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ECOLOGICAL INVENTORY OF KLONDIKE GOLD RUSH NATIONAL HISTORICAL PARK AND ADJACENT NATIONAL FOREST LANDS

By
S.J. Paustian, S.J. Trull, R.A. Foster, N.D. Atwood,
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Completed under Interagency Agreement between
USDI National Park Service, Alaska Regional Office and
USDA Forest Service, Tongass National Forest, Chatham Area

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EXECUTIVE SUMMARY

Existing descriptions of the natural environment of the Klondike Gold Rush National Historical Park (KLGO) and adjacent Tongass National Forest lands in Skagway, Alaska, were generalized and limited. Consequently, the Chatham Area of the Tongass National Forest, USDA Forest Service, and the Klondike Gold Rush National Historical Park of the Alaska Region, USDI National Park Service, formed an interagency agreement to conduct an integrated resource inventory for the area. Information gained under this cooperative project may be used by both agencies for research and management purposes. The information was provided to KLGO in the Klondike Gold Rush National Historical Park Ecological Reconnaissance Inventory Final Report, March 1994. This document serves to provide the same information to Forest Service readers.

This report summarizes field work and analyses and provides a reconnaissance level, ecological inventory for (KLGO) and adjacent Tongass National Forest lands. During field work in July-August 1993, 49 locations were sampled for soil and vegetation characterization and eight locations for stream characterization by a USDA Forest Service interdisciplinary team.

The Chilkoot and White Pass Units of KLGO were mapped for terrestrial ecological units based on field work and aerial photograph interpretation. One estuarine unit was mapped for the nonforested Dyea Flats area. In the valley bottom, four floodplain, alluvial fan, and footslope units were mapped, differing by landform, soil, vegetation type, disturbance frequency, and dissection. On the mountainslopes, nine units were mapped, differing by landform, slope, soil, dissection, and vegetation type. In the alpine zone, three terrestrial ecological units were found in the Park: rugged summits, rounded summits, and glaciers. The map units are described in detail in the report, and locations are shown on Figures 2, 4, and 6.

The Chilkoot and White Pass Units were also mapped for channel type. Seven channel type process groups were found in the Park, with 18 specific channel types varying from narrow, bedrock walled, and steep gradient mountainslope streams to wide, shallow, and slow moving, floodplain streams. Information on channel morphology and hydraulics, aquatic habitat units, water chemistry, fish species, and aquatic macroinvertebrate communities is presented. The channel types are described in detail in the report, and locations are shown on Figures 3, 5, and 7.

In addition to mapping the terrestrial and aquatic units in KLGO, the team conducted a botanical survey. Both vascular and nonvascular plants were collected, identified, and processed for addition to the KLGO herbarium. A list of all plants collected by the project botanist, recorded by terrestrial sampling teams, or identified as occurring in the area from collections made in the 1960s is included in this report. A total of 374 plants were identified as occurring in KLGO: 12 trees, 44 shrubs, 173 forbs, 15 ferns and fern allies, 52 grasses and grass-like plants, 16 mosses, and 62 lichens. There are certainly additional species in the Park, which would be found in a more comprehensive survey. Lichens collected in the Park may include some species previously unreported for Southeast Alaska (but not necessarily rare, since comprehensive lichen surveys have not been completed for Alaska). Plant communities and associations sampled during field work are described in the report, with information presented on species composition, abundance, and structure.

Recommendations for future research and monitoring in the Park are also presented.

ACKNOWLEDGEMENTS

This project was conducted under an interagency agreement (IA 9700-2-9024) between the Chatham Area of the Tongass National Forest, USDA Forest Service, and the Klondike Gold Rush National Historical Park of the Alaska Region, USDI National Park Service. The assistance of Park personnel Peter Cleary, Christy Colburn, Dale Gosnell, Gretchen Guidotti, David Hayes, Amy Orenstein, and Nancy Schave during the field work phase, and Bruce Reed throughout the project, was invaluable. Jeff Mow and Debbie Sanders assisted with logistical planning and plant collection planning respectively. Lyman Thorsteinson in the Anchorage Office provided guidance and support throughout the project. The Park Service provided funding for much of the project.

Plant identification was accomplished by Dr. George Argus (willows), Dr. Duane Atwood, Mary Stensvold, and Dr. Stanley Welsh (vascular plants), Kitty LaBounty (mosses and liverworts), and Dr. Larry St.Clair (lichens). Mary Stensvold also assisted with planning, logistics, and funding. Kaye Thorne, Assistant Curator of Brigham Young University Herbarium, was responsible for vascular plant herbarium sheet preparation.

Forest Service volunteers and seasonal employees Matthew Barmann, Tom Hardy, Eric Marohn, Katy McLeod, and Mark Parr assisted with field work and data entry. Nida Crumley completed the digitizing for GIS map layers.

Among the authors, Steve Paustian prepared the aquatic resources sections, including the aquatic ecological unit descriptions, and completed the channel type mapping; Sue Trull prepared various introductory sections, the vegetation sections, and the wildlife list, and was responsible for compilation, formatting, and editing of the report; Rick Foster prepared the climate, soils, and geology sections, including the map unit descriptions, and completed the terrestrial unit mapping; Duane Atwood was responsible for collecting plants and coordinating plant identification and preparation of herbarium sheets as well as preparing the vascular plant list; Brad Krieckhaus prepared the glossary, literature cited section, and assisted with mapping; and John Rickers supervised data entry and analysis, coordinated GIS work, and prepared the ecological unit and channel type figures.

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INTRODUCTION

Purpose and Objectives

In July, 1992, the USDI National Park Service (NPS) and the USDA Forest Service (USFS) signed an interagency agreement to conduct a reconnaissance level inventory at the Klondike Gold Rush National Historical Park (KLGO) in Skagway, Alaska. The policy of the NPS is to assemble baseline inventory data describing the natural resources under its stewardship, and to monitor these resources forever; to detect or predict changes that may require intervention; and to provide reference points for comparison with other, more altered environments (Management Policies of the NPS IV-4 1988). In response to this policy, the project was intended to establish basic inventory information about the species and plant communities of KLGO. The principal objectives of the project are as follows:

1. To inventory and characterize the major plant communities and their dominant habitat associations;

2. To provide a preliminary assessment of the successional status and condition of major ecosystems;

3. To provide technical advice toward developing a long-term monitoring program for use by Park staff;

4. To collect and prepare rare specimens for the Park's herbarium;

5. To prepare reconnaissance-level landform maps delineating major ecozones, climatic changes, and describing major soils, plant associations, and aquatic regimes for KLGO utilizing Park base maps.

Setting

Geology, Geomorphology, and Soils

KLGO lies within the Coast Range batholith of southeastern Alaska. Geology of the Park can be separated into bedrock and surficial geology. The bedrock geology consists mainly of granitics which were determined during this inventory. The Park does not have published geologic maps, but based on surrounding areas that have been mapped, the granitics are of the Late Jurassic and Early Cretaceous periods (Gilbert, 1988; Callahan, 1965) and are dominated by granodiorite. Bedrock is expressed in the rock outcrop areas of the alpine and broken mountainslopes. It also underlies the surficial deposits of the mountainslopes.

The surficial geology consists of Quaternary glacial ice and colluvial, residual, and alluvial deposits. These deposits are mostly derived from granitics and have been accumulating and reworked since the retreat of the glaciers. Some glaciomarine deposits occur in the uplifted estuary (Dyea). The ice is in the glaciers and ice fields. The colluvial deposits generally occur at the base or footslopes of the mountainslopes. They are formed by materials washing down the mountainslopes or by gravity or both. Residual deposits occur on the mountainslopes and are formed by materials weathering in place. Alluvial deposits occur on the alluvial fans and floodplains.

Geomorphology deals with the geologic processes that helped shape the current topography. Continental glaciation, specifically the Cordilleran ice sheet, covered the entire Park area over 10,000 years ago. Since that time, glaciers have retreated, leaving remnant alpine glaciers, typical U-shaped valleys, and scoured alpine summits. Glacial deposits left on the mountainslopes have since been washed downslope to form colluvial footslope

and floodplain landforms. Floodplain deposits have been extensively reworked by historic and present day floodwaters. Present day processes shaping the area include fluvial erosion, mass wasting, tectonism, and isostatic rebound (the earth's land mass rebounding upwards after removal of the weight of the glacial ice with retreat).

Soils in the Park generally fall within the same groups as soils mapped throughout the Chatham Area of the Forest Service. Soils are generally drier in the Park, primarily due to the lower precipitation for the Skagway area compared to the rest of Southeast Alaska. Alpine areas, however, receive sufficient snow and rain to directly correlate with soils in other Southeast Alaska locations.

Soils on the alpine landforms are generally undeveloped (regarding soil horizon formation) due to the harsh climate conditions and short growing season. They are shallow to granitic bedrock, and range from well to poorly drained. They consist of either organics from alpine meadow vegetation (Lithic Cryosaprists) with thin mineral layers or mostly mineral soil with thin organic surfaces (Lithic Cryorthents). Figure 1 shows the general landscape position for soils in KLGO.

Soils on the avalanche chutes have slight development, ranging from shallow on the upper slopes next to rock outcrops (Lithic Cryorthents) to very deep on the lower slopes (Entic Cryumbrepts). They are mostly well drained. They have a thick, organic-enriched mineral surface layer due to the abundance of shrub litter.

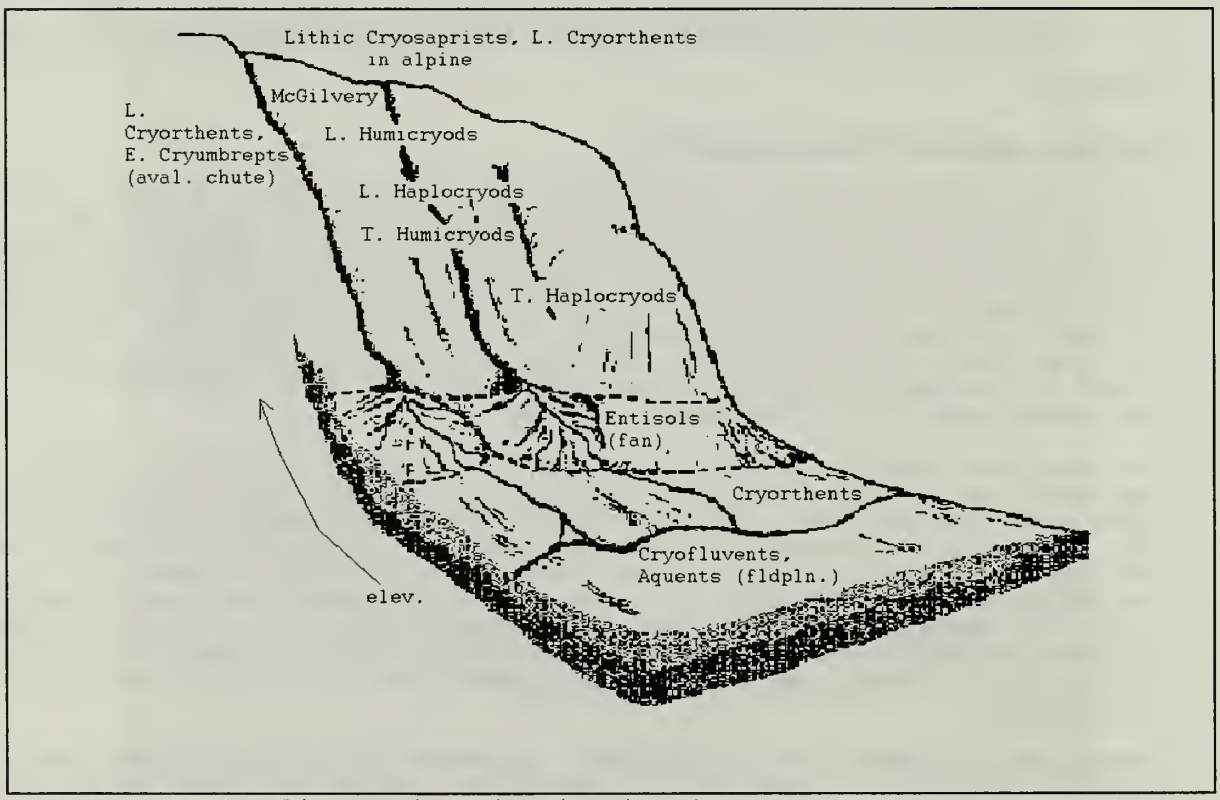


Figure 1. Generalized Soils Distribution for KLGO

There are generally three soils on the mountainslopes. On the upper slopes, organic soils (McGilvery series) are predominant and are shallow to bedrock. Mid to upper slope positions are mostly well developed mineral soils with thin organic surfaces (Lithic Haplocryods at lower elevations and Lithic Humicryods at higher elevations) that are shallow to bedrock. Lower slopes are predominantly deep, well developed mineral soils with thin organic surfaces (Typic Haplocryods at lower elevations and Typic Humicryods at higher elevations). Rock outcrop occurs as main components of some of the units and as inclusions in others. Development in these soils of the mountainslopes occurs in the B horizons (spodic horizons) with accumulation of iron and aluminum oxides with or without humus. The higher elevations have more humus accumulation than the lower elevations due to cooler temperatures and higher precipitation.

Soils on the mountain footslopes and alluvial fans are recent and not well developed (Entisols) except on older portions of these landforms. Soils are deep and well drained. They consist mostly of mineral material, some highly stratified, with thin organic surfaces developed from forested vegetation.

Soils on the floodplains are generally undeveloped, highly stratified, very deep, and range from well to poorly drained depending on the position in the landform (Cryofluvents and Aquents). Floodplain areas with higher relief are generally older and well drained with conifer forests (Cryorthents). Lower relief areas are wetter and more susceptible to current flood events supporting hardwood and shrub vegetation.

Soils on the estuary at Dyea are undeveloped, very deep, and range from well to poorly drained, also depending on position (Cryofluvents). Areas that are still under tidal influence are poorly drained (Aquents) and the older, more uplifted, areas are well drained (Cryorthents).

History and Culture

Chilkat Tlingits lived in the KLGO area long before the gold rush began. They may have impacted vegetation communities in the area through tree cutting, clearing, or selective harvesting and planting. However, the impact was probably not extensive. In 1897 and 1898, thousands of gold rush stampeders passed through the Skagway and Dyea areas en route to the northern goldfields. These people had a much greater impact on existing vegetation in the area, primarily by site clearing and tree cutting. For example, much of the Dyea area was cleared and is now in second growth forest. The artifacts and historical presence the stampeders imparted to the area are amply described in other Park documents and will not be discussed here.

In recent years, the Chilkoot Trail and White Pass areas have been used extensively for recreation. While tree cutting is limited to trail and campground maintenance needs, other impacts occur to the vegetation, in terms of trampling by hikers and campers. Management considerations relating to hiker impacts and trail maintenance concerns are included in the terrestrial ecological unit descriptions section of this report.

Climate

The Park's climate is influenced by the coastal waters and surrounding mountains. The rugged mountainous terrain can cause much variation in precipitation throughout the Park; varying by two to three times within a few miles (City of Skagway, 1991). The Skagway and Dyea areas average 39 inches of snowfall annually, while the mountain passes average 500 inches.

The Skagway area is in a rainshadow, receiving far less precipitation than most southeastern Alaska communities. It receives about 26 inches of precipitation per year; in comparison, Juneau receives approximately 86 inches of precipitation. Temperature, precipitation, snowfall, and wind data for Skagway (Southeast Alaska Regional Profile, as cited in City of Skagway, 1991) are shown in Table 1.

Table 1. Meteorological Data for Skagway

January temperature	28.9 °F (-1.7 °C)
Mean July temperature	65.9 °F (18.8 °C)
Mean annual temperature	48.2 °F (9 °C)
Average annual precipitation (including water equivalent of snow)	26.34 inches (669 mm)
Mean annual snowfall	39 inches (991 mm)
Prevailing wind direction	south in summer; north in winter

At present, there are no records on file with the state climatologist for the mountainous areas around Skagway. It may be assumed, however, that due to elevational cooling and orographic effects, the higher mountainous areas of the Park are cooler and receive much higher amounts of precipitation than Skagway.

Aquatic Resources

Water resource conditions in the KLGO Park are highly varied. Portions of two large river basins, the Taiya River (179 mi^2 [464 km^2]) and Skagway River (145 mi^2 [375 km^2]) basins, are in the survey area. Runoff from mountain glaciers and snowfields is the dominant influence on water resource characteristics of these basins. These watersheds have 17% to 37% permanent snow and ice cover respectively.

Hydrology

Table 2 displays stream flow characteristics for the Lower Taiya and Skagway Rivers, as well as West Creek, a major tributary to the Taiya River. These data were derived from US Geological Survey stream gauging records from 1963 to 1986. Stream flow ranges are extreme with high fall and summer runoff from glacial melt water and low winter temperatures that limit surface flow and ground-water inflow. The West Creek drainage has been studied for potential hydroelectric development (Bishop, 1981).

Table 2. Streamflow Data for KLGO Watersheds

Drainage	Mean Annual Discharge	Minimum Discharge (period of record)	Maximum Discharge (period of record)
West Creek	12 yd^3/sec (9.5 m^3/sec)	0.22 yd^3/sec (0.17 m^3/sec)	376 yd^3/sec (287 m^3/sec)
Taiya River	42 yd^3/sec (32 m^3/sec)	0.59 yd^3/sec (0.45 m^3/sec)	930 yd^3/sec (est.) (710 m^3/sec)
Skagway River	21 yd^3/sec (16 m^3/sec)	0.10 yd^3/sec (0.08 m^3/sec)	601 yd^3/s (459 m^3/sec)

Water Quality

Watersheds in the study area are pristine and have not been significantly influenced by human activities since the early 1900s. The entire study area is underlain by granitic rocks, resulting in low quantities of dissolved solutes in surface and groundwater (specific conductance is generally less than 50 μmhos/cm). Dissolved nutrient concentrations (nitrate, NO_3; phosphate, PO_4) are very low as is typical for the region (Table 3). High glacial silt loads from glacial runoff are the primary type of water quality impairment in the KLGO survey area.

Table 3. Water Quality Data for KLGO Streams

Stream Reach	pH	Sp. C. (μmho)	Alk. mg/l	PO_4 mg/l	PO_4 mg/l	SO_4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l
Skagway River Warm Pass Fork	7.9	22.2	--	0.4	0.13	--	--	--	--
Skagway River White Pass Fork	7.2	22.9	--	0.5	0.53	--	--	--	--
Skagway River	7.4	72	25	--	0.3	4.2	2.0	8.7	1.1
Lower Taiya River	6.8	21	8.5	--	0.2	1.0	--	--	--
Upper Taiya River	6.8	12	12	--	0.31	--	--	--	--
Taiya Tributary	7.1	33	14	1.2	0.4	--	--	--	--
Nelson Creek	6.8	52	5.5	--	--	--	--	--	--
West Branch Taiya River	7.3	127	31	1.1	--	--	--	--	--

Aquatic Biota

The lower Taiya River and its valley bottom tributaries support a relatively diverse fishery. The Taiya estuary has a large spring run of eulachon (*Thaleichthys pacificus*) that spawn in the river. Pink (*Oncorhynchus gorbuscha*) and chum (*Oncorhynchus keta*) salmon utilize extensive areas of the Taiya below Canyon City for spawning habitat. Dolly Varden char (*Salvelinus malma*) and coho salmon (*Oncorhynchus kisutch*) are the primary rearing species observed in the lower Taiya

system. Steelhead (*Salmo gairdneri*) and cutthroat trout (*Salmo clarki*) may also be present since they are found in upper Taiya Inlet (City of Skagway 1991). The upper portions of the Taiya and Skagway Rivers within the KLGO park boundary are fishless.

Macroinvertebrate samples collected from seven streams throughout the park indicate a wide range of diversity in key EPT taxa (Gabrielson, 1993). The EPT group includes the Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) families, which are particularly important as indicators of good water quality and diverse aquatic habitat. The number of genera in this group ranges from 3 to 12 in the sample reaches. Streams in the survey area with lower EPT values had high amounts of silt and sands from glacial meltwater. Chironomids (blackflies) were the dominant macroinvertebrates inhabiting sediment rich streams.

Vegetation

KLGO lies at the northern end of the maritime hemlock-spruce-cedar temperate rainforest which extends northward from California. The natural vegetation in the area is a mosaic of old growth coniferous forest, peatlands, alpine vegetation, and successional communities in frequently disturbed areas such as floodplains, estuaries, and avalanche chutes. Unvegetated glaciers, snowfields, and rock outcrops are common inclusions in the mosaic.

The KLGO area is transitional to interior Alaska plant communities, where a continental climate results in vastly different vegetation from the lush coniferous forest produced by abundant rainfall in southeast Alaska.

Due to the Park's position at the head of Lynn Canal where precipitation decreases and climate changes from maritime to continental, plant diversity is high, and the dominant plant communities are somewhat different from those found further south in the Alexander Archipelago.

Vegetation distribution is governed by a number of factors including soil type, depth, and drainage; light availability; precipitation; temperature (including aspect and elevation effects on temperature and growing degree-days); and disturbance patterns. Frequently, species composition changes along gradients, such as elevation or moisture gradients. For example, as one moves from Dyea to Sheep Camp and The Scales, the vegetation changes from estuarine non-forest communities to forest to subalpine, scrubby forest, to alpine meadow and heath.

The number of plant species in Southeast Alaska is considerably lower than in locations further south. Western and mountain hemlock, Sitka spruce, and lodgepole pine are the main coniferous tree species, and red alder, black cottonwood, and paper birch are the main deciduous trees in KLGO (scientific names for plants found in KLGO are provided in the plant list section of this report and in Appendix 1). Common shrubs are Sitka alder, blueberry, devil's club, red-osier dogwood, willow, and rusty menziesia. Common forbs include bunchberry, five-leaf bramble, enchanter's nightshade, twisted stalk, and violet. Graminoids, ferns, and mosses are also common in the Park.

Disturbance, Succession, and Vegetation Health

Disturbance

Disturbance is a pervasive factor in southeast Alaska vegetation communities. Common natural disturbance factors include windthrow, mass wasting, insect infestation, disease, and flooding. Because of

the cool and wet climate, wildfires are a much less frequent form of disturbance than in drier areas in the contiguous United States or in the Alaskan interior. Man-made disturbance factors include logging, roading, recreational uses, and fires. Disturbance may be low magnitude, removing a few trees and creating small gaps which are often colonized by existing vegetation, or it may be more extensive, occurring on a stand level.

In much of the Tongass National Forest (TNF), windthrow is probably the most common process of low intensity vegetation disturbance (Harris, 1989). Treefall gaps have increased light, nutrients, and space available for plants and are quickly colonized by surrounding vegetation and new recruits.

In KLGO, avalanche is a common disturbance process, especially at the higher elevations and on steep slopes. Avalanche chutes are typically colonized by shrubs such as Sitka alder and currant and are often dense, nearly impenetrable shrub thickets. Mass wasting, or slumps and landslides, can also occur on these steeper slopes, especially when the soils are wet and shallow. Avalanches and mass wasting may destroy all existing vegetation, starting successional processes anew.

Succession

The typical secondary succession sequence for productive coniferous forest land in Southeast Alaska has been described by a number of researchers including Alaback (1982), Harris and Farr (1974), Kessler (1982) and Deal et al. (1991). The sequence may be summarized as follows. Subsequent to overstory removal by logging or windthrow, existing seedlings and germinants exploit the newly available light and space and exhibit a growth spurt. Shrubs and herbs also typically show increased growth. During this high productivity phase, these stands are valuable wildlife forage sites. The "greening-up" process usually takes 4-5 years.

With continued growth, the canopy closes and a dense, "doghair" stand develops. Canopy closure limits light penetration to the understory, causing a decline of understory shrubs and forbs. After a few years, the understory is typically depauperate, mainly mosses and an occasional saprophytic or parasitic herb. Such stands have little wildlife forage value. After 100 or more years, overstory openings occur and the canopy stratifies vertically. Gaps allow understory development, and the stand gradually begins to resemble old growth.

There are variations on this general theme, of course, often relating to the degree of disturbance. If mineral soil is exposed, for example with landslides, alder may establish and slow successional sequences.

This typical successional sequence could occur following windthrow in KLGO on lower slopes where hemlock and spruce forest currently exists (for example, map units 31ND and 35NC). Other successional sequences are also likely in the Park, for example, on river bars and avalanche chutes where disturbance is periodic. In these cases, succession is unlikely to proceed beyond grass-shrub community types.

A third type of succession in KLGO is occurring on the uplifting estuary/Dyea area. With rebound of the land, flooding frequency decreases, drainage improves, and grass-forb communities have developed. Barring disturbance from human uses (such as off-road vehicles), succession is likely to proceed through shrub communities

and eventually to forest. The colonizing spruce trees on the upper Dyea Flats are evidence of this process.

Vegetation Health

Numerous organisms such as fungi, bacteria, and insects impact vegetation health in southeast Alaska. Common organisms include spruce aphid, bark beetle, *Annosus* and *Armillaria* root diseases (fungal), decay fungi, and hemlock dwarf mistletoe (a vascular, parasitic plant). No major diseases or tree abnormalities were noted during field work in KLGO.

Introduced Species

The majority of introduced weedy species of plants was observed in the Dyea area and along the narrow gauge railroad to White Pass. Some of these species may have been introduced during the gold rush period through the use of horses and mules (and their fodder) while transporting men, equipment and supplies, and during construction activities. Some species probably occupied the disturbed areas as pioneer species and have persisted due to the slow successional process and continued disturbances in the Dyea area and along the railroad. These weedy species were not observed outside of these areas and have not invaded adjacent natural plant communities.

METHODS AND APPLICATIONS

Standard reconnaissance level sampling procedures were used in the resource inventory for KLGO. These methods are described here.

Site Selection

Sampling locations were selected by the project hydrologist, ecologist, botanist, and soil scientists using aerial photographs, maps, and prior mapping information. Sites were selected to cover as many habitat types as possible within the constraints of accessibility and limited field time. On the ground, stand selection was a sampling team decision involving both expertise in vegetation and site factors.

Terrestrial Ecological Unit Mapping

The terrestrial ecological unit mapping process relies on landform, vegetation, geology, soils, and slope to stratify the landscape into integral units that are natural and reflect ecological processes. Features used to set unit boundaries, that is, the mapping criteria, are either directly observed or inferred from aerial photographs.

The KLGO inventory used a three-phased, interdisciplinary approach to identify resources and terrestrial ecological units. The first phase was pre-mapping, or a photo-interpretive delineation of ecological units on color infrared photographs at a scale of 1:63,360 or 1 inch to the mile. Features visible on, or inferable from, the photographs were used to draft preliminary boundaries. These features included landforms, vegetation, geology, soils, and slope.

The second phase involved field verification of the unit boundaries and designations. Field methods are described below.

The third phase was final mapping, or adjustment of ecological unit boundaries based on field work. In the final mapping phase, black and white aerial photographs (scale 1:6,000) of the Park were also used. Mapping was finalized on overlays to USGS topographic quarter quadrangles (1:25,000) used as base maps for the KLGO area. Mapping was digitized into a geographical information system (GIS) to produce large maps showing terrestrial ecological units, aquatic units, and plot locations. These maps have been provided to KLGO; reduced versions are included in this report (Figures 2-7).

Terrestrial Sampling

For terrestrial sampling, field work was conducted in two-person teams, each consisting of a soils specialist and a vegetation specialist. At each site, a general card was completed to show site location information, general environmental and site condition information, and brief vegetation, wildlife, and disturbance information.

At most sites, a soil profile card was also completed, listing information on geologic and soil conditions. This information was drawn from a soil pit dug and examined by the soils member of the sampling team. All excavations were completed under oversight by a KLGO archaeologist to ensure appropriate treatment of any artifacts which might be encountered. A detailed soil profile description was made for each pit, extending from the surface down into the unconsolidated material in which the soil formed or down to bedrock. Depth, color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, movement and accumulation of iron and aluminum or humus, and other features that enable the soil to be identified were recorded for each horizon or

soil layer. Soils were described according to National Cooperative Soil Survey Standards using Keys to Soil Taxonomy (USDA SCS, 1992) and Chapter 4 of the Soil Survey Manual (USDA SCS, 1981).

Soils data summaries are given in Appendix 2.

Also at most sites, a vegetation card was completed, listing information on species composition, abundance, and structure. This information was drawn from three plots placed in the stand. First, a temporary, 42-foot radius, circular plot was marked with flagging at plot center and plot radius in four perpendicular locations. All vascular plants within the plot were identified to species. Plants which could not be identified to the species level due to phenology were identified to the genus level. Due to the difficulty of differentiating between *Vaccinium alaskaense* and *Vaccinium ovalifolium* throughout the growing season, the two were identified only to genus. Taxonomic nomenclature follows Muller (1982), which is based on Hulten (1968), Welsh (1974), and Hitchcock and Cronquist (1978). Percent canopy cover was estimated for each species in the plot. Total canopy cover was also estimated for each stratum, or vegetative layer, of the plot.

Second, for all forested plots, a variable radius plot was located at plot center of the fixed radius plot. The variable plot is used to gather data on tree size and structure, and includes several "count" trees which pass a minimum size threshold on a basal area prism. These trees may fall within or beyond the fixed radius plot, depending on their size. For each count tree, various data such as height and diameter are collected.

Third, also for all forested plots, a coarse woody debris plot was completed. This plot is a 16-foot wide belt, running from plot top to bottom. Size and structure data were collected for all down woody debris greater than 5 inches (12.7 cm) diameter, including logs, dead or dying fallen trees, rootwads, and stumps less than 12 feet (3.7 m) tall.

Vegetation data summaries are given in Appendix 1.

Botanical Survey/Sampling

Botanical sampling was conducted by the project botanist and field crews. As many habitat types as possible were visited and plant samples collected. Although the interagency agreement called for collection only of rare species, more common species were also collected to add to the Park's herbarium. Due to the rough topography, limited field time, inaccessibility and logistical problems, many of the areas more likely to have rare plant species were not visited. These include the high alpine areas--alpine meadows, rock stripes and other outcrops, glacial moraines, cirques, and ridgetops. Other habitats where rare plants may be located include unusual geologic areas, isolated gravel bars, peatlands, and possibly estuaries. The limited time spent during this study and the lateness of the season provided an opportunity to sample the vegetation, but not to complete a comprehensive survey. The KLGO has had very limited botanical work prior to this effort and considerable work is needed during spring, summer, and fall at different elevations, aspects, and soil gradients, and in small, uncommon, vegetation communities to determine the complete floristic components. Most of these areas occur in terrestrial ecological units 12A, 21, and 75. No rare plants or new taxa were discovered during the survey period.

Plant specimens were pressed in the field for later identification. Vascular plants, lichens, and mosses were collected. Specimens were mounted (vascular types) or packaged (lichens and mosses) using standard

herbarium procedures and have been provided to the Park.

Species identification was completed by various experts: Dr. George Argus (willows), Dr. Duane Atwood, Mary Stensvold, and Dr. Stanley Welsh (vascular plants), Kitty LaBounty (mosses and liverworts), and Dr. Larry St.Clair (lichens). The plant list for KLGO is a compilation of species collected for this project and species recorded by sampling teams but not specifically collected (although some may have been). Plants collected in the KLGO area by Dr. Welsh in the 1960s (prior to park designation) have also been listed (voucher specimens from the 1960s collections are held at the Brigham Young University herbarium).

Aquatic Sampling

The aquatic portion of this survey is based on the channel type classification and mapping approach that has been widely applied to reconnaissance stream surveys throughout Southeast Alaska (Paustian et al., 1992). Initial stream mapping units are delineated by interpretation of topographic maps and air photography. Once the drainage network is stratified by channel type, representative stream reaches of about 100 m in length are selected for detailed field evaluation. The number of sample reaches in the KLGO survey was extremely limited due to limited personnel and time. An attempt was made to sample at least one representative stream reach for the more common stream mapping units within the survey area, and to obtain a wide geographic distribution of sample stream reaches. Some channel type map units commonly occurring in the survey area were not field sampled due to poor access and high water conditions that prevented instream survey work in many stream segments. Map unit descriptions (MUDs) for streams are based on regional data that represent a range of conditions attributable to a specific channel type. Where available, site specific data for the KLGO survey area are included in the stream MUDs.

Low level helicopter observations and on-the-ground spot checks are used to verify the accuracy of initial channel type mapping. Final stream map units were delineated on 1:24,000 scale topographic quadrangle maps and converted to digital GIS data (ARCINFO, GIS).

Field sampling at representative stream reaches included basic channel morphology measurements, quantification of aquatic habitat units, and fish observations. At selected sites, macroinvertebrate sample and water chemistry measurements where also made. Channel morphology data (landform, channel width, substrate) utilized standard channel type field verification protocol. Channel cross-section and hydraulic characterizations in Appendix 3 were derived using XSPRO (Grant et. al, 1992). Aquatic habitat unit classification data is based on Bryant and others (1992). Water chemistry data was collected using a HACH portable water quality lab. Macroinvertebrate samples were collected using protocol from Winget and Mangum (1979), and the samples were analyzed by the Environment and Natural Resources Institute, University of Alaska Anchorage (Appendix 4). Fish observations were made visually for adult salmonids. Minnow traps baited with fresh salmon eggs were deployed in a variety of habitats to identify juvenile salmon species.

Data Processing

All terrestrial sampling field data were entered into the Chatham Area Integrated Resource Inventory data base for processing and analysis. Various data summaries and classifications were made and are included in this report (see appendices). Raw data were provided to KLGO and are also held at the Chatham Area Forest Supervisor's Office in Sitka, Alaska.

Applications

The data provided in this report may be used by KLGO staff to address the following concerns listed in the interagency agreement: interpretation of ecological processes and natural systems for Park visitors; establish baselines on plant succession to monitor land use practices and changes in historic viewshed; document the occurrence of rare or threatened plant species; and gathering baseline data to assist management decisions. The data provided may be used by Tongass National Forest staff in planning and ecosystem management.

OVERVIEW OF ECOLOGICAL UNITS

This section describes the aquatic (AEUs) and terrestrial ecological units (TEUs) that occur on the various landforms for the Chilkoot and White Pass units in KLGO. Information on specific channel types, soils, and vegetation is provided in the Specific Type Descriptions section of this report. Location of AUEs and TEUs is shown on Figures 2-7.

Chilkoot Unit

Dyea Estuary

This broad, tidal river delta was formed by sediments deposited by the Taiya River, a major glacial river basin at the head of Lynn Canal. This area is represented by map unit 75. It is mostly uplifted estuary with very deep soils ranging from poorly to well drained. Vegetation is mainly graminoids and forbs.

A broad braided channel (type ES8) from the Taiya mainstem bisects the southeast portion of the uplifted estuary unit. This channel is a major upstream migration route for anadromous salmon and provides important spawning habitat for some species.

A narrow estuary slough (ES2), West Branch Creek, flows along the western boundary of the estuary. The source of this stream is a shallow aquifer-fed slough that begins below the confluence with the West Creek drainage. There is little sediment movement through this channel, discharge ranges are low, and slow water aquatic habitat (glide, pool) predominates. This is an important rearing area, particularly for coho salmon.

The Nelson Creek tributary (AF1) enters the estuary near the mouth of West Branch Creek. The short alluvial fan segment (330 ft. [100 m]) has a shallow, poorly confined, cobble bed channel that is utilized by chum and pink spawners and also provides limited salmonid rearing habitat.

Taiya Floodplain

The Taiya floodplain unit extends from Dyea to Canyon City and averages about 3300 ft. (1,000 m) in width. It consists of a series of shallow glacial outwash terraces that encompass the entire valley bottom. Soils are very deep and range from somewhat poorly to well drained. They are generally extremely stony throughout in the upper end of the unit (Canyon City area) and range to sandy in the lower end (Dyea area).

The main Taiya floodplain channel segment (G04) consists of broad (160+ ft. [50+ m]) multiple to braided segments indicative of high bed loads and frequent lateral channel adjustments. Numerous side channels (G01) parallel main channel thalwegs. Channel gradients of glacial channels are low, less than 2%. Accumulations of large woody debris (tree stems and root wads) are concentrated at channel bends and medial gravel bars and islands. Clear water sloughs (PA3) occupy abandoned outwash channels on elevated terraces along floodplain margins. Flow in these channels is sustained by mountainslope runoff and shallow floodplain aquifers. Two major glacial tributaries, West Creek and Lower Nourse River (G02), enter from the west at mile 2 (km 3.2) and mile 8 (km 12.9) respectively. Nourse River has the most significant influence on floodplain morphology of the mainstem Taiya. Frequent channel migration and channel braiding is likely attributable to high bedload sediment supplied to the valley floodplain by the Nourse system.

Fig. 2. Chilkoot (South) Terrestrial Ecological Units

Joins Chilkoot (North)

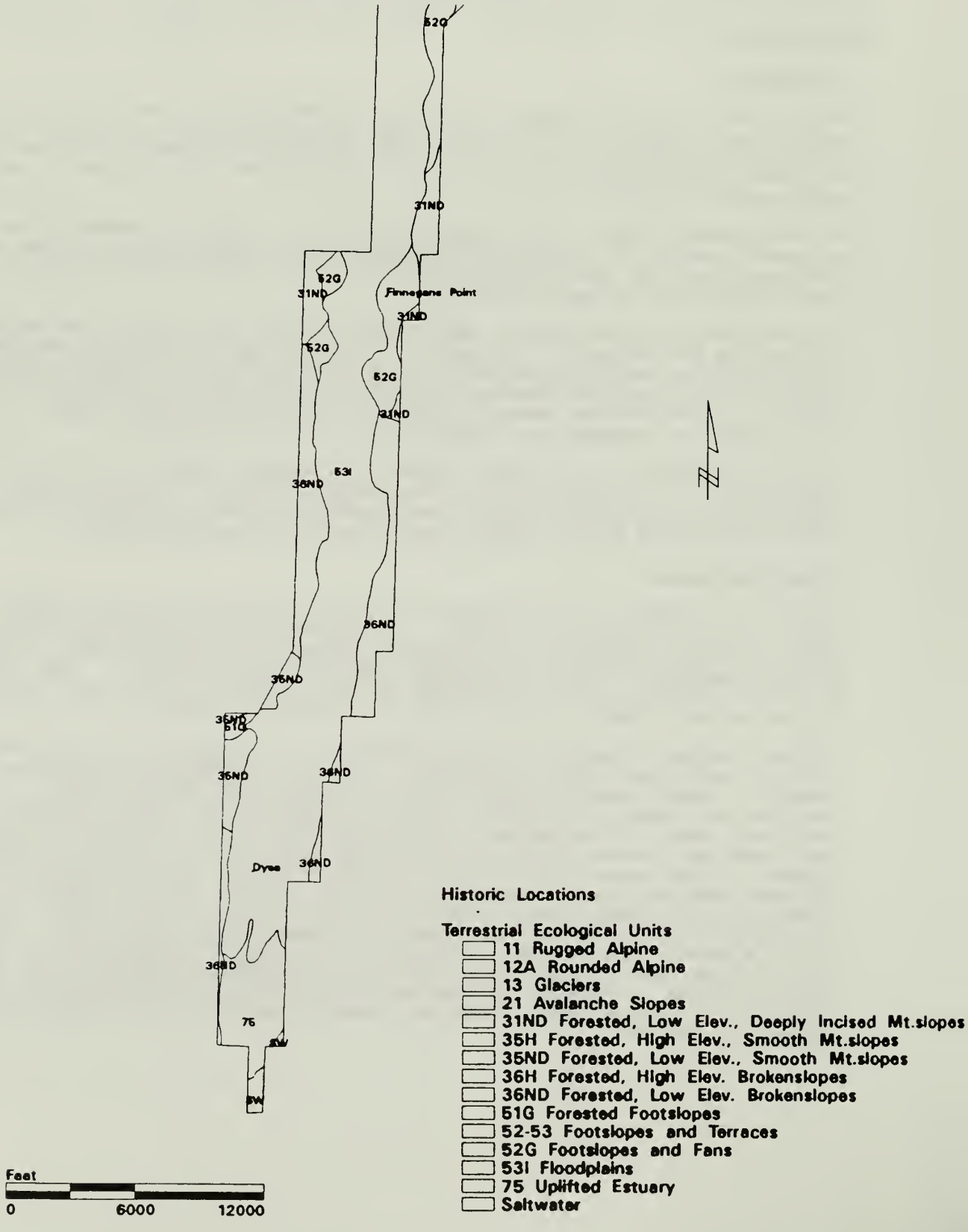
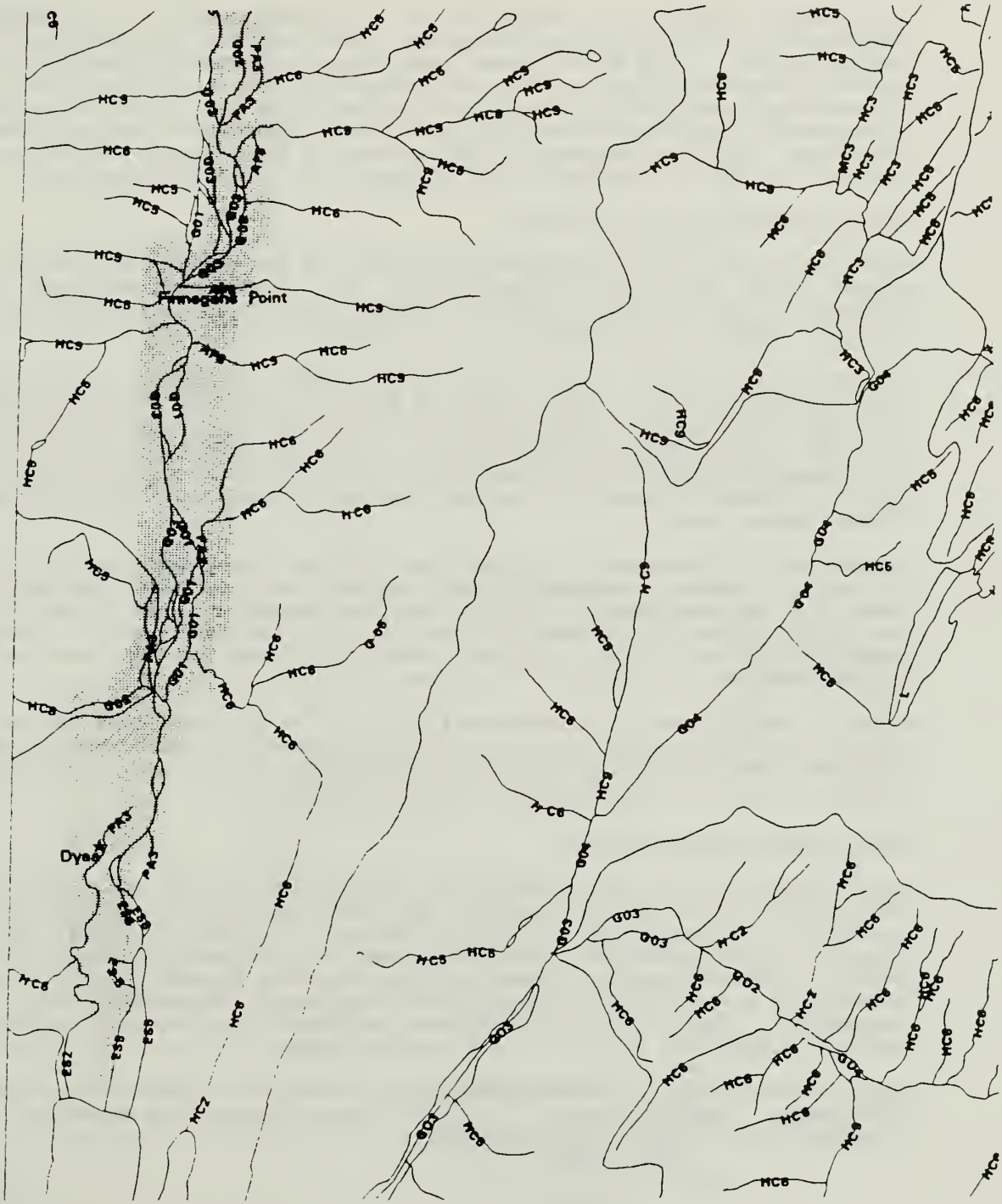


Fig. 3. Channel Types: Lower Taiya River



Important anadromous fish habitat extends into the lower Nourse channel and to Canyon City on the Taiya branch. Main channel margins, side-channels, and sloughs along floodplain terraces are key spawning and rearing areas for salmon. Mainstem instability, high sediment loads, and wide flow range are primarily limiting factors for salmonid habitat in the lower Taiya floodplain system.

The riparian vegetation community in the Taiya floodplain is dominated by a cottonwood overstory and willow-alder shrub cover (see vegetation type descriptions). This mid-successional riparian community reflects historic glacial outwash floods as well as frequent severe flooding within the present day floodplain. Alpine and valley glaciers in the Taiya system are in recession and should begin to have less influence on major floods in the longterm. Riparian vegetation may gradually be succeeded by spruce plant communities as the frequency and intensity of flooding decrease.

Footslopes and Alluvial Fans

These large fan or cone-shaped landforms are associated with major mountainslope tributary channels (HC8, HC9). Surficial material is composed of poorly sorted cobble, stone, and boulder size material. Soils are very deep and are generally well drained.

Several very active alluvial fan channel segments (AF8) occur on both sides of the Taiya valley. Large areas of bedload outwash zones and poorly confined, multi-branched channels are common in this unit. Bedload sediment derived from mountainslope ravines and hanging glaciers during late summer and early fall freshets is the main factor contributing to highly unstable channels. Debris from spring avalanche activity may also affect these areas.

Anadromous and resident fish habitat in these footslope channels is extremely limited. However, these channels are important aquifer source areas for mainstem and floodplain terrace channels. Ground-water upwelling and infiltration from these shallow alluvial aquifers can be a very important factor influencing the location of spawning beds and low flow refuge habitat.

Riparian vegetation is composed of early to mid-successional shrub (alder-willow) and cottonwood communities (see vegetation type descriptions). Frequent severe flooding and sediment deposition are the major limiting factors to plant community and soil development.

Upper Taiya Valley Bottom

This area, north of Canyon City, is represented by TEU 52/53 and TEU 51G. The floodplain is greatly reduced and, when present, is associated with the mountain footslopes (TEU 52/53). In areas where the floodplain is essentially non-existent, the footslopes are the main landform (TEU 51G). Soils for the floodplain component are the same as mentioned in the Taiya floodplain section above, except they are mainly extremely stony throughout. Soils for the footslope component are the same as mentioned in the footslopes and alluvial fans section above.

Taiya River runoff is considerably diminished above the Nourse River confluence. Between Canyon City and Pleasant Camp, the Taiya is constrained by high bedrock sidewalls.

Fig. 4. Chilkoot (North) Terrestrial Ecological Units

Fig. 5. Channel Types: Upper Taiya River

Feet
0 5000 10000

Chilkoot Unit in gray

The HC8 channel unit is mostly high gradient cascades that are a complete barrier to upstream fish migration. Above Pleasant Camp there is a narrow floodplain with a 10 ft. (30 m) wide channel. The moderate gradient GO4 unit extends upstream to the Sheep Camp area where channel gradient and confinement again increase (HC8 and HC3 units). The upper Taiya River floodplain is less complex than the lower, with fewer side channels and mountainslope tributaries. Suitable fish habitat exists in the upper Taiya system but no fish were sampled. It is likely that the Canyon City falls have been an effective fish migration barrier since glacial ice sheets receded from the valley.

Riparian vegetation communities have a similar composition to those in the lower Taiya Valley, however, more inclusions of varied forest types are present.

Mountainslopes

The mountainslopes are represented by different sets of map units below and above Canyon City. Units below Canyon City are 35ND and 36ND, which are an association of three soils under western hemlock/blueberry and western hemlock/rusty menziesia vegetation types. Units above Canyon City are 35H and 36H which also are an association of three similar soils. Vegetation is similar to that below Canyon City except shrub communities and paper birch are more common in the harsher environmental conditions. Avalanche slopes (TEU 21) occur above and below Canyon City. These units are composed of deep, well drained soils under shrub communities.

Numerous mountainslope tributary channels (HC6, HC9) intersect the Taiya River along its entire length. These drain the primary runoff and sediment source areas for the Taiya watershed. The HC9 segments have the highest sediment and flow discharge due to substantial glacial melt runoff. Aquatic biota are scarce in these drainages.

Alpine

Alpine areas are represented by units 11 and 12A. They are both associations of shallow soils and bedrock in varying proportions under alpine lichen and alpine meadow vegetation. Glaciers are represented by TEU 13.

White Pass Unit

Warm Pass Valley

The Warm Pass fork of the Skagway River upstream from White Pass City has a high degree of structural control from bedrock outcrops. This area is represented by TEU 52G in the valley bottom. Soils are similar to unit 52G in the Chilkoot Unit, but the vegetation is dominantly the subalpine fir plant associations. Mountainslopes, including avalanche slopes, also have soils similar to the Chilkoot Unit mountainslopes, but, again, the forested areas are dominated by subalpine fir associations.

Fig. 6. White Pass Terrestrial Ecological Units

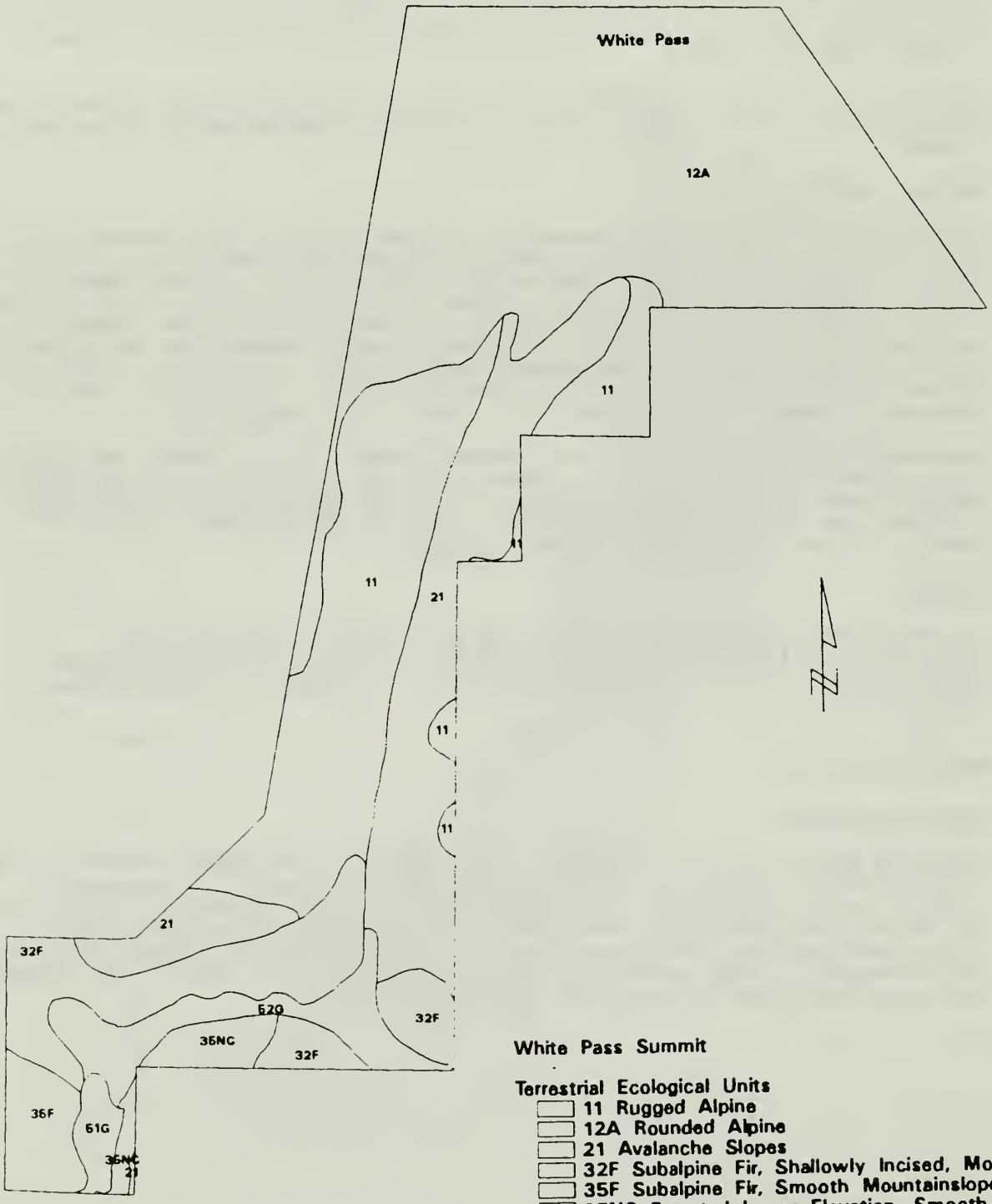


Fig. 7. Channel Types: Skagway River, White Pass Fork

Feet
0 5000 10000

White Pass Unit in gray

Primary channel units are GO4 and HC8. The main stem segment from Heney to Glacier Loop is mostly a series of chutes and falls confined by sheer canyon walls. The GO4 segment above the railway to the Laughton Glacier tributary confluence has a more moderate valley gradient and some floodplain development. Small footslope tributary units (HC2) on the south side of the valley have clear water with suitable fish habitat. No fish were observed and it is likely that downstream falls have been a permanent barrier to upstream fish migration. A major tributary draining the Laughton Glacier is a high gradient alluvial channel having poor flow containment and extensive bedload deposition areas with boulder size substrate.

The north side of the valley is dominated by snow avalanche tracks (AF2 channel units). Numerous HC6 and HC5, high gradient mountainslope channels, contribute runoff to the valley mainstem.

White Pass Subalpine-Alpine

The channel segment on the White Pass fork is a contained high gradient, glacial cascade channel (HC8) as far as White Pass summit. This area is represented by units 11 and 12A. Soils and vegetation are similar to those of the Chilkoot Unit alpine areas.

At the summit, headwaters moderate gradient entrenched (MC2) channel units enter the mainstem. Shallow bedrock trench lakes punctuate many of these segments. The mainstem channel gradient moderates and the channel widens near the Canadian border. There is still a high degree of bedrock control along the headwater GO4 channel unit. No resident fish were observed and little suitable habitat exists in any portion of the White Pass Fork.

SPECIFIC TYPE DESCRIPTIONS: MAP UNIT DESCRIPTIONS (MUDs) AND VEGETATION TYPE DESCRIPTIONS FOR KLGO

Aquatic Ecological Unit MUDs

Moderate Gradient Mixed Control Process Group

This process group includes MM1 (narrow) and MM2 (moderate width) mixed control channel types. These channel types are moderate gradient (2-6%) streams where sediment deposition processes are limited. Channel banks are frequently composed of boulder or bedrock materials that limit later channel migration and floodplain development along many segments of these channel types. High flows are mostly contained within the active stream channel. Riparian areas seldom extend beyond 100 ft. (30 m) from stream banks.

Narrow Mixed Control Channel
Channel Mapping Symbol: MM1 (Formerly B2)

Physical Characteristics

Geographic Setting: The MM1 stream is normally situated in the middle reaches of small drainage basins. Accordingly, the drainage basin area is small. Commonly, an HC3 channel will precede an MM1 in the basin network. The MM1 will often flow into an MM2 reach. MM1 streams may also occur as upstream tributaries to FP3 and MC2 reaches. Bank material is normally a mixture of alluvial and colluvial deposits. Small bedrock nickpoints and short cascades or falls may be present.

Channel Structure:
Stream Gradient: 2-6%, mean = 3% (sample site gradient = 2%)
Incision Depth: less than or = 4 m (13 ft.)
Bankfull Width: less than or = 10 m (33 ft.), mean = 5 m (16 ft.)
(sample site width = 7 m (23 ft.)
Dominant Substrate: fine gravel to large cobble
Stream Bank Composition: mixture of alluvium and colluvium
Channel Pattern: linear to slightly sinuous, single channel
Drainage Basin Area: 2.6-5.2 km^2 (1-2 mi^2)

Riparian Vegetation

The riparian plant associations for the MM1 channel type are typically dominated by the western hemlock series. At the Taiya survey site, the riparian area is a mosaic of spruce, hemlock, cottonwood, and birch. Sitka alder and willow shrub communities occur immediately adjacent to the stream banks.

Management Considerations

Hydrologic Function: MM1 channels are sediment transport-oriented. Sediment inputs come from upstream, high gradient, contained tributaries. Stream energy is moderate due to channel gradient and flow containment provided by stable alluvial/colluvial banks. Most fine sediment is readily transported through these streams to downstream reaches.

Aquatic Habitat Capability: MM1 channels are generally accessible to anadromous fish species. Downstream barriers account for most cases where access is restricted. Occasionally barriers occur at bedrock falls within MM1 streams. These channels are frequented by spawning coho, and, to a lesser degree, by pink and chum spawners. Use by

spawning Dolly Varden char is also high. Where located next to accessible lakes, these channels provide moderate quality spawning habitat for sockeye salmon and steelhead trout. Rearing coho and Dolly Varden char frequently use these channels. Overwintering habitat is available where inchannel woody debris is abundant.

Large woody debris (LWD) volume is relatively high in many MM1 channel types. The LWD plays an important role in trapping cobble and gravel substrate used by spawning fish, and in the formation of pool habitat for rearing fish. LWD accumulations in the Taiya sample reach are very low compared to normal LWD in MM1 channels. LWD frequency in the sample reach is 12.5 pieces/100 m (330 ft.), with a total volume of 5.4 m^3 (7 yd^3)/100 m.

Stream banks are composed mostly of coarse textured alluvial and colluvial sediments that are only moderately sensitive to disturbance. Stream bank vegetation plays an important role in bank stabilization.

No fish were observed in the sample reach in the Upper Taiya River valley. Mainstem barrier falls have prevented immigration. Habitat is dominated by fast water riffle habitat (348 m^2 [3744 ft^2]/100 m). Pool habitat is a minor component with only 6 m^2 (65 ft^2)/100 m of backwater eddy pool and 22 m^2 (237 ft^2)/100 m of midchannel scour pool in the sample reach.

Macroinvertebrate samples indicate that this reach is the most pristine water of the sites surveyed in the Taiya and Skagway Rivers (Appendix 4). The MM1 has a high number of genera associated with good water quality (EPT ratio = 0.89); numbers of taxa tolerant to pollution are low (FBI = 2.9); and the rapid bio assessment is the highest possible rating (RBA = 4).

Moderate Gradient Contained Process Group

This process group includes MC1 (narrow, shallow incision), MC2 (moderate width and incision), and MC3 (deeply incised) moderate gradient contained channel types. Stream flow in this process group is completely contained by adjacent landforms and upper channel banks. Stream bank and stream bed erosion is frequently controlled by the presence of bedrock outcrops. These channels are efficient sediment transport and delivery conduits. Gravel bars are infrequent channel features. Riparian areas are limited to the stream bank influence zone, generally less than 30 meters (100 feet).

Moderate Width and Incision, Contained Channel

Channel Mapping Symbol: MC2 (Formerly B6)

Physical Characteristics

Geographic Setting: MC2 channels are associated with glacially scoured lowland and low relief hillslope landforms. In the KLGO survey area, MC2 channels are restricted to low relief subalpine zones above the White Pass summit. These well-contained channels are confined by adjacent landforms. Bedrock control of channel banks and streambed is prevalent, resulting in a single linear to rectangular channel pattern.

Channel Structure:
Stream Gradient: 2-6%, mean = 3%
Incision Depth: 4-20 m (13-66 ft.), mean = 13 m (43 ft.)
Bankfull Width: mean = 9 m (30 ft.)

Dominant Substrate: bedrock (24%), boulder (19%), cobble (34%)
Stream Bank Composition: bedrock to mixed
Sideslope Length: 4-20 m, mean = 11 m (36 ft.)
Sideslope Angle: mean = 76% (37º)
Channel Pattern: single, linear channel (follow fault zones)
Drainage Basin Area: 5.2-13 km^2 (2-5 mi^2)

Riparian Vegetation

Typical forest vegetation communities are not represented in the KLGO MC2 riparian areas due to high elevation (1000 m [3300 ft]) and interior climate effects. Overstory vegetation is dominantly krummholz subalpine fir with a ground cover of heather and alpine meadow plant communities.

Management Considerations

Hydrologic Function: MC2 channels are sediment transport systems. Stream energy is high due to moderate channel gradient and high flow containment. As a result, inchannel sediment storage, as gravel bars, is low. Fine sediment is easily flushed through these channels. Stream bank erosion is variable in these channels due to a high degree of bedrock control. Shallow mass wasting of weathered bedrock and poorly consolidated glacial till on channel sideslopes, though generally not frequent, is a primary source of sediment in MC2 channels.

Aquatic Habitat Capability: No fish species are present in the KLGO MC2 stream segments. Aquatic biota are severely limited by winter icing (see White Pass Summit GO4 map unit description).

High Gradient Contained Process Group

This process group includes HC1, HC2, HC3, HC4, HC5, and HC6 channel types which are shallowly to deeply incised, high gradient (over 6%), mountainslope streams. High to moderate gradient glacial meltwater streams, HC8 and HC9 channel types, are also included in this process group. These first and second order headwater channels are characterized as primary sediment source zones. Relatively high stream energy enables these streams to transport large sediment loads during spring and fall freshets. The associated riparian area generally extends to the upper stream bank slope break.

Shallowly to Moderately Incised Footslope Channel

Channel Mapping Symbol: HC2 (Formerly A7)

Physical Characteristics

Geographic Setting: The HC2 streams are predominantly associated with footslope landforms. Hill landforms are less frequently found adjacent to these channels. The HC2 channel type consists of high gradient, footslope streams, well contained by moderate (less than 10 meters [33 feet]) sideslope development. HC5 and HC6 channels commonly grade into an HC2 channel. HC2 channels are often tributaries to MM1 or MM2 streams. Stream bank composition is predominantly alluvium, although bedrock segments may occur as inclusions.

Channel Structure:
Stream Gradient: 6-15%, mean = 10%
Incision Depth: 1-10 m (3-33 ft.), mean = 3 m (10 ft.)
Bankfull Width: 1-15 m (3-50 ft.), mean = 5 m (16 ft.)
Dominant Substrate: coarse gravel to small boulder
Stream Bank Composition: alluvium or colluvium
Sideslope Length: mean = 10 m (33 ft.)
Sideslope Angle: mean = 19% (11º)
Channel Pattern: single, linear

Riparian Vegetation

The riparian plant communities are dominantly western hemlock series, with western hemlock/blueberry the most common plant association. The nonforested communities and Sitka spruce series are also well represented. Nonforested salmonberry, Sitka alder, and red alder shrub communities occur adjacent to the stream 46% of the time.

Management Considerations

Hydrologic Function: HC2 channels are sediment transport systems. Sediment is delivered from steep mountain headwaters. Since HC2 channels are situated on alluvial/colluvial footslopes, stream bank erosion can introduce significant sediment loads to these channels. However, most sediment is rapidly transported downstream. Some retention of fine sediment occurs in small pools behind woody debris jams.

Aquatic Habitat Capability: Due to high streamflow velocities, HC2 channels are only occasionally accessible to anadromous species. Lower reaches near the confluence with accessible valley channels have the best fish habitat potential. HC2 channels have marginal spawning potential and limited rearing capability. Overwintering capability is insignificant. They are used primarily by Dolly Varden char. However, due to their location in sediment/water source areas of watersheds, they typically affect downstream fish habitat productivity.

Deeply Incised Upper Valley Channel
Channel Mapping Symbol: HC3 (Formerly A2)

Physical Characteristics

Geographic Setting: The HC3 channels are found in steep sided, narrow V-shaped valleys. Adjacent landforms are usually avalanche slopes or mountainslopes. HC3 channel types are typically an upper valley tributary. Valley sideslopes often extend immediately to the stream's edge, but can be separated by short, steep, upper bank sideslopes. Flow containment is excellent, due to the deep incision and close proximity of valley sideslopes. Cascades, low vertical falls, and bedrock nickpoints are common features.

The HC3 streams can also be found in association with broken hilly or rolling terrain. In these situations, the stream is straight, moderately to deeply incised, and directly controlled by steep hillslopes or bedrock fault lines.

Channel Structure:
Stream Gradient: 6-15%, mean = 10%
Incision Depth: 2 m (6.5 ft.), mean = 17 m (56 ft.)
Bankfull Width: variable, mean = 7 m (23 ft.)
Dominant Substrate: small cobble to bedrock
Stream Bank Composition: bedrock and cobble
Sideslope Length: mean = 21 m (69 ft.)
Sideslope Angle: mean = 90% (32º)
Channel Pattern: single, linear
Drainage Basin Area: 2.6-13 km^2 (1-5 mi^2)

Riparian Vegetation

The riparian plant communities are predominantly western hemlock series and nonforested salmonberry and Sitka alder shrub communities.

Management Considerations

Hydrologic Function: HC3 channels are sediment transport systems. Steep mountainslopes may contribute significant amounts of sediment from mass wasting. Steep channel gradients and high stream power limit sediment storage, therefore, sediment is rapidly delivered to downstream channels. Stream flow responds quickly to intense rainfall events.

Aquatic Habitat Capability: Due to high stream flow velocity HC3 channels are generally not accessible to anadromous species. These channels contain very little spawning habitat for anadromous fish species, and, where accessible, minimal rearing habitat. Resident Dolly Varden char inhabit these streams to some extent. HC3 channels typically affect downstream anadromous fish habitat through transport of sediment, large woody debris, nutrients, and aquatic insects.

Shallowly Incised Very High Gradient Channel
Channel Mapping Symbol: HC5 (Formerly A4)

Physical Characteristics

Geographic Setting: HC5 streams occur in upper headwater regions of glacially scoured valleys. They are generally found in alpine, avalanche, and subalpine mountain landforms. The HC5 streams are occasionally found on hilly and sloping lowland landforms. They are most often an outlet channel to alpine lakes, cirque basins, or hanging valleys. They can extend from the cirque basin through high relief alpine or subalpine sideslopes directly to the main valley floor. The HC5 channel types are shallowly to moderately incised, very high gradient, mountainslope streams. Channel gradient is highly variable in this channel type, due to the frequent occurrence of falls and cascades. Channel pattern is linear and single, with bedrock control predominating.

Channel Structure:
Stream Gradient: mean = 28%
Incision Depth: mean = 4.5 m (15 ft.)
Bankfull Width: mean = 4 m (13 ft.)
Dominant Substrate: large rubble to bedrock
Stream Bank Composition: bedrock
Sideslope Length: mean = 7.5 m (25 ft.)
Sideslope Angle: mean = 43% (23º)
Channel Pattern: single, linear

Riparian Vegetation

The riparian plant communities are variable with western hemlock series, Sitka spruce series, and mixed conifer series being the most dominant. Nonforested species are also quite common, representing 16% of the riparian vegetation cover.

Management Considerations

Hydrologic Function: HC5 channels function as sediment transport systems. Surface erosion and hillslope mass wasting are the principal sources of stream sediment load. Stream flow responds quickly to intense rainfall and rain-on-snow events.

Aquatic Habitat Capability: Fish access to these channels is prevented by high velocity stream flows and barriers. No significant fish habitat occurs within these channels. However, if resident fish populations (e.g. grayling or rainbow trout) are present in the associated alpine lakes, the confluence of the stream and lake may be used for spawning. Typically, HC5 channels affect downstream anadromous fish habitat through transport of sediment, large woody debris, nutrients, and aquatic insects.

Deeply Incised Mountainslope Channel
Channel Mapping Symbol: HC6 (Formerly A1)

Physical Characteristics

Geographic Setting: HC6 channels are most commonly found on mountainslope or hill landforms. They occur in large ravines, with a consistent sideslope length greater than 10 meters (33 ft.). They usually initiate as first order streams and commonly extend to ridgetops and summits. HC6 channels can extend from the alpine zone to the footslope or valley floor landforms. Snow avalanche chutes may be associated with HC6 streams. On steep mountainslopes along inlets and straits, channels flow directly into saltwater.

Channel Structure:
Channel Gradient: mean = 27%
Incision Depth: mean = 22 m (73 ft.)
Bankfull Channel Width: mean = 6 m (20 ft.)
Dominant Substrate : bedrock, boulders, and cobble
Stream Bank Composition: bedrock
Sideslope Length: mean = 15 m (50 ft.)
Sideslope Angle: mean = 115% (49º)
Channel Pattern: single, linear

Riparian Vegetation

The riparian plant communities are dominated by the western hemlock series. Nonforested communities, which occur on disturbed channel sideslopes, are also common.

Management Considerations

Hydrologic Function: HC6 channels are primarily sediment transport systems. Channel sideslopes are often highly unstable, with a high sediment input potential. Landslides entering the channel may result in debris torrents that scour a significant length of stream. Steep channel gradients rapidly deliver sediment to downstream reaches.

Stream flow responds quickly to intense rainfall events. Short term entrapment of minor volumes of sediment is provided by woody debris. These deposits rapidly become mobile during high flow events.

Aquatic Habitat Capability: HC6 channels are generally not accessible to anadromous or resident fish species because of high stream gradient, high flow velocity, seasonally low water and migration barriers. These channels contain negligible spawning or rearing habitat.

High bed load sediment and debris loads carried in these streams can pose a high risk to stream crossing structures (e.g. bridges) and downstream fish habitat.

Moderate/High Gradient Glacial Cascade Channel
Channel Mapping Symbol: HC8 (Formerly D7)

Physical Characteristics

Geographic Setting: The HC8 is usually situated in a constricted valley bottom, with steep mountain or hillslope landforms immediately adjacent to the channel. These channels drain small valley glaciers. HC8 segments are common in the upper Taiya and Skagway river basins. Bedrock control falls and chutes form frequent nickpoints in the channel profile.

Channel Structure:
Stream Gradient: 3-10%, mean = 7%
Incision Depth: mean = 12 m (40 ft.)
Bankfull Width: 15-30 m (49-98 ft.), mean = 19 m (62 ft.)
Dominant Substrate: large rubble (cobble) to bedrock
Stream Bank Composition: bedrock
Sideslope Length: highly variable
Sideslope Angle: mean = 45% (30º)
Channel Pattern: single channel

Riparian Vegetation

The riparian plant communities are dominated by the nonforested salmonberry, willow, and Sitka alder shrub communities.

Management Considerations

Hydrologic Function: Rapid sediment transport is typical of HC8 channels. Steep channel gradient, large diameter substrate, and well contained flows result in high stream power. A high glacial silt load is characteristic since glacial channels normally precede the HC8 in the watershed network. Sediment inputs from slope failures are moderately frequent. Bank stability is high due to bedrock composition, and in-channel sediment storage is minimal.

Aquatic Habitat Capability: These channels have restricted accessibility to anadromous species due to within segment and downstream barriers. They may get some use in lower gradient, downstream reaches by spawning king salmon, chum salmon, or Dolly Varden char which frequent associated glacial GO4 or GO2 channels. Spawning success is highly unlikely due to high velocities and high bedload movement. Rearing capability is also insignificant.

High Gradient Incised Glacial Torrent Channel
Channel Mapping Symbol: HC9 (Formerly D2)

Physical Characteristics

Geographic Setting: The HC9 channel type occurs in upper watershed areas or on mountainslopes. The HC9 channel is a very high gradient channel emanating from the terminus of a steep valley glacier or perched alpine glacier. A high silt and sediment load is characteristic, and stream power is also quite high.

Channel Structure:
Stream Gradient: mean = 19%
Incision Depth: variable, mean = 6.5 m (21 ft.)
Bankfull Width: mean = 17 m (56 ft.)
Dominant Substrate: large cobble to bedrock
Stream Bank Composition: bedrock
Sideslope Length: mean = 18 m (58 ft.)
Sideslope Angle: mean = 26% (17º)
Channel Pattern: single, linear channel

Riparian Vegetation

The riparian plant communities are dominated by nonforested Sitka alder and willow shrub communities. The mountain hemlock series is also significant.

Management Considerations

Hydrologic Function: HC9 channels function as sediment transport systems. High channel gradient, large size substrate material, and well contained flows result in high stream power. Stream flows are largely derived from snow and glacier melt, and carry a high glacial silt load. Peak flows occur during the spring/summer melt season and again in the heavy rainfall season.

Aquatic Habitat Capability: These channels are almost entirely inaccessible to anadromous and resident species due to high streamflow velocities and the presence of numerous local and downstream barriers.

Alluvial Fan Process Group

This process group includes AF1 (moderate gradient), AF2 (high gradient), and AF8 (glacial) alluvial fan/cone channel types. These are low to moderate gradient stream channels that are strongly influenced by alluvial sediment deposition. These are generally tributary streams that are located on footslope landforms in a transitional area between valley floodplains and steep mountainslopes. Sediment deposition tends to create elongated islands of bare cobbles and gravel between a multi-branched channel network. Alluvial fan deposits are formed by the rapid change in transport capacity as the high energy mountainslope stream segments spill onto the valley bottom. Drainage channels change course frequently, resulting in a multi-branched stream network. Riparian areas commonly associated with these poorly contained streams are very narrow at the top of the fans and become wider as the fan spreads out.

Moderate Gradient Alluvial Fan Channel
Channel Mapping Symbol: AF1 (Formerly B5)

Physical Characteristics

Geographic Setting: The AF1 channel type is exclusively associated with the alluvial fan landform. Normally, this landform is positioned between steep mountainslopes or hillslopes and flat valley bottoms or lowlands. In many valleys, AF1 streams lie adjacent to and merge with low gradient floodplain streams.

Channel Structure:
Stream Gradient: 1-6%, mean = 4% (reference site = 2%)
Incision Depth: mean = 1 m (3.3 ft.) (reference site less than 1 m)
Bankfull Width: mean = 6 m (20 ft.) (reference site = 6.5 m [21 ft.])
Dominant Substrate: fine gravel to large cobble
Stream Bank Composition: alluvium
Channel Pattern: single to multiple, channels spread across alluvial fan deposits
Drainage Basin Area: less than 5.2 km^2 (2 mi^2)

Riparian Vegetation

This channel segment is tributary to the West Branch estuary slough at Dyea. Riparian vegetation is estuarine meadow: graminoids and forbs such as umbels (plants in the parsley family).

Management Considerations

Hydrologic Function: AF1 channels are transitional streams from high gradient mountainslope to low gradient, valley bottom streams. This complex stream network exhibits a wide range of sediment erosion, transport, and deposition processes. Bank erosion, outwash sediment deposition, and lateral channel are common dynamic processes. Sediment transport occurs in the high and moderate gradient reaches of alluvial fan channels, leaving a substrate composed of larger cobble size materials. Extensive fine gravel deposits are common on the lower reaches of the AF1 streams adjacent to the valley bottom floodplain channels.

Aquatic Habitat Capability: AF1 channels are frequently accessible to anadromous species. The available rearing habitat is good, especially where they join mainstem channels in the lower reaches of a watershed. Coho and Dolly Varden use the pools (17% of active water, mean depth of 0.27 meters [0.9 feet]) commonly associated with large woody debris accumulations. Overwintering habitat is provided in these pools and along low gradient channel segments near the base of the alluvial fan where upwelling ground water moderates water temperature and inhibits ice formation. Spawning areas located in the lower gradient, downstream portions of AF1 channels are moderately used by most species of anadromous salmon and Dolly Varden. The reference reach, Nelson Creek, is located adjacent to the Dyea flats and is not forested. Therefore, large woody debris does not significantly influence habitat structure. Habitat consists largely of gravel riffles. Stream banks are naturally unstable in AF1 stream segments due to fine textured alluvial bank materials. Active bedload deposition and channel aggradation result in the formation of numerous side channels. Two or more main flow channels with extensive braided outwash deposits are common on the more active alluvial fans. Erosion control and stream bank protection should be emphasized for these streams.

Minnow traps in the reference reach yielded predominantly coho smolts and a few Dolly Varden char. This would indicate that these small estuary tributaries are important holding areas for coho smolt prior to saltwater migration. Approximately 12 adult chum salmon were observed spawning in the sample reach. Evidence of bear predation on the adult chums was also found.

High Gradient Alluvial Cone Channel
Channel Mapping Symbol: AF2 (Formerly A3)

Physical Characteristics

Geographic Setting: AF2 streams are typically situated on alluvial fan/cone landforms in steep sided, V-shaped valleys. These streams are located on transitional areas between mountain sideslopes and valley floors. AF2 channels are frequently located directly downstream from HC5 and HC6 channels. Less frequently, AF2 streams occur on sloping lowlands preceded by an HC3 stream. These channels have shallow incision, with poor flow containment. Channel pattern is single to multibranched. (Note that no AF2 reaches were sampled during the KLGO survey).

Channel Structure:
Stream Gradient: greater than 6%, mean = 11%
Incision Depth: less than or = 4 m (13 ft.), mean = 2 m (6.6 ft.)
Bankfull width: variable, mean = 4 m (13 ft.)
Dominant Substrate: coarse gravel to small boulders
Stream Bank Composition: alluvium
Sideslope Length: not significant, alluvial cone landform is concave in cross-section
Sideslope Angle: not significant
Channel Pattern: single to multibranched at lower end
Drainage Basin Area: less than 5.2 km^2 (2 mi^2)

Riparian Vegetation

The riparian plant communities are predominantly Sitka spruce series, with western hemlock series and the nonforested communities also common. Red alder, salmonberry, and Sitka alder shrubs dominate the nonforest riparian plant communities. AF2 segments tributary to the Warm Pass Fork of the Skagway River have subalpine fir riparian communities in addition to the modal communities for this channel type.

Management Considerations

Hydrologic Function: AF2 channels function in a transitional capacity for the steep sediment transport oriented channels upstream and the lower gradient, valley bottom channels downstream. These streams flow over and actively rework the deposited material that has formed the alluvial cone landform. AF2 channels act as rapid transport systems for material smaller than small cobbles. Small accumulations of fine sediment may be stored in pools associated with large boulders. Large woody debris plays a critical role in the stability of the banks and channels. Snow avalanche and debris flow processes also affect AF2 stream courses.

Aquatic Habitat Capability: Due to high stream flow velocities, AF2 channels are only occasionally accessible to anadromous fish species. When accessible, it is the downstream end, usually adjacent to FP4

and FP5 channels, where the gradient is low enough to allow AF2 habitat to be used for salmonid spawning and rearing.

These channel map segments are not utilized by anadromous or resident species in the upper Taiya (above Canyon City), or in the upper Skagway River channel network. AF2 channels contain low amounts of spawning and rearing habitat. These segments are located at the sediment/water source areas of watersheds, and influence downstream fish habitat productivity through the processes of sedimentation and groundwater infiltration.

Large woody debris has moderate influence on many AF2 channel types. Except for segments located below avalanche tracks, which contain shrub cover and minor debris loading, large woody debris is integral in retarding downstream sediment transport, and forming pool habitat units. Channel shifts are easily precipitated by log jams, removal of riparian vegetation, debris deposits from upstream mass wasting, and avalanche activity. Multiple channels are common below the apex of alluvial cone landforms.

Glacial Alluvial Cone Channel
Channel Mapping Symbol: AF8 (Formerly D6)

Physical Characteristics

Geographic Setting: The AF8 occurs on alluvial cone landforms in glacial drainage basins. At least 15% of the drainage area must be covered by a glacier or permanent snowfield to qualify as an AF8 channel. Channel gradients are commonly 6% or greater. Channel pattern is variable, usually singular at the apex of the cone and branching at the terminus. Suspended glacial silt load is high in these channels.

Channel Structure:
Stream Gradient: variable, (reference reaches 6-12%)
Incision Depth: less than or = 2 m (6.5 ft.)
Bankfull Width: variable, (reference reaches 9-20 m [30-66 ft.])
Dominant Substrate: coarse gravel to small boulder
Stream Bank Composition: alluvium
Channel Pattern: single to multiple channel, normally single at the apex of the fan with channel branching at the terminus
Drainage Basin Area: 2.6-13 km^2 (1-5 mi^2)

Riparian Vegetation

The riparian plant community is dominated by nonforested Sitka alder, willow, and salmonberry shrub communities. Cottonwood communities also occur adjacent to AF8 channels in the lower Taiya River valley.

Management Considerations

Hydrologic Function: AF8 channels have high rates of sediment transport and deposition. Sediment is delivered to these cone or fan channels from alpine glacier runoff, mountainslope avalanche, and mass wasting processes. Sediment outwash lobes are deposited across the surface of the alluvial cone by a network of multiple branched channels. Consequently, these are very dynamic landforms.

Aquatic Habitat Capability: AF8 channels are often accessible to

anadromous fish and resident fish. The amount of spawning and rearing area is insignificant. Substrate material is generally large, consisting of 22% gravel, 43% rubble, and 31% boulders and bedrock. Chum salmon and Dolly Varden char may spawn where finer substrate is found at the base of these alluvial cones near the junction with mainstem river channels. Shallow ground-water aquifers associated with alluvial cones can significantly improve spawning habitat in adjacent mainstem streams where ground-water upwelling occurs. No fish were observed in the reference stream reaches.

Stream banks are naturally unstable in AF8 channels, and riparian vegetation plays an important role in stabilizing these banks. Therefore, maintaining riparian vegetation integrity is an important management concern. Large sediment loads from glacial meltwater and snow avalanches cause extensive channel aggradation and frequent channel shifting.

Estuarine Process Group

This process group includes ES1 (silt substrate), ES2 (narrow, sand substrate), ES3 (narrow, cobble substrate), ES4 (large estuary), and ES8 (glacial outwash) estuarine channel types. These are all intertidal streams and are directly influenced by tidal inundation. Stream stage fluctuations, channel morphology, sediment transport, and water chemistry are all characteristics that are influenced, to some degree, by saltwater inundation in these stream segments. Estuarine channels are associated with saltwater marshes, meadows, mudflats, and gravel deltas that are all predominantly depositional environments. The associated riparian area encompasses the entire estuarine wetland system.

Narrow Small Substrate Estuarine Channel

Channel Mapping Symbol: ES2 (Formerly E3)

Physical Characteristics

Geographic Setting: ES2 streams occur exclusively within estuary landforms, usually draining a small to moderate size watershed. These channels are most commonly found in drainages along outer coastal beaches.

Channel Structure:
Stream Gradient: less than or = 1%, mean = 1% (sample site = 0.25%)
Incision Depth: less than 3 m (9.8 ft.), mean = 2 m (6.5 ft.)
Bankfull Width: less than 15 m (49 ft.), mean = 10 m (33 ft.)
(sample site 12 m [39 ft.])
Dominant Substrate: sand to gravel
Stream Bank Composition: alluvium (sand)
Channel Pattern: single, sinuous
Drainage Basin Area: less than 25.9 km^2 (10 mi^2)

Riparian Vegetation

The riparian plant community is dominated by nonforested plant communities consisting of estuarine meadow forbs and graminoids.

Management Considerations

Hydrologic Function: ES2 streams are predominantly depositional channels. Stream energy is very low for these channels. Substrate material consists mainly of gravel and sand. Bank erosion is

influenced more by ocean erosion processes than by stream discharge events.

Aquatic Habitat Capability: These channels are always accessible to anadromous species. Available spawning area (ASA) is high and seems to be limited primarily by fine sediment content. Pink and chum salmon frequently, and Dolly Varden char occasionally, spawn in ES2 channels. Coho salmon and Dolly Varden char will move into ES2 channels from upstream areas during summer and will rear until fall. Pink and chum salmon fry may also temporarily inhabit the ES2 channel before migrating seaward.

At the West Branch sample site (0227), backwater dam pool (520 m^2 [5600 ft^2]/100 m [330 ft.]) and glide (465 m^2 [5000 ft^2]/100 m) habitat units dominate. Gravel riffle habitat represents a minor component of the sample reach (35 m^2 [377 ft^2]/100 m). Predominant cover type is overhanging riparian vegetation along stream banks. Mean pool depth is relatively deep (0.9 m [2.9 ft.]), with a residual pool depth of 0.6 m (2 ft.) at the West Branch site.

Macroinvertebrate samples at the ES2 reach of West Branch Creek indicate impaired water quality. Few EPT genera are present and the EPT index is very low (0.08). Fine substrate and sluggish flow favors chironomids (blackfly). Periodic inundation by brackish estuarine water may also explain the lack of macro-invertebrate diversity. (Refer to Appendix 4 for complete macroinvertebrate sampling results).

Broad Braided Glacial Outwash Estuarine Channel
Channel Mapping Symbol: ES8 (Formerly E5)

Physical Characteristics

Geographic Setting: ES8 streams are associated with large glacial river deltas. These watersheds typically have greater than 15% of their drainage area covered by active glaciers and snowfields.

Channel Structure:
Stream Gradient: 0.5-1.5%
Incision Depth: less than 2 m (6.5 ft.)
Bankfull Width: variable, normally very wide delta (50+ m [160+ ft.])
Dominant Substrate: sand to coarse gravel
Stream Bank Composition: glacial alluvium
Channel Pattern: highly braided
Drainage Basin Area: 51.8 km^2 (20 mi^2)

Riparian Vegetation

The riparian areas immediately adjacent to these channels generally are unvegetated sand and gravel outwash and extensive tidal mudflats. Salt tolerant grasses and sedges dominate the more stable terraces away from the active deposition zone.

Management Considerations

Hydrologic Function: ES8 channels are depositional streams. GO3 channels immediately precede the ES8; consequently, characteristics such as braided channels and excessive sediment loads are very similar. ES8 substrate material ranges from small cobble to glacial

silt, and suspended silt loads are high. Tidal influences may affect stream flow and river stage a great distance upstream from saltwater.

Aquatic Habitat Capability: ES8 channels are always accessible to anadromous species. Out migrants and returning adults of all anadromous species may make frequent use of these channels for staging prior to in or out migration. In the lower Taiya system, pink and chum salmon utilize limited spawning areas. In other mainland river basins, sockeye use channel margins and slough habitat for summer rearing.

Glacial Outwash Process Group

This process group includes GO1 (glacial side channel), GO2 (large meandering), GO3 (large braided), GO4 (moderate width), and GO5 (cirque channel) glacial outwash channel types. These are generally valley or lowland streams, with the exception of high elevation, cirque basin channel types (GO5). Mountain glacier meltwater is the source of runoff to these streams. Consequently, these streams carry extremely high sediment loads and turbid water. Glacial outwash channel types are alluvial channels with stream gradients mostly less than 3%. Riparian areas are wide and may extend for more than a thousand meters in large braided outwash plain river systems.

Glacial Outwash Floodplain Side Channel

Channel Mapping Symbol: GO1 (Formerly D8)

Physical Characteristics

Geographic Setting: The GO1 channel type is usually situated within the broad, glacial valley or foreland landform. The GO1 channel is a side channel that bisects the glacial river terrace and is connected to the main GO2 or GO3 river.

Channel Structure:
Stream Gradient: 0-1%, mean = 1%
Incision Depth: 0-4 m (13 ft.)
Bankfull Width: 10-200 m (33-660 ft.), mean = 26 m (86 ft.)
Dominant Substrate: sand to coarse gravel
Stream Bank Composition: silt, sand, gravel alluvium
Channel Pattern: single to multiple channels, sinuous
Drainage Basin Area: N/A

Riparian Vegetation

The riparian plant community is dominated by nonforested Sitka alder, willow, and cottonwood plant communities. The Sitka spruce series is also a significant riparian vegetation component. The nonforested plant communities occur adjacent to the stream 78% of the time.

Management Considerations

Hydrologic Function: GO1 channels function as both sediment transport and storage systems. Low gradient, contained channels with high flow volumes have moderate stream energy. Sloughing of the fine textured stream banks can be a common occurrence. GO1 inlets and outlets are normally connected to larger glacial outwash channels (GO3), therefore, stream velocity and stream stage are controlled by the mainstem river and vary greatly with season.

Aquatic Habitat Capability: These channels are associated with the GO3 large glacial riverine systems and are generally accessible to anadromous fish. Available spawning area decreases and rearing area increases as the GO1 channel departs from the mainstem glacial channel. Flow velocities decrease and the number of side channel pools increase (30% of active water with a mean depth of 0.61 m (1.2 ft.) downstream from the GO1 junction with the main channel. Chinook and chum salmon will spawn in moderate densities where stream velocity and substrate are adequate, and in areas where ground-water upwelling occurs. Chinook salmon juveniles will frequently rear in these channels, and rearing coho will occasionally use stream bank habitat with shrub cover. Sockeye salmon will spawn and rear where side channel pools are large or backwater sloughs are nearby. Dolly Varden char will also occasionally spawn and rear in GO1 channels. Although natural sources of in-channel large woody debris is generally low in GO1 side channels, stable debris accumulations are key habitat features for rearing king salmon and, to some extent, coho.

Stream banks are commonly composed of fine, loosely consolidated alluvium (sands and silt). Riparian shrub and forest vegetation is a very important factor for maintaining stream bank stability in GO1 channels. These streams are usually one component of very extensive glacial floodplain complexes. Adjacent sloughs, small tributaries, beaver ponds, and wetlands are important fish and wildlife habitats.

Large Meandering Glacial Outwash Channel
Channel Mapping Symbol: GO2 (Formerly D4)

Physical Characteristics

Geographic Setting: The GO2 streams occur in middle to lower valley positions in large drainage basins. Valleys are U-shaped, with large, discontinuous flood terraces adjacent to GO2 streams. Floodplains are the typical adjacent landform in broad valley bottom areas, but inclusions of lowland, footslope and mountainslope landforms can occur. These channels are often found at the outlet of glacial lakes.

Channel Structure:
Stream Gradient: less than 3%, mean = 2%
Incision Depth: less than or = 4 m (13 ft.), mean = 2 m (6.5 ft.)
Bankfull Width: variable, mean = 42 m (140 ft.)
Dominant Substrate: coarse gravel to small boulder
Stream Bank Composition: alluvium
Sideslope Length: not significant. (Exception may be where GO2 channels cut through remnant glacial moraine deposits.)
Channel Pattern: single, sinuous
Drainage Basin Area: 51.8 km^2 (20 mi^2)

Riparian Vegetation

The riparian plant community is dominated by nonforested Sitka alder, willow, and salmonberry shrub communities, which occur adjacent to the stream 64% of the time. Cottonwood is the dominant overstory type.

Management Considerations

Hydrologic Function: GO2 streams are transport channels that carry high sediment loads. They are more sediment transport oriented than other channel types in the Glacial Outwash Process Group. These are moderate energy streams due to flow containment and a mean gradient of 2%.

Aquatic Habitat Capability: These channels are usually accessible to anadromous species. Because the substrate consists of larger material (20% gravel, 52% rubble, 18% boulders), available spawning area is generally low. Spawning king and chum salmon use these channels in moderate amounts, as do sockeye salmon when lakes or side sloughs are present in the drainage. Rearing king salmon and Dolly Varden char make use of pools (3% of active water) having a mean depth of 0.24 m (0.8 ft.). Coho salmon rear in clear water, off-channel, and side channel areas that flow into GO2 channels. The influence of large woody debris on channel stability and fish productivity in GO2 channel types is moderate. Stable in-channel debris generally consists of trees anchored to stream banks or large debris jams at meanders. Most of the limited rearing habitat is keyed to this large woody debris. Stream banks in GO2 channels are moderately susceptible to erosion. They are composed of unconsolidated alluvium, therefore, the banks are easily undermined by high velocity currents. Riparian vegetation is integral in maintaining bank stability and the protection of sensitive alluvial soils in GO2 channels. Floodplain side channels and sloughs, though infrequent, are often very important fish rearing areas.

Large Braided Glacial Outwash Channel
Channel Mapping Symbol: GO3 (Formerly D5)

Physical Characteristics

Geographic Setting: GO3 channels occur in very large, glacial drainage basins. They are located in broad, glacial valley bottoms or on outwash plains. Large floodplains occur adjacent to these channels.

Channel Structure:
Stream Gradient: less than 3%, mean = 2% (sample site = 1.25%)
Incision Depth: less than or = 2 m (6.5 ft.)
Bankfull Width: 60-300 m (200-1000 ft.), mean = 65 m (213 ft.), (sample site = 52 m [171 ft.])
Dominant Substrate: coarse gravel to large cobble
Stream Bank Composition: alluvium
Channel Pattern: braided, very wide
Drainage Basin Area: greater than 51.8 km^2 (20 mi^2)

Riparian Vegetation

The riparian plant communities are dominated by nonforested Sitka alder and willow shrub communities and the Sitka spruce-cottonwood/alder plant association. The nonforested communities occur immediately adjacent to the stream 73% of the time.

Management Considerations

Hydrologic Function: The GO3 channels function as sediment deposition systems. These low gradient, uncontained channels have low stream energy. GO3 channels have extremely large sediment loads, resulting in a braided channel network and extensive floodplain.

Peak flow events occur during the summer melt period and during the early fall rainy season.

Aquatic Habitat Capability: GO3 channels are usually accessible to anadromous species. Typically, they provide migration routes to salmon spawning areas in clear water tributaries. Chinook, chum, and sockeye salmon use spawning habitat in portions of the main channel. Spawning capability is limited by fine sediment in gravel spawning beds. Sockeye and chum salmon tend to select gravel where upwelling groundwater is present. Primarily sockeye and king utilize rearing areas associated with sloughs, side channel pools, and stream bank habitat. Coho and Dolly Varden char rear in low numbers in these channels.

Alaska Department of Fish and Game anadromous fish atlas indicates that no sockeye or king salmon utilize the Taiya River. Chum and pink salmon spawn in low to moderate numbers in the lower Taiya. Primary rearing species are Dolly Varden char, with lower densities of coho salmon and possibly steelhead trout. Fish trapping during the July survey yielded mostly Dolly Varden juveniles and low numbers of coho fry. No steelhead juveniles were found rearing in the Taiya main channel or off-channel habitats. The Taiya also has a spring run of eulachon (Pacific smelt) that spawn in the main channel up to the West Creek confluence (Bishop, 1981).

Large wood accumulations have moderate influence on instream habitat in GO3 channel types. Most stable wood accumulations are located along channel margins, sloughs, or side channels. Large wood accumulations in the reference reach comprised 15.6 pieces per 100 m (330 ft.) channel length with an approximate volume of 13 m^3 (17 yd^3)/100 m. Pool and bank cover associated with large woody debris is particularly important for rearing coho and Dolly Varden.

Stream banks are naturally susceptible to erosion. Flood flows are poorly contained. Channel aggradation and scour processes are very active due to the extremely large sediment loads. Side channels, sloughs, and adjacent wetlands are typically very extensive. The numerous tributary streams and beaver ponds on GO3 outwash plains are extremely important for fish rearing and spawning. Riparian vegetation is also an important factor mitigating potentially destructive flood flows.

The Taiya reference reach has a wide variety of habitat units but fast water gravel riffle (6,193 m^2 [66,600 ft^2]/100 m) habitat is by far the most dominant. Slow water habitat units include: mid-channel scour pool (34.6 m^2 [372 ft^2]/100 m), lateral scour pool (126 m^2 [1400 ft^2]/100 m), backwater eddy pool (14 m^2 [150 ft^2]/100 m), glide (117 m^2 [1260 ft^2]/100 m), offchannel glide (38 m^2 [400 ft^2]/100 m), offchannel slough (14 m^2 [150 ft^2]/100 m), and side channel 212 m^2 [2280 ft^2]/100 m). The most important cover components are overhanging bank vegetation, large woody debris accumulations, and slash. Average pool depth is 1 m (3.3 ft.) with 0.5 m (1.6 ft.) residual pool depth. It should be noted that habitat survey data is representative of river stages approaching bankfull levels.

Macroinvertebrate samples taken at a shallow riffle have a high EPT ratio with Ephemeroptera (mayfly family) the dominant taxa. This indicates relatively good water quality conditions. However, the FBI index indicates a moderate number of pollution tolerant taxa (Chironomidae). The rapid bio assessment rating (RBA = 3.9) for the lower Taiya is in the fair to good range reflecting the influence of

silty glacial meltwater. (Refer to Appendix 4 for complete macroinvertebrate results.)

Moderate Width Glacial Channel
Channel Mapping Symbol GO4

Physical Characteristics

Geographic Setting: The GO4 channel type occurs in the mid to upper valley position in glacial watersheds. Adjacent flood terrace areas are primarily composed of glacial outwash or till. Large valley glaciers and snowfields occur upstream of the GO4 channel type. Snow avalanche cones and subalpine mountainslopes typically occur adjacent to GO4 channels.

Channel Structure:
Stream Gradient: 2-6%, mean = 4% (reference reaches 4%-5%)
Incision Depth: less than or = 4 m (13 ft.), mean = 3 m (10 ft.)
Bankfull Width: variable, mean = 31 m (102 ft.) (reference reaches 17-20 m [56-66 ft.])
Dominant Substrate: coarse gravel to small boulder
Stream Bank Composition: alluvium with frequent boulder/bedrock intrusions
Sideslope Length: variable length
Sideslope Angle: mean = 12% (8º)
Channel Pattern: single or multiple
Drainage Basin Area: 13-100 km^2 (5-39 mi^2)

Riparian Vegetation

The riparian plant community is dominated by nonforested alder and willow shrub plant communities. A complex of alpine meadow and subalpine fir krummholz riparian communities occurs along the White Pass Fork of Skagway River. A willow-alder and subalpine fir forest community predominates along the Warm Pass Fork of Skagway River. Riparian communities along the Upper Taiya GO4 channel type near Sheep Camp are a mix of the willow-alder-cottonwood type along lower terraces and the birch-spruce type along elevated terraces.

Management Considerations

Hydrologic Function: GO4 channels are moderate energy streams that transport large sediment loads. Moderate gradient and large size substrate material are indicative of moderate to high stream power. Some inchannel retention of fine gravel and sand may occur in lower gradient reaches. Bedload transport is predominantly coarse gravel and cobble particle fractions. Peak flows occur in the spring/summer melt period and in the early fall. A high suspended glacial silt load is also characteristic of GO4 channels.

Aquatic Habitat Capability: Downstream barriers frequently make GO4 channels inaccessible to anadromous species. Typically, they get little use from spawning salmon. Rearing coho and king juveniles also infrequently use the available rearing area. Dolly Varden char may spawn in the rubble (39%) and gravel (19%) substrate, and rear in side channel pools, and the occasional pool associated with large woody debris. These channels provide little overwintering habitat.

Downstream waterfalls prevent upstream fish migration to both the upper Taiya and Skagway River systems. Trapping in all three

reference reaches indicate that no anadromous or resident fish species inhabit these channel segments.

Habitat unit measurements at the upper Taiya reference reach typify habitat capability in the GO4 segments. Boulder riffle (268 m^2 [2,880 ft^2]/100 m [330 ft.]) and boulder rapids (490 m^2 [5,270 ft^2]/100 m) are fast water habitats that offer little spawning or rearing potential. Backwater dam pool (4.3 m^2 [46 ft^2]/100 m) and backwater eddy pool (1.1 m^2 [12 ft^2]/100 m) are minor slow water habitat components. Primary cover types are boulder pocket water and undercut banks. All reference reaches were mostly devoid of large woody structure. Upper Taiya has 1.4 pieces of LWD per 100 m with a total volume of only 0.5 m^3 (2 yd^3)/100 m.

Macroinvertebrate sampling on GO4 reaches in the Upper Taiya River and Warm Pass Fork of the Skagway River indicates poor to fair water quality. At the Warm Pass reach, few clean water taxa were present (EPT ratio = 0.24) and chironomids, a pollution-tolerant taxa, dominated (FBI = 5.4). These results accurately reflect very high glacial silt loads observed at the Warm Pass sample reach. Macroinvertebrate indices for the Upper Taiya sample reach had mid-range values (EPT ratio = 0.55; FBI = 4.4). This site had more clean water taxa (stonefly, mayfly, caddisfly). Overall water quality is rated fair due to lesser influence from silty glacial meltwater.

Stream bank sensitivity is moderate for GO4 channel segments. Bank composition is mainly poorly sorted alluvium that is readily eroded by high velocity flows. High sediment loads in GO4 channels result in naturally high rates of channel aggradation and scouring. Floodplain riparian vegetation contributes greatly to channel stability and reduces channel erosion during flood events.

Palustrine Process Group

This process group includes PA1 - PA5 palustrine or wetland channel types. Channels within this process group are very low gradient streams associated with low relief landforms and wetland drainage networks. Water movement is slow and sediment transport is low. These channel types typically act as traps and storage areas for fine organic and inorganic sediments. Channel banks are generally stable and floodplain depositional features, such as gravel bars, are absent. Riparian area size is highly variable, but may encompass very large wetlands.

Shallow Ground-Water Fed Slough

Channel Mapping Symbol: PA3 (Formerly L4)

Physical Characteristics

Geographic Setting: PA3 streams are located on low relief glacial outwash floodplains. These channels typically occupy relict glacial braided channels and are recharged by clear groundwater flow.

Channel Structure:
Stream Gradient: mean = 1% (sample site = 0.5%)
Incision Depth: less than or = 4 m (13 ft.), mean = 2.5 m (8 ft.)
Bankfull Width: variable, mean = 12 m (4 ft.)(sample site = 16.8 m [55 ft.])
Dominant Substrate: silt to fine gravel (fine particulate organics also common)
Stream Bank Composition: alluvium
Channel Pattern: single to braided
Drainage Area: variable (ground water influenced)

Riparian Vegetation

The riparian plant communities are dominated by the Sitka spruce series, with inclusions of cottonwood and birch overstory components. Nonforested plant communities, predominantly willow and alder shrubs, commonly occur as a fringe along stream banks.

Management Considerations

Hydrologic Function: PA3 streams tend to store fine sediment due to low stream energy and, normally, low peak flows. During high flow periods the PA3 may be inundated by heavily silt laden water from adjacent glacial outwash channels. Base stream flow in these channels is maintained by groundwater recharge.

Aquatic Habitat Capability: PA3 channels are only moderately accessible to anadromous species because of seasonally low flows and possible physical isolation. Substrate consists of 20% gravel and 75% fine gravel, sand, and silt/muck. Available spawning area is generally low, but what is available may be used by coho salmon, steel head, king salmon, and Dolly Varden char. Sockeye salmon will spawn in these channels more frequently, especially where there is active upwelling of groundwater. All of the above species, especially coho and sockeye salmon, find PA3 channels favorable for rearing.

Habitat units in the lower Taiya tributary reference reach include: boulder riffle (166 m^2 [1,790 ft^2]/100 m), glide (119 m^2 [1,280 ft^2]/100 m), lateral scour pool (100 m^2 [1,080 ft^2]/100 m), and boulder glide (46 m^2 [495 ft^2]/100 m). Predominant cover types are overhanging vegetation and undercut banks. Average pool depth is 0.42 m (1.4 ft.) with a residual pool depth of 0.17 m (0.6 ft.). Habitat structure reflects historic fluvial geomorphic processes when this channel was connected to the main glacial floodplain channel network. Habitat condition is currently very stable.

Rearing salmonids sampled in order of abundance include: coho smolt, Dolly Varden juveniles, coho fry, and coho parr. Two spawning redds were observed (possibly spring steelhead) in the sample reach.

Terrestrial Ecological Unit MUDs

The following terrestrial ecological unit (TEU) MUDs are a subset of the entire set of MUDs from the Tongass National Forest, Chatham Area, Integrated Resource Inventory (IRI) for Admiralty, Baranof, and Chichagof Islands (ABC Islands). Only those MUDs occurring in KLGO are included here. The MUDs are established units and have been designed to represent areas of large extent. The mode described in each MUD may differ somewhat from KLGO conditions, due to KLGO's location in the transitional northern Lynn Canal area. However, KLGO conditions are included in the range of natural variation for each map unit. Where necessary, new map units have been created for KLGO, such as the subalpine fir unit.

Representative soils in most of the terrestrial ecological units are not drawn from soil descriptions for plots in the Park. However, the soils described in the Park are similar to the established classification and mapping concept. Appendix 2 summarizes data for soils described in the Park and adjacent national forest land.

Alpine MUDs

The alpine map units occur at high elevations. Slopes may be steep. Soils are generally undeveloped and shallow and bedrock is often exposed. Trees are rarely present, except in krummholz form. Lichens, graminoids, and forbs are the dominant vegetation, and may be sparse or lush in protected meadow areas. Alpine TEUs in KLGO include map units 11, 12, and 13.

Rugged Alpine

Unit Mapping Symbol: 11

Landform: Rugged mountain summits
Slope: 36-140%

Soil Taxa:
ROCK OUTCROP on very steep slopes, cliffs, aretes, peaks, and cirques, making up 70-90% (80% average) of the unit.
Sample soil pedon description (cm):
0 - bedrock
Parent material: exposed bedrock at surface

LITHIC CRYORTHENTS on moderately steep to very steep slopes, benches, and knobs, making up 0-20% (10% average) of the unit.
Sample soil pedon description (cm):
10-0 - mucky peat
0-3 - very dark gray very gravelly loam
3-33 - dark gray very gravelly loam
33 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

Inclusions: Lithic Cryosaprists occur on plateaus and rounded mountain summit landform inclusions.

Plant Association or Community:
Alpine Lichen-Rock Outcrop
Alpine Meadow

Management Considerations: Lichens are slow-growing and fragile plants; excessive hiker use of lichen-dominated areas (such as for scenic overlooks, etc.) may damage these communities beyond recovery.

Representative plots in KLGO for this map unit: None.

Rounded Alpine

Unit Mapping Symbol: 12A

Landform: Rounded mountain summits
Slope: 0-35%

Soil Taxa:
LITHIC CRYOSAPRISTS on rounded summits, making up 50-90% (60% average) of the unit.
Sample soil pedon description (cm):
0-13 - very dusky red peat
13-25 - dark reddish brown muck
25-63 - black muck
63 - bedrock
Soil drainage: very poorly drained
Permeability: moderately slow to moderately rapid
Parent material: organic material
Soil depth: very shallow to moderately deep

ROCK OUTCROP on scarps and shoulderslopes, making up 0-50% (30% average) of the unit.
Sample soil pedon description (cm):
0 - bedrock
Parent material: exposed bedrock at surface

Inclusions: Lithic Cryohemists occur on broad plateaus and in concave depressions. McGilvery soils occur on mounds and knobs. Krummholz vegetation occurs in some of the more protected areas in this unit.

Plant Association or Community:
Alpine Lichen-Rock Outcrop (especially in White Pass Unit of KLGO)
Alpine Meadow

Management Considerations: As in the Rugged Alpine type, lichen communities in this map unit may be damaged by excessive hiker use. Sedge-dominated alpine meadows are fairly resistant to trampling but, once damaged, may be slow to recover.

Representative plots in KLGO for this map unit: 5268, 5269, 5270, 5271, 5272, 5507.

Glaciers

Unit Mapping Symbol: 13

Landform: Snow and ice
Slope: variable

Soil Taxa: None

Inclusions: Rock outcrop nunataks.

Plant Association or Community:
Unvegetated

Management Considerations: None

Representative plots in KLGO for this map unit: None.

Mountainslope MUDs

The mountainslope units form the bulk of the Park and extend from valley bottoms to timberline. Slopes are moderately to very steep. Soils are shallow to moderately deep and bedrock may be exposed at higher elevations. Trees are the dominant vegetation except in avalanche and mass wasting areas where brush dominates. Mountainslope TEUs in KLGO include map units 21, 31ND, 32F, 35F, 35H, 35NC, 35ND, 36H, and 36ND.

Avalanche Slopes
Unit Mapping Symbol: 21

Landform: Mountainslopes with snow avalanching and mass wasting
Slope: 76-140%

Soil Taxa:
ENTIC CRYUMBREPTS on lower slopes, making up 30-60% (45% average) of the unit.

Sample soil pedon description (cm):
5-0 - mucky peat
0-5 - very dark grayish brown very gravelly sandy loam
5-18 - dark brown very gravelly loamy sand
18-25 - dark gray very gravelly loam
25-40 - dark brown very gravelly loamy sand
40-150 - dark brown very gravelly sandy loam
Soil drainage: moderately well drained
Permeability: moderately rapid
Parent material: colluvium
Soil depth: moderately deep to very deep

LITHIC CRYORTHENTS on upper slopes, making up 0-70% (35% average) of the unit.
Sample soil pedon description (cm):
10-0 - mucky peat
0-3 - very dark gray very gravelly loam
3-33 - dark gray very gravelly loam
33 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

Inclusions: Spodosols occur on narrow vertical strips of forest land along snow avalanche tracks. Well drained, deep to very deep, soils occur on lower depositional mountainsides with slopes less than 76%. Oxyaquic Cryumbrepts occur in drainage areas dominated by devil's club vegetation. Talus slopes occur randomly, both unvegetated and vegetated with early seral grasses, forbs, and shrubs. Snow accumulation and avalanche runout zones occur at the base of avalanche chutes, with less steep slopes. Alpine heath and meadow communities occur in small pockets.

Plant Association or Community:
Mixed Shrub (willow, Sitka alder, mountain ash, rusty menziesia, highbush cranberry, with grass and ferns)
Mountain Hemlock/Rusty Menziesia
Western Hemlock/Rusty Menziesia, below mountain hemlock zone
Mountain Hemlock-Subalpine Fir Krummholz, in areas free from avalanche disturbance but too exposed for normal tree growth

Management Considerations: Plant communities in this map unit are held in mid-succession by periodic avalanching and mass wasting. These same disturbances may present problems for trail location and maintenance. The shrub communities serve as a red flag for periodically disturbed areas. This unit includes areas of forest where disturbance is infrequent or does not occur; these are better options for trail locations.

Representative plots in/near KLGO for this map unit: 5061, 5062, 5063, 5069, 5262, 5263, 5264, 5265, 5266, 5267, 5508.

Forested, Lower Elevation, Deeply Incised Mountainslopes
Unit Mapping Symbol: 31ND

Landform: Frequently dissected, deeply incised mountainslopes
Slope: 56-75%

Soil Taxa:
MCGILVERY on shoulder and very steep upper slopes, making up 40% of the unit.
Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HAPLOCRYODS on mid to upper slope positions, making up 25% of the unit.
Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HAPLOCRYODS on all landscape positions, making up 20% of the unit.

Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium, ablation till and residuum
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountainslopes. Histic Cryaquepts occur on the lowest slope gradients.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: 5056, 5057, 55067, 5068, 5501, 5502.

Subalpine Fir, Shallowly Incised Mountainslopes
Unit Mapping Symbol: 32F

Landform: Frequently dissected, shallowly incised mountainslopes
Slope: 36-55%

Soil Taxa:
MCGILVERY on shoulder slopes and upper slopes, making up 30% of the unit.

Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HUMICRYODS on all landscape positions, making up 30% of the unit.

Sample soil pedon description (cm):
27-24 - dark reddish brown peat
24-20 - dark reddish brown mucky peat
20-8 - very dusky red muck
8-0 - black muck
0-8 - light brownish gray gravelly fine sandy loam
8-17 - black gravelly sandy loam
17-20 - black gravelly coarse sandy loam
20 - bedrock

Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HUMICRYODS on lower slopes, making up 25% of the unit.
Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand

Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and till
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountain backslopes. Histic Cryaquepts occur on lowest slope gradients. Typic Humicryods in incipient drainages with devil's club have numerous buried horizon sequences indicating soil disturbance on regularly occurring intervals. Avalanche slopes occur.

Plant Association or Community:
Subalpine Fir/Rusty Menziesia
Subalpine Fir/Devils' Club

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in/near KLGO for this map unit: 5070, 5071, 5072.

Subalpine Fir, Smooth Mountainslopes
Unit Mapping Symbol: 35F

Landform: Infrequently dissected, smooth mountainslopes
Slope: 36-75%

Soil Taxa:
MCGILVERY on shoulder slopes and upper slopes, making up 30% of the unit.

Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HUMICRYODS on all landscape positions, making up 30% of the unit.
Sample soil pedon description (cm):
27-24 - dark reddish brown peat
24-20 - dark reddish brown mucky peat
20-8 - very dusky red muck
8-0 - black muck
0-8 - light brownish gray gravelly fine sandy loam
8-17 - black gravelly sandy loam
17-20 - black gravelly coarse sandy loam
20 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HUMICRYODS on lower slopes, making up 25% of the unit.
Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and till
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountain backslopes. Histic Cryaquepts occur on lowest slope gradients. Typic Humicryods in incipient drainages with devil's club have numerous buried horizon sequences indicating soil disturbance on regularly occurring intervals. Avalanche slopes occur.

Plant Association or Community:
Subalpine Fir/Rusty Menziesia
Subalpine Fir/Devils' Club

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in/near KLGO for this map unit: 5070, 5071, 5072, 5273.

Forested, Higher Elevation, Smooth Mountainslopes
Unit Mapping Symbol: 35H

Landform: Infrequently dissected, smooth mountainslopes
Slope: 56-140%

Soil Taxa:
MCGILVERY on knobs, interfluves with 76-140% slope, making up 40-90% (50% average) of the unit.
Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HUMICRYODS on 56-120% slopes, making up 0-50% (25% average) of the unit.
Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock

Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: shallow or very shallow

ROCK OUTCROP, making up 0-50% (20% average) of the unit.
Parent material: exposed bedrock at surface

Inclusions: Typic Humicryods occur on depositional slopes below cliffs. Lithic Cryorthents occur on unstable ravine sideslopes. Birch occurs in seral stands at higher elevations.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: None.

Forested, Lower Elevation, Smooth Mountainslopes
Unit Mapping Symbol: 35NC

Landform: Smooth mountainslopes
Slope: 36-55%

Soil Taxa:
MCGILVERY on shoulder slopes and upper slopes, making up 40% of the unit.
Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HAPLOCRYODS on all landscape positions, making up 25% of the unit.
Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HAPLOCRYODS on lower slopes, making up 20% of the unit.
Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and till
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountainslopes. Histic Cryaquepts occur on lower slope gradients.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units

are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: None.

Forested, Lower Elevation, Smooth Mountainslopes (Steeper)
Unit Mapping Symbol: 35ND

Landform: Smooth mountainslopes
Slope: 56-75%

Soil Taxa:
MCGILVERY on shoulder slopes and upper slopes, making up 40% of the unit.
Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HAPLOCRYODS on all landscape positions, making up 25% of the unit.

Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock

Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HAPLOCRYODS on lower slopes, making up 20% of the unit.
Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and till
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountainslopes. Histic Cryaquepts occur on lower slope gradients.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: 5056.

Forested, Higher Elevation, Brokenslopes
Unit Mapping Symbol: 36H

Landform: Broken mountainslopes or broken hillslopes
Slope: 56-140%

Soil Taxa:
MCGILVERY on knobs and interfluves with 76-140% slopes, making up 40-90% (50% average) of the unit.

Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HUMICRYODS on 56-120% slopes, making up 0-50% (25% average) of the unit.
Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

ROCK OUTCROP making up 0-50% (20% average) of the unit.
Parent material: exposed bedrock at surface

Inclusions: Typic Humicryods occur on depositional slopes below cliffs. Lithic Cryorthents occur on unstable ravine sideslopes. Birch occurs in seral stands, especially at higher elevations.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: 5064, 5065, 5259, 5260, 5505.

Forested, Lower Elevation, Brokenslopes
Unit Mapping Symbol: 36ND

Landform: Broken mountainslopes or broken hillslopes
Slope: 56-75%

Soil Taxa:
MCGILVERY on shoulder slopes and upper slopes, making up 40% of the unit.

Sample soil pedon description (cm):
0-18 - dark reddish brown peat
18-20 - black mucky peat
20-24 - gray gravelly sandy loam
24-25 - very dark brown mucky loam
25 - bedrock
Soil drainage: well drained
Permeability: moderately rapid
Parent material: organic material
Soil depth: very shallow or shallow

LITHIC HAPLOCRYODS on all landscape positions, making up 25% of the unit.
Sample soil pedon description (cm):
4-0 - peat, mucky peat, muck
0-5 - gray gravelly sandy loam
5-8 - dark reddish brown gravelly silt loam
8-48 - dark brown gravelly sandy loam
48 - bedrock
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and residuum
Soil depth: very shallow or shallow

TYPIC HAPLOCRYODS on lower slopes, making up 20% of the unit.
Sample soil pedon description (cm):
9-0 - mucky peat, muck
0-5 - dark grayish brown gravelly sandy loam
5-10 - black silt loam
10-48 - black, very dusky red, dark brown very gravelly sandy loam
48-150 - dark grayish brown fine sand
Soil drainage: moderately well or well drained
Permeability: moderately rapid
Parent material: colluvium and till
Soil depth: moderately deep to very deep

Inclusions: Lithic Cryosaprists and Histic Lithic Cryaquepts occur on steep concave mountainslopes. Histic Cryaquepts occur on the lower slope gradients.

Plant Association or Community:
Western Hemlock/Blueberry
Western Hemlock/Rusty Menziesia

Management Considerations: Plant communities in this map unit are primarily old growth, except where stand level disturbance has occurred, such as from historic logging or clearing, or from windthrow. Second growth development can be expected to follow the general sequence described in the introductory section of this report. However, the more open vegetation types may not achieve a full canopy closure phase. Plot 5260 is a good example of second growth hemlock forest in KLGO. Except on steeper slopes, these units are stable and present no particular trail or hiker concerns.

Representative plots in KLGO for this map unit: 5057, 5067, 5068, 5501, 5502.

Alluvial Fan, Floodplain, and Footslope MUDs

The fan, floodplain, and footslope map units occupy valley bottom positions and are common in KLGO. Slopes are gentle to moderate. Soils can be very deep, and these units are often the most productive sites. However, there is little organic soil development. Soil disturbance by water is frequent, especially on the floodplain landforms. Flooding maintains many of these sites in early seral vegetation: shrubs and widely scattered trees, usually spruce or cottonwood. On the footslopes and fans, more dense stands of conifers dominate. Fan, floodplain, and footslope TEUs in KLGO include map units 51G, 52G, 52/53, and 53I.

Forested Footslopes
Unit Mapping Symbol: 51G

Landform: Infrequently dissected footslopes
Slope: 0-35%

Soil Taxa:
ENTISOLS on all landscape positions, making up 85% of the unit.
Sample soil pedon description (cm):
3-0 - mucky peat
0-3 - brown loamy very fine sand
3-10 - light brownish gray loamy very fine sand
10-23 - light brownish gray very fine sand
23-135 - light gray very gravelly coarse sand
Soil drainage: somewhat poorly to excessively drained
Permeability: moderately rapid
Parent material: glacial outwash and alluvium
Soil depth: deep or very deep

Inclusions: Cryods occur sporadically on older surfaces. Gravel and cobbles occur sporadically on the younger surfaces.

Plant Association or Community:
Sitka Spruce-Cottonwood Series
Sitka Spruce Series

Management Considerations: None.

Representative plots in KLGO for this map unit: None.

Footslopes and Fans
Unit Mapping Symbol: 52G

Landform: Frequently dissected footslopes and alluvial fans
Slope: 0-35%

Soil Taxa:
ENTISOLS on all landscape positions, making up 85% of the unit.
Sample soil pedon description (cm):
3-0 - mucky peat
0-3 - brown loamy very fine sand
3-10 - light brownish gray loamy very fine sand
10-23 - light brownish gray very fine sand
23-135 - light gray very gravelly coarse sand

Soil drainage: somewhat poorly to excessively drained
Permeability: moderately rapid
Parent material: glacial outwash and alluvium
Soil depth: deep or very deep

Inclusions: Cryods occur sporadically on older surfaces. Gravel and cobbles occur sporadically on the younger surfaces.

Plant Association or Community:
Sitka Spruce-Cottonwood Series
Sitka Spruce Series
Subalpine Fir Series in White Pass Unit of KLGO

Management Considerations: The frequent small drainages in this unit may present problems for trail location and maintenance. Bridges may be required to avoid continual washouts.

Representative plots in/near KLGO for this map unit: 5274, 5503.

Footslopes and Terraces
Unit Mapping Symbol: 52/53

Landform: Association of frequently dissected footslopes, alluvial fans, and floodplains.
Slope: 0-35%

Soil Taxa:
ENTISOLS on all landscape positions on footslopes, making up 45% of the unit.

Sample soil pedon description (cm):
3-0 - mucky peat
0-3 - brown loamy very fine sand
3-10 - light brownish gray loamy very fine sand
10-23 - light brownish gray very fine sand
23-135 - light gray very gravelly coarse sand
Soil drainage: somewhat poorly to excessively drained
Permeability: moderately rapid
Parent material: glacial outwash and alluvium
Soil depth: deep or very deep

CRYOFLUVENTS on lower terraces of active floodplains, making up 40% of the unit.
Sample soil pedon description (cm):
5-0 - peat
0-1 - grayish brown loamy sand
1-5 - black sandy loam
5-10 - grayish brown loamy sand
10-13 - muck
13-70 - dark yellowish brown and dark brown sandy loam
70-143 - dark grayish brown loamy sand
Soil drainage: somewhat poorly to well drained
Permeability: