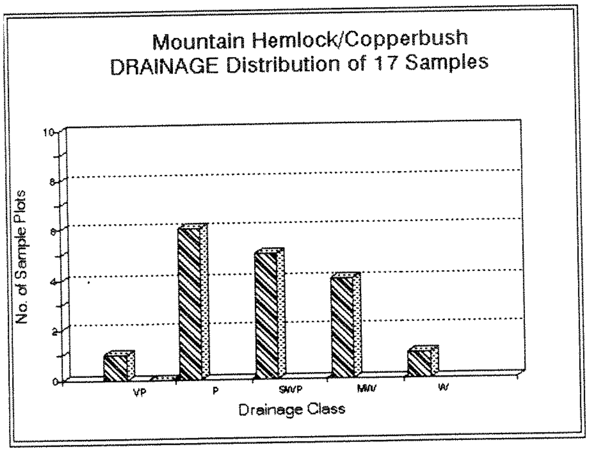


Fig. 78. Drainage Distribution of Mountain Hemlock/Copperbush Plots.

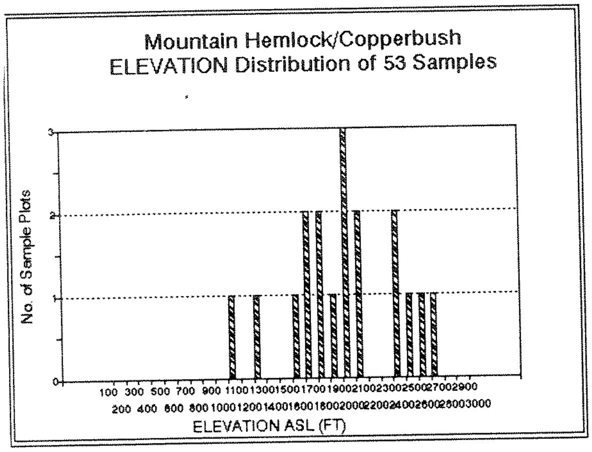


Fig. 79. Elevation Distribution of Mountain Hemlock/Copperbush Plots.

Typical Soils-- Mountain Hemlock/Copperbush

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Traitors	Colluvium	Mountain Slopes	3,6
Sunnyhay	Organics	Summits	245
Calamity	Residuum	Summits, High Mountain Slopes	246

All the above soils are shallow (depth less than 20 inches).

Similar Associations

This association is similar to others in the Mountain Hemlock Series, but is distinguished by the lack of *Cassiope* and *Luetkea*, and the presence (minimum 5 percent cover) of copperbush. It is also very similar to the Mixed Conifer/Copperbush/Deer Cabbage association, but the latter represents a somewhat warmer environment and lacks 20 percent mountain hemlock overstory cover. The two associations can overlap, however.

Management Implications

Timber volume for Mountain Hemlock/Copperbush averages 11,500 bd ft/ac (Volume Class 4). By species, 77 percent is mountain hemlock, 22 percent is yellowcedar, and 1 percent is Sitka spruce. Site productivity is so low, and sites on average so high in elevation, that this association is unlikely to be logged. A few sites might be incidentally included in logging units.

Expect very slow **conifer regeneration** following logging because of cold soil temperatures, short growing season, and late snow melt.

This association is designated **non-wetland** using the criteria developed by the Federal Interagency Committee (1989, DeMeo and Loggy 1989). It can occur in wetland map units, however, such as the Sunnyhay listed above. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

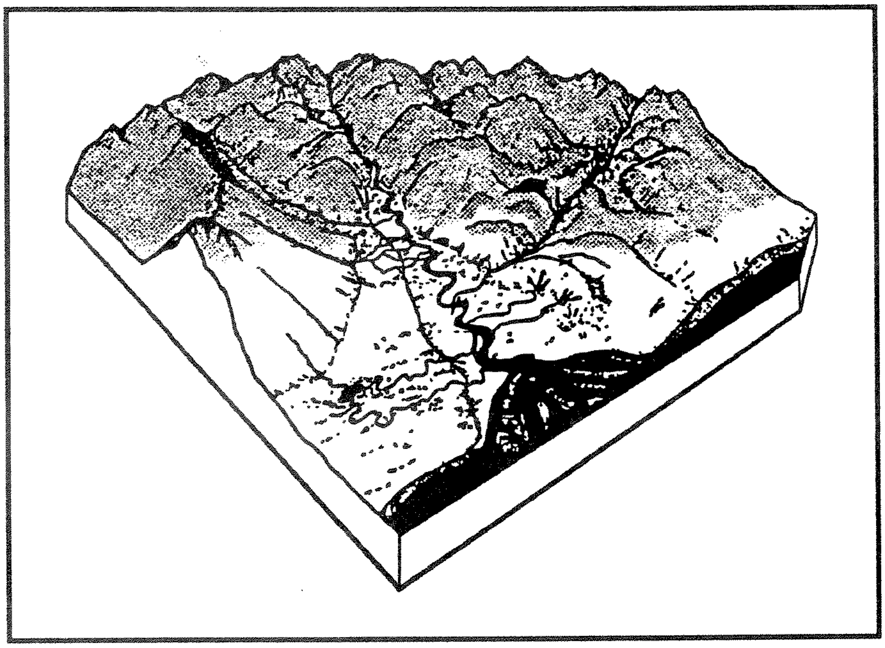
Culturally, false hellebore (a common plant in this association, also known as skookum root) provided a powerful medicine for Tlingit shamans to induce dreams. The plant is also laden with cyanide, so it took an expert shaman to use just the right amount of root without poisoning himself. "Skookum" comes from the Chinook trade language and means strong or capable. (Information on medicinal properties was provided by Tlingit elder Esther Shea.)

Mountain hemlock/Copperbush represents good **deer summer range**. Nutrient-rich forbs are plentiful during the brief growing season, and a combination of security (hiding) cover and open meadows are available.

Trail construction is feasible; avoid wet spots with deer cabbage. **Road construction** feasibility will be determined on a site-by-site basis (BMPs 14.2, 14.3, 14.7, 16.4).

Representative Field Locations

Near Ketchikan, the Deer Mountain Trail just below the mountain summit provides a good sample. On the Craig District, the subalpine zone on Green Monster Mountain near Polk Inlet provides classic examples of this and other mountain hemlock associations, as well as non-forested alpine meadows and peatlands (muskegs).



Most common landscape position(s) of the Mountain Hemlock/Copperbush association.

Mountain Hemlock/Cassiope
Tsuga mertensiana/Cassiope Spp.
TSME/CASSI 530

Vegetation

Stands are very open and represent a transition to non-forested alpine. Mountain hemlock averages 35 percent overstory cover. Other conifers are not consistently present. The understory shows a similar pattern, except that Sitka spruce is common in small amounts. Subalpine fir, while uncommon in this association, may occur in small amounts at the highest elevations.

The shrub layer is designated by low alpine heathers, namely Steller's cassiope, Merten's cassiope, mountain heather, and *Luetkea*. Not all species are always present, but combined cover should total at least 3 percent. These species indicate very cold conditions, late snow melt, and severely restricted growing conditions due to wind, cold, and shallow soils. Tall blueberry is nearly always present, however, and averages 37 percent cover. Rusty menziesia and copperbush are also common.

Five-leaved bramble and twisted stalk are the most common forbs, although no one species dominates. False hellebore, deer cabbage, and marsh marigold are fairly common. Deer fern was found in 78 percent of sample plots. The short, wiry blackish sedge (*Carex nigricans*) was found in 40 percent of sample plots.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	35%	100%	Merten's Cassiope	16	93%
Yellowcedar	9	27	Steller's Cassiope	6	78
Sitka spruce	4	33	Mountain heather	7	45
Subalpine fir	4	6	Luetkea	14	75
			Tall blueberry	37	100
			Copperbush	17	72
Tree Understory			**Forbs, etc.**		
Mountain hemlock	14	93	Deer fern	4	78
Yellowcedar	14	33	Twisted stalk	3	87
Sitka spruce	2	81	Deer cabbage	17	69
Subalpine fir	1	3	Five-leaved bramble	6	93

Distribution and Environment

Cold conditions at the highest subalpine level characterize Mountain Hemlock/Cassiope. Soil drainage varies (see Fig. 80). Soils are nearly always shallow. The association is strictly tied to upper mountain slope and summit landforms.

The growing season is short, but can produce attractive alpine flora such as Nootka lupine, Indian paintbrush, Alaska saxifrage, and alpine fireweeds.

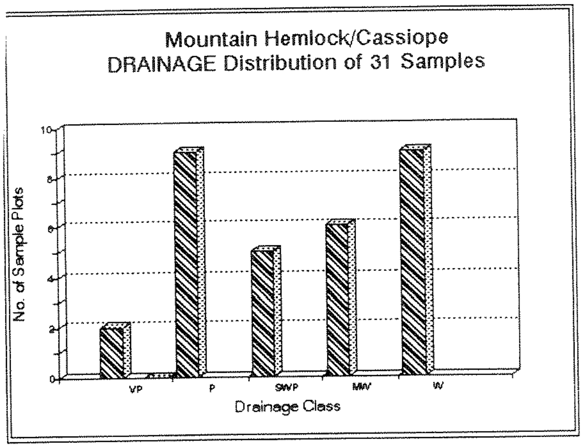


Fig. 80. Drainage Distribution of Mountain Hemlock/Cassiope Sample Plots.

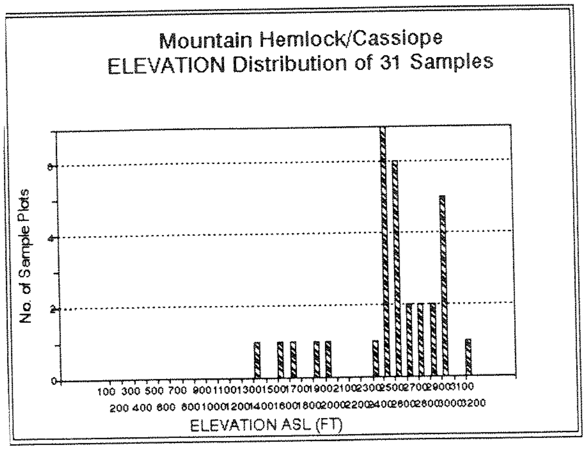


Fig. 81. Elevation Distribution of Mountain Hemlock/Cassiope Sample Plots.

Typical Soils-- Mountain Hemlock/Cassiope

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Sunnyhay	Organics	Summits	245
Calamity	Residuum	Summits, High Mountain Slopes	246
Tolstoi	Colluvium	Mountain Slopes	528

All the above soils are shallow (depth less than 20 inches).

Similar Associations

Mountain Hemlock/Cassiope is most like Mountain Hemlock/Copperbush/Deer Cabbage, but shows at least 3 percent combined cover of *Cassiope* spp. and *Luetkea*, denoting an even colder environment than copperbush. It is the "last stop" before non-forest alpine conditions dominate.

Management Implications

Timber volume for Mountain Hemlock/Cassiope averages only 7,800 bd ft/ac, corresponding to non-commercial timber. By species, it is mostly mountain hemlock (85 percent). Sitka spruce makes up 11 percent, and yellowcedar, 4 percent. Sites will not be logged, as they comprise non-commercial forest at the highest forested elevations.

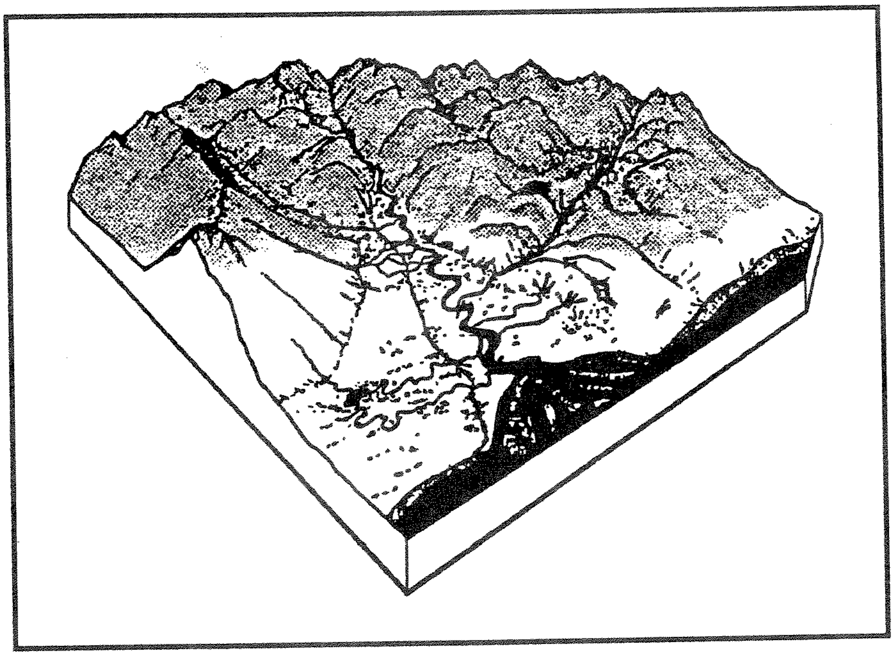
This is not a **wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), although it forms complexes with alpine muskegs that are wetlands. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Mountain Hemlock/Cassiope provides excellent **summer deer range**. Because of the short growing season, forage is nutrient rich. These sites also provide forage for **mountain goats. Brown bears**, unlike black bears, will use this elevation for denning sites.

Trail construction will not require much excavation because of the shallow soils over bedrock, but wet spots with deer cabbage should be avoided. This ecosystem is fragile, and disturbed soils will be very slow to revegetate (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

The summit of Deer Mountain provides a location for Ketchikan residents to observe this association. It is also quite common on peaks of the Cleveland Peninsula. On Prince of Wales Island, try Green Monster Mountain for the Craig District and Ratz Peak for the Thorne Bay District.



Most common landscape position(s) of the Mountain Hemlock/Cassiope association.

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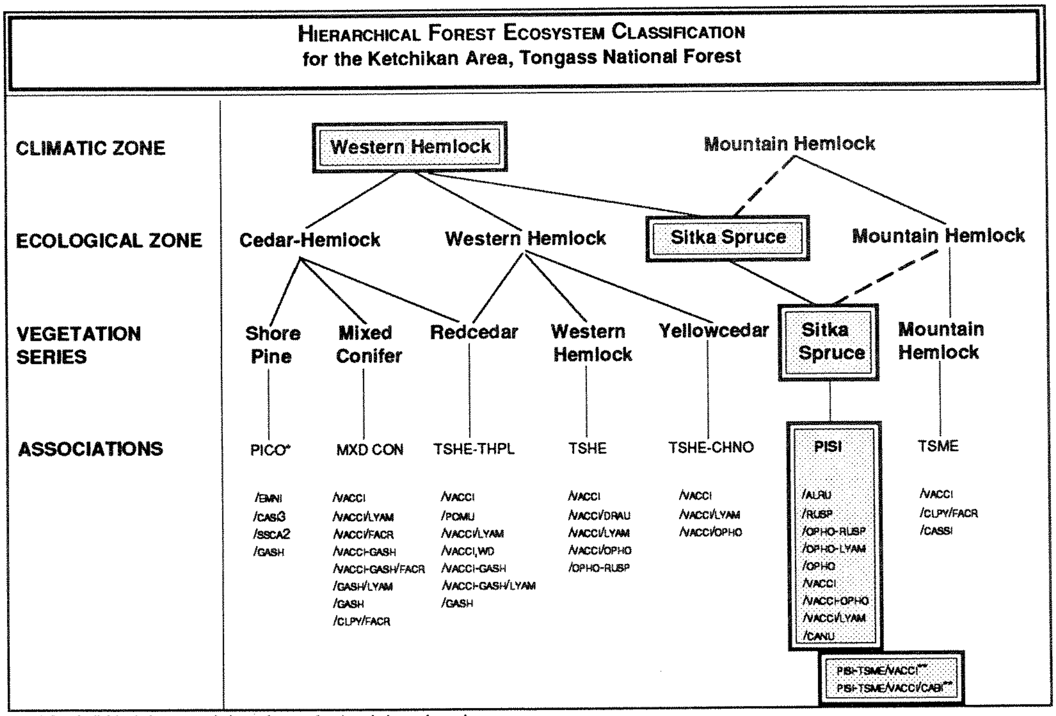
Sitka Spruce Series



* See individual plant association write-ups for descriptions of species acronyms.
** Although the Sitka Spruce Series occurs primarily on low elevation floodplains, these spruce associations are found in the Mountain Hemlock Ecological Zone. See text for further discussion.

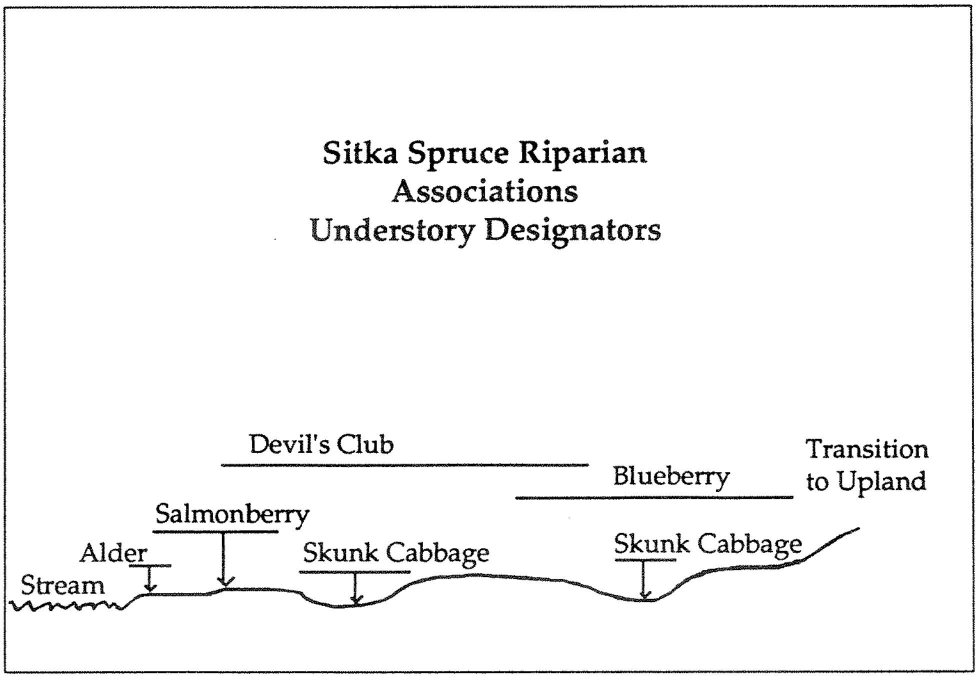


Fig. 82. Schematic of Sitka spruce riparian associations. Microsites in the riparian zone vary greatly.

9
SITKA SPRUCE SERIES

Sitka Spruce Ecological Zone

Sitka spruce indicates soil disturbance. Disturbance includes water movement (either downhill through the soil or in open streams and rivers), windthrow, soil mass movement (landslides and avalanche debris), and wind and salt spray influence on the beach fringe.

Sitka spruce plant associations can be grouped by the type of disturbance. The first and major group comprises associations of the riparian zone. Streams and rivers deposit fresh, nutrient-rich soil material (sediment) in relatively frequent flood events, which also inhibit the deposition and accumulation of organic matter. Another result of flooding is varied microsites with varied organic matter depths. In this group are associations designated by devil's club, salmonberry, and alder. Associations designated by blueberry (alone or with skunk cabbage) represent a transition to upland habitats.

Upland habitats with spruce have not been fully described on the Ketchikan Area. Two major factors have inhibited a full reconnaissance of these sites: 1) They generally occur in steep, rugged country that presents a serious safety hazard; and 2) They are most frequent in areas designated Wilderness (e.g., Misty Fiords) on the Area. Until recently these areas have had a low priority for ecological survey.

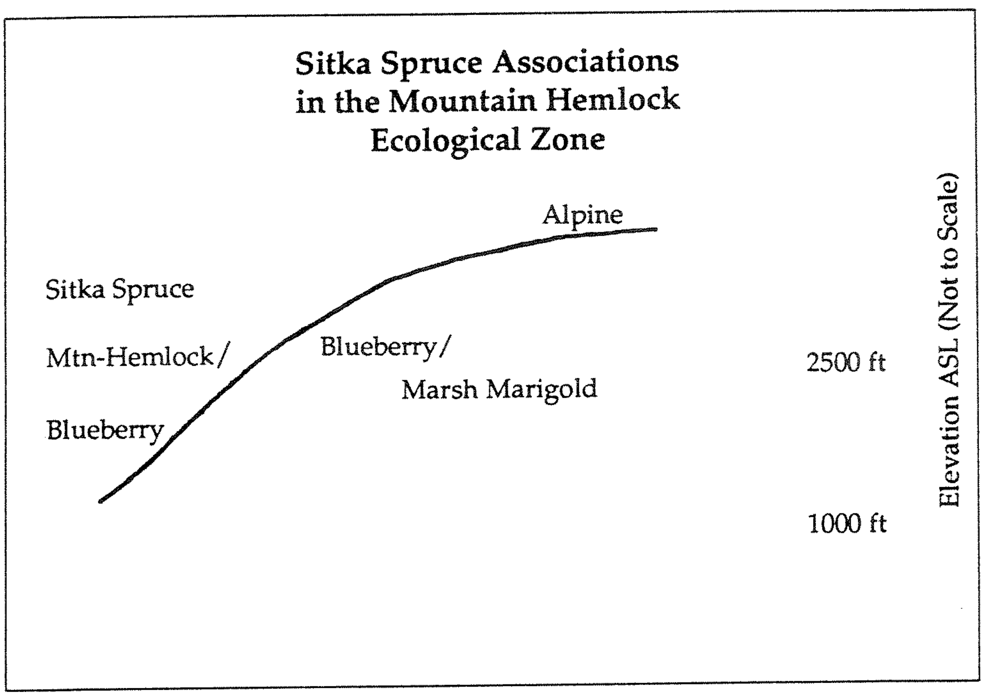


Fig. 83. Schematic of Sitka spruce associations in the Mountain Hemlock Ecological Zone. Spruce associations here are affected by cold temperatures, windthrow, and soil mass movement, with fluvial processes much less significant than in riparian zones.

Of the spruce associations that follow, only those with mountain hemlock are clearly upland. Undoubtedly there are upland spruce sites in steep country characterized by salmonberry and alder. In nearly all cases these sites would present such severe soil stability and safety hazards they would not be logged.

The third group consists of a single representative-- Sitka Spruce/Pacific Reedgrass. This habitat occupies the beach fringe, particularly in exposed headlands.

On riparian sites, Sitka spruce reaches the greatest size of any tree in Southeast Alaska. Diameters greater than 7 feet and heights over 200 feet have been observed. In structure, these stands are rather open, and often the forest floor is dense with salmonberry or devil's club. Alder is often an overstory component on the sites most frequently disturbed by flooding. Western hemlock often occupies a second overstory layer below the towering spruce; because of wind breakage and relatively rapid decay, the hemlock layer "turns over" relatively rapidly while the spruce remains relatively static.

Sitka spruce riparian habitats are an intertwined mosaic related to channel hydrology of the riparian system. Vegetation provides an indicator of frequency of disturbance. Sitka Spruce/Alder designates the most frequently disturbed habitat adjacent to channels. Salmonberry is on somewhat more stable ground that is less frequently disturbed, followed by associations designated with devil's club. These are generalizations, and patterns in the riparian zone are usually made up of subtle gradations rather than sharp divisions.

Skunk cabbage associations, as in other series, represent inclusions of more poorly drained or excess water sites within a matrix of more actively disturbed sites. Skunk cabbage sites, unlike some in other series, are productive in this series. Like the Western Hemlock Series, trees on spruce/skunk cabbage sites grow on woody debris or stumps, and can attain large size.

The importance of woody debris in providing growing sites for trees is critical in Sitka spruce associations. Debris also helps stabilize riparian channels, especially in slow-moving channels that are not well defined. In braided channels, a complex pattern of microsites emerges, as old stream channels fill with organic matter and begin supporting skunk cabbage. Old logs and stumps also play a critical role in supporting tree regeneration. Because of flooding events and competition with mosses, survival of both hemlock and spruce is limited on the forest floor. Woody debris serves as safe regeneration sites for conifers (Harmon and Franklin 1989).

Riparian zones present profound management implications. Salmon streams are a world-class resource that have been the focus of intense management, political, and scientific interest. Timber values are very high-- large dimension spruce logs bring a premium in overseas and domestic markets, with the best quality logs reserved for specialty uses such as guitar faces (hence the term "music trees"). Deer, bear, marten, and a host of other mammals use these sites. Structural diversity on spruce sites, especially those with alder, provides valuable habitat for a variety of birds.

In a larger sense, riparian zones are a "keystone ecosystem," the heart of the landscape that facilitates water, fish, and wildlife movement. Many of these sites have been altered by management, and highly productive Sitka spruce riparian sites with old growth are now locally scarce on Prince of Wales Island.

In recent years, riparian sites have been protected by leave strips (buffers) when an area is logged, and this has been given force of law by the Tongass Timber Reform Act. Much remains to be learned, however, about how effective buffers will be in maintaining ecosystem function.

Additionally, upland spruce sites will receive scrutiny as riparian spruce becomes scarce or unavailable for harvest. Important resource values will ensure that the Sitka spruce series will be a focus for years to come, and managers should strive to become familiar with it. This section is intended as a contribution to that understanding.

The following association descriptions are arranged by group (riparian, upland, and beach), and within each group, in order of decreased association with soil disturbance.

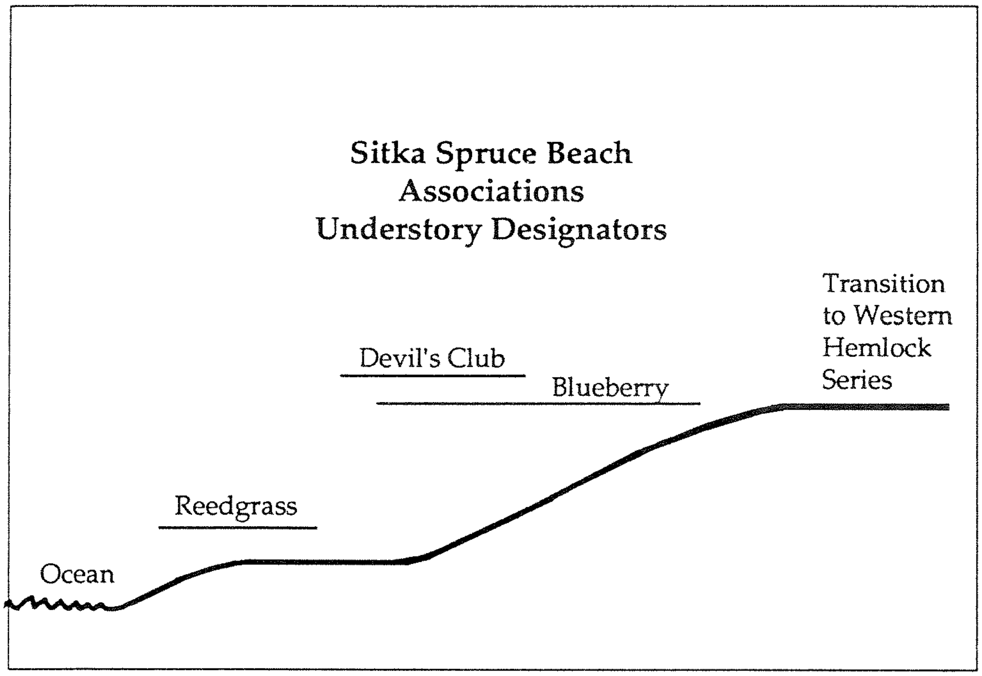


Fig. 84. Schematic Representation of Sitka Spruce Associations in the Beach Zone. This is a generalization, and differences between associations are often subtle transitions rather than sharp divisions.

Sitka Spruce/Red Alder

Picea sitchensis/Alnus rubra

PISI/ALRU 350

Vegetation

Stands have a relatively closed canopy (average cover 55 percent). Western hemlock cover averages 10 percent, Sitka spruce 26 percent, and red alder 30 percent. Trees are not well represented in the understory; total understory cover is only 8 percent.

The shrub layer is dominated by salmonberry (39 percent mean cover). Devil's club averages 10 percent cover and stink currant 6 percent. Other shrubs are minor components.

Trifoliate foamflower and enchanter's nightshade are consistently present and are good indicators of aerated, nutrient-rich soils with water flowing through them. Stream violet and twisted stalk are also consistently present.

Snags may be present, but this association is so frequently disturbed by sediment that old-growth characteristics are not as fully developed as in other spruce associations. Stand height averages 148 feet.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	10%	25%	Salmonberry	39%	100%
Sitka spruce	26	100	Devil's club	10	100
Red alder	30	100	Stink currant	6	100
			Blueberry	3	75
Tree Understory			**Forbs**		
Western hemlock	5	75%	Twisted stalk	2	100%
Sitka spruce	2	75	Trifoliate foamflower	7	100
Red alder	3	100	Stream violet	5	100
			Enchanter's nightshade	7	100

Distribution and Environment

This association is found strictly on floodplains adjacent to channels. It represents the most frequently disturbed portion of the riparian zone. It is found on the Tonowek soil-- basically undifferentiated alluvium. The soil environment is well drained, and while usually saturated, soil water is moving. Organic layers are variable in depth, the pH remains relatively high, and nutrients are available. All samples were found at less than 200 feet elevation.

Typical Soil-- Sitka Spruce/Alder

Soil Series	Parent Material	Landform	Soil Map Units
Tonowek	Alluvium	Floodplains	10

Similar Associations

Sitka Spruce/Alder is most similar to Sitka Spruce/Salmonberry, the next association in the riparian zone along a disturbance gradient from most to least disturbed. In many cases, stands that appear to be the alder association may actually have alder only because of past logging, which will be indicated by stumps.

Management Implications

Timber volume for Sitka spruce/alder averages 58,500 bd ft/ac, corresponding to Volume Class 7. By species, 82 percent is spruce, 12 percent is western hemlock, and only 6 percent is alder. Alder diameters are generally much smaller than those of spruce and hemlock.

This association should not be logged. It is adjacent to slow-moving alluvial channels that quickly lose streambank stability when disturbed. If disturbed, this association will experience salmonberry and alder expansion for an extended period. (BMPs 12.6, 13.2, 13.8, 13.16.)

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) because the soil water environment, while saturated, is well aerated. Additionally, vegetation present is clearly non-hydric.

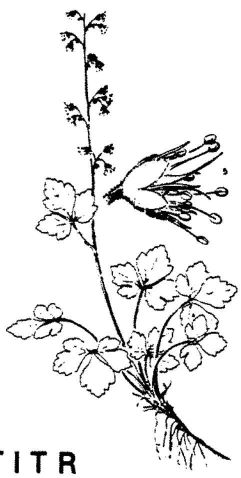
Value for **deer** habitat is low to moderate. Salmonberry thickets will impede movement. Spruce canopies are relatively open, allowing snow accumulation to impede movement, and providing relatively poor thermal cover. Because of alder adjacent to stream channels, this association provides valuable habitat for **birds**. Value of bird habitat is usually more related to diversity of structure than to plant species diversity (Kimmins 1987).

Trail and road construction would require careful placement to avoid serious bank stability problems (BMPs 14.2, 14.3, 14.13, 16.4, 12.4, 12.6).

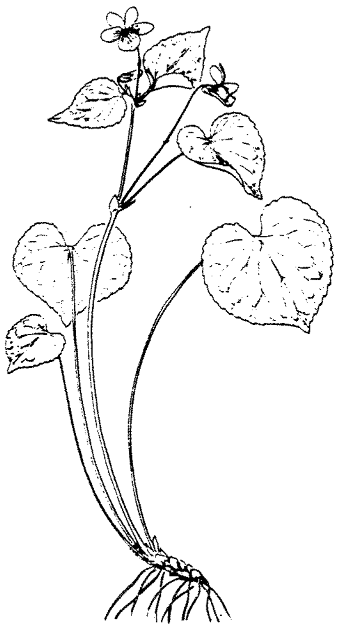
Culturally, alder is valuable for smoking salmon and for carving. Traditionally, the Tlingits used alder for spoons and bowls, since it does not impart a flavor to food.

Representative Field Locations

Sections of Ward Creek near Ketchikan feature this association. The proposed Rio Roberts Research Natural Area, along a tributary of the Thorne River, provides an example on Prince of Wales Island.



TITR
Tiarella trifoliata
Coolwort foamflower



VIOLA SPP.
(*Viola glabella* **VIGL**
used for example)

Sitka Spruce/Salmonberry

Picea sitchensis/Rubus spectabilis

PISI/RUSP 380

Vegetation

Stands are relatively open (average cover 46 percent). Western hemlock cover averages 19 percent and Sitka spruce 31 percent. In the understory, conifers are not well represented (11 percent hemlock and 5 percent spruce, on average).

The shrub layer is clearly dominated by salmonberry (45 percent mean cover). Other shrubs are either uncommon or show little cover. The most common forbs are deerberry (false lily of the valley) and trifoliate foamflower, followed by enchanter's nightshade and skunk cabbage. Shield fern is the most common and abundant fern.

Stands are productive, with an average stand height of 146 feet. Spruce are often of large dimensions, and it is in this association where the species reaches record size. Snags are not very abundant, but are highly valuable spruce.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock Sitka spruce	19% 31	100% 100	Salmonberry Devil's Club Tall blueberry	45 4 4	100% 83 100
Tree Understory			**Forbs**		
Western hemlock Sitka spruce	11 5	100 100	Trifoliate foamflower Deerberry Skunk cabbage Shield fern	3 2 5 7	83 33 66 83

Distribution and Environment

Sitka Spruce/Salmonberry occurs on the most recently formed terraces in riparian zones. Soils are alluvial-- the well drained Tonowek (undifferentiated alluvium) and Tuxekan (showing spodic development). Flooding occurs nearly every year, and may persist for an extended period of time. Soils are productive because of frequent fresh deposits of sediment. This also implies a frequently disturbed environment for which salmonberry is well suited.

This habitat is most clearly associated with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5) (USDA Forest Service 1992). All samples were collected at less than 200 feet.

Although not well documented, spruce/salmonberry occurs as an upland association on steep slopes. Vegetation composition can be expected to be similar to the riparian form, but productivity will be less due to the lack of alluvial inputs. At higher elevations, temperature will also limit productivity.

Typical Soils-- Sitka Spruce/Salmonberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Stream Terraces, Floodplains	10

Similar Associations

Sitka Spruce/Salmonberry is similar to both spruce/alder and spruce/devil's club-salmonberry. It occupies an intermediate position between the two along a disturbance gradient from most to least disturbed. It is distinguished by lack of alder and abundance of salmonberry.

Management Implications

Timber volume of this association is very high, averaging 68,200 bd ft/ac, corresponding to Volume Class 7. By species, 63 percent is Sitka spruce and 37 percent is western hemlock. This association is likely to feature the "pumpkin" spruce highly prized as "music trees" (used for guitar faces).

Because of current buffer strip requirements, this and other spruce associations are less likely to be logged now than in the past. Never an abundant association on the landscape, this habitat has become locally scarce on Prince of Wales Island because of past logging. (BMPs 12.6, 13.16.)

If logged, yarding systems should minimize surface soil disturbance. Shovel yarding may be most appropriate. Because deflection is difficult to achieve on the nearly level sites characteristic of this association, cable yarding is likely to scarify soils, encouraging salmonberry expansion or alder invasion.

Regardless of approach, this association is likely to become a salmonberry field following harvest. **Planting** is not recommended. Repeated attempts to restock a site along the North Thorne River with spruce by planting have failed. If planting is attempted, the only chance for success will be to ensure that it occurs immediately after harvest (BMPs 12.6, 13.9, 13.8, 13.2).

Conifer regeneration will be delayed, but can be expected sometime past age 10 in the resulting stand. Salmonberry-dominated second growth along the North Thorne has been observed to contain fairly abundant spruce beneath it. (BMP 13.19.)

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats. Riparian zones are not considered wetlands, primarily because the soil water environment is aerated, and also because associated vegetation is mostly non-hydric (DeMeo and Loggy 1989).

Value for **deer forage** and cover is low. **Bears** are common on spruce sites (especially when salmon are spawning), and use the hollows under trees with buttressed roots as dens.

Trail construction will be complicated by salmonberry. This tenacious shrub easily sprouts from rootstocks when clipped off. **Road construction** in riparian zones should be minimized. (BMPs 12.4, 12.6, 14.2, 14.3, 14.13, 16.4.)

Representative Field Locations

No good riparian examples of this association exist near Ketchikan. A steep area on a spur of the Brown Mountain Road shows the upland form. On the Thorne Bay District, good examples occur in the proposed Rio Roberts Research Natural Area. Logged examples about 15 years old occur along the North Thorne River. Klakas Lake in the South Prince of Wales Wilderness provides an example for the Craig District, as well as Big Creek, a tributary to Cholmondeley Sound.

Sitka Spruce/Devil's Club-Salmonberry
Picea sitchensis/Oplopanax horridum-Rubus spectabilis
PISI/OPHO-RUSP 335

Vegetation

Stands are open (average canopy cover 54 percent) because of the structural dominance of enormous Sitka spruce. Spruce overstory cover averages 38 percent and western hemlock 21 percent. In the understory, hemlock cover averages 15 percent and spruce 2 percent.

The shrub layer is dominated by salmonberry (34 percent mean cover) and devil's club (30 percent cover). This layer is often completely occupied, inhibiting conifer regeneration. Blueberry is also present and averages 10 percent cover.

The most common and abundant forbs are those associated with deposits of nutrient-rich alluvium--trifoliate foamflower, rosy twisted stalk, and deerberry. Lady fern, also a designator of this environment, is the most common fern.

Site productivity is among the highest of any forested plant association. Average stand height is 164 feet, surpassing average heights in the Western Hemlock Series. Record-size trees can be anticipated within this association.

Characteristic Species

Sample size = 7

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Sitka spruce Western hemlock	38% 21	100% 100	Salmonberry Devil's club Blueberry	34 30 10	100% 100 100

Tree Understory			Forbs		
Sitka spruce Western hemlock	2 15	100% 100%	Five-leaved bramble Trifoliate foamflower Twisted stalk	8 16 3	100% 85 85

Distribution and Environment

Sitka Spruce/Devil's Club-Salmonberry is associated with seasonal flooding, particularly the salmonberry component. It can be found on any alluvial riparian landform, and occasionally on as adjacent footslopes. Soils are well drained alluvium. While elevations can range up to 1,000 feet, most are near sea level.

This habitat is most clearly associated with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5) (USDA Forest Service 1992a). Woody debris is critical in maintaining stability of the forest floor.

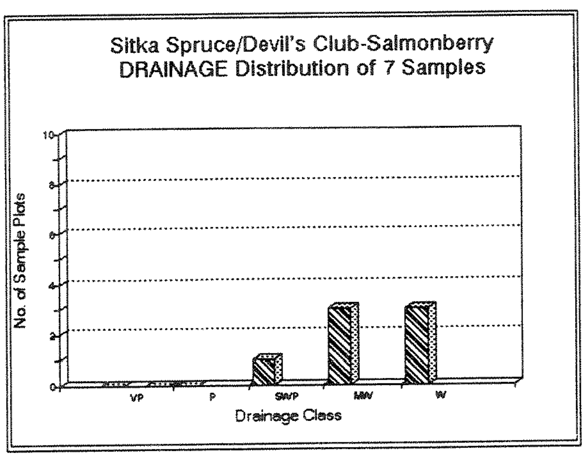


Fig. 85. Drainage Distribution of Sitka Spruce/Devil's Club-Salmonberry Sample Plots.

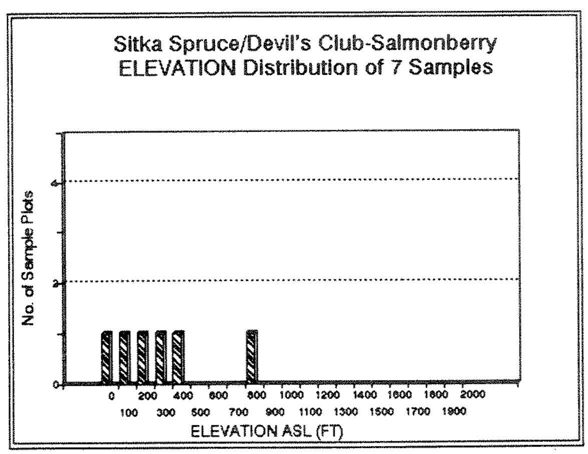


Fig. 86. Elevation Distribution of Sitka Spruce/Devil's Club-Salmonberry Sample Plots

Typical Soils-- Sitka Spruce/Devil's Club-Salmonberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10

Similar Associations

Sitka Spruce/Devil's Club-Salmonberry represents a somewhat more stable soil environment than spruce/salmonberry, but less than that of spruce/blueberry-devil's club. Both salmonberry and devil's club are clearly represented in this association.

Management Implications

Timber volume of this association is very high, averaging 72,100 bd ft/ac, corresponding to Volume Class 7. By species, 86 percent is Sitka spruce and 14 percent is western hemlock.

Because of current buffer strip requirements, this and other spruce associations are less likely to be logged now than in the past. If logged, yarding systems should be employed to minimize surface soil disturbance. Individual tree harvesting or group selection methods may be options, provided an intact buffer strip is retained along streams.

Regardless of logging, sites are likely to become salmonberry fields after harvest, and this condition will persist for quite some time. **Planting is not recommended**; salmonberry competition is very strong and can easily dominate tree seedlings. In time (beyond age 10-15), natural spruce regeneration will begin to overtop the salmonberry if sites have not been scarified too severely. Once free to grow, increases in height and volume should be rapid. BMPs 12.6, 13.16, 13.8, 13.9, and 13.19 apply to these sites.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats. Riparian zones are not considered wetlands, primarily because the soil water environment is aerated, and also because associated vegetation is mostly non-hydric (DeMeo and Loggy 1989).

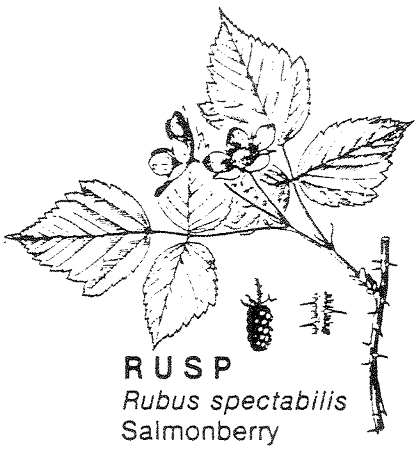
Value for **deer forage** is low to moderate. Thermal cover is moderate due to the generally open canopy. **Bears**, in contrast, are common on spruce sites (especially when salmon are spawning), and use the hollows under trees with buttressed roots as dens and resting sites during feeding cycles.

The backwater sloughs common in this habitat are prime rearing habitat for **coho salmon**. Woody debris is of the utmost importance in maintaining habitat integrity, and is critical in providing nurse logs for tree regeneration (BMPs 12.6, 13.16).

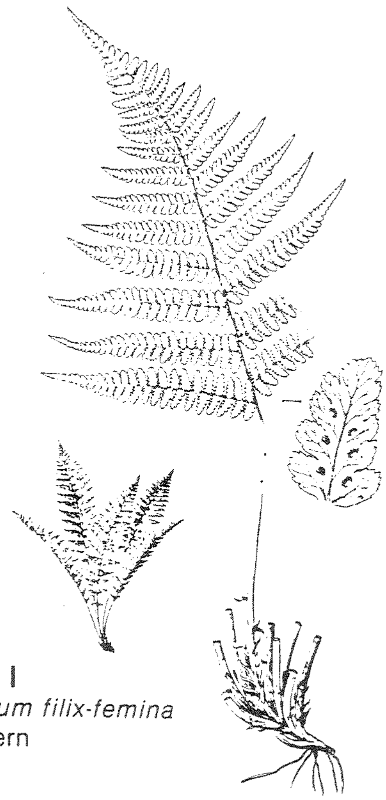
Trail construction is easy because soil is easily removed, but the possibility of flooding events should be considered. **Road construction** in riparian zones should be minimized (BMPs 12.4, 12.6, 14.2, 14.3, 14.13, 16.4.).

Representative Field Locations

Near Ketchikan, the headwaters of the White River along the Brown Mountain road will provide examples of this association. On the Thorne Bay District, the proposed Rio Roberts Research Natural Area contains superb examples. On the Craig District, Klakas Lake in the South Prince of Wales Wilderness, or Big Creek (flowing into Cholmondeley Sound) provide illustrations.



RUSP
Rubus spectabilis
Salmonberry

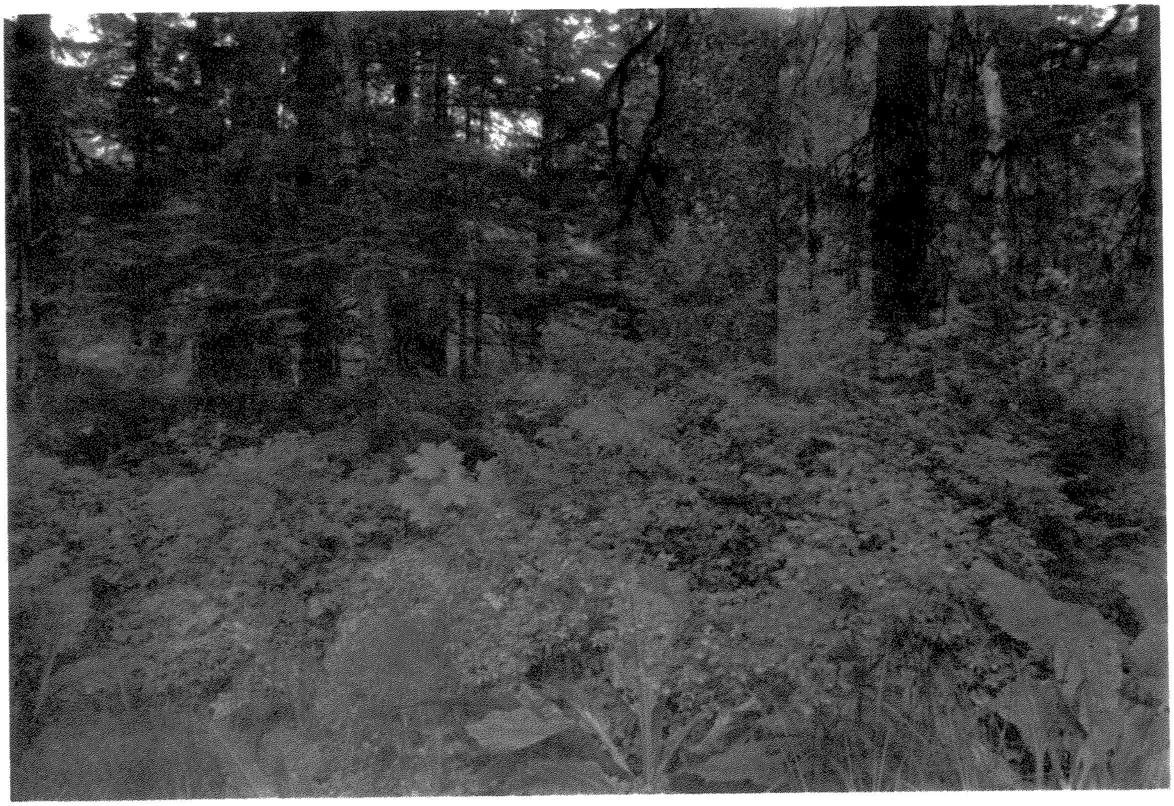


ATFI
Athyrium filix-femina
Ladyfern

Sitka Spruce/Devil's Club-Skunk Cabbage

Picea sitchensis/Oplopanax horridum/Lysichitum americanum

PISI/OPHO-LYAM 340



Vegetation

Stands have a relatively closed canopy (average cover 63 percent). Western hemlock cover averages 27 percent and Sitka spruce 32 percent. In the understory, western hemlock is a stronger component (13 percent cover) than Sitka spruce (6 percent).

The shrub layer is dominated by blueberry (23 percent mean cover) and devil's club (21 percent cover). Rusty menziesia is usually present and averages 5 percent cover. Other shrubs are minor components. Forbs include those of upland western hemlock habitats (bunchberry and five-leaved bramble) as well as those associated with alluvium (trifoliate foamflower), but the emphasis is on the former. Skunk cabbage designates the association. Oak fern is the most common and abundant fern. Stands are productive, averaging 141 feet in height.

Characteristic Species 10 Samples

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	27%	100%	Blueberry	23	90
Sitka spruce	32	100	Devil's club	21	100
			Rusty menziesia	5	90

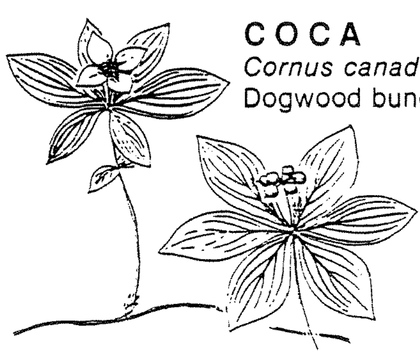
Tree Understory			Forbs, etc.		
Western hemlock	13	90	Bunchberry	10	90
Sitka spruce	6	90	Five-leaved bramble	5	100
			Skunk cabbage	8	100
			Oak fern	9	90

Distribution and Environment

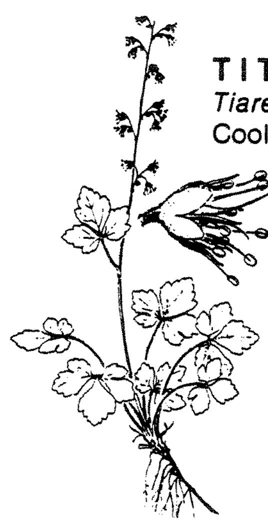
Sitka Spruce/Devil's Club/Skunk Cabbage represents small inclusions of organic matter accumulation in a matrix of alluvial deposits. The two cannot be separated. Trees grow on old logs and stumps. The microtopography is exceptionally varied. Depressions with skunk cabbage are typically old side channels that have filled in with organic matter.

This is an association of the riparian zone, but represents the first along the gradient (away from the stream or river) that clearly has upland elements. It can be found on footslopes more frequently than associations designated with salmonberry. Sites occur up to 900 feet elevation but are usually much lower.

This habitat is most clearly associated with low gradient floodplain stream channels (channel types FP3, FP4, and FP5) (USDA Forest Service 1992a).



COCA
Cornus canadensis
Dogwood bunchberry



TITR
Tiarella trifoliata
Coolwort foamflower

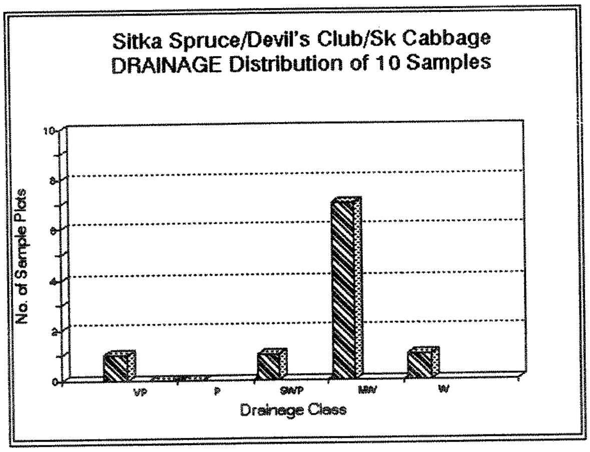


Fig. 87. Drainage Distribution of Sitka Spruce/Devil's Club/Skunk Cabbage Sample Plots

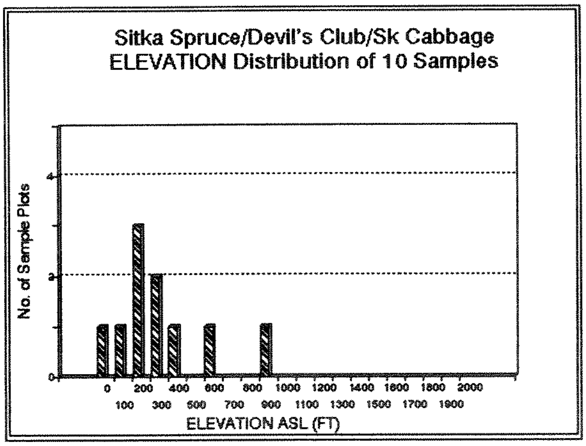


Fig. 88. Elevation Distribution of Sitka Spruce/Devil's Club/Skunk Cabbage Sample Plots

Typical Soils-- Sitka Spruce/Devil's Club/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10

Similar Associations

Sitka Spruce/Devil's Club/Skunk Cabbage is similar to Spruce/Devil's Club and Spruce/Blueberry/Skunk Cabbage, but designates a different environment than either of those associations. Unlike Spruce/Devil's Club, it features depressions with skunk cabbage, and unlike Spruce/Blueberry/Skunk Cabbage, it is more clearly riparian.

Management Implications

Timber volumes of this association are high, averaging 71,400 bd ft/ac, corresponding to Volume Class 7. By species, 75 percent is Sitka spruce and 24 percent is western hemlock. Redcedar may occur in trace amounts.

Because of current buffer strip requirements, this and other spruce associations are less likely to be logged now than in the past. Cable yarding without adequate deflection should be avoided, as sites are very susceptible to damage. Unless the riparian zone is very narrow between steeper valley walls, it will be nearly impossible to achieve much deflection. Without deflection, logs will catch in the depressions during yarding and tear up the site. Shovel yarding is not recommended due to the uneven topography and the low bearing strength of depressions with skunk cabbage. BMPs 12.6, 13.2, 13.7, 13.8, 13.9 apply to these sites.

Another negative effect of logging these sites is that hydrology can be altered so that adjacent spruce (in buffers, for example) receive too much water and die. Additionally, logging slash can attract beavers, and subsequent beaver dam construction can bring about flooding that kills trees.

If sites are logged, **conifer regeneration** will be spotty at best. **Planting** with spruce may be appropriate if done immediately following logging. Salmonberry expansion/invasion is possible, but less likely than in Spruce/Salmonberry or Spruce/Devil's Club-Salmonberry. (BMP 13.19.)

The second-growth response graphs presented for Spruce/Blueberry are generally applicable to this association.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats. Skunk cabbage, while an obligate wetland plant (Reed 1988), is insufficient to designate this habitat as wetland, because the soil hydrology is generally aerated, and other vegetation is primarily non-wetland in nature.

Value for **deer forage** is moderate to high. Winter range and thermal cover is good. Large trees with abundant limbs intercept snow, and riparian zones are generally close to saltwater and are ameliorated by warmer ocean temperatures. **Bears** are common on spruce sites (especially when salmon are spawning), and use the hollows under trees with buttressed roots as dens. Like spruce/devil's club/salmonberry, this association can feature the side channels and backwater sloughs used by **coho salmon** for rearing habitat.

Trail and road construction should be avoided. Depressions with skunk cabbage present obstacles, and site hydrology will be adversely affected. (BMPs 14.2, 14.3, 12.6, 16.4.)

Representative Field Locations

Near Ketchikan, the headwaters of the White River along the Brown Mountain road will provide examples of this association. For Prince of Wales Island, the Thorne River just north of the Thorne River Bridge provides an example, although the stand is edge now due to road construction.

Second-growth examples of this association can be found on the North Thorne River, and along Goose Creek, both near Thorne Bay.

Sitka Spruce/Devil's Club

Picea sitchensis/Oplopanax horridum

PISI/OPHO 330

Vegetation

Stands have a generally open canopy (average cover 55 percent). Western hemlock cover averages 27 percent and Sitka spruce 33 percent. In the understory, western hemlock is a stronger component (17 percent cover) than Sitka spruce (5 percent). Canopies are often two-tiered, with spruce towering above a second canopy layer of hemlock.

The shrub layer is dominated by devil's club (27 percent mean cover). Blueberry is nearly always present, but averages only 8 percent cover. Salmonberry was found in 73 percent of sampled stands and averaged 5 percent cover.

Trifoliate foamflower, twisted stalk, and deerberry are the most common forbs-- all species associated with alluvium. Shield fern is the most common fern, with 7 percent average cover.

Stands are productive, with an average stand height of 153 feet. Structure is varied. Snags comprise only 8 percent of the basal area but are mostly hemlock and spruce, which are valuable for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	27%	94%	Tall blueberry	8%	94%
Sitka spruce	33	100	Salmonberry	5	73
			Devil's club	27	100

Tree Understory			Forbs		
Western hemlock	17	94	Twisted stalk	3	68
Sitka spruce	5	87	Trifoliate foamflower	8	89
			Deerberry	13	63
			Shield fern	7	89

Distribution and Environment

Sitka Spruce/Devil's Club is found on alluvial terraces and fans in the riparian zone. Additionally, it can be found on adjacent footslopes and mountainsides, as well as on uplifted beaches (in late successional stages). Although not well documented, it can also occur on upland sites at higher elevation. Elevations of up to 1,700 feet have been recorded. Sites are clearly well drained.

