

PROGRESS REPORT

**ECOLOGICAL CLASSIFICATION OF
LOW-ELEVATION RIPARIAN VEGETATION ON
THE OLYMPIC EXPERIMENTAL STATE FOREST:
A FIRST APPROXIMATION**

**Christopher B. Chappell
Washington Natural Heritage Program
Washington Department of Natural Resources
Olympia, Washington
April 1999**

INTRODUCTION AND OBJECTIVES

Riparian zones constitute the interface between freshwater aquatic and terrestrial ecosystems. In the broadest sense they include a wide variety of sites such as floodplains, bogs, marshes, lakeshores, wetlands, and upland sites that have a strong direct influence on freshwater aquatic ecosystems. Sometimes, the word riparian is used more narrowly to refer only to the interface between riverine systems and adjacent uplands, thereby excluding impounded wetlands and lakes. However the word is defined, riparian zones play a crucial role in the function of aquatic ecosystems and the maintenance of biodiversity and fish habitat.

Riparian vegetation can be classified into units variously referred to as plant communities, plant associations, ecological types, or habitat types. Regardless of the name and its specific use, a classification that is structured around a correlation between physical site factors and vegetation types that consistently recur across the landscape is a useful tool for communication, management, and monitoring. Such a classification system can be used to improve communication within and across jurisdictional boundaries, plan management based on the ecological potential of sites, stratify research sites according to ecologically meaningful units, fashion restoration targets that are more in line with the functioning of systems, and monitor the condition of riparian ecosystems.

The vegetation of riparian zones in western Washington has been described in a general fashion (Franklin and Dyrness 1973). In addition, much research has been completed in the region that has led to a fuller understanding of riparian function and process, particularly with regard to large woody structures (Naiman and Bilby 1998). However, classifications of riparian plant communities or associations in the region have been relatively few and mostly very limited in their geographic scope. The only comprehensive riparian vegetation classification that covers a significant geographic area in western Washington is that for the Gifford Pinchot National Forest (Diaz and Mellen 1996). Kunze (1994) completed a preliminary classification of freshwater wetland vegetation in western Washington that largely excluded riverine ecosystems. Fonda (1974), describing vegetation of a portion of the Hoh River valley, is the local study of greatest significance to riparian vegetation work on the Olympic Experimental State Forest.

The objective of this ongoing project is to develop a classification of existing riparian vegetation that is related to physical site factors on the Olympic Experimental State Forest (OESF) of the western Olympic Peninsula. Apparent successional trends will also be described and updated as more information becomes available. For the purposes of this project, riparian vegetation is defined as that which is associated with riverine ecosystems and either influenced by the aquatic ecosystem or having a strong influence on the aquatic ecosystem. Emphasis is placed on describing vegetation types that have not been previously described. Some plant associations previously described from uplands on the OESF (Bigley and Hull 1995) may be described herein in their riparian setting, particularly if they are very common in riparian zones. Work to date has focused on low elevations and relatively natural vegetation. Future work will expand to higher elevations and second-growth vegetation. This classification is preliminary and will be revised in the future as more data is collected.

METHODS

This classification was derived from data collected during the summer of 1998. All data were collected on stream reaches located below 1000 feet elevation, most were below 700 feet. Data were collected on stream reaches that ran through mature or old-growth forests. Stream reaches were initially chosen using orthophotos or air photos and then refined in terms of location on the ground to best represent typical conditions.

A total of 30 stream reaches were sampled. Valleys within which stream reaches were located were characterized by their shape, gradient, valley wall steepness, and width. Vertical and horizontal sketches of the stream reach valley were completed illustrating relative positions of fluvial surfaces and plant communities based on overstory and understory dominance. A variation of a Rosgen Level III analysis was completed on each stream reach (Rosgen 1996). Stream reaches were classified as Rosgen stream types and stream channel characteristics were evaluated including bank erosion, channel stability, gradient, organic debris, depositional features, meander types, sinuosity, width/depth ratio, and floodplain width. Percent cover of surface substrates in the channel was visually estimated. Three to six (typically 4) variable basal area plots were completed at bankfull level along each stream reach with a 20 BAF prism.

Along each stream reach, one to 10 vegetation plots were installed. Sites sampled included floodplains and other fluvial surfaces, riparian terraces, and toeslopes. Toeslopes were a higher priority for plot sampling when the vegetation present was distinctly different than upland plant associations of the OESF described by Bigley and Hull (1995). Plot locations were subjectively to randomly selected to represent a particular fluvial surface or recognizable plant community. Plots varied in size from 1/80 to 1/10 acre and in shape from circular to rectangular depending on the scale and shape of the vegetation being sampled. All forest plots were 1/20 acre minimum and most were 1/10 acre circular plots. Shrubland and herbaceous plots were mostly 1/20 acre or 1/80 acre.

On each plot, percent crown cover for all vascular plant species was estimated in classes of <1%, 1-5%, 6-10%, 11-15%, 16-25%, 26-35%, 36-45%, 46-55%, 56-65%, 66-75%, 76-85%, 86-95%, and 96-100%. The same cover classes were used to estimate surface cover of bare ground, mosses, litter, gravel, cobble/stones, bedrock, overstory trees, understory trees, shrubs, graminoids, and forbs/ferns. Understory trees were defined as those less than 5 inches dbh. Stand age was recorded as old-growth (200+ years) or to the nearest year possible based on a core of a typical tree representing the dominant cohort. On 1/10 acre forest plots, trees and saplings were counted by species in diameter classes and logs were recorded on transects by decay class and diameter.

Aspect, slope, estimated tree, shrub, and herb heights were also recorded. The vertical and horizontal distance from bankfull to the plot was recorded. Soils on most plots were described as a series of horizons differing significantly in texture or color. Soil texture was determined in the field with hand methods and coarse fragments were visually estimated. Depth to mottling, gleying, or impermeable layers was recorded, particularly if depth to any of these features was less than 60 cm. Forest floor depth and forest floor type (mor, moder, mull) was recorded where possible. Relative soil moisture regime and relative soil nutrient regime were recorded for each plot (Green and Klinka 1994).

Data analysis has focused so far on vegetation composition and summary of environmental data associated with each vegetation type classified. Multivariate analysis in the form of ordination (detrended correspondence analysis), cluster analysis, and divisive classification (TWINSPAN) was used to explore patterns in the vegetation composition data. Valleys were classified in geomorphic categories of moderate slope-bound, lower alluviated, alluviated mountain, u-shaped glacial trough, incised moderate-gradient, incised steep-gradient, incised till or colluvium, or valley wall (Diaz and Mellen 1996). An index to flood frequency was developed based on the vertical position of fluvial surfaces in relation to bankfull measurements:

$$\text{floodprone position index} = \frac{\text{height above bankfull}}{\text{bankfull depth max.}}$$

Negative values of the index indicate locations within the bankfull zone. Increasing positive values of the index are likely to be correlated with decreasing flood frequency (Rosgen 1996).

Plant associations and plant communities were classified based on ecological interpretation of multivariate analysis results in conjunction with inspection of environmental data. Major dominant vegetation physiognomy is the first cut in the classification and was helpful for stratification of plots during analysis. The *plant associations* thus described refer to existing vegetation types that appear to be the potential vegetation for a given fluvial surface in its current hydrologic setting. The *plant communities* described refer to existing vegetation types that appear to be either seral to other vegetation types or whose seral status is uncertain. Each plant association or plant community fits into one of the following physiognomic categories that correspond with class or a set of subclasses in the National Vegetation Classification (Grossman et al. 1998): conifer or mixed forest/woodland; deciduous or mixed forest/woodland; shrubland; herbaceous vegetation. Classification and data collection methodology are similar to that applied by Kovalchik (1987), Hansen et al. (1995), and Diaz and Mellen (1996), and are intended to be consistent with the National Vegetation Classification (Grossman et al. 1998).

Each community/association account includes a description of the vegetation, environment, distribution, disturbance, and successional processes associated with the type. Future analysis and data summary can incorporate information on tree density and size distribution, down logs, and possibly other physical parameters. Plant taxonomy follows Kartesz (1994), but common names are those typically used by Pacific Northwest residents. An appendix shows the differences between Kartesz (1994) and Hitchcock and Cronquist (1973) for species mentioned in the text.

KEYS TO PLANT ASSOCIATIONS AND PLANT COMMUNITIES

The following keys are designed such that if the plot fits the statement (statement is true), then read over to the right for the series or association or drop to the next line indented below. If the plot does not fit the statement (statement is not true), then skip to the next line below that is **not indented**. All percentages are percent crown cover, defined as vertical projection of a polygon created by connecting the perimeter of a plant's crown. "Undescribed type" refers to plant communities that have not been described in this report or in other literature. Some of these may appear on pages 37-38 as "Other Types Sampled." Types that appear in the key with an asterisk, but not as separate association/community descriptions, can be found in the "Other Types Sampled" section on pages 37-38 where reference is made to the publication where the type is described. This key is draft and will be altered as more information is collected.

KEY TO PHYSIOGNOMIC CATEGORIES:

- Trees > 25%
 Conifers have greater total cover in overstory than deciduous hardwoods..... **Key to Conifer Forest Types**
 Deciduous hardwoods overstory cover > conifer overstory cover..... **Key to Deciduous Forest Types**
- Shrubs > 25% **Key to Shrubland Types**
- Herbaceous Vegetation > 25% **Key to Herbaceous Types**

KEY TO CONIFER FOREST TYPES

- Pacific silver fir > 5%
 Salal present and Oregon oxalis or sword fern >5% **ABAM/GASH/POMU**
 Not as above **refer to Bigley and Hull (1995)**
- Sitka spruce > 5%
 Slough sedge > 5% **PISI/CAOB-LYAM**
- Skunkcabbage > 5% **PISI-ALRU/LYAM**
- Devil's club > 5% **PISI/OPHO**
- Pacific golden-saxifrage > 10% and red alder prominent **ALRU/RUSP/CHGL**
- Black cottonwood + bigleaf maple > 20% and salmonberry > 10% **POTR-ACMA-PISI/RUSP**
- Vine maple > 10% **PISI/ACCI**
- Oregon oxalis > 5% **PISI/OXOR**
- Not as above **refer to Bigley and Hull (1995)**
- Western hemlock > 10%
 Devils club > 5% **TSHE/OPHO**

Oregon oxalis > 5%
 Salal > 5% **TSHE/GASH/OXOR***
 Salal < 5% **TSHE/OXOR***

Deerfern > 5% and Salal < 5% **TSHE/MEFE/BLSP***

Not as above **refer to Bigley and Hull (1995)**

KEY TO DECIDUOUS FOREST TYPES

Black cottonwood or bigleaf maple > 20%
 Salmonberry > 10% and black cottonwood usually present **POTR-ACMA-PISI/RUSP**

Vine maple > 10% and black cottonwood absent **ACMA/ACCI***

Not as above **Undescribed type**

Red alder the dominant deciduous tree
 Slough sedge or skunkcabbage > 5% and slough sedge present **ALRU/RUSP/CAOB-LYAM**

Pacific golden-saxifrage > 10% **ALRU/RUSP/CHGL**

Devils club > 5% **ALRU/OPHO***

Understory dominated by grasses or trailing blackberry, blue wildrye > 1% **ALRU/RUUR/ELGL**

Salmonberry + stink currant > 20% **ALRU/RUSP**

Not as above **Undescribed type**

KEY TO SHRUBLAND TYPES

Sitka willow the dominant shrub and herbaceous cover < 50% **SASI/EQAR**

Devils club > 10% **OPHO**

Salmonberry or stink currant the dominant shrub **RIBR-RUSP***

Not as above **Undescribed type**

KEY TO HERBACEOUS TYPES

Slough sedge the dominant herb **CAOB***

Colts foot the dominant herb **PEFR***

Small-fruited bulrush the dominant herb **SCMI***

Not as above **Undescribed type**

* Refer to pages 37-38 for references where these types are described in detail.

FOREST TYPES

Pacific Silver Fir/Salal/Sword Fern Forest Association *Abies amabilis/Gaultheria shallon/Polystichum munitum* ABAM/GASH/POMU

N=4 plots

Vegetation Composition and Structure:

This association is a conifer forest with a sparse to moderate shrub layer and sparse to moderate herbaceous cover consisting of ferns and forbs. Moss cover is typically well-developed. The tree canopy is relatively closed and completely dominated by conifers. The shrub layer is dominated by evergreen broadleaf low shrubs.

The overstory tree layer is dominated primarily by western hemlock (TSHE) and secondarily by Pacific silver fir (PISI). Sitka spruce is moderately frequent, usually with low percent cover. Western hemlock and Pacific silver fir dominate tree regeneration. The shrub layer is typically dominated by relatively low-growing salal (GASH). Oval-leaf huckleberry (VAOV) is always present and averages nearly 10% cover. Red huckleberry (VAPA), foals huckleberry (MEFE), and salmonberry (RUSP) are frequent in small amounts. The herbaceous layer is dominated by a somewhat variable mixture of sword fern (POMU), deerfern (BLSP) and Oregon oxalis (OXOR). Oxalis or sword fern typically occupy >5% cover. Coolwort foamflower (TITR), small-flowered wood-rush (LUPA), beadruby (MADI), and lady-fern (ATFI) are present with high constancy and low cover. Sphagnum moss (*Sphagnum* spp.) is sometimes present.

Species	Code	Constancy	Cover
Overstory trees			
		100	88
<i>Tsuga heterophylla</i>	TSHE	100	73
<i>Abies amabilis</i>	ABAM	100	20
<i>Picea sitchensis</i>	PISI	50	8
Understory trees			
		100	20
<i>Tsuga heterophylla</i>	TSHE	100	15
<i>Abies amabilis</i>	ABAM	100	5
Shrubs			
		100	27
<i>Gaultheria shallon</i>	GASH	100	18
<i>Vaccinium ovalifolium</i>	VAOV	100	9
<i>Rubus spectabilis</i>	RUSP	100	3
<i>Vaccinium parvifolium</i>	VAPA	100	2
<i>Menziesia ferruginea</i>	MEFE	100	1
Forbs and ferns			
		100	28
<i>Blechnum spicant</i>	BLSP	100	13
<i>Oxalis oregana</i>	OXOR	100	11
<i>Polystichum munitum</i>	POMU	100	9
<i>Tiarella trifoliata</i>	TITR	100	1
<i>Dryopteris expansa</i>	DREX	100	1
<i>Maianthemum dilatatum</i>	MADI	75	2
Graminoids			
		100	1
<i>Luzula parviflora</i>	LUPA	100	1

Environment and Distribution:

This association occurs on mesic, relatively nitrogen-poor sites located above the floodprone zone in smaller valleys at low elevations in very wet climatic zones. Sites sampled are terraces or toeslopes that are very infrequently flooded if ever (floodprone position index 1.3-2.2 for terraces, minimum 2 feet above bankfull). Soils included loam, silt loam, and clay loam textures with few to no coarse fragments. A high water table may be absent or present (minimum depth recorded 35 cm). Inferred nitrogen status was typically moderate, with relatively thick mor-type (less commonly moder) forest floors (3-10 cm). There was very little to no exposed bare soil, rock, or gravel on these plots.

Valleys were narrow to moderately broad, with low to moderate gradients. Streams had little to moderate floodplain development (Rosgen types B, C, and F) and gravel or cobble beds. These were small to moderately small streams (mean bankfull width 29 feet) with low to moderate sinuosity in moderate slope bound valleys or u-shaped glacial trough valleys. Floodprone zones averaged 64 feet wide. Surficial geology was sedimentary bedrock or glacial drift. Mean annual precipitation for all plots was 125 inches and elevation was about 400 feet.

Succession and Disturbance:

All plots sampled were old-growth, though younger stands probably also occur. Flooding would only occur on a portion of these sites during very extreme events. Size-class distribution of trees suggests that the vegetation composition of this type is relatively stable, with hemlock and silver fir not differing much in their relative representation in the understory versus overstory. Sitka spruce, where present, is likely to decrease in importance over long time periods. Herbivores did not appear to be having a significant impact on these sites, though at one site there was moderate use by both elk and mountain beaver.

Associated Vegetation:

The riparian type that most commonly occurred adjacent is the Red Alder/Salmonberry association (ALRU/RUSP). The Sitka Spruce-Red Alder/Skunkcabbage (PISI-ALRU/LYAM) community also occurred adjacent. At one site, an adjacent floodplain hosted an undescribed Pacific silver fir-Sitka spruce/Oregon oxalis community. Adjacent uplands were typically occupied by the Pacific silver fir/Salal (ABAM/GASH) association (Bigley and Hull 1995). In one case, the ABAM/GASH/POMU association occupied most of the toeslopes of the uplands surrounding the stream.

Similar Riparian Associations in this Classification:

The Western Hemlock/Salal/Oxalis (TSHE/GASH/OXOR) differs in having very little to no Pacific silver fir.

Relationship to Other Classifications:

The vegetation composition of this association is very similar to the Pacific silver fir/Salal/Oregon Oxalis (ABAM/GASH/OXOR) association on the Olympic National Forest (Henderson et al. 1989). ABAM/GASH/POMU does not correspond with any of the described upland associations on the Olympic Experimental State Forest (Bigley and Hull 1995): ABAM/GASH-OXOR described therein differs in having consistently low coverage of salal and greater abundance of moist/rich site indicators including sword fern and oxalis.

Red Alder/Salmonberry Forest Community
Alnus rubra/Rubus spectabilis
 ALRU/RUSP

N=14 plots

Vegetation Composition and Structure:

This community is a deciduous hardwood forest with a moderate to dense shrub layer and a well-developed herbaceous layer. Moss cover is low to moderate. The broadleaf deciduous tree canopy ranges from open to closed. The shrub layer is primarily dominated by medium-tall deciduous shrubs. The herb layer is dominated by forbs or ferns.

The overstory tree layer is dominated by red alder (ALRU). Sitka spruce (PISI) or western hemlock (TSHE) may be present in the canopy but are minor in importance. Conifer regeneration is limited to large woody debris substrates and, when present, is Sitka spruce or western hemlock. The shrub layer is dominated by salmonberry (RUSP). Stink currant (RIBR) or red elderberry (SARA) sometimes co-dominate. The variable herbaceous layer is dominated or co-dominated most often by youth-on-age (TOME), Oregon oxalis (OXOR), or sword fern (POMU). Pacific water-parsley (OESA), lady-fern (ATFI), coastal mitrewort (MIOV), Cooley's hedge-nettle (STCI), Siberian springbeauty (CLSI), and Dewey's sedge (CADE) are frequent.

Species	Code	Constancy	Cover
Overstory trees		100	81
<i>Alnus rubra</i>	ALRU	100	80
<i>Picea sitchensis</i>	PISI	29	12
Understory trees		79	15
<i>Picea sitchensis</i>	PISI	57	5
<i>Tsuga heterophylla</i>	TSHE	50	13
Shrubs		100	67
<i>Rubus spectabilis</i>	RUSP	100	58
<i>Ribes bracteosum</i>	RIBR	71	10
<i>Sambucus racemosa</i>	SARA	64	11
Forbs and ferns		100	71
<i>Oxalis oregana</i>	OXOR	100	26
<i>Tolmiea menziesii</i>	TOME	100	24
<i>Athyrium filix-femina</i>	ATFI	100	2
<i>Polystichum munitum</i>	POMU	93	20
<i>Mitella ovalis</i>	MIOV	86	5
<i>Stachys ciliata</i>	STCI	86	5
<i>Claytonia siberica</i>	CLSI	79	2
<i>Oenanthe sarmentosa</i>	OESA	64	7
<i>Viola glabella</i>	VIGL	57	5
Graminoids		100	9
<i>Carex deweyana</i>	CADE	71	3
<i>Luzula parviflora</i>	LUPA	64	1
<i>Bromus vulgaris</i>	BRVU	50	4
<i>Festuca subulata</i>	FESU	50	3
Moss		100	38

Environment and Distribution:

This common community occurs on mesic well-drained sites, primarily located on floodplains or terraces throughout the area on a variety of streams. Sites sampled were mostly terraces or floodplains located within the floodprone zone (median floodprone position index .72; 1-6 feet above bankfull). Sites were less commonly on terraces above the floodprone zone or on sloping debris torrent deposits. The association also commonly occurs on streambanks, though it is so narrow there that it is difficult to sample. The most frequent soil texture was loam, with silt loam, sandy loam, and loamy sand also recorded. Coarse fragments were typically absent or less than 35% in surface horizons, though they ranged up to 70%. In about half of the plots, subsoils at a depth of 20-80 cm had significantly more coarse fragments than surface horizons. Inferred nitrogen status was rich to, less commonly, very rich, with mull-type forest floors typical. Typically there was a small amount of bare ground exposed, but occasionally up to 40%.

Valleys were narrow to very broad, with very low to high gradients (low most typical). Streams typically had moderate to major floodplain development (Rosgen types B and C, less commonly F) and had gravel or cobble beds. These were small to very large streams (bankfull width 11-295 feet) with low to moderate sinuosity located in a variety of valley types. Floodprone zones ranged from 32 to 3300 feet wide. Surficial geology was variable, including alluvium, glacial drift, and sedimentary bedrock. Mean annual precipitation ranged from 95 to 135 inches and elevation ranged from 50 to 760 feet.

Succession and Disturbance:

Sampled stands ranged in age from 25 to 115 years old (mean 59). These are early to mid seral stands, with a successional trajectory that may vary depending on a number of factors. Sites that are flooded relatively frequently may be arrested in this association or may become shrublands after the death of the alder canopy (Henderson 1978). Infrequently flooded sites have the potential to succeed to conifer dominance if conifer logs are present for seedling establishment of conifers. In the absence of conifer logs, succession could lead to shrub dominance after the alder dies out (Henderson 1978). Major disturbance is likely to result in reestablishment of alder. In the absence of major disturbance or periodic flooding and in the presence of conifer logs, the potential vegetation is expected to be part of the Sitka spruce series, less commonly perhaps the Western hemlock series. Flooding on these sites varies from once every few years to never. Moderate use by elk on some sites results in apparent increases in cover of graminoids and creeping buttercup (RARE), and reductions in salmonberry cover. The Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL) community apparently occurs on some sites that are similar to a portion of the environmental range of ALRU/RUSP (coarse-textured soils), the difference in vegetation being apparently controlled by intense elk impacts on the former.

Associated Vegetation:

The riparian types that occurred adjacent were Sitka Spruce/Vine Maple (PISI/ACCI), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Western Hemlock/Oregon Oxalis (TSHE/OXOR), Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM), Pacific Silver Fir/Salal/Sword Fern (ABAM/GASH/POMU), Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL), Sitka Willow/Field Horsetail (SASI/EQAR), Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP), Red Alder-Sitka Spruce/Salmonberry (ALRU-PISI/RUSP), and Small-fruited Bulrush (SCMI). In addition, the strictly upland associations Pacific Silver Fir/Salal (ABAM/GASH) and Sitka Spruce/Salal-Fools

Huckleberry (PISI/GASH-MEFE) (Bigley and Hull 1995) also occurred adjacent to ALRU/RUSP.

Similar Riparian Associations in this Classification:

The Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL) community has >10% cover of Pacific golden-saxifrage. The Red Alder/Devils Club (ALRU/OPHO) community has >10% cover of devils club. The Red Alder-Sitka Spruce/Salmonberry (ALRU-PISI/RUSP) community has >25% cover of Sitka Spruce in the overstory. The Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP) community has abundant black cottonwood or bigleaf maple. The Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL) community has less salmonberry, >10% cover of trailing blackberry, and abundant grass cover including blue wildrye. The Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM) community has >5% cover of slough sedge or skunkcabbage.

Relationship to Other Classifications:

This community is similar to that described by Henderson (1978) from western Oregon and to the Red Alder/Salmonberry/Youth-on-age (ALRU/RUSP/TOME) and Red Alder/Salmonberry/Oxalis (ALRU/RUSP/OXALIS) community types described on the Gifford Pinchot and Mount Hood National Forests (Diaz and Mellen 1996). The Olympic type differs primarily from these in the high constancy of Sitka spruce.

Red Alder/Salmonberry/Slough Sedge-Skunkcabbage Forest Community N=3 plots
Alnus rubra/Rubus spectabilis/Carex obnupta-Lysichiton americanus
ALRU/RUSP/CAOB-LYAM

Vegetation Composition and Structure:

This community is a deciduous hardwood forest with a moderate to dense shrub layer and a well-developed herbaceous layer. Moss cover is relatively low. The broadleaf deciduous tree canopy is typically closed. The shrub layer is primarily dominated by medium to medium-tall deciduous shrubs. The herb layer is dominated by graminoids and forbs.

The overstory tree layer is dominated by red alder (ALRU). Sitka spruce (PISI) may be present in the canopy in small amounts. Tree regeneration is limited primarily to large woody debris substrates and, when present, is mostly Sitka spruce. The shrub layer is dominated by salmonberry (RUSP). The herbaceous layer is dominated by slough sedge (CAOB) or skunkcabbage (LYAM) with youth-on-age (TOME) codominant. Either slough sedge or skunkcabbage has >5% cover and slough sedge is always present. Occasional co-dominants include rough-stalk bluegrass (POATRI), creeping buttercup (RARE), Pacific golden-saxifrage (CHGL), and kneeling angelica (ANGE). Other frequent species include Pacific water-parsley (OESA), lady-fern (ATFI), Cooley's hedge-nettle (STCI), sword fern (POMU), Oregon oxalis (OXOR), yellow monkey-flower (MIGU), and enchanter's nightshade (CIAL).

Species	Code	Constancy	Cover
Overstory trees		100	93
<i>Alnus rubra</i>	ALRU	100	93
<i>Picea sitchensis</i>	PISI	67	8
Understory trees		100	6
<i>Picea sitchensis</i>	PISI	67	2
Shrubs		100	60
<i>Rubus spectabilis</i>	RUSP	100	57
<i>Acer circinatum</i>	ACCI	67	4
Forbs and ferns		100	73
<i>Tolmiea menziesii</i>	TOME	100	34
<i>Polystichum munitum</i>	POMU	100	6
<i>Oenanthe sarmentosa</i>	OESA	100	6
<i>Stachys ciliata</i>	STCI	100	4
<i>Athyrium filix-femina</i>	ATFI	100	4
<i>Chrysosplenium glechomifolium</i>	CHGL	67	15
<i>Oxalis oregana</i>	OXOR	67	8
<i>Mimulus guttatus</i>	MIGU	67	4
<i>Circaea alpina</i>	CIAL	67	3
<i>Lysichiton americanus</i>	LYAM	33	30
<i>Ranunculus repens</i>	RARE	33	20
<i>Angelica genuflexa</i>	ANGE	33	20
Graminoids		100	41
<i>Carex obnupta</i>	CAOB	100	30
<i>Poa trivialis</i>	POATRI	33	30
Moss		100	20

Environment and Distribution:

This community occurs on frequently flooded, somewhat poorly to poorly drained soils of well-developed riverine floodplains. Sites sampled were low terraces or floodplains located in the lower to middle portion of the floodprone zone (mean floodprone position index .46; 1-3 feet above bankfull). The surface soil texture was silt loam with no coarse fragments. Subsoils varied in texture. A high water table is present during the growing season. Depth to mottling or water table ranged from 12 to 80 cm (mean 46). Inferred nitrogen status was rich to moderate. There was a very small amount of bare ground exposed.

Valleys were broad to very broad, with very low to low gradients. Streams had major floodplain development (Rosgen types C and E) and had sand, gravel, or cobble beds. These were medium to large streams (bankfull width 31-148 feet) with moderate to high sinuosity located in u-shaped glacial trough valleys and lower alluviated valleys. Floodprone zones ranged from 200 to 700 feet wide. Surficial geology was alluvium or glacial drift. Mean annual precipitation ranged from 95 to 125 inches and elevation ranged from 200 to 600 feet.

Succession and Disturbance:

Sampled stands ranged in age from 32 to 78 years old. Wet soils and frequent flooding limit conifer regeneration primarily to large conifer logs. Over long time frames this association would be expected to succeed toward a potential vegetation of Sitka Spruce/Slough Sedge-Skunkcabbage (PISI/CAOB-LYAM). The rate of this succession may depend on frequency and type of flooding and availability of conifer logs. In the absence of conifer logs, succession could lead to shrub or herbaceous dominance after the alder dies out. Major disturbance is likely to result in reestablishment of alder. Heavy use by elk on one site showed apparent increases in cover of rough-stalk bluegrass (POATRI) and creeping buttercup (RARE), and reductions in salmonberry cover.

Associated Vegetation:

The riparian types that occurred adjacent were the Sitka Spruce/Vine Maple (PISI/ACCI), Red Alder/Salmonberry (ALRU/RUSP), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL), Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP), Lady-fern (ATFI), Pacific Ninebark (PHCA), as well as backwater channels.

Similar Riparian Associations in this Classification:

The Red Alder/Salmonberry (ALRU/RUSP) and Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL) communities have less than 5% cover of slough sedge and skunk cabbage. The Sitka Spruce-Red Alder/Skunkcabbage (PISI-ALRU/LYAM) community lacks slough sedge, has less salmonberry and more spruce and hemlock. The Sitka Spruce/Slough Sedge-Skunkcabbage (PISI/CAOB-LYAM) community is dominated by spruce rather than alder.

Relationship to Other Classifications:

This community is relatively similar in composition to the community of the same name described by Kunze (1994) from western Washington surge plain wetlands. Similar vegetation has also been described in Oregon.

Red Alder/Salmonberry/Pacific Golden-saxifrage Forest Community
Alnus rubra/Rubus spectabilis/Chrysosplenium glechomifolium
ALRU/RUSP/CHGL

N=5 plots

Vegetation Composition and Structure:

This community is a deciduous hardwood forest, or less commonly a mixed forest, with a moderate shrub layer and a well-developed herbaceous layer. Moss cover is moderate to high. The tree canopy is semi-open to closed. The canopy is typically dominated by deciduous trees, though infrequently it is co-dominated by conifers. The shrub layer is dominated by medium-tall deciduous shrubs. The herb layer is dominated primarily by forbs.

The overstory tree layer is typically dominated by red alder (ALRU). Sitka spruce (PISI) or western hemlock (TSHE) infrequently co-dominate with alder. Tree regeneration is limited to large woody debris substrates and consists of Sitka spruce and western hemlock. The shrub layer is typically dominated by salmonberry (RUSP), with stink currant (RIBR) prominent. Vine maple (ACCI) is occasionally co-dominant. The herbaceous layer is dominated by Pacific golden-saxifrage (CHGL), youth-on-age (TOME), Oregon oxalis (OXOR), and Pacific water-parsley (OESA). Skunkcabbage (LYAM), Siberian springbeauty (CLSI), lady-fern (ATFI), seaside bittercress (CAAN), sword fern (POMU), sweet-scented bedstraw (GATR), bearded fescue (FESU), yellow monkey-flower (MIGU), coastal mitrewort (MIOV), and pioneer violet (VIGL) are some of the most frequent species.

Species	Code	Constancy	Cover
Overstory trees		100	82
<i>Alnus rubra</i>	ALRU	100	64
<i>Picea sitchensis</i>	PISI	80	23
<i>Tsuga heterophylla</i>	TSHE	60	10
Understory trees		100	5
Shrubs		100	56
<i>Rubus spectabilis</i>	RUSP	100	39
<i>Ribes bracteosum</i>	RIBR	100	16
<i>Acer circinatum</i>	ACCI	40	31
Forbs and ferns		100	82
<i>Chrysosplenium glechomifolium</i>	CHGL	100	30
<i>Tolmiea menziesii</i>	TOME	100	26
<i>Oxalis oregana</i>	OXOR	100	19
<i>Oenanthe sarmentosa</i>	OESA	100	13
<i>Claytonia siberica</i>	CLSI	100	7
<i>Mitella ovalis</i>	MIOV	100	6
<i>Viola glabella</i>	VIGL	100	5
<i>Athyrium filix-femina</i>	ATFI	100	5
<i>Polystichum munitum</i>	POMU	100	4
<i>Galium triflorum</i>	GATR	100	4
<i>Cardamine angulata</i>	CAAN	100	3
<i>Lysichiton americanus</i>	LYAM	80	4
Graminoids		100	7
<i>Festuca subulata</i>	FESU	80	5
Moss		100	56

Environment and Distribution:

This community occurs on sites with saturated soils located on toeslopes or terraces in very wet climatic zones. Sites sampled were mostly sites of past mass wasting with seepage. This includes seepy toeslope slumps and a debris torrent track. Two plots were on terraces, one of these within the floodprone zone and the other well above it. The most frequent surface soil texture was silty clay loam, with sandy clay loam and silty clay also recorded. Coarse fragments were absent or less than 25% in surface horizons. Subsoils were typically silty clay or clay. A high water table, expressed by soil mottling, was always present (median depth of 15 cm). Inferred nitrogen status was moderate to, less commonly, rich, with forest floors very thin to non-existent. Typically there was some bare ground exposed, always less than 15% of each plot.

Valleys were very narrow to very broad, with very low to high gradients. Streams varied in their floodplain development (Rosgen types A, B, C, and E) and all had gravel beds. These were very small to large streams (mean bankfull width 48 feet) with very low to high sinuosity located in a variety of valley types. Floodprone zones ranged from 1.2 to 412 feet wide. Surficial geology was mapped as glacial drift. Mean annual precipitation ranged from 119 to 125 inches and elevation ranged from 270 to 600 feet.

Succession and Disturbance:

Sampled stands ranged in age from 24 to 135 years old (mean 66). The high water table coupled with unstable soils on many of these sites probably favors continued dominance by red alder. Alder is likely to colonize these sites after soil mass movements. The high water table prevents conifer regeneration except on woody debris. Windthrow of conifers is also probably exacerbated compared to more xeric sites. In the absence of disturbance or other factors preventing conifer establishment and growth, the potential vegetation is part of the Sitka spruce series. Riparian flooding is typically not a major process for this community, but sites can be flooded by streams. Mountain beaver are typically abundant in this community, where they appear to reduce the importance of skunkcabbage. One plot heavily impacted by elk trampling and browsing had very little cover of salmonberry.

Associated Vegetation:

The riparian types that occurred adjacent were the Sitka Spruce/Vine Maple (PISI/ACCI), Red Alder/Salmonberry (ALRU/RUSP), Sitka Spruce/Devils Club (PISI/OPHO), Western Hemlock/Devils Club (TSHE/OPHO), Small-fruited Bulrush (SCMI), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Western Hemlock/Oregon Oxalis (TSHE/OXOR), Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM), and Red Alder/Devils Club (ALRU/OPHO).

Similar Riparian Associations in this Classification:

The Red Alder/Salmonberry (ALRU/RUSP) community has less than 10% cover of Pacific golden-saxifrage. The Sitka Spruce-Red Alder/Skunkcabbage (PISI-ALRU/LYAM) community has >5% cover of skunkcabbage. The Red Alder/Devils Club (ALRU/OPHO) community has >10% cover of devils club.

Relationship to Other Classifications:

This association has not been previously described.

Red Alder/Trailing Blackberry/Blue Wildrye Forest Community
Alnus rubra/Rubus ursinus/Elymus glaucus
ALRU/RUUR/ELGL

N=4 plots

Vegetation Composition and Structure:

This community is a deciduous hardwood forest with a sparse to moderate shrub layer and a well-developed herbaceous layer. Moss cover is relatively low. The broadleaf deciduous tree canopy is typically relatively closed. The shrub layer is dominated primarily by dwarf trailing deciduous broadleaf shrubs, and secondarily by a variable layer of medium-tall or very tall deciduous shrubs. The herb layer is dominated by graminoids and forbs.

The overstory tree layer is completely dominated by red alder (ALRU). Conifer regeneration is limited to large woody debris substrates and consists primarily of Sitka spruce (PISI). The shrub layer is dominated by the low vine-like shrub trailing blackberry (RUUR). Salmonberry (RUSP) is also typically present and sometimes co-dominates. A somewhat diffuse mid-canopy layer of very tall shrubs consisting of Sitka willow (SASI) is often present. The herbaceous layer is dominated by a mixture of exotic and native species, including bentgrass (AGROST, especially creeping bentgrass *Agrostis stolonifera*), blue wildrye (ELGL), creeping buttercup (RARE), common velvetgrass (HOLA), and rough-stalk bluegrass (POATRI). Other frequent herbs are youth-on-age (TOME), sword fern (POMU), Cooley's hedge-nettle (STCI), Dewey's sedge (CADE), self-heal (PRVU), Columbia brome (BRVU), and bearded fescue (FESU).

Species	Code	Constancy	Cover
Overstory trees			
<i>Alnus rubra</i>	ALRU	100	87
Understory trees			
<i>Picea sitchensis</i>	PISI	100	6
Shrubs			
<i>Rubus ursinus</i>	RUUR	100	26
<i>Rubus spectabilis</i>	RUSP	100	14
<i>Salix sitchensis</i>	SASI	75	20
Forbs and ferns			
<i>Ranunculus repens</i>	RARE	100	17
<i>Polystichum munitum</i>	POMU	100	9
<i>Stachys ciliata</i>	STCI	100	4
<i>Prunella vulgaris</i>	PRVU	100	4
<i>Tolmiea menziesii</i>	TOME	100	3
Graminoids			
<i>Agrostis spp.</i>	AGROST	100	40
<i>Elymus glaucus</i>	ELGL	100	22
<i>Carex deweyana</i>	CADE	100	4
<i>Holcus lanatus</i>	HOLA	75	20
<i>Poa trivialis</i>	POATRI	75	12
<i>Festuca subulata</i>	FESU	75	7
Moss		100	12

Environment and Distribution:

This association occurs on relatively dry, well-drained sites on floodplains and low terraces of large alluvial valleys. Sites sampled were all low terraces or floodplains located within the floodprone zone (median floodprone position index .51; 2-5 feet above bankfull). Soil textures were relatively coarse and ranged from loam to loamy sand. Coarse fragments were typically absent or less than 25% in surface horizons. Subsoils were typically more coarse than surface horizons and had abundant coarse fragments. Inferred nitrogen status was rich to, less commonly, moderate, with thin to non-existent forest floors. Typically there was a small amount of bare ground exposed and occasionally some gravel also.

Valleys were broad to very broad, with very low to low gradients. Streams all had major floodplain development (Rosgen type C) and had gravel or cobble beds. These were large to very large streams (bankfull width 148-450 feet) with moderate to high sinuosity located in lower alluviated valleys. Floodprone zones ranged from 580 to 4000 feet wide. Surficial geology was typically alluvium. Mean annual precipitation ranged from 119 to 135 inches and elevation ranged from 200 to 500 feet.

Succession and Disturbance:

Sampled stands ranged in age from 12 to 40 years old. These are early seral stands, with the potential to (1) gradually succeed toward Sitka spruce forest, (2) become shrublands or meadows after the death of the alder canopy, or (3) be impacted by a major disturbance that restarts a successional sequence. Flooding on these sites would be expected with a frequency of once every 2-20 years. Periodic deposition of sediments in the absence of a major scouring event should lead to a gradual rising of the elevation of the surface, thus changing the site type and facilitating succession. This combined with gradual accumulation of large woody debris suggests a gradual succession toward a Sitka spruce association in the absence of a major disturbance. The severity of elk herbivory is a major influence on this association. Graminoids and creeping buttercup appear to be favored, and salmonberry and sword fern discouraged, by increasing elk pressure. Some of these sites appear capable of supporting the Red Alder/Salmonberry (ALRU/RUSP) community in the absence of heavy elk use.

Associated Vegetation:

The riparian types that most commonly occurred adjacent were Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP) and Sitka Willow/Field Horsetail (SASI/EQAR). Sitka Spruce/Vine Maple (PISI/ACCI) occurred in the same valleys but typically not adjacent.

Similar Riparian Associations in this Classification:

The Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP) community has abundant black cottonwood or bigleaf maple and more cover of Sitka spruce. The Red Alder/Salmonberry (ALRU/RUSP) community has more salmonberry, <10% cover of trailing blackberry, and low percent cover of grasses. The Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM) community has >5% cover of slough sedge or skunkcabbage. The Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL) community has >10% cover of Pacific golden-saxifrage.

Relationship to Other Classifications:

This association is very similar to the alder flat community described in the Hoh River valley (Fonda 1974). The community described by Fonda differs mainly in having less cover of

salmonberry and greater cover of graminoids, probably because of heavier elk use in the national park than outside it. The Red Alder/Blue Wildrye (ALRU/ELGL) community type described on the Gifford Pinchot and Mount Hood National Forests (Diaz and Mellen 1996) is also similar, but has Douglas-fir instead of spruce, has less salmonberry and trailing blackberry, and has lower abundance of exotic species.

Sitka Spruce-Red Alder/Skunkcabbage Forest Community
Picea sitchensis*-*Alnus rubra*/*Lysichiton americanus
PISI-ALRU/LYAM

N=3 plots

Vegetation Composition and Structure:

This community is a mixed conifer-deciduous hardwood forest, with a sparse to moderate shrub layer and a well-developed herbaceous layer. Moss cover is moderate to high. The tree canopy is typically somewhat open. The canopy is co-dominated by conifers, some of which typically form a tall scattered super-canopy, and deciduous broadleaf trees. The shrub layer is dominated primarily by medium-tall deciduous shrubs. The herb layer is dominated primarily by forbs.

The overstory tree layer is dominated by western hemlock (TSHE), red alder (ALRU), and Sitka spruce (PISI). Conifer regeneration is limited to large woody debris substrates and consists of Sitka spruce and western hemlock. The open shrub layer is dominated primarily by salmonberry (RUSP). The herbaceous layer is dominated primarily by Pacific golden-saxifrage (CHGL), skunkcabbage (LYAM), and Oregon oxalis (OXOR). Several other species collectively contribute considerable cover including Pacific water-parsley (OESA), lady-fern (ATFI), coastal mitrewort (MIOV), tall mannagrass (GLEL), sword fern (POMU), mountain brookfoam (BOMA), youth-on-age (TOME), yellow monkey-flower (MIGU), and pioneer violet (VIGL).

Species	Code	Constancy	Cover
Overstory trees		100	77
<i>Tsuga heterophylla</i>	TSHE	100	40
<i>Alnus rubra</i>	ALRU	100	27
<i>Picea sitchensis</i>	PISI	100	20
Understory trees		100	17
<i>Tsuga heterophylla</i>	TSHE	100	9
<i>Picea sitchensis</i>	PISI	100	7
Shrubs		100	22
<i>Rubus spectabilis</i>	RUSP	100	12
<i>Vaccinium ovalifolium</i>	VAOV	100	3
<i>Gaultheria shallon</i>	GASH	100	3
Forbs and ferns		100	80
<i>Oxalis oregana</i>	OXOR	100	23
<i>Chrysosplenium glechomifolium</i>	CHGL	100	23
<i>Lysichiton americanus</i>	LYAM	100	21
<i>Oenanthe sarmentosa</i>	OESA	100	11
<i>Polystichum munitum</i>	POMU	100	9
<i>Mitella ovalis</i>	MIOV	100	8
<i>Claytonia siberica</i>	CLSI	100	6
<i>Athyrium filix-femina</i>	ATFI	100	5
<i>Tolmiea menziesii</i>	TOME	67	11
<i>Boykinia major</i>	BOMA	67	10
<i>Viola glabella</i>	VIGL	67	8
Graminoids		100	12
<i>Glyceria elata</i>	GLEL	100	6
Moss		100	67

Environment and Distribution:

This community occurs on very wet sites with fine-textured soils on gentle toeslopes or high terraces outside the influence of riverine flooding. Sites sampled were toeslopes or high terraces with seeps. All sites were well above the floodprone zone. Surface soil horizons were silty clay loam texture without coarse fragments. Subsoils were typically silty clay. Considerable partially decayed organic matter was present in some soil horizons. Mean depth to high water table, expressed by soil mottling, was 7 cm. Inferred nitrogen status was moderate to rich, with forest floors very thin to non-existent. Typically there was some bare ground exposed, always less than 15% of each plot.

Valleys were narrow to broad, with low gradients. Streams had moderate floodplain development (Rosgen types B and C) and all had cobble beds. These were small to medium streams (mean bankfull width 46 feet) with low to moderate sinuosity located in u-shaped glacial trough valleys and moderate slope bound valleys. Surficial geology was sedimentary bedrock or glacial drift. Mean annual precipitation ranged from 119 to 125 inches and elevation ranged from 230 to 500 feet.

Succession and Disturbance:

Sampled stands ranged in age from 76 years old to old-growth. Multiple age classes appeared to be typical in the stands sampled, with a few old trees present in younger stands or a younger cohort(s) present along with a dominant old cohort. The very high water table probably facilitates high rates of windthrow and tipover of tall conifers. This pervasive small-scale disturbance creates small openings that are colonized by red alder. The conifers regenerate solely on good-sized conifer logs. The greater geomorphic stability of these sites and the lack of riverine flooding compared to some of the other wet-site associations, allows conifers to consistently co-dominate this community. In the theoretical absence of disturbance, the potential vegetation would be Sitka Spruce/Skunkcabbage. Mountain beaver are typically abundant in this association, where they appear to reduce the importance of skunkcabbage.

Associated Vegetation:

The riparian types that occurred adjacent were the Sitka Spruce/Vine Maple (PISI/ACCI), Western Hemlock/Oregon Oxalis (TSHE/OXOR), Devils Club (OPHO), and Pacific Silver Fir/Salal/Sword Fern (ABAM/GASH/POMU) associations.

Similar Riparian Associations in this Classification:

The Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL) community has <5% cover of skunkcabbage and typically has more alder and fewer conifers. The Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM) community has slough sedge present to abundant and typically has greater cover of alder and salmonberry.

Relationship to Other Classifications:

This community has not been previously described. The Sitka Spruce-Red Alder/Skunkcabbage (PISI-ALRU/LYAM) community described by Kunze (1994) differs in several respects, e.g. by having less western hemlock and an abundance of slough sedge.

Sitka Spruce/Vine Maple Forest Association
Picea sitchensis/Acer circinatum
PISI/ACCI

N=9 plots

Vegetation Composition and Structure:

This association is a conifer or mixed conifer-hardwood forest with a tall shrub layer and a well-developed herbaceous layer. Moss cover is relatively well-developed. The tree canopy is semi-open to closed. The upper canopy is dominated by conifer trees. A middle canopy layer of conifers and/or broadleaf deciduous hardwoods is sometimes present. The shrub layer is dominated by deciduous tall shrubs. The herb layer is dominated by ferns and forbs.

The overstory tree layer is dominated primarily by Sitka spruce (PISI). Bigleaf maple (ACMA) or western hemlock (TSHE) are often present to co-dominant, but lower in stature. Western hemlock is the most abundant tree regeneration, but Sitka spruce is also common. The shrub layer is dominated by vine maple (ACCI). Salmonberry (RUSP) and red huckleberry (VAPA) are usually present in small amounts. The herbaceous layer is dominated by sword fern (POMU) and Oregon oxalis (OXOR). Lady-fern (ATFI), coolwort foamflower (TITR), deerfern (BLSP), Dewey's sedge (CADE), sweet-scented bedstraw (GATR), coastal mitrewort (MIOV), Cooley's hedge-nettle (STCI), Siberian springbeauty (CLSI), and nodding trisetum (TRCE) are frequent.

Species	Code	Constancy	Cover
<i>Overstory trees</i>		100	79
<i>Picea sitchensis</i>	PISI	100	53
<i>Tsuga heterophylla</i>	TSHE	67	37
<i>Acer macrophyllum</i>	ACMA	67	20
<i>Alnus rubra</i>	ALRU	56	12
<i>Understory trees</i>		89	10
<i>Tsuga heterophylla</i>	TSHE	89	7
<i>Picea sitchensis</i>	PISI	78	3
<i>Shrubs</i>		100	38
<i>Acer circinatum</i>	ACCI	100	34
<i>Rubus spectabilis</i>	RUSP	89	2
<i>Forbs and ferns</i>		100	83
<i>Polystichum munitum</i>	POMU	100	55
<i>Oxalis oregana</i>	OXOR	100	41
<i>Tiarella trifoliata</i>	TITR	100	3
<i>Galium triflorum</i>	GATR	100	1
<i>Athyrium filix-femina</i>	ATFI	100	1
<i>Claytonia siberica</i>	CLSI	89	2
<i>Mitella ovalis</i>	MIOV	89	1
<i>Blechnum spicant</i>	BLSP	89	1
<i>Stachys ciliata</i>	STCI	67	2
<i>Graminoids</i>		100	3
<i>Luzula parviflora</i>	LUPA	100	2
<i>Trisetum cernuum</i> var. <i>cernuum</i>	TRCE	89	1
<i>Carex deweyana</i>	CADE	67	2
<i>Moss</i>		100	51

Environment and Distribution:

This association occurs on mesic well-drained deep-soiled productive sites located on terraces in the upper end of the floodprone zone or above the floodprone zone of major streams with large floodplains. Sites sampled are middle to upper terraces that are infrequently or never flooded (median floodprone position index 1.2; 3-13 feet above bankfull). The most frequent soil texture was loam, with silt loam, sandy loam, and silty clay loam also recorded. Coarse fragments were typically absent in surface horizons as well as subsoils. These were deep loamy soils. Inferred nitrogen status was rich to very rich, with thin mull type forest floors. Typically there was very little to no bare ground exposed.

Valleys were broad to very broad, with very low to low gradients. Streams typically had major floodplain development (Rosgen type C, rarely E or B) and gravel or cobble beds. These were medium to very large streams (mean bankfull width 202 feet) with moderate to high sinuosity located in lower alluviated valleys and u-shaped glacial trough valleys. Floodprone zones ranged from 112 to 4000 feet wide. Surficial geology was typically alluvium or glacial drift. Mean annual precipitation ranged from 105 to 135 inches and elevation ranged from 50 to 600 feet.

Succession and Disturbance:

Most sampled stands were old-growth, with the youngest being 130 years old. These are mid-to late seral stands that are not expected to change much in their composition. This association can be considered the potential natural vegetation on the sites where it occurs. As stand development continues, western hemlock may gradually increase in importance on some sites. Bigleaf maple will likely persist for hundreds of years where it is present. Flooding is expected to occur very infrequently, if at all, on these sites. Elk have the potential to significantly influence this vegetation type, though their effects are less apparent than in some adjacent associations. Possible impacts include (1) largely excluding western redcedar (THPL) from the community, (2) limiting the importance of western hemlock, and (3) reducing the cover of salmonberry and sword fern in favor of forbs and graminoids.

Associated Vegetation:

The riparian types that most commonly occurred adjacent were Red Alder/Salmonberry (ALRU/RUSP) and Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP). Other adjacent communities included Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL), and Sitka Spruce-Red Alder/Skunkcabbage (PISI-ALRU/LYAM).

Similar Riparian Associations in this Classification:

The Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP) community has abundant black cottonwood or bigleaf maple and >10% cover of salmonberry. The Bigleaf Maple/Vine Maple (ACMA/ACCI) community has <20% overstory cover of Sitka spruce. The Sitka Spruce/Oregon Oxalis (PISI/OXOR) association has <10% cover of vine maple.

Relationship to Other Classifications:

This association is somewhat similar in composition and environment to the high terrace community described by Fonda (1974) from the Hoh River. A similar community was also described by Franklin and Dyrness (1973).

Sitka Spruce/Devils Club Forest Association
Picea sitchensis/Oplopanax horridus
PISI/OPHO

N=3 plots

Vegetation Composition and Structure:

This association is conifer forest, occasionally a mixed conifer-hardwood forest, with a moderate to dense shrub layer and a well-developed herbaceous layer. Moss cover is relatively high. The tree canopy is typically semi-open. The canopy is dominated by conifers, with smaller amounts of deciduous hardwoods sometimes present. The shrub layer is dominated primarily by medium-tall to tall deciduous shrubs. The herb layer is dominated by forbs and ferns.

The overstory tree layer is dominated by a mixture of western hemlock (TSHE) and Sitka spruce (PISI). Red alder (ALRU) is often present and occasionally co-dominant. Conifer regeneration is dominated by western hemlock, with lesser amounts of Sitka spruce. The shrub layer is dominated primarily by devils club (OPHO). Salmonberry (RUSP) and stink currant (RIBR) are usually present in substantial amounts also. Vine maple (ACCI) is sometimes co-dominant, forming a taller layer. Oval-leaf huckleberry (VAOV), red huckleberry (VAPA), and fools huckleberry (MEFE) are always present in small amounts. The herbaceous layer is dominated primarily by Oregon oxalis (OXOR) and sword fern (POMU). Other frequent herbs are coolwort foamflower (TITR), lady-fern (ATFI), coastal mitrewort (MIOV), deerfern (BLSP), youth-on-age (TOME), nodding trisetum (TRCE), spreading woodfern (DREX), small-flowered wood-rush (LUPA), western trillium (TROV), and pioneer violet (VIGL).

Species	Code	Constancy	Cover
Overstory trees			
<i>Tsuga heterophylla</i>	TSHE	100	53
<i>Picea sitchensis</i>	PISI	100	23
<i>Alnus rubra</i>	ALRU	67	16
Understory trees			
<i>Tsuga heterophylla</i>	TSHE	100	8
<i>Picea sitchensis</i>	PISI	67	2
Shrubs			
<i>Oplopanax horridus</i>	OPHO	100	30
<i>Rubus spectabilis</i>	RUSP	100	15
<i>Menziesia ferruginea</i>	MEFE	100	4
<i>Acer circinatum</i>	ACCI	67	35
<i>Ribes bracteosum</i>	RIBR	67	16
Forbs and ferns			
<i>Oxalis oregana</i>	OXOR	100	43
<i>Polystichum munitum</i>	POMU	100	27
<i>Tiarella trifoliata</i>	TITR	100	8
<i>Tolmiea menziesii</i>	TOME	100	6
<i>Mitella ovalis</i>	MIOV	100	4
<i>Athyrium filix-femina</i>	ATFI	100	4
<i>Blechnum spicant</i>	BLSP	100	4
Graminoids			
Moss			
		100	63

Environment and Distribution:

This association occurs on infrequently flooded terraces or gentle slopes with saturated or moist, deep, fine-textured rooting zones. Sites sampled were toeslopes or high terraces. Sites ranged from the upper end of the floodprone zone to well outside it. Surface soil horizons were loams and silty clay loam with few to no coarse fragments. A high water table, indicated by soil mottling, was typically present during the growing season at a depth of 35-60 cm. However, one plot with a deep homogeneous silty clay loam soil did not show evidence of a high water table. Inferred nitrogen status was moderate to rich, with moderately thick forest floors typically of moder type humus form. Typically there was little to no bare ground or rock exposed.

Valleys were narrow to very broad, with very low to moderate gradients. Streams had moderate to major floodplain development (Rosgen types B, C, and E) with gravel or cobble beds. These were small to large streams (bankfull width 12-225 feet) with low to high sinuosity located in moderate slope bound, incised moderate-gradient, and lower alluviated valleys. Surficial geology was variable. Mean annual precipitation ranged from 95 to 125 inches and elevation ranged from 60 to 500 feet.

Succession and Disturbance:

Sampled stands were all old-growth in age. Alders are younger where they are present and associated with small-scale disturbance. This association is the potential natural vegetation where it occurs.

Associated Vegetation:

The riparian types that occurred adjacent were Sitka Spruce/Oregon Oxalis (PISI/OXOR), Western Hemlock/Oregon Oxalis (TSHE/OXOR), Devils Club (OPHO), Red Alder/Salmonberry/Pacific Golden-saxifrage (ALRU/RUSP/CHGL), and Red Alder/Devils Club (ALRU/OPHO).

Similar Riparian Associations in this Classification:

The Western Hemlock/Devils Club (TSHE/OPHO) association has <5% cover of Sitka spruce.

Relationship to Other Classifications:

Similar vegetation has been described on the Olympic National Forest (Henderson et al. 1986) and in the Oregon Coast Range (Hemstrom and Logan 1986).

Sitka Spruce/Oregon Oxalis Forest Association
Picea sitchensis/Oxalis oregana
PISI/OXOR

N=4 plots

Vegetation Composition and Structure:

This association is a conifer forest, or occasionally a mixed conifer-deciduous hardwood forest, with a sparse shrub layer and a well-developed herbaceous layer. Moss cover is moderate to high. The tree canopy is typically relatively closed. The canopy is dominated by conifers, with smaller amounts of deciduous hardwoods sometimes present. The shrub layer is dominated primarily by low to medium deciduous shrubs. The herb layer is dominated by forbs and ferns.

The overstory tree layer is dominated by a mixture of western hemlock (TSHE) and Sitka spruce (PISI). Red alder (ALRU) or western redcedar (THPL) are often present but subordinate in importance. Bigleaf maple (ACMA) is occasionally important. Tree regeneration is dominated by western hemlock, with small amounts of Sitka spruce. The shrubs salmonberry (RUSP), red huckleberry (VAPA), oval-leaf huckleberry (VAOV), and fools huckleberry (MEFE) are typically present in small amounts. The herbaceous layer is dominated by Oregon oxalis (OXOR) and sword fern (POMU). Other frequent herbs are coolwort foamflower (TITR), lady-fern (ATFI), deerfern (BLSP), youth-on-age (TOME), spreading woodfern (DREX), small-flowered wood-rush (LUPA), western trillium (TROV), Smith's fairybells (DISM), bearded fescue (FESU), sweet-scented bedstraw (GATR), Siberian springbeauty (CLSI), beadruby (MADI), and Cooley's hedge-nettle (STCI).

Species	Code	Constancy	Cover
Overstory trees			
		100	85
<i>Tsuga heterophylla</i>	TSHE	100	58
<i>Picea sitchensis</i>	PISI	100	21
<i>Alnus rubra</i>	ALRU	50	20
<i>Thuja plicata</i>	THPL	50	13
<i>Acer macrophyllum</i>	ACMA	25	20
Understory trees			
		100	19
<i>Tsuga heterophylla</i>	TSHE	100	19
<i>Picea sitchensis</i>	PISI	100	2
Shrubs			
		100	7
<i>Rubus spectabilis</i>	RUSP	100	3
<i>Vaccinium parvifolium</i>	VAPA	100	2
Forbs and ferns			
		100	78
<i>Oxalis oregana</i>	OXOR	100	50
<i>Polystichum munitum</i>	POMU	100	35
<i>Blechnum spicant</i>	BLSP	100	6
<i>Tiarella trifoliata</i>	TITR	100	4
<i>Galium triflorum</i>	GATR	100	2
<i>Trillium ovatum</i>	TROV	75	3
Graminoids			
		100	7
<i>Luzula parviflora</i>	LUPA	100	4
<i>Bromus vulgaris</i>	BRVU	75	6
Moss			
		100	55

Environment and Distribution:

This association occurs on mesic sites not influenced by flooding that are located in smaller valleys. Sites sampled were toeslopes or high terraces above the floodprone zone. Soils were silt loam in texture with coarse fragments variable. Inferred nitrogen status was too rich to very rich, with relatively thin forest floors of moder or mull type humus form. Typically there was little to no bare ground or rock exposed.

Valleys were narrow to moderate in width, with low gradients. Streams had minimal to significant floodplain development (Rosgen type B most common, also A and C) with bedrock, gravel or cobble beds. These were small to medium streams (mean bankfull width 47 feet) with very low to moderate sinuosity located in moderate slope bound, incised moderate-gradient, and alluviated mountain valleys. Surficial geology was sedimentary bedrock. Mean annual precipitation ranged from 95 to 125 inches and elevation ranged from 100 to 480 feet.

Succession and Disturbance:

Sampled stands were all old-growth in age. Alders are younger where they are present and associated with small-scale disturbance. This association is the potential natural vegetation where it occurs.

Associated Vegetation:

The riparian types that occurred adjacent were Devils Club (OPHO), Red Alder/Salmonberry (ALRU/RUSP), Red Alder/Devils Club (ALRU/OPHO), Red Alder-Sitka Spruce/Salmonberry (ALRU-PISI/RUSP), and Colts Foot (PEFR).

Similar Riparian Associations in this Classification:

The Western Hemlock/Oregon Oxalis (TSHE/OXOR) association has <5% cover of Sitka spruce. The Sitka Spruce/Vine Maple (PISI/ACCI) association has >10% cover of vine maple.

Relationship to Other Classifications:

This association has been described as PISI/POMU-OXOR in the Olympic National Forest (Henderson et al. 1989) and PISI/OXOR on the Olympic Experimental State Forest (Bigley and Hull 1995). The latter included two plots that would probably be classified as PISI/ACCI in this classification.

Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry Forest Community
Populus balsamifera spp. trichocarpa-Acer macrophyllum-Picea sitchensis/Rubus spectabilis
POTR-ACMA-PISI/RUSP **N=6 plots**

Vegetation Composition and Structure:

This association is a mixed hardwood-conifer or a nearly pure deciduous hardwood forest with a typically moderate shrub layer and a well-developed herbaceous layer. Moss cover is moderate. The tree canopy is semi-open to closed. The upper canopy is typically dominated by deciduous trees. A well-developed middle canopy layer is most often dominated by a mix of conifers and hardwoods, though the conifers are occasionally low in importance. The shrub layer is dominated by deciduous medium to tall shrubs. The herb layer can be dominated by ferns or forbs, with graminoids typically less prominent.

The overstory tree layer is dominated by a somewhat variable mixture of black cottonwood (POTR), bigleaf maple (ACMA), Sitka spruce (PISI), and red alder (ALRU). Cottonwoods are typically the tallest trees. Cottonwood or maple are occasionally absent. Sitka spruce dominates tree regeneration. The shrub layer is typically dominated by salmonberry (RUSP) or a mixture of it and vine maple (ACCI). The herbaceous layer is dominated by a variable mixture of sword fern (POMU), Oregon oxalis (OXOR), or youth-on-age (TOME). Several other forbs or graminoids are frequent or occasionally co-dominant including lady-fern (ATFI), coastal mitrewort (MIOV), Cooley's hedge-nettle (STCI), Siberian springbeauty (CLSI), rough-stalk bluegrass (POATRI), creeping buttercup (RARE), and Dewey's sedge (CADE).

Species	Code	Constancy	Cover
Overstory trees			
<i>Picea sitchensis</i>	PISI	100	26
<i>Populus balsamifera spp. trichocarpa</i>	POTR	100	22
<i>Alnus rubra</i>	ALRU	83	21
<i>Acer macrophyllum</i>	ACMA	67	42
Understory trees			
<i>Picea sitchensis</i>	PISI	83	7
Shrubs			
<i>Rubus spectabilis</i>	RUSP	100	34
<i>Acer circinatum</i>	ACCI	67	19
<i>Symphoricarpos albus</i>	SYAL	50	4
Forbs and ferns			
<i>Tolmiea menziesii</i>	TOME	100	24
<i>Oxalis oregana</i>	OXOR	100	19
<i>Stachys ciliata</i>	STCI	100	6
<i>Polystichum munitum</i>	POMU	83	48
<i>Mitella ovalis</i>	MIOV	83	7
<i>Athyrium filix-femina</i>	ATFI	83	3
<i>Ranunculus repens</i>	RARE	67	7
Graminoids			
<i>Carex deweyana</i>	CADE	100	3
<i>Poa trivialis</i>	POATRI	67	5
Moss		100	27

Environment and Distribution:

This association occurs on mesic well-drained productive sites located typically within but near the upper end of the floodprone zone of major streams with large floodplains. Sites sampled are middle to upper terraces that are infrequently flooded (median floodprone position index .85; 3-9 feet above bankfull). The most frequent soil texture was loam, with silt loam, fine sandy loam, and silty clay loam also recorded. Coarse fragments were absent in surface horizons. Subsoils were often more coarse in texture than surface horizons with coarse fragments prominent. Inferred nitrogen status was rich to very rich, with thin mull type (less commonly moder) forest floors. Typically there was some bare ground exposed, always less than 10% of each plot.

Valleys were broad to very broad, with very low to low gradients. Streams had major floodplain development (Rosgen type C) and gravel or cobble beds. These were large to very large streams (mean bankfull width 288 feet) with moderate to high sinuosity located in lower alluviated valleys. Floodprone zones ranged from about 400 to 4000 feet wide. Surficial geology was typically alluvium, though at two sites it was mapped as glacial drift. Mean annual precipitation ranged from 105 to 135 inches and elevation ranged from 50 to 300 feet.

Succession and Disturbance:

Sampled stands ranged in age from 70 to 130 years old. These appear to be mid-seral stands that are becoming more conifer-dominated as time passes without major disturbance. In the absence of major disturbance the potential vegetation is probably the Sitka Spruce/Vine Maple (PISI/ACCI) association. Black cottonwood and red alder are dying out in these stands and can be expected to disappear without another major disturbance. Bigleaf maple will likely persist for hundreds of years where it is present. Flooding is expected to occur infrequently on these sites, perhaps once every 10-50 years. Elk are a major influence within this vegetation type, and the understory composition typically reflects the severity of elk use. Where elk use is more severe, cover of salmonberry and sword fern is reduced and cover of graminoids and forbs is favored. Exotic species, especially creeping buttercup (RARE) and grasses, are more prominent where elk use is heavy.

Associated Vegetation:

The riparian types that most commonly occurred adjacent were Sitka Spruce/Vine Maple (PISI/ACCI), Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL), and Red Alder/Salmonberry (ALRU/RUSP). Other adjacent communities included Sitka Willow/Field Horsetail (SASI/EQAR), Red Alder/Salmonberry/Slough Sedge-Skunkcabbage (ALRU/RUSP/CAOB-LYAM), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Sitka Spruce/Devils Club (PISI/OPHO), and Small-fruited Bulrush (SCMI).

Similar Riparian Associations in this Classification:

The Red Alder/Salmonberry (ALRU/RUSP) and Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL) communities have very little to no black cottonwood or bigleaf maple. The Sitka Spruce/Vine Maple (PISI/ACCI) association has very little to no black cottonwood or salmonberry, and typically has more Sitka spruce.

Relationship to Other Classifications:

This association is similar in composition and environment to the low terrace community described by Fonda (1974) from the Hoh River. The community Fonda describes appears to be more heavily impacted by elk and therefore has less salmonberry and sword fern, and greater

dominance of forbs, graminoids, and exotic species than POTR-ACMA-PISI/RUSP. Fonda's samples were from within Olympic National Park, where elk populations are very high.

Western Hemlock/Devils Club Forest Association
Tsuga heterophylla/Oplopanax horridus
TSHE/OPHO

N=3 plots

Vegetation Composition and Structure:

This association is a conifer forest, with a moderately dense shrub layer and a well-developed herbaceous layer. Moss cover is relatively high. The tree canopy is typically semi-open. The canopy is dominated by conifers. The shrub layer is dominated primarily by medium-tall deciduous shrubs. The herb layer is dominated by forbs and ferns.

The overstory tree layer is dominated by western hemlock (TSHE) or a mixture of it and western redcedar (THPL). Sitka spruce (PISI) is occasionally present in small amounts. Conifer regeneration is dominated by western hemlock, with lesser amounts of western redcedar. The shrub layer is dominated by devils club (OPHO). Salmonberry (RUSP), oval-leaf huckleberry (VAOV), red huckleberry (VAPA), salal (GASH), and fools huckleberry (MEFE) are always present in smaller amounts. The herbaceous layer is dominated by Oregon oxalis (OXOR) and sword fern (POMU). Deerfern (BLSP) is also abundant, but of secondary importance. Other frequent herbs include coolwort foamflower (TITR), lady-fern (ATFI), youth-on-age (TOME), small-flowered wood-rush (LUPA), western trillium (TROV), and sweet-scented bedstraw (GATR).

Species	Code	Constancy	Cover
Overstory trees		100	73
<i>Tsuga heterophylla</i>	TSHE	100	63
<i>Thuja plicata</i>	THPL	33	30
Understory trees		100	8
<i>Tsuga heterophylla</i>	TSHE	100	8
Shrubs		100	53
<i>Oplopanax horridus</i>	OPHO	100	41
<i>Rubus spectabilis</i>	RUSP	100	7
<i>Vaccinium parvifolium</i>	VAPA	100	5
<i>Gaultheria shallon</i>	GASH	100	2
<i>Menziesia ferruginea</i>	MEFE	100	2
Forbs and ferns		100	83
<i>Oxalis oregana</i>	OXOR	100	53
<i>Polystichum munitum</i>	POMU	100	27
<i>Blechnum spicant</i>	BLSP	100	16
<i>Tiarella trifoliata</i>	TITR	100	8
<i>Tolmiea menziesii</i>	TOME	100	6
<i>Galium triflorum</i>	GATR	100	2
<i>Trillium ovatum</i>	TROV	100	2
<i>Boykinia occidentalis</i>	BOOC	67	7
Graminoids		100	12
<i>Luzula parviflora</i>	LUPA	100	2
<i>Trisetum cernuum</i> var. <i>cernuum</i>	TRCE	67	2
<i>Bromus vulgaris</i>	BRVU	33	20
Moss		100	63

Environment and Distribution:

This associations occurs on steep toeslopes with subsurface irrigation/saturation perched above impermeable soil layers. Sites sampled were all toeslopes. Sites were well outside the floodprone zone. Surface soil horizons were silt loams and silty clay loam with abundant coarse fragments. Bedrock or other impermeable layers were present at a depth of 40-60 cm, with subsurface irrigation perched above this layer. Inferred nitrogen status was moderate to rich, with moderately thick forest floors typically of moder type humus form. Typically there was a small amount of bare ground and gravel or rock exposed.

Valleys were narrow to moderate in width, with low to high gradients. Streams had very little to moderate floodplain development (Rosgen types B, E, and F) with bedrock, gravel or cobble beds. These were small streams (mean bankfull width 21 feet) with low to moderate sinuosity located in incised moderate-gradient valleys and valley wall tributaries. Surficial geology was sedimentary bedrock or, less commonly, glacial drift. Mean annual precipitation ranged from 95 to 135 inches and elevation ranged from 300 to 760 feet.

Succession and Disturbance:

Sampled stands were all old-growth in age. This association is the potential natural vegetation where it occurs.

Associated Vegetation:

The riparian types that occurred adjacent were Sitka Spruce/Oregon Oxalis (PISI/OXOR), Western Hemlock/Oregon Oxalis (TSHE/OXOR), Red Alder/Salmonberry (ALRU/RUSP), and Stink Currant-Salmonberry (RIBR-RUSP). The upland association Western Hemlock/Salal (TSHE/GASH) (Bigley and Hull 1995) also occurred adjacent.

Similar Riparian Associations in this Classification:

The Sitka Spruce/Devils Club (PISI/OPHO) association has >5% cover of Sitka spruce.

Relationship to Other Classifications:

This association is similar to that described from many areas of western Washington, including the Olympic National Forest (Henderson et al. 1989).

SHRUBLAND TYPES

Sitka Willow/Field Horsetail Shrubland Community

N=6 plots

Salix sitchensis/Equisetum arvense

SASI/EQAR

Vegetation Composition and Structure:

This community is a tall deciduous shrubland with a sparse herbaceous layer. Moss cover is sparse. The tall shrub layer is typically semi-open to closed and range in height from 5 to 45 feet in this sample. Regenerating deciduous hardwood trees are present and often occupy considerable cover (mean 22%). They are typically about as tall as the tall shrubs, though are sometimes somewhat taller. The herb layer is dominated by graminoids and forbs. A sparse low to medium shrub layer is sometimes present.

The shrub layer is completely dominated by Sitka willow (SASI). Regenerating trees are primarily red alder (ALRU), with small amounts of black cottonwood (POTR) or Pacific willow (SALU) sometimes present. Salmonberry (RUSP) is frequent as a low shrub but low in cover. The herbaceous layer is typically not dominated by a single species but consists of a variable mixture of exotic and native species. The most important include field horsetail (EQAR), bentgrass (*Agrostis*), creeping buttercup (RARE), common velvetgrass (HOLA), Dewey's sedge (CADE), slender hairgrass (DEEL), wall lettuce (MYMU), colts foot (PEFR), and Cooley's hedge-nettle (STCI).

Species	Code	Constancy	Cover
Overstory trees		17	13
<i>Populus balsamifera</i> spp. <i>trichocarpa</i>	POTR	17	13
<i>Salix lucida</i> ssp. <i>lasiandra</i>	SALU	17	3
Understory trees		100	22
<i>Alnus rubra</i>	ALRU	83	22
<i>Salix lucida</i> ssp. <i>lasiandra</i>	SALU	50	4
<i>Populus balsamifera</i> spp. <i>trichocarpa</i>	POTR	33	11
Shrubs		100	82
<i>Salix sitchensis</i>	SASI	100	82
<i>Rubus spectabilis</i>	RUSP	83	2
<i>Rubus ursinus</i>	RUUR	50	1
Forbs and ferns		100	10
<i>Equisetum arvense</i>	EQAR	83	2
<i>Ranunculus repens</i>	RARE	83	2
<i>Mycelis muralis</i>	MYMU	83	2
<i>Stachys ciliata</i>	STCI	67	3
<i>Oxalis oregana</i>	OXOR	67	1
<i>Petasites frigidus</i>	PEFR	50	4
Graminoids		100	9
<i>Agrostis</i> spp.	AGROST	83	5
<i>Holcus lanatus</i>	HOLA	67	7
<i>Carex deweyana</i>	CADE	67	1
<i>Deschampsia elongata</i>	DEEL	50	3
Moss		100	8

Environment and Distribution:

This community occurs on very well-drained, frequently flooded sites in alluviated valleys. Sites sampled included depositional bars, floodplains, and channel shelves (lower streambanks) located low in the floodprone zone or high in the bankfull zone (median floodprone position index .19; 3 feet below to 4 feet above bankfull). Soil textures were all loamy sand, with coarse fragments absent to abundant. Subsoils typically had abundant coarse fragments at a depth of 40 cm or less. Inferred nitrogen status was moderate to rich, with non-existent to thin litter layers. This association typically had considerable exposed bare ground, gravel, and/or cobble at the surface, more than any other association. The water table probably remains high enough during the growing season to keep the rooting zone moist, despite high permeability of the soils.

Valleys were very broad to (infrequently) moderate in width, with very low to low gradients. Streams all had significant floodplain development (Rosgen type C) and had gravel or cobble beds. These were medium-sized to very large streams (bankfull width 61-450 feet) with moderate to high sinuosity located primarily in lower alluviated valleys (one in alluviated mountain valley). Surficial geology was typically mapped as alluvium, less commonly glacial drift. Mean annual precipitation ranged from 117 to 135 inches and elevation ranged from 50 to 500 feet.

Succession and Disturbance:

Sampled stands were all 15 years or younger in age. These are very early seral stands that may have two alternative successional pathways. One pathway is probably seral to the Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL) community and would be expected where flooding occurs once every few years. Another pathway is maintenance of SASI dominance on sites where annual or nearly annual flooding occurs. Periodic deposition of sediments in the absence of a major scouring event could lead to a gradual rising of the elevation of the surface, thus changing the site type and facilitating succession to alder. Elk browsing is likely to decrease or eliminate cottonwood regeneration.

Associated Vegetation:

The riparian type that most commonly occurred adjacent was Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL). Others were Black Cottonwood-Bigleaf Maple-Sitka Spruce/Salmonberry (POTR-ACMA-PISI/RUSP) and Red Alder/Salmonberry (ALRU/RUSP).

Similar Riparian Associations in this Classification:

The Red Alder/Trailing Blackberry/Blue Wildrye (ALRU/RUUR/ELGL) community is dominated by red alder rather than Sitka willow. Very young examples of that association can otherwise resemble SASI/EQAR.

Relationship to Other Classifications:

This association is similar to the Sitka Willow (SASI) community described on the Gifford Pinchot and Mt. Hood National Forests (Diaz and Mellen 1996).

Devils Club Shrubland Association
Oplopanax horridus
OPHO

Vegetation Composition and Structure:

This association is a medium-tall deciduous shrubland with a well-developed herbaceous layer. Moss cover is very well-developed. The tall shrub layer is typically relatively closed and ranges in height from 7 to 10 feet in this sample. Small regenerating conifer trees are typically present but occupy very little cover and are confined to coarse woody debris. The dense herb layer is dominated primarily by forbs, with graminoids averaging 18% cover.

The shrub layer is dominated by devils club (OPHO). Salmonberry (RUSP) and stink currant (RIBR) are always present and contribute significant cover (mean 11-15%). The few regenerating trees are primarily western hemlock (TSHE). The herb layer is typically dominated by youth-on-age (TOME) and Oregon oxalis (OXOR), though several other species collectively contribute significant cover, including sword fern (POMU), lady-fern (ATFI), deerfern (BLSP), Columbia brome (BRVU), enchanter's nightshade (CIAL), bearded fescue (FESU), sweet-scented bedstraw (GATR), coastal mitrewort (MIOV), Siberian springbeauty (CLSI), Cooley's hedge-nettle (STCI), clasping-leaved twisted-stalk (STAM), coolwort foamflower (TITR), and pioneer violet (VIGL).

Species	Code	Constancy	Cover
Overstory trees		25	13
<i>Alnus rubra</i>	ALRU	25	13
Understory trees		100	4
<i>Tsuga heterophylla</i>	TSHE	100	2
Shrubs		100	87
<i>Oplopanax horridus</i>	OPHO	100	70
<i>Rubus spectabilis</i>	RUSP	100	15
<i>Ribes bracteosum</i>	RIBR	100	11
<i>Acer circinatum</i>	ACCI	25	20
Forbs and ferns		100	88
<i>Tolmiea menziesii</i>	TOME	100	20
<i>Polystichum munitum</i>	POMU	100	12
<i>Galium triflorum</i>	GATR	100	7
<i>Tiarella trifoliata</i>	TITR	100	7
<i>Athyrium filix-femina</i>	ATFI	100	6
<i>Blechnum spicant</i>	BLSP	100	4
<i>Stachys ciliata</i>	STCI	100	4
<i>Oxalis oregana</i>	OXOR	75	43
<i>Circaea alpina</i>	CIAL	75	10
<i>Mitella ovalis</i>	MIOV	75	10
<i>Claytonia siberica</i>	CLSI	75	7
<i>Adiantum pedatum</i>	ADPE	50	10
Graminoids		100	19
<i>Festuca subulata</i>	FESU	100	10
<i>Bromus vulgaris</i>	BRVU	100	6
Moss		100	73

Environment and Distribution:

This association occurs on sites with a saturated rooting zone due to seepage or flooding combined with a moderately high water table or impermeable bedrock. Sites sampled included floodplains, terraces, and steep wet slumps. Terrace and floodplain sites varied from somewhat low to somewhat high in the floodprone zone (mean floodprone position index .59; 0.7-2 feet above bankfull). Soil textures varied considerably, from silty clay loam to sandy loam, with few to very abundant coarse fragments. Soils were saturated at some point within the rooting zone due to high water table or subsurface irrigation perched above bedrock (mean depth to mottles or bedrock 50 cm). Inferred nitrogen status was rich, with thin to moderately thick litter/fragmentation/humus layers. Where coarse fragments were abundant, there was considerable gravel and cobble exposed at the surface.

Valleys were narrow to moderate in width, with low to moderate gradients. Streams had minimal to moderate floodplain development (Rosgen types A, B, C, E) and had bedrock or gravel beds. These were smaller streams (bankfull width 12-37 feet) with low to no sinuosity located in incised moderate-gradient and moderate slope bound valleys. Surficial geology was typically sedimentary bedrock, less commonly glacial drift. Mean annual precipitation ranged from 95 to 125 inches and elevation ranged from 200 to 500 feet.

Succession and Disturbance:

This association is unlikely to be seral to other types due to the saturated soils and/or frequent flooding. Occasionally, if there is a significant source of large conifer logs for tree seedling establishment, this association could succeed to either the Western Hemlock/Devils Club (TSHE/OPHO) or Sitka Spruce/Devils Club (PISI/OPHO) association.

Associated Vegetation:

The riparian types that most occurred adjacent were Sitka Spruce/Devils Club (PISI/OPHO), Sitka Spruce/Oregon Oxalis (PISI/OXOR), Red Alder-Sitka Spruce/Skunkcabbage (ALRU-PISI/LYAM), and Red Alder/Devils Club (ALRU/OPHO). Upland associations that occurred adjacent included Western Hemlock/Fools Huckleberry-Deerfern (TSHE/MEFE-BLSP) and Pacific Silver Fir/Salal-Oregon Oxalis (ABAM/GASH-OXOR) (Bigley and Hull 1995).

Similar Riparian Associations in this Classification:

The Sitka Spruce/Devils Club (PISI/OPHO) and the Western Hemlock/Devils Club (TSHE/OPHO) associations are woodlands or forests dominated by conifer trees.

Relationship to Other Classifications:

This association is similar to the Devils Club (OPHO) association described on the Gifford Pinchot and Mt. Hood National Forests (Diaz and Mellen 1996), but has a somewhat different composition in the herbaceous layer.

OTHER TYPES SAMPLED

The following is a list of communities with only one or two plots sampled and brief reference to similar types.

Pacific Silver Fir/Salal/Skunkcabbage Forest

Abies amabilis/Gaultheria shallon/Lysichiton americanus

Same as Olympic Experimental State Forest association (Bigley and Hull 1995)

Bigleaf Maple/Vine Maple Forest

Acer macrophyllum/Acer circinatum

Previously described for rainforest valleys (Franklin and Dyrness 1973)

Bigleaf Maple/Trailing Blackberry/Blue Wildrye Forest

Acer macrophyllum/Rubus ursinus/Elymus glaucus

Red Alder/Devils Club Forest

Alnus rubra/Oplopanax horridus

Similar to that described by Diaz and Mellen (1996)

Red Alder/Oregon Oxalis Forest

Alnus rubra/Oxalis oregana

Red Alder/Sword Fern Forest

Alnus rubra/Polystichum munitum

Red Alder-Sitka Spruce/Salmonberry Forest

Alnus rubra-Picea sitchensis/Rubus spectabilis

Lady-fern Herbaceous Vegetation

Athyrium filix-femina

Slough Sedge Herbaceous Vegetation

Carex obnupta

Similar to that described by Kunze (1994)

Pacific Water-parsley Herbaceous Vegetation

Oenanthe sarmentosa

Colts Foot Herbaceous Vegetation

Petasitis frigidus

Similar to that described by Diaz and Mellen (1996)

Pacific Ninebark Shrubland

Physocarpus capitatus

Sitka Spruce/Slough Sedge-Skunkcabbage Forest

Picea sitchensis/Carex obnupta-Lysichiton americanus

Similar to PISI-ALRU/RUSP/CAOB and PISI-ALRU/LYAM described by Kunze (1994)

Black Cottonwood-Sitka Spruce/Sword Fern Forest
Populus balsamifera spp. *trichocarpa*-*Picea sitchensis*/*Polystichum munitum*

Stink Currant-Salmonberry Shrubland
Ribes bracteosum-*Rubus spectabilis*
Similar to RIBR-RUSP/OXALIS and RIBR-RUSP/TOME communities described by Diaz and Mellen (1996)

Thimbleberry Shrubland
Rubus parviflorus

Sitka Willow/Salmonberry Shrubland
Salix sitchensis/*Rubus spectabilis*

Small-flowered Bulrush Herbaceous Vegetation
Scirpus microcarpus
Similar to that described by Diaz and Mellen (1996)

Western Hemlock/Salal/Oregon Oxalis Forest
Tsuga heterophylla/*Gaultheria shallon*/*Oxalis oregana*
Similar to associations on Olympic Experimental State Forest (Bigley and Hull 1995) and Olympic National Forest (Henderson et al. 1989)

Western Hemlock/Fools Huckleberry/Deerfern Forest
Tsuga heterophylla/*Menziesia ferruginea*/*Blechnum spicant*
Similar to that described on Olympic Experimental State Forest (Bigley and Hull 1995)

Western Hemlock/Oregon Oxalis Forest
Tsuga heterophylla/*Oxalis oregana*
Similar to TSHE/OXOR-DRAU2 on Olympic Experimental State Forest (Bigley and Hull 1995) and TSHE/OXOR on Olympic National Forest (Henderson et al. 1989)

REFERENCES

- Bigley, R., and S. Hull. 1995. Draft guide to plant associations on the Olympic State Experimental Forest. Wash. Dept. of Natural Resources.
- Diaz, N. M., and T. K. Mellen. 1996. Riparian ecological types - Gifford Pinchot and Mt. Hood National Forests, Columbia River Gorge National Scenic Area. U.S.D.A. Forest Service, Pac. Northwest Region. R6-NR-TP-10-96.
- Fonda, R. W. 1974. Forest succession in relation to river terrace development in Olympic National Park, Washington. *Ecology* 55(5):927-942.
- Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. U.S.D.A. Forest Service Gen. Tech. Rep. PNW-8.
- Green, R. N., and K. Klinka. 1994. A field guide to site identification and interpretation for the Vancouver forest region. Ministry of Forests, Research Branch, Victoria, B.C.
- Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bougeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Vol. 1. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, VA.
- Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Forest and Cons. Exp. Sta., School of Forestry, Univ. of Montana, Missoula, MT. Misc. Publ. No. 54.
- Hemstrom, M. A., and S. E. Logan. 1986. Plant association and management guide Siuslaw National Forest. U.S.D.A. Forest Service, Pac. Northwest Region. R6 ECOL 220-1986a.
- Henderson, J. A. 1978. Plant succession on the *Alnus rubra/Rubus spectabilis* habitat type in western Oregon. *Northwest Science* 52(3):156-167.
- Henderson, J., D. Peter, and R. Leshner. 1986. Preliminary plant associations of the Olympic National Forest. U.S.D.A. Forest Service, Pac. Northwest Region, Olympic National Forest.
- Henderson, J. A., D. H. Peter, R. D. Leshner, and D. C. Shaw. 1989. Forested plant associations of the Olympic National Forest. U.S.D.A. Forest Service, Pac. Northwest Region. R6 ECOL Tech. Paper 001-88.
- Hitchcock, C. L., and A. Cronquist. 1973. Flora of the Pacific Northwest: an illustrated manual. Univ. of Wash. Press, Seattle, WA.
- Kartesz, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Second ed. Volume 1. Checklist. Timber Press, Portland,

OR.

Kovalchik, B. L. 1987. Riparian zone associations - Deschutes, Ochoco, Fremont, and Winema National Forests. U.S.D.A. Forest Service, Pac. Northwest Region. R6 ECOL TP-279-87.

Kunze, L. M. 1994. Preliminary classification of native, low elevation, freshwater wetland vegetation in western Washington. Washington Natural Heritage Program, Dept. of Natural Resources, Olympia, WA.

Naiman, R. J., and R. E. Bilby, eds. 1998. River ecology and management: lessons from the Pacific coastal ecoregion. Springer-Verlag, New York.

Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

APPENDIX. Synonymy of species names used in text between Kartesz (1994) and Hitchcock and Cronquist (1973).

Kartesz 1994

Agrostis stolonifera
Boykinia occidentalis
Claytonia siberica
Dryopteris expansa
Lysichiton americanus
Mycelis muralis
Oplopanax horridus
Populus balsamifera spp. *trichocarpa*
Salix lucida ssp. *lasiandra*
Stachys ciliata
Vaccinium ovalifolium

Hitchcock & Cronquist 1973

Agrostis alba
Boykinia elata
Montia sibirica
Dryopteris austriaca
Lysichiton americanum
Lactuca muralis
Oplopanax horridum
Populus trichocarpa
Salix lasiandra
Stachys cooleyae
Vaccinium alaskaense, ovalifolium

Common name

creeping bentgrass
 coastal brookfoam
 Siberian springbeauty
 spreading woodfern
 skunkcabbage
 wall lettuce
 devils club
 black cottonwood
 Pacific willow
 Cooley's hedge-nettle
 oval-leaf huckleberry