This habitat is most clearly associated with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5), but is also found with mixed control, moderate gradient channels (types MM1 and MM2) (USDA Forest Service 1992a).

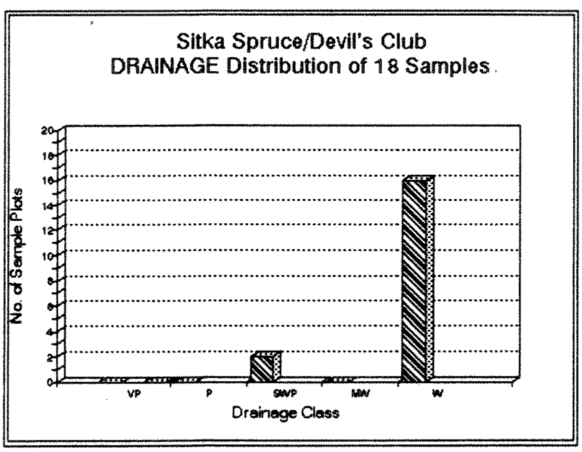


Fig. 89. Drainage Distribution of Sitka Spruce/Devil's Club Sample Plots.

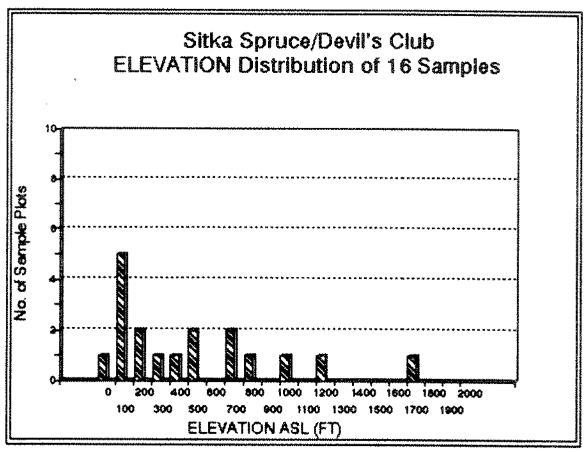


Fig. 90. Elevation Distribution of Sitka Spruce/Devil's Club Sample Plots.

Typical Soils-- Sitka Spruce/Devil's Club

Soil Series	Parent Material	Landform	Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10
Remedios	Colluvium	Hillslopes, Mountainslopes	11
Salt Chuck	Beach Sediment	Uplifted Beach	13

Similar Associations

The Sitka Spruce/Devil's Club association is intermediate in composition between Spruce/Blueberry-Devil's Club and Spruce/Devil's Club-Salmonberry. The difference in composition is related to disturbance frequency, with blueberry indicating a relatively stable environment and salmonberry a more disturbed environment. Spruce/Devil's Club is often found in combination with Spruce/Devil's Club/Skunk Cabbage in braided or former stream channels.

Management Implications

Timber volume of this association is very high, averaging 76,100 bd ft/ac, corresponding to Volume Class 7. By species, 71 percent is Sitka spruce and 29 percent is western hemlock.

Because of current buffer strip requirements, this and other spruce associations are now less likely to be logged than in the past. Sitka Spruce/Devil's Club, however, can be found at the edge of riparian buffers or in clearly upland positions, and may be subject to logging in those locations (BMPs 12.6, 13.16, 13.8).

If logged, yarding systems should be employed to minimize surface soil disturbance, as scarification is likely to lead to invasion by alder or salmonberry. **Planting** of spruce may be appropriate if full stocking of spruce is an objective; **conifer regeneration** can be spotty. Any planting should take place immediately following logging, because the risk of salmonberry expansion/invasion is very real. (BMPs 13.2, 13.7, 13.9, 13.19.)

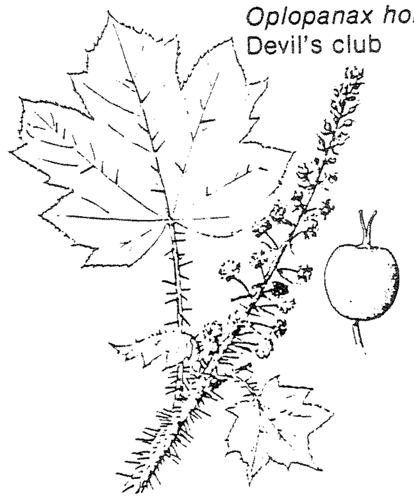
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats. Riparian zones are not considered wetlands, primarily because the soil water environment is aerated, and also because associated vegetation is mostly non-hydric (DeMeo and Loggy 1989). Wetlands can, however, sometimes occur as inclusions within riparian zones.

Value for **deer forage** is moderate-high. Winter range and thermal cover is moderate. **Bears** are common on spruce sites (especially along anadromous streams when salmon are spawning), and use the hollows under trees with buttressed roots as dens.

Trail construction is easy because soil is easily removed, but may need to plan for flooding events. **Road construction** in riparian zones should be minimized. (BMPs 12.4, 12.6, 14.2, 14.3, 16.4.)

Representative Field Locations

Near Ketchikan, the headwaters of the White River along the Brown Mountain road provide examples of this association. On the Thorne Bay District, the proposed Rio Roberts Research Natural Area provides good examples. On the Craig District, Klakas Lake and Big Creek (Cholmondeley Sound) illustrate Spruce/Devil's Club. Trocadero Creek illustrates a second-growth community of this association, as well as destabilization of stream channels that can occur following logging.

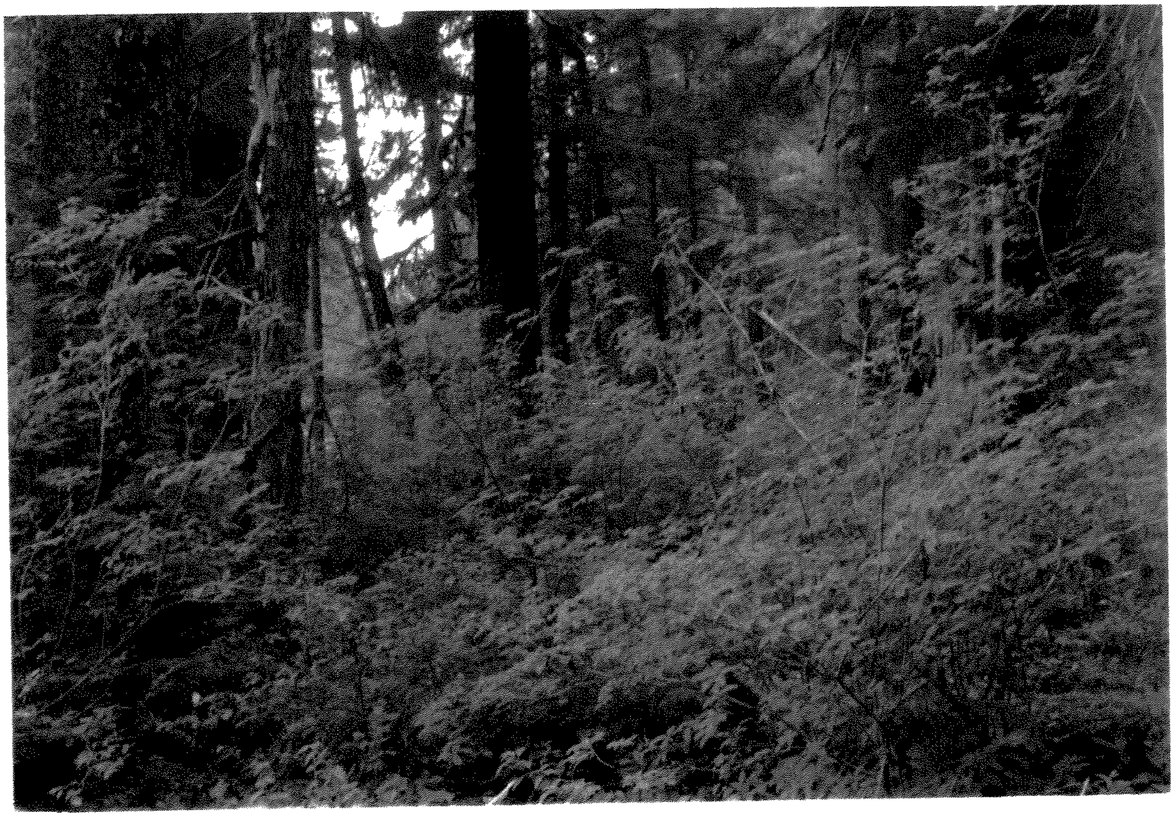


OPHO
Oplopanax horridum
Devil's club

Sitka Spruce/Blueberry

Picea sitchensis/Vaccinium spp.

PISI/VACCI   310



Vegetation

Stands have a relatively closed canopy (average cover 62 percent). Western hemlock cover averages 35 percent and Sitka spruce 31 percent. In the understory, western hemlock is a stronger component (22 percent cover) than Sitka spruce (7 percent).

The shrub layer is dominated by blueberry (25 percent mean cover). Rusty menziesia was found in two thirds of sampled stands. Other shrubs are minor components. In contrast to the Western Hemlock Series, forbs are inconsistently represented in spruce/blueberry, perhaps because of more frequent disturbance events (flooding and windthrow) affecting the forest floor. Twisted stalk, five-leaved bramble, and trifoliate foamflower are the most common, but none of them occurs more than 70 percent of the time. Shield fern is the most common fern, with 77 percent constancy.

Stands are productive, with an average stand height of 134 feet. Structure is varied. Snags are 11 percent of the basal area, and feature hemlock and spruce, which are valuable for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Western hemlock	35%	92%	Blueberry	25%	100%
Sitka spruce	31	100	Rusty menziesia	4	66
			Red huckleberry	4	55
Tree Understory			**Forbs, etc.**		
Western hemlock	22	96	Twisted stalk	2	70
Sitka spruce	7	77	Five-leaved bramble	6	66
			Fernleaf goldthread	4	51
			Shield fern	3	77

Distribution and Environment

Sitka Spruce/Blueberry represents the oldest alluvial terraces (deposits of soil materials from flooding) in a riparian system. Additionally, it can be found on adjacent footslopes and mountainsides. Spruce/blueberry can also occur on clearly upland, non-riparian sites, particularly on karst topography. On these sites, however, western hemlock associations are generally more prevalent.

Sites are moderately to well drained (Fig. 91). Elevation is typically near sea level (Fig. 92), but sites can range up to 1,700 feet.

This habitat is most clearly associated with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5), but is also found with mixed control, moderate gradient channels (types MM1 and MM2) (USDA Forest Service 1992a).

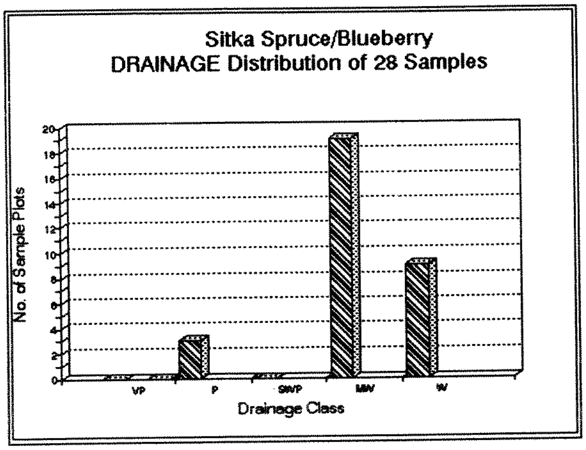


Fig. 91. Drainage Distribution of Sitka Spruce/Blueberry Sample Plots.

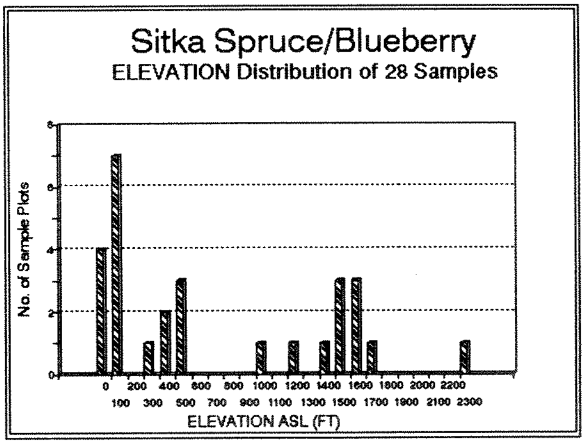


Fig. 92. Elevation Distribution of Sitka Spruce/Blueberry Sample Plots.

Typical Soils-- Sitka Spruce/Blueberry

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10
Remedios	Colluvium	Hillslopes, Mountainslopes	11
Salt Chuck	Beach Sediment	Uplifted Beach	13
Ulloa-Sarkar	Residuum/Colluv.	Sideslopes and ridges	442

Similar Associations

Sitka Spruce/Blueberry is distinguished from other spruce associations by its lack of appreciable devil's club, salmonberry, or alder. It is most like Hemlock/Blueberry/Shield Fern in composition, but shows at least 15 percent overstory spruce. It represents the transition from riparian spruce to upland western hemlock. This transition can be gradual, and this association therefore occurs on a much greater range of landforms and soils than most other spruce associations.

Management Implications

Timber volume of this association is very high, averaging 70,500 bd ft/ac, corresponding to Volume Class 7. By species, 73 percent of sampled stands was Sitka spruce and 27 percent was western hemlock.

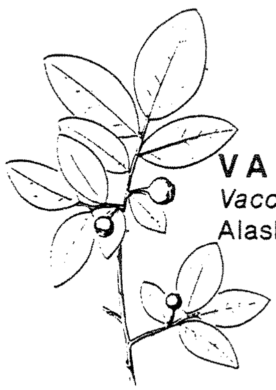
Because of current buffer strip requirements, this and other spruce associations are now less likely to be logged than in the past. Sitka Spruce/Blueberry, however, is most likely to be at the edge of riparian buffers or in clearly upland positions, and may be subject to logging in those locations. (BMPs 12.6, 13.16.)

If logged, yarding systems should minimize surface soil disturbance, as scarification is likely to lead to invasion by alder or salmonberry. **Planting** may be appropriate if full stocking of spruce is an objective. The expected ratio of spruce to hemlock will vary directly with soil scarification, provided the scarification is not extreme. (BMPs 12.6, 13.2, 13.8, 13.9, 13.19.)

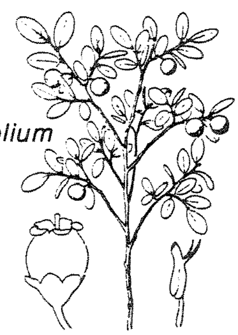
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats. Riparian zones are not considered wetlands, primarily because the soil water environment is aerated, and also because associated vegetation is mostly non-hydric (DeMeo and Loggy 1989).

Value for **deer forage** is moderate to high. Winter range and thermal cover is good. Large trees with abundant limbs intercept snow, and riparian zones are generally close to saltwater and are influenced by warmer ocean temperatures.

Following logging, blueberry cover increases, but forb response is poor (Fig. 93). Spruce sites are poor candidates for canopy gap creation or thinning to induce forage production.



VAAL
Vaccinium alaskaense
Alaska huckleberry



VAPA
Vaccinium parvifolium
Red huckleberry

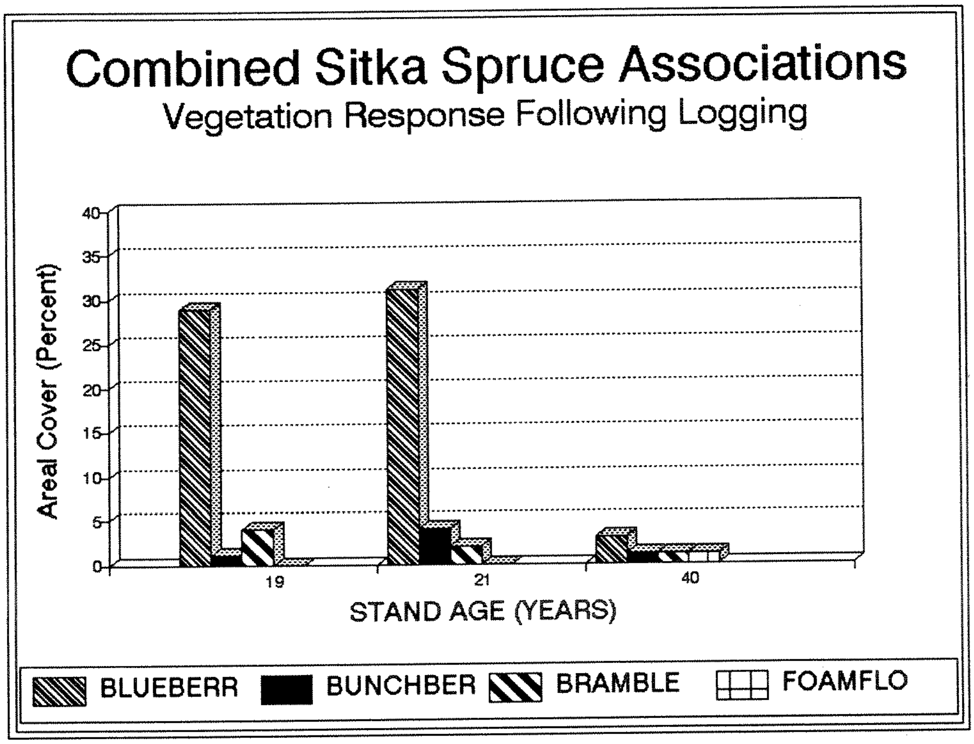


Fig. 93. Combined Sitka Spruce Associations: Vegetation Response Following Logging

Trail construction is easy because soil is easily removed, but may need to plan for flooding events. **Road construction** in riparian zones should be minimized. (BMPs 14.2, 14.3, 16.4, 14.13, 12.4, 12.6.)

Representative Field Locations

Near Ketchikan, the headwaters of the White River along the Brown Mountain road provide examples of this association. On the Thorne Bay District, the Thorne River just north of the Thorne River Bridge provides an example, although the stand is edge now due to road construction. On the Craig District, Goose Bay or the Rock Creek estuary on Polk Inlet can be investigated for examples of this association.

Sitka Spruce/Blueberry-Devil's Club

Picea sitchensis/Vaccinium spp.-Oplopanax horridum

PISI/VACCI-OPHO 320

Vegetation

Stands have a relatively closed canopy (average cover 69 percent). Western hemlock cover averages 39 percent and Sitka spruce 31 percent. In the understory, western hemlock is a stronger component (19 percent cover) than Sitka spruce (3 percent).

The shrub layer is dominated by blueberry (27 percent mean cover) and devil's club (6 percent cover). Other shrubs are minor components. In the forb layer, this association represents a transition from riparian to upland habitats, with emphasis on the latter. Bunchberry, five-leaved bramble, and trifoliate foamflower are the most common forbs. Shield fern is the most common fern.

Stands are productive (127 feet average stand height), but among the lowest in the Sitka Spruce Series. Snags represent 8 percent of basal area and are spruce and hemlock, which are valuable for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Con-stancy
Western hemlock Sitka spruce	39% 31	100% 100	Tall blueberry Devil's club	27% 6	100% 100
Tree Understory			**Forbs**		
Western hemlock Sitka spruce	19 3	100 80	Bunchberry Five-leaved bramble Trifoliate foamflower Shield fern	9 10 2 3	100 100 80 100

Distribution and Environment

Sitka Spruce/Blueberry-Devil's Club represents a transition to upland sites. Accordingly, it is found on a range of landforms similar to that of spruce/blueberry-- footslopes and mountainsides as well as riparian terraces. Karst topography, with its associated hydrology, provides excellent sites for this association as well. Sites are moderately to well drained (Fig. 94). Elevation is typically near sea level (Fig. 95), but sites can range up to 1,700 feet.

This habitat is associated both with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5), and mixed control, moderate gradient channels (types MM1 and MM2) (USDA Forest Service 1992a).

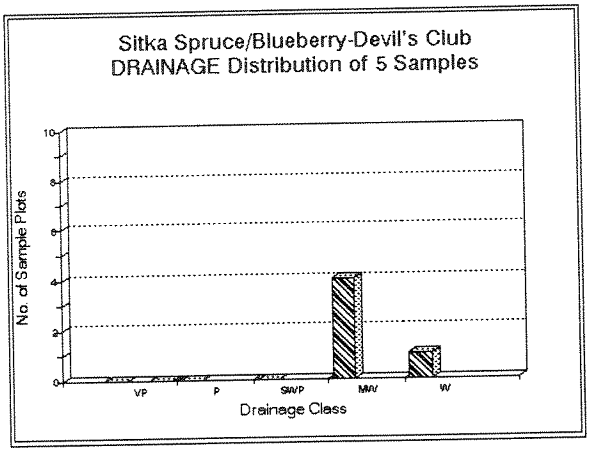


Fig. 94. Drainage Distribution of Sitka Spruce/Blueberry-Devil's Club Sample Plots

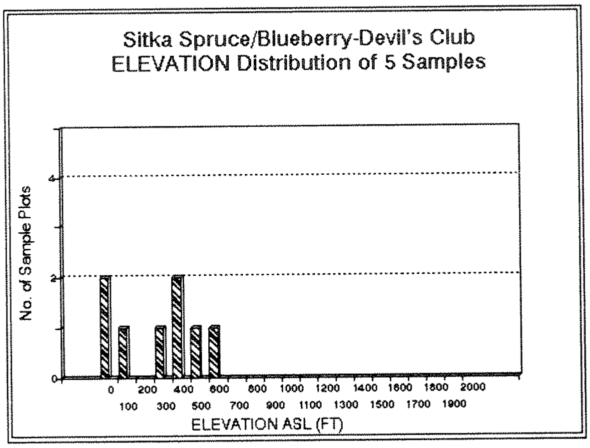


Fig. 95. Elevation Distribution of Sitka Spruce/Blueberry-Devil's Club Plots.

Typical Soils-- Sitka Spruce/Blueberry-Devil's Club

Soil Series	Parent Material	Landform	Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10
Kupreanof	Colluvium	Hillslopes, Mountainslopes	74,75
Vixen	Colluvium of phyllite/schist	Hillslopes, Mountainslopes	1

Similar Associations

Sitka Spruce/Blueberry-Devil's Club is similar to both Spruce/Blueberry and Spruce/Devil's Club. It is more similar to the former, as it represents more of an upland habitat.

Management Implications

Timber volume of this association is high, averaging 65,700 bd ft/ac, corresponding to Volume Class 7. By species, 65 percent is Sitka spruce and 35 percent is western hemlock.

Because of current buffer strip requirements, this and other spruce associations are less likely to be logged now than in the past. Sitka Spruce/Blueberry-Devil's Club, however, may be subject to logging whenit occurs at the edge of riparian buffers or in clearly upland positions (BMPs 12.6, 13.16).

If logged, yarding systems should minimize surface soil disturbance, as scarification is likely to lead to invasion by alder or salmonberry. **Planting** may be appropriate if full stocking of spruce is an objective; **conifer regeneration** can be spotty. If planting is chosen, it should take place immediately after logging (BMPs 13.2, 13.8, 12.6, 13.19).

The graphs presented for Spruce/Blueberry second-growth response will generally be true for this association also.

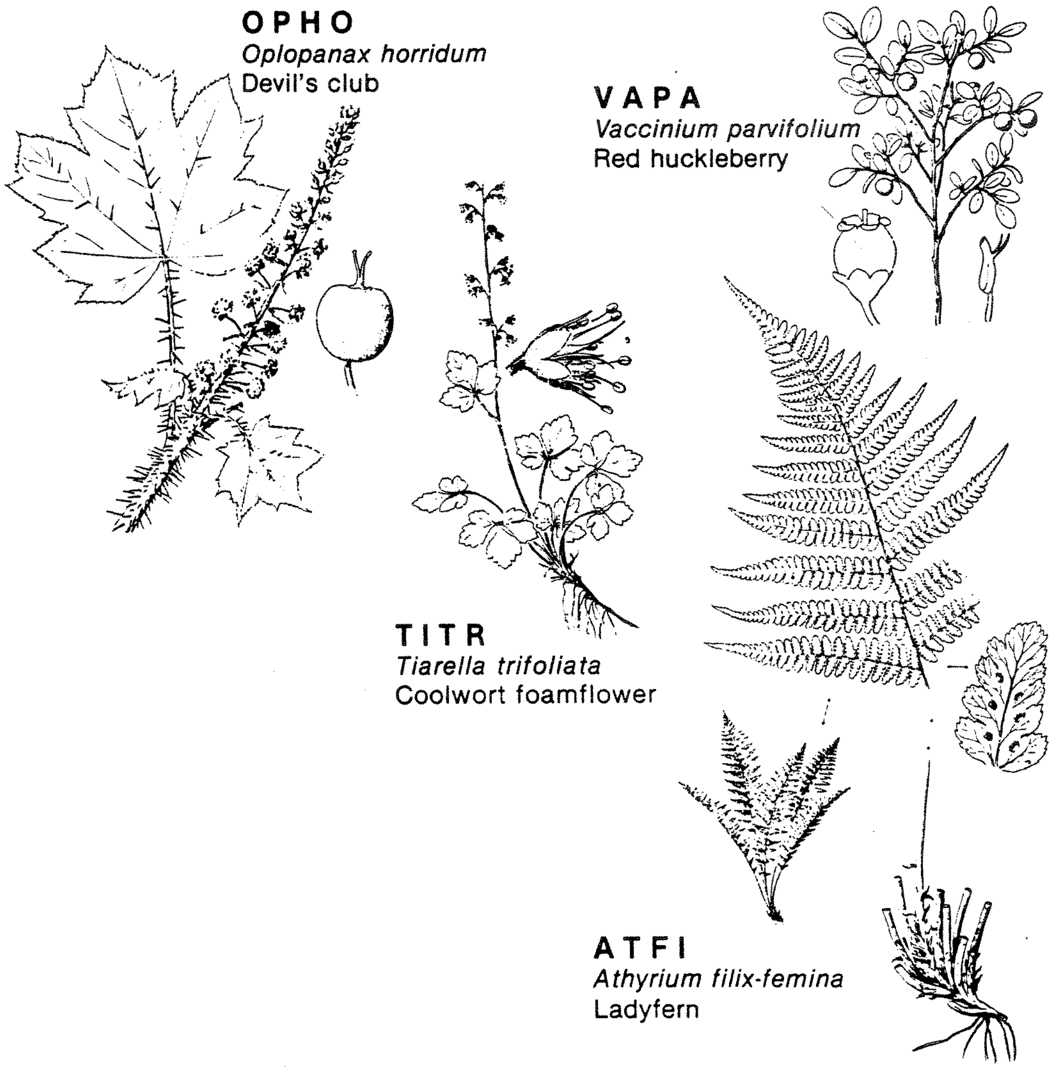
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989) and is seldom associated with wetland habitats.

Value for **deer forage** is high. Winter range and thermal cover are also good. **Bears** are common on spruce sites (especially when salmon are spawning), and use the hollows under trees with buttressed roots as dens. **Birds** correlated with non-riparian old growth (see Ebasco Environmental 1992) can be expected in this association.

Trail construction should be easy. **Road construction** in riparian zones should be minimized. On footslopes (a common location of this association) it is generally acceptable, but hydrology (water accumulating from upslope, and drainage downslope) should be considered. (BMPs 12.4, 12.6, 14.2, 14.3, 14.13, 16.4.)

Representative Field Locations

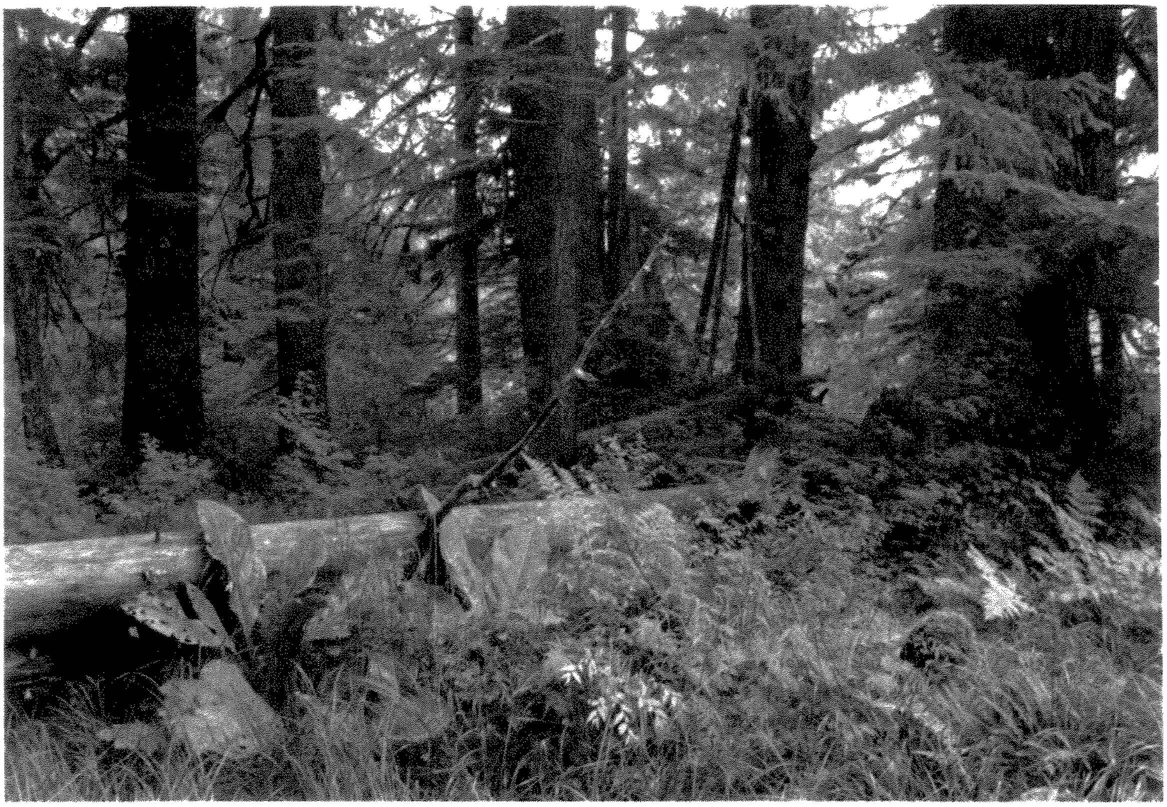
Near Ketchikan, the headwaters of the White River along the Brown Mountain road provide examples of this association. On the Thorne Bay District, the proposed Rio Roberts Natural Area illustrates this habitat. On the Craig District, Goose Bay or the Rock Creek estuary on Polk Inlet can be investigated for examples.



Sitka Spruce/Blueberry/Skunk Cabbage

Picea sitchensis/Vaccinium spp./Lysichitum americanum

PISI/VACCI/LYAM 370



Vegetation

The overstory is dominated by western hemlock (average 31 percent cover) and Sitka spruce (26 percent cover). Red alder or redcedar may occasionally occur. Total overstory cover averages 56 percent.

Understory hemlock averages 16 percent cover. Spruce, when present, averages only 3 percent cover. The shrub layer is characterized by blueberry (20 percent mean cover). Rusty menziesia and salmonberry are common.

Skunk cabbage designates the forb layer and averages 16 percent cover. Bunchberry, five-leaved bramble, and goldthread are common forbs. Oak fern is the most common fern. Sphagnum moss is often present in significant amounts.

Average stand height is 123 feet-- productive, but the lowest in the Sitka Spruce series. Snags are 9 percent of the basal area and feature hemlock and spruce, valuable for cavity nesters.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Con-stancy
Western hemlock Sitka spruce	31% 26	100% 100	Tall blueberry Salmonberry	20% 5	100% 68
Tree Understory			**Forbs**		
Western hemlock Sitka spruce	16 3	93 87	Skunk cabbage Trifoliate foamflower Bunchberry Oak fern	16 3 4 3	100 93 81 100

Distribution and Environment

Sitka Spruce/Blueberry/Skunk Cabbage can be found on a variety of landforms. Floodplains, uplifted beaches (as a late successional stage), and footslopes adjacent to foodplains are the most common sites. This association occurs across all drainage classes and is often complexed with sites supporting Spruce/Devil's Club or Spruce/Blueberry.

Microsite variability is so great that sites are often complexes of two or more soils, with more poorly drained soil in sloughs and backwater areas, and better-drained soil on hillocks. Elevation ranges from near sea level to 1,100 feet, and slopes are gentle to moderate (0-45 percent).

This habitat is often associated with alluvial terraces near low gradient floodplain stream channels (channel types FP3, FP4, and FP5) (USDA Forest Service 1992a).

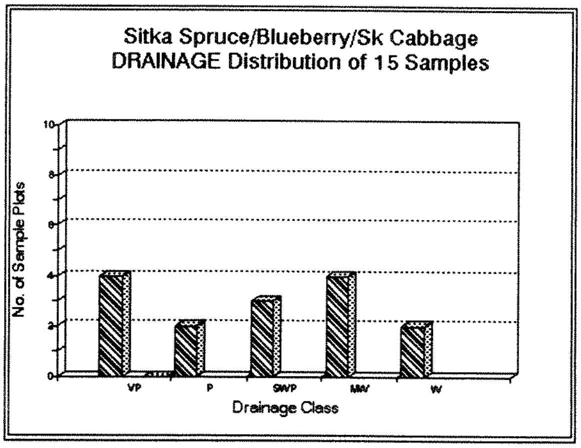


Fig. 96. Drainage distribution of Sitka Spruce/Blueberry-Skunk Cabbage Sample Plots

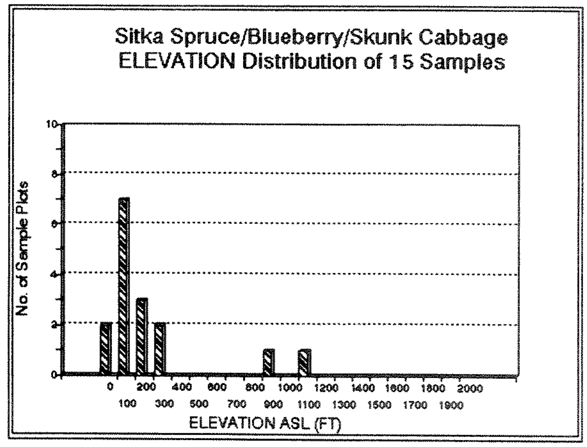


Fig. 97. Elevation Distribution of Sitka Spruce/Blueberry-Skunk Cabbage Plots

Typical Soils-- Sitka Spruce/Blueberry/Skunk Cabbage

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Tuxekan-Tonowek	Alluvium	Fans, Floodplains, Stream terraces	10
Karheen	Organics over Beach Sediments	Uplifted Beaches	61

Similar Associations

Sitka Spruce/Blueberry/Skunk Cabbage is similar to Spruce/Devil's Club/Skunk Cabbage, but has much less devil's club. It is also found on a wider range of sites than Devil's Club/Skunk Cabbage. In vegetative composition and site characteristics, this habitat is most similar to Western Hemlock/Blueberry/Skunk Cabbage.

Management Implications

Timber volume of this association is moderate, averaging 58,900 bd ft/ac, corresponding to Volume Class 7. By species, 64 percent is Sitka spruce and 35 percent is western hemlock. Small amounts of redcedar may be present.

Because of current buffer strip requirements, this and other spruce associations are less likely to be logged now than in the past. Sitka Spruce/Blueberry, however, can occur on non-riparian footslopes. (BMPs 12.6, 13.16.)

If **logged**, yarding systems should be employed to minimize surface soil disturbance. Shovel yarding should be excluded; abundant skunk cabbage is an indicator of soil inclusions that are easily damaged when disturbed. (BMPs 13.2, 13.7, 13.8, 12.6.)

Following logging, expect spotty **conifer regeneration**. Hemlock regeneration is more likely than spruce. Planting is not recommended. Abundant inclusions with skunk cabbage represent poor planting sites.

This is generally a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), but can be associated with wetland habitats. In site-specific cases, it may meet the criteria for wetland designation, but usually the vegetation is largely non-hydric.

Value for **deer forage** is moderate to high. Winter range and thermal cover is moderate. **Bears** will eat the tubers of skunk cabbage.

Road construction should avoid riparian zones where possible. **Trail construction** may require use of boardwalk. (BMPs 12.4, 12.6, 14.2, 14.3, 14.13, 16.4.)

Representative Field Locations

On Revillagigedo Island, the Naha River system provides good examples of this association. On Prince of Wales Island, try Logjam Creek on the Thorne Bay District and Big Creek (Cholmondeley Sound) on the Craig District.

Sitka Spruce/Pacific Reedgrass

Picea sitchensis/Calamagrostis nutkatensis
PISI/CANU 360

Vegetation

Sitka Spruce/Pacific Reedgrass is a beach fringe habitat most common on exposed, rocky headlands. Its vegetative composition is quite different from other spruce associations, reflecting the unique high light, high exposure sites it occurs on.

Stands are open and park-like, with only 44 percent average stand cover. Overstory is clearly spruce, with only 8 percent average hemlock cover present.

Unlike other spruce sites, the understory is dominated by grasses, primarily Pacific reedgrass (10 percent cover). Deerberry (false lily-of-the-valley) is prominent, with 24 percent average cover. Deerberry is most common in environments associated with disturbance, such as alluvial (riparian) zones and beach fringes.

Shrubs are generally inconspicuous. Blueberry, rusty menziesia, and salal may be present, but usually only in small amounts.

Stand height averages 115 feet, lowest of any in the spruce series. Productivity is often limited by shallow soil. Constant buffeting of winds leads to frequent tree stem breakage, also limiting productivity.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Con-stancy
Western hemlock Sitka spruce	8% 39	60% 100	Tall blueberry Salal	1% 1	60% 40
Tree Understory			**Forbs, etc.**		
Western hemlock Sitka spruce	12 5	60 80	Deerberry Pacific reedgrass	24 10	100 100

Distribution and Environment

Sitka Spruce/Pacific Reedgrass occurs on coastal landforms: uplifted beaches, and rocky platforms and headlands. It may also occur on alluvial material at estuary fringes. Soils are well drained but often skeletal. Surface boulders or rock outcrops are common. **Sites are always near or adjacent to saltwater**.

Typical Soils-- Sitka Spruce/Pacific Reedgrass

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Karheen	Organics over beach sediment	Uplifted Beach	61
Salt Chuck Tonowek	Beach Sediment Alluvium	Uplifted Beach Floodplains, Alluvial Fans	13 10

Similar Associations

Among forested habitats, this association is unique because of its consistent association with saltwater. Stands are distinctly open and the trees notably smaller in diameter than in other spruce associations. This is the only forested plant association characterized by abundant grass cover. (Some mixed conifer and shore pine associations have significant amounts of sedges.) It is likewise the forested plant association with the least shrub development.

Management Implications

Timber volume of this association is high, averaging 50,900 bd ft/ac, corresponding to Volume Class 7. (This is lower than any riparian spruce association, however.) By species, 93 percent is Sitka spruce and 6 is western hemlock, with trace amounts of red alder. The preponderance of spruce illustrates the frequent disturbance characteristic of this association.

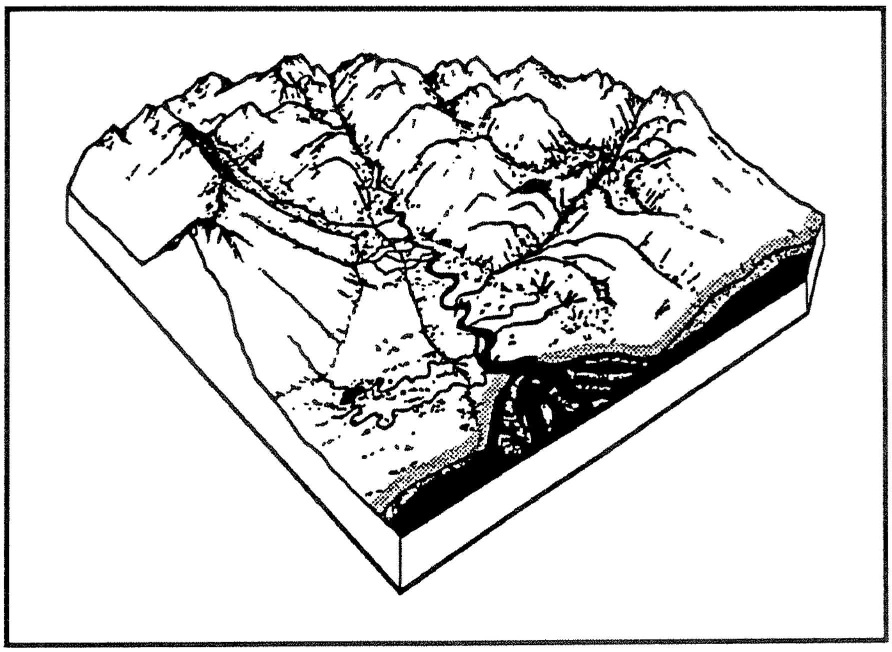
Beach fringe areas on National Forest System lands typically receive protection 500 feet from salt water, in order to preserve **bald eagle** nests and maintain **visual** appearance. Eagle nests are very common in this habitat.

This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), but may sometimes be associated with estuaries. **Trail construction** is easy (BMPs 14.2, 14.3, 16.4).

Representative Field Locations

This association is rare near Ketchikan, because of the protected nature of the coastline. Exposed areas near Point Alava would be the most likely locations. Near Thorne Bay, a good example at Sandy Beach is within easy driving distance.

On the Craig District, most examples are remote. Many of the inlets in the vicinity of the South Prince of Wales Wilderness will provide examples, as will Veta Bay on Baker Island.



Most common landscape position(s) of the Sitka Spruce/Pacific Reedgrass association.

Sitka Spruce-Mountain Hemlock/Blueberry

Picea sitchensis-Tsuga mertensiana/Vaccinium spp.

PISI-TSME/VACCI 390

Vegetation

Stands show great variety in overstory cover and vertical structure. Canopy cover averages 56 percent. Mountain hemlock and Sitka spruce share the overstory, with an average of 30 percent and 18 percent, respectively. Western hemlock may often be present, but other conifers are uncommon.

Mountain hemlock is always present in the understory, and averages 7 percent cover. Western hemlock is common and averages 11 percent. In contrast, Sitka spruce averages only 2 percent understory cover.

The shrub layer is dominated by blueberry, with an average of 31 percent cover. Other shrubs are much less significant. Rusty menziesia is the only other shrub that occurs more than half of the time, and averaged only 3 percent in sample plots.

Because this association is found in the transition from the Western Hemlock to the Mountain Hemlock Ecological Zones, alpine vegetation-- such as low shrubs and false hellebore-- can be evident, along with species more characteristic of midslope forests. Five-leaved bramble, goldthread, twisted stalk, foamflower, and twayblade are the most common forbs. Forb diversity overall is high. Ferns are less abundant than in other forested series, but deer fern is usually present and averages 3 percent cover.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Con-stancy
Mountain hemlock	30%	100%	Tall blueberry	31%	100%
Sitka spruce	18	100	Rusty menziesia	3	57
Western hemlock	20	64			

Tree Understory			Forbs		
Mountain hemlock	7	100	Five-leaved bramble	7	92
Western hemlock	11	71	Goldthread	6	78
Sitka spruce	2	92	Twisted stalk	3	78
			Foamflower	3	71
			False hellebore	3	50

Distribution and Environment

This association is most common on smooth upper mountain shoulders around 1,500 feet. Soils are most often moderately well drained (Fig. 98). Sites are most often encountered in the transition from the mountain hemlock zone to the western hemlock or hemlock-yellowcedar series, but can also occur well within the mountain hemlock zone.

Sitka spruce is an indicator of disturbance, and this association is frequently found along small streams. Windthrow can also be a factor affecting spruce abundance. Cold soil and air temperatures also affect the composition of this association.

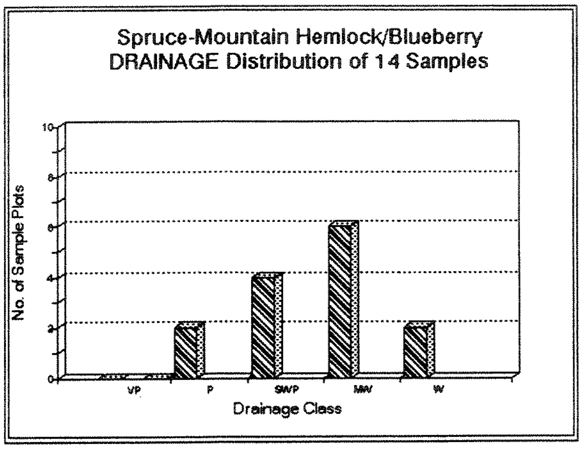


Fig. 98. Drainage Distribution of Spruce-Mountain Hemlock/Blueberry Sample Plots

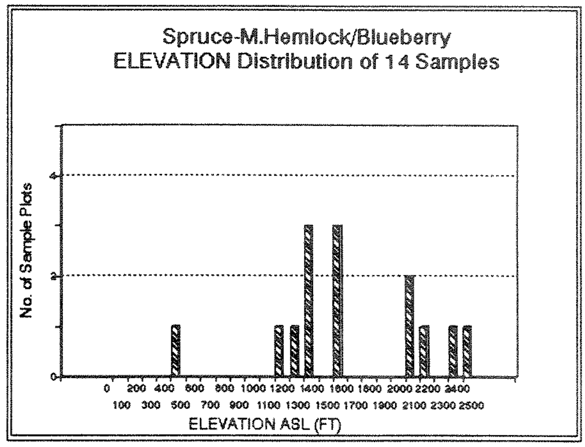


Fig. 99. Elevation Distribution of Spruce-Mountain Hemlock/Blueberry Sample Plots.

Typical Soils-- Sitka Spruce-Mountain Hemlock/Blueberry Association

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Remedios	Colluvium	Upper Slopes	11
Helm/Granitic	Residuum/ Colluvium	Upper Slopes	19,63

Similar Associations

This association is quite different from low elevation spruce sites, and can be distinguished by abundance of mountain hemlock. Note, however, that this association can sometimes be found at lower elevations when beavers are active. Beavers use the stems of western hemlock saplings but avoid those of mountain hemlock; over time, mountain hemlock replaces western hemlock on the site. This phenomenon has been observed along the headwaters of the White River near Ketchikan, as well as elsewhere (observations of Stikine Area wildlife biologist Gene Degayner).

Management Implications

Timber value of this association is moderate to high, averaging 36,700 bd ft/ac (Volume Class 6). Timber volume estimates from 15 sampled stands range from 13,400 to 62,500 bd ft/ac. By species, 50 percent is combined mountain and western hemlocks, and 50 percent is Sitka spruce. Spruce makes up much less of the stand volume than in riparian spruce associations, which typically average 70 percent spruce by volume.

Sitka Spruce-Mountain Hemlock/Blueberry sites have seldom been selected for logging in the past, because they occur at higher elevations. Higher elevation sites are now receiving increased attention and being selected for harvest. This is not only due to depletion of lower elevation timber, but also to projected deer habitat requirements in retained old-growth blocks at low elevation.

If this association is selected for logging, careful design of **logging systems** is essential. Soil mass movement is a potential concern. (BMPs 13.2, 13.9, 13.5.)

Documentation on **conifer regeneration** for this association is unknown. Colder temperatures will inhibit conifer growth. Sitka spruce would presumably respond well to soil disturbance. Invasion or expansion of salmonberry, so characteristic of low elevation riparian spruce response, may be inhibited by colder temperatures here. (BMP 13.19.)

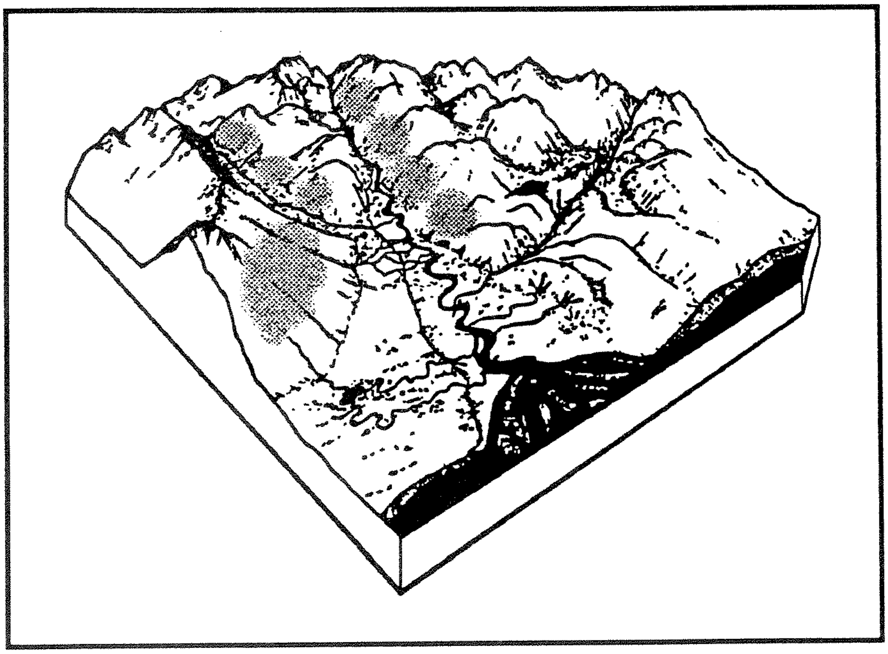
This is a **non-wetland** association (Interagency Committee 1989, DeMeo and Loggy 1989), and is usually not associated with wetlands.

Value for **deer** summer range is high. Abundant blueberry, as well as a wide range of forbs, characterize sites. Thermal cover is adequate, but because this association occurs at higher elevations, it is unlikely to be of use in the winter, when thermal cover is most critical.

Trail construction will not require extensive excavation. **Road construction** will need to consider mass movement concerns. (BMPs 14.2, 14.3, 16.4, 14.7.)

Representative Field Location

Near Ketchikan, the headwaters of the White River, along the Brown Mountain Road, provide the "beaver-induced" example mentioned above (see **Similar Associations**). Known locations on Prince of Wales Island require helicopter access.



Most common landscape position(s) of the Sitka Spruce-Mountain Hemlock/Blueberry association.

Sitka Spruce-Mountain Hemlock/Blueberry/Marsh Marigold

Picea sitchensis-Tsuga mertensiana/Vaccinium spp./Caltha biflora

PISI-TSME/VACCI/CABI 391

Vegetation

Stands show great variety in overstory cover and vertical structure. Canopy cover averages 58 percent. Mountain hemlock and Sitka spruce share the overstory, with an average of 33 percent and 15 percent, respectively. Other conifers are uncommon.

Mountain hemlock is usually present in the understory, and averages 17 percent cover. Western hemlock, uncommon in the overstory, is common here, and averages 15 percent cover. Western hemlock is limited by cold temperatures in this association, and may require an overstory to ameliorate air temperatures. Sitka spruce is also common in the understory, but averages only 4 percent cover.

The shrub layer is dominated by blueberry, with an average of 48 percent cover. Rusty menziesia is common, and averages 6 percent cover. Marsh marigold designates the association, and averages 11 percent cover. Five-leaved bramble is consistently present and averages 11 percent cover. Other common forbs are goldthread, twisted stalk, and false hellebore. Bunchberry, the most common forb in many associations, occurred in only two thirds of sample plots. Like western hemlock, it is probably temperature limited here.

Characteristic Species

Tree Overstory	Mean Cover	Constancy	Shrubs	Mean Cover	Constancy
Mountain hemlock	33%	100%	Tall blueberry	48%	94%
Sitka spruce	15	100	Rusty menziesia	6	72
Western hemlock	19	38			
Tree Understory			**Forbs**		
Mountain hemlock	17	94	Five-leaved bramble	11	100
Western hemlock	15	72	Goldthread	7	77
Sitka spruce	4	83	Twisted stalk	3	77
			Marsh marigold	11	100
			False hellebore	4	83

Distribution and Environment

This association is most common on upper hill- and mountainslope positions above 1,500 feet elevation (Fig. 101). Sites have been recorded as high as 2,900 feet. This association is nearly always within the Mountain Hemlock Ecological Zone. Soils are most often somewhat poorly or moderately well drained. Marsh marigold indicates restricted drainage, occupying a niche similar to that of skunk cabbage at lower elevations. This association represents a soil mosaic of both water movement (as indicated by spruce) and water collection (as indicated by marsh marigold).

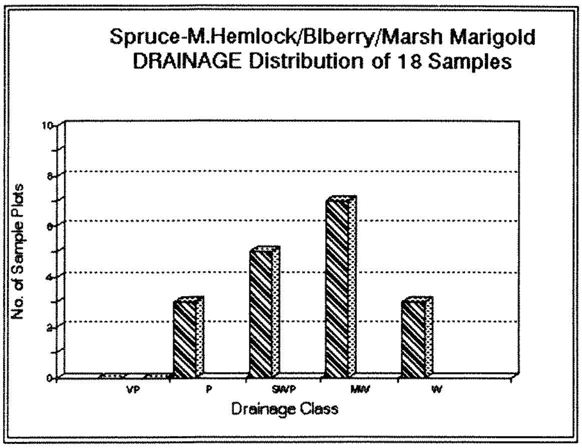


Fig. 100. Drainage Distribution of Spruce-Mountain Hemlock/Blueberry/ Marsh Marigold Sample Plots

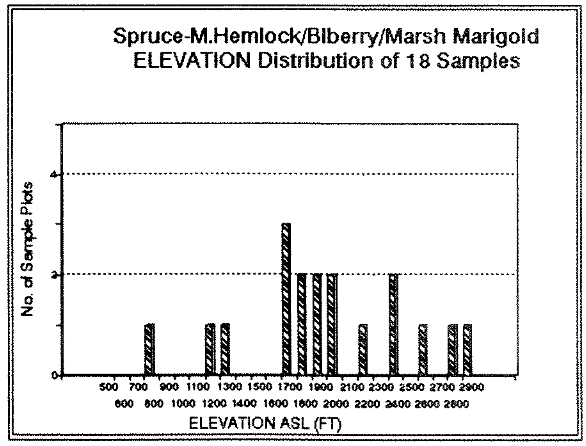


Fig. 101. Elevation Distribution of Spruce-Mountain Hemlock/ Blueberry/Marsh Marigold Sample Plots

Typical Soils-- Sitka Spruce-Mountain Hemlock/Blueberry/ Marsh Marigold Association

Soil Series	Parent Material	Landform	Most Common Soil Map Units
Traitors	Colluvium	Upper Slopes	2,6
Waterfall	Residuum/ Colluvium	Upper Slopes	19,63
Tolstoi	Colluvium	Hill- and Mountain Slopes	35

Similar Associations

This association is similar to Sitka Spruce/Mountain Hemlock/Blueberry, but occurs at higher elevations and can approach the alpine. Its soil drainage tends to be poorer than the blueberry association, and productivity is correspondingly less. It is distinguished by the presence of a minimum 3 percent marsh marigold cover.

Marsh marigold is often confused with deer cabbage, a designator for associations in the Mixed Conifer Series. It is distinguished from deer cabbage by the lack of notched leaves and by single, rather than multiple, flower stalks on individual plants (DeMeo et al. 1990). The two species often occur together.

Management Implications

Timber value of this association is low-moderate, averaging 21,500 bd ft/ac (Volume Class 5). By species, 70 percent is combined mountain and western hemlocks, 25 percent is Sitka spruce, and 5 percent is yellowcedar.

Sitka Spruce-Mountain Hemlock/Blueberry sites have seldom been selected for logging in the past, because they occur at higher elevations. Higher elevation sites are now receiving increased attention and are being selected for harvest, however. This is due not only to depletion of lower elevation timber, but also to projected deer habitat requirements in retained old-growth blocks at low elevation. However, high elevation, low timber productivity, and soil stability concerns will probably preclude selection of these sites for **logging**. (BMPs 13.1, 13.2, 13.5.)

Documentation on **conifer regeneration** for this association is unknown. Colder temperatures will inhibit conifer growth. Sitka spruce would presumably respond well to soil disturbance. Invasion or expansion of salmonberry, so characteristic of low elevation riparian spruce response, will probably be inhibited by colder temperatures here. (BMP 13.19.)

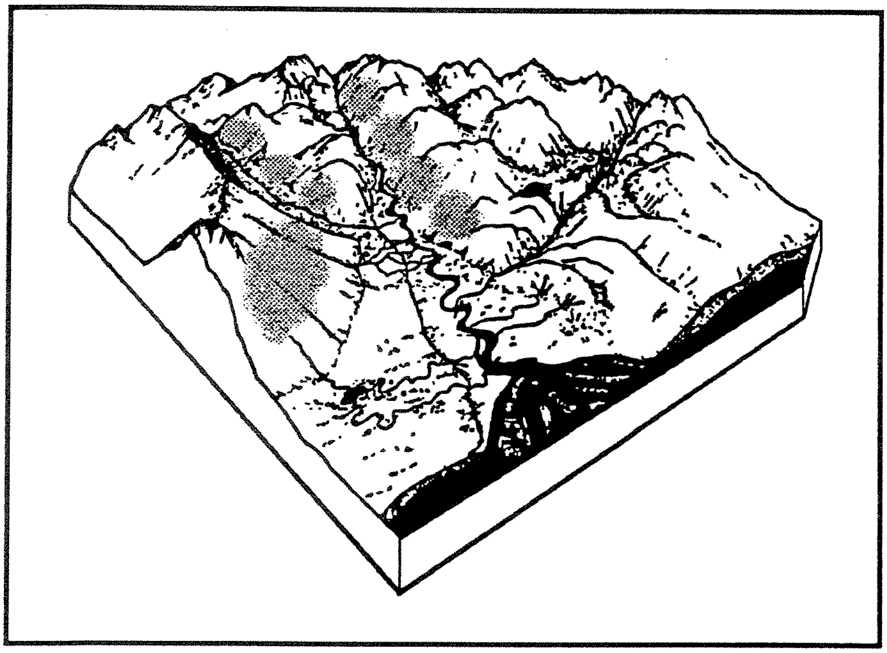
Wetlands status (Interagency Committee 1989, DeMeo and Loggy 1989) for this association has not been determined. Because marsh marigold is an obligate wetland plant (Reed 1988), however, this association would be a likely candidate. In any case, wet unstable soils typical of this association present a concern. Care should be taken when management activities occur in wetland areas (BMPs 12.5, 13.15).

Value for **deer** summer range is high. Abundant blueberry, as well as a wide range of forbs, characterize sites. Thermal cover is adequate, but because this association occurs at higher elevations, it is unlikely to be of use in the winter, when thermal cover is most critical.

Trail construction will need to consider soil drainage and stability. **Road construction** plans should consider mass movement concerns. (BMPs 14.2, 14.13, 14.7, 16.5.)

Representative Field Locations

No examples of this association easily accessible by roads have been documented.



Most common landscape position(s) of the Sitka Spruce-Mountain Hemlock/Blueberry/Marsh Marigold Association.

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10
BIODIVERSITY ASSESSMENT

Evaluating Biodiversity

Biodiversity encompasses the full variety of life, including variation in structure, composition, and function at scales from genetic to landscape (Hunter 1990, Hughes and Noss 1992). The table below illustrates these elements and provides examples for Southeast Alaska.

The task of analyzing diversity, let alone implications of resource management on it, is overwhelming. Traditional approaches at assessing diversity have focused on tallies of or variation in the number of species. (This is known as a "fine filter" approach.) Even if a tally of all species were considered necessary, it would be technically impossible to accomplish (Hunter 1990). In part this is because assessing differences in species counts is full of statistical pitfalls that can lead to incorrect interpretations (Boyle et al. 1990). Perhaps the worst defect of a species-only focus is that it can ignore important aspects of ecosystem structure and function. For example, the number of species in an area can remain static even while ecosystem structural and functional diversity deteriorate (Hughes and Noss 1992). Typically, this is the greatest concern in plans dealing with forest management. Our responsibility is not to maximize diversity, but to maintain critical ecosystem functions.

Fortunately, a "coarse filter" approach is gaining acceptance as the most meaningful and technically feasible method of assessing biodiversity for planning documents. Assessment and conservation at the landscape, ecosystem, and community levels is emphasized (Noss 1990, USDA Forest Service 1992b). Using Geographic Information Systems (GIS) now available, these scales of biodiversity can be mapped, and changes following management activities portrayed. It is thought that conservation of functioning ecosystems will imply conservation of the suite of species associated with them. This approach is supported by administrative direction, as the planning regulations associated with biodiversity (36 CFR 219) are undergoing revision to reflect an ecosystem rather than individual species focus.

This in no way implies that individual species are unimportant. Rare species can be identified, along with the communities that support them (USDA Forest Service 1992b).

Components of Biodiversity at Varied Scales, With Examples for Southeast Alaska (after Noss 1990).

Component	Scale	Example
Compositional	Landscape Types	Interior old-growth habitat distribution across a landscape (gamma diversity)
	Communities, Ecosystems	Variation from one community to another (beta diversity)
	Species, Populations	Plant species richness (number of species)
Structural	Landscape Patterns	Differences in canopy structure by ecological zone
	Habitat	Variation in snag characteristics by plant association
	Population	Tree diameter class distribution by species
	Genetic	How closely tree form is influenced by genetics
Functional	Landscape Processes and Disturbances, Land-Use Trends	Depauperate understories in some locations because of deer browsing
	Interspecific Actions	Role of mycorrhizae in tree nutrient uptake
	Life Histories	Coho salmon require backwater sloughs as rearing habitat

As an introduction to biodiversity assessment, the objective of this chapter is **to assess plant species and structural diversity** among a range of plant associations. It can be considered an initial effort to identify habitats with high diversity and relate this to ecosystem factors, such as light availability, soil drainage, and frequency of soil disturbance. **The ultimate goal of the work is to provide managers in silviculture, wildlife, planning, and other disciplines with concise guidelines for ranking areas by diversity. While valuable in itself, these diversity indices will also apply to wildlife habitat needs, definition of desired future conditions, etc.**

This chapter provides a brief introduction to diversity concepts using plant associations. Plant species and tree structural diversity will be assessed as examples. This is in no way a comprehensive biodiversity assessment. It is expected this chapter will be expanded in subsequent revisions.

Plant Species and Structural Diversity

Ecologists have devised a number of mathematical ways to describe diversity (Magurran 1988). This section describes within-community (alpha) plant diversity for forested associations on the Ketchikan Area. **Plant species and stand structure** (distribution of tree size classes) are assessed.

To describe species diversity, the terms **richness, dominance**, and **evenness** will be used. **Richness** is simply the average number of vascular plant species present on 500-square-meter sample plots.

Dominance is an expression of the very abundant plant species in a sample. Open, park-like habitats usually show greater dominance than a closed-canopy forest, because a greater number of species can become abundant on open sites.

Evenness is a measure of how consistently plant species appear on sample plots of the same association.

In addition to species diversity, methods are being developed to describe **structural diversity**. Structure refers to the vertical arrangement of plants in an ecosystem. For the purposes of this section, structure refers to the distribution of tree sizes using diameters at breast height (dbh). Assessment of structure is important because it facilitates vital ecosystem functions (e.g., amelioration of microclimate, woody debris input, etc.) and relates to suitability of wildlife habitat (e.g., snags for cavity nesting birds, large trees for deer thermal cover, etc.). Forests that are more structurally diverse provide more niches for plants and animals (Hunter 1990).

Methods

Since 1986, nearly 1,000 vegetation/soils/timber reconnaissance plots have been collected on the Ketchikan Area. Resulting data, in addition to their primary purpose of building a plant association classification, have been used for a variety of applications. Because the plots are large (each is 500 square meters in area), vegetation data (plant percent areal cover) is ideal for analyses of species diversity. Additionally, each plot is associated with a variable plot timber tally. These data are useful for assessing structural diversity.

Data for 10 randomly selected sample plots of each plant association were analysed. Using the same number of sample plots for each association avoids the potential problem of species richness increasing with sample size.

Analysis of species diversity was performed using the HILL computer programs, developed by Mark Hill of Cornell. The version used was in the form of a software package developed by Brad Smith of the Okanogan National Forest. Mathematically, species richness is simply the average number of vascular plant species per plot. Dominance is a measure of the abundances of the most common species (Southwood 1978, Magurran 1988). Evenness describes how evenly the abundances are distributed among the species.

Results

As Fig. 102 illustrates, species richness is generally higher on sites with lower canopy cover. Lower average canopy cover (X-axis) is correlated with higher light availability for understory vegetation. Open, poorly drained sites (shore pine and mixed conifer associations at left of figure) and sites designated by skunk cabbage (see plant association code list at the beginning of this text) have the greatest number of vascular plant species. In Southeast Alaska, open habitats show more species, even though they are less productive because of poor drainage. This is partially attributable to increased light availability, allowing great niche differentiation. With an average 300+ cloudy days per year, light is a critical limiting factor in Southeast Alaska ecosystems.

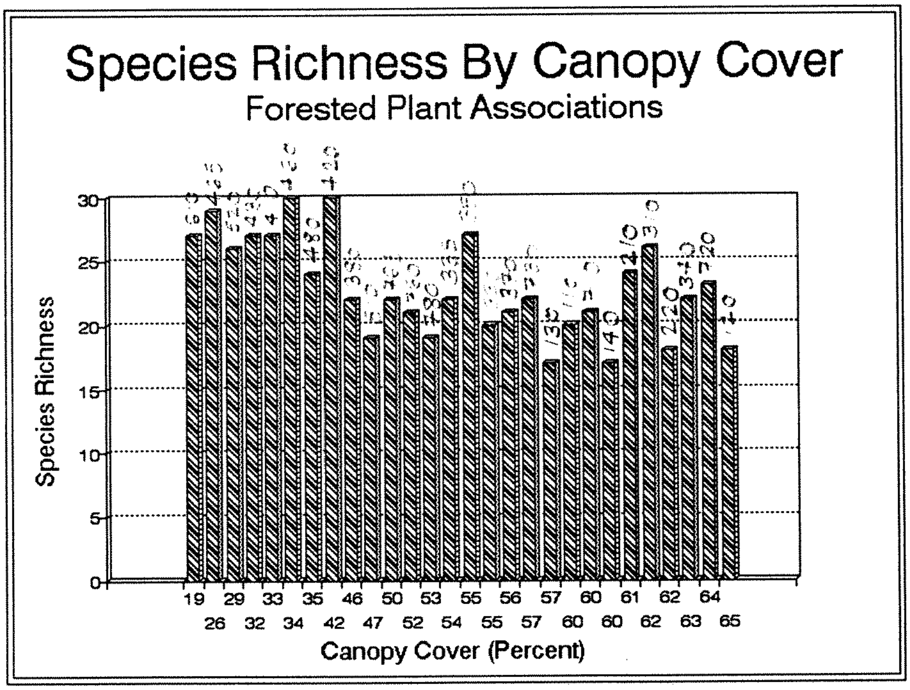


Fig. 102. Species Richness (no. of vascular plant species) of Forested Plant Associations by Canopy Cover. Sample size for each association = 10. Numeric codes refer to plant associations.

Fig. 103, a view of dominance (the most abundant species) reinforces the interpretations of Fig. 102.

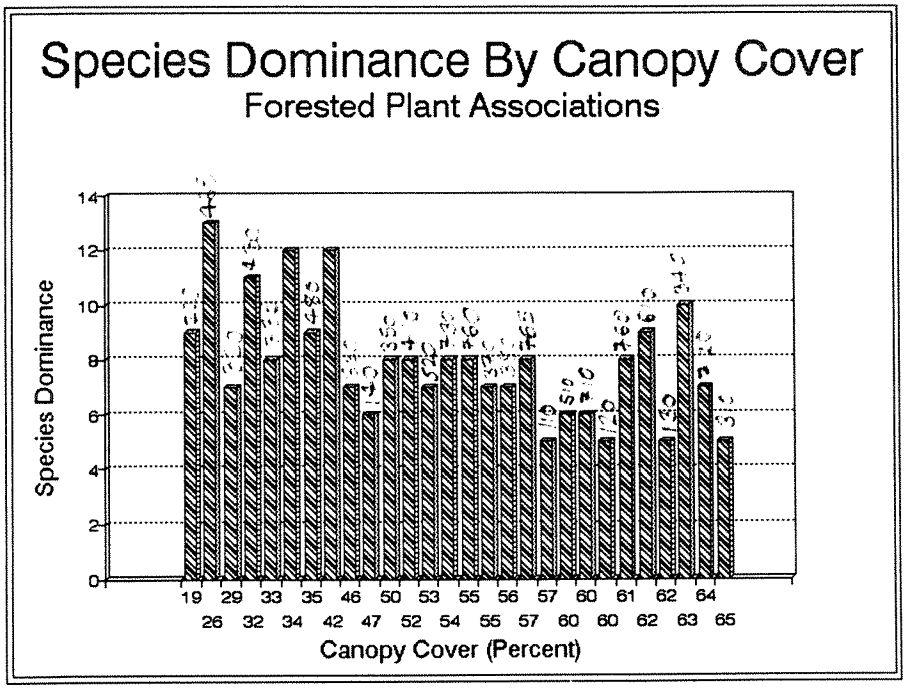


Fig. 103. Species Dominance by Canopy Cover, Forested Plant Associations. Sample size for each association = 10. Numeric codes refer to plant associations.

Species evenness, the variation of species distributions within individual plant associations is remarkably even on the Ketchikan Area, as illustrated in Fig. 104.

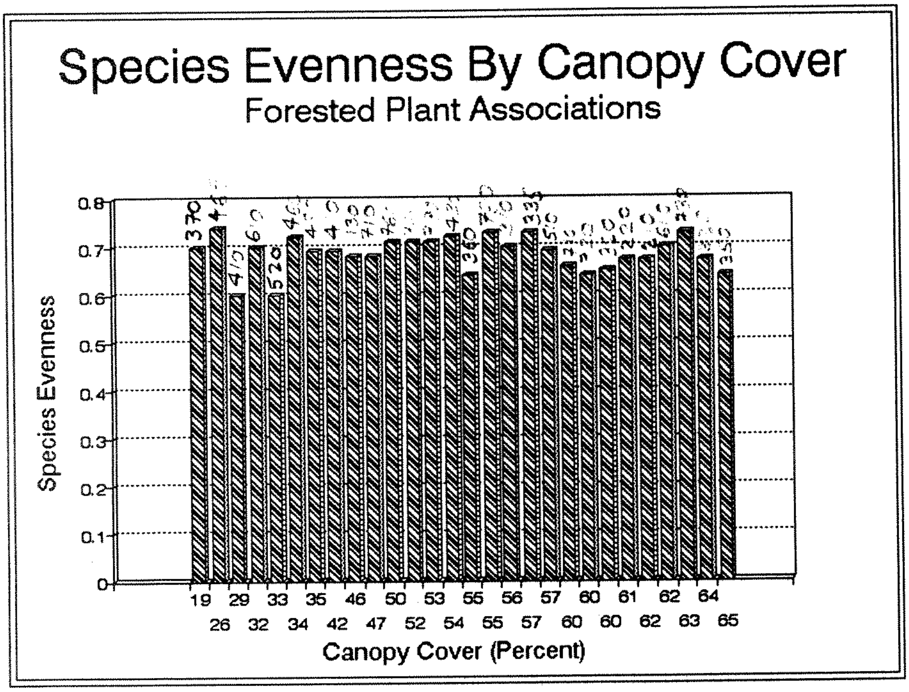


Fig. 104. Species Evenness by Canopy Cover, Forested Plant Associations. Sample size for each association = 10. Numeric codes refer to plant associations.

In Fig. 105 (as well as Figs. 106 and 107), associations are grouped by understory plant indicator. Plant associations characteristic of lower site productivity (muskeg, salal, and skunk cabbage) have greater species diversity (see Fig. 102). Those characteristic of frequent soil disturbance by water movement (devil's club and salmonberry) also show high diversity. Those characterized by blueberry designate relatively stable, productive sites where overstory conifers dominate with greater canopy cover.

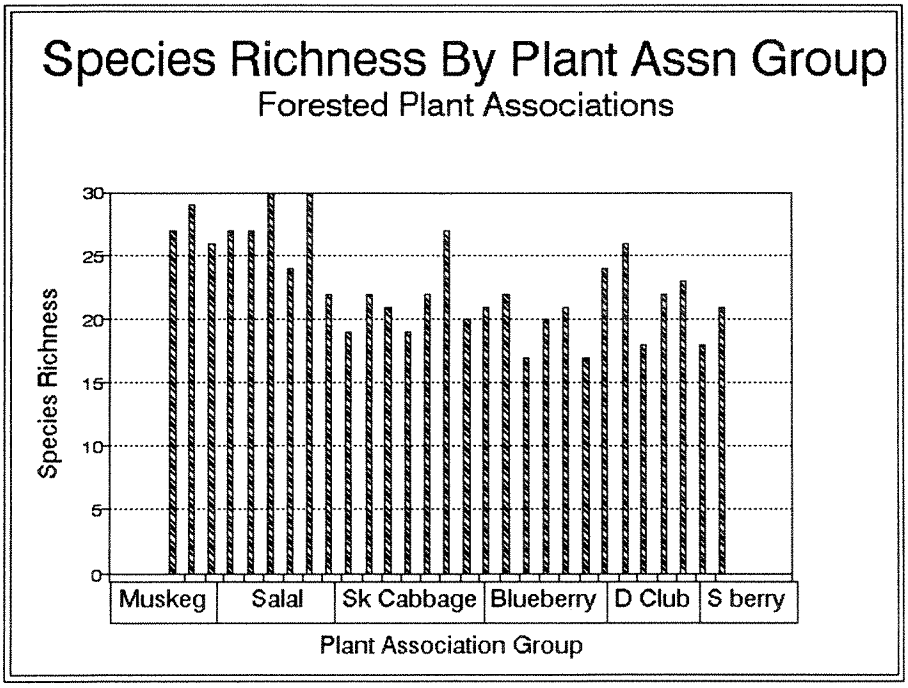


Fig. 105. Species Richness by Plant Association Group. Sample size for each plant association = 10.

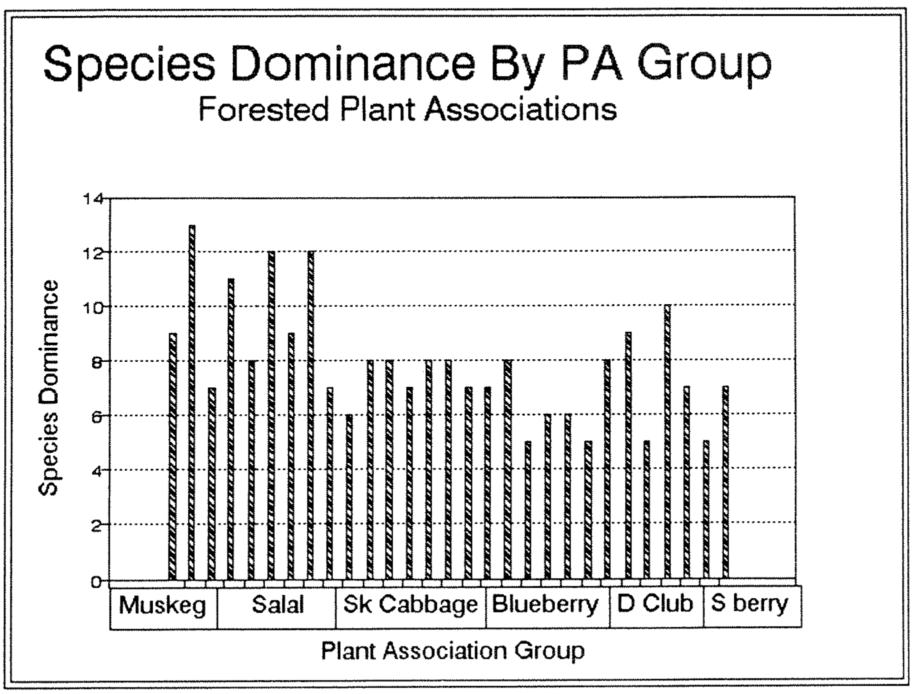


Fig. 106. Species Dominance by Plant Association Group. Sample size for each plant association = 10.

In Fig. 107 (species evenness by plant association group), note that some salal associations show less than the general trend. This may be due to the nature of salal to form dense shrub layers on shallow soils, particularly on southern Prince of Wales Island.

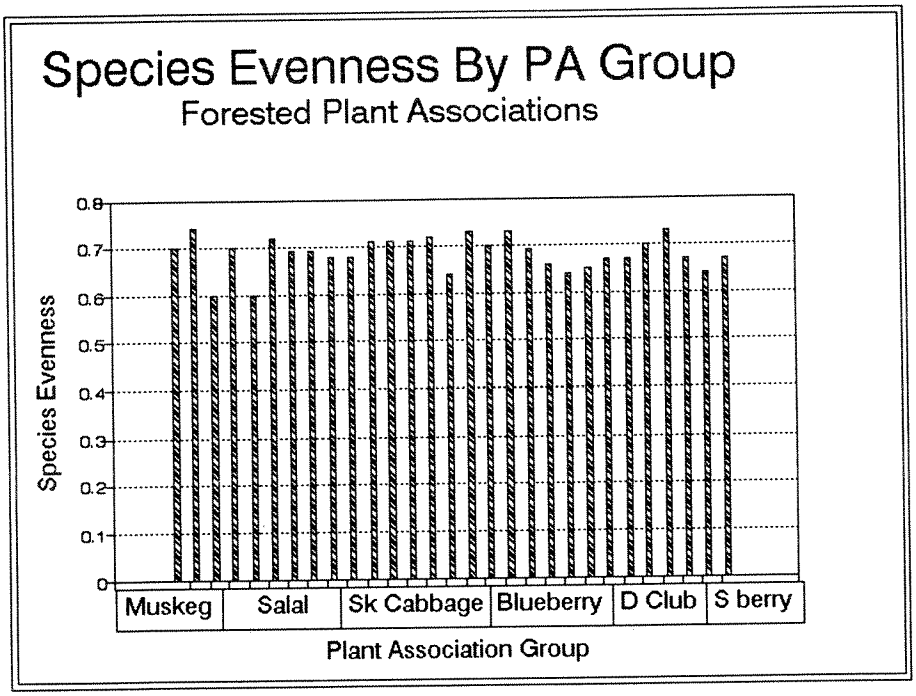


Fig. 107. Species Evenness by Plant Association Group. Sample size for each plant association = 10.

Poorly drained, less productive sites, such as this Mixed Conifer association, exhibit high species diversity. Open, park-like conditions and higher light availability correlate with a wider range of species.

Figs. 108 through 110 illustrate structural diversity of the forest overstory. In Fig. 108, illustrating the number of tree diameter classes, the associations shown are arranged in order of increasing productivity and frequency of soil disturbance. More productive associations exhibit greater structural diversity.

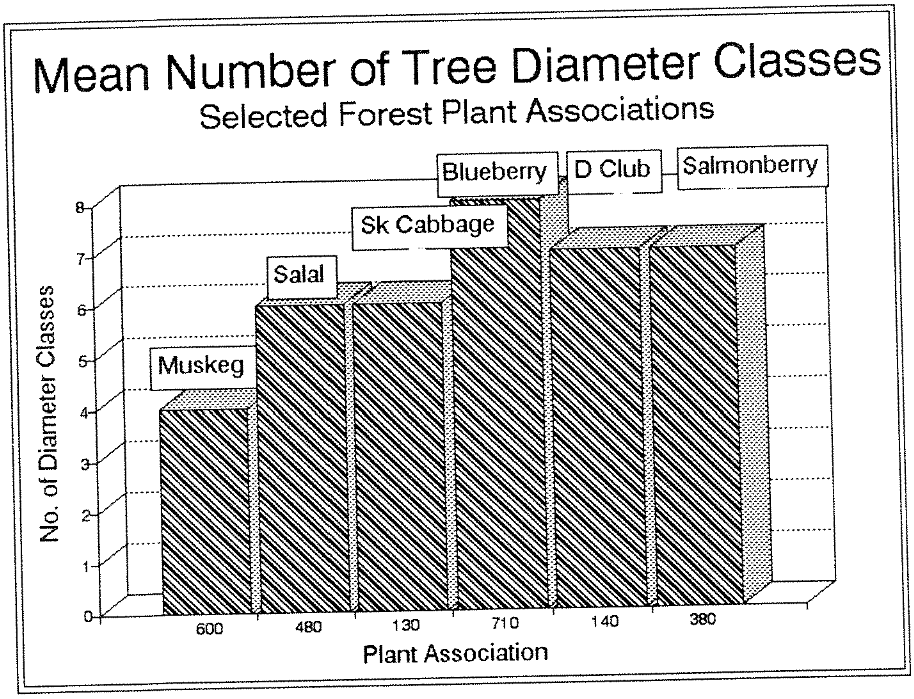


Fig. 108. Mean Number of Tree Diameter Classes for Selected Plant Associations. Size of each diameter class = 1 in. Sample size for each association = 10.

By weighting average tree diameters by trees per acre in each size class, a measure of how big the trees are for each association is obtained. This is illustrated in Fig. 109.

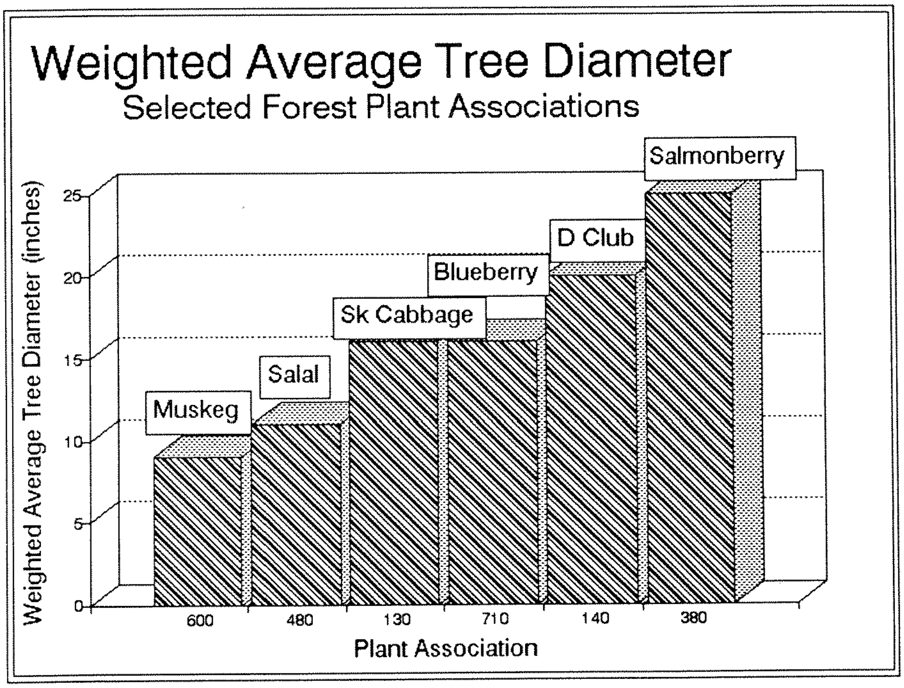


Fig. 109. Weighted Average Tree Diameter, Selected Forest Plant Associations. Size of each diameter class = 1 in. Sample size for each association = 10.

Finally, in Fig. 110, the standard deviations of values for Fig. 109 are presented in graph form. Usually a dry statistic of little interest to managers, standard deviations in this case are of critical value. By measuring variation, they show how complex the stand structure for each association is. Associations designated by devil's club and salmonberry are the most complex structurally, because of frequent windthrow events, soil movement, and fluvial processes.

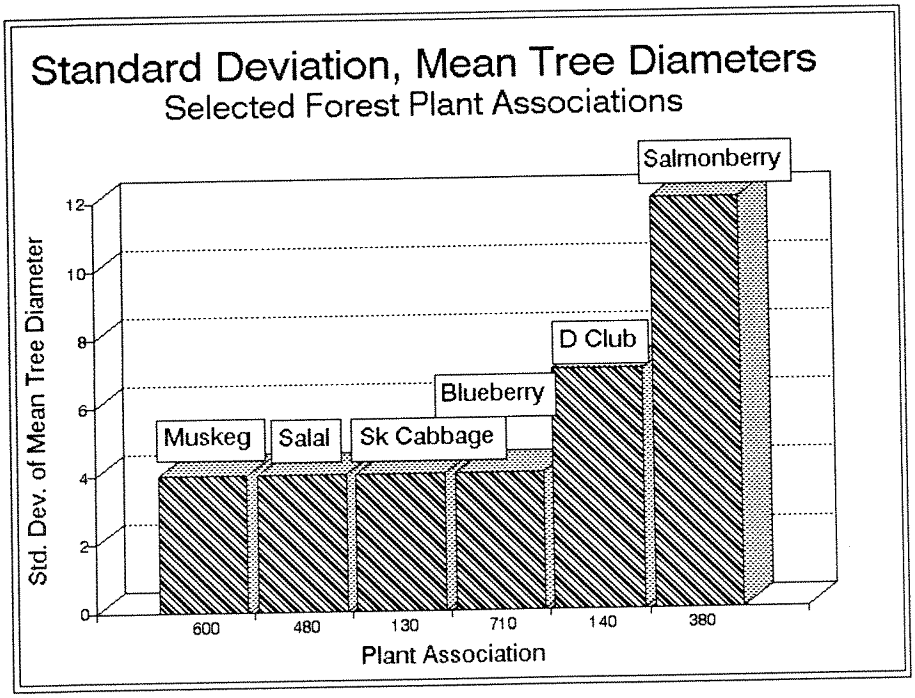
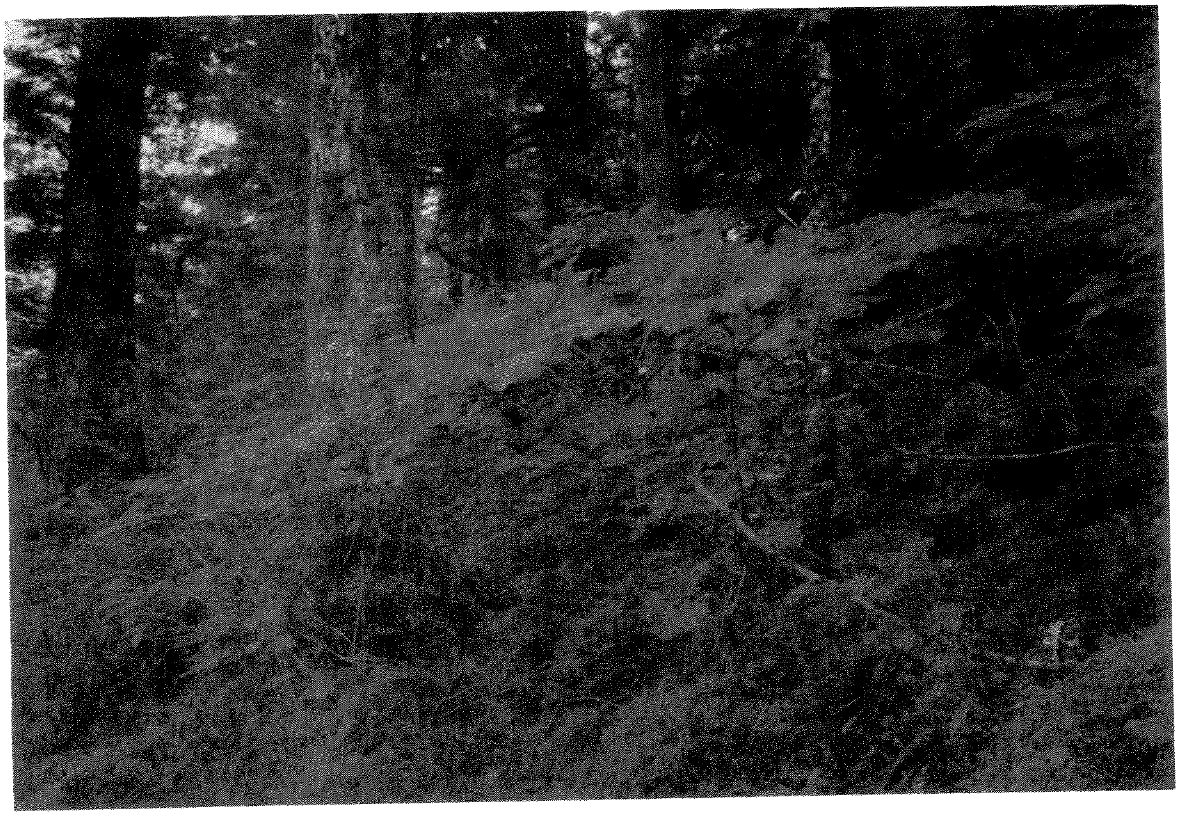


Fig. 110. Standard Deviation of Mean Tree Diameters, Selected Forest Plant Associations. Size of each diameter class = 1 in. Sample size for each association = 10.



Well drained, more productive sites, such as Western Hemlock/Devil's Club-Salmonberry, exhibit lower species diversity in a more closed canopy. Structurally, however, these habitats show high diversity. Frequent disturbance events because of windthrow and moving water remove trees and allow for their replacement much more rapidly than on poor sites.

11
PRELIMINARY VEGETATION MAP DESCRIPTIONS FOR THE KETCHIKAN AREA

Background

Accurate vegetation maps are becoming critical for a number of resource applications at both planning and project levels. Existing timber type maps meet many needs. For some applications, however, a vegetation map based on ecosystem classification is desirable. Wildlife habitat requirements, wetlands analysis, diversity assessments, and landscape-level analysis are just a few major issues that would be ably served by an ecosystem classification map.

Using the classification of this guide, we describe below a vegetation mapping method for a Geographic Information System (GIS). It is based on soil map units generated from a third-order field survey coupled with photo interpretation. Not all map units below have been adequately field-checked for the accuracy of the vegetation map predictions, so the following should be used with great care, and considered a working draft.

Explanation of Descriptions

For each soil map unit below, there are two sets of interrelated codes. The first is a proposed six-digit code that describes: a) broad ecological zone (1 digit), b) landform series (2 digits), c) vegetation series (2 digits), and d) characteristic understory vegetation (1 digit). This code represents a proposed ecological land unit (ELU). This approach seeks to meet both a wide range of resource application needs, and national direction for the National Forest System.

The second set of codes is a set of plant association complex codes similar to existing plant association codes. These codes are two digits each, and they aggregate similar associations within a vegetation series. For example "11" represents the western hemlock series (first digit), and combined associations designated blueberry, blueberry/shield fern, and blueberry/skunk cabbage (second digit). A maximum of three codes (with corresponding percentages) are listed for each ecological land unit.

Comments

Verification of vegetation map codes is ongoing. At this writing, the percentages that follow are predictions based on field data that are not fully verified. During the 1991 field season, data from approximately 50 field transects were used to tally plant associations for soil map units. The following list of codes has been partially tested by systematically comparing plant association field data cards against the list. (Each data card lists the soil map unit in which it was collected.)

Predictions for the western hemlock series appear strong. Those for mixed conifer are correct with high frequency, but there are problems with salal types and at higher elevation, where a transition to the mountain hemlock series is made. This problem was also encountered in vegetation mapping analysis done for the Tongass Land Management Plan (TLMP), where the greatest errors in timber volume showed up in the subalpine zone. As a hypothesis, these errors may result because soils cover much broader areas of the environment than vegetation types. The Wadleigh and Kaikli series provide good examples; each can be found at relatively high elevation and show tremendous variation in vegetation.

To remedy this, we will be segregating these and other map units by elevation and physiographic province, where appropriate. Segregating southern Prince of Wales from other areas should improve predictability of salal associations, and putting elevation breaks on the Wadleigh and Kaikli series should improve predictability of the mountain hemlock series. These are just preliminary examples of how vegetation maps could be improved.

Code Legend

ECOLOGICAL LAND UNITS (ELUs)

6 digits:

First Digit-- Ecological Zone

1 = Western Hemlock (includes yellowcedar and better redcedar plant associations)
2 = Cedar-Hemlock (includes shore pine, mixed conifer, and poorer redcedar)
3 = Mountain Hemlock
4 = Sitka Spruce
5 = Estuaries
6 = Low Elevation Muskegs
7 = Alpine Ecosystems

Second and third digits--Landform series. Two possible. If only one listed, the other is designated "0."

1 = Mountain Summits
3 = Mountain Slopes
4 = Hills
5 = Valleys
6 = Lowlands
7 = Coastal Landforms
8 = Steep disturbed areas (landslides, talus, rock and ice)

Fourth and fifth digits-- Vegetation Series

1 = Western Hemlock
2 = Hemlock-Yellowcedar
3 = Sitka Spruce
4 = Mixed Conifer
5 = Mountain Hemlock
6 = Shore Pine
7 = Redcedar

8 = Estuaries
9 = Muskeg, Low Elevation
0 = High Elevation *

*Note: High elevation vegetation is designated only when a "0" appears in the fifth digit. (In the fourth digit, "0" is merely a placeholder.)

Sixth digit-- Characteristic Understory Vegetation

1 = Blueberry (includes associations designated by blueberry, shield fern, and skunk cabbage)
2 = Deer Cabbage
3 = Salal
4 = Copperbush
5 = Cassiope and Other Alpine Plants
6 = Swordfern
7 = Disturbance species (devil's club, salmonberry, alder)
8 = Estuarine Vegetation
9 = Muskeg Vegetation (sedges, bog laurel, Labrador tea, etc.)
0 = Alpine Vegetation (also includes rock and ice)

PLANT ASSOCIATION COMPLEXES

This concept is still in preliminary form, but for now a two-digit code is used. The first digit is the vegetation series code above, and the second is the characteristic understory vegetation unit above. A maximum of three complex codes are listed for each ecological land unit. Total percentage must total 100.

As work progresses, a more integrated plant association complex concept will be developed. As an example, the Wadleigh series on hill landforms might be designated Cedar-Hemlock/Blueberry and include the better-drained plant associations of the existing mixed Conifer and Hemlock-Redcedar series.

ADDITIONAL CONSIDERATIONS

In developing the vegetation codes for soil map units, slope class was used as a rough indicator of elevation; that is, steeper slope classes were assumed to correlate with higher elevations. This is admittedly a poor assumption, and this fault will be corrected as more field correlation data is collected and analyzed. Additionally, elevation lines in the GIS could be used to help define correlations. For example, a soil map unit below 500 feet elevation could be designated with a salal understory, and above that elevation with a blueberry association.

Physiographic province boundaries should also be used to improve predictability of the model. Soil map units on southern Prince or Wales, for example, are much more likely to feature salal than those on the northern Prince of Wales physiographic province.

Mapping Unit Descriptions

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
1C Vixen	1 35 17 1	Western Hemlock/ Devil's Club	11/80 17/20
1D	1 34 17 1		11/70 17/30
1E	1 34 17 1		11/70 17/20 71/10
1F	1 03 17 1		11/60 17/30 77/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley becoming Hill and Mountain, then Steep Mountain Slopes
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage is associated with Helm soil inclusions in this map unit.

Discussion: Frequently dissected mountain slopes. Western hemlock/blueberry on slopes, devil's club along V-notches. Skunk cabbage an inclusion on Helm soils in this unit. Redcedar abundance generally increases with elevation. It is usually not a significant portion of this map unit.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
2D Traitors	1 34 17 1	Western Hemlock/ Devil's Club	11/90 17/10
2E	1 34 12 1		11/40 21/40 27/20
2F	1 34 12 1		21/80 27/20

Ecological Zone: Western Hemlock
Landforms: Hill and Mountainslopes, often infrequently dissected.
Vegetation Series: Western Hemlock dominant, redcedar associated at lower elevations and yellowcedar at higher elevations.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes and benches. Rusty menziesia common in yellowcedar associations.

Discussion: Shallower counterpart of Vixen on frequently dissected hill- and mountainslopes. Most abundant on Cleveland Peninsula and Revilla Island. Vegetation similar to that of Vixen. Yellowcedar at highest elevations in this map unit. Devil's club common throughout.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
3D Vixen-Traitors	1 34 17 1	Western Hemlock/ Devil's Club	11/80 17/20
3E	1 34 17 1		11/80 17/20
3F	1 34 27 1		21/50 71/40 77/10

Frequently dissected mountain slopes. Western hemlock series becoming redcedar on steeper slopes. Skunk cabbage on poorly drained inclusions. Devil's club common throughout. Cedars more common here than Vixen or Traitors separately.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
4C Helm	2 45 41 1	Cedar-Hemlock, Mixed Conifer Blueberry	41/60 42/30 21/10
4D	2 45 41 1		41/60 71/20 42/20
4E	2 34 27 1	Cedar-Hemlock, Cedars, Drainage Limited	71/60 21/40
4F	2 34 27 1		21/70 51/30

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Valley becoming Hill and Mountain.
Vegetation Series: Mixed Conifer becoming Yellowcedar.
Characteristic Understory Vegetation: Blueberry. Deer Cabbage in depressions.

Discussion: Poorly drained, shallow soil on hill footslopes and backslopes. Although there is substantial variation in vegetation, it is best described as mixed conifer. Red- and yellowcedar associations increase with elevation. Transition to mountain hemlock on steepest slopes. Most abundant on Revilla Island and Cleveland Peninsula.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
5C Meares	2 45 74 1	Cedar-Hemlock Cedars	71/60 73/30 41/10
5D	2 45 74 1		71/60 43/30
5E	2 45 72 1		71/80 21/10 41/10

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Valley, particularly foot- and toeslopes.
Vegetation Series: Mixed Conifer/Redcedar, becoming Yellowcedar/Redcedar.
Characteristic Understory Vegetation: Blueberry and salal. Deer cabbage in depressions. Skunk cabbage in depressions and on footslopes.

Discussion: Poorly drained shallow soil over till on footslopes. Best described as Hemlock-Redcedar series, although both cedar series represented. To date this soil has been mapped only on Suemez Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
6 McGilvery-Traitors	1 34 17 1	Cedar Hemlock, Shallow Soils	11/100

Ecological Zone: Cedar-Hemlock
Landforms: Steep (60-100% slope) Mountain and Hillslopes.
Vegetation Series: Western hemlock.
Characteristic Understory Vegetation: Blueberry.

Discussion: Steep, broken hills with shallow soil.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
7D Waterfall	1 34 17 1	Western Hemlock Mesic	11/70 17/20 71/10
7E	1 34 71 1	Western Hemlock, Redcedar Associated	71/50 11/50
7F	1 34 71 1		71/40 21/30 11/30

Ecological Zone: Western Hemlock
Landforms: Mountain and Hillslopes.
Vegetation Series: Redcedar dominant, western hemlock associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches.

Discussion: Upper slopes and mountain shoulders. Represents upper portion of the Western Hemlock Ecological zone, before becoming the Mountain Hemlock Zone. Found on Suemez and Sukkwan Islands, as well as in the vicinity of Waterfall Cannery on the west coast of Prince of Wales Island. Elevation ranges from 0 to 1,000 feet.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
10 Tonowek-Tuxekan	4 05 31 7	Sitka Spruce Riparian	37/80 31/10 11/10

Ecological Zone: Sitka Spruce
Landforms: Valley Floodplains and Alluvial Terraces.
Vegetation Series: Sitka Spruce dominant, Western hemlock associated.
Characteristic Understory Vegetation: Devil's Club/Salmonberry. Alder on most frequently flooded areas, blueberry on terraces no longer flooded.

Discussion: Plant association complexes cannot be delineated at the current map scale. A keystone ecosystem with immense management implications.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
11C Remedios	1 34 17 1	Western Hemlock Mesic	11/60 17/40
11D	1 34 17 1		11/70 71/30
11E	1 34 17 1		11/50 27/30 71/20

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley becoming Hill and Mountain, then Steep Mountain Slopes
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes. Rusty menziesia characteristic of yellowcedar sites.

Discussion: Deep, well drained productive soils supporting western hemlock. Cedars more abundant on upper slopes.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
12 Aeric Cryaquepts	5 07 08 8	Estuaries	88/100

Ecological Zone: Estuaries
Landforms: Estuaries, including Mudflats.
Vegetation Series: Non-forest. Sedges, grasses, and mudflats.
Characteristic Understory Vegetation: Sedges and grasses.

Discussion: Vegetation not yet fully inventoried. Some information on tentative plant associations in wetlands writeup (DeMeo and Loggy 1989).

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
13 Salt Chuck	1 07 17 1	Western Hemlock Beach Fringe	11/60 31/30 71/10

Ecological Zone: Western Hemlock
Landforms: Uplifted beaches.
Vegetation Series: Western hemlock and Sitka spruce dominat, redcedar associated.
Characteristic Understory Vegetation: Blueberry.

Discussion: Limited to uplifted beaches, frequently at salt chucks, as the name implies. Productive sites. Expect redcedar on southern Prince of Wales, Sitka spruce or hemlock elsewhere.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
14 Shakan	4 31 30 7	Spruce Alder/ Salmonberry	07/60 37/40
14EF	4 31 30 7		07/70 37/30

Ecological Zone: Sitka spruce
Landforms: Steep Mountain and hillslopes
Vegetation Series: Non-forest alder/salmonberry/bare soil is most typical in this map unit, with spruce associated.
Characteristic Understory Vegetation: Salmonberry.

Discussion: Soil is moderately deep and well-drained, but productivity is limited by instability. Landslides are frequent. This map unit often features upland spruce, a group of plant associations that are incompletely inventoried. On more stable slopes, expect open, tall Sitka spruce with a salmonberry understory. On less stable slopes, expect non-forest alder/salmonberry.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
18C Hofstad	2 46 47 1	Cedar Hemlock Cedars, Drainage-Limited	41/60 71/30 42/10
18D	2 34 47 1		71/60 41/20 42/20
18E	2 34 47 1		71/70 21/20 27/10

Ecological Zone: Cedar-Hemlock
Landforms: Lowlands and Hills becoming Hill- and Mountainslopes.
Vegetation Series: Mixed Conifer and redcedar, becoming redcedar and yellowcedar on steeper slopes.
Characteristic Understory Vegetation: Blueberry/deer cabbage matrix.

Discussion: Matrix of low-productivity mixed conifer/redcedar associations on lowlands/rolling hillcountry, becoming more productive redcedar/yellowcedar on steeper slopes.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
19C Helm, Granitic Phase (formerly Southmountain)	1 34 17 1	Western Hemlock Mesic	11/40 21/40 71/20
19D	2 34 27 1	Western Hemlock, Redcedar Associated	41/60 71/30 77/10
19E	2 34 27 1		21/70 71/20 77/10
19F	1 34 27 1		21/80 77/20

Ecological Zone: Western Hemlock and Cedar-Hemlock
Landforms: Mountain and Hillslopes.
Vegetation Series: Mixed Conifer, Yellowcedar, Redcedar and western hemlock all well-represented. Classic yellowcedar on E and F slopes.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes.

Discussion: Soil shallow and somewhat poorly-drained. Represents transition from Cedar-Hemlock to Western Hemlock Ecological zone. Cedars well represented. Needs further vegetation correlation and delineation work.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
20C Maybeso-Kaikli	2 45 47 1	Cedar Hemlock, Mixed Conifer Blueberry	41/60 43/30 71/10
20D	2 45 47 1		41/60 21/30 42/10

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Valley becoming Hill and Mountain.
Vegetation Series: Mixed conifer dominant, Redcedar and Yellowcedar associated.
Characteristic Understory Vegetation: Blueberry. Salal on many sites, especially on southern Prince of Wales.

Discussion: Characteristic of hill footslopes and rolling hillcountry. Productivity limited by soil drainage.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
21A Kogish	6 56 09 9	Sedge Peatlands	99/100

Ecological Zone: Low elevation muskeg
Landforms: Lowlands and Valleys.
Vegetation Series: Non-forest sphagnum peat muskeg.
Characteristic Understory Vegetation: Sphagnum and other bog plants.

Discussion: Sphagnum muskeg. Map units seldom exceed 20 acres.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
23 Kina-Kaikli	2 46 46 9	Cedar-Hemlock Mixed Conifer Muskeg	69/10 99/60 42/30

Ecological Zone: Cedar Hemlock
Landforms: Lowlands and Rolling Hills.
Vegetation Series: Non-forest scrub shrub evergreen muskeg and Mixed conifer.
Characteristic Understory Vegetation: Bog plants such as Labrador tea, Bog laurel, etc.

Discussion: Matrix of non-forest/Mixed Conifer with higher portion non-forest.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
24AC Kaikli	2 46 47 3	Cedar Hemlock Cedars	43/70 41/20 42/10
24D	2 34 47 1		41/60 71/20 42/20
24E	2 34 47 1		73/40 41/20 71/40

Ecological Zone: Cedar Hemlock
Landforms: Lowlands and Rolling Hills becoming poorly drained benches on hill and mountain slopes.
Vegetation Series: Mixed Conifer and Redcedar.
Characteristic Understory Vegetation: Salal and blueberry at low elevation, becoming blueberry at higher elevations.

Discussion: For vegetation mapping, this unit clearly needs to be stratified by elevation. At higher elevation, mountain hemlock associations characterize this unit, and that is not reflected in the above delineation.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
25 Kaikli-Kina	2 46 49 1	Cedar Hemlock Mixed Conifer Peatlands	41/50 42/20 99/30

Ecological Zone: Cedar Hemlock
Landforms: Lowlands, Rolling Hills, and benches on hills.
Vegetation Series: Mixed Conifer in matrix with non-forest scrub-shrub evergreen peatlands, mixed conifer predominant.
Characteristic Understory Vegetation: Blueberry with bog vegetation in peatlands.

Discussion: Very common low elevation habitat on glacial outwash plains.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
26A Staney	6 56 09 9	Non-forest sedge peatlands	99/100

Ecological Zone: Low-elevation peatlands
Landforms: Lowlands and Valleys.
Vegetation Series: Non-forest sedge peatlands.
Characteristic Understory Vegetation: Tall sedge (*Carex sitchensis*).

Discussion: Tall sedge on "floating" organic soil that is poorly decomposed. Map units generally of small size.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
27EF Talus Slopes-McGilvery	8 31 84 0	Sitka Spruce Upland	07/50 77/20 00/20

Ecological Zone: High elevation disturbance.
Landforms: Steep, rocky portions of mountains and summits.
Vegetation Series: Highly disturbed non-forest (alder/salmonberry) interspersed with bare talus and forest.
Characteristic Understory Vegetation: Blueberry where soil relatively stable (McGilvery series), alder/salmonberry elsewhere.

Discussion: This map unit may also include upland spruce sites with devil's club/salmonberry understories.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
28 McGilvery-Tolstoi	1 34 17 1	Western Hemlock, Shallow Soils	11/50 71/40 17/10

Ecological Zone: Western Hemlock.
Landforms: Mountain and Hillslopes.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry, some Devil's Club.

Discussion: Soils better-drained but productivity limited by soil depth. Western Hemlock/Blueberry is characteristic.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
29C McGilvery	1 34 17 1	Western Hemlock, Redcedar Associated	11/70 71/20 73/10
29D	1 34 17 1		11/50 71/40 17/10
29EF	1 34 71 1		71/60 11/20 77/20

Ecological Zone: Western Hemlock
Landforms: Wide variety of Mountain and Hillslopes.
Vegetation Series: Western Hemlock and Redcedar.
Characteristic Understory Vegetation: Salal and blueberry becoming blueberry at higher elevation. Devil's club along V-notches.

Discussion: Moderately productive; productivity limited by soil depth. Soil map unit with much variation that is difficult to predict.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
30C Karta	1 35 17 1	Western Hemlock Mesic	11/80 71/10 17/10
30D	1 34 17 1		11/50 71/30 17/20
30E	1 34 17 1		11/50 71/20 17/30
30F	1 03 17 1		11/50 71/20 77/30

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley becoming Hill and Mountain.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes; associated with Wadleigh and Maybeso soil inclusions.

Discussion: Well-drained productive soil characteristic of glacial valley sideslopes on Prince of Wales Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
31C Wadleigh	2 46 74 1	Cedar Hemlock Cedars, Drainage	71/60 43/20 41/20
31D	2 34 74 1	Limited	71/60 43/20 41/20
31E	2 34 74 1		71/80 41/20

Ecological Zone: Cedar-Hemlock
Landforms: Lowlands and Rolling Hills becoming Hill and Mountain Slopes.
Vegetation Series: Redcedar and Mixed Conifer.
Characteristic Understory Vegetation: Blueberry. Skunk cabbage in depressions. Salal at elevations below 500 feet.

Discussion: A very broad soil map unit that needs further delineation for vegetation mapping. Separating lowland landform from rolling hills would improve predictive ability, for example.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
32C St. Nicholas	2 34 47 1	Cedar Hemlock Cedars, Drainage	71/40 41/40 43/20
32D	2 34 47 1	Limited	71/50 41/40 43/20
32E	2 34 47 1		71/50 41/20 21/20
32F	2 34 47 1		71/60 21/30 54/10

Ecological Zone: Cedar Hemlock
Landforms: Hill and Mountain slope benches.
Vegetation Series: Redcedar and Mixed Conifer.
Characteristic Understory Vegetation: Blueberry. Salal at elevations below 500 feet. Copperbush at highest elevations. Skunk cabbage and deer cabbage are strongly represented.

Discussion: Stratifying by elevation would improve vegetation predictability.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
33C St. Nicholas-McGilvery	2 34 47 1	Cedar-Hemlock Cedars, Shallow	41/60 43/20 42/20
33D	2 34 47 1		71/60 73/20 42/20
33E	2 34 47 1		71/50 21/40 42/10
33F	2 34 47 1		71/40 21/40 77/20

Ecological Zone: Cedar-Hemlock
Landforms: Mountain and Valley benches, broken mountain slopes.
Vegetation Series: Mixed Conifer and Redcedar, with Yellowcedar at higher elevations.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Deer cabbage and skunk cabbage in depressions. Salal below 500 feet elevation.

Discussion: Complex of shallow, more poorly drained soil with shallow, well drained soil. Often includes rock outcrops.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
34D St. Nicholas-Shakan	2 34 27 1	Cedar Hemlock Shallow Soils	71/40 41/40 21/20
34E	2 03 27 1	Western Hemlock Shallow Soils	21/50 71/40 77/10
34F	1 03 27 1		21/40 71/40 17/20

Ecological Zone: Cedar Hemlock; Western Hemlock on steepest slopes
Landforms: Mountain and Valley becoming Mountain.
Vegetation Series: Redcedar and Yellowcedar; also Western Hemlock at highest elevations.
Characteristic Understory Vegetation: Blueberry. Salmonberry/Devil's club on Shakan soil.

Discussion: Mountain hemlock series may be present at highest elevations. Stratifying by elevation would improve prediction.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
35C St. Nicholas-Tolstoi	1 34 17 1	Western Hemlock Shallow Soil	11/40 71/40 21/20
35D	1 34 17 1		11/30 71/50 21/20
35E	1 34 17 1		11/20 71/60 21/40
35F	1 34 17 1		71/70 11/20 21/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley slopes.
Vegetation Series: Western Hemlock, Redcedar, and Yellowcedar. Mountain hemlock at highest elevation.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage an inclusion in depressions and on footslopes.

Discussion: Site productivity limited by soil depth.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
36AC Magnetic	7 36 49 9	Non-Forest Scrub-Shrub Evergreen	99/90 41/10
36D	7 36 49 9	Peatlands	99/90 41/10

Ecological Zone: Cedar Hemlock
Landforms: Benches or Plateaus on Mountain landforms.
Vegetation Series: Mixed Conifer and alpine peatlands (muskegs).
Characteristic Understory Vegetation: Scrub-shrub evergreen peatlands (muskeg) vegetation.

Discussion: Shallow, poorly drained soil also limited by colder temperatures. Mapped only on the Cleveland Peninsula. Found at middle elevations (1,000-1,500 feet).

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
37AC Golden	2 36 45 4	Cedar Hemlock Mixed Conifer	41/40 44/40 99/20
37D	2 36 45 4	Peatlands	41/30 44/30 99/40

Ecological Zone: Cedar Hemlock
Landforms: Mountain plateaus and benches.
Vegetation Series: Mixed conifer and peatlands (muskegs).
Characteristic Understory Vegetation: Blueberry/Copperbush.

Discussion: Mapped only on Cleveland Peninsula. Found at middle elevations (1,000-1,500 feet).

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
38AC Magnetic-Golden	2 36 45 9	Non-forest Scrub-Shrub	41/40 54/40 99/60
38D	2 36 45 9	Evergreen Peatlands	41/50 54/20 99/30

Ecological Zone: Cedar Hemlock
Landforms: Mountain plateaus and benches.
Vegetation Series: Mixed conifer and scrub-shrub evergreen muskegs.
Characteristic Understory Vegetation: Muskeg plants/Copperbush.

Discussion: Mapped only on Cleveland Peninsula. Found at middle elevations (1,000-1,500 feet).

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
40C Sarkar-McGilvery	1 34 17 1	Western Hemlock Limestone, Shallow	11/50 17/30 71/20
40D	1 34 17 1		11/50 17/30 71/20
40E	1 34 17 1		11/30 17/30 71/40

Ecological Zone: Western Hemlock
Landforms: Mountain and Hill Slopes, Rolling Hill Country. Karst topography.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Devil's club more abundant than in similar map units on glacial soils. Skunk cabbage less abundant.

Discussion: Shallow but very productive soils due to calcareous nature of karst topography. Rock outcrops and sinkholes common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
43D Shakan-McGilvery	8 34 24 1	Western Hemlock Shallow	11/40 17/40 07/20
43EF	8 03 15 1		11/40 17/20 07/40

Ecological Zone: Western Hemlock.
Landforms: Steep mountain and hillslopes.
Vegetation Series: Western Hemlock, Mixed Conifer, Mountain Hemlock, Non-forested High Elevation Disturbance
Characteristic Understory Vegetation: Blueberry/Devil's Club.

Discussion: Rock outcrops and landslides common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
47C Helm Granitic Phase/Kitkun (Formerly Southmountain/Moira)	2 34 47 1	Cedar Hemlock Cedars, Drainage Limited	41/40 71/40 43/20

Ecological Zone: Cedar-Hemlock
Landforms: Mountain and Valley.
Vegetation Series: Mixed Conifer, Redcedar,and Yellowcedar.
Characteristic Understory Vegetation: Blueberry. Salal below 500 feet elevation. Skunk cabbage and deer cabbage in depressions.

Discussion: Smooth mountain slopes, especially on southern Prince of Wales.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
48C Helm-Kitkun (formerly Helm-Moira)	2 04 47 1	Cedar Hemlock Mixed Conifer Blueberry	41/40 71/40 43/20

Ecological Zone: Cedar-Hemlock
Landforms: Hillslopes and Rolling Hillcountry, Benches.
Vegetation Series: Mixed Conifer and Redcedar.
Characteristic Understory Vegetation: Blueberry. Salal below 500 feet.

Discussion: This map unit is most common on southern Prince of Wales.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
49C Kina-Kitkun (formerly Kina-Moira)	2 46 47 9	Cedar Hemlock Mixed Conifer	41/40 99/40 73/20
49D	2 04 47 9	Peatlands	41/30 71/40 99/30

Ecological Zone: Cedar-Hemlock
Landforms: Hills and Lowlands.
Vegetation Series: Mixed Conifer, Redcedar, and low elevation muskeg.
Characteristic Understory Vegetation: Peatlands (muskeg) vegetation/Blueberry.

Discussion: Map unit is a forest/peatlands matrix.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
50C Tolstoi-Karta	1 35 17 1	Western Hemlock Devil's Club	11/40 71/20 17/40
50D	1 35 17 1		11/30 71/40 17/30
50E	1 03 17 1		11/40 71/20 17/40
50CF	1 35 17 1		11/40 71/20 17/40
50F	1 03 27 1		21/30 71/30 17/40

Ecological Zone: Western Hemlock
Landforms: Highly-dissected foot- and backslopes.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage an inclusion in depressions and on footslopes.

Discussion: Expect high abundance of devil's club associations and abundant V-notches.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
51AC Kitkun (formerly Moira)	2 46 47 1 Cedars,	Cedar Hemlock Drainage Limited	41/40 43/40 71/20
51D	2 34 47 1		41/30 71/50 21/20
51EF	2 34 27 1		41/50 21/30 71/20

Ecological Zone: Cedar-Hemlock
Landforms: Lowland and Hills becoming Hill and Mountainslopes. Smooth slopes.
Vegetation Series: Mixed conifer, Redcedar, and Yellowcedar.
Characteristic Understory Vegetation: Blueberry. Salal common below 500 feet.

Discussion: Most abundant on southern Prince of Wales. Vegetation needs to be stratified by elevation. This map unit is generally found from sea level to 1,000 feet.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
53C Tolstoi	1 34 17 1	Western Hemlock Shallow	11/50 71/30 17/20
53D	1 34 17 1		11/40 71/40 17/20
53E	1 34 17 1		11/30 71/50 21/20
53F	1 34 27 1		71/50 21/40 51/10

Ecological Zone: Western Hemlock
Landforms: Smooth Mountain and Valley slopes.
Vegetation Series: Western Hemlock dominant, Redcedar associated. Classic yellowcedar in E and F slope classes. Mountain hemlock at highest elevations.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage an inclusion in depressions and on footslopes.

Discussion: Most common on south Prince of Wales and Cleveland Peninsula.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
54C Tokeen	1 34 17 1	Western Hemlock Mesic	11/70 71/10 17/20
54D	1 34 17 1		11/60 71/10 17/30
54E	1 34 17 1		11/50 71/10 17/30
54F	1 03 25 1		21/40 27/20 51/40

Ecological Zone: Western Hemlock
Landforms: Mountain and Hillslopes becoming Steep Mountain Slopes. Smooth.
Vegetation Series: Western Hemlock, Redcedar associated. Yellowcedar on E and F slopes; Mountain hemlock on F slopes.
Characteristic Understory Vegetation: Blueberry. Skunk cabbage in depressions and on footslopes.

Discussion: Similar to Tolstoi in vegetation.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
57C Petrel	2 34 46 9	Cedar Hemlock Cedars, Drainage	41/70 69/30
57D	2 34 47 1	Limited	41/70 71/20 21/10
57E	2 34 45 2		42/40 44/30 51/30

Ecological Zone: Cedar-Hemlock
Landforms: Backslopes of hills and mountains.
Vegetation Series: Mixed Conifer, becoming Mixed Conifer and Redcedar on steeper slopes. Mountain Hemlock at highest elevations.
Characteristic Understory Vegetation: Blueberry and peatlands (muskeg) vegetation.

Discussion: Uncommon map unit. Most like Helm and Magnetic map units. Mapped only on Suemez Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
61 Karheen	1 74 17 1	Western Hemlock, Beach Fringe	11/60 71/40

Ecological Zone: Western Hemlock
Landforms: Uplifted beaches and hills.
Vegetation Series: Western Hemlock and Redcedar.
Characteristic Understory Vegetation: Blueberry. Skunk cabbage in old stream channels.

Discussion: Not as productive as Salt Chuck, a similar beach deposit soil.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
62 Karheen-McGilvery	1 07 17 1	Western Hemlock Beach Fringe	11/40 71/40 41/20

Ecological Zone: Western Hemlock
Landforms: Uplifted beaches (Karheen) with rock outcrops (McGilvery).
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Skunk cabbage in old stream channels.

Discussion: May occasionally include spruce associations.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
63C Helm, Granitic Phase -McGilvery (formerly Southmountain-McGilvery)	1 34 17 1	Western Hemlock Cedar Associated	11/70 71/30
63D	1 34 27 1		71/40 21/40 41/20
63E	1 34 27 1		71/30 21/60 73/10
63F	1 03 27 1		21/70 71/20 51/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Hills becoming steep mountain slopes.
Vegetation Series: Western Hemlock dominant, redcedar and yellowcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes.

Discussion: Yellowcedar well represented in this map unit. Rock outcrops common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
64C Helm-McGilvery	2 46 47 1	Cedar Hemlock Shallow Soils	41/60 43/20 71/20

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowlands.
Vegetation Series: Mixed Conifer dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Salal common below 500 feet.

Discussion: Expect Redcedar or Western Hemlock on better-drained portions, Mixed Conifer on the poorer.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
71 Isidor	2 46 47 1	Cedar Hemlock, Drainage Limited	41/40 43/40 73/20

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowland.
Vegetation Series: Mixed conifer and redcedar.
Characteristic Understory Vegetation: Blueberry/Salal.

Discussion: Much like the Wadleigh soil in associated vegetation, but covers a less extensive range of sites. Productivity impaired by a cemented placic horizon.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
72 Isidor-Kina	2 46 46 1	Cedar Hemlock Mixed Conifer Peatlands	41/40 43/20 99/40

Ecological Zone: Cedar Hemlock
Landforms: Hill and Lowland
Vegetation Series: Cedar-Hemlock, Low Elevation muskeg.
Characteristic Understory Vegetation: Blueberry/Bog plants. Salal common below 500 feet elevation.

Discussion: Peatlands (muskegs) are scrub-shrub evergreen, with Labrador tea, bog kalmia, crowberry, etc.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
73C St. Nicholas -Kina	2 46 49 1	Cedar Hemlock Mixed Conifer Peatlands	41/40 43/20 99/40

Ecological Zone: Cedar-Hemlock.
Landforms: Hill and Lowland.
Vegetation Series: Western Hemlock dominant, Scrub-shrub evergreen peatlands associated.
Characteristic Understory Vegetation: Blueberry. Peatlands vegetation on Kina soil.

Discussion: Redcedar and Yellowcedar associations also may occur.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
74C Kupreanof	1 35 17 1	Western Hemlock Mesic	11/70 71/20 17/10
74D	1 34 17 1		11/60 71/30 17/20
74E	1 34 17 1		11/40 71/40 17/20
74F	1 03 17 1		11/30 71/60 76/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley becoming Hill and Mountain, then Steep Mountain Slopes.
Vegetation Series: Western Hemlock dominant, Redcedar associated. Very productive sites
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage in depressions and on footslopes.

Discussion: Similar to Karta and Vixen soils in vegetation, but the Vixen is on more frequently dissected slopes, so devil's club is more abundant.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
75D Kupreanof-McGilvery	1 34 17 1	Western Hemlock Shallow	11/80 71/10 17/10
75E	1 34 17 1		11/80 71/20
75F	1 03 17 1		11 60 71 20 76 20

Ecological Zone: Western Hemlock
Landforms: Hill and Mountain becoming steep mountain slopes; benches.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Swordfern on steep, rocky portions.

Discussion: Rock outcrops common. The Kupreanof portion of this unit supports a Western Hemlock Mesic ELU.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
76 Kupreanof Variant	1 34 17 1	Western Hemlock Mesic	11/60 71/40

Ecological Zone: Western Hemlock
Landforms: Hill and Mountain.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry.

Discussion: Productive sites. This soil develops from volcanic cinders and so is uncommon on the Ketchikan Area. Only known map unit is near Shoal Cove on Revillagigedo Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
78D Mitkof	2 34 47 1	Cedar Hemlock Drainage Limited	41/60 73/20 21/20
78E	2 34 47 1		41/30 71/40 21/30
78F	2 34 42 1		71/40 21/60

Ecological Zone: Cedar-Hemlock
Landforms: Upper mountain slopes, concave sites with collected colluvium and ablation till.
Vegetation Series: Mixed Conifer and Redcedar. Yellowcedar replaces redcedar over 900 feet.
Characteristic Understory Vegetation: Blueberry. Salal common below 500 feet elevation.

Discussion: Productivity low-moderate. Somewhat poorly drained soil.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
79D McGilvery-Mitkof	1 34 71 1	Western Hemlock Shallow	11/30 71/30 73/40
79EF	1 34 72 1		11/10 71/50 21/40

Ecological Zone: Western Hemlock
Landforms: Mountain and Hill Backslopes.
Vegetation Series: Redcedar dominant, western hemlock associated. Yellowcedar at higher elevations.
Characteristic Understory Vegetation: Salal in D slope class; blueberry in EF class.

Discussion: Mixed conifer may also be present.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
80D McGilvery-Kaikli	2 34 47 1	Cedar Hemlock Cedars	41/60 71/30 11/10
80E	2 34 47 1		41/40 71/40 43/20

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Mountain slopes with benches or plateaus.
Vegetation Series: Mixed Conifer, Redcedar
Characteristic Understory Vegetation: Blueberry. Deer cabbage and skunk cabbage common on Kaikli component.

Discussion: Western hemlock and yellowcedar associations may also be present. Rock outcrops common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
82 McGilvery-Kitkun (formerly McGilvery-Moira)	2 34 47 1	Cedar Hemlock Cedars, Shallow Soil	41/40 71/30 43/30

Ecological Zone: Cedar-Hemlock
Landforms: Broken mountain and hill slopes.
Vegetation Series: Mixed Conifer, Redcedar.
Characteristic Understory Vegetation: Blueberry. Salal common at lower elevations (less than 500 feet).

Discussion: Very poor productivity, limited by soil depth and (in the case of Moira) restricted drainage.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
83 Kina-Grindall	6 46 94 9	Non-forest Scrub-Shrub Evergreen Peatlands	99/90 69/10

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowland
Vegetation Series: Scrub-shrub evergreen peatlands (muskeg). Some shore pine.
Characteristic Understory Vegetation: Peatlands vegetation such as bog laurel, Labrador tea, sedges.

Discussion: Non-forest wetland. Can occur across a wide range of elevations.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
84A Grindall	6 34 09 9	Non-forest Scrub Shrub Evergreen Peatlands	99/100
84C	6 34 49 9		99/100

Ecological Zone: Mid-elevation (1,000-1,500 feet) peatlands (muskeg).
Landforms: Flat toeslopes of hills and mountains.
Vegetation Series: Scrub-shrub evergreen peatlands.
Characteristic Understory Vegetation: Peatland plants (Labrador tea, crowberry, etc.) Swamp gentian (*Gentiana douglasii*) is diagnostic.

Discussion: May have false hellebore or mountain hemlock present.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
85 Kina	6 46 96 9	Non-Forest Scrub-Shrub Evergreen Peatlands	99/80 69/10 41/10

Ecological Zone: Low Elevation Muskeg
Landforms: Hills and Lowlands, including plateaus.
Vegetation Series: Scrub-shrub evergreen muskeg.
Characteristic Understory Vegetation: Muskeg plants.

Discussion: Shore pine and mixed conifer will typically comprise the edge of this map unit. May find adjacent mountain hemlock associations at higher elevations.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
86CD Kaikli-Grindall	2 46 46 1	Non-Forest Scrub-Shrub Evergreen Peatlands	41/70 99/30

Ecological Zone: Cedar Hemlock
Landforms: Hills and Lowlands, including Plateaus.
Vegetation Series: Mixed Conifer/Scrub-shrub evergreen peatlands (muskegs).
Characteristic Understory Vegetation: Muskeg plants, such as bog kalmia, crowberry, etc. Swamp gentian (*Gentiana douglasii*) is diagnostic of Grindall sites.

Discussion: Elevation range is typically 1,000-1,500 feet.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
87CD Grindall-St. Nicholas	2 34 09 1	Cedar Hemlock Mixed Conifer Peatlands	41/40 21/20 99/40

Ecological Zone: Cedar-Hemlock
Landforms: Ridges and upper backslopes of hills and mountains.
Vegetation Series: Mixed Conifer and high elevation peatlands (muskegs).
Characteristic Understory Vegetation: Blueberry/Peatland plants. Swamp gentian diagnostic of Grindall sites.

Discussion: Elevation range typically 1,000-1,500 feet.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
90C Grindall-Kitkun	2 46 49 9	Cedar Hemlock Mixed Conifer	41/40 99/60
90D	2 34 49 9	Peatlands	41/30 21/10 99/60

Ecological Zone: Cedar Hemlock
Landforms: Hills and Lowlands becoming Hills and Mountains.
Vegetation Series: Scrub-shrub evergreen peatlands, Mixed Conifer
Characteristic Understory Vegetation: Peatland Plants.

Discussion: Peatlands/Marginal forest complex.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
91C Maybeso	2 46 47 1	Cedar Hemlock Cedars	41/40 71/40 43/20
91D	2 46 47 1		41/40 71/40 43/20

Ecological Zone: Cedar Hemlock
Landforms: Rolling hills, footslopes, and lowlands over till.
Vegetation Series: Mixed Conifer, Redcedar
Characteristic Understory Vegetation: Blueberry/Salal.

Discussion: Skunk cabbage in depressions. A very common map unit.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
92C Maybeso-Kina	2 46 49 1	Cedar Hemlock Mixed Conifer Peatlands	41/40 99/40 71/20

Ecological Zone: Cedar Hemlock
Landforms: Footslopes and Lowlands.
Vegetation Series: Mixed conifer and low elevation peatlands.
Characteristic Understory Vegetation: Blueberry. Peatland plants on Kina.

Discussion: Salal also common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
153 McGilvery-Kogish	2 46 49 9	Cedar Hemlock Mixed Conifer Peatlands	41/40 43/20 99/40

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowlands.
Vegetation Series: Mixed Conifer/Low elevation peatlands (muskegs).
Characteristic Understory Vegetation: Peatland plants, especially sphagnum moss. Salal common below 500 feet.

Discussion: Low productivity. Rock outcrops common.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
157 Kina-McGilvery	2 46 94 9	Cedar Hemlock Mixed Conifer Peatlands (Muskeg)	11/30 41/30 99/40

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowland.
Vegetation Series: Low elevation peatlands/Mixed Conifer.
Characteristic Understory Vegetation: Bog plants on Kina, blueberry on McGilvery.

Discussion: Mountain hemlock associations may be present at higher elevations.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
201 Kogish-Maybeso	2 46 94 9	Cedar Hemlock Mixed Conifer Peatlands	41/40 43/10 99/50

Ecological Zone: Cedar Hemlock
Landforms: Hill and Lowland
Vegetation Series: Cedar-Hemlock, Low Elevation Sphagnum peatlands.
Characteristic Understory Vegetation: Sphagnum on Kogish, Blueberry/Salal on Maybeso.

Discussion: Can occur on a variety of slope positions, depending on deposition of associated till.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
220C Kina-Maybeso	2 46 94 9	Cedar Hemlock Mixed Conifer	99/50 41/30 71/20
220D	2 46 94 9	Peatlands	99/50 41/30 21/20

Ecological Zone: Cedar-Hemlock
Landforms: Hill and Lowland.
Vegetation Series: Mixed conifer/low elevation peatlands.
Characteristic Understory Vegetation: Blueberry on Maybeso, peatland plants on Kina.

Discussion: Very common map unit on northern Prince of Wales Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
244CD Hydaburg-Grindall	2 31 40 4	Subalpine Peatlands	44/10 09/90

Ecological Zone: Mountain Hemlock
Landforms: Mountain slopes and summits.
Vegetation Series: Mixed Conifer/Yellowcedar, high elevation peatlands.
Characteristic Understory Vegetation: Copperbush, peatland plants.

Discussion: Represents subalpine to alpine transition; elevation ranges from 2,000-3,000 feet.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
245CD Hydaburg-Sunnyhay	7 31 50 0	Mountain Hemlock Alpine	51/30 54/30 00/40
245E	7 31 50 0		51/20 54/50 55/30

Ecological Zone: Mountain Hemlock
Landforms: Upper Mountain slopes and summits.
Vegetation Series: Mountain Hemlock, Alpine vegetation.
Characteristic Understory Vegetation: Copperbush/Cassiope. Other alpine plants include Luetkea, mountain heather, etc.

Discussion: Patches of bare rock common. Alpine vegetation includes muskeg, meadows, and krummholz (dwarf trees with growth inhibited by cold and wind).

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
246CD Calamity-Hydaburg	3 13 50 0	Mountain Hemlock Alpine	54/20 55/50 09/30
246E	3 13 50 0		54/10 55/70 09/20

Ecological Zone: Mountain Hemlock
Landforms: Upper mountain slopes and summits.
Vegetation Series: Mountain hemlock, alpine vegetation.
Characteristic Understory Vegetation: Copperbush/Cassiope

Discussion: Patches of bare rock common. Alpine vegetation includes muskeg, meadows, and krummholz.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
247CD Hydaburg-Rock Outcrop	5 13 50 0	Mountain Hemlock Alpine	55/20 00/40 09/40
247E	5 13 50 0		55/20 00/40 09/40

Ecological Zone: Mountain Hemlock
Landforms: Upper mountain slopes and summits.
Vegetation Series: Mountain hemlock, non-forest alpine vegetation.
Characteristic Understory Vegetation: Cassiope, Luetkea, dwarf blueberry, etc.

Discussion: 40% bare rock.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
252 Wadleigh-Kogish	2 46 49 1	Cedar Hemlock Mixed Conifer Peatlands	99/30 41/40 43/30

Ecological Zone: Cedar-Hemlock
Landforms: Hills and Lowlands. Till plains, drumlin fields, and toeslopes.
Vegetation Series: Mixed Conifer dominant, Sphagnum peatlands associated.
Characteristic Understory Vegetation: Blueberry/Salal on Wadleigh; Sphagnum moss on Kogish.

Discussion: Common on north Prince of Wales Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
320C Wadleigh-Maybeso	2 45 47 1	Cedar Hemlock Cedars, Drainage -Limited	41/40 71/40 43/20
320D	2 45 47 1		40/71 71/40 73/20

Ecological Zone: Cedar-Hemlock
Landforms: Toe-, foot-, and lower backslopes of hills and valleys.
Vegetation Series: Mixed conifer dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Salal common below 500 feet elevation.

Discussion: Common map unit on northern Prince of Wales Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
331C Karta-Wadleigh	1 35 17 1	Western Hemlock, Redcedar Assoc.	11/70 71/20 17/20
331D	1 34 17 1		11/70 71/20 17/20

Ecological Zone: Western Hemlock
Landforms: Mountain and Hill slopes of rounded glacial valleys.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage occupies depressions and on footslopes, and comprises less than 10 percent of the unit.

Discussion: Redcedar most associated with Wadleigh. The primary soil of glaciated valleys on northern and central Prince of Wales Island.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
351D Karta-Tolstoi	1 34 17 1	Western Hemlock Shallow Soils	11/70 71/20 17/20
351E	1 34 17 1		11/60 17/30 71/10

Ecological Zone: Western Hemlock
Landforms: Mountain (lower- to mid-slope) and Hillslopes.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club in V-notches. Skunk cabbage an inclusion in depressions and on footslopes.

Discussion: Productive sites.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
442C Ulloa-Sarkar	1 34 17 1	Western Hemlock On Limestone	11/60 17/30 71/10
442D	1 34 17 1		11/60 17/30 71/10
442E	1 34 17 1		11/60 17/30 71/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Valley karst topography. Rock outcrops and sinkholes common.
Vegetation Series: Western Hemlock dominant, Redcedar associated.
Characteristic Understory Vegetation: Blueberry. Devil's club abundant due to subsurface hydrology.

Discussion: Highly productive. One of the most important map units for management implications.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
528D Tolstoi-McGilvery	1 34 17 1	Western Hemlock Shallow Soils	11/70 71/20 73/10
528E	1 34 17 1		11/70 71/20 73/10
528F	1 34 17 1		11/60 72/30 51/10

Ecological Zone: Western Hemlock
Landforms: Mountain and Hill upper slopes; associated with benches and rock formations.
Vegetation Series: Western Redcedar dominant, western hemlock associated.
Characteristic Understory Vegetation: Blueberry, with some salal below 500 feet elevation.

Discussion: Soils shallow throughout.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
540 Tokeen-McGilvery	1 31 17 1	Western Hemlock Shallow	11/60 37/10 17/30

Ecological Zone: Western Hemlock
Landforms: Upper mountain slopes, knobs and ridges.
Vegetation Series: Western Hemlock dominant, upland Sitka Spruce associated.
Characteristic Understory Vegetation: Blueberry. Devil's club on very steep or unstable slopes.

Discussion: Upland spruce associations need further evaluation.

Soil Map Unit	Proposed ELU Code	Proposed ELU Name	Proposed Plant Association Complex Codes/Percents
550C St.Nicholas-Kaikli	2 45 47 1	Cedar Hemlock Cedars, Drainage Limited	41/40 71/40 73/20
550D	2 45 47 1		41/50 71/20 42/30
150E	2 45 47 1		41/20 71/30 42/30

Ecological Zone: Cedar-Hemlock
Landforms: Hillslope and Valley sides.
Vegetation Series: Mixed Conifer and Redcedar.
Characteristic Understory Vegetation: Blueberry. Salal common below 500 feet. Strong component of skunk cabbage/deer cabbage.

Discussion: Yellowcedar associations may occur at higher elevations (especially 1,000-1,500 feet).

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REFERENCES CITED

Alaska Climate Center. 1986. Technical Note No. 3.

Alaback, P.B. 1982. Dynamics of understory biomass in Sitka spruce-western hemlock forests of Southeast Alaska. Ecology 63(6):1932-1948.

__________. 1984. Secondary succession following logging in the Sitka spruce-western hemlock forests of Southeast Alaska: Implications for wildlife management. USDA For. Serv. Gen. Tech. Rep. PNW-173. Pac. NW For. and Range Exp. Sta., Portland, OR. 26 pp.

__________. 1988. Endless battles, verdant survivors. Natural History 97.

__________. 1991. Ecological characteristics of temperate rainforests: Some implications for management of bald eagle habitat. Unpub. paper on file, USDA For. Serv. PNW Res. Sta., Juneau, AK. 33 pp.

__________, and J.C. Tappeiner II. 1991. Response of western hemlock (*Tsuga heterophylla*) and early huckleberry (*Vaccinium ovalifolium*) seedlings to forest windthrow. Can. J. For. Res. 21: 534-539.

Allen, B.H. 1987. Ecological type classification for California: The Forest Service approach. USDA Forest Service GTR PSW-98. Pacific Southwest Forest and Range Exp. Stn. 8 pp.

Arndt, K.L., R.H. Sackett, and J.A. Ketz. 1987. A cultural resource overview of the Tongass National Forest, Alaska. Fairbanks, AK: GDM, Inc. 329 pp.

Baichtal, J.F. 1991. Management of the karst areas within the Ketchikan Area of the Tongass National Forest, southeastern Alaska. *In* Proc. Amer. Cave Cons. Assoc. Symp., Nat. Cave Mgmt. Assoc., Bowling Green, KY. 10 pp.

Bailey, A.W. 1966. Forest associations and secondary plant succession in the southern Oregon Coast Range. Ph.D. dissertation. Oregon State Univ., Corvallis, OR.

Barnes, G.H. 1962. Yield of even-aged stands of western hemlock. Tech. Bull. 1273. U.S. Dept. of Agric., Wash., DC. 16pp.

Bormann, F.H., and G.E. Likens. 1979. Pattern and Process in a Forested Ecosystem. New York: Springer-Verlag. 253 pp.

Boughton, J.L. 1990. Clearcutting: Overview of a threatened and endangered silvicultural method. Juneau, AK: USDA For. Serv. Regional Office, Unpub. rep. on file. 12 pp.

Boyle, T.P., G.M. Smillie, J.C. Anderson, and D.R. Beeson. 1990. A sensitivity analysis of nine diversity and seven similarity indices. Res. J. Water Pollut. Control Fed. 62:749-762.

Brown, E.R. 1961. The black-tailed deer of western Washington. Wash. State Game Dept. Biol. Bull. 13.

Brown, M., P. Tierney, C. Crocker-Bedford, and T. DeMeo. 1992. Second-growth management and wildlife benefits in Southeast Alaska. Unpublished report, USDA Forest Service, Tongass Natl. For., Ketchikan Area. 9 pp.

Bull, E.L., R.S. Holthausen, and D.B. Marx. 1990. How to determine snag density. Western J. of Applied Forestry 5(2):56-58.

__________, and A.D. Partridge. 1986. Methods of killing trees for use by cavity nesters. Wildl. Soc. Bull. 14(2):142-146.

Bunnell, F.L., and G.W. Jones. 1984. Black-tailed deer and old-growth forests--A synthesis. *In*, Fish and Wildlife Relationships in Old-Growth Forests, W.R. Meehan et al., eds. Proceedings of a Symposium held in Juneau, Alaska, 12-15 April 1982. American Institute of Fishery Research Biologists.

Burns, R.M., ed. 1983. Silvicultural systems for the major forest types of the United States. Washington, DC: USDA For. Serv. Agric. Handbook 445. 191 pp.

__________, and B.H. Honkala, eds. 1990. Silvics of North America: Volume 1: Conifers. Washington, DC: USDA For. Serv. Ag. Handbook 654. 675 pp.

Chatwin, S.C., D.E. Howes, J.W. Schwab, and D.N. Swanston. 1991. A guide for management of landslide-prone terrain in the Pacific Northwest. B.C. Min. of For. Land Man. Handbook 18. Victoria, B.C. 212 pp.

Cline, S.P., A.B. Berg, and H.M. Wight. 1980. Snag characteristics and dynamics in Douglas-fir forests, western Oregon. J. Wildl. Manage. 44(4):773-786.

Cooper, W.S. 1937. The recent ecological history of Glacier Bay: An initial report upon a long term study. Ecology 4:355-65.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, USDI Fish and Wildlife Service, Wash. DC. FWS/OBS-79/31. 131 pp.

Crocker, R.L., and J. Major. 1955. Soil development in relation to vegetation and surface age at Glacier Bay, Alaska. J. Ecol. 43:427-448.

Cullen, P.L. 1987. Using soil and landform characteristics to predict site productivity on Prince of Wales Island, Alaska. Senior paper for Soil Sci. Dept., Calif. Polytechnic State Univ., San Luis Obispo, CA.

Daubenmire, R. 1978. Plant Geography. Academic Press, New York. 338 pp.

Davis, J.W., G.A. Goodwin, and R.A. Ockenfels, tech. coords. 1983. Snag habitat management: Proceedings of the symposium. USDA For. Serv. Gen. Tech. Rep. RM-99. Rocky Mtn. For. and Range Exp. Stn., Ft. Collins, Colo. 226 pp.

DeMeo, T.E. 1991. Preliminary second growth response summaries for selected plant associations. Review draft report. USDA For. Serv., Tongass N.F., Ketchikan Area. 55 pp.

DeMeo, T.E., D. Johnson, and C. Crocker-Bedford. 1990. Short-term vegetation response and deer use of artificial canopy gaps in Southeast Alaska. USDA For. Serv. unpublished report. 9 pp.

__________, and W.D. Loggy. 1989. Identification, classification, and delineation of wetlands using soils and vegetation data. Unpublished report, USDA Forest Service, Tongass N.F. 59 pp.

Doerr, J.G. and N.H. Sandburg. 1986. Effects of precommercial thinning on understory vegetation and deer habitat utiliization on Big Level Island in Southeast Alaska. Forest Sci. 32:1092-1095.

Ebasco Environmental. 1992. Evaluation of young-growth treatments for wildlife. Annual report 1991, Tongass National Forest. Ebasco Environmental, Bellevue, WA.

Farr, W.A. and E.W. Ford. 1988. Site quality, forest growth, and soil-site studies in the forests of coastal Alaska. *In* Slaughter, C.W. and T. Gasbarro, eds. Proceedings of the Alaska Forest Soil Productivity Workshop, Anchorage Alaska, April 28-30, 1987. USDA Forest Service, PNW-GRR-219, pp. 49-54.

__________, and A.S. Harris. 1979. Site index of Sitka spruce along the Pacific coast related to latitude and temperatures. Forest Sci. 25(1):145-153.

Fox, J.L. 1983. Constraints on winter habitat selection by the mountain goat (*Oreamnos americanus*) in Alaska. Ph.D. Dissertation, Univ. of Wash. 147 pp.

__________, C.A. Smith, and J.W. Schoen. 1989. Relation between mountain goats and their habitat in southeastern Alaska. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-246. Pac. NW Res. Sta., Portland, OR. 25 pp.

Ford, D. and P. Williams. 1989. Karst Geomorphology and Hydrology. London: Unwin Hyman, Ltd. 601 pp.

Franklin, J.F. 1989. Toward a new forestry. Am. Forests November/December:37-44.

__________. 1991. Old growth and the new forestry. *In* Copenhagen, M.J., ed. Proceedings of the New Perspectives Workshop: Petersburg, Alaska, July 17-19, 1990. USDA For. Serv. Reg. 10, Juneau, AK.

__________, and R.H. Waring. 1980. Distinctive features of the northwestern coniferous forest: Development, structure, function. *In* Waring, R.H., ed. Forests: Fresh Perspectives from Ecosystems Analysis. Proceedings of 40th Ann. Biol. Colloq., Oregon State Univ. Press, Corvallis, OR. pp. 59-89.

Fyles, J.W., I.H. Fyles, W.J. Beese, and M.C. Feller. 1991. Forest floor characteristics and soil nitrogen availability on slash-burned sites in coastal British Columbia. Can. J. For. Res. 21:1516-1522.

Garrison, G.A., J.M. Skovlin, G.E. Poulton, and A.H. Winward. 1976. Northwest plant names and symbols for ecosystem inventory and analysis. Fourth edition. USDA For. Serv. Gen. Tech. Rep. PNW-46. Pacific NW Forest and Range Exp. Sta., Portland, OR. 263 pp.

Haeussler, S., D. Coates, and J.Mather. 1990. Autecology of common plants in British Columbia: A literature review. Forestry Canada and B.C. Min. For., Victoria, BC.

Hanley, T.A. 1991. Old-growth forests and biological conservation in temperate rain forests of North America. *In* Maruyama, N., B. Bobek, Y. Ono, W. Regelin, L. Bartos, and P. Ratcliffe, eds. Wildlife Conservation: Present Trends and Perspectives for the 21st Century. Proceedings of the International

Symposium on Wildlife Conservation in Tsukuba and Yokohama, Japan (21-25 August 1990). The V International Congress for Ecology. Japan Wildlife Research Center, Tokyo. pp. 65-68.

__________, and J.D. McKendrick. 1985. Potential nutritional limitations for black-tailed deer in a spruce-hemlock forest, southeastern Alaska. J. Wildl. Manage. 49:103-114.

__________, C.T. Robbins, and D.E. Spalinger. 1989. Forest habitats and the nutritional ecology of Sitka black-tailed deer: A research synthesis with implications for forest management. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-230. Pac. NW Res. Sta., Portland, OR.

Harmon, M.E. 1986. Logs as sites of tree regeneration in *Picea sitchensis-Tsuga heterophylla* forests of coastal Washington and Oregon. Ph.D. thesis, Oregon State University, Corvallis. 183 pp.

__________ and J.F. Franklin. 1989. Tree seedlings on logs in *Picea-Tsuga* forests of Oregon and Washington. Ecology 70(1): 48-59.

Harris, A.S. 1989. Wind in the forests of Southeast Alaska and guides for reducing damage. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-244. Pac. NW Res. Stn., Portland, OR. 63 pp.

Hemstrom, M.A. and S.E. Logan. 1986. Plant association and management guide: Siuslaw National Forest. USDA For. Serv. Pub. R6-Ecol 220-1986a, Portland, OR. 121 pp.

Hennon, P.E., ed. 1992. Current knowledge of ecology and silviculture of yellow-cedar in southeast Alaska: Information exchanged at Sitka, Alaska, November 1991. USDA For. Serv. Gen. Tech. Rep. R10-TP-24. 31 pp.

__________, Hansen, E.M., and Shaw, C.G. III. 1990a. Dynamics of decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska. Can. J. Bot. 68: 651-662.

__________, Shaw, C.G. III, and Hansen, E.M. 1990b. Dating decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska. For. Sci. 36: 502-515.

Hocker, K.M. 1990. Influence of canopy gaps on forest dynamics in Southeast Alaskan hemlock-spruce forests. Senior thesis in biology, in cooperation with For. Sci. Lab., Juneau, AK.

Hopwood, D. 1991. Principles and Practices of New Forestry: A guide for British Columbians. Report commissioned by the Old-Growth Strategy Working Group. BC Min. For. Land Manage. Rep. 71. Crown Publications, Inc., Victoria, BC. 95 pp.

Hughes, R.M. and R.F. Noss. 1992. Biological diversity and biological integrity: Current concerns for lakes and streams. Fisheries 17(3):11-19.

Hunter, M.J. 1990. Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. Prentice-Hall, Englewood Cliffs, NJ.

Interagency Committee. 1989. Federal manual for identifying and delineating jurisdictional wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication. 107 pp. plus appendices.

Kessler, W.B. 1979. Bird population responses to clearcutting in Tongass National Forests of Southeast Alaska. USDA For. Serv., Alaska Region. Rep. 71.

__________. 1982. Wildlife and second-growth forests of Southeast Alaska: Problems and potential for management. USDA For. Serv., Alaska Region Admin. Doc. 110.

__________, and T. E. Kogut. 1985. Habitat orientations of forest birds in southeastern Alaska. Northwest Sci. 59:58-65.

Kimmins, J.P. 1987. Forest Ecology. Macmillan Pub. Co., New York. 531 pp.

Kirchhoff, M.D. and J.W. Schoen. 1987. Forest cover and snow implications for deer habitat in Southeast Alaska. J. Wildl. Manage. 51:28-33.

__________, __________, and O.C. Wallmo. 1983. Black-tailed deer use in relation to forest clear-cut edges in southeastern Alaska. J. Wildl. Manage. 47:5497-501.

Klinka, K., R.E. Carter, G.F. Weetman, and M.Jull. 1992. Silvicultural analysis of the subalpine mountain hemlock forest. Draft report to B.C. Min. For., Vancouver Forest Region, Burnaby, BC.

__________, V.J. Krajina, A. Ceska, and A.M. Scagel. 1989. Indicator plants of Coastal British Columbia. Univ. of BC Press, Vancouver. 288 pp.

Landwehr, D. no date. Ketchikan Area shovel yarding guidelines: Interim guidelines. Unpublished report, USDA Forest Service, Ketchikan Area.

Logan, S.E., M.A. Hemstrom, and W. Pavlat. 1987. Plant association and management guide: Willamette National Forest. Portland, OR: USDA For. Serv. PNW Region Rep. R6-Ecol 257-A-86, 223 pp.

MacKinnon, A., D. Meidinger, and K. Klinka. 1992. Use of the biogeoclimatic ecosystem system in British Columbia. The Forestry Chronicle 68(1):100-120.

Magurran, A.E. 1988. Ecological Diversity and Its Measurement. Princeton Univ. Press, Princeton, NJ. 179 pp.

Mankowski, J.D., and J.M. Peek. 1989. Habitat use of Sitka black-tailed deer in logged and unlogged forests, Prince of Wales Island, Southeast Alaska. Moscow, ID: Univ. of Idaho, Dept. of Fisheries and Wildlife Res. 27 pp.

Mann, D.H. 1986. Wisconsin and Holocene glaciation of Southeast Alaska. *In* Hamilton, T.D., K.M. Reed, and R.M. Thorson. eds. Glaciation in Alaska. Alaska Geological Society, Anchorage, AK. pp. 237-265.

Messier, C., and J.P. Kimmins. 1990. Factors limiting coniferous seedling growth in recently clearcut sites dominated by *Gaultheria shallon* in the CWHvm Subzone. Forestry Canada/B.C. Ministry of Forestry. 30 pp.

__________, and __________. 1991. Above- and below-ground vegetation recovery in recently clearcut and burned sites dominated by *Gaultheria shallon* in coastal British Columbia. For. Ecol. Manage. 46:275-294.

__________. 1992. Growth of western red cedar seedlings in relation to microtopography, forest floor nutrient status, and fireweed and salal on clear-cut sites in coastal British Columbia. Can. J. For. Res. 22:273-278.

Minore, D. 1983. Western redcedar-A literature review. USDA For. Serv. GTR PNW-150. Pacific Northwest Forest and Range Exp. Stn., Portland, OR. 70 pp.

Myer, W.H. 1937. Yield of even-aged stands of Sitka spruce and western hemlock. Tech. Bull. 544. U.S. Dept. of Agric., Wash., DC. 86 pp.

Noble, R.E. and P. Harrington. 1978. Snag characteristics in old-growth forests on Prince of Wales Island, Alaska. Wildlife and Fisheries Habitat Management Notes: 1. USDA For. Serv. Alaska Region Rep. No. 125. 88 pp.

Noss, R.R. 1990. Indicators for monitoring biodiversity: A hierarchical approach. Conserv. Biol. 4:355-364.

Nyberg, J.B., F.L. Bunnell, D.W. Janz, and R.M. Ellis. 1986. Managing young forests as black-tailed deer winter ranges. B.C. Min. For., Victoria, BC., Land Manage. Rep. 37.

Old Growth Definition Task Group. 1991. Ecological definitions for old-growth forest types in Southeast Alaska. USDA For. Serv. Pub. R10-TP-28, Juneau, AK. 60 pp.

Oliver, C.D., and B.C. Larson. 1990. Forest stand dynamics. McGraw-Hill Inc.

Paustian, S.J., ed. 1992. A channel type users guide for the Tongass National Forest, Southeast Alaska. USDA Forest Service, Alaska Region, R10-TP-26.

Pickett, S.T.A. and P.S. White, eds. 1985. The Ecology of Natural Disturbance and Patch Dynamics. New York: Academic Press, 472 pp.

Pielou, E.C. 1991. After the Ice Age: The Return of Life to Glaciated North America. University of Chicago Press, Chicago. 366 pp.

Pfister, R.D. and S.F. Arno. 1980. Classifying forest habitat types based on potential climax vegetation. Forest Science 26(1):52-70.

Reed, P.B. Jr. 1988. National list of plant species that occur in wetlands: Alaska (Region A). National Wetlands Inventory, Biological Report 88 (26.II), U.S. Fish and Wildlife Service, Wash., DC. 87 pp.

Reserve Tree Guideline Committee. 1992. Reserve tree selection guidelines. Draft report. USDA For. Serv. Alaska Region. 24 pp.

Rose, C.L. 1990. Application of the carbon/nitrogen balance concept to predicting the nutritional quality of blueberry foliage to deer in southeastern Alaska. Ph.D. dissertation, Oregon State University, Corvallis, OR. 150 pp.

Ruth, R.H., and A.S. Harris. 1979. Management of western hemlock-Sitka spruce forests for timber production. USDA For. Serv., GTR PNW-88. Pac. NW For. and Range Exp. Stn., Portland, OR. 197 pp.

Schoen, J.W., and M.D. Kirchhoff. 1990. Seasonal habitat use by Sitka black-tailed deer on Admiralty Island, Alaska. J. Wildl. Manage. 54:371-378.

____________, ____________, and J.H. Hughes. 1988. Wildlife and old-growth forests in Southeast Alaska. Natural Areas Journal 8:138-145.

Southwood, T.R.E. 1978. Ecological Methods. Chapman and Hall, London.

Stephens, F.R., C.R. Gass, and R.F. Billings. 1968. Soils and site index in Southeast Alaska. Rep. No. 2 of the Soil-Site Index, Administrative Study. USDA For. Serv., Alaska Region. 17 pp.

Swanston, D. (ed.). 1985. Proceedings of a workshop on slope stability: Problems and solutions in forest management. USDA For. Serv. Gen. Tech. Rep. PNW-180. Pac. Northwest For. and Range Exp. Sta., Portland, OR. 122 pp.

Taylor, R.F. 1934. Yield of second-growth western hemlock-Sitka spruce stands in southeastern Alaska. Tech. Bull. 412. U.S. Dept. of Agric., Wash. DC. 34 pp.

Thomas, J.W. (ed.). 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. Washington, DC: USDA For. Serv. Agric. Handbook 553. 512 pp.

Tierney, P.J. 1990. Management prescription for silvicultural certification 1990: The Dart Stand. USDA For. Serv., Thorne Bay (AK) R.D. Unpub. rep. on file. 21 pp. plus fig. and appendices.

USDA Forest Service. 1987. Soils: Ketchikan Area, Tongass National Forest. Report on file, Ketchikan, AK.

___________. 1991. USDA Forest Service Soil and Water Conservation Handbook, FSH 2509.22.

___________. 1992a. A channel type users guide for the Tongass National Forest, Southeast Alaska: USDA Forest Service, Alaska Region. Juneau, AK: USDA For. Serv. R10 Tech. Paper 26. 179 pp.

___________. 1992b. Trail Creek Supplemental Information Report. Northern Region, Beaverhead N.F., Wisdom R.D. 48 pp.

Van Hees, W.W.S. 1988. Timber productivity of seven forest ecosystems in southeastern Alaska. Res. Pap. PNW-RP-391. USDA For. Serv. Pac. NW Res. Stn., Portland, OR. 10 pp.

Van Horne, B., T.A. Hanley, R.G. Cates, J.D. McKendrick and J.D. Horner. 1988. Influence of seral stage and season on leaf chemistry of southeastern Alaska deer forage. Can. J. For. Res. 18:90-99.

Wallmo, O.C. and J.W. Schoen, eds. 1979. Sitka black-tailed deer. Proceedings of a conference held in Juneau, Alaska. USDA Forest Service, Alaska Region, Pub. R10-48. 231 pp.

___________, and ___________. 1980. Response of deer to secondary forest succession in Southeast Alaska. Forest Sci. 26:448-462.

White, W.B. 1988. Geomorphology and Hydrology of Karst Terrains. Oxford Univ. Press, New York. 464 pp.

Whittaker, R.H. 1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecol. Monogr. 30:279-338.

___________. 1965. Dominance and diversity in land plant communities. Science 147:250-260.

Yeo, J.J., and J.M. Peek. 1992. Habitat selection by female Sitka black-tailed deer in logged forests of southeastern Alaska. J. Wildl. Manage. 56(2):253-261.

APPENDICES

Note: In Appendix A (Vegetation Summary Statistics by Association), the following abbreviations are used:

CONST - Constancy, the percentage of sample plots where the plant species occurred.

FREQ - Frequency, the number of sample plots where the species was recorded.

MIN - Minimum value encountered in the field.

MAX - Maximum value encountered in the field.

RANGE - Maximum percent cover encountered minus minimum percent cover encountered.

MEAN - The average percent cover on all plots **where the species occurred.**

S.D. - Standard deviation of the mean.

S.E. - Standard error of the mean (equals standard deviation divided by the square root of the sample size (frequency)).

CI- 5% - 95% confidence interval about the mean. In other words, 95% of the time, the percent cover for that species can be expected to fall within plus or minus this value from the mean.

Appendix A: Vegetation Summary Statistics by Association

Vegetation Statistics for Western Hemlock/Blueberry (110)

63 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	63	15	90	75	59.4	14.8	1.9	3.8
TSHE	100%	63	10	90	80	53.9	16.6	2.1	4.2
THPL	23%	15	1	9	8	4.7	2.3	.6	1.3
TSME	6%	4	1	10	9	5.3	3.7	1.8	5.9
CHNO	14%	9	3	30	27	7.6	8.5	2.8	6.5
PISI	58%	37	1	15	14	6.9	3.4	.6	1.1
ALRU	3%	2	1	2	1	1.5	.7	.5	6.4

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	63	2	80	78	23.6	16.9	2.1	4.3
TSHE	96%	61	2	80	78	22.2	16.2	2.1	4.2
PISI	57%	36	1	15	14	1.7	2.4	.4	.8
THPL	15%	10	1	9	8	2.6	2.5	.8	1.8
TSME	6%	4	3	3	0	3.0	.0	.0	.0
CHNO	11%	7	1	12	11	3.6	4.0	1.5	3.7
ALRU	1%	1	5	5	0	5.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	63	2	96	94	45.6	27.9	3.5	7.1
VACCI	100%	63	1	90	89	38.1	28.1	3.6	7.1
MEFE	87%	55	1	45	44	6.6	9.2	1.2	2.5
VAPA	58%	37	1	31	30	5.1	6.1	1.0	2.0
OPHO	36%	23	1	6	5	1.8	1.5	.3	.7
RUSP	20%	13	1	8	7	2.2	2.1	.6	1.3
SARA	3%	2	1	1	0	1.0	.0	.0	.0
RIBR	1%	1	6	6	0	6.0	.0	.0	.0
GASH	4%	3	1	2	1	1.3	.6	.3	1.4
RILA	1%	1	1	1	0	1.0	.0	.0	.0
SOSI	1%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
PHGL	1%	1	3	3	0	3.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	4%	3	1	50	49	17.7	28.0	16.2	69.6
CAREX	6%	4	1	1	0	1.0	.0	.0	.0
CAME2	1%	1	1	1	0	1.0	.0	.0	.0
CAPL	1%	1	1	1	0	1.0	.0	.0	.0
CACA	1%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry (110)

63 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	63	0	96	96	16.6	17.6	2.2	4.4
COCA	84%	53	1	20	19	5.1	5.1	.7	1.4
RUPE	79%	50	1	30	29	5.7	6.7	1.0	1.9
STRO	68%	43	1	6	5	1.6	1.2	.2	.4
COAS	55%	35	1	30	29	4.3	5.7	1.0	2.0
TITR	53%	34	1	4	3	1.5	.9	.2	.3
LICO3	58%	37	1	3	2	1.3	.6	.1	.2
LYAM	39%	25	1	8	7	1.5	1.4	.3	.6
STAM	28%	18	1	3	2	1.2	.5	.1	.3
MADI2	31%	20	1	10	9	2.1	2.8	.6	1.3
CLUN	25%	16	1	6	5	2.6	1.7	.4	.9
MOUN	22%	14	1	2	1	1.1	.3	.1	.2
VIGL	6%	4	1	1	0	1.0	.0	.0	.0
COTR2	11%	7	1	2	1	1.1	.4	.1	.3
PRAL	7%	5	1	1	0	1.0	.0	.0	.0
VEVI	6%	4	1	3	2	1.5	1.0	.5	1.6
LICA3	4%	3	1	1	0	1.0	.0	.0	.0
PYSE	1%	1	2	2	0	2.0	.0	.0	.0
CABI	4%	3	1	3	2	2.0	1.0	.6	2.5
LIBO2	1%	1	2	2	0	2.0	.0	.0	.0
FACR	1%	1	1	1	0	1.0	.0	.0	.0
STST	1%	1	1	1	0	1.0	.0	.0	.0
DODEC	1%	1	1	1	0	1.0	.0	.0	.0
GATR	1%	1	1	1	0	1.0	.0	.0	.0
TREU	1%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	98%	62	0	47	47	8.3	9.3	1.2	2.4
DRAU2	61%	39	1	2	1	1.0	.2	.0	.1
BLSP	79%	50	1	38	37	4.2	6.8	1.0	1.9
GYDR	73%	46	1	34	33	3.7	6.0	.9	1.8
SPHAG	79%	50	1	68	67	11.3	13.4	1.9	3.8
ATFI	38%	24	1	5	4	1.5	1.1	.2	.4
POMU	20%	13	1	41	40	8.2	11.6	3.2	7.0
LYCOP	26%	17	1	7	6	2.3	2.2	.5	1.1
THPH	12%	8	1	2	1	1.4	.5	.2	.4
POGL4	20%	13	1	1	0	1.0	.0	.0	.0
LYAN	14%	9	1	2	1	1.1	.3	.1	.3
LYSE	11%	7	1	7	6	2.9	2.9	1.1	2.6
ADPE	7%	5	1	5	4	2.2	1.8	.8	2.2
LYCL	7%	5	1	5	4	1.8	1.8	.8	2.2
CYFR	3%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry/Shield Fern (120)

80 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	80	25	95	70	65.8	15.0	1.7	3.3
TSHE	100%	80	20	95	75	63.5	16.1	1.8	3.5
PISI	41%	33	1	25	24	6.4	5.1	.9	1.8
THPL	7%	6	1	5	4	3.7	1.5	.6	1.6
TSME	6%	5	2	25	23	7.8	9.7	4.4	12.1
CHNO	2%	2	1	1	0	1.0	.0	.0	.0
ALRU	1%	1	15	15	0	15.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	80	3	90	87	25.1	18.6	2.1	4.1
TSHE	100%	80	3	80	77	24.6	18.4	2.1	4.0
PISI	48%	39	1	12	11	2.1	2.7	.4	.9
THPL	7%	6	1	4	3	1.8	1.3	.5	1.4
TSME	6%	5	1	6	5	2.6	1.9	.9	2.4
CHNO	3%	3	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	80	5	86	81	39.8	21.9	2.5	4.9
VACCI	100%	80	1	80	79	33.6	21.3	2.4	4.7
MEFE	71%	57	1	15	14	3.1	3.0	.4	.8
VAPA	67%	54	1	15	14	3.1	2.7	.4	.7
OPHO	70%	56	1	8	7	2.5	1.7	.2	.5
RUSP	42%	34	1	7	6	1.9	1.6	.3	.6
SARA	6%	5	1	3	2	1.4	.9	.4	1.1
RIBR	1%	1	1	1	0	1.0	.0	.0	.0
GASH	1%	1	1	1	0	1.0	.0	.0	.0
ALSI	1%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	75%	60	0	31	31	.5	4.0	.5	1.0
VACA	2%	2	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	1%	1	1	1	0	1.0	.0	.0	.0
CAREX	1%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry/Shield Fern (120) Cont.

80 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	97%	78	1	90	89	23.2	20.8	2.4	4.6
COCA	83%	67	1	25	24	6.8	6.2	.8	1.5
RUPE	82%	66	1	30	29	7.7	7.5	.9	1.8
STRO	73%	59	1	7	6	1.7	1.3	.2	.3
COAS	61%	49	1	30	29	6.1	7.1	1.0	2.1
TITR	51%	41	1	12	11	3.1	3.4	.5	1.1
LICO3	36%	29	1	3	2	1.1	.4	.1	.2
LYAM	18%	15	1	2	1	1.2	.4	.1	.2
STAM	30%	24	1	3	2	1.2	.5	.1	.2
MADI2	27%	22	1	8	7	2.5	2.4	.5	1.1
CLUN	23%	19	1	18	17	5.8	5.3	1.2	2.6
MOUN	13%	11	1	2	1	1.2	.4	.1	.3
VIGL	14%	12	1	7	6	2.2	1.7	.5	1.1
COTR2	11%	9	1	5	4	2.1	1.4	.5	1.0
CIAL	6%	5	1	6	5	2.2	2.2	1.0	2.7
PRAL	1%	1	5	5	0	5.0	.0	.0	.0
VEVI	3%	3	1	2	1	1.3	.6	.3	1.4
LICA3	6%	5	1	1	0	1.0	.0	.0	.0
PYSE	7%	6	1	4	3	1.7	1.2	.5	1.3
CABI	2%	2	1	3	2	2.0	1.4	1.0	12.7
LIBO2	1%	1	1	1	0	1.0	.0	.0	.0
VILA	2%	2	1	2	1	1.5	.7	.5	6.4
TIUN	3%	3	1	6	5	2.7	2.9	1.7	7.2
GALIU	1%	1	1	1	0	1.0	.0	.0	.0
STST	1%	1	10	10	0	10.0	.0	.0	.0
OSPU	1%	1	1	1	0	1.0	.0	.0	.0
HELA	1%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	80	2	65	63	13.8	9.8	1.1	2.1
DRAU2	100%	80	2	35	33	5.8	5.6	.6	1.2
BLSP	77%	62	1	13	12	2.8	2.5	.3	.6
GYDR	83%	67	1	30	29	3.7	4.2	.5	1.0
SPHAG	63%	51	1	65	64	6.8	10.2	1.4	2.9
ATFI	48%	39	1	10	9	2.5	2.1	.3	.7
POMU	18%	15	1	15	14	4.3	3.8	1.0	2.1
CLUBS	17%	14	1	10	9	1.9	2.4	.6	1.4
THPH	16%	13	1	15	14	2.8	3.9	1.1	2.4
POGL4	7%	6	1	1	0	1.0	.0	.0	.0
LYAN	6%	5	1	1	0	1.0	.0	.0	.0
LYSE	8%	7	1	2	1	1.1	.4	.1	.3
ADPE	3%	3	1	6	5	2.7	2.9	1.7	7.2
LYCL	2%	2	1	1	0	1.0	.0	.0	.0
CYFR	5%	4	1	1	0	1.0	.0	.0	.0
PTAQ	1%	1	2	2	0	2.0	.0	.0	.0
THLI	1%	1	2	2	0	2.0	.0	.0	.0
LYSI	1%	1	10	10	0	10.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry/Skunk Cabbage (130)

38 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	38	30	89	59	58.1	13.7	2.2	4.5
TSHE	100%	38	23	95	72	54.1	16.0	2.6	5.3
TSME	15%	6	1	15	14	5.0	5.1	2.1	5.4
CHNO	2%	1	5	5	0	5.0	.0	.0	.0
PISI	73%	28	1	15	14	6.3	3.3	.6	1.3
THPL	13%	5	3	5	2	4.6	.9	.4	1.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	38	5	60	55	24.2	14.3	2.3	4.7
TSHE	94%	36	4	60	56	21.9	14.3	2.4	4.8
PISI	73%	28	1	7	6	2.3	1.8	.3	.7
THPL	10%	4	1	2	1	1.8	.5	.3	.8
TSME	26%	10	1	5	4	2.3	1.9	.6	1.4
CHNO	0%	0	0	0	0	.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	38	2	90	88	51.6	19.6	3.2	6.4
VACCI	100%	38	1	80	79	41.4	21.6	3.5	7.1
MEFE	97%	37	1	35	34	8.4	7.6	1.3	2.5
VAPA	52%	20	1	15	14	3.3	3.8	.8	1.8
OPHO	26%	10	1	8	7	3.6	2.7	.8	1.9
RUSP	26%	10	1	2	1	1.3	.5	.2	.3
SARA	2%	1	2	2	0	2.0	.0	.0	.0
RIBR	2%	1	2	2	0	2.0	.0	.0	.0
GASH	2%	1	7	7	0	7.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	81%	31	0	10	10	.5	1.8	.3	.7
VACA	7%	3	1	2	1	1.7	.6	.3	1.4

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	10%	4	1	2	1	1.3	.5	.3	.8
CAREX	5%	2	1	1	0	1.0	.0	.0	.0
LUZUL	2%	1	1	1	0	1.0	.0	.0	.0
AGROS	2%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry/Skunk Cabbage (130)

38 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	38	9	85	76	30.4	16.6	2.7	5.4
COCA	86%	33	1	20	19	5.1	4.0	.7	1.4
RUPE	81%	31	1	20	19	6.1	4.5	.8	1.7
STRO	60%	23	1	4	3	1.5	1.0	.2	.4
COAS	65%	25	1	15	14	4.3	4.0	.8	1.7
TITR	44%	17	1	15	14	2.7	3.4	.8	1.7
LICO3	71%	27	1	5	4	1.3	.8	.2	.3
LYAM	100%	38	3	30	27	11.2	8.1	1.3	2.7
STAM	21%	8	1	3	2	1.3	.7	.3	.6
MADI2	28%	11	1	5	4	1.4	1.2	.4	.8
CLUN	28%	11	1	6	5	2.8	1.6	.5	1.1
MOUN	15%	6	1	1	0	1.0	.0	.0	.0
VIGL	13%	5	1	4	3	1.8	1.3	.6	1.6
COTR2	7%	3	2	5	3	3.7	1.5	.9	3.8
CIAL	10%	4	1	2	1	1.5	.6	.3	.9
VEVI	2%	1	3	3	0	3.0	.0	.0	.0
LICA3	2%	1	1	1	0	1.0	.0	.0	.0
CABI	7%	3	1	8	7	3.3	4.0	2.3	10.0
LIBO2	5%	2	1	1	0	1.0	.0	.0	.0
GATR2	2%	1	1	1	0	1.0	.0	.0	.0
FACR	5%	2	1	2	1	1.5	.7	.5	6.4
RUCH	2%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	37	1	32	31	5.6	5.7	.9	1.9
DRAU2	68%	26	1	20	19	2.4	3.8	.7	1.5
BLSP	84%	32	1	6	5	2.7	1.5	.3	.5
GYDR	47%	18	1	8	7	2.2	1.8	.4	.9
SPHAG	92%	35	2	35	33	13.1	9.5	1.6	3.3
ATFI	31%	12	1	5	4	1.7	1.2	.4	.8
POMU	7%	3	1	4	3	2.3	1.5	.9	3.8
CLUBS	2%	1	1	1	0	1.0	.0	.0	.0
THPH	2%	1	1	1	0	1.0	.0	.0	.0
POGL4	7%	3	1	2	1	1.3	.6	.3	1.4
LYAN	5%	2	1	1	0	1.0	.0	.0	.0
LYCL	2%	1	1	1	0	1.0	.0	.0	.0
PTAQ	7%	3	1	2	1	1.3	.6	.3	1.4

Vegetation Statistics for Western Hemlock/Blueberry-Devil's Club (140)

26 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	7	80	73	60.2	16.5	3.2	6.6
TSHE	100%	26	2	80	78	58.1	17.1	3.4	6.9
PISI	57%	15	1	10	9	5.3	2.7	.7	1.5
THPL	7%	2	2	2	0	2.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	1	65	64	24.2	17.5	3.4	7.1
TSHE	100%	26	3	65	62	24.3	17.7	3.5	7.2
PISI	69%	18	1	14	13	1.8	3.1	.7	1.5
THPL	11%	3	1	2	1	1.3	.6	.3	1.4
TSME	3%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	25	4	100	96	53.6	23.4	4.7	9.7
VACCI	96%	25	1	55	54	23.8	14.1	2.8	5.8
MEFE	65%	17	1	20	19	4.9	5.5	1.3	2.8
VAPA	57%	15	1	15	14	3.9	4.7	1.2	2.6
OPHO	100%	26	10	65	55	25.3	13.5	2.6	5.4
RUSP	76%	20	1	8	7	2.6	2.2	.5	1.0
SARA	26%	7	1	2	1	1.4	.5	.2	.5
RIBR	15%	4	1	5	4	2.8	2.1	1.0	3.3
COST	3%	1	2	2	0	2.0	.0	.0	.0
RUPA	3%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	7%	2	1	1	0	1.0	.0	.0	.0
CAREX	7%	2	1	2	1	1.5	.7	.5	6.4
CAME2	3%	1	2	2	0	2.0	.0	.0	.0
LUPA	3%	1	1	1	0	1.0	.0	.0	.0
DEAT	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Blueberry-Devil's Club (140) Cont.

26 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	1	100	99	33.7	30.5	6.0	12.3
COCA	88%	23	1	25	24	8.4	7.1	1.5	3.1
RUPE	92%	24	1	25	24	7.1	7.3	1.5	3.1
STRO	69%	18	1	8	7	2.6	2.0	.5	1.0
COAS	65%	17	1	25	24	7.1	8.1	2.0	4.2
TITR	92%	24	1	30	29	5.8	6.8	1.4	2.9
LICO3	19%	5	1	3	2	1.4	.9	.4	1.1
LYAM	23%	6	1	38	37	14.0	15.2	6.2	16.0
STAM	46%	12	1	1	0	1.0	.0	.0	.0
MADI2	19%	5	1	3	2	1.6	.9	.4	1.1
CLUN	19%	5	1	5	4	2.8	1.5	.7	1.8
MOUN	11%	3	1	1	0	1.0	.0	.0	.0
VIGL	34%	9	1	10	9	3.4	3.4	1.1	2.6
CIAL	26%	7	1	10	9	3.4	3.6	1.4	3.4
PRAL	19%	5	1	1	0	1.0	.0	.0	.0
VEVI	11%	3	1	1	0	1.0	.0	.0	.0
LICA3	3%	1	1	1	0	1.0	.0	.0	.0
PYSE	3%	1	1	1	0	1.0	.0	.0	.0
LIBO2	3%	1	1	1	0	1.0	.0	.0	.0
VILA	11%	3	1	2	1	1.3	.6	.3	1.4
TIUN	3%	1	3	3	0	3.0	.0	.0	.0
GATR2	7%	2	1	1	0	1.0	.0	.0	.0
GALIU	3%	1	2	2	0	2.0	.0	.0	.0
RUCH	3%	1	5	5	0	5.0	.0	.0	.0
OSPU	3%	1	1	1	0	1.0	.0	.0	.0
GAKA	3%	1	1	1	0	1.0	.0	.0	.0
ARNIC	3%	1	15	15	0	15.0	.0	.0	.0
CLSI	3%	1	1	1	0	1.0	.0	.0	.0
HEGL2	3%	1	21	21	0	21.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	4	50	46	19.2	10.5	2.1	4.2
DRAU2	84%	22	1	45	44	7.0	9.3	2.0	4.1
BLSP	76%	20	1	5	4	2.9	1.2	.3	.6
GYDR	96%	25	1	17	16	4.6	4.1	.8	1.7
SPHAG	69%	18	1	30	29	8.5	9.6	2.3	4.8
ATFI	84%	22	1	20	19	5.0	4.2	.9	1.9
POMU	26%	7	1	10	9	4.4	3.7	1.4	3.4
CLUBS	26%	7	1	2	1	1.1	.4	.1	.3
THPH	53%	14	1	6	5	1.7	1.5	.4	.9
POGL4	23%	6	1	1	0	1.0	.0	.0	.0
LYAN	15%	4	1	1	0	1.0	.0	.0	.0
LYSE	7%	2	1	2	1	1.5	.7	.5	6.4
ADPE	19%	5	1	4	3	1.6	1.3	.6	1.7
CYFR	3%	1	1	1	0	1.0	.0	.0	.0
POBR	11%	3	1	15	14	6.0	7.8	4.5	19.4
THLI	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Devil's Club/Salmonberry (150)

9 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	40	78	38	58.4	15.0	5.0	11.5
TSHE	100%	9	30	76	46	55.4	17.9	6.0	13.8
PISI	44%	4	1	10	9	6.5	4.0	2.0	6.4
THPL	11%	1	6	6	0	6.0	.0	.0	.0
TSME	11%	1	10	10	0	10.0	.0	.0	.0
CHNO	11%	1	3	3	0	3.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	2	30	28	15.1	7.8	2.6	6.0
TSHE	100%	9	1	30	29	15.4	8.7	2.9	6.7
PISI	66%	6	1	2	1	1.3	.5	.2	.5
THPL	11%	1	1	1	0	1.0	.0	.0	.0
TSME	11%	1	4	4	0	4.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	30	90	60	66.7	22.4	7.5	17.2
VACCI	88%	8	2	65	63	30.1	23.1	8.2	19.3
MEFE	77%	7	1	18	17	6.1	6.0	2.3	5.5
VAPA	55%	5	1	12	11	6.2	4.7	2.1	5.8
OPHO	100%	8	1	55	54	20.2	16.1	5.7	13.5
RUSP	100%	9	10	45	35	18.7	11.8	3.9	9.1
SARA	22%	2	3	3	0	3.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	2	85	83	26.7	27.8	9.3	21.3
COCA	88%	8	1	19	18	7.5	6.8	2.4	5.7
RUPE	77%	7	2	25	23	13.7	10.3	3.9	9.5
STRO	77%	7	1	5	4	2.1	2.0	.7	1.8
COAS	55%	5	1	35	34	11.6	13.6	6.1	16.8
TITR	55%	5	2	7	5	4.4	1.9	.9	2.4
LICO3	11%	1	1	1	0	1.0	.0	.0	.0
LYAM	22%	2	1	6	5	3.5	3.5	2.5	31.8
STAM	22%	2	1	3	2	2.0	1.4	1.0	12.7
MADI2	11%	1	2	2	0	2.0	.0	.0	.0
CLUN	22%	2	1	1	0	1.0	.0	.0	.0
VIGL	11%	1	1	1	0	1.0	.0	.0	.0
COTR2	11%	1	1	1	0	1.0	.0	.0	.0
PRAL	11%	1	1	1	0	1.0	.0	.0	.0
LIBO2	11%	1	1	1	0	1.0	.0	.0	.0
LISTE	11%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock/Devil's Club/Salmonberry (150) Cont.

9 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	10	26	16	16.8	5.5	1.8	4.3
DRAU2	100%	9	1	15	14	5.6	4.5	1.5	3.5
BLSP	77%	7	1	10	9	4.3	3.2	1.2	3.0
GYDR	77%	7	1	11	10	4.1	3.4	1.3	3.1
SPHAG	88%	8	1	38	37	11.4	12.5	4.4	10.5
ATFI	55%	5	1	5	4	3.0	1.6	.7	2.0
POMU	33%	3	5	15	10	8.7	5.5	3.2	13.7
CLUBS	11%	1	1	1	0	1.0	.0	.0	.0
THPH	11%	1	2	2	0	2.0	.0	.0	.0
POGL4	22%	2	1	1	0	1.0	.0	.0	.0
LYAN	11%	1	1	1	0	1.0	.0	.0	.0
LYSE	11%	1	1	1	0	1.0	.0	.0	.0
ADPE	11%	1	1	1	0	1.0	.0	.0	.0
POBR	11%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Yellowcedar/Blueberry (210)

26 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	40	84	44	62.8	11.5	2.3	4.7
CHNO	100%	26	8	60	52	24.4	11.8	2.3	4.8
TSHE	100%	26	5	60	55	35.2	16.6	3.3	6.7
PISI	46%	12	1	30	29	5.7	8.1	2.3	5.2
TSME	34%	9	2	15	13	6.3	4.0	1.3	3.1
THPL	19%	5	2	7	5	4.8	1.8	.8	2.2

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	0	70	70	21.3	18.2	3.6	7.4
TSHE	88%	23	2	60	58	18.6	17.5	3.6	7.6
CHNO	80%	21	1	19	18	4.1	4.7	1.0	2.1
TSME	38%	10	1	8	7	3.6	2.4	.8	1.7
PISI	46%	12	1	3	2	1.5	.7	.2	.4
THPL	11%	3	1	3	2	2.0	1.0	.6	2.5

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	5	90	85	52.4	21.4	4.2	8.7
VACCI	100%	26	1	75	74	39.7	19.4	3.8	7.8
MEFE	96%	25	1	40	39	9.6	8.8	1.8	3.6
VAPA	61%	16	1	19	18	5.3	5.7	1.4	3.0
OPHO	61%	16	1	4	3	1.8	1.1	.3	.6
RUSP	19%	5	1	8	7	3.8	3.4	1.5	4.2

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	2	43	41	11.4	9.3	1.8	3.8
BLSP	92%	24	1	15	14	4.4	3.4	.7	1.4
GYDR	80%	21	1	8	7	3.0	1.6	.3	.7
SPHAG	61%	16	1	20	19	5.6	5.2	1.3	2.8
ATFI	46%	12	1	3	2	1.7	.9	.3	.6
DRAU2	30%	8	1	4	3	1.6	1.1	.4	.9
CLUBS	34%	9	1	3	2	1.6	.7	.2	.6
LYAN	34%	9	1	2	1	1.1	.3	.1	.3
THPH	38%	10	1	12	11	3.7	3.5	1.1	2.5
LYCL	19%	5	1	2	1	1.4	.5	.2	.7
POGL4	15%	4	1	1	0	1.0	.0	.0	.0
ADPE	15%	4	1	3	2	2.3	1.0	.5	1.5
LYSE	7%	2	1	1	0	1.0	.0	.0	.0
POMU	3%	1	5	5	0	5.0	.0	.0	.0
CYFR	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Yellowcedar/Blueberry (210) Cont.

26 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	26	10	80	70	32.8	18.6	3.6	7.5
COCA	96%	25	1	25	24	7.7	7.4	1.5	3.0
RUPE	100%	26	1	20	19	6.5	5.2	1.0	2.1
COAS	92%	24	1	20	19	7.6	6.9	1.4	2.9
STRO	88%	23	1	4	3	1.6	.8	.2	.4
TITR	80%	21	1	41	40	4.3	8.5	1.9	3.9
LICO3	80%	21	1	5	4	1.7	1.1	.2	.5
LYAM	46%	12	1	2	1	1.7	.5	.1	.3
CLUN	46%	12	1	8	7	3.0	2.4	.7	1.6
COTR2	38%	10	1	6	5	1.8	1.6	.5	1.2
CABI	23%	6	1	10	9	4.3	3.1	1.3	3.2
STAM	30%	8	1	2	1	1.1	.4	.1	.3
VEVI	26%	7	1	4	3	2.1	1.2	.5	1.1
MADI2	23%	6	1	4	3	1.7	1.2	.5	1.3
LICA3	23%	6	1	1	0	1.0	.0	.0	.0
PRAL	19%	5	1	4	3	2.2	1.3	.6	1.6
VIGL	19%	5	1	4	3	1.8	1.3	.6	1.6
FACR	3%	1	2	2	0	2.0	.0	.0	.0
HELA	7%	2	1	2	1	1.5	.7	.5	6.4
LIBO2	7%	2	1	3	2	2.0	1.4	1.0 1	2.7
OSPU	3%	1	1	1	0	1.0	.0	.0	.0
CIAL	3%	1	1	1	0	1.0	.0	.0	.0
PYSE	3%	1	1	1	0	1.0	.0	.0	.0
MOUN	7%	2	1	1	0	1.0	.0	.0	.0
EQUIS	3%	1	1	1	0	1.0	.0	.0	.0
TIUN	3%	1	1	1	0	1.0	.0	.0	.0
GATR2	3%	1	1	1	0	1.0	.0	.0	.0
EPLU	3%	1	1	1	0	1.0	.0	.0	.0
LICO	3%	1	1	1	0	1.0	.0	.0	.0
SETR	3%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	11%	3	1	2	1	1.3	.6	.3	1.4
CAREX	11%	3	1	3	2	2.0	1.0	.6	2.5
CAMA4	3%	1	3	3	0	3.0	.0	.0	.0
AGGI	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Yellowcedar/Blueberry/Skunk Cabbage (220)

10 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	50	99	49	69.6	14.1	5.0	11.8
CHNO	100%	10	10	56	46	23.6	13.2	4.2	9.4
TSHE	100%	10	5	60	55	37.6	19.0	6.0	13.6
PISI	60%	6	1	20	19	8.8	7.1	2.9	7.4
TSME	20%	2	5	10	5	7.5	3.5	2.5	31.8
THPL	30%	3	2	20	18	8.3	10.1	5.8	25.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	70%	7	5	35	30	20.4	12.5	4.7	11.5
TSHE	90%	9	5	35	30	15.0	9.9	3.3	7.6
CHNO	50%	5	1	15	14	7.8	6.8	3.1	8.5
TSME	60%	6	1	5	4	2.0	1.7	.7	1.8
PISI	50%	5	1	1	0	1.0	.0	.0	.0
THPL	30%	3	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	20	85	65	45.0	19.8	7.0	16.6
VACCI	100%	10	10	80	70	36.2	23.4	7.8	18.0
MEFE	90%	9	1	25	24	8.8	8.1	2.7	6.2
VAPA	50%	5	2	7	5	3.8	2.0	.9	2.5
OPHO	30%	3	2	5	3	3.7	1.5	.9	3.8
RUSP	10%	1	2	2	0	2.0	.0	.0	.0
GASH	30%	3	1	35	34	13.0	19.1	11.0	47.4

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
GRAMI	20%	2	1	1	0	1.0	.0	.0	.0
CAREX	10%	1	1	1	0	1.0	.0	.0	.0
DEPU	10%	1	9	9	0	9.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Yellowcedar/Blueberry/Skunk Cabbage (220) Cont.

10 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	70%	7	14 1	00	86	45.0	30.0	11.3	27.7
COCA	90%	9	1	20	19	8.3	6.3	2.1	4.9
RUPE	90%	9	1	20	19	6.3	5.9	2.0	4.5
COAS	80%	8	2	45	43	11.5	14.3	5.1	12.0
STRO	60%	6	1	5	4	3.0	1.7	.7	1.8
TITR	70%	7	1	15	14	5.7	5.2	2.0	4.8
LICO3	70%	7	1	3	2	1.6	.8	.3	.7
LYAM	100%	10	3	25	22	7.7	6.6	2.1	4.7
CLUN	30%	3	1	7	6	4.0	3.0	1.7	7.5
COTR2	20%	2	1	2	1	1.5	.7	.5	6.4
CABI	30%	3	1	4	3	2.7	1.5	.9	3.8
STAM	20%	2	1	1	0	1.0	.0	.0	.0
VEVI	30%	3	1	2	1	1.3	.6	.3	1.4
MADI2	10%	1	5	5	0	5.0	.0	.0	.0
LICA3	20%	2	1	1	0	1.0	.0	.0	.0
PRAL	10%	1	1	1	0	1.0	.0	.0	.0
VIGL	10%	1	2	2	0	2.0	.0	.0	.0
FACR	10%	1	1	1	0	1.0	.0	.0	.0
HELA	10%	1	1	1	0	1.0	.0	.0	.0
LIBO2	10%	1	1	1	0	1.0	.0	.0	.0
OSPU	10%	1	1	1	0	1.0	.0	.0	.0
PYSE	10%	1	1	1	0	1.0	.0	.0	.0
STST	10%	1	1	1	0	1.0	.0	.0	.0

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	80%	8	1	25	24	11.7	9.3	3.3	7.8
BLSP	100%	10	1	25	24	8.8	9.0	2.8	6.4
GYDR	70%	7	1	7	6	3.0	2.2	.8	2.1
SPHAG	70%	7	2	45	43	13.9	14.6	5.5	13.5
ATFI	60%	6	1	3	2	1.3	.8	.3	.9
DRAU2	40%	4	1	2	1	1.5	.6	.3	.9
CLUBS	40%	4	1	51	50	13.7	24.8	12.4	39.5
LYAN	30%	3	1	1	0	1.0	.0	.0	.0
THPH	20%	2	1	1	0	1.0	.0	.0	.0
LYCL	20%	2	1	1	0	1.0	.0	.0	.0
POGL4	10%	1	1	1	0	1.0	.0	.0	.0
ADPE	10%	1	1	1	0	1.0	.0	.0	.0
LYSE	30%	3	1	50	49	17.3	28.3	16.3	70.3
POMU	10%	1	5	5	0	5.0	.0	.0	.0
THLI	10%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Yellowcedar/Blueberry-Devil's Club (250)

6 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	55	90	35	68.7	12.4	5.1	13.0
CHNO	100%	6	10	40	30	23.5	12.0	4.9	12.6
TSHE	100%	6	25	60	35	39.0	13.9	5.7	14.6
PISI	66%	4	1	25	24	13.0	11.3	5.7	18.0
TSME	33%	2	3	3	0	3.0	.0	.0	.0
THPL	33%	2	4	7	3	5.5	2.1	1.5	19.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	8	42	34	21.8	12.3	5.0	12.9
TSHE	100%	6	7	17	10	12.0	4.2	1.7	4.4
CHNO	83%	5	1	24	23	6.4	9.9	4.4	12.3
TSME	50%	3	1	2	1	1.7	.6	.3	1.4
PISI	50%	3	1	3	2	2.3	1.2	.7	2.9
THPL	33%	2	1	5	4	3.0	2.8	2.0	25.4
ALRU	16%	1	6	6	0	6.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	50	79	29	63.5	11.7	4.8	12.3
VACCI	100%	6	10	71	61	44.5	24.4	10.0	25.6
MEFE	100%	6	3	35	32	15.3	13.5	5.5	14.1
VAPA	50%	3	1	4	3	2.3	1.5	.9	3.8
OPHO	100%	6	5	20	15	9.8	6.2	2.5	6.5
RUSP	50%	3	1	3	2	2.3	1.2	.7	2.9
SOSI	33%	2	1	2	1	1.5	.7	.5	6.4
RIBES	16%	1	1	1	0	1.0	.0	.0	.0
CLPY	16%	1	2	2	0	2.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	83%	5	25	92	67	59.0	27.8	12.4	34.5
COCA	100%	6	4	16	12	11.7	6.0	2.4	6.3
RUPE	100%	6	6	39	33	19.7	11.8	4.8	12.4
COAS	100%	6	6	20	14	10.2	5.2	2.1	5.5
STRO	83%	5	1	3	2	2.0	1.0	.4	1.2
TITR	66%	4	1	20	19	7.8	8.4	4.2	13.4
LICO3	66%	4	1	2	1	1.3	.5	.3	.8
LYAM	100%	6	1	6	5	2.3	1.9	.8	2.0
CLUN	33%	2	2	2	0	2.0	.0	.0	.0
CABI	50%	3	3	12	9	6.3	4.9	2.8	12.3
STAM	33%	2	1	2	1	1.5	.7	.5	6.4
VEVI	33%	2	1	3	2	2.0	1.4	1.0	12.7
MADI2	50%	3	2	6	4	4.0	2.0	1.2	5.0
LICA3	16%	1	1	1	0	1.0	.0	.0	.0
PRAL	50%	3	1	2	1	1.3	.6	.3	1.4
VIGL	33%	2	1	15	14	8.0	9.9	7.0	88.9
FACR	16%	1	2	2	0	2.0	.0	.0	.0
VILA	16%	1	10	10	0	10.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	16%	1	1	1	0	1.0	.0	.0	.0
CAREX	16%	1	2	2	0	2.0	.0	.0	.0
TRISE	16%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	8	30	22	14.8	8.9	4.0	11.0
BLSP	66%	4	3	5	2	3.8	1.0	.5	1.5
GYDR	100%	6	2	15	13	5.8	4.7	1.9	4.9
SPHAG	66%	4	2	6	4	4.5	1.7	.9	2.8
ATFI	33%	2	5	8	3	6.5	2.1	1.5	19.1
DRAU2	83%	5	1	5	4	3.0	1.6	.7	2.0
CLUBS	16%	1	1	1	0	1.0	.0	.0	.0
LYAN	16%	1	1	1	0	1.0	.0	.0	.0
THPH	33%	2	1	10	9	5.5	6.4	4.5	57.2
LYCL	16%	1	1	1	0	1.0	.0	.0	.0
POGL4	16%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Blueberry (310)

27 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	30	85	55	61.7	15.1	2.9	6.0
ALRU	3%	1	1	1	0	1.0	.0	.0	.0
CHNO	3%	1	5	5	0	5.0	.0	.0	.0
PISI	100%	27	15	75	60	30.8	15.7	3.0	6.2
THPL	11%	3	3	5	2	4.3	1.2	.7	2.9
TSHE	92%	25	3	70	67	34.6	19.0	3.8	7.8
TSME	22%	6	2	15	13	5.8	4.7	1.9	4.9

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	4	75	71	26.8	16.9	3.3	6.7
THPL	3%	1	1	1	0	1.0	.0	.0	.0
ALRU	0%	0	0	0	0	.0	.0	.0	.0
TSHE	96%	26	4	55	51	22.0	12.9	2.5	5.2
TSME	18%	5	1	8	7	4.0	3.3	1.5	4.1
PISI	77%	21	1	75	74	6.9	16.2	3.5	7.4

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	2	85	83	29.2	24.9	4.8	9.8
ALSI	3%	1	1	1	0	1.0	.0	.0	.0
MEFE	66%	18	1	10	9	3.6	2.9	.7	1.4
OPHO	40%	11	1	4	3	1.8	1.2	.4	.8
RILA	3%	1	1	1	0	1.0	.0	.0	.0
RUSP	29%	8	1	7	6	2.4	2.1	.7	1.7
SARA	3%	1	3	3	0	3.0	.0	.0	.0
VACCI	100%	26	1	85	84	24.9	26.0	5.1	10.5
VAPA	55%	15	1	20	19	3.5	4.8	1.2	2.6

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	2	40	38	10.0	9.5	1.8	3.8
CLUBS	25%	7	1	3	2	1.4	.8	.3	.7
SPHAG	48%	13	1	60	59	11.2	16.1	4.5	9.8
ADPE	11%	3	1	1	0	1.0	.0	.0	.0
ATFI	44%	12	1	20	19	3.3	5.3	1.5	3.4
BLSP	51%	14	1	5	4	1.9	1.4	.4	.8
CYFR	3%	1	1	1	0	1.0	.0	.0	.0
DRAU2	77%	21	1	15	14	3.1	3.2	.7	1.4
GYDR	74%	20	1	10	9	3.4	2.4	.5	1.1
LYAN	18%	5	1	1	0	1.0	.0	.0	.0
LYSE	11%	3	1	2	1	1.7	.6	.3	1.4
POMU	29%	8	1	20	19	5.3	6.4	2.3	5.3
THPH	33%	9	1	15	14	3.3	4.5	1.5	3.5

Vegetation Statistics for Sitka Spruce/Blueberry (310)

27 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	1	65	64	17.2	16.7	3.2	6.6
MOUN	22%	6	1	1	0	1.0	.0	.0	.0
COTR2	11%	3	1	1	0	1.0	.0	.0	.0
FACR	7%	2	1	1	0	1.0	.0	.0	.0
CABI	7%	2	1	5	4	3.0	2.8	2.0	25.4
CIAL	11%	3	1	2	1	1.7	.6	.3	1.4
CLUN	7%	2	1	2	1	1.5	.7	.5	6.4
COAS	51%	14	1	15	14	3.7	4.1	1.1	2.4
COCA	44%	12	1	25	24	7.2	7.6	2.2	4.8
GATR2	11%	3	1	1	0	1.0	.0	.0	.0
HELA	3%	1	1	1	0	1.0	.0	.0	.0
LIBO2	3%	1	1	1	0	1.0	.0	.0	.0
LICA3	11%	3	1	1	0	1.0	.0	.0	.0
LICO3	40%	11	1	2	1	1.1	.3	.1	.2
LYAM	22%	6	1	2	1	1.3	.5	.2	.5
MADI2	51%	14	1	35	34	4.2	8.9	2.4	5.2
PRAL	18%	5	1	5	4	2.0	1.7	.8	2.2
PYSE	7%	2	1	1	0	1.0	.0	.0	.0
RUPE	66%	18	1	25	24	6.1	7.2	1.7	3.6
STAM	22%	6	1	2	1	1.3	.5	.2	.5
STRO	70%	19	1	8	7	2.2	2.2	.5	1.1
STST	3%	1	1	1	0	1.0	.0	.0	.0
TITR	62%	17	1	10	9	2.6	2.5	.6	1.3
TIUN	7%	2	1	1	0	1.0	.0	.0	.0
VASI	3%	1	1	1	0	1.0	.0	.0	.0
VEVI	7%	2	1	1	0	1.0	.0	.0	.0
VIGL	11%	3	1	4	3	2.0	1.7	1.0	4.3
VILA	11%	3	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	14%	4	1	10	9	3.8	4.3	2.1	6.8
CAREX	11%	3	1	2	1	1.3	.6	.3	1.4
CAMA4	3%	1	1	1	0	1.0	.0	.0	.0
LUZUL	7%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Blueberry-Devil's Club (320)

5 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	65	75	10	69.0	4.2	1.9	5.2
CHNO	20%	1	7	7	0	7.0	.0	.0	.0
PISI	100%	5	15	60	45	31.0	19.2	8.6	23.8
THPL	20%	1	5	5	0	5.0	.0	.0	.0
TSHE	100%	5	20	60	40	39.0	18.2	8.1	22.6
TSME	20%	1	5	5	0	5.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	2	45	43	18.4	18.4	8.2	22.9
ALRU	20%	1	1	1	0	1.0	.0	.0	.0
TSHE	100%	5	2	55	53	18.6	22.3	10.0	27.7
TSME	20%	1	3	3	0	3.0	.0	.0	.0
PISI	80%	4	1	5	4	2.5	1.7	.9	2.8

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	20	55	35	36.6	13.7	6.1	17.0
MEFE	60%	3	1	5	4	2.7	2.1	1.2	5.2
OPHO	100%	5	1	8	7	5.8	2.9	1.3	3.7
RIBR	20%	1	6	6	0	6.0	.0	.0	.0
RUSP	40%	2	1	4	3	2.5	2.1	1.5	19.1
VACCI	100%	5	10	45	35	27.0	14.8	6.6	18.4
VAPA	60%	3	2	6	4	4.0	2.0	1.2	5.0

Low Shrub	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	0	1	1	.2	.4	.2	.6
VACA	20%	1	1	1	0	1.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	13	70	57	29.6	23.5	10.5	29.2
MOUN	20%	1	1	1	0	1.0	.0	.0	.0
COTR2	40%	2	3	3	0	3.0	.0	.0	.0
CABI	20%	1	2	2	0	2.0	.0	.0	.0
COAS	20%	1	5	5	0	5.0	.0	.0	.0
COCA	100%	5	2	30	28	9.4	11.7	5.2	14.5
LICO3	40%	2	1	3	2	2.0	1.4	1.0	12.7
LYAM	60%	3	1	2	1	1.7	.6	.3	1.4
MADI2	60%	3	1	6	5	3.0	2.6	1.5	6.6
PRAL	20%	1	1	1	0	1.0	.0	.0	.0
RUPE	100%	5	3	25	22	10.2	8.8	3.9	10.9
STAM	40%	2	1	2	1	1.5	.7	.5	6.4
STRO	40%	2	1	2	1	1.5	.7	.5	6.4
TITR	80%	4	1	3	2	2.3	1.0	.5	1.5
VEVI	40%	2	1	1	0	1.0	.0	.0	.0
VIGL	40%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Blueberry-Devil's Club (320)

5 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	5	18	13	10.6	5.6	2.5	6.9
SPHAG	80%	4	1	5	4	3.3	2.1	1.0	3.3
ATFI	80%	4	1	10	9	4.8	3.9	1.9	6.1
BLSP	80%	4	1	1	0	1.0	.0	.0	.0
DRAU2	100%	5	1	8	7	3.4	2.7	1.2	3.4
GYDR	80%	4	2	4	2	3.0	1.2	.6	1.8
POGL4	20%	1	1	1	0	1.0	.0	.0	.0
THPH	20%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Devil's Club (330)

19 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	35	75	40	55.3	10.6	2.4	5.1
ALRU	10%	2	1	2	1	1.5	.7	.5	6.4
PISI	100%	19	15	50	35	33.1	12.5	2.9	6.0
TSHE	94%	18	4	70	66	26.6	16.8	4.0	8.4
TSME	5%	1	5	5	0	5.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	4	45	41	19.7	12.0	2.7	5.8
ALRU	10%	2	4	10	6	7.0	4.2	3.0	38.1
TSHE	94%	18	3	50	47	16.6	11.9	2.8	5.9
TSME	5%	1	3	3	0	3.0	.0	.0	.0
PISI	87%	17	1	40	39	5.1	9.3	2.2	4.8

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	15	80	65	44.8	17.4	4.0	8.4
ALSI	10%	2	1	3	2	2.0	1.4	1.0	12.7
CLPY	5%	1	3	3	0	3.0	.0	.0	.0
GASH	15%	3	1	1	0	1.0	.0	.0	.0
MEFE	68%	13	1	9	8	4.7	2.9	.8	1.8
OPHO	100%	19	8	65	57	27.2	15.2	3.5	7.3
PHCA	5%	1	1	1	0	1.0	.0	.0	.0
RIBR	15%	3	2	15	13	8.0	6.6	3.8	16.3
RUPA	10%	2	1	10	9	5.5	6.4	4.5	57.2
RUSP	73%	14	1	20	19	4.9	5.2	1.4	3.0
SARA	21%	4	1	3	2	1.5	1.0	.5	1.6
VACCI	94%	18	1	50	49	7.7	11.7	2.8	5.8
VAPA	52%	10	1	7	6	2.7	2.2	.7	1.6

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	31%	6	1	25	24	6.7	9.3	3.8	9.7
CAREX	10%	2	1	35	34	18.0	24.0	17.0	216.0
LUPA	5%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Devil's Club (330)

19 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	3	71	68	25.8	20.6	4.7	9.9
MOUN	15%	3	1	1	0	1.0	.0	.0	.0
COTR2	15%	3	1	1	0	1.0	.0	.0	.0
GECA4	5%	1	1	1	0	1.0	.0	.0	.0
CABI	5%	1	1	1	0	1.0	.0	.0	.0
CIDO	5%	1	11	11	0	11.0	.0	.0	.0
CIAL	26%	5	2	7	5	3.8	1.9	.9	2.4
CLUN	5%	1	1	1	0	1.0	.0	.0	.0
COAS	36%	7	1	10	9	2.9	3.3	1.3	3.1
COCA	52%	10	1	6	5	2.3	1.8	.6	1.3
GATR2	5%	1	1	1	0	1.0	.0	.0	.0
GATR	5%	1	1	1	0	1.0	.0	.0	.0
HELA	5%	1	1	1	0	1.0	.0	.0	.0
HIMO	5%	1	1	1	0	1.0	.0	.0	.0
LICA3	5%	1	1	1	0	1.0	.0	.0	.0
LICO3	21%	4	1	1	0	1.0	.0	.0	.0
LYAM	21%	4	1	2	1	1.5	.6	.3	.9
MADI2	63%	12	1	55	54	12.5	17.8	5.1	11.3
OSPU	5%	1	1	1	0	1.0	.0	.0	.0
PRAL	36%	7	1	4	3	1.9	1.1	.4	1.0
RANUN	5%	1	1	1	0	1.0	.0	.0	.0
RUPE	57%	11	1	20	19	4.4	5.7	1.7	3.9
STAM	42%	8	1	1	0	1.0	.0	.0	.0
STRO	68%	13	1	20	19	2.7	5.2	1.5	3.2
TITR	89%	17	1	30	29	7.8	9.9	2.4	5.1
VEVI	5%	1	1	1	0	1.0	.0	.0	.0
VIGL	31%	6	1	5	4	2.2	1.8	.7	1.9
VILA	5%	1	2	2	0	2.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	3	43	40	17.6	11.0	2.5	5.3
CLUBS	21%	4	1	1	0	1.0	.0	.0	.0
SPHAG	31%	6	1	15	14	6.3	5.3	2.2	5.5
ADPE	15%	3	1	2	1	1.7	.6	.3	1.4
ATFI	68%	13	2	15	13	5.5	3.7	1.0	2.3
BLSP	36%	7	1	5	4	2.1	1.5	.6	1.4
DRAU2	89%	17	1	25	24	6.6	7.0	1.7	3.6
GYDR	78%	15	1	10	9	3.5	2.7	.7	1.5
LYAN	10%	2	1	1	0	1.0	.0	.0	.0
LYSE	5%	1	1	1	0	1.0	.0	.0	.0
POGL4	31%	6	1	1	0	1.0	.0	.0	.0
POLYS	5%	1	30	30	0	30.0	.0	.0	.0
POMU	31%	6	1	6	5	3.0	2.1	.9	2.2
POBR	5%	1	1	1	0	1.0	.0	.0	.0
PTAQ	5%	1	10	10	0	10.0	.0	.0	.0
THPH	42%	8	1	4	3	1.8	1.2	.4	1.0

Vegetation Statistics for Sitka Spruce/Devil's Club-Salmonberry (335)

7 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	35	70	35	54.3	12.4	4.7	11.5
PISI	100%	7	20	55	35	37.9	12.5	4.7	11.6
TSHE	100%	7	15	30	15	20.7	6.7	2.5	6.2

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	3	60	57	17.4	19.2	7.3	17.8
ALRU	14%	1	3	3	0	3.0	.0	.0	.0
TSHE	100%	7	2	50	48	14.9	16.3	6.2	15.1
PISI	100%	7	1	5	4	2.0	1.5	.6	1.4

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	60	95	35	77.6	12.6	4.8	11.6
ALSI	14%	1	5	5	0	5.0	.0	.0	.0
MEFE	57%	4	1	3	2	2.0	1.2	.6	1.8
OPHO	100%	7	14	60	46	29.9	19.7	7.4	18.2
RIBR	28%	2	2	10	8	6.0	5.7	4.0	50.8
RUSP	100%	7	15	60	45	33.6	19.1	7.2	17.7
SARA	28%	2	1	1	0	1.0	.0	.0	.0
VACCI	100%	7	3	15	12	10.4	5.0	1.9	4.6
VAPA	14%	1	10	10	0	10.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	17	80	63	42.6	28.0	10.6	25.9
TREU	14%	1	18	18	0	18.0	.0	.0	.0
MOUN	14%	1	1	1	0	1.0	.0	.0	.0
BRASS	14%	1	1	1	0	1.0	.0	.0	.0
CIAL	42%	3	2	25	23	10.0	13.0	7.5	32.3
CLUN	28%	2	1	1	0	1.0	.0	.0	.0
COAS	14%	1	2	2	0	2.0	.0	.0	.0
COCA	42%	3	1	5	4	3.0	2.0	1.2	5.0
GATR2	14%	1	5	5	0	5.0	.0	.0	.0
GATR	14%	1	1	1	0	1.0	.0	.0	.0
LYAM	57%	4	1	35	34	13.0	16.1	8.0	25.6
MADI2	57%	4	1	10	9	4.3	4.0	2.0	6.4
PRAL	14%	1	1	1	0	1.0	.0	.0	.0
RUPE	100%	7	1	30	29	7.7	10.3	3.9	9.5
STAM	57%	4	1	3	2	1.8	1.0	.5	1.5
STRO	85%	6	1	5	4	2.5	1.6	.7	1.7
TITR	85%	6	1	40	39	16.0	14.4	5.9	15.1
VIGL	42%	3	1	6	5	2.7	2.9	1.7	7.2
VILA	14%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Devil's Club-Salmonberry (335)

7 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	14	30	16	21.1	6.3	2.4	5.8
SPHAG	28%	2	2	5	3	3.5	2.1	1.5	19.1
ATFI	85%	6	3	10	7	6.0	3.0	1.2	3.2
BLSP	28%	2	1	2	1	1.5	.7	.5	6.4
DRAU2	100%	7	1	15	14	6.6	5.2	2.0	4.8
GYDR	100%	7	2	15	13	7.3	6.0	2.3	5.5
POGL4	14%	1	1	1	0	1.0	.0	.0	.0
POMU	14%	1	7	7	0	7.0	.0	.0	.0
THPH	42%	3	1	2	1	1.3	.6	.3	1.4

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	57%	4	1	1	0	1.0	.0	.0	.0
CAREX	14%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Devil's Club/Skunk Cabbage (340)

10 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	55	75	20	63.3	7.8	2.5	5.6
ALRU	20%	2	1	2	1	1.5	.7	.5	6.4
PISI	100%	10	1	45	44	32.1	14.5	4.6	10.4
THPL	20%	2	5	5	0	5.0	.0	.0	.0
TSHE	100%	10	7	55	48	26.7	14.2	4.5	10.2
TSME	40%	4	2	15	13	7.5	6.1	3.1	9.8

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	5	30	25	16.1	7.4	2.3	5.3
TABR	10%	1	3	3	0	3.0	.0	.0	.0
THPL	20%	2	1	1	0	1.0	.0	.0	.0
ALRU	10%	1	8	8	0	8.0	.0	.0	.0
TSHE	90%	9	5	30	25	13.1	8.8	2.9	6.7
TSME	30%	3	1	5	4	3.0	2.0	1.2	5.0
PISI	90%	9	1	25	24	6.1	7.6	2.5	5.9

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	21	80	59	50.6	19.1	6.0	13.7
ALSI	10%	1	3	3	0	3.0	.0	.0	.0
MEFE	90%	9	1	10	9	4.6	3.5	1.2	2.7
OPHO	100%	10	5	50	45	20.5	14.8	4.7	10.6
RIBR	10%	1	1	1	0	1.0	.0	.0	.0
RUPA	10%	1	5	5	0	5.0	.0	.0	.0
RUSP	60%	6	2	5	3	3.8	1.3	.5	1.4
SARA	20%	2	1	3	2	2.0	1.4	1.0	12.7
VACCI	90%	9	5	60	55	23.1	18.1	6.0	13.9
VAPA	30%	3	1	15	14	7.7	7.0	4.1	17.4
VIED	20%	2	1	1	0	1.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	10	10	86	76	37.5	23.3	7.4	16.6
MOUN	10%	1	1	1	0	1.0	.0	.0	.0
COTR2	10%	1	5	5	0	5.0	.0	.0	.0
CABI	10%	1	1	1	0	1.0	.0	.0	.0
CIAL	20%	2	5	8	3	6.5	2.1	1.5	19.1
COAS	60%	6	1	20	19	6.8	7.2	2.9	7.6
COCA	90%	9	2	25	23	9.6	8.4	2.8	6.5
LICO3	30%	3	1	2	1	1.3	.6	.3	1.4
LYAM	100%	10	3	15	12	7.9	3.6	1.1	2.6
MADI2	50%	5	1	3	2	2.2	1.1	.5	1.4
PRAL	20%	2	1	3	2	2.0	1.4	1.0	12.7
RUPE	100%	10	1	20	19	4.9	6.1	1.9	4.3
STAM	50%	5	1	1	0	1.0	.0	.0	.0
STRO	70%	7	1	15	14	4.4	5.0	1.9	4.6
TITR	80%	8	1	15	14	6.5	5.0	1.8	4.2
VIGL	60%	6	1	3	2	1.3	.8	.3	.9
VILA	10%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Devil's Club/Skunk Cabbage (340) Cont.

10 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	90%	9	7	29	22	15.3	8.2	2.7	6.3
LYCOP	20%	2	1	1	0	1.0	.0	.0	.0
SPHAG	70%	7	2	15	13	7.7	4.3	1.6	4.0
ATFI	70%	7	1	5	4	2.9	1.3	.5	1.2
BLSP	50%	5	1	3	2	1.6	.9	.4	1.1
DRAU2	70%	7	1	12	11	3.6	4.0	1.5	3.7
GYDR	90%	9	2	25	23	9.3	8.4	2.8	6.5
LYAN	10%	1	1	1	0	1.0	.0	.0	.0
LYCL	10%	1	1	1	0	1.0	.0	.0	.0
POMU	10%	1	1	1	0	1.0	.0	.0	.0
THPH	10%	1	2	2	0	2.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	20%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Red Alder (350)

4 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	4	30	75	45	55.0	23.5	11.7	37.3
ALRU	100%	4	10	60	50	30.0	24.5	12.2	39.0
PISI	100%	4	20	40	20	26.2	9.5	4.7	15.1
TSHE	25%	1	10	10	0	10.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	4	5	12	7	8.0	2.9	1.5	4.7
ALRU	100%	4	1	5	4	2.8	1.7	.9	2.7
TSHE	75%	3	4	5	1	4.7	.6	.3	1.4
PISI	75%	3	1	5	4	2.3	2.3	1.3	5.7

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	4	14	85	71	56.7	30.3	15.2	48.3
MAFU	25%	1	1	1	0	1.0	.0	.0	.0
OPHO	100%	4	1	20	19	10.0	9.0	4.5	14.3
PHCA	25%	1	1	1	0	1.0	.0	.0	.0
RIBR	100%	4	1	15	14	5.5	6.6	3.3	10.5
RUSP	100%	4	4	60	56	38.5	24.4	12.2	38.8
SARA	25%	1	2	2	0	2.0	.0	.0	.0
SOSI	25%	1	1	1	0	1.0	.0	.0	.0
VACCI	75%	3	1	5	4	2.7	2.1	1.2	5.2
VAPA	25%	1	1	1	0	1.0	.0	.0	.0
VIED	50%	2	1	2	1	1.5	.7	.5	6.4

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	4	10	89	79	45.7	33.8	16.9	53.7
RAUN	25%	1	1	1	0	1.0	.0	.0	.0
CABI	50%	2	1	3	2	2.0	1.4	1.0	12.7
CIAL	100%	4	1	20	19	7.0	8.8	4.4	14.1
COCA	50%	2	1	3	2	2.0	1.4	1.0	12.7
GAKA	25%	1	1	1	0	1.0	.0	.0	.0
GATR2	25%	1	1	1	0	1.0	.0	.0	.0
GATR	25%	1	2	2	0	2.0	.0	.0	.0
HELA	25%	1	2	2	0	2.0	.0	.0	.0
HEMI	25%	1	1	1	0	1.0	.0	.0	.0
LYAM	75%	3	4	70	66	26.0	38.1	22.0	94.7
MADI2	75%	3	1	3	2	2.0	1.0	.6	2.5
OSDE	25%	1	1	1	0	1.0	.0	.0	.0
PRAL	75%	3	1	1	0	1.0	.0	.0	.0
RUPE	25%	1	2	2	0	2.0	.0	.0	.0
STAM	50%	2	1	1	0	1.0	.0	.0	.0
STRO	100%	4	1	3	2	1.5	1.0	.5	1.6
TITR	100%	4	2	10	8	6.5	3.7	1.8	5.9
VEVI	25%	1	1	1	0	1.0	.0	.0	.0
VIGL	100%	4	1	10	9	4.8	4.5	2.3	7.2

Vegetation Statistics for Sitka Spruce/Red Alder (350) Cont.

4 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	4	6	13	7	8.0	3.4	1.7	5.4
LYCOP	25%	1	2	2	0	2.0	.0	.0	.0
SPHAG	50%	2	1	3	2	2.0	1.4	1.0	12.7
ATFI	100%	4	2	3	1	2.5	.6	.3	.9
BLSP	50%	2	1	1	0	1.0	.0	.0	.0
DRAU2	75%	3	1	2	1	1.3	.6	.3	1.4
GYDR	75%	3	1	5	4	3.0	2.0	1.2	5.0
LYSE	25%	1	2	2	0	2.0	.0	.0	.0
POGL4	50%	2	1	1	0	1.0	.0	.0	.0
POMU	25%	1	1	1	0	1.0	.0	.0	.0
THPH	100%	4	1	3	2	1.5	1.0	.5	1.6

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	75%	3	1	2	1	1.3	.6	.3	1.4
CAREX	25%	1	4	4	0	4.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Pacific Reedgrass (360)

5 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	35	60	25	44.0	9.6	4.3	11.9
PISI	100%	5	35	43	8	38.6	3.5	1.6	4.4
THPL	20%	1	6	6	0	6.0	.0	.0	.0
TSHE	60%	3	2	15	13	8.3	6.5	3.8	16.2

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	3	25	22	12.0	8.5	3.8	10.5
THPL	20%	1	2	2	0	2.0	.0	.0	.0
TSHE	60%	3	7	20	13	12.3	6.8	3.9	16.9
PISI	80%	4	1	12	11	5.3	4.8	2.4	7.6

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	0	15	15	5.6	6.0	2.7	7.5
MAFU	20%	1	3	3	0	3.0	.0	.0	.0
ALSI	20%	1	4	4	0	4.0	.0	.0	.0
GASH	40%	2	1	1	0	1.0	.0	.0	.0
LOIN	20%	1	2	2	0	2.0	.0	.0	.0
MEFE	80%	4	1	4	3	2.3	1.5	.8	2.4
VACCI	60%	3	1	1	0	1.0	.0	.0	.0
VAPA	20%	1	2	2	0	2.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	15	45	30	30.8	10.7	4.8	13.3
MOUN	20%	1	1	1	0	1.0	.0	.0	.0
LYAM	20%	1	2	2	0	2.0	.0	.0	.0
MADI2	100%	5	7	40	33	23.8	13.8	6.2	17.1
PRAL	40%	2	1	15	14	8.0	9.9	7.0	88.9
RUPE	40%	2	1	1	0	1.0	.0	.0	.0
STAM	60%	3	1	1	0	1.0	.0	.0	.0
TITR	60%	3	2	8	6	4.0	3.5	2.0	8.6

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	10	70	60	38.8	25.2	11.3	31.3
CACA	20%	1	24	24	0	24.0	.0	.0	.0
CANU3	10%	1	10	10	0	10.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	5	1	8	7	4.8	2.9	1.3	3.6
ATFI	60%	3	1	1	0	1.0	.0	.0	.0
BLSP	20%	1	1	1	0	1.0	.0	.0	.0
DRAU2	60%	3	1	1	0	1.0	.0	.0	.0
POMU	80%	4	1	8	7	4.0	2.9	1.5	4.7
THPH	20%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Blueberry/Skunk Cabbage (370)

16 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	40	80	40	55.6	11.8	3.0	6.3
ALRU	12%	2	1	4	3	2.5	2.1	1.5	19.1
PISI	100%	16	15	55	40	26.2	12.8	3.2	6.8
THPL	31%	5	1	15	14	6.2	5.6	2.5	7.0
TSHE	100%	16	5	70	65	31.1	17.3	4.3	9.2

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	3	40	37	18.3	12.6	3.2	6.7
THPL	25%	4	1	3	2	2.0	1.2	.6	1.8
ALRU	6%	1	1	1	0	1.0	.0	.0	.0
TSHE	93%	15	1	45	44	16.3	13.9	3.6	7.7
PISI	87%	14	1	10	9	2.9	2.3	.6	1.4

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	11	70	59	41.1	18.0	4.5	9.6
GASH	6%	1	1	1	0	1.0	.0	.0	.0
MEFE	81%	13	2	55	53	12.8	14.3	4.0	8.7
OPHO	75%	12	1	7	6	2.8	2.1	.6	1.4
RIBR	12%	2	7	30	23	18.5	16.3	11.5 1	46.1
RILA	6%	1	2	2	0	2.0	.0	.0	.0
RUSP	68%	11	1	30	29	5.3	8.5	2.6	5.7
SARA	12%	2	1	10	9	5.5	6.4	4.5	57.2
VACCI	100%	16	1	55	54	20.2	17.4	4.4	9.3
VAPA	62%	10	1	5	4	2.6	1.2	.4	.8

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	81%	13	0	35	35	2.8	9.7	2.7	5.9
VACA	6%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	12%	2	1	2	1	1.5	.7	.5	6.4
CAPA1	6%	1	1	1	0	1.0	.0	.0	.0
CAREX	18%	3	1	2	1	1.7	.6	.3	1.4
CAPL	6%	1	1	1	0	1.0	.0	.0	.0
JUNCU	6%	1	1	1	0	1.0	.0	.0	.0
LUZUL	6%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce/Blueberry/Skunk Cabbage (370) Cont.

16 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	20	66	46	37.0	14.0	3.5	7.5
MOUN	25%	4	1	1	0	1.0	.0	.0	.0
COTR2	12%	2	1	1	0	1.0	.0	.0	.0
CLSI	12%	2	1	3	2	2.0	1.4	1.0	12.7
RUCH	6%	1	1	1	0	1.0	.0	.0	.0
GECA4	6%	1	3	3	0	3.0	.0	.0	.0
CABI	12%	2	1	4	3	2.5	2.1	1.5	19.1
CIAL	37%	6	1	5	4	3.0	1.4	.6	1.5
CLUN	12%	2	1	1	0	1.0	.0	.0	.0
COAS	56%	9	1	10	9	3.1	3.0	1.0	2.3
COCA	81%	13	1	10	9	4.2	3.0	.8	1.8
GATR2	6%	1	1	1	0	1.0	.0	.0	.0
GATR	6%	1	2	2	0	2.0	.0	.0	.0
HELA	6%	1	4	4	0	4.0	.0	.0	.0
LIBO2	6%	1	1	1	0	1.0	.0	.0	.0
LICA3	6%	1	1	1	0	1.0	.0	.0	.0
LICO3	62%	10	1	2	1	1.2	.4	.1	.3
LYAM	100%	16	3	50	47	16.1	12.2	3.1	6.5
MADI2	81%	13	1	20	19	3.5	5.2	1.4	3.1
PRAL	18%	3	1	1	0	1.0	.0	.0	.0
PYSE	6%	1	1	1	0	1.0	.0	.0	.0
RUPE	75%	12	1	15	14	4.6	4.3	1.2	2.7
STAM	50%	8	1	1	0	1.0	.0	.0	.0
STRO	81%	13	1	3	2	1.4	.7	.2	.4
TITR	93%	15	1	5	4	2.5	1.5	.4	.8
VEVI	31%	5	1	10	9	3.2	3.9	1.7	4.8
VIGL	31%	5	1	5	4	2.0	1.7	.8	2.2
VILA	12%	2	1	7	6	4.0	4.2	3.0	38.1

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	1	30	29	11.3	9.0	2.3	4.8
LYCOP	6%	1	1	1	0	1.0	.0	.0	.0
SPHAG	75%	12	1	15	14	6.0	5.1	1.5	3.2
ADPE	6%	1	1	1	0	1.0	.0	.0	.0
ATFI	68%	11	1	25	24	7.0	8.5	2.6	5.7
BLSP	37%	6	1	5	4	2.3	1.8	.7	1.8
CYFR	6%	1	1	1	0	1.0	.0	.0	.0
DRAU2	87%	14	1	8	7	2.4	2.1	.6	1.2
GYDR	100%	16	1	6	5	2.7	1.6	.4	.8
LYAN	6%	1	1	1	0	1.0	.0	.0	.0
LYSE	6%	1	1	1	0	1.0	.0	.0	.0
POGL4	18%	3	1	1	0	1.0	.0	.0	.0
POMU	12%	2	1	2	1	1.5	.7	.5	6.4
THPH	37%	6	1	4	3	1.7	1.2	.5	1.3

Vegetation Statistics for Sitka Spruce/Salmonberry (380)

6 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	25	70	45	45.8	19.3	7.9	20.3
ALRU	16%	1	5	5	0	5.0	.0	.0	.0
PISI	100%	6	15	50	35	30.5	12.3	5.0	12.9
TSHE	100%	6	10	40	30	18.5	11.1	4.5	11.7

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	1	25	24	15.7	9.7	3.9	10.1
TSHE	100%	6	1	25	24	11.2	10.2	4.2	10.7
PISI	100%	6	1	15	14	4.8	5.3	2.2	5.6

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	35	98	63	63.2	25.9	10.6	27.2
MEFE	50%	3	2	4	2	3.0	1.0	.6	2.5
OPHO	83%	5	1	8	7	4.4	3.0	1.4	3.8
RIBR	66%	4	2	10	8	4.0	4.0	2.0	6.4
RILA	16%	1	1	1	0	1.0	.0	.0	.0
RUSP	100%	6	20	85	65	45.3	29.3	12.0	30.8
SARA	50%	3	2	10	8	5.7	4.0	2.3	10.0
VACCI	100%	6	1	10	9	5.3	4.5	1.8	4.7
VAPA	50%	3	1	7	6	3.7	3.1	1.8	7.6

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	0	20	20	13.0	7.6	3.1	8.0
MOUN	16%	1	1	1	0	1.0	.0	.0	.0
COTR2	16%	1	1	1	0	1.0	.0	.0	.0
BRASS	16%	1	1	1	0	1.0	.0	.0	.0
CIAL	66%	4	2	8	6	5.0	2.9	1.5	4.7
COCA	33%	2	1	2	1	1.5	.7	.5	6.4
GATR2	16%	1	1	1	0	1.0	.0	.0	.0
LICO3	16%	1	1	1	0	1.0	.0	.0	.0
LYAM	66%	4	1	10	9	4.5	4.0	2.0	6.4
MADI2	83%	5	1	4	3	1.6	1.3	.6	1.7
OSPU	16%	1	1	1	0	1.0	.0	.0	.0
PRAL	33%	2	1	3	2	2.0	1.4	1.0	12.7
RUPE	33%	2	1	1	0	1.0	.0	.0	.0
STAM	50%	3	1	1	0	1.0	.0	.0	.0
STRO	50%	3	1	4	3	2.0	1.7	1.0	4.3
TITR	83%	5	1	6	5	3.4	1.8	.8	2.3
VIGL	50%	3	1	5	4	2.7	2.1	1.2	5.2

Vegetation Statistics for Sitka Spruce/Salmonberry (380)

6 Samples

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	16%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	6	0	17	17	10.7	7.4	3.0	7.8
CLUBS	16%	1	1	1	0	1.0	.0	.0	.0
SPHAG	50%	3	1	3	2	2.0	1.0	.6	2.5
ADPE	33%	2	1	1	0	1.0	.0	.0	.0
ATFI	66%	4	1	5	4	2.8	1.7	.9	2.7
BLSP	16%	1	2	2	0	2.0	.0	.0	.0
DRAU2	83%	5	2	10	8	6.8	3.4	1.5	4.2
GYDR	66%	4	2	4	2	2.5	1.0	.5	1.6
LYSE	16%	1	1	1	0	1.0	.0	.0	.0
POMU	33%	2	2	3	1	2.5	.7	.5	6.4
THPH	16%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce-Mountain Hemlock/Blueberry (390)

14 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	5	91	86	56.1	20.8	5.6	12.0
PISI	100%	14	10	45	35	18.4	11.4	3.0	6.6
TSME	100%	14	15	50	35	30.1	10.9	2.9	6.3
TSHE	64%	9	2	50	48	19.6	14.7	4.9	11.3
CHNO	14%	2	2	10	8	6.0	5.7	4.0	50.8
ALRU	7%	1	2	2	0	2.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	4	36	32	15.0	10.8	2.9	6.2
TSME	100%	14	1	23	22	7.1	5.7	1.5	3.3
PISI	92%	13	1	3	2	1.6	.9	.2	.5
TSHE	71%	10	2	26	24	10.5	7.1	2.2	5.1
CHNO	14%	2	1	1	0	1.0	.0	.0	.0
THPL	14%	2	1	1	0	1.0	.0	.0	.0
ABLA	7%	1	2	2	0	2.0	.0	.0	.0
ALRU	7%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	1	70	69	35.1	22.9	6.1	13.2
VACCI	100%	14	1	60	59	31.3	21.7	5.8	12.5
MEFE	57%	8	1	9	8	3.1	2.9	1.0	2.4
OPHO	42%	6	1	6	5	2.5	1.9	.8	2.0
RUSP	28%	4	1	6	5	2.3	2.5	1.3	4.0
VAPA	21%	3	1	5	4	2.3	2.3	1.3	5.7
CLPY	14%	2	1	1	0	1.0	.0	.0	.0
RIBES	7%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	78%	11	0	9	9	1.2	2.7	.8	1.8
LUPE	7%	1	1	1	0	1.0	.0	.0	.0
CAST5	7%	1	2	2	0	2.0	.0	.0	.0
VACA	7%	1	10	10	0	10.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	28%	4	1	20	19	5.8	9.5	4.8	15.1
CAREX	7%	1	5	5	0	5.0	.0	.0	.0
CACA	14%	2	4	10	6	7.0	4.2	3.0	38.1
CAMA	7%	1	5	5	0	5.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce-Mountain Hemlock/Blueberry (390) Cont.

14 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	2	55	53	28.9	16.0	4.3	9.2
RUPE	92%	13	2	17	15	7.4	5.7	1.6	3.4
COAS	78%	11	1	15	14	5.5	4.4	1.3	2.9
STRO	78%	11	1	7	6	3.4	1.9	.6	1.3
VEVI	50%	7	1	6	5	3.1	2.2	.8	2.0
TITR	71%	10	1	8	7	2.8	2.3	.7	1.7
LICO3	78%	11	1	5	4	2.0	1.5	.5	1.0
COCA	57%	8	1	12	11	4.3	3.4	1.2	2.8
CABI	21%	3	1	2	1	1.3	.6	.3	1.4
LYAM	28%	4	1	4	3	2.3	1.5	.8	2.4
FACR	50%	7	1	15	14	5.6	4.9	1.8	4.5
VIGL	42%	6	1	4	3	2.3	1.0	.4	1.1
STAM	28%	4	1	2	1	1.3	.5	.3	.8
COTR2	14%	2	1	3	2	2.0	1.4	1.0	12.7
LISTE	14%	2	1	3	2	2.0	1.4	1.0	12.7
HELA	14%	2	1	6	5	3.5	3.5	2.5	31.8
MOUN	14%	2	1	1	0	1.0	.0	.0	.0
HEGL2	7%	1	1	1	0	1.0	.0	.0	.0
PRAL	7%	1	1	1	0	1.0	.0	.0	.0
CALTH	7%	1	2	2	0	2.0	.0	.0	.0
LICA3	7%	1	1	1	0	1.0	.0	.0	.0
ARNIC	7%	1	2	2	0	2.0	.0	.0	.0
PYSE	7%	1	1	1	0	1.0	.0	.0	.0
COUM	14%	2	2	3	1	2.5	.7	.5	6.4
STST	7%	1	5	5	0	5.0	.0	.0	.0
ERPE	7%	1	1	1	0	1.0	.0	.0	.0
SAST	7%	1	2	2	0	2.0	.0	.0	.0
CLUN	7%	1	1	1	0	1.0	.0	.0	.0
GATR	7%	1	2	2	0	2.0	.0	.0	.0
METR	7%	1	2	2	0	2.0	.0	.0	.0
CIDO	7%	1	3	3	0	3.0	.0	.0	.0
PAFI	7%	1	2	2	0	2.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	0	14	14	6.0	4.5	1.2	2.6
BLSP	85%	12	1	6	5	2.8	1.6	.5	1.0
SPHAG	78%	11	1	20	19	7.4	6.9	2.1	4.6
GYDR	50%	7	1	6	5	2.1	1.9	.7	1.7
DRAU2	42%	6	1	5	4	2.7	2.0	.8	2.1
ATFI	35%	5	1	10	9	4.2	3.5	1.6	4.3
LYAN	21%	3	1	1	0	1.0	.0	.0	.0
LYCOP	7%	1	2	2	0	2.0	.0	.0	.0
THPH	7%	1	1	1	0	1.0	.0	.0	.0
ADPE	7%	1	1	1	0	1.0	.0	.0	.0
POMU	7%	1	1	1	0	1.0	.0	.0	.0
LYSE	7%	1	1	1	0	1.0	.0	.0	.0
POBR	7%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce-Mountain Hemlock/Blueberry/Marsh Marigold (391)

18 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	35	82	47	57.7	14.4	3.4	7.2
PISI	100%	18	10	33	23	15.1	6.8	1.6	3.4
TSME	100%	18	20	55	35	33.3	9.8	2.3	4.9
TSHE	38%	7	12	27	15	18.6	5.3	2.0	4.9
CHNO	22%	4	9	21	12	16.5	5.7	2.9	9.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	8	60	52	29.6	16.0	3.8	7.9
TSME	94%	17	3	37	34	16.6	9.5	2.3	4.9
PISI	83%	15	1	17	16	4.1	4.0	1.0	2.2
TSHE	72%	13	1	40	39	14.5	13.9	3.9	8.4
CHNO	22%	4	2	12	10	6.3	4.3	2.2	6.9
THPL	5%	1	4	4	0	4.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	18	93	75	54.9	24.6	5.8	12.3
VACCI	94%	17	15	85	70	48.3	20.2	4.9	10.4
MEFE	72%	13	1	20	19	5.6	5.6	1.6	3.4
OPHO	38%	7	1	3	2	1.4	.8	.3	.7
RUSP	22%	4	1	5	4	2.8	2.1	1.0	3.3
VAPA	22%	4	1	45	44	12.0	22.0	11.0	35.0
CLPY	16%	3	1	2	1	1.7	.6	.3	1.4
RIBR	5%	1	1	1	0	1.0	.0	.0	.0
SOSI	5%	1	1	1	0	1.0	.0	.0	.0
COST	5%	1	4	4	0	4.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	44%	8	0	16	16	3.0	5.8	2.0	4.8
LUPE	11%	2	1	16	15	8.5	10.6	7.5	95.3
CAST5	5%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	27%	5	1	9	8	3.6	3.4	1.5	4.3
CAREX	33%	6	1	10	9	3.5	4.0	1.6	4.2
DEAT	11%	2	1	1	0	1.0	.0	.0	.0
LUZUL	11%	2	1	1	0	1.0	.0	.0	.0
CAPA1	5%	1	7	7	0	7.0	.0	.0	.0
DEPU	5%	1	11	11	0	11.0	.0	.0	.0
SCCA2	5%	1	1	1	0	1.0	.0	.0	.0
CANI2	5%	1	4	4	0	4.0	.0	.0	.0

Vegetation Statistics for Sitka Spruce-Mountain Hemlock/Blueberry/Marsh Marigold (391) Cont.

18 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	10 1	00	90	46.9	31.0	7.3	15.4
RUPE	100%	18	2	52	50	10.8	13.0	3.1	6.5
COAS	77%	14	1	37	36	7.3	9.5	2.5	5.5
STRO	77%	14	1	15	14	3.4	3.8	1.0	2.2
VEVI	83%	15	1	21	20	3.5	5.2	1.3	2.9
TITR	66%	12	1	9	8	2.5	2.2	.6	1.4
LICO3	55%	10	1	3	2	1.6	1.0	.3	.7
COCA	66%	12	1	31	30	6.6	9.3	2.7	5.9
CABI	100%	16	3	41	38	10.9	9.3	2.3	5.0
LYAM	55%	10	1	36	35	7.7	10.6	3.4	7.6
FACR	27%	5	1	8	7	3.2	2.9	1.3	3.7
VIGL	33%	6	1	5	4	2.0	1.7	.7	1.8
STAM	38%	7	1	7	6	3.1	2.5	.9	2.3
COTR2	44%	8	1	1	0	1.0	.0	.0	.0
LISTE	22%	4	1	17	16	5.0	8.0	4.0	12.7
HELA	16%	3	1	16	15	6.0	8.7	5.0	21.5
MOUN	16%	3	1	1	0	1.0	.0	.0	.0
HEGL2	16%	3	1	2	1	1.3	.6	.3	1.4
PRAL	16%	3	1	1	0	1.0	.0	.0	.0
CALTH	11%	2	5	15	10	10.0	7.1	5.0	63.5
LICA3	11%	2	1	1	0	1.0	.0	.0	.0
ARNIC	11%	2	1	1	0	1.0	.0	.0	.0
PYSE	5%	1	1	1	0	1.0	.0	.0	.0
OSMOR	11%	2	1	1	0	1.0	.0	.0	.0
MADI2	11%	2	1	2	1	1.5	.7	.5	6.4
STST	5%	1	8	8	0	8.0	.0	.0	.0
HASA	11%	2	1	1	0	1.0	.0	.0	.0
ERPE	5%	1	1	1	0	1.0	.0	.0	.0
RUCH	5%	1	1	1	0	1.0	.0	.0	.0
VASI3	5%	1	2	2	0	2.0	.0	.0	.0
DODEC	5%	1	1	1	0	1.0	.0	.0	.0
GECA4	5%	1	1	1	0	1.0	.0	.0	.0
COCH	5%	1	1	1	0	1.0	.0	.0	.0
HABEN	5%	1	1	1	0	1.0	.0	.0	.0
SAPU	5%	1	1	1	0	1.0	.0	.0	.0
OSPU	5%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	88%	16	1	50	49	10.8	13.1	3.3	7.0
BLSP	88%	16	1	39	38	5.1	9.5	2.4	5.1
SPHAG	83%	15	1	38	37	11.5	10.5	2.7	5.8
GYDR	77%	14	1	11	10	3.2	3.9	1.0	2.2
DRAU2	50%	9	1	8	7	2.9	2.4	.8	1.8
ATFI	38%	7	1	6	5	2.1	2.0	.8	1.9
LYAN	33%	6	1	1	0	1.0	.0	.0	.0
LYCOP	27%	5	1	10	9	2.8	4.0	1.8	5.0
THPH	16%	3	1	1	0	1.0	.0	.0	.0
ADPE	11%	2	1	1	0	1.0	.0	.0	.0
CYFR	11%	2	1	8	7	4.5	4.9	3.5	44.5
POMU	5%	1	1	1	0	1.0	.0	.0	.0
LYSE	5%	1	1	1	0	1.0	.0	.0	.0
THLI	5%	1	1	1	0	1.0	.0	.0	.0
POGL4	5%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry (410)

32 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	32	10	90	80	44.0	18.7	3.4	6.9
CHNO	84%	27	2	50	48	18.4	11.5	2.2	4.6
TSME	87%	28	1	20	19	8.3	5.8	1.1	2.2
TSHE	81%	26	3	57	54	17.7	14.8	2.9	6.0
THPL	46%	15	2	35	33	12.7	10.2	2.6	5.6
PICO	25%	8	5	26	21	13.9	7.8	2.8	6.6
ALRU	6%	2	4	22	18	13.0	12.7	9.0	114.4
PISI	31%	10	1	10	9	5.1	2.8	.9	2.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	31	7	60	53	27.6	13.6	2.4	5.0
TSME	87%	28	1	25	24	6.8	5.7	1.1	2.2
TSHE	90%	29	1	30	29	11.3	7.7	1.4	2.9
CHNO	84%	27	1	37	36	8.0	9.3	1.8	3.7
PISI	56%	18	1	7	6	1.8	1.6	.4	.8
THPL	59%	19	1	20	19	5.2	5.7	1.3	2.7
ALRU	12%	4	1	6	5	4.3	2.2	1.1	3.5
PICO	21%	7	1	25	24	8.0	8.5	3.2	7.9

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	32	1	85	84	42.0	27.5	4.9	9.9
VACCI	100%	29	1	70	69	36.7	24.9	4.6	9.5
MEFE	90%	29	1	15	14	6.5	4.7	.9	1.8
VAPA	62%	20	1	6	5	2.2	1.6	.4	.8
GASH	25%	8	1	4	3	1.9	1.1	.4	.9
CLPY	15%	5	1	15	14	7.0	6.2	2.8	7.7
RUSP	18%	6	1	6	5	2.5	2.1	.8	2.2
ALSI	3%	1	1	1	0	1.0	.0	.0	.0
OPHO	18%	6	1	16	15	4.0	5.9	2.4	6.2
VIED	3%	1	2	2	0	2.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	87%	28	0	78	78	9.9	20.8	3.9	8.1
VACA	21%	7	1	16	15	6.3	6.4	2.4	6.0
LEGR	21%	7	1	26	25	9.0	9.0	3.4	8.3
EMNI	25%	8	1	51	50	15.1	19.9	7.0	16.6
VAVI	9%	3	1	2	1	1.3	.6	.3	1.4
KAPO	21%	7	1	9	8	3.4	3.1	1.2	2.9
VAOX	12%	4	1	12	11	4.0	5.4	2.7	8.5
VAUL	15%	5	1	26	25	8.8	10.1	4.5	12.5
PHGL	12%	4	1	17	16	6.5	7.5	3.8	12.0
CAST5	6%	2	3	9	6	6.0	4.2	3.0	38.1
CAME	3%	1	1	1	0	1.0	.0	.0	.0
ARUV	3%	1	1	1	0	1.0	.0	.0	.0
JUCO	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry (410) Cont.

32 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	32	4	94	90	28.8	21.4	3.8	7.7
COCA	96%	31	1	30	29	8.4	7.8	1.4	2.8
LYAM	65%	21	1	15	14	2.1	3.0	.7	1.4
COAS	81%	26	1	10	9	4.0	3.1	.6	1.2
RUPE	78%	25	1	21	20	7.0	5.0	1.0	2.1
FACR	15%	5	1	70	69	15.6	30.4	13.6	37.8
LICO3	78%	25	1	5	4	1.4	.9	.2	.4
STRO	65%	21	1	4	3	1.6	.8	.2	.4
VEVI	40%	13	1	2	1	1.2	.4	.1	.2
MADI2	28%	9	1	3	2	1.3	.7	.2	.5
TITR	43%	14	1	4	3	1.5	.9	.3	.5
LIBO2	18%	6	1	6	5	3.0	2.4	1.0	2.6
CABI	28%	9	1	21	20	6.8	6.6	2.2	5.0
COTR2	18%	6	1	6	5	2.3	2.0	.8	2.1
STAM	31%	10	1	1	0	1.0	.0	.0	.0
LICA3	15%	5	1	1	0	1.0	.0	.0	.0
SANGU	3%	1	1	1	0	1.0	.0	.0	.0
CLUN	21%	7	1	6	5	2.3	1.8	.7	1.7
GEDO	3%	1	1	1	0	1.0	.0	.0	.0
RUCH	12%	4	1	37	36	10.0	18.0	9.0	28.6
PYSE	3%	1	1	1	0	1.0	.0	.0	.0
TREU	3%	1	1	1	0	1.0	.0	.0	.0
DROSE	3%	1	1	1	0	1.0	.0	.0	.0
PRAL	3%	1	2	2	0	2.0	.0	.0	.0
SAST	3%	1	8	8	0	8.0	.0	.0	.0
ERPE	3%	1	1	1	0	1.0	.0	.0	.0
MOUN	3%	1	1	1	0	1.0	.0	.0	.0
DODEC	3%	1	1	1	0	1.0	.0	.0	.0
GECA4	3%	1	1	1	0	1.0	.0	.0	.0
SAME	6%	2	1	3	2	2.0	1.4	1.0	12.7
HELA	3%	1	1	1	0	1.0	.0	.0	.0
VILA	3%	1	2	2	0	2.0	.0	.0	.0
OSPU	3%	1	1	1	0	1.0	.0	.0	.0
GATR2	3%	1	1	1	0	1.0	.0	.0	.0
HADI	3%	1	1	1	0	1.0	.0	.0	.0
SASI	3%	1	1	1	0	1.0	.0	.0	.0
SANGU	3%	1	3	3	0	3.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	21%	7	1	25	24	6.3	8.4	3.2	7.8
CAREX	15%	5	1	30	29	11.0	11.9	5.3	14.8
CAPL	6%	2	2	9	7	5.5	4.9	3.5	44.5
CASI3	6%	2	1	11	10	6.0	7.1	5.0	63.5
CAPA1	3%	1	3	3	0	3.0	.0	.0	.0
SCCA2	3%	1	7	7	0	7.0	.0	.0	.0
AGGI	3%	1	5	5	0	5.0	.0	.0	.0
ERIOP	6%	2	1	1	0	1.0	.0	.0	.0
TRISE	3%	1	1	1	0	1.0	.0	.0	.0
CAMA4	3%	1	15	15	0	15.0	.0	.0	.0
JUNCU	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry (410) Cont.

32 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	32	1	60	59	8.5	12.0	2.1	4.3
BLSP	90%	29	1	10	9	3.1	2.6	.5	1.0
SPHAG	71%	23	1	79	78	9.9	18.3	3.8	7.9
CLUBS	50%	16	1	3	2	1.4	.6	.2	.3
LYAN	37%	12	1	2	1	1.1	.3	.1	.2
LYCL	25%	8	1	2	1	1.1	.4	.1	.3
GYDR	50%	16	1	3	2	1.4	.7	.2	.4
ATFI	15%	5	1	2	1	1.2	.4	.2	.6
PTAQ	12%	4	1	15	14	5.8	6.4	3.2	10.2
DRAU2	25%	8	1	6	5	1.8	1.8	.6	1.5
LYSE	9%	3	1	1	0	1.0	.0	.0	.0
THPH	9%	3	1	6	5	3.0	2.6	1.5	6.6
POGL4	3%	1	1	1	0	1.0	.0	.0	.0
ADPE	6%	2	1	7	6	4.0	4.2	3.0	38.1
RHLO	3%	1	46	46	0	46.0	.0	.0	.0
HYSP	3%	1	32	32	0	32.0	.0	.0	.0
POBR	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Skunk Cabbage (420)

35 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	35	20	91	71	48.3	15.4	2.6	5.3
CHNO	82%	29	3	43	40	15.7	10.3	1.9	3.9
TSME	88%	31	1	30	29	10.5	7.2	1.3	2.6
TSHE	97%	34	2	65	63	17.1	13.3	2.3	4.7
PICO	11%	4	2	20	18	11.2	9.6	4.8	15.2
PISI	68%	24	1	15	14	4.2	4.1	.8	1.7
THPL	68%	24	1	30	29	12.3	9.0	1.8	3.8

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	35	7	60	53	26.1	13.4	2.3	4.6
ALRU	2%	1	25	25	0	25.0	.0	.0	.0
TSME	91%	32	1	15	14	4.5	3.5	.6	1.3
TSHE	91%	32	2	45	43	14.6	10.5	1.9	3.8
CHNO	68%	24	1	39	38	6.2	8.9	1.8	3.7
PISI	71%	25	1	10	9	2.7	2.9	.6	1.2
THPL	62%	22	1	20	19	4.5	4.6	1.0	2.0
PICO	14%	5	1	6	5	2.2	2.2	1.0	2.7

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	35	9	85	76	50.1	19.0	3.2	6.5
VACCI	97%	34	2	75	73	39.2	21.3	3.7	7.5
MEFE	100%	35	2	30	28	9.6	7.7	1.3	2.7
VAPA	77%	27	1	30	29	3.7	5.5	1.1	2.2
GASH	20%	7	1	4	3	2.7	1.6	.6	1.5
CLPY	11%	4	1	4	3	2.0	1.4	.7	2.3
RUSP	8%	3	1	2	1	1.3	.6	.3	1.4
ALSI	2%	1	25	25	0	25.0	.0	.0	.0
OPHO	25%	9	1	2	1	1.2	.4	.1	.3
VIED	2%	1	1	1	0	1.0	.0	.0	.0
SOSI	2%	1	1	1	0	1.0	.0	.0	.0
RUPA	2%	1	2	2	0	2.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	85%	30	0	38	38	2.4	7.0	1.3	2.6
MYGA	2%	1	1	1	0	1.0	.0	.0	.0
VACA	17%	6	1	15	14	3.7	5.6	2.3	5.9
LEGR	14%	5	1	8	7	2.8	2.9	1.3	3.7
EMNI	5%	2	2	9	7	5.5	4.9	3.5	44.5
VAVI	20%	7	1	4	3	1.6	1.1	.4	1.0
KAPO	8%	3	1	6	5	3.0	2.6	1.5	6.6
VAOX	5%	2	1	1	0	1.0	.0	.0	.0
VAUL	2%	1	3	3	0	3.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Skunk Cabbage (420) Cont.

35 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	35	8	100	92	47.2	22.9	3.9	7.9
COCA	88%	31	2	20	18	9.3	5.0	.9	1.8
LYAM	100%	35	2	50	48	13.0	12.5	2.1	4.3
COAS	94%	33	1	50	49	7.9	9.4	1.6	3.3
RUPE	97%	34	1	30	29	6.9	7.4	1.3	2.6
FACR	34%	12	1	34	33	4.2	9.4	2.7	6.0
LICO3	60%	21	1	3	2	1.5	.7	.1	.3
STRO	77%	27	1	10	9	2.4	2.5	.5	1.0
VEVI	40%	14	1	10	9	1.9	2.5	.7	1.4
MADI2	31%	11	1	5	4	1.7	1.3	.4	.9
TITR	48%	17	1	7	6	2.5	1.7	.4	.9
LIBO2	45%	16	1	4	3	1.6	.8	.2	.4
CABI	31%	11	1	17	16	6.2	5.5	1.7	3.7
COTR2	31%	11	1	7	6	2.3	2.0	.6	1.3
STAM	34%	12	1	2	1	1.1	.3	.1	.2
LICA3	14%	5	1	1	0	1.0	.0	.0	.0
SANGU	8%	3	1	11	10	4.3	5.8	3.3	14.3
CLUN	17%	6	1	3	2	1.3	.8	.3	.9
GEDO	5%	2	1	1	0	1.0	.0	.0	.0
PYSE	11%	4	1	2	1	1.3	.5	.3	.8
HASA	5%	2	1	1	0	1.0	.0	.0	.0
TREU	5%	2	1	1	0	1.0	.0	.0	.0
DROSE	2%	1	1	1	0	1.0	.0	.0	.0
PRAL	5%	2	1	3	2	2.0	1.4	1.0	12.7
SAST	2%	1	1	1	0	1.0	.0	.0	.0
MOUN	8%	3	1	1	0	1.0	.0	.0	.0
DODEC	2%	1	20	20	0	20.0	.0	.0	.0
TOGL	2%	1	1	1	0	1.0	.0	.0	.0
SAME	2%	1	1	1	0	1.0	.0	.0	.0
ASBO	2%	1	2	2	0	2.0	.0	.0	.0
VIGL	2%	1	1	1	0	1.0	.0	.0	.0
VILA	2%	1	1	1	0	1.0	.0	.0	.0
EPAN	5%	2	1	3	2	2.0	1.4	1.0	12.7
OSPU	2%	1	1	1	0	1.0	.0	.0	.0
GATR2	2%	1	1	1	0	1.0	.0	.0	.0
STST	2%	1	1	1	0	1.0	.0	.0	.0
EQUIS	2%	1	1	1	0	1.0	.0	.0	.0
CIAL	2%	1	2	2	0	2.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	37%	13	1	16	15	3.2	4.2	1.2	2.5
CAREX	17%	6	1	25	24	13.7	10.9	4.4	11.4
CANU3	8%	3	1	10	9	4.3	4.9	2.8	12.3
CACA	2%	1	6	6	0	6.0	.0	.0	.0
CASI3	5%	2	1	20	19	10.5	13.4	9.5	120.7
AGROS	2%	1	10	10	0	10.0	.0	.0	.0
CAAN5	2%	1	7	7	0	7.0	.0	.0	.0
CANI2	5%	2	5	20	15	12.5	10.6	7.5	95.3
CAAQ	2%	1	3	3	0	3.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Skunk Cabbage (420) Cont.

35 Samples

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	97%	34	1	26	25	6.2	5.3	.9	1.9
BLSP	88%	31	1	20	19	4.1	3.7	.7	1.4
SPHAG	77%	27	1	75	74	14.6	17.4	3.4	6.9
LYCOP	51%	18	1	3	2	1.4	.7	.2	.4
LYAN	48%	17	1	2	1	1.2	.4	.1	.2
LYCL	34%	12	1	4	3	1.3	.9	.3	.6
GYDR	40%	14	1	5	4	1.9	1.2	.3	.7
ATFI	25%	9	1	5	4	1.8	1.4	.5	1.1
PTAQ	11%	4	1	15	14	5.0	6.7	3.4	10.7
DRAU2	17%	6	1	1	0	1.0	.0	.0	.0
LYSE	2%	1	1	1	0	1.0	.0	.0	.0
THPH	11%	4	1	6	5	2.3	2.5	1.3	4.0
POGL4	8%	3	1	1	0	1.0	.0	.0	.0
POMU	2%	1	10	10	0	10.0	.0	.0	.0
LYAL	2%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Deer Cabbage (430)

36 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	8	89	81	39.1	15.6	2.6	5.3
CHNO	88%	32	3	40	37	16.7	8.8	1.5	3.2
TSME	91%	33	2	40	38	11.8	8.0	1.4	2.9
TSHE	72%	26	1	95	94	13.2	19.2	3.8	7.7
THPL	22%	8	5	30	25	14.7	8.6	3.1	7.2
PICO	38%	14	1	29	28	14.2	8.0	2.1	4.6
PISI	27%	10	1	5	4	2.0	1.5	.5	1.1
TABR	2%	1	1	1	0	1.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	9	72	63	30.1	15.0	2.5	5.1
TSME	94%	34	2	34	32	11.3	9.0	1.5	3.1
TSHE	88%	32	1	40	39	9.7	9.1	1.6	3.3
CHNO	88%	32	1	51	50	12.3	12.2	2.2	4.4
PISI	47%	17	1	8	7	2.2	1.9	.5	1.0
THPL	27%	10	1	10	9	6.1	3.1	1.0	2.2
PICO	41%	15	1	21	20	5.4	5.9	1.5	3.3
ALRU	5%	2	6	7	1	6.5	.7	.5	6.4

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	6	82	76	50.0	22.1	3.7	7.4
VACCI	100%	36	1	80	79	38.7	21.6	3.6	7.3
MEFE	100%	36	1	30	29	9.9	7.8	1.3	2.6
VAPA	36%	13	1	6	5	2.7	1.8	.5	1.1
GASH	11%	4	1	1	0	1.0	.0	.0	.0
CLPY	22%	8	1	17	16	4.0	5.4	1.9	4.5
RUSP	19%	7	1	7	6	2.7	2.9	1.1	2.7
ALSI	13%	5	1	5	4	2.6	1.7	.7	2.1
OPHO	5%	2	1	2	1	1.5	.7	.5	6.4
SOSI	2%	1	1	1	0	1.0	.0	.0	.0
RIBR	2%	1	4	4	0	4.0	.0	.0	.0
SPDO	2%	1	5	5	0	5.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	86%	31	0	85	85	15.7	22.2	4.0	8.1
VACA	41%	15	1	26	25	8.7	7.5	1.9	4.1
LEGR	33%	12	1	14	13	4.4	4.6	1.3	2.9
EMNI	33%	12	1	30	29	11.3	9.2	2.7	5.9
VAVI	25%	9	1	16	15	3.9	5.1	1.7	3.9
KAPO	36%	13	1	12	11	4.1	3.1	.9	1.9
VAOX	11%	4	1	7	6	2.8	2.9	1.4	4.6
VAUL	5%	2	6	25	19	15.5	13.4	9.5	120.7
PHGL	13%	5	2	10	8	7.0	3.3	1.5	4.1
CAME	5%	2	3	5	2	4.0	1.4	1.0	12.7
LUPE	2%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Deer Cabbage (430) Cont.

36 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	15 1	00	85	54.2	24.9	4.1	8.4
COCA	100%	36	2	30	28	10.9	8.1	1.4	2.7
LYAM	88%	32	1	39	38	10.4	8.7	1.5	3.1
COAS	83%	30	1	30	29	5.4	6.2	1.1	2.3
RUPE	75%	27	1	20	19	4.3	4.1	.8	1.6
FACR	100%	35	2	38	36	15.2	12.7	2.1	4.4
LICO3	50%	18	1	8	7	1.6	1.6	.4	.8
STRO	52%	19	1	4	3	1.3	.7	.2	.4
VEVI	30%	11	1	15	14	3.5	4.0	1.2	2.7
MADI2	16%	6	1	2	1	1.3	.5	.2	.5
TITR	30%	11	1	6	5	1.9	1.8	.5	1.2
LIBO2	27%	10	1	15	14	3.9	5.9	1.9	4.2
CABI	27%	10	2	32	30	8.4	9.0	2.8	6.4
COTR2	38%	14	1	6	5	1.5	1.3	.4	.8
STAM	13%	5	1	3	2	1.6	.9	.4	1.1
LICA3	5%	2	1	1	0	1.0	.0	.0	.0
SANGU	16%	6	3	8	5	4.7	2.1	.8	2.2
CLUN	8%	3	1	1	0	1.0	.0	.0	.0
GEDO	2%	1	3	3	0	3.0	.0	.0	.0
RUCH	11%	4	1	4	3	2.5	1.3	.6	2.1
PYSE	8%	3	1	1	0	1.0	.0	.0	.0
HASA	5%	2	1	2	1	1.5	.7	.5	6.4
TREU	13%	5	1	1	0	1.0	.0	.0	.0
DROSE	11%	4	1	3	2	1.8	1.0	.5	1.5
SAST	11%	4	1	16	15	7.0	6.4	3.2	10.1
ERPE	8%	3	1	2	1	1.3	.6	.3	1.4
DODEC	2%	1	1	1	0	1.0	.0	.0	.0
GECA4	8%	3	1	2	1	1.3	.6	.3	1.4
TOGL	2%	1	1	1	0	1.0	.0	.0	.0
ASBO	2%	1	3	3	0	3.0	.0	.0	.0
SAME4	2%	1	3	3	0	3.0	.0	.0	.0
EQUIS	2%	1	2	2	0	2.0	.0	.0	.0
CIAL	2%	1	1	1	0	1.0	.0	.0	.0
LISTE	2%	1	1	1	0	1.0	.0	.0	.0
PIVU	2%	1	1	1	0	1.0	.0	.0	.0
PAFI	2%	1	1	1	0	1.0	.0	.0	.0
HAHY	2%	1	1	1	0	1.0	.0	.0	.0
RACO	2%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	50%	18	1	12	11	4.2	4.3	1.3	2.9
CAREX	50%	18	1	85	84	13.3	18.8	4.4	9.4
CAPL	13%	5	3	18	15	10.0	6.4	2.9	7.9
CACA	5%	2	6	21	15	13.5	10.6	7.5	95.3
CASI3	8%	3	2	53	51	24.3	26.1	15.1	64.8
CAPA1	5%	2	1	5	4	3.0	2.8	2.0	25.4
AGROS	2%	1	4	4	0	4.0	.0	.0	.0
SCCA2	5%	2	40	60	20	50.0	14.1	10.0	127.1
CAAN5	11%	4	1	11	10	5.8	4.6	2.3	7.3
DEAT	8%	3	1	1	0	1.0	.0	.0	.0
ERIOP	2%	1	1	1	0	1.0	.0	.0	.0
CANI2	2%	1	8	8	0	8.0	.0	.0	.0
TRISE	2%	1	2	2	0	2.0	.0	.0	.0
TRCE	2%	1	9	9	0	9.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry/Deer Cabbage (430) Cont.

36 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	88%	32	0	29	29	6.3	7.3	1.3	2.6
BLSP	66%	24	1	10	9	3.6	2.4	.5	1.0
SPHAG	69%	25	3	70	67	14.8	16.4	3.3	6.8
LYCOP	38%	14	1	5	4	1.9	1.2	.3	.7
LYAN	47%	17	1	3	2	1.5	.8	.2	.4
LYCL	22%	8	1	2	1	1.3	.5	.2	.4
GYDR	25%	9	1	7	6	2.6	2.2	.7	1.7
ATFI	13%	5	1	16	15	6.0	6.7	3.0	8.4
PTAQ	11%	4	1	14	13	6.5	6.1	3.1	9.8
DRAU2	8%	3	3	5	2	3.7	1.2	.7	2.9
LYSE	11%	4	1	1	0	1.0	.0	.0	.0
THPH	5%	2	2	2	0	2.0	.0	.0	.0
POGL4	2%	1	2	2	0	2.0	.0	.0	.0
POMU	2%	1	3	3	0	3.0	.0	.0	.0
ADPE	2%	1	3	3	0	3.0	.0	.0	.0
LYSI	2%	1	5	5	0	5.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal (460)

25 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	20	60	40	38.6	11.5	2.3	4.7
CHNO	92%	23	2	24	22	10.7	5.8	1.2	2.5
TSME	84%	21	1	20	19	6.5	5.5	1.2	2.5
TSHE	84%	21	1	22	21	8.4	5.7	1.2	2.6
THPL	92%	23	4	50	46	14.7	11.6	2.4	5.0
PICO	36%	9	2	27	25	10.7	9.6	3.2	7.4
PISI	36%	9	1	5	4	2.6	1.4	.5	1.1
ALRU	4%	1	8	8	0	8.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	15	96	81	44.5	24.0	4.8	9.9
TSME	76%	19	1	15	14	5.9	4.0	.9	1.9
TSHE	96%	24	5	40	35	18.4	10.6	2.2	4.5
CHNO	80%	20	1	72	71	15.3	19.0	4.3	8.9
PISI	64%	16	1	8	7	3.1	2.4	.6	1.3
THPL	76%	19	3	41	38	10.4	8.5	1.9	4.1
PICO	48%	12	1	8	7	3.0	2.4	.7	1.5
ALRU	4%	1	6	6	0	6.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	18	100	82	53.9	23.5	4.7	9.7
VACCI	100%	24	1	78	77	18.7	17.1	3.5	7.2
MEFE	84%	21	1	76	75	10.5	16.9	3.7	7.7
VAPA	72%	18	1	15	14	5.3	3.7	.9	1.9
GASH	100%	25	5	76	71	29.8	18.2	3.6	7.5
RUSP	7%	2	1	8	7	4.5	4.9	3.5	44.5
ALSI	7%	2	1	5	4	3.0	2.8	2.0	25.4

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	60%	15	0	50	50	15.0	18.7	4.8	10.4
VACA	28%	7	3	38	35	18.6	12.1	4.6	11.2
LEGR	24%	6	4	34	30	13.8	11.9	4.9	12.5
EMNI	16%	4	1	24	23	10.7	9.9	5.0	15.8
VAVI	16%	4	1	13	12	4.0	6.0	3.0	9.5
KAPO	20%	5	1	9	8	3.6	3.4	1.5	4.3
VAOX	12%	3	1	6	5	3.3	2.5	1.5	6.3
VAUL	7%	2	1	1	0	1.0	.0	.0	.0
LUPE	4%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal (460) Cont.

25 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	24	5	100	95	32.9	27.9	5.7	11.8
COCA	96%	24	1	34	33	9.5	9.9	2.0	4.2
LYAM	84%	21	1	40	39	7.5	11.3	2.5	5.1
COAS	76%	19	1	7	6	2.4	2.0	.5	1.0
RUPE	60%	15	1	9	8	2.8	2.4	.6	1.3
FACR	40%	10	1	39	38	17.5	16.2	5.1	11.6
LICO3	44%	11	1	2	1	1.2	.4	.1	.3
STRO	40%	10	1	3	2	1.2	.6	.2	.5
VEVI	48%	12	1	3	2	1.3	.6	.2	.4
MADI2	60%	15	1	6	5	1.9	1.3	.3	.7
TITR	32%	8	1	1	0	1.0	.0	.0	.0
LIBO2	32%	8	1	12	11	3.0	3.7	1.3	3.1
CABI	16%	4	2	7	5	3.3	2.5	1.3	4.0
COTR2	32%	8	1	2	1	1.1	.4	.1	.3
STAM	20%	5	1	1	0	1.0	.0	.0	.0
LICA3	16%	4	1	4	3	1.8	1.5	.8	2.4
SANGU	12%	3	1	4	3	2.0	1.7	1.0	4.3
GEDO	7%	2	1	1	0	1.0	.0	.0	.0
RUCH	20%	5	1	13	12	5.0	4.7	2.1	5.9
HASA	7%	2	1	1	0	1.0	.0	.0	.0
TREU	4%	1	1	1	0	1.0	.0	.0	.0
DROSE	4%	1	1	1	0	1.0	.0	.0	.0
PRAL	12%	3	1	1	0	1.0	.0	.0	.0
SAST	4%	1	1	1	0	1.0	.0	.0	.0
ERPE	4%	1	1	1	0	1.0	.0	.0	.0
TOGL	7%	2	1	1	0	1.0	.0	.0	.0
SAME	4%	1	4	4	0	4.0	.0	.0	.0
HELA	4%	1	1	1	0	1.0	.0	.0	.0
VILA	4%	1	2	2	0	2.0	.0	.0	.0
SAME4	7%	2	1	2	1	1.5	.7	.5	6.4
OSPU	4%	1	1	1	0	1.0	.0	.0	.0
GATR2	4%	1	1	1	0	1.0	.0	.0	.0
EQUIS	4%	1	1	1	0	1.0	.0	.0	.0
LISTE	4%	1	1	1	0	1.0	.0	.0	.0
ARNIC	7%	2	6	6	0	6.0	.0	.0	.0
PYAS	4%	1	1	1	0	1.0	.0	.0	.0
SMRA	4%	1	1	1	0	1.0	.0	.0	.0
GATR	4%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	40%	10	1	38	37	4.9	3.5	1.2	2.9
CAREX	40%	10	1	38	37	7.0	11.2	3.5	8.0
CANU3	4%	1	10	10	0	10.0	.0	.0	.0
CAPL	7%	2	4	14	10	9.0	7.1	5.0	63.5
CACA	12%	3	1	24	23	9.0	13.0	7.5	32.3
CASI3	4%	1	2	2	0	2.0	.0	.0	.0
SCCA2	12%	3	1	10	9	5.0	4.6	2.6	11.4
DEAT	7%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal (460) Cont.

25 Samples

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	92%	23	1	39	38	9.2	9.8	2.0	4.2
BLSP	84%	21	1	20	19	5.6	5.1	1.1	2.3
SPHAG	80%	20	1	79	78	15.8	19.5	4.4	9.1
LYCOP	48%	12	1	2	1	1.3	.5	.1	.3
LYAN	52%	13	1	4	3	1.2	.8	.2	.5
LYCL	44%	11	1	2	1	1.1	.3	.1	.2
GYDR	20%	5	1	2	1	1.4	.5	.2	.7
ATFI	4%	1	30	30	0	30.0	.0	.0	.0
PTAQ	16%	4	1	36	35	11.0	16.8	8.4	26.7
DRAU2	7%	2	1	11	10	6.0	7.1	5.0	63.5
LYSE	16%	4	1	2	1	1.3	.5	.3	.8
THPH	4%	1	1	1	0	1.0	.0	.0	.0
POGL4	7%	2	1	1	0	1.0	.0	.0	.0
POLO	4%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal/Deer Cabbage (465)

25 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	9	50	41	27.3	12.1	2.4	5.0
CHNO	84%	21	1	20	19	11.1	5.6	1.2	2.6
TSHE	40%	10	1	6	5	2.9	1.9	.6	1.4
TSME	84%	21	1	25	24	6.9	4.9	1.1	2.2
THPL	56%	14	2	35	33	10.4	8.4	2.3	4.9
PICO	92%	23	2	50	48	9.0	10.7	2.2	4.6
PISI	12%	3	1	2	1	1.3	.6	.3	1.4

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	14	65	51	33.6	15.3	3.1	6.3
TSME	96%	24	1	30	29	9.6	7.4	1.5	3.1
TSHE	64%	16	2	12	10	6.6	3.4	.8	1.8
CHNO	88%	22	1	38	37	12.2	8.7	1.9	3.9
PISI	60%	15	1	4	3	2.1	1.1	.3	.6
THPL	60%	15	1	20	19	9.1	6.3	1.6	3.5
PICO	84%	21	1	20	19	4.2	5.6	1.2	2.6
ALRU	4%	1	5	5	0	5.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	5	100	95	39.6	21.9	4.4	9.0
VACCI	100%	25	1	30	29	7.6	8.2	1.7	3.5
MEFE	96%	24	1	15	14	5.6	4.8	1.0	2.0
VAPA	64%	16	1	10	9	2.3	2.5	.6	1.3
GASH	100%	25	5	80	75	24.9	18.6	3.7	7.7
CLPY	28%	7	1	10	9	3.7	3.5	1.3	3.2
RUSP	4%	1	1	1	0	1.0	.0	.0	.0
ALSI	20%	5	1	4	3	2.8	1.6	.7	2.0
OPHO	4%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	24	0	68	68	11.9	16.9	3.5	7.1
MYGA	4%	1	3	3	0	3.0	.0	.0	.0
VACA	40%	10	1	15	14	5.3	4.9	1.6	3.5
LEGR	60%	15	1	25	24	4.6	6.5	1.7	3.6
EMNI	40%	10	1	50	49	10.3	15.3	4.8	10.9
VAVI	52%	13	1	10	9	2.4	2.8	.8	1.7
KAPO	36%	9	1	4	3	1.6	1.0	.3	.8
VAOX	24%	6	1	3	2	1.7	1.0	.4	1.1
VAUL	24%	6	1	5	4	2.5	2.0	.8	2.1
LUPE	4%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal/Deer Cabbage (465)

25 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	25	9	92	83	36.3	22.3	4.5	9.2
COCA	92%	23	1	30	29	6.8	7.3	1.5	3.2
LYAM	80%	20	1	25	24	8.0	7.9	1.8	3.7
COAS	76%	19	1	6	5	1.8	1.3	.3	.6
RUPE	44%	11	1	8	7	1.7	2.1	.6	1.4
FACR	100%	24	2	40	38	10.3	9.4	1.9	4.0
LICO3	24%	6	1	1	0	1.0	.0	.0	.0
STRO	7%	2	1	3	2	2.0	1.4	1.0	12.7
VEVI	64%	16	1	10	9	2.6	2.3	.6	1.2
MADI2	36%	9	1	2	1	1.1	.3	.1	.3
TITR	16%	4	1	10	9	3.3	4.5	2.3	7.2
LIBO2	52%	13	1	3	2	1.2	.6	.2	.4
CABI	24%	6	1	35	34	13.2	15.2	6.2	15.9
COTR2	24%	6	1	6	5	1.8	2.0	.8	2.1
LICA3	4%	1	1	1	0	1.0	.0	.0	.0
SANGU	20%	5	1	4	3	1.6	1.3	.6	1.7
GEDO	32%	8	1	2	1	1.1	.4	.1	.3
RUCH	4%	1	2	2	0	2.0	.0	.0	.0
HASA	16%	4	1	1	0	1.0	.0	.0	.0
TREU	4%	1	1	1	0	1.0	.0	.0	.0
DROSE	4%	1	1	1	0	1.0	.0	.0	.0
ERPE	4%	1	1	1	0	1.0	.0	.0	.0
DODEC	12%	3	1	4	3	2.0	1.7	1.0	4.3
GECA4	4%	1	1	1	0	1.0	.0	.0	.0
TOGL	4%	1	1	1	0	1.0	.0	.0	.0
ASBO	7%	2	1	1	0	1.0	.0	.0	.0
VIGL	4%	1	2	2	0	2.0	.0	.0	.0
HELA	4%	1	1	1	0	1.0	.0	.0	.0
HABEN	4%	1	1	1	0	1.0	.0	.0	.0
SASI	4%	1	3	3	0	3.0	.0	.0	.0
GEPL	4%	1	1	1	0	1.0	.0	.0	.0
CALTH	4%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	64%	16	1	24	23	5.6	6.3	1.6	3.4
CAREX	60%	15	1	60	59	14.3	19.2	5.0	10.7
CANU3	7%	2	2	4	2	3.0	1.4	1.0	12.7
CACA	12%	3	1	6	5	2.7	2.9	1.7	7.2
CAPA1	4%	1	1	1	0	1.0	.0	.0	.0
AGROS	12%	3	1	5	4	2.3	2.3	1.3	5.7
SCCA2	4%	1	1	1	0	1.0	.0	.0	.0
AGGI	4%	1	1	1	0	1.0	.0	.0	.0
CANI2	4%	1	1	1	0	1.0	.0	.0	.0
LUPA	7%	2	1	3	2	2.0	1.4	1.0	12.7
JUNCU	4%	1	1	1	0	1.0	.0	.0	.0
CASP	4%	1	1	1	0	1.0	.0	.0	.0
CARO2	4%	1	50	50	0	50.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Blueberry-Salal/Deer Cabbage (465)

25 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	24	0	20	20	5.0	4.5	.9	1.9
BLSP	80%	20	1	12	11	4.1	2.6	.6	1.2
SPHAG	68%	17	1	40	39	9.8	10.8	2.6	5.6
LYCOP	72%	18	1	40	39	3.9	9.1	2.1	4.5
LYAN	44%	11	1	2	1	1.1	.3	.1	.2
LYCL	40%	10	1	5	4	1.6	1.3	.4	.9
ATFI	7%	2	1	1	0	1.0	.0	.0	.0
PTAQ	20%	5	1	20	19	5.0	8.4	3.8	10.4
DRAU2	4%	1	6	6	0	6.0	.0	.0	.0
LYSE	12%	3	1	1	0	1.0	.0	.0	.0
THPH	4%	1	1	1	0	1.0	.0	.0	.0
POGL4	4%	1	1	1	0	1.0	.0	.0	.0
ADPE	4%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Salal/Skunk Cabbage (470)

7 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	25	40	15	30.0	5.0	1.9	4.6
CHNO	85%	6	2	23	21	12.3	8.1	3.3	8.5
TSME	71%	5	3	40	37	12.8	15.4	6.9	19.1
TSHE	85%	6	2	15	13	7.5	5.9	2.4	6.2
THPL	71%	5	2	15	13	8.4	6.1	2.7	7.6
PICO	42%	3	2	10	8	4.7	4.6	2.7	11.5
PISI	57%	4	1	4	3	2.5	1.3	.6	2.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	20	40	20	29.3	8.4	3.2	7.8
TSME	85%	6	4	12	8	8.0	3.2	1.3	3.3
TSHE	85%	6	12	26	14	17.8	6.0	2.5	6.3
CHNO	71%	5	3	10	7	6.0	3.1	1.4	3.8
PISI	100%	7	1	4	3	1.6	1.1	.4	1.0
THPL	57%	4	1	15	14	6.8	6.9	3.5	11.1
PICO	14%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	20	85	65	43.6	23.4	8.8	21.6
VACCI	85%	6	1	30	29	7.2	11.3	4.6	11.8
MEFE	85%	6	1	15	14	5.2	5.2	2.1	5.4
VAPA	85%	6	2	10	8	4.5	3.1	1.3	3.2
GASH	100%	7	7	75	68	29.4	25.3	9.6	23.4
RUSP	14%	1	5	5	0	5.0	.0	.0	.0
ALSI	28%	2	1	5	4	3.0	2.8	2.0	25.4

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	71%	5	0	1	1	.4	.5	.2	.7
EMNI	28%	2	1	1	0	1.0	.0	.0	.0
VAVI	14%	1	1	1	0	1.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	7	13	90	77	35.9	26.8	10.1	24.8
COCA	100%	7	1	10	9	4.3	3.3	1.2	3.0
LYAM	100%	7	3	25	22	10.6	7.4	2.8	6.9
COAS	57%	4	1	7	6	3.8	3.2	1.6	5.1
RUPE	42%	3	2	12	10	6.0	5.3	3.1	13.1
FACR	14%	1	1	1	0	1.0	.0	.0	.0
LICO3	28%	2	1	1	0	1.0	.0	.0	.0
STRO	42%	3	1	1	0	1.0	.0	.0	.0
VEVI	28%	2	3	3	0	3.0	.0	.0	.0
MADI2	57%	4	1	3	2	2.5	1.0	.5	1.6
TITR	57%	4	1	2	1	1.3	.5	.3	.8
CABI	42%	3	1	15	14	5.7	8.1	4.7	20.1
STAM	14%	1	1	1	0	1.0	.0	.0	.0
LICA3	14%	1	1	1	0	1.0	.0	.0	.0
PRAL	14%	1	1	1	0	1.0	.0	.0	.0
ERPE	28%	2	2	3	1	2.5	.7	.5	6.4

Vegetation Statistics for Mixed Conifer/Salal/Skunk Cabbage (470) Cont.

7 Samples

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	85%	6	1	60	59	14.8	23.0	9.4	24.1
CAREX	57%	4	1	10	9	5.0	4.7	2.3	7.5
AGROS	14%	1	15	15	0	15.0	.0	.0	.0
CAAN5	14%	1	3	3	0	3.0	.0	.0	.0
CAME2	14%	1	1	1	0	1.0	.0	.0	.0
CAPR	14%	1	4	4	0	4.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	85%	6	1	15	14	7.2	5.3	2.2	5.5
BLSP	85%	6	1	15	14	6.8	5.0	2.0	5.2
SPHAG	85%	6	2	25	23	8.3	8.5	3.5	8.9
LYCOP	71%	5	1	2	1	1.2	.4	.2	.6
LYAN	71%	5	1	1	0	1.0	.0	.0	.0
LYCL	14%	1	1	1	0	1.0	.0	.0	.0
GYDR	14%	1	2	2	0	2.0	.0	.0	.0
DRAU2	14%	1	5	5	0	5.0	.0	.0	.0
LYSE	28%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Salal (480)

27 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	15	75	60	38.2	15.6	3.0	6.2
CHNO	81%	22	5	35	30	15.0	7.6	1.6	3.4
TSME	66%	18	1	18	17	4.9	4.1	1.0	2.0
TSHE	81%	22	2	25	23	9.0	6.7	1.4	3.0
THPL	88%	24	2	30	28	13.8	7.2	1.5	3.0
PICO	44%	12	1	75	74	13.2	20.1	5.8	12.7
PISI	37%	10	1	10	9	3.1	3.1	1.0	2.2
TABR	7%	2	2	2	0	2.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	3	80	77	31.7	19.8	3.8	7.8
TSME	70%	19	1	16	15	5.3	3.9	.9	1.9
TSHE	81%	22	2	30	28	13.8	8.1	1.7	3.6
CHNO	66%	18	1	60	59	12.0	14.6	3.4	7.3
PISI	70%	19	1	7	6	1.7	1.4	.3	.7
THPL	88%	24	1	80	79	11.8	16.8	3.4	7.1
PICO	33%	9	1	8	7	3.0	2.4	.8	1.8
ALRU	3%	1	6	6	0	6.0	.0	.0	.0
TABR	3%	1	2	2	0	2.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	27	12	100	88	44.1	24.5	4.7	9.7
VACCI	88%	24	1	9	8	2.7	2.2	.4	.9
MEFE	92%	25	1	20	19	3.7	4.3	.9	1.8
VAPA	70%	19	1	8	7	2.4	2.1	.5	1.0
GASH	100%	26	6	90	84	36.5	22.9	4.5	9.2
RUSP	3%	1	1	1	0	1.0	.0	.0	.0
ALSI	22%	6	1	5	4	3.3	1.6	.7	1.7
VIED	3%	1	5	5	0	5.0	.0	.0	.0
SOSI	3%	1	1	1	0	1.0	.0	.0	.0
MAFU	3%	1	15	15	0	15.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	59%	16	0	15	15	2.4	4.3	1.1	2.3
VACA	3%	1	1	1	0	1.0	.0	.0	.0
LEGR	14%	4	1	10	9	3.5	4.4	2.2	6.9
EMNI	18%	5	1	10	9	3.4	3.9	1.7	4.9
VAVI	22%	6	1	3	2	1.8	.8	.3	.8
KAPO	3%	1	1	1	0	1.0	.0	.0	.0
VAUL	3%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Salal (480)

27 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	26	1	35	34	8.2	7.6	1.5	3.1
COCA	77%	21	1	12	11	2.8	2.6	.6	1.2
LYAM	55%	15	1	15	14	2.3	3.6	.9	2.0
COAS	22%	6	1	3	2	2.0	.9	.4	.9
RUPE	40%	11	1	4	3	1.5	1.0	.3	.7
FACR	37%	10	1	2	1	1.2	.4	.1	.3
LICO3	44%	12	1	1	0	1.0	.0	.0	.0
STRO	11%	3	1	1	0	1.0	.0	.0	.0
VEVI	44%	12	1	2	1	1.3	.5	.1	.3
MADI2	55%	15	1	3	2	1.2	.6	.1	.3
TITR	18%	5	1	1	0	1.0	.0	.0	.0
LIBO2	22%	6	1	4	3	1.7	1.2	.5	1.3
CABI	14%	4	1	8	7	3.8	3.4	1.7	5.4
COTR2	3%	1	1	1	0	1.0	.0	.0	.0
STAM	18%	5	1	1	0	1.0	.0	.0	.0
LICA3	25%	7	1	1	0	1.0	.0	.0	.0
SANGU	7%	2	1	1	0	1.0	.0	.0	.0
CLUN	3%	1	1	1	0	1.0	.0	.0	.0
GEDO	7%	2	1	1	0	1.0	.0	.0	.0
HASA	7%	2	1	1	0	1.0	.0	.0	.0
TREU	3%	1	1	1	0	1.0	.0	.0	.0
DROSE	3%	1	1	1	0	1.0	.0	.0	.0
PRAL	3%	1	1	1	0	1.0	.0	.0	.0
HELA	3%	1	2	2	0	2.0	.0	.0	.0
EPAN	3%	1	1	1	0	1.0	.0	.0	.0
HABEN	3%	1	1	1	0	1.0	.0	.0	.0
VIGI	3%	1	5	5	0	5.0	.0	.0	.0
LIB02	3%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	62%	17	1	17	16	4.4	4.3	1.1	2.2
CAREX	29%	8	1	10	9	4.0	3.9	1.4	3.3
CANU3	7%	2	1	10	9	5.5	6.4	4.5	57.2
CAPL	3%	1	1	1	0	1.0	.0	.0	.0
CACA	3%	1	1	1	0	1.0	.0	.0	.0
CASI3	3%	1	1	1	0	1.0	.0	.0	.0
CAPA1	11%	3	1	10	9	4.3	4.9	2.8	12.3
AGROS	3%	1	1	1	0	1.0	.0	.0	.0
DEAT	3%	1	1	1	0	1.0	.0	.0	.0
AGGI	11%	3	1	6	5	2.7	2.9	1.7	7.2

Vegetation Statistics for Mixed Conifer/Salal (480)

27 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	96%	26	0	20	20	5.1	5.1	1.0	2.1
BLSP	88%	24	1	20	19	4.8	5.2	1.1	2.2
SPHAG	55%	15	1	90	89	11.3	22.9	5.9	12.7
LYCOP	62%	17	1	15	14	2.2	3.4	.8	1.7
LYAN	37%	10	1	15	14	2.5	4.4	1.4	3.1
LYCL	51%	14	1	2	1	1.1	.4	.1	.2
GYDR	3%	1	3	3	0	3.0	.0	.0	.0
ATFI	7%	2	1	1	0	1.0	.0	.0	.0
PTAQ	18%	5	1	3	2	1.8	.8	.4	1.0
LYSE	11%	3	1	1	0	1.0	.0	.0	.0
THPH	7%	2	1	2	1	1.5	.7	.5	6.4
POGL4	7%	2	1	1	0	1.0	.0	.0	.0
POMU	7%	2	1	5	4	3.0	2.8	2.0	25.4
LYCOP	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Copperbush/Deer Cabbage (490)

16 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	5	55	50	30.6	13.6	3.4	7.3
CHNO	87%	14	1	30	29	13.8	8.8	2.4	5.1
TSME	100%	16	2	17	15	8.9	4.5	1.1	2.4
TSHE	62%	10	1	15	14	6.2	5.5	1.7	3.9
THPL	43%	7	1	45	44	10.0	15.7	5.9	14.5
PICO	37%	6	2	20	18	7.5	7.9	3.2	8.3
PISI	31%	5	1	4	3	1.8	1.3	.6	1.6
ALRU	12%	2	5	10	5	7.5	3.5	2.5	31.8

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	10	55	45	23.2	11.2	2.8	5.9
TSME	100%	16	1	25	24	9.5	7.3	1.8	3.9
TSHE	68%	11	1	10	9	5.1	2.7	.8	1.8
CHNO	87%	14	1	33	32	13.0	10.1	2.7	5.8
PISI	56%	9	1	3	2	1.9	.8	.3	.6
THPL	31%	5	1	4	3	2.6	1.1	.5	1.4
PICO	25%	4	1	2	1	1.3	.5	.3	.8
ALRU	12%	2	1	6	5	3.5	3.5	2.5	31.8

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	10	75	65	48.9	19.7	4.9	10.5
VACCI	93%	15	7	60	53	30.5	18.8	4.8	10.4
MEFE	93%	15	1	13	12	4.7	3.5	.9	1.9
VAPA	37%	6	2	60	58	13.0	23.1	9.4	24.2
GASH	18%	3	1	12	11	4.7	6.4	3.7	15.8
CLPY	100%	16	3	35	32	12.2	9.4	2.3	5.0
RUSP	25%	4	1	1	0	1.0	.0	.0	.0
ALSI	6%	1	10	10	0	10.0	.0	.0	.0
OPHO	6%	1	1	1	0	1.0	.0	.0	.0
VIED	6%	1	3	3	0	3.0	.0	.0	.0
SOSI	6%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mixed Conifer/Copperbush/Deer Cabbage (490)

16 Samples

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	0	40	40	7.3	10.0	2.5	5.4
VACA	43%	7	1	15	14	4.1	5.1	1.9	4.8
LEGR	12%	2	1	1	0	1.0	.0	.0	.0
EMNI	50%	8	1	10	9	3.4	3.0	1.1	2.5
VAVI	25%	4	1	2	1	1.8	.5	.3	.8
KAPO	37%	6	1	5	4	2.2	1.6	.7	1.7
VAOX	6%	1	1	1	0	1.0	.0	.0	.0
VAUL	6%	1	10	10	0	10.0	.0	.0	.0
PHGL	37%	6	2	5	3	3.5	1.0	.4	1.1
CAST5	18%	3	1	1	0	1.0	.0	.0	.0
CAME	6%	1	8	8	0	8.0	.0	.0	.0
LUPE	6%	1	1	1	0	1.0	.0	.0	.0
ANPO	6%	1	1	1	0	1.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	15	95	80	41.2	24.4	6.1	13.0
COCA	93%	15	1	25	24	7.5	6.3	1.6	3.5
LYAM	81%	13	1	10	9	2.9	2.8	.8	1.7
COAS	87%	14	1	30	29	7.9	8.0	2.1	4.6
RUPE	75%	12	1	25	24	5.8	6.9	2.0	4.4
FACR	87%	14	3	45	42	10.9	10.3	2.8	5.9
LICO3	75%	12	1	2	1	1.3	.5	.1	.3
STRO	50%	8	1	3	2	1.9	1.0	.4	.8
VEVI	43%	7	1	4	3	2.1	1.2	.5	1.1
MADI2	12%	2	1	3	2	2.0	1.4	1.0	12.7
TITR	31%	5	1	5	4	1.8	1.8	.8	2.2
LIBO2	43%	7	1	4	3	1.9	1.1	.4	1.0
CABI	31%	5	1	25	24	9.2	9.4	4.2	11.7
COTR2	31%	5	1	2	1	1.2	.4	.2	.6
LICA3	25%	4	1	2	1	1.3	.5	.3	.8
CLUN	12%	2	1	1	0	1.0	.0	.0	.0
GEDO	12%	2	1	1	0	1.0	.0	.0	.0
RUCH	6%	1	1	1	0	1.0	.0	.0	.0
PYSE	31%	5	1	7	6	2.6	2.5	1.1	3.1
DROSE	6%	1	1	1	0	1.0	.0	.0	.0
PRAL	6%	1	1	1	0	1.0	.0	.0	.0
SAST	6%	1	2	2	0	2.0	.0	.0	.0
MOUN	18%	3	1	1	0	1.0	.0	.0	.0
DODEC	6%	1	1	1	0	1.0	.0	.0	.0
GECA4	6%	1	1	1	0	1.0	.0	.0	.0
TOGL	6%	1	1	1	0	1.0	.0	.0	.0
SAME	6%	1	5	5	0	5.0	.0	.0	.0
ASBO	6%	1	1	1	0	1.0	.0	.0	.0
VIGL	12%	2	1	1	0	1.0	.0	.0	.0
VILA	6%	1	1	1	0	1.0	.0	.0	.0
STST	12%	2	1	1	0	1.0	.0	.0	.0
HADI	6%	1	1	1	0	1.0	.0	.0	.0
CALE2	12%	2	1	20	19	10.5	13.4	9.5	120.7

Vegetation Statistics for Mixed Conifer/Copperbush/Deer Cabbage (490)

16 Samples

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	43%	7	1	10	9	2.9	3.3	1.2	3.0
CAREX	31%	5	2	15	13	7.2	5.4	2.4	6.7
CANU3	18%	3	1	5	4	2.7	2.1	1.2	5.2
CAPL	6%	1	8	8	0	8.0	.0	.0	.0
CAPA1	6%	1	10	10	0	10.0	.0	.0	.0
ERIOP	6%	1	1	1	0	1.0	.0	.0	.0
TRISE	6%	1	3	3	0	3.0	.0	.0	.0
CAMA4	6%	1	3	3	0	3.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	16	1	18	17	4.5	4.1	1.0	2.2
BLSP	87%	14	1	6	5	2.8	1.6	.4	.9
SPHAG	81%	13	1	25	24	5.9	6.6	1.8	4.0
LYCOP	68%	11	1	4	3	1.5	.9	.3	.6
LYAN	43%	7	1	3	2	1.6	.8	.3	.7
LYCL	50%	8	1	2	1	1.1	.4	.1	.3
GYDR	18%	3	1	1	0	1.0	.0	.0	.0
ATFI	25%	4	1	5	4	2.3	1.9	.9	3.0
PTAQ	12%	2	1	3	2	2.0	1.4	1.0	12.7
DRAU2	18%	3	1	1	0	1.0	.0	.0	.0
LYSE	6%	1	1	1	0	1.0	.0	.0	.0
THPH	12%	2	1	1	0	1.0	.0	.0	.0
POMU	12%	2	1	10	9	5.5	6.4	4.5	57.2

Vegetation Statistics for Mountain Hemlock/Blueberry (510)

53 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	53	20	80	60	54.0	13.7	1.9	3.7
TSME	100%	53	10	75	65	35.8	15.8	2.2	4.3
PISI	54%	29	1	13	12	5.3	3.0	.5	1.1
TSHE	69%	37	1	43	42	14.3	10.9	1.8	3.6
CHNO	52%	28	2	40	38	14.6	10.5	2.0	4.1
THPL	5%	3	2	10	8	5.3	4.2	2.4	10.3

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	53	4	86	82	25.2	18.0	2.5	4.9
TSME	92%	49	1	40	39	12.5	9.8	1.4	2.8
TSHE	88%	47	1	45	44	9.3	9.7	1.4	2.9
PISI	67%	36	1	11	10	2.2	2.3	.4	.8
CHNO	52%	28	1	30	29	6.5	6.4	1.2	2.5
THPL	9%	5	1	15	14	6.8	5.7	2.5	7.0
ABLA	3%	2	1	1	0	1.0	.0	.0	.0
ALRU	1%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	53	1	95	94	55.0	21.7	3.0	6.0
VACCI	100%	51	1	90	89	46.6	19.3	2.7	5.4
MEFE	86%	46	1	40	39	8.5	8.5	1.3	2.5
CLPY	22%	12	1	6	5	2.4	1.7	.5	1.1
RUSP	33%	18	1	30	29	5.6	8.3	2.0	4.1
VAPA	30%	16	1	80	79	11.4	22.8	5.7	12.1
OPHO	32%	17	1	14	13	2.3	3.7	.9	1.9
SOSI	5%	3	1	3	2	1.7	1.2	.7	2.9
GASH	3%	2	1	30	29	15.5	20.5	14.5	184.2
RIBR	3%	2	1	1	0	1.0	.0	.0	.0
ALSI	3%	2	5	6	1	5.5	.7	.5	6.4

Vegetation Statistics for Mountain Hemlock/Blueberry (510)

53 Samples

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	66%	35	0	20	20	1.9	4.6	.8	1.6
CAME	9%	5	1	2	1	1.2	.4	.2	.6
LUPE	9%	5	1	1	0	1.0	.0	.0	.0
CAST5	1%	1	1	1	0	1.0	.0	.0	.0
PHGL	9%	5	1	4	3	1.8	1.3	.6	1.6
EMNI	7%	4	1	3	2	1.5	1.0	.5	1.6
VACA	1%	1	1	1	0	1.0	.0	.0	.0
VAVI	3%	2	5	20	15	12.5	10.6	7.5	95.3
KAPO	1%	1	1	1	0	1.0	.0	.0	.0
VAOX	1%	1	2	2	0	2.0	.0	.0	.0

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	53	1	100	99	41.5	28.0	3.8	7.7
RUPE	90%	48	1	40	39	10.6	9.5	1.4	2.8
COAS	84%	45	1	43	42	7.7	8.4	1.2	2.5
STRO	69%	37	1	9	8	3.0	2.0	.3	.7
VEVI	50%	27	1	9	8	2.4	2.3	.4	.9
COCA	69%	37	1	23	22	7.8	6.1	1.0	2.0
FACR	43%	23	1	35	34	7.3	9.5	2.0	4.1
CABI	45%	24	1	37	36	11.0	9.8	2.0	4.1
TITR	50%	27	1	16	15	3.5	3.6	.7	1.4
STAM	35%	19	1	20	19	3.0	5.4	1.2	2.6
LYAM	30%	16	1	36	35	8.2	9.8	2.5	5.2
COTR2	7%	4	1	1	0	1.0	.0	.0	.0
LICA3	15%	8	1	1	0	1.0	.0	.0	.0
LISTE	3%	2	1	1	0	1.0	.0	.0	.0
VIGL	13%	7	1	4	3	1.7	1.3	.5	1.2
CLUN	15%	8	1	1	0	1.0	.0	.0	.0
MADI2	7%	4	1	2	1	1.3	.5	.3	.8
HEGL2	3%	2	1	8	7	4.5	4.9	3.5	44.5
VASI	3%	2	1	2	1	1.5	.7	.5	6.4
MOUN	7%	4	1	1	0	1.0	.0	.0	.0
PYSE	1%	1	3	3	0	3.0	.0	.0	.0
STST	7%	4	1	10	9	4.8	3.9	1.9	6.1
SANGU	3%	2	1	12	11	6.5	7.8	5.5	69.9
OSPU	3%	2	1	2	1	1.5	.7	.5	6.4
TIUN	1%	1	1	1	0	1.0	.0	.0	.0
GECA4	5%	3	1	2	1	1.3	.6	.3	1.4
LIBO2	1%	1	10	10	0	10.0	.0	.0	.0
ERPE	1%	1	2	2	0	2.0	.0	.0	.0
RUCH	1%	1	4	4	0	4.0	.0	.0	.0
CALE2	1%	1	1	1	0	1.0	.0	.0	.0
HELA	1%	1	1	1	0	1.0	.0	.0	.0
ASTER	1%	1	1	1	0	1.0	.0	.0	.0
TREU	1%	1	2	2	0	2.0	.0	.0	.0
VIOLA	1%	1	1	1	0	1.0	.0	.0	.0
ARSY	1%	1	1	1	0	1.0	.0	.0	.0
DIFO	1%	1	1	1	0	1.0	.0	.0	.0
VILA	1%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Blueberry (510)

53 Samples

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	20%	11	1	20	19	7.2	9.2	3.8	9.7
CAREX	20%	11	1	40	39	10.3	12.0	3.6	8.0
CANI2	11%	6	3	21	18	13.8	7.2	2.9	7.6
DEAT	1%	1	1	1	0	1.0	.0	.0	.0
CAPL	1%	1	3	3	0	3.0	.0	.0	.0
CAPA1	1%	1	7	7	0	7.0	.0	.0	.0
POA	1%	1	18	18	0	18.0	.0	.0	.0
DEPU	1%	1	11	11	0	11.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	98%	52	0	50	50	9.7	10.0	1.4	2.8
BLSP	83%	44	1	39	38	6.7	7.3	1.1	2.2
SPHAG	75%	40	1	68	67	15.1	15.9	2.5	5.1
DRAU2	50%	27	1	9	8	2.1	1.9	.4	.8
GYDR	49%	26	1	22	21	3.0	4.5	.9	1.8
LYAN	33%	18	1	3	2	1.2	.5	.1	.3
ATFI	26%	14	1	2	1	1.3	.5	.1	.3
LYCOP	26%	14	1	3	2	1.5	.8	.2	.4
LYCL	11%	6	1	2	1	1.2	.4	.2	.4
THPH	11%	6	1	4	3	1.5	1.2	.5	1.3
LYSE	9%	5	1	1	0	1.0	.0	.0	.0
POBR	13%	7	1	17	16	4.9	6.3	2.4	5.8
POMU	7%	4	1	15	14	6.8	6.9	3.5	11.1
THLI	7%	4	1	7	6	2.5	3.0	1.5	4.8
POGL4	7%	4	1	1	0	1.0	.0	.0	.0
CYFR	1%	1	1	1	0	1.0	.0	.0	.0
ADPE	3%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Copperbush (520)

18 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	25	75	50	45.0	15.5	3.8	8.0
TSME	100%	18	20	72	52	33.4	14.0	3.3	7.0
PISI	44%	8	1	12	11	4.8	3.2	1.1	2.7
TSHE	33%	6	2	12	10	5.2	3.5	1.4	3.7
CHNO	61%	11	4	28	24	13.2	8.3	2.5	5.6

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	17	4	70	66	22.1	16.9	4.1	8.7
TSME	88%	16	3	24	21	10.5	5.7	1.4	3.0
TSHE	61%	11	1	15	14	6.1	4.8	1.5	3.3
PISI	50%	9	1	6	5	3.2	2.0	.7	1.5
CHNO	61%	11	2	48	46	11.4	13.3	4.0	8.9
THPL	6%	3	1	1	0	1.0	.0	.0	.0
ALRU	5%	1	6	6	0	6.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	18	25	95	70	57.9	21.7	5.3	11.2
VACCI	100%	18	3	72	69	37.0	21.4	5.1	10.7
MEFE	94%	17	2	15	13	7.0	4.3	1.0	2.2
CLPY	100%	18	5	25	20	13.9	7.4	1.7	3.7
RUSP	22%	4	1	1	0	1.0	.0	.0	.0
VAPA	11%	2	2	3	1	2.5	.7	.5	6.4
SOSI	22%	4	1	1	0	1.0	.0	.0	.0
GASH	5%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	61%	11	0	4	4	.9	1.2	.4	.8
CAME	5%	1	1	1	0	1.0	.0	.0	.0
LUPE	16%	3	1	1	0	1.0	.0	.0	.0
CAST5	16%	3	1	1	0	1.0	.0	.0	.0
PHGL	11%	2	1	1	0	1.0	.0	.0	.0
EMNI	5%	1	2	2	0	2.0	.0	.0	.0
VAVI	11%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Copperbush (520)

18 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	17	13	82	69	42.2	22.3	5.4	11.5
RUPE	88%	16	1	21	20	9.6	6.3	1.6	3.4
COAS	83%	15	1	35	34	6.6	8.9	2.3	4.9
STRO	72%	13	1	8	7	2.5	2.0	.6	1.2
VEVI	83%	15	1	6	5	2.9	1.5	.4	.8
COCA	66%	12	1	5	4	3.1	1.4	.4	.9
FACR	77%	14	1	25	24	7.9	6.9	1.8	4.0
CABI	55%	10	3	42	39	18.1	14.6	4.6	10.4
LICO3	55%	10	1	3	2	1.8	.8	.2	.6
TITR	33%	6	1	4	3	1.7	1.2	.5	1.3
STAM	16%	3	1	12	11	4.7	6.4	3.7	15.8
LYAM	33%	6	1	5	4	3.2	1.6	.7	1.7
COTR2	16%	3	1	2	1	1.3	.6	.3	1.4
LICA3	5%	1	1	1	0	1.0	.0	.0	.0
LISTE	16%	3	1	2	1	1.3	.6	.3	1.4
VIGL	11%	2	1	1	0	1.0	.0	.0	.0
CLUN	5%	1	1	1	0	1.0	.0	.0	.0
MADI2	16%	3	1	1	0	1.0	.0	.0	.0
HEGL2	11%	2	1	1	0	1.0	.0	.0	.0
VASI	5%	1	1	1	0	1.0	.0	.0	.0
PYSE	11%	2	1	1	0	1.0	.0	.0	.0
SETR	11%	2	1	2	1	1.5	.7	.5	6.4
CAPA	11%	2	4	10	6	7.0	4.2	3.0	38.1
SANGU	11%	2	1	1	0	1.0	.0	.0	.0
OSPU	5%	1	1	1	0	1.0	.0	.0	.0
ERPE	5%	1	1	1	0	1.0	.0	.0	.0
HABEN	5%	1	1	1	0	1.0	.0	.0	.0
HASA	5%	1	2	2	0	2.0	.0	.0	.0
CALE2	5%	1	3	3	0	3.0	.0	.0	.0
HELA	5%	1	1	1	0	1.0	.0	.0	.0
ASTER	5%	1	1	1	0	1.0	.0	.0	.0
SALY	5%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	33%	6	1	25	24	8.4	10.6	4.7	13.1
CAREX	33%	6	1	10	9	4.7	4.3	1.7	4.5
DEAT	16%	3	1	2	1	1.3	.6	.3	1.4
CAPL	11%	2	1	10	9	5.5	6.4	4.5	57.2
TRISE	5%	1	1	1	0	1.0	.0	.0	.0
CAPA1	5%	1	10	10	0	10.0	.0	.0	.0
AGROS	5%	1	1	1	0	1.0	.0	.0	.0
LUZUL	5%	1	1	1	0	1.0	.0	.0	.0
CANU3	5%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Copperbush (520)

18 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	88%	16	1	18	17	6.0	5.0	1.3	2.7
BLSP	94%	17	1	18	17	5.3	4.9	1.2	2.5
SPHAG	61%	11	1	61	60	14.1	18.4	5.5	12.3
DRAU2	22%	4	1	4	3	1.8	1.5	.8	2.4
GYDR	16%	3	1	1	0	1.0	.0	.0	.0
LYAN	11%	2	1	1	0	1.0	.0	.0	.0
ATFI	11%	2	2	2	0	2.0	.0	.0	.0
LYCOP	11%	2	1	1	0	1.0	.0	.0	.0
LYCL	5%	1	1	1	0	1.0	.0	.0	.0
THPH	5%	1	1	1	0	1.0	.0	.0	.0
THLI	5%	1	3	3	0	3.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Cassiope (530)

33 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	33	20	65	45	38.2	12.3	2.1	4.4
TSME	100%	33	20	65	45	34.9	13.5	2.4	4.9
PISI	33%	11	1	8	7	4.2	2.1	.6	1.4
TSHE	15%	5	1	32	31	9.2	12.9	5.8	16.0
CHNO	27%	9	2	20	18	8.8	6.3	2.1	4.8
ABLA2	6%	2	2	5	3	3.5	2.1	1.5	19.1
ALRU	3%	1	1	1	0	1.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	33	2	70	68	21.9	14.4	2.5	5.1
TSME	93%	31	2	46	44	14.0	11.0	2.0	4.0
TSHE	45%	15	1	35	34	6.7	9.1	2.3	5.0
PISI	81%	27	1	6	5	1.9	1.3	.2	.5
CHNO	33%	11	2	65	63	13.8	17.9	5.4	12.0
THPL	3%	1	3	3	0	3.0	.0	.0	.0
ABLA	3%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	33	22	87	65	52.9	17.2	3.0	6.1
VACCI	100%	33	3	80	77	37.0	22.4	3.9	8.0
MEFE	75%	25	1	29	28	5.7	6.3	1.3	2.6
CLPY	72%	24	3	35	32	16.7	10.3	2.1	4.3
RUSP	3%	1	1	1	0	1.0	.0	.0	.0
SOSI	9%	3	2	10	8	5.0	4.4	2.5	10.8
COST	3%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	33	2	77	75	26.5	22.1	3.8	7.9
CAME	93%	31	1	51	50	16.1	13.3	2.4	4.9
LUPE	75%	25	1	55	54	9.0	14.1	2.8	5.8
CAST5	78%	26	1	44	43	5.6	9.9	1.9	4.0
PHGL	45%	15	1	27	26	6.7	8.1	2.1	4.5
EMNI	9%	3	5	5	0	5.0	.0	.0	.0
VACA	18%	6	1	7	6	2.5	2.5	1.0	2.6
KAPO	3%	1	2	2	0	2.0	.0	.0	.0
JUCO	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Cassiope (530)

33 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	33	7	100	93	42.8	21.9	3.8	7.8
RUPE	93%	31	1	24	23	6.9	5.8	1.1	2.1
COAS	63%	21	1	31	30	5.9	8.0	1.7	3.6
STRO	87%	29	1	14	13	3.2	3.4	.6	1.3
VEVI	66%	22	1	7	6	2.4	2.0	.4	.9
COCA	42%	14	1	8	7	4.1	2.2	.6	1.3
FACR	69%	23	1	57	56	17.2	14.0	2.9	6.1
CABI	69%	23	1	50	49	16.3	15.6	3.3	6.7
LICO3	42%	14	1	6	5	1.6	1.3	.4	.8
TITR	12%	4	1	3	2	1.5	1.0	.5	1.6
STAM	24%	8	1	13	12	3.4	4.4	1.6	3.7
LYAM	3%	1	1	1	0	1.0	.0	.0	.0
COTR2	15%	5	1	22	21	6.2	9.1	4.1	11.3
LICA3	9%	3	1	2	1	1.3	.6	.3	1.4
LISTE	18%	6	1	1	0	1.0	.0	.0	.0
VIGL	3%	1	1	1	0	1.0	.0	.0	.0
HEGL2	6%	2	1	1	0	1.0	.0	.0	.0
VASI	9%	3	1	1	0	1.0	.0	.0	.0
MOUN	6%	2	1	1	0	1.0	.0	.0	.0
PYSE	3%	1	1	1	0	1.0	.0	.0	.0
SETR	6%	2	1	1	0	1.0	.0	.0	.0
CAPA	6%	2	4	15	11	9.5	7.8	5.5	69.9
TIUN	6%	2	1	1	0	1.0	.0	.0	.0
LIBO2	3%	1	1	1	0	1.0	.0	.0	.0
HABEN	3%	1	1	1	0	1.0	.0	.0	.0
HASA	3%	1	1	1	0	1.0	.0	.0	.0
RUCH	3%	1	2	2	0	2.0	.0	.0	.0
PRAL	6%	2	1	2	1	1.5	.7	.5	6.4
SAFE	6%	2	1	1	0	1.0	.0	.0	.0
DODEC	3%	1	1	1	0	1.0	.0	.0	.0
ARLA	3%	1	1	1	0	1.0	.0	.0	.0
EQUIS	3%	1	1	1	0	1.0	.0	.0	.0
ARNIC	3%	1	1	1	0	1.0	.0	.0	.0
EPILO	3%	1	1	1	0	1.0	.0	.0	.0
EPAN	3%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	42%	14	1	65	17	6.7	6.9	2.3	5.3
CAREX	24%	8	1	43	42	10.7	13.8	4.9	11.5
CANI2	42%	14	1	65	64	21.1	23.8	6.4	13.8
DEAT	21%	7	1	3	2	1.4	.8	.3	.7
CAPL	9%	3	1	20	19	8.0	10.4	6.0	25.9
TRISE	9%	3	1	2	1	1.3	.6	.3	1.4
CAPA1	6%	2	1	21	20	11.0	14.1	10.0	127.1
AGROS	6%	2	1	1	0	1.0	.0	.0	.0
SCCA2	9%	3	1	9	8	5.7	4.2	2.4	10.3
LUZUL	6%	2	1	3	2	2.0	1.4	1.0	12.7
POA	3%	1	1	1	0	1.0	.0	.0	.0
CALE5	3%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Mountain Hemlock/Cassiope (530)

33 Samples

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	93%	31	1	37	36	5.2	7.1	1.3	2.6
BLSP	78%	26	1	16	15	4.1	4.3	.8	1.7
SPHAG	48%	16	1	67	66	12.4	17.2	4.3	9.2
DRAU2	24%	8	1	2	1	1.1	.4	.1	.3
GYDR	3%	1	1	1	0	1.0	.0	.0	.0
LYAN	18%	6	1	1	0	1.0	.0	.0	.0
ATFI	15%	5	1	1	0	1.0	.0	.0	.0
LYCOP	9%	3	1	1	0	1.0	.0	.0	.0
LYCL	3%	1	1	1	0	1.0	.0	.0	.0
LYSE	6%	2	1	1	0	1.0	.0	.0	.0
POMU	3%	1	1	1	0	1.0	.0	.0	.0
CYFR	9%	3	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Crowberry (610)

12 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	1	67	66	32.0	20.0	6.0	13.5
PICO	91%	11	12	56	44	24.1	13.8	4.2	9.3
CHNO	50%	6	1	19	18	6.8	6.9	2.8	7.2
TSME	25%	3	2	21	19	10.7	9.6	5.5	23.9
THPL	41%	5	1	14	13	7.0	6.1	2.7	7.6
TSHE	25%	3	4	5	1	4.7	.6	.3	1.4
PISI	16%	2	1	12	11	6.5	7.8	5.5	69.9

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	91%	11	12	95	83	54.5	32.8	9.9	22.0
CHNO	100%	11	3	66	63	26.0	21.8	6.6	14.7
PICO	75%	9	2	42	40	11.7	13.4	4.5	10.3
TSHE	66%	8	1	15	14	9.0	4.6	1.6	3.8
TSME	33%	4	3	24	21	10.7	10.0	5.0	15.9
THPL	66%	8	1	50	49	22.2	21.4	7.6	17.9
PISI	33%	4	1	20	19	5.8	9.5	4.8	15.1
ALRU	16%	2	9	9	0	9.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	91%	11	1	85	84	24.6	28.7	8.7	19.3
MEFE	66%	8	1	23	22	4.4	7.7	2.7	6.5
VACCI	66%	8	1	73	72	15.6	24.4	8.6	20.4
GASH	50%	6	1	70	69	19.0	28.2	11.5	29.6
VAPA	41%	5	1	4	3	2.0	1.4	.6	1.8
CLPY	8%	1	1	1	0	1.0	.0	.0	.0
COST	8%	1	34	34	0	34.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	1	100	99	53.8	37.6	11.3	25.3
VAUL	8%	1	12	12	0	12.0	.0	.0	.0
SOSI	8%	1	1	1	0	1.0	.0	.0	.0
EMNI	91%	11	1	95	94	30.2	34.4	10.4	23.1
VACA	91%	11	1	28	27	11.1	9.0	2.7	6.0
LEGR	83%	10	1	95	94	25.2	32.2	10.2	23.0
KAPO	83%	10	1	21	20	3.9	6.2	2.0	4.5
VAOX	33%	4	1	4	3	2.0	1.4	.7	2.3
VAVI	33%	4	1	2	1	1.5	.6	.3	.9
VAUL	25%	3	2	8	6	4.0	3.5	2.0	8.6
JUCO	33%	4	1	15	14	4.8	6.8	3.4	10.9
PHGL	16%	2	1	18	17	9.5	12.0	8.5	108.0
CAST5	16%	2	4	33	29	18.5	20.5	14.5	184.2
LUPE	16%	2	1	12	11	6.5	7.8	5.5	69.9
MYGA	8%	1	10	10	0	10.0	.0	.0	.0
ANPO	8%	1	1	1	0	1.0	.0	.0	.0
CAME	8%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Crowberry (610)

12 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	83%	10	12	70	58	42.5	21.4	6.8	15.3
COCA	91%	11	1	40	39	15.9	15.3	4.6	10.3
COAS	50%	6	1	2	1	1.3	.5	.2	.5
LYAM	50%	6	1	15	14	4.3	5.5	2.2	5.7
FACR	66%	8	2	68	66	23.5	23.0	8.1	19.2
SANGU	58%	7	1	15	14	4.0	5.0	1.9	4.6
RUCH	50%	6	1	13	12	4.0	4.6	1.9	4.9
COTR2	41%	5	1	1	0	1.0	.0	.0	.0
MADI2	50%	6	1	6	5	2.2	2.0	.8	2.1
LIBO2	25%	3	1	2	1	1.3	.6	.3	1.4
DROSE	33%	4	1	1	0	1.0	.0	.0	.0
GEDO	33%	4	1	1	0	1.0	.0	.0	.0
CABI	16%	2	6	39	33	22.5	23.3	16.5	29.6
TOGL	33%	4	1	1	0	1.0	.0	.0	.0
LICO3	8%	1	1	1	0	1.0	.0	.0	.0
SAST	8%	1	63	63	0	63.0	.0	.0	.0
SAME	8%	1	4	4	0	4.0	.0	.0	.0
HABEN	8%	1	1	1	0	1.0	.0	.0	.0
VEVI	8%	1	1	1	0	1.0	.0	.0	.0
STAM	8%	1	1	1	0	1.0	.0	.0	.0
RUPE	8%	1	4	4	0	4.0	.0	.0	.0
ASBO	16%	2	1	1	0	1.0	.0	.0	.0
PIVU	8%	1	1	1	0	1.0	.0	.0	.0
STRO	8%	1	1	1	0	1.0	.0	.0	.0
TREU	8%	1	1	1	0	1.0	.0	.0	.0
DODEC	8%	1	1	1	0	1.0	.0	.0	.0
SASI	8%	1	1	1	0	1.0	.0	.0	.0
IRSE	8%	1	1	1	0	1.0	.0	.0	.0
HASA	8%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
CAREX	50%	6	1	90	89	19.7	34.9	14.2	36.6
SCCA2	50%	6	1	36	35	13.0	16.7	6.8	17.6
CASI3	25%	3	2	72	70	26.3	39.6	22.8	98.3
CAPL	25%	3	1	25	24	10.0	13.1	7.5	32.5
DEAT	8%	1	1	1	0	1.0	.0	.0	.0
AGROS	8%	1	1	1	0	1.0	.0	.0	.0
DESCH	8%	1	2	2	0	2.0	.0	.0	.0
FERU	8%	1	27	27	0	27.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	66%	8	0	29	29	8.0	9.2	3.3	7.7
SPHAG	100%	12	1	80	79	22.7	25.1	7.2	15.9
BLSP	33%	4	1	4	3	1.8	1.5	.8	2.4
LYCL	41%	5	1	2	1	1.2	.4	.2	.6
LYAN	66%	8	1	12	11	2.5	3.9	1.4	3.2
PTAQ	33%	4	1	9	8	5.5	3.4	1.7	5.4
LYCOP	25%	3	1	1	0	1.0	.0	.0	.0
SELAG	8%	1	1	1	0	1.0	.0	.0	.0
LYCO4	8%	1	1	1	0	1.0	.0	.0	.0
DRAU2	8%	1	16	16	0	16.0	.0	.0	.0
LYAL	8%	1	1	1	0	1.0	.0	.0	.0
POGL4	8%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Sitka Sedge (630)

3 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	3	30	51	21	37.0	12.1	7.0	30.1
PICO	100%	3	21	41	20	29.7	10.3	5.9	25.5
CHNO	33%	1	6	6	0	6.0	.0	.0	.0
TSME	66%	2	4	6	2	5.0	1.4	1.0	12.7
PISI	66%	2	2	6	4	4.0	2.8	2.0	25.4

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	3	10	70	60	45.0	31.2	18.0	77.6
CHNO	67%	2	44	50	6	47.0	4.2	3.0	38.1
PICO	100%	3	5	6	1	5.7	.6	.3	1.4
TSHE	66%	2	4	11	7	7.5	4.9	3.5	44.5
TSME	100%	3	5	15	10	9.3	5.1	3.0	12.7
PISI	100%	3	1	4	3	2.3	1.5	.9	3.8

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	3	9	60	51	43.0	29.4	17.0	73.2
MEFE	100%	3	6	19	13	12.7	6.5	3.8	16.2
VACCI	100%	3	3	52	49	32.7	26.1	15.1	64.8
VAPA	33%	1	9	9	0	9.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	66%	2	45	80	35	62.5	24.7	17.5	22.4
VAUL	33%	1	12	12	0	11.0	.0	.0	.0
EMNI	100%	3	5	18	13	10.3	6.8	3.9	16.9
VACA	100%	3	18	78	60	50.3	30.3	17.5	75.2
LEGR	100%	3	2	15	13	7.0	7.0	4.0	17.4
KAPO	100%	3	2	6	4	4.3	2.1	1.2	5.2
VAOX	33%	1	12	12	0	12.0	.0	.0	.0
VAVI	66%	2	11	11	0	11.0	.0	.0	.0
PHGL	33%	1	3	3	0	3.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Sitka Sedge (630)

3 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	3	85	100	15	91.7	7.6	4.4	19.0
COCA	100%	3	16	41	25	26.7	12.9	7.4	32.0
COAS	100%	3	1	3	2	1.7	1.2	.7	2.9
LYAM	66%	2	1	32	31	16.5	21.9	15.5	196.9
FACR	33%	1	28	28	0	28.0	.0	.0	.0
RUCH	33%	1	8	8	0	8.0	.0	.0	.0
MADI2	33%	1	1	1	0	1.0	.0	.0	.0
LIBO2	33%	1	1	1	0	1.0	.0	.0	.0
CABI	33%	1	51	51	0	51.0	.0	.0	.0
SAST	100%	3	2	30	28	13.0	14.9	8.6	37.1
SAME	66%	2	2	31	29	16.5	20.5	14.5	184.2
VEVI	66%	2	1	1	0	1.0	.0	.0	.0
STAM	33%	1	1	1	0	1.0	.0	.0	.0
RUPE	66%	2	1	3	2	2.0	1.4	1.0	12.7
VIGL	33%	1	1	1	0	1.0	.0	.0	.0
HADI2	33%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
CAREX	66%	2	21	26	5	23.5	3.5	2.5	31.8
CASI3	100%	3	13	21	8	18.0	4.4	2.5	10.8
CAPL	66%	2	8	41	33	24.5	23.3	16.5	209.6
DEAT	66%	2	1	5	4	3.0	2.8	2.0	25.4
CAPA1	66%	2	5	7	2	6.0	1.4	1.0	12.7

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	3	1	2	1	1.7	.6	.3	1.4
SPHAG	66%	2	36	81	45	58.5	31.8	22.5	285.9
BLSP	100%	3	1	2	1	1.3	.6	.3	1.4
ATFI	33%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Tufted Clubrush (640)

8 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	8	11	45	34	29.0	10.8	3.8	9.0
PICO	100%	8	8	28	20	22.4	6.8	2.4	5.7
CHNO	75%	6	2	19	17	6.8	6.6	2.7	6.9
TSME	37%	3	2	7	5	4.0	2.6	1.5	6.6
TSHE	12%	1	2	2	0	2.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	8	26	68	42	48.2	15.8	5.6	13.2
CHNO	87%	7	12	59	47	26.0	15.7	5.9	14.5
PICO	87%	7	1	40	39	17.0	13.7	5.2	12.7
TSHE	87%	7	1	7	6	3.4	2.2	.8	2.1
TSME	100%	8	1	41	40	9.1	13.1	4.6	10.9
THPL	37%	3	3	14	11	7.3	5.9	3.4	14.6
PISI	25%	2	1	4	3	2.5	2.1	1.5	19.1

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	8	1	60	59	24.4	21.0	7.4	17.6
MEFE	75%	6	1	14	13	6.7	4.7	1.9	4.9
VACCI	25%	2	10	17	7	13.5	4.9	3.5	44.5
GASH	25%	2	8	34	26	21.0	18.4	13.0	165.2
VAPA	25%	2	3	5	2	4.0	1.4	1.0	12.7
CLPY	12%	1	1	1	0	1.0	.0	.0	.0
COST	12%	1	16	16	0	16.0	.0	.0	.0
ALSI	12%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	87%	7	25	90	65	52.4	25.0	9.5	23.1
VAUL	12%	1	30	30	0	30.0	.0	.0	.0
EMNI	100%	8	5	70	65	36.0	25.8	9.1	21.5
VACA	100%	8	2	50	48	18.1	15.9	5.6	13.3
LEGR	85%	6	7	30	23	5.0	8.2	3.3	8.6
KAPO	100%	8	2	20	18	10.1	6.2	2.2	5.2
VAOX	75%	6	1	13	12	4.0	4.6	1.9	4.8
VAVI	37%	3	1	2	1	1.7	.6	.3	1.4
VAUL	62%	5	1	25	24	13.2	9.8	4.4	12.1
JUCO	12%	1	1	1	0	1.0	.0	.0	.0
PHGL	25%	2	1	10	9	5.5	6.4	4.5	57.2
CAST5	12%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Tufted Clubrush (640)

8 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	87%	7	37	94	57	60.1	20.8	7.8	19.2
COCA	100%	8	3	30	27	13.0	8.0	2.8	6.7
COAS	75%	6	1	9	8	2.5	3.2	1.3	3.4
LYAM	62%	5	1	5	4	2.0	1.7	.8	2.2
FACR	75%	6	8	39	31	21.8	11.2	4.6	11.8
SANGU	87%	7	2	41	39	16.3	12.6	4.8	11.7
RUCH	62%	5	1	21	20	6.0	8.5	3.8	10.5
COTR2	62%	5	1	1	0	1.0	.0	.0	.0
MADI2	12%	1	2	2	0	2.0	.0	.0	.0
LIBO2	25%	2	2	3	1	2.5	.7	.5	6.4
DROSE	37%	3	1	1	0	1.0	.0	.0	.0
GEDO	12%	1	1	1	0	1.0	.0	.0	.0
CABI	25%	2	17	26	9	21.5	6.4	4.5	57.2
TOGL	25%	2	1	2	1	1.5	.7	.5	6.4
LICO3	25%	2	1	1	0	1.0	.0	.0	.0
SAME	12%	1	5	5	0	5.0	.0	.0	.0
HABEN	37%	3	1	1	0	1.0	.0	.0	.0
ASBO	12%	1	2	2	0	2.0	.0	.0	.0
PIVU	12%	1	1	1	0	1.0	.0	.0	.0
TREU	12%	1	1	1	0	1.0	.0	.0	.0
GECA4	12%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	8	5	37	32	21.2	11.4	4.0	9.5
CAREX	50%	4	5	38	33	17.2	15.2	7.6	24.1
SCCA2	100%	8	5	37	32	22.2	11.4	4.0	9.5
CASI3	25%	2	10	12	2	11.0	8.4	1.0	12.7
CAPL	50%	4	2	19	17	7.0	11.1	4.1	12.9
DEAT	25%	2	2	5	3	3.5	2.1	1.5	19.1
CAPA1	25%	2	7	34	27	20.5	19.1	13.5	171.5
TRISE	12%	1	4	4	0	4.0	.0	.0	.0
CAMA	12%	1	5	5	0	5.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	62%	5	1	3	2	1.8	.8	.4	1.0
SPHAG	87%	7	3	70	67	31.4	23.1	8.7	21.4
BLSP	37%	3	1	3	2	2.0	1.0	.6	2.5
LYCL	37%	3	1	1	0	1.0	.0	.0	.0
LYAN	12%	1	1	1	0	1.0	.0	.0	.0
PTAQ	25%	2	1	1	0	1.0	.0	.0	.0
LYCOP	12%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Shore Pine/Salal (650)

9 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	16	51	35	33.6	12.6	4.2	9.7
PICO	100%	9	14	37	23	27.8	8.1	2.7	6.3
CHNO	67%	6	1	9	8	4.3	3.1	1.3	3.2
TSME	33%	3	2	10	8	5.3	4.2	2.4	10.3
THPL	44%	4	1	10	9	5.5	3.7	1.8	5.9
TSHE	44%	4	1	7	6	4.0	2.6	1.3	4.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	30	100	70	64.7	21.6	7.2	16.6
CHNO	89%	8	24	52	28	36.4	10.1	3.6	8.5
PICO	100%	9	1	46	45	28.0	13.5	4.5	3.2
TSHE	88%	8	4	15	11	9.9	4.3	1.5	3.6
TSME	88%	8	1	7	6	3.1	2.1	.7	1.8
THPL	89%	8	2	39	37	15.4	12.3	4.4	10.3
PISI	11%	1	2	2	0	2.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	20	100	80	53.1	31.6	10.5	24.3
MEFE	77%	7	2	18	16	7.9	6.4	2.4	5.9
VACCI	88%	8	2	18	16	9.1	6.2	2.2	5.2
GASH	100%	9	8	76	68	36.6	25.4	8.5	19.6
VAPA	55%	5	1	26	25	6.8	10.8	4.8	13.4

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	20	89	69	61.0	25.7	8.6	19.7
EMNI	88%	8	2	43	41	20.6	15.3	5.4	12.8
VACA	77%	7	3	28	25	10.9	8.5	3.2	7.9
LEGR	89%	8	15	60	45	26.4	14.7	2	12.3
KAPO	67%	6	1	5	4	2.7	1.6	.7	1.7
VAOX	22%	2	1	12	11	6.5	7.8	5.5	69.9
VAVI	44%	4	1	16	15	8.3	6.6	3.3	10.5
VAUL	22%	2	3	20	17	11.5	12.0	8.5	108.0

Vegetation Statistics for Shore Pine/Salal (650)

9 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	8	98	90	52.3	29.9	10.0	23.0
COCA	67%	6	6	63	57	33.5	19.9	8.1	20.9
COAS	66%	6	1	5	4	2.0	1.7	.7	1.8
LYAM	78%	7	1	17	16	4.6	5.6	2.1	5.2
FACR	55%	5	1	38	37	17.0	14.8	6.6	18.4
SANGU	55%	5	1	3	2	1.4	.9	.4	1.1
RUCH	55%	5	1	5	4	2.0	1.7	.8	2.2
COTR2	55%	5	1	1	0	1.0	.0	.0	.0
MADI2	44%	4	1	11	10	3.5	5.0	2.5	8.0
LIBO2	44%	4	1	6	5	3.0	2.4	1.2	3.9
DROSE	22%	2	1	3	2	2.0	1.4	1.0	12.7
GEDO	33%	3	1	2	1	1.3	.6	.3	1.4
CABI	22%	2	6	37	31	21.5	21.9	15 5	196.9
TOGL	11%	1	1	1	0	1.0	.0	.0	.0
LICO3	22%	2	1	1	0	1.0	.0	.0	.0
SAST	11%	1	4	4	0	4.0	.0	.0	.0
STAM	11%	1	1	1	0	1.0	.0	.0	.0
SAME4	22%	2	7	12	5	9.5	3.5	2.5	31.8
STRO	11%	1	1	1	0	1.0	.0	.0	.0
DODEC	11%	1	2	2	0	2.0	.0	.0	.0
LISTE	11%	1	1	1	0	1.0	.0	.0	.0
SAME2	11%	1	2	2	0	2.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
CAREX	55%	5	1	28	27	9.2	11.4	5.1	14.1
SCCA2	33%	3	2	36	34	14.3	18.8	10.9	46.8
CASI3	22%	2	3	35	32	19.0	22.6	16.0	203.3
CAPL	11%	1	17	17	0	17.0	.0	.0	.0
DEAT	22%	2	1	2	1	1.5	.7	.5	6.4
CAPA1	22%	2	2	11	9	6.5	6.4	4.5	57.2
TRISE	33%	3	2	10	8	6.0	4.0	2.3	9.9
CACA	11%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	9	1	20	19	9.0	6.8	2.3	5.2
SPHAG	88%	8	6	55	49	27.9	17.4	6.2	14.6
BLSP	44%	4	1	12	11	5.0	5.2	2.6	8.3
LYCL	55%	5	1	2	1	1.2	.4	.2	.6
LYAN	33%	3	1	2	1	1.3	.6	.3	1.4
PTAQ	66%	6	3	20	17	9.0	6.3	2.6	6.6
LYSE	11%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Blueberry (710)

47 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	95%	45	30	80	50	59.3	13.0	1.9	3.9
TSHE	100%	47	7	70	63	33.1	14.5	2.1	4.3
THPL	100%	47	8	60	52	25.0	11.4	1.7	3.4
PISI	38%	18	1	15	14	4.8	3.9	.9	2.0
CHNO	31%	15	1	12	11	5.9	3.6	.9	2.0
TSME	10%	5	5	10	5	6.8	2.2	1.0	2.7

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	97%	46	1	40	39	23.5	10.8	1.6	3.2
TSHE	100%	47	1	40	39	19.5	11.4	1.7	3.4
THPL	74%	35	1	35	34	5.7	6.9	1.2	2.4
PISI	46%	22	1	8	7	1.6	1.7	.4	.7
CHNO	14%	7	1	5	4	2.6	1.5	.6	1.4
TSME	12%	6	1	5	4	3.2	1.3	.5	1.4

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	47	3	95	92	36.6	23.9	3.6	7.2
MEFE	100%	47	1	25	24	6.3	5.7	.8	1.7
VACCI	100%	46	2	85	83	27.9	21.3	3.1	6.3
VAPA	76%	36	1	10	9	3.4	2.7	.5	.9
GASH	8%	4	1	3	2	1.8	1.0	.5	1.5
OPHO	31%	15	1	4	3	1.4	.9	.2	.5
RUSP	21%	10	1	2	1	1.1	.3	.1	.2
SARA	2%	1	2	2	0	2.0	.0	.0	.0
RIBR	2%	1	2	2	0	2.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	74%	35	1	1	1	.0	.2	.0	.1
VACA	2%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Blueberry (710)

47 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	97%	46	0	85	85	18.4	16.3	2.4	4.9
COCA	82%	39	1	25	24	6.4	6.3	1.0	2.0
LICO3	72%	34	1	3	2	1.3	.6	.1	.2
TITR	65%	31	1	10	9	2.0	1.9	.3	.7
RUPE	82%	39	1	25	24	4.7	4.3	.7	1.4
STRO	72%	34	1	6	5	1.6	1.2	.2	.4
MADI2	44%	21	1	7	6	2.1	1.7	.4	.8
LYAM	29%	14	1	2	1	1.3	.5	.1	.3
COAS	74%	35	1	25	24	4.0	4.5	.8	1.5
STAM	29%	14	1	1	0	1.0	.0	.0	.0
CLUN	34%	16	1	5	4	3.4	1.7	.4	.9
LICA3	17%	8	1	2	1	1.1	.4	.1	.3
LIBO2	8%	4	1	6	5	3.0	2.2	1.1	3.4
VEVI	2%	1	1	1	0	1.0	.0	.0	.0
PRAL	6%	3	1	1	0	1.0	.0	.0	.0
COTR2	4%	2	1	1	0	1.0	.0	.0	.0
PYSE	2%	1	3	3	0	3.0	.0	.0	.0
MOUN	2%	1	1	1	0	1.0	.0	.0	.0
STST	2%	1	1	1	0	1.0	.0	.0	.0
CIAL	2%	1	1	1	0	1.0	.0	.0	.0
VILA	2%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	4%	2	1	1	0	1.0	.0	.0	.0

Ferns Total	CONST 97%	FREQ 46	MIN 1	MAX 31	RANGE 30	MEAN 10.5	S.D. 7.0	S.E. 1.0	CI- 5% 2.1
BLSP	87%	41	1	20	19	5.9	5.1	.8	1.6
GYDR	85%	40	1	20	19	4.2	3.9	.6	1.2
SPHAG	59%	28	1	25	24	3.1	4.5	.9	1.8
CLUBS	42%	20	1	3	2	1.3	.6	.1	.3
DRAU2	51%	24	1	3	2	1.3	.7	.1	.3
POMU	23%	11	1	2	1	1.4	.5	.2	.3
ATFI	29%	14	1	3	2	1.1	.5	.1	.3
LYAN	27%	13	1	1	0	1.0	.0	.0	.0
THPH	19%	9	1	3	2	1.4	.7	.2	.6
LYSE	14%	7	1	2	1	1.1	.4	.1	.3
POGL4	14%	7	1	1	0	1.0	.0	.0	.0
LYCL	12%	6	1	2	1	1.2	.4	.2	.4
ADPE	8%	4	1	1	0	1.0	.0	.0	.0
PTAQ	2%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Swordfern (720)

15 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	15	35	80	45	63.5	13.0	3.4	7.2
TSHE	100%	15	10	70	60	41.2	16.3	4.2	9.1
THPL	100%	15	5	39	34	22.1	10.3	2.7	5.7
PISI	60%	9	1	11	10	5.6	4.1	1.4	3.1
CHNO	13%	2	5	5	0	5.0	.0	.0	.0
ALRU	6%	1	3	3	0	3.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	15	15	65	50	35.9	16.4	4.2	9.1
TSHE	100%	15	15	65	50	33.7	16.3	4.2	9.0
THPL	73%	11	1	10	9	4.8	3.3	1.0	2.2
PISI	60%	9	1	2	1	1.2	.4	.1	.3

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	15	1	85	84	22.1	23.9	6.2	13.3
MEFE	100%	15	1	30	29	5.5	8.3	2.1	4.6
VACCI	100%	15	1	65	64	11.5	19.1	4.9	10.6
VAPA	73%	11	1	15	14	3.5	4.2	1.3	2.8
GASH	33%	5	1	3	2	2.0	.7	.3	.9
OPHO	73%	11	1	8	7	2.4	2.2	.7	1.5
RUSP	80%	12	1	3	2	1.5	.8	.2	.5
SARA	6%	1	2	2	0	2.0	.0	.0	.0
ALSI	6%	1	10	10	0	10.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	53%	8	1	1	1	.1	.4	.1	.3

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	15	1	52	51	14.4	18.0	4.6	9.9
COCA	66%	10	1	30	29	7.1	9.8	3.1	7.0
LICO3	73%	11	1	2	1	1.3	.5	.1	.3
TITR	73%	11	1	8	7	1.9	2.1	.6	1.4
RUPE	33%	5	1	20	19	8.4	7.9	3.5	9.8
STRO	73%	11	1	3	2	1.5	.7	.2	.5
MADI2	73%	11	1	15	14	3.1	4.2	1.3	2.8
LYAM	13%	2	1	2	1	1.5	.7	.5	6.4
COAS	13%	2	8	10	2	9.0	1.4	1.0	12.7
STAM	40%	6	1	1	0	1.0	.0	.0	.0
CLUN	6%	1	5	5	0	5.0	.0	.0	.0
LICA3	6%	1	1	1	0	1.0	.0	.0	.0
PRAL	6%	1	1	1	0	1.0	.0	.0	.0
COTR2	6%	1	1	1	0	1.0	.0	.0	.0
ARSY	13%	2	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Swordfern (720)

15 Samples

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	13%	2	1	1	0	1.0	.0	.0	.0

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	15	7	39	32	21.2	10.9	2.8	6.1
BLSP	86%	13	1	20	19	6.3	6.3	1.7	3.8
GYDR	93%	14	1	7	6	2.9	1.9	.5	1.1
SPHAG	40%	6	1	5	4	2.0	1.7	.7	1.8
CLUBS	46%	7	1	2	1	1.4	.5	.2	.5
DRAU2	60%	9	1	4	3	2.0	1.2	.4	.9
POMU	100%	15	3	18	15	9.3	5.1	1.3	2.8
ATFI	53%	8	1	9	8	2.9	2.9	1.0	2.4
LYAN	53%	8	1	1	0	1.0	.0	.0	.0
THPH	66%	10	1	5	4	2.0	1.4	.4	1.0
LYSE	13%	2	1	1	0	1.0	.0	.0	.0
POGL4	26%	4	1	1	0	1.0	.0	.0	.0
LYCL	13%	2	1	1	0	1.0	.0	.0	.0
ADPE	33%	5	1	4	3	1.8	1.3	.6	1.6

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry/Skunk Cabbage (730)

36 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	30	75	45	54.6	12.1	2.0	4.2
TSHE	100%	36	8	45	37	26.2	10.8	1.8	3.6
THPL	100%	36	8	55	47	25.7	11.1	1.9	3.7
TSME	13%	5	1	15	14	5.2	5.6	2.5	6.9
CHNO	19%	7	2	20	18	6.9	6.4	2.4	5.9
PISI	58%	21	1	20	19	7.7	4.6	1.0	2.1

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	4	53	49	25.5	12.1	2.0	4.2
TSHE	100%	36	3	55	52	21.1	11.5	1.9	3.9
THPL	72%	26	1	22	21	4.8	6.2	1.2	2.5
PISI	86%	31	1	11	10	3.0	2.7	.5	1.0
CHNO	11%	4	1	4	3	2.3	1.3	.6	2.0
TSME	25%	9	1	3	2	1.8	1.0	.3	.7

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	10	95	85	50.4	21.9	3.8	7.7
MEFE	97%	35	2	55	53	13.5	11.6	2.0	4.0
VACCI	100%	36	1	75	74	32.6	20.3	3.4	6.8
VAPA	77%	28	1	15	14	3.9	3.4	.6	1.3
GASH	27%	10	1	3	2	1.3	.7	.2	.5
OPHO	33%	12	1	7	6	2.0	1.8	.5	1.1
RUSP	27%	10	1	10	9	3.0	3.2	1.0	2.3
VIED	2%	1	1	1	0	1.0	.0	.0	.0
RIBR	2%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	75%	27	0	25	25	1.1	4.8	.9	1.9
VAVI	5%	2	1	1	0	1.0	.0	.0	.0
VACA	2%	1	2	2	0	2.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry/Skunk Cabbage (730) (Continued)

36 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	10	80	70	37.4	19.2	3.2	6.5
COCA	88%	32	1	30	29	7.8	7.3	1.3	2.6
LICO3	72%	26	1	2	1	1.3	.5	.1	.2
TITR	61%	22	1	10	9	2.7	2.4	.5	1.0
RUPE	80%	29	1	15	14	4.2	3.5	.6	1.3
STRO	63%	23	1	5	4	2.1	1.5	.3	.6
MADI2	58%	21	1	16	15	3.3	3.7	.8	1.7
LYAM	100%	36	3	60	57	15.3	13.9	2.3	4.7
COAS	50%	18	1	20	19	5.4	5.9	1.4	2.9
STAM	30%	11	1	3	2	1.2	.6	.2	.4
CLUN	19%	7	1	10	9	4.6	3.1	1.2	2.9
LICA3	8%	3	1	1	0	1.0	.0	.0	.0
LIBO2	22%	8	1	3	2	1.3	.7	.3	.6
VEVI	13%	5	2	10	8	5.0	3.4	1.5	4.2
PRAL	5%	2	1	3	2	2.0	1.4	1.0	2.7
COTR2	13%	5	1	20	19	5.2	8.3	3.7	10.3
VIGL	5%	2	1	2	1	1.5	.7	.5	6.4
PYSE	5%	2	1	5	4	3.0	2.8	2.0	25.4
CABI	11%	4	1	4	3	2.5	1.3	.6	2.1
MOUN	5%	2	1	1	0	1.0	.0	.0	.0
FACR	2%	1	1	1	0	1.0	.0	.0	.0
CIAL	2%	1	2	2	0	2.0	.0	.0	.0
VILA	2%	1	7	7	0	7.0	.0	.0	.0
GATR2	5%	2	1	1	0	1.0	.0	.0	.0
CLSI	2%	1	1	1	0	1.0	.0	.0	.0

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	36	1	50	49	9.3	11.5	1.9	3.9
BLSP	77%	28	1	38	37	4.6	7.6	1.4	2.9
GYDR	69%	25	1	11	10	3.3	2.3	.5	1.0
SPHAG	66%	24	1	80	79	14.8	16.8	3.4	7.1
LYCOP	27%	10	1	15	14	3.6	4.9	1.5	3.5
DRAU2	22%	8	1	5	4	1.8	1.4	.5	1.2
POMU	25%	9	1	15	14	6.6	5.9	2.0	4.6
ATFI	33%	12	1	10	9	2.4	2.8	.8	1.8
LYAN	22%	8	1	10	9	2.1	3.2	1.1	2.7
THPH	5%	2	1	1	0	1.0	.0	.0	.0
LYSE	5%	2	1	1	0	1.0	.0	.0	.0
POGL4	13%	5	1	1	0	1.0	.0	.0	.0
LYCL	8%	3	1	1	0	1.0	.0	.0	.0
PTAQ	11%	4	1	6	5	2.3	2.5	1.3	4.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	22%	8	1	3	2	1.5	1.0	.5	1.6
CAREX	22%	8	1	2	1	1.3	.5	.2	.4
CAPL	5%	2	1	2	1	1.5	.7	.5	6.4
JUNCU	2%	1	1	1	0	1.0	.0	.0	.0
LUZUL	2%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry, Well-Drained Variant (750)

12 Samples

Over-story Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	50	92	42	64.3	11.5	3.3	7.3
TSHE	100%	12	20	60	40	41.2	13.9	4.0	8.9
THPL	100%	12	6	35	29	17.0	9.6	2.8	6.1
PISI	75%	9	1	30	29	9.8	9.0	3.0	6.9
CHNO	16%	2	1	3	2	2.0	1.4	1.0	12.7

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	10	70	60	33.2	17.1	4.9	10.9
TSHE	91%	11	15	70	55	35.3	14.9	4.5	10.0
THPL	83%	10	1	15	14	5.1	4.9	1.6	3.5
PISI	66%	8	1	3	2	1.5	.8	.3	.6
CHNO	8%	1	1	1	0	1.0	.0	.0	.0
TSME	8%	1	2	2	0	2.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	11	85	74	46.2	23.5	6.8	15.0
MEFE	100%	12	1	10	9	4.3	3.7	1.1	2.3
VACCI	100%	12	1	70	69	28.7	22.8	6.6	14.5
VAPA	50%	6	1	5	4	3.3	2.0	.8	2.1
GASH	8%	1	2	2	0	2.0	.0	.0	.0
OPHO	100%	12	1	10	9	6.8	3.2	.9	2.0
RUSP	66%	8	1	6	5	2.9	2.0	.7	1.6
SARA	8%	1	1	1	0	1.0	.0	.0	.0
RUPA	16%	2	1	5	4	3.0	2.8	2.0	25.4
VIED	8%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	50%	6	0	7	7	1.1	2.9	1.2	3.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry, Well-Drained Variant (750)

12 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	12	1	74	73	23.7	24.9	7.2	15.8
COCA	83%	10	1	21	20	6.7	7.1	2.2	5.1
LICO3	66%	8	1	2	1	1.1	.4	.1	.3
TITR	91%	11	1	8	7	2.8	2.2	.7	1.5
RUPE	83%	10	1	20	19	6.2	6.7	2.1	4.8
STRO	91%	11	1	2	1	1.3	.5	.1	.3
MADI2	41%	5	1	4	3	1.8	1.3	.6	1.6
LYAM	33%	4	1	2	1	1.3	.5	.3	.8
COAS	58%	7	1	8	7	3.7	2.4	.9	2.2
STAM	58%	7	1	1	0	1.0	.0	.0	.0
CLUN	25%	3	1	25	24	15.0	12.5	7.2	31.0
LICA3	8%	1	1	1	0	1.0	.0	.0	.0
LIBO2	8%	1	1	1	0	1.0	.0	.0	.0
PRAL	25%	3	1	2	1	1.7	.6	.3	1.4
COTR2	8%	1	1	1	0	1.0	.0	.0	.0
VIGL	16%	2	1	1	0	1.0	.0	.0	.0
MOUN	8%	1	1	1	0	1.0	.0	.0	.0
ARSY	16%	2	1	1	0	1.0	.0	.0	.0
STST	8%	1	1	1	0	1.0	.0	.0	.0
CIAL	8%	1	1	1	0	1.0	.0	.0	.0
VILA	8%	1	1	1	0	1.0	.0	.0	.0
ACRU	8%	1	2	2	0	2.0	.0	.0	.0

Ferns	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total		100%	12	5	40	35	22.2	11.8	3.4 7.5
BLSP		91%	11	1	20	19	6.7	6.1	1.8 4.1
GYDR		91%	11	2	17	15	5.2	4.7	1.4 3.1
SPHAG		50%	6	1	25	24	6.3	9.3	3.8 9.7
LYCOP		58%	7	1	4	3	1.6	1.1	.4 1.0
DRAU2		91%	11	1	8	7	3.1	2.3	.7 1.6
POMU		58%	7	1	30	29	8.1	10.8	4.1 10.0
ATFI		100%	12	1	5	4	1.8	1.3	.4 .8
LYAN		25%	3	1	2	1	1.3	.6	.3 1.4
THPH		58%	7	1	4	3	2.0	1.4	.5 1.3
LYSE		41%	5	1	1	0	1.0	.0	.0 .0
POGL4		33%	4	1	1	0	1.0	.0	.0 .0
LYCL		16%	2	1	2	1	1.5	.7	.5 6.4
ADPE		33%	4	1	6	5	2.8	2.2	1.1 3.5
CYFR		8%	1	1	1	0	1.0	.0	.0 .0
POBR		8%	1	1	1	0	1.0	.0	.0 .0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry/Salal (760)

19 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	30	75	45	53.3	13.5	3.1	6.5
TSHE	100%	19	8	40	32	21.6	10.2	2.4	4.9
THPL	100%	19	10	45	35	26.2	10.8	2.5	5.2
PISI	47%	9	1	10	9	4.1	2.8	.9	2.2
CHNO	52%	10	1	22	21	9.4	7.4	2.3	5.3
TSME	5%	1	1	1	0	1.0	.0	.0	.0
ALRU	5%	1	1	1	0	1.0	.0	.0	.0
TABR	5%	1	2	2	0	2.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	20	70	50	40.7	15.7	3.6	7.6
TSHE	100%	19	10	67	57	29.4	13.9	3.2	6.7
THPL	94%	18	2	40	38	13.4	10.2	2.4	5.1
PISI	47%	9	1	15	14	3.4	4.5	1.5	3.5
CHNO	36%	7	1	7	6	3.0	2.4	.9	2.2
TSME	5%	1	1	1	0	1.0	.0	.0	.0
TABR	5%	1	1	1	0	1.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	22	100	78	58.9	21.7	5.0	10.5
MEFE	89%	17	1	26	25	9.1	6.6	1.6	3.4
VACCI	100%	19	1	50	49	19.6	13.0	3.0	6.3
VAPA	94%	18	1	26	25	7.9	7.8	1.8	3.9
GASH	100%	19	5	99	94	28.7	21.9	5.0	10.5
OPHO	21%	4	1	2	1	1.5	.6	.3	.9
RUSP	36%	7	1	4	3	2.1	1.1	.4	1.0
SARA	5%	1	1	1	0	1.0	.0	.0	.0
ALSI	5%	1	2	2	0	2.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	47%	9	0	14	14	1.6	4.7	1.6	3.6
VACA	5%	1	2	2	0	2.0	.0	.0	.0
LEGR	5%	1	6	6	0	6.0	.0	.0	.0
VAOX	5%	1	5	5	0	5.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry/Salal (760)

19 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	19	2	47	45	13.2	11.7	2.7	5.7
COCA	94%	18	1	36	35	4.6	8.1	1.9	4.0
LICO3	84%	16	1	2	1	1.1	.3	.1	.1
TITR	78%	15	1	4	3	1.3	.8	.2	.5
RUPE	63%	12	1	13	12	2.8	3.5	1.0	2.2
STRO	21%	4	1	2	1	1.3	.5	.3	.8
MADI2	73%	14	1	15	14	3.4	4.0	1.1	2.3
LYAM	52%	10	1	2	1	1.1	.3	.1	.2
COAS	42%	8	1	4	3	1.8	1.0	.4	.9
STAM	31%	6	1	1	0	1.0	.0	.0	.0
CLUN	21%	4	1	6	5	2.5	2.4	1.2	3.8
LICA3	26%	5	1	1	0	1.0	.0	.0	.0
LIBO2	26%	5	1	2	1	1.4	.5	.2	.7
VEVI	15%	3	1	1	0	1.0	.0	.0	.0
PRAL	5%	1	1	1	0	1.0	.0	.0	.0
COTR2	5%	1	1	1	0	1.0	.0	.0	.0
PYSE	5%	1	1	1	0	1.0	.0	.0	.0
FACR	5%	1	1	1	0	1.0	.0	.0	.0
RUCH	5%	1	1	1	0	1.0	.0	.0	.0

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	5%	1	4	4	0	1.0	.0	.0	.0
CASI3	5%	1	4	4	0	4.0	.0	.0	.0
DEAT	5%	1	2	2	0	2.0	.0	.0	.0
TRISE	5%	1	2	2	0	2.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	94%	18	1	74	73	20.8	18.6	4.4	9.2
BLSP	89%	17	1	65	64	15.5	15.7	3.8	8.1
GYDR	57%	11	1	12	11	3.8	3.8	1.1	2.5
SPHAG	63%	12	1	46	45	6.7	12.7	3.7	8.0
LYCOP	52%	10	1	3	2	1.4	.7	.2	.5
DRAU2	42%	8	1	12	11	3.5	3.9	1.4	3.3
POMU	47%	9	1	6	5	1.8	1.6	.5	1.3
ATFI	21%	4	1	5	4	2.0	2.0	1.0	3.2
LYAN	36%	7	1	1	0	1.0	.0	.0	.0
THPH	31%	6	1	8	7	2.3	2.8	1.1	2.9
LYSE	21%	4	1	1	0	1.0	.0	.0	.0
POGL4	10%	2	1	1	0	1.0	.0	.0	.0
LYCL	21%	4	1	2	1	1.3	.5	.3	.8
ADPE	5%	1	1	1	0	1.0	.0	.0	.0
PTAQ	5%	1	4	4	0	4.0	.0	.0	.0
CYFR	5%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry-Salal/Skunk Cabbage (765)

14 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	35	70	35	50.4	12.7	3.5	7.7
TSHE	100%	14	3	52	49	18.0	13.6	3.6	7.9
THPL	100%	14	10	43	33	26.9	10.7	2.9	6.2
PISI	50%	7	1	10	9	5.1	2.9	1.1	2.7
CHNO	28%	4	2	15	13	10.5	6.1	3.1	9.8
TSME	28%	4	1	7	6	4.5	2.5	1.3	4.0
ALRU	7%	1	1	1	0	1.0	.0	.0	.0

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	92%	13	10	75	65	30.8	17.5	4.9	10.6
TSHE	100%	14	7	40	33	19.3	11.0	2.9	6.3
THPL	85%	12	1	25	24	8.2	8.7	2.5	5.5
PISI	50%	7	1	3	2	1.6	.8	.3	.7
CHNO	28%	4	1	3	2	1.8	1.0	.5	1.5
TSME	28%	4	3	7	4	4.8	1.7	.9	2.7

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	14	35	95	60	53.4	18.7	5.2	11.3
MEFE	100%	14	1	25	24	9.0	8.5	2.3	4.9
VACCI	100%	14	1	20	19	8.6	6.1	1.6	3.5
VAPA	78%	11	1	20	19	6.5	5.5	1.7	3.7
GASH	100%	14	15	85	70	36.1	20.0	5.3	11.5
OPHO	14%	2	1	1	0	1.0	.0	.0	.0
RUSP	28%	4	1	4	3	2.0	1.4	.7	2.3
RUPA	7%	1	3	3	0	3.0	.0	.0	.0
MAFU	7%	1	2	2	0	2.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	64%	9	0	6	6	1.1	2.3	.8	1.7
VAVI	14%	2	4	6	2	5.0	1.4	1.0	12.7

Graminoids	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	35%	5	1	4	3	1.8	1.3	.6	1.6
SEDGE	28%	4	1	5	4	3.0	2.3	1.2	3.7
CAREX	14%	2	5	11	6	8.0	4.2	3.0	38.1
CASI3	7%	1	1	1	0	1.0	.0	.0	.0
CANI2	14%	2	3	10	7	6.5	4.9	3.5	44.5
CAME2	14%	2	1	2	1	1.5	.7	.5	6.4
CANU3	7%	1	4	4	0	4.0	.0	.0	.0
FESTU	7%	1	1	1	0	1.0	.0	.0	.0
CASE	7%	1	1	1	0	1.0	.0	.0	.0
AGROS	7%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/ Blueberry-Salal/Skunk Cabbage (765)

14 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	92%	13	11	58	47	28.4	16.9	4.7	10.2
COCA	92%	13	1	25	24	6.5	6.9	1.9	4.1
LICO3	78%	11	1	2	1	1.1	.3	.1	.2
TITR	57%	8	1	10	9	3.0	3.3	1.2	2.8
RUPE	71%	10	1	10	9	3.7	2.8	.9	2.0
STRO	71%	10	1	5	4	1.6	1.3	.4	.9
MADI2	71%	10	1	6	5	2.2	1.9	.6	1.3
LYAM	100%	14	3	45	42	11.8	13.9	3.7	8.0
COAS	50%	7	1	12	11	3.3	3.9	1.5	3.6
STAM	14%	2	1	1	0	1.0	.0	.0	.0
CLUN	21%	3	1	15	14	6.0	7.8	4.5	19.4
LICA3	21%	3	1	1	0	1.0	.0	.0	.0
LIBO2	7%	1	3	3	0	3.0	.0	.0	.0
VEVI	28%	4	1	2	1	1.5	.6	.3	.9
PRAL	7%	1	1	1	0	1.0	.0	.0	.0
COTR2	7%	1	1	1	0	1.0	.0	.0	.0
VIGL	7%	1	1	1	0	1.0	.0	.0	.0
CABI	7%	1	1	1	0	1.0	.0	.0	.0
FACR	14%	2	1	3	2	2.0	1.4	1.0	12.7
STST	7%	1	1	1	0	1.0	.0	.0	.0
HABEN	7%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	92%	13	1	27	26	10.9	8.7	2.4	5.3
BLSP	85%	12	2	20	18	8.9	5.3	1.5	3.4
GYDR	21%	3	1	10	9	4.7	4.7	2.7	11.7
SPHAG	71%	10	1	40	39	8.0	12.0	3.8	8.6
CLUBS	35%	5	1	2	1	1.2	.4	.2	.6
DRAU2	7%	1	1	1	0	1.0	.0	.0	.0
POMU	21%	3	1	8	7	4.7	3.5	2.0	8.7
ATFI	28%	4	1	1	0	1.0	.0	.0	.0
LYAN	7%	1	1	1	0	1.0	.0	.0	.0
THPH	21%	3	1	6	5	4.0	2.6	1.5	6.6
LYSE	21%	3	1	2	1	1.3	.6	.3	1.4
LYCL	7%	1	1	1	0	1.0	.0	.0	.0
ADPE	7%	1	3	3	0	3.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Salal (780)

21 Samples

Overstory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	21	30	80	50	52.0	13.4	3.0	6.3
TSHE	100%	21	8	37	29	18.0	8.4	1.8	3.8
THPL	100%	21	7	70	63	28.9	13.9	3.0	6.3
PISI	42%	9	3	20	17	7.6	5.4	1.8	4.2
CHNO	42%	9	1	25	24	11.3	8.3	2.8	6.4
TSME	9%	2	1	3	2	2.0	1.4	1.0	12.7

Understory Trees	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	21	4	50	46	31.0	14.2	3.2	6.6
TSHE	100%	21	5	65	60	25.2	13.1	2.8	5.9
THPL	95%	20	1	30	29	9.8	8.4	1.9	3.9
PISI	52%	11	1	3	2	1.4	.7	.2	.5
CHNO	28%	6	1	5	4	2.8	1.8	.7	1.9
TSME	4%	1	1	1	0	1.0	.0	.0	.0
ALRU	4%	1	2	2	0	2.0	.0	.0	.0
TABR	4%	1	2	2	0	2.0	.0	.0	.0

Tall Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	100%	21	10	100	90	39.7	24.2	5.4	11.3
MEFE	95%	20	1	20	19	5.3	5.0	1.1	2.3
VACCI	80%	17	1	7	6	3.1	2.0	.5	1.0
VAPA	85%	18	1	5	4	2.5	1.4	.3	.7
GASH	100%	21	5	80	75	32.6	24.9	5.4	11.3
OPHO	4%	1	1	1	0	1.0	.0	.0	.0
RUSP	23%	5	1	8	7	2.6	3.0	1.4	3.8
SARA	4%	1	1	1	0	1.0	.0	.0	.0

Low Shrubs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	4%	1	1	1	0	1.0	.0	.0	.0
VAVI	4%	1	1	1	0	1.0	.0	.0	.0

Vegetation Statistics for Western Hemlock-Western Redcedar/Salal (780)

21 Samples

Forbs	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total	95%	20	1	15	14	5.9	3.5	.8	1.7
COCA	57%	12	1	5	4	1.8	1.2	.4	.8
LICO3	57%	12	1	1	0	1.0	.0	.0	.0
TITR	71%	15	1	2	1	1.1	.4	.1	.2
RUPE	23%	5	1	3	2	1.4	.9	.4	1.1
STRO	28%	6	1	4	3	1.5	1.2	.5	1.3
MADI2	66%	14	1	9	8	2.3	2.3	.6	1.3
LYAM	52%	11	1	2	1	1.3	.5	.1	.3
COAS	19%	4	1	1	0	1.0	.0	.0	.0
STAM	42%	9	1	1	0	1.0	.0	.0	.0
CLUN	4%	1	1	1	0	1.0	.0	.0	.0
LICA3	33%	7	1	1	0	1.0	.0	.0	.0
VEVI	14%	3	1	2	1	1.3	.6	.3	1.4
PRAL	4%	1	1	1	0	1.0	.0	.0	.0
PYSE	4%	1	1	1	0	1.0	.0	.0	.0
GATR	4%	1	1	1	0	1.0	.0	.0	.0

Ferns et al.	CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E.	CI- 5%
Total		95%	20	0	61	61	18.9	16.0	3.6 7.5
BLSP		90%	19	1	36	35	13.6	12.3	2.8 6.0
GYDR		28%	6	1	11	10	3.8	3.7	1.5 3.8
SPHAG		33%	7	1	30	29	5.9	10.7	4.0 9.9
LYCOP		57%	12	1	22	21	3.3	5.9	1.7 3.8
DRAU2		28%	6	1	2	1	1.2	.4	.2 .4
POMU		52%	11	1	20	19	7.8	6.1	1.8 4.1
ATFI		14%	3	1	4	3	2.0	1.7	1.0 4.3
LYAN		28%	6	1	1	0	1.0	.0	.0 .0
THPH		9%	2	2	2	0	2.0	.0	.0 .0
LYSE		33%	7	1	20	19	3.7	7.2	2.7 6.6
POGL4		14%	3	1	1	0	1.0	.0	.0 .0
LYCL		19%	4	1	3	2	2.0	.8	.4 1.3
ADPE		4%	1	8	8	0	8.0	.0	.0 .0

Graminoids		CONST	FREQ	MIN	MAX	RANGE	MEAN	S.D.	S.E. CI- 5%
Total		14%	3	1	1	0	1.0	.0	.0 .0
SEDGE		19%	4	1	24	23	9.0	10.9	5.4 17.3
CAREX		9%	2	1	24	23	12.5	16.3	11.5 16.1
DEAT		4%	1	1	1	0	1.0	.0	.0 .0
CACA		4%	1	10	10	0	10.0	.0	.0 .0

Appendix B. Selected Environmental Data, Forested Plant Associations, Ketchikan Area

Plant Association	Slope (%)			Elevation (ft.)			Soil Organic Horizon Depth (in.)*			Soil Drainage	No. of
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Mean	Samples
TSHE/VACCI	0	90	36	10	1700	517	2	69	8	Moderately Well	63
/VACCI/DRAU2	0	95	40	20	1650	587	1	27	7	Moderately Well	80
/VACCI/LYAM	0	65	18	0	1500	441	2	99	18	Somewhat Poorly	38
/VACCI-OPHO	2	110	46	0	1300	562	1	20	6	Moderately Well	26
/OPHO-RUSP	27	85	52	0	1500	656	4	10	7	Moderately Well	9
TSHE-CHNO/VACCI	25	100	50	50	1600	931	3	21	8	Somewhat Poorly	26
/VACCI/LYAM	20	67	42	300	1150	766	4	9	7	Somewhat Poorly	10
/VACCI-OPHO	2	45	29	120	1550	870	3	39	10	Somewhat Poorly	6
PISI/VACCI	0	90	24	20	2300	693	1	23	6	Moderately Well	27
/VACCI-OPHO	1	40	21	50	1700	610	2	8	6	Moderately Well	5
/OPHO	0	80	21	10	1700	410	1	29	6	Moderately Well	19
/OPHO-RUSP	0	15	5	25	2200	561	1	8	4	Moderately Well	7
/OPHO/LYAM	0	15	7	20	850	317	2	11	6	Moderately Well	10
/ALRU	0	1	0	20	160	95	1	17	6	Moderately Well	4
/CANU	0	45	9	10	100	34	2	22	14	Moderately Well	5
/VACCI/LYAM	0	45	13	25	1100	225	1	99	14	Somewhat Poorly	16
/RUSP	0	10	4	25	175	88	2	99	23	Moderately Well	6
PISI-TSME/VACCI	15	85	44	500	2500	1658	1	26	7	Moderately Well	14
/VACCI/CABI	15	69	44	800	2850	1947	3	31	7	Moderately Well	18
MXD CON/VACCI	0	83	38	100	2050	851	4	99	15	Somewhat Poorly	32
/VACCI/LYAM	0	68	28	10	1600	644	3	99	18	Somewhat Poorly	35
/VACCI/FACR	3	75	28	0	1800	975	2	99	20	Poorly	36
/VACCI-GASH	0	80	29	0	1500	400	2	99	20	Poorly	25
/VACCI-GASH/FACR	2	75	21	60	1300	529	3	44	14	Somewhat Poorly	7
/GASH	1	80	30	25	1200	488	3	36	10	Somewhat Poorly	16
/CLPY/FACR	0	100	44	400	1800	1234	2	26	12	Somewhat Poorly	7
TSME/VACCI	15	70	45	1500	2400	1863	4	12	7	Moderately Well	53
/CLPY	50	75	63	1600	2500	2038	1	8	6	Somewhat Poorly	18
/CASSI	20	130	74	1250	3300	2513	2	18	6	Somewhat Poorly	33

* A "99" indicates an unknown depth greater than 50 inches.

	Slope (%)			Elevation (ft.)			Soil Organic Horizon Depth (in.)*			Soil Drainage	No. of
PICO/EMNI	1	26	9	40	1900	449	4	99	40	Very Poorly	12
/CASSI	3	19	9	100	1100	767	38	63	52	Very Poorly	3
/SCCA2	10	87	25	100	1050	669	6	54	29	Poorly	8
/GASH	1	11	5	100	600	244	3	56	31	Poorly	9
TSHE-THPL/VACCI	5	100	45	0	1400	419	2	32	8	Moderately Well	47
/POMU	5	90	59	0	800	393	1	8	6	Moderately Well	15
/VACCI/LYAM	0	55	21	25	850	290	3	99	19	Somewhat Poorly	36
/VACCI, WD	30	75	57	150	1000	500	2	13	7	Moderately Well	12
/VACCI-GASH	5	100	46	0	800	387	3	21	8	Moderately Well	19
/VACCI-GASH/LYAM	10	65	33	10	500	249	2	19	7	Somewhat Poorly	14
/GASH	2	90	48	20	850	427	2	27	7	Moderately Well	21

* A "99" indicates an unknown depth greater than 50 inches.

Appendix C. Height and Canopy Cover of Forested Plant Associations, Ketchikan Area

Plant Association	Mean Height (ft.)	Canopy Cover (%)	No. of Samples
TSHE/VACCI	116	59	63
/VACCI/DRAU2	126	66	80
/VACCI/LYAM	111	58	38
/VACCI-OPHO	131	60	26
/OPHO-RUSP	125	58	9
TSHE-CHNO/VACCI	100	63	26
/VACCI/LYAM	81	70	10
/VACCI-OPHO	110	69	6
PISI/VACCI	134	62	27
/VACCI-OPHO	127	69	5
/OPHO	153	55	19
/OPHO-RUSP	164	54	7
/OPHO/LYAM	141	63	10
/ALRU	148	55	4
/CANU	115	44	5
/VACCI/LYAM	123	56	16
/RUSP	146	46	6
PISI-TSME/VACCI	89	56	14
/VACCI/CABI	69	58	18
MXD CON/VACCI	73	44	32
/VACCI/LYAM	70	48	35
/VACCI/FACR	64	39	36
/VACCI-GASH	60	39	25
/VACCI-GASH/FACR	44	27	25
/GASH/LYAM	74	30	7
/GASH	49	38	27
/CLPY/FACR	55	31	16
TSME/VACCI	82	54	53
/CLPY	61	45	18
/CASSI	53	38	33
PICO/EMNI	45	32	13
/CASI3	34	37	3
/SCCA2	39	29	9
/GASH	44	34	9
TSHE-THPL/VACCI	107	59	47
/POMU	103	64	15
/VACCI/LYAM	95	55	36
/VACCI, WD	120	64	12
/VACCI-GASH	83	53	19
/VACCI-GASH/LYAM	87	50	14
/GASH	77	52	21

Appendix D. Wetland Character of Selected Forest Plant Associations, Based on Wetland Vegetation Index

The wetland (or hydrophytic) vegetation index is the ratio of wetland vegetation abundance to upland vegetation abundance. Values greater than 1.00 denote wetland plant associations, based on vegetation. See DeMeo and Loggy (1989) for a full description of calculation of the index. Indices for associations not listed are not yet available.

Plant Association	Wetland Vegetation Index	Plant Association	Wetland Vegetation Index
PICO/EMNI	2.51	TSME/CASSI	0.44
MXD CON/VACCI/FACR	1.43	MXD CON/VACCI	0.42
MXD CON/VACCI/LYAM	1.39	TSHE-CHNO/VACCI	0.41
TSHE/VACCI/LYAM	1.25	PISI/OPHO/LYAM	0.39
TSHE-THPL/VACCI/LYAM	1.02	PISI/VACCI	0.29
TSHE-CHNO/VACCI/LYAM	0.97	TSHE/VACCI/DRAU2	0.24
MXD CON/VACCI-GASH	0.78	TSHE-THPL/VACCI-GASH	0.22
TSHE-THPL/VACCI-GASH/LYAM	0.74	TSHE/VACCI-OPHO	0.21
TSME/VACCI	0.61	TSHE-THPL/VACCI	0.14
PISI/VACCI/LYAM	0.58	PISI/OPHO-RUSP	0.12
MXD CON/GASH	0.55	PISI/OPHO	0.11
TSHE/VACCI	0.54	PISI/VACCI-OPHO	0.08
TSHE-THPL/GASH	0.51	TSHE-THPL/POMU	0.07
PISI/ALRU	0.50		

Appendix E. Deer Forage Species Availability Among Plant Associations, Ketchikan Area

Plant Association	Percent Cover/Constancy			
	VACCI	LYAM	COCA	RUPE
WESTERN HEMLOCK/				
Blueberry	38/100	2/ 39	5/ 84	6/ 79
Blueberry/Shield Fern	34/100	1/ 18	7/ 83	8/ 82
Blueberry/Skunk Cabbage	41/100	11/100	5/ 86	6/ 81
Blueberry/Devil's Club	24/100	14/ 23	8/ 88	7/ 92
Devil's Club-Salmonberry	30/ 88	4/ 22	8/ 88	14/ 77
WESTERN HEMLOCK-YELLOWCEDAR/				
Blueberry	40/100	2/ 46	8/ 96	7/100
Blueberry/Skunk Cabbage	36/100	8/100	8/ 90	6/ 90
Blueberry-Devil's Club	45/100	2/100	12/100	20/100
SITKA SPRUCE/				
Blueberry	25/100	1/ 22	7/ 44	6/ 66
Blueberry-Devil's Club	27/100	2/ 60	9/100	10/100
Devil's Club	8/ 94	2/ 21	2/ 52	4/ 57
Devil's Club-Salmonberry	10/100	13/ 57	3/ 42	8/100
Devil's Club/Skunk Cabbage	23/ 90	8/100	10/ 90	5/100
Red Alder	3/ 75	26/ 75	2/ 50	2/ 25
Pacific Reedgrass	1/ 60	2/ 20	_/ _	1/ 40
Blueberry/Skunk Cabbage	20/100	16/100	4/ 81	5/ 75
Salmonberry	5/100	5/ 66	2/ 33	1/ 33
-Mountain Hemlock/Blueberry	31/100	2/ 28	4/ 57	7/ 92
-Mountain Hemlock/Blueberry/ Marsh Marigold	20/100	8/ 55	7/ 66	11/100
MIXED CONIFER/				
Blueberry	37/100	2/ 65	8/ 96	7/ 78
Blueberry/Skunk Cabbage	39/100	13/100	9/ 88	7/ 97
Blueberry/Deer Cabbage	39/100	10/ 88	11/100	4/ 75
Blueberry-Salal	19/100	8/ 84	10/ 96	3/ 60
Blueberry-Salal/Deer Cabbage	7/ 85	11/100	4/100	6/ 42
Salal	3/ 88	2/ 55	3/ 77	2/ 40
Copperbush/Deer Cabbage	31/ 93	8/ 81	8/ 93	6/ 75
MOUNTAIN HEMLOCK/				
Blueberry	47/100	8/ 30	8/ 69	11/ 90
Copperbush	37/100	3/ 33	3/ 66	10/ 88
Cassiope	37/100	1/ 3	4/ 42	7/ 93
SHORE PINE/				
Crowberry	16/ 66	4/ 50	16/ 91	4/ 8
Sitka Sedge	33/100	17/ 66	27/100	2/ 66
Tufted Clubrush	14/ 25	2/ 62	14/100	_/ _
Salal	9/ 88	5/ 77	34/ 66	_/ _

WESTERN HEMLOCK-WEST. REDCEDAR/				
Blueberry	28/100	1/ 29	6/ 82	5/ 82
Swordfern	12/100	2/ 13	7/ 66	8/ 33
Blueberry/Skunk Cabbage	33/100	15/100	8/ 88	4/ 80
Blueberry, Well-Drained Var.	29/100	1/ 33	7/ 83	6/ 83
Blueberry-Salal	20/100	1/ 52	5/ 94	3/ 63
Blueberry-Salal/Skunk Cabbage	9/100	1/ 52	5/ 94	3/ 63
Salal	3/ 80	1/ 52	2/ 57	1/ 23

Appendix F. Estimated Timber Volumes of Plant Associations, Ketchikan Area

S.E. = Standard error of the mean. Volumes with an asterisk represent combined red- and yellowcedar. Two asterisks indicate red alder volume. Three asterisks indicate shore pine volume.

Mean Timber Volumes (bd ft/ac)

Association	Spruce	Hemlocks	Yellow-cedar	Redcedar	Total	Sample Size
TSHE/VACCI	3700	26600	800	1200	32400	20
S.E.	1200	2800	400	500	2700	20
TSHE/VACCI/DRAU	5600	36500	—	1200	43400	20
S.E.	2500	3100	—	800	3500	20
TSHE/VACCI/LYAM	9300	23800	*800	—	34000	20
S.E.	2600	10000	500	—	4200	20
TSHE/VACCI-OPHO	8300	35400	—	—	43700	20
S.E.	1800	3500	—	—	3800	20
TSHE/OPHO-RUSP	8000	26300	300	—	34700	8
S.E.	2300	3300	300	—	3400	8
TSHE-CHNO/VACCI	2100	12900	15600	1100	31600	20
S.E.	1200	1900	1800	600	2700	20
TSHE-CHNO/ VACCI-LYAM	2800	12900	12400	—	28200	5
S.E.	800	2000	1400	—	2400	5
TSHE-CHNO/ VACCI-OPHO	9500	14500	14900	800	39600	6
S.E.	4000	4200	4200	700	6000	6
PISI/VACCI	51500	18700	*200	—	70500	20
S.E.	6400	4300	200	—	7500	20
PISI/VACCI-OPHO	42600	16800	**400	—	65700	10
S.E.	8300	5100	600	—	11400	10
PISI/OPHO	54300	24400	—	—	76100	19
S.E.	6900	4100	—	—	8100	19
PISI/OPHO-RUSP	62200	9900	—	—	72100	13
S.E.	7500	1500	—	—	7200	13
PISI/OPHO/LYAM	53900	17200	*300	—	71400	16
S.E.	8700	2900	300	—	9800	16
PISI/ALRU	48100	7100	**3300	—	58500	10
S.E.	8200	6000	1400	—	9800	10
PISI/CANU	47100	2800	**900	—	50900	5
S.E.	3100	2400	800	—	5000	5

Association	Spruce	Hemlocks	Yellow-cedar	Redcedar	Total	Sample Size
PISI/VACCI/LYAM	38000	20700	--	200	58900	15
S.E.	5600	4400	--	200	7700	15
PISI/RUSP	43000	24900	__	300	68200	11
S.E.	6900	5200	__	300	8700	11
PISI-TSME/VACCI	18500	18200	--	--	36700	10
S.E.	3800	4300	--	--	6200	10
PISI-TSME/ VACCI/CABI	6000	14000	*1200	--	21300	6
S.E.	1800	6000	800	--	7700	6
MXD CON/VACCI	1500	6400	7000	2300	17200	20
S.E.	600	1500	1300	700	2500	20
MXD CON/VACCI/ LYAM	2700	5400	4900	1700	15000	10
S.E.	900	2400	1700	900	3100	10
MXD CON/VACCI/ FACR	1100	5000	4200	1600	12500	10
S.E.	900	3200	1600	700	4400	10
MXD CON/VACCI-GASH	300	2200	5500	2700	10900	10
S.E.	300	600	1500	700	1500	10
MXD CON/VACCI-GASH/FACR	***1500	300	1000	2000	4800	10
S.E.	700	200	500	700	1000	10
MXD CON/GASH/ LYAM	300	2500	3200	3500	9600	10
S.E.	200	1100	1200	1200	1900	10
MXD CON/GASH	600	3100	4800	3400	12200	10
S.E.	500	1200	1500	1500	2800	10
MXD CON/CLPY/ FACR	500	2100	4200	2200	9300	10
S.E.	400	1100	1000	1100	1600	10
TSME/VACCI	2500	20200	6000	__	28600	10
S.E.	1300	5300	2700	__	5100	10
TSME/CLPY	100	8900	2500	__	11500	10
S.E.	100	3400	1600	__	3500	10
TSME/CASSI	900	6600	300	__	7800	11
S.E.	400	1800	200	__	1800	11
PICO/EMNI	***500	90	__	200	800	4
S.E.	200	80	__	100	80	4
PICO/CASSI	***3400	700	200	--	2500	4
S.E.	1400	600	100	--	1000	4

Association	Spruce	Hemlocks	Yellow-cedar	Redcedar	Total	Sample Size
PICO/SCCA2	***1300	--	--	--	1300	3
S.E.	300	--	--	--	300	3
PICO/GASH	***2800	50	1100	100	4100	8
S.E.	1500	50	800	100	2300	8
TSHE-THPL/VACCI	2300	13800	3300	14800	34300	10
S.E.	1500	3800	1700	2400	4100	10
TSHE-THPL/POMU	3200	19900	--	9000	32100	10
S.E.	1300	3900	--	2100	3800	10
TSHE-THPL/VACCI/ LYAM	1600	10800	1600	13300	27300	10
S.E.	900	2900	1000	2800	3900	10
TSHE-THPL/VACCI, WD	4200	21300	--	10500	35900	10
S.E.	1300	2900	--	2500	3300	10
TSHE-THPL/VACCI-GASH	700	4800	1500	14800	21800	10
S.E.	600	1800	1200	2900	3600	10
TSHE-THPL/VACCI-GASH/LYAM	1700	5700	4100	16600	28100	10
S.E.	800	700	2400	3300	2700	10
TSHE-THPL/GASH	1700	8700	2700	14600	27700	10
S.E.	900	1900	1200	3100	3600	10

Appendix G. Plant Species Acronym (Code) List, Ketchikan Area. Codes follow those of Garrison et al. (1976).

Scientific Name	Species Code	Common Name
TREES		
Abies amabilis	ABAM	Pacific silver fir
Acies lasiocarpa	ABLA	Subalpine fir
Alnus rubra	ALRU	Red alder
Chamecyparis nootkatensis	CHNO	Alaska cedar
Picea sitchensis	PISI	Sitka spruce
Taxus brevifolia	TABR	Pacific yew
Pinus contorta	PICO	Shore pine
Thuja plicata	THPL	Western redcedar
Tsuga heterophylla	TSHE	Western hemlock
Tsuga mertensiana	TSME	Mountain hemlock
SHRUBS		
Alnus sinuata	ALSI	Sitka alder
Andromeda polifolia	ANPO	Bog rosemary
Caltha biflora	CABI	Marsh marigold
Caltha leptosepala	CALE	Mountain marsh marigold
Caltha palustris	CAPA	Marsh marigold
Cassiope mertensiana	CAME	Mertens cassiope
Cassiope stelleriana	CAST5	Starry cassiope
Cladothamnus pyrolaeflorus	CLPY	Copperbush
Empetrum nigrum	EMNI	Crowberry
Gaultheria shallon	GASH	Salal
Kalmia polifolia	KAPO	Bog kalmia
Ledum groenlandicum	LEGR	Labrador tea
Luetkea pectinata	LUPE	Luetkea
Menziesia ferruginea	MEFE	Rusty menziesia
Oplopanax horridum	OPHO	Devil's club
Phyllodoce glanduliflora	PHGL	Yellow mountain-heather

Scientific Name	Species Code	Common Name
SHRUBS (Continued)		
Ribes bracteosum	RIBR	Stink currant
Ribes lacustre	RILA	Trailing currant
Ribes spp.	RIBES	Currant
Rubus spectabilis	RUSP	Salmonberry
Sambucus racemosa	SARA	Pacific red elderberry
Sorbus sitchensis	SOSI	Sitka mountain ash
Vaccinium alaskaense/ ovalifolium	VACCI	Blueberry
Vaccinium caespitosum	VACA	Dwarf blueberry
Vaccinium oxycoccos	VAOX	Bog cranberry
Vaccinium parvifolium	VAPA	Red huckleberry
Vaccinium uliginosum	VAUL	Bog blueberry
Vaccinium vitis-idea	VAVI	Mountain cranberry
Viburnum edule	VIED	Highbush cranberry
HERBS		
Aconitum delphinifolium	ACDE2	Monkshood
Actaea rubra	ACRU	Baneberry
Arnica spp.	ARNIC	Arnica
Aruncus sylvester	ARSY	Goatsbeard
Aster spp.	ASTER	Aster
Caltha biflora	CABI	Marsh marigold
Castilleja parviflora	CAPA3	Paintbrush
Cerastium spp.	CERAS	Chickweed
Circaea alpina	CIAL	Enchanter's nightshade
Claytonia sibirica	CLSI	Siberian spring-beauty
Clintonia uniflora	CLUN	Blue-bead
Coptis asplenifolia	COAS	Fern-leaf goldthread
Coptis trifolia	COTR2	Trifoliate goldthread
Corallorhiza mertensiana	COME	Merten's coral-root
Cornus canadensis	COCA	Bunchberry
Cornus suecica	COSU3	Lapland cornel
Delphinium glaucum	DEGL	Glaucous larkspur

Scientific Name	Species Code	Common Name
HERBS (Continued)		
Dodecatheon spp.	DODEC	Shooting star
Drosera rotundifolia	DRRO	Round-leaf sundew
Epilobium spp.	EPILO	Fireweed
Epilobium alpinum	EPAL	Alpine willow-herb
Epilobium glandulosum	EPGL2	Glandular willow-herb
Epilobium latifolium	EPLA	Dwarf fireweed
Equisetum spp.	EQUIS	Horsetail
Erigeron peregrinus	ERPE	Subaloine daisy
Fauria crista-galli	FACR	Deer cabbage
Fritillaria camschatcensis	FRCA2	Chocolate lily
Galium aparine	GAAP	Cleavers
Galium kamtschaticum	GAKA	Northern wild-licorice
Galium spp.	GALIU	Bedstraw
Galium trifidium	GATR3	Small bedstraw
Galium triflorum	GATR	Sweet-scented bedstraw
Gentiana douglasiana	GEDO	Swamp gentian
Gentiana platypetala	GEPL	Alpine gentian
Geranium erianthum	GEER	Northern geranium
Geum calthifolium	GECA4	Caltha-leaf avens
Habenaria spp.	HABEN	Bog-orchid
Habenaria chorisiana	HACH	Choris bog-orchid
Heracleum lanatum	HELA	Cow parnip
Heuchera glabra	HEGL2	Alpine heuchera
Hiericium gracile	HIGR	Slender hawkweed
Hippuris montana	HIMO	Mountain marestail
Hypopitys monotropa	HYMO	Pinesap
Leptarrhena pyrolifolia	LEPY2	Leatherleaf saxifrage
Linneaea borealis	LIBO2	Twin flower
Listera caurina	LICA3	Western twayblade
Listera cordata	LICO3	Heart-leaved twayblade
Lysichitum americanum	LYAM	Yellow skunk cabbage
Malaxis spp.	MALAX	Adder's tongue
Mainthemum dialatatum	MADI2	Deerberry
Mitella spp.	MITEL	Mitrewort
Moneses uniflora	MOUN	Single delight
Montia spp.	MONTI	Montia
Osmorhiza chilensis	OSCH	Chile sweet-cicely
Osmorhiza purpurea	OSPU	Sitka sweet-cicely

Scientific Name	Species Code	Common Name
HERBS (Continued)		
Parnassia fimbriata	PAFI	Fringed grass of parnassus
Petasites frigidus	PEFR2	Arctic sweet coltsfoot
Pinguicula vulgaris	PIVU	Common butterwort
Prenanthes alata	PRAL	Rattlesnake root
Pyrola secunda	PYSE	One-sided wintergreen
Ranunculus spp.	RANUN	Buttercup
Ranunculus uncinatus	RAUN2	Bongard's buttercup
Rubus chamaemorus	RUCH	Cloudberry
Rubus pedatus	RUPE	Five-leaf bramble
Sanguisorba sitchensis	SASI	Sitka burnet
Saxifraga ferruginea	SAFE	Alaska saxifrage
Selaginella selaginoides	SESE3	Low selaginella
Stellaria spp.	STELL	Starwort
Stellaria crispa	STCR	Crisp starwort
Streptopus spp.	STREP	Twisted-stalk
Streptopus roseus	STRO	Rosy twisted-stalk
Streptopus amplexifolius	STAM	Clasping twisted stalk
Tiarella trifoliata	TITR	Trifoliate foamflower
Tiarella unifoliata	TIUN	Unifoliate foamflower
Tolfieldia glutinosa	TOGL	Sticky tofieldia
Trientalis europea	TREU	Arctic starflower
Valeriana sitchensis	VASI	Sitka valerian
Veratrum viride	VEVI	False hellebore
Viola spp.	VIOLA	Violet
Viola glabella	VIGL	Stream violet
Viola langsdorfii	VILA	Alaska violet
GRAMINOIDS		
Agrostis spp.	AGROS	Bentgrass
Calamagrostis canadensis	CACA	Bluejoint
Calamagrostis nutkaensis	CANU3	Pacific Reedgrass
Carex spp.	CAREX	Sedge

Scientific Name	Species Code	Common Name
GRAMINOIDS (Continued)		
Carex anthoxanthea	CAAN5	None
Carex lenticularis	CALE5	None
Carex macrochaeta	CAMA4	Long-awn sedge
Carex mertensii	CAME2	Mertens sedge
Carex nigricans	CANI2	Blackish sedge
Carex pauciflora	CAPA11	Few-flowered sedge
Carex phyllomanica	CAPH2	Stellate sedge
Carex pluriflora	CAPL	Many-flower sedge
Carex sitchensis	CASI3	Sitka sedge
Deschampsia atropurpurea	DEAT	Mountain hairgrass
Eriophorum	ERIOP	Cotton grass
Festuca rubra	FERU	Red fescue
Juncus spp.	JUNCU	Rush
Luzula parviflora	LUPA	Small-flowered woodrush
Luzula soo.	LUZUL	Wood rush species
Phleum alpinum	PHAL	Alpine timothy
Poa spp.	POA	Bluegrass
Scirpus caespitosus	SCCA2	Tufted clubrush
Trisetum spp.	TRISE	Oatgrass
Trisetum cernuum	TRCE	Nodding oatgrass
FERNS ET AL.		
Adiantum pedatum	ADPE	Maiden-hair fern
Athyrium filix-femina	ATFI	Lady fern
Blechnum spicant	BLSP	Deer fern
Cystopteris fragilis	CYFR	Fragile fern
Lycopodium spp.-	CLUBS	Club mosses
Dryopteris austriaca	DRAU2	Spinulose shield fern
Gymnocarpium dryopteris	GYDR	Oak-fern
Lycopodium spp.-	LYCOP	Clubmoss
Lycopodium annotinum-	LYAN	Stiff clubmoss
Lycopodium clavatum -	LYCL	Running clubmoss
Lycopodium selago -	LYSE	Fir clubmoss
Polypodiam glycyrrhiza	POGL4	Licorice fern

Scientific Name	Species Code	Common Name
FERNS (Continued)		
Polystichum	POLYS	Holly-fern
Polystichum braunii	POBR2	Prickly shield-fern
Polystichum lonchitis	POLO2	Holly-fern
Polysticum munitum	POMU	Swordfern
Pteridium aquilinum	PTAQ	Western bracken fern
Sphagnum spp.	SPHAG	Sphagnum moss
Thelypteris limbosperma	THLI	Mountain wood-fern
Thelypteris phegopteris	THPH	Northern beech-fern

Appendix H. Glossary

Sources for this glossary are Interagency Committee 1989, Thomas 1979, and Daubenmire 1978.

Abundance - "How much" of a plant occurs on a sample plot. Percent covers are a measure of abundance.

Alluvium - Soil material deposited from river or stream flooding.

Anaerobic - Situation in which molecular oxygen is absent (or effectively so) from the environment.

Aspect - The direction toward which a slope faces.

Average percent cover - The mean of percent cover values for a species on all available sample plots. For example, if a species occurs on three of 10 available sample plots, and its percent cover on each of those plots is 1 percent, then the average percent cover is (3 X 1)/10, or 0.3 percent. Average percent cover is a measure of the dominance of a species in a plant association.

Basal area - The cross-sectional area of a tree at breat height (4.5 ft). Basal area is usually reported on an area basis (e.g., total basal area per acre).

Biodiversity - The sum total of life in an area. Biodiversity is perhaps best divided into structure (e.g., tree sizes), composition (e.g., variety of plant species), and function (e.g., nutrient cycling), at scales ranging from genetic to landscape (Noss 1990). Forest managers are directed to consider biodiversity by the National Forest Management Act (NFMA) of 1976, and associated regulations (36 CFR 219).

Biological legacies - Components of ecosystem function, composition, or structure that are retained from the previous forest following a disturbance. For example, snags and future snags usually remain following windthrow, but clearcutting removes them. The term was apparently coined by ecologist Jerry Franklin. This concept is at the core of Ecosystem Management, or to quote Aldo Leopold, "The first rule of intelligent tinkering is to save all the parts."

Biome - Very broad aggregations of ecosystems across the earth's surface. For example, the coastal coniferous forest biome of the Pacific Northwest stretches from northern California to Prince William Sound.

Board foot - A unit of timber volume measurement equal to a piece of wood measuring 12 inches by 12 inches by 1 inch. Usually expressed on an area basis (e.g., 12,000 board feet per acre). Note that MBF = thousands of board feet and MMBF = millions of board feet.

Examples: A mixed conifer association might show 8 MBF/ac; the Thorne Bay District annual timber harvest is about 200 MMBF.

Buffer (strip) - A strip of vegetation that is left or managed to reduce the impact of a treatment or action of one area on another.

Clearcutting - A logging method where all trees are removed from an area.

Climatic Zone - Broad landscape zone based on climate. In this document, the landscape is divided into a colder, higher elevation Mountain Hemlock Climatic Zone, and a warmer, lower elevation Western Hemlock Climatic Zone.

Climax - The oldest, steady-state plant community that is reached at the end of a sere (series of succesional stages). Climax forest can be refered to as old growth. In practice, climax conditions can be difficult to define, and some ecologists question the value of the concept.

Constancy - How frequently a plant species was encountered in sample plots. For example, if a species was found on 5 plots of a total 10 sampled, its constancy is 50 percent.

Criteria - Standards, rules, or tests on which a judgement or decision may be based.

Data - Information. In this document, the term is used to mean quantifiable information collected in the field.

Database - In this document, the term denotes field-collected, quantitative information stored in computer files.

Disturbance - In ecology, any perturbation to a site that alters soil or vegetation. In this document, the focus in on soil disturbance through water and windthrow.

Dominant species - A plant species that exerts a controlling influence on or defines the character of a community. Dominance can be assessed by measuring plant height, basal area, frequency, or percent cover. The database used in this document uses percent cover information.

Drainage - The movement of water through a soil profile. Well-drained soils are associated with aerobic conditions; poorly drained soils with anaerobic conditions.

Dwarf mistletoe - A parasitic flowering plant that affects western hemlock. The plant causes the host hemlock to grow many small branches, forming a "witches broom." Seeds are carried by birds to infect other trees. Dwarf mistletoe is a consideration in partial harvesting, as it can easily spread from residuals to younger trees.

Ecological Zones - In this document, aggregates of landforms and their associated soil and vegetation.

Ecology - The science the studies the interactions of organisms and their environment. From the classical Greek *oikos* ("home") and *ogy* ("the study of"). This document focuses mostly on vegetative composition and structure.

Ecosystem - A functioning aggregation of organisms and their environment.

Ecosystem Management - A Forest Service program focusing on maintainence of natural systems and functions (e.g., water flows, nutrient cycling, and habitat requirements) rather than commodity outputs.

Entisols - Soils that are very young (in geologic terms). Generally, they are poorly (if at all) differentiated into soil horizons.

Environment - The surroundings of an organism or a community.

Fidelity - How closely a plant species is associated with a particular environment. A plant that is found only on cold sites (such as Cassiope) shows strong fidelity. A plant that is found on a wide variety of sites (such as tall blueberry) shows poor fidelity. Note that constancy is not the same as fidelity. A plant could show 100% constancy in many plant associations (such as tall blueberry) and have poor fidelity. A plant that was found in only a few associations (such as Cassiope), but showed high constancy in one of them would show strong fidelity.

Fluvial - Refering to flooding and associated processes in riparian ecosystems.

Frequency - The distribution of individuals of a species in an area. It is quantitatively expressed as

$$\frac{\textit{Number of samples containing species A}}{\text{Total number of samples}} \times 100$$

More than one species may have a frequency of 100 percent within the same area.

Gradients - Changes across the landscape. In Southeast Alaska, the most important gradients affecting vegetation are related to drainage and elevation.

Green trees - Trees left in logging units, expected to become snags in the future.

Growing Degree Days- Number of days during the growing season where temperatures are sufficient to support plant growth. Plant growth in Southeast Alaska is limited by cold soil temperatures. Soil temperatures throughout the year vary much less than air temperatures.

Habitat -Refers to food, cover, and other requirements of wildlife. From the French verb *habiter*, "to live."

Habitat type - In this document follows Daubenmire's (1978) definition: The potential vegetation of a site integrated with soil and other environmental factors.

Hierarchical - In ecosystem classification, an approach that allows integration at all scales from site to landscape (or even regional or biome) levels.

Histosols - Soils made of accumulated organic matter. The degree of decomposition of the organic matter varies. From the Greek *histos* ("tissue").

Hydric - In this document, the term means having wetland characteristics.

Hydric soil - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions favoring the growth and regeneration of hydrophytic vegetation . Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

Hydrophytic - Vegetation with wetland characteristics. In this document, equivalent to the term "wetland vegetation."

Inceptisols - Mineral soils that show initial signs of soil horizon development.

Indicator - Plant that occurs with sufficient frequency on an environmental variable (such as soil drainage, light regime, etc.) that it is characteristic of that variable. In other words, it is a plant with strong fidelity to the variable.

Keystone - Of vital importance. Can refer to either species or ecosystems. In Southeast Alaska, riparian zones are keystone ecosystems because of their variety of landscape functions.

Landform - a contiguous, recognizable surface on the landscape. Examples include lowlands, rolling hills, and mountain summits.

Landscape - A heterogeneous area composed of many ecosystems. The forest landscape of Southeast Alaska shows a high degree of heterogeneity, because of the frequent interspersion of peatlands (muskeg) with forest.

Large organic debris (LOD) - Another term for woody debris; commonly used in refering to riparian zones. Many streams are dependent on woody debris to maintain their composition and function.

Mass movement - Catastrophic soil disturbance refering to landslides and avalanches.

Mineral soils - Soils derived from bedrock, alluvium, rock fragments, or till. Note that mineral soils also generally have surface organic layers.

Muskeg - See Peatlands.

Nonwetland - Area where vegetation or soil or hydrology does not show wetland character.

Old growth - A set of climax forest attributes including variation in canopy layers and tree sizes, plant diversity, gap formation, snags, and woody debris. Old growth age varies. Generally more productive sites show younger old growth than poorer sites. Ages of old growth stands in Southeast Alaska are not well documented but are thought to exceed 200 years as a minumum and range up to 1,000 years.

Organic - Derived from living material. In this document the term usually refers to partially decomposed vegetation.

Overstory - The forest canopy.

Parameter - A characteristic component of a unit that can be defined. A parameter is an intrinsic character; a variable is our measure of it. For example, site productivity is a parameter; tree height is one measure of it. Vegetation, soils, and hydrology (moisture regime) are the three parameters used for a wetland determination in this document.

Partial harvesting - In this document, the term refers to any logging where trees are left in an area. Includes individual tree selection, group selection, and retention of patches (forest islands).

Peatlands (muskegs) - Non-forest ecosystems of Southeast Alaska characterized by organic soils and poor soil drainage. Vegetation is typically sedges, sphagnum moss, and short ericaceous shrubs. The term "muskeg" is vague and is now discouraged in scientific literature.

Percent cover - Fraction of a site dominated by a species. Equivalent to the term "areal percent cover."

Plant association - A vegetative community. In a strict sense, it is not integrated with site factors. (That would be a habitat type). In this document, however, the two terms are used interchangeably.

Pristine - Unaltered by man. Old growth forest is considered pristine, but note that second growth can also be pristine, if it is generated by a natural event (such as windthrow).

Profile - In soil science, refers to the sequence of horizons (layers) in a soil.

Range (1) - The array of sampled values. For example, the sampled percent covers for deer cabbage in a plant association might range from 1 to 15.

Range (2) - Habitat, particularly forage, to support ungulates (deer, elk, mountain goats, and moose are examples). In this document, usually refers to Sitka black-tailed deer.

Residuals - Trees left in an area that is logged.

Resiliency - Ability of an ecosystem to withstand disturbance and maintain its function.

Riparian - Refering to a streamside environment.

Rotation - The projected length of time for crop trees to mature. Productive sites on the Ketchikan Area can be expected to reach rotation in 80 to 100 years. Poorer sites can have rotations of 200 years or more.

Sample plot - An area of land used for measuring or observing existing conditions.

Saturated soil conditions - A condition in which all easily drained voids (pores) between soil particles in the root zone are temporarily or permanently filled with water to the soil surface at pressures greater than atmospheric.

Second growth - The plant community that develops following disturbance. Second growth can be natural (e.g., generated by windthrow) or man-caused (from logging). Some authors prefer the term "young growth."

Sere - The collection of successional stages from bare ground to climax forest.

Shifting steady-state mosaic - Term used by ecologists to describe the disturbance pattern in some old-growth forests (including those of Southeast Alaska). Gaps in old growth are continually created by small-scale windthrow; the gaps regenerate and produce a mosaic of tree species and sizes. While the forest is continually changing at small scales, overall it is a remarkably stable system (shows great resiliency to natural events).

Site - The combination of environmental factors (including soil, geology, climate, and hydrology) that support vegetation. The integration of site and vegetation is refered to as a habitat type.

Site productivity - The capability of a specific area to produce biomass. In Southeast Alaska, site productivity depends largely on soil drainage (Cullen 1987), elevation, and the frequency of disturbance.

Series (soil) - A group of soils having horizons similar in differentiating characteristics and arrangement in the soil profile, except for texture of the surface horizon.

Series (vegetation) - Plant associations grouped by overstory vegetation. Do not confuse with soil series, an entirely different concept.

Silviculture - The art and science of growing trees, providing for forest regeneration, and maintaining forest functions and productivity.

Snags - Standing dead trees

Spodic - Soil characteristic of some mineral soils. Relates to zones of leaching and accumulation. Found in high rainfall environments and thus common in Southeast Alaska. Spodic soils are called Spodosols.

Succession - Changes in vegetation and associated animal life that occur over time from disturbance to climax conditions. Succession can be primary (starting with bare rock or soil, such as that following glaciation) or secondary (following disturbance of an established ecosystem). Vegetation that follows windthrow or logging is considered secondary succession. Succession is one of the keystone concepts of ecology; its study can take up several lifetimes.

Till - Debris (soil and rock) left behind by glaciers. Till can be compact or loose (ablation till).

Transect- A line on the ground along which observations are made at some interval.

Understory - Vegetation beneath the forest canopy. Can include trees, shrubs, forbs, ferns, and mosses.

Upland - Non-wetland in character. In this document, the term is equivalent with non-wetland.

Wetlands - Those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetland Index - The ratio of the wetland vegetation score to the upland vegetation score for a plant association. Indices greater than 1.00 indicate wetland vegetation. The index is a useful measure of the hydric character of the vegetation along a gradient from wet to dry conditions.

Wetland Plant Association - Vegetative community with hydric (wetland) character.

Wetland Soil - A soil that has characteristics developed in a reducing atmosphere, which exists when periods of prolonged soil saturation result in anaerobic conditions. Hydric soils that are sufficiently wet to support hydrophytic vegetation are wetland soils.

Wetland Vegetation - Plants of an association considered hydric because of a systematic determination. As used in this document, the term means hydric character for the vegetation parameter only.

Windthrow - Trees blown down. Synonymous with blowdown.

Woody debris - Logs and stumps on the forest floor. See also Large Organic Debris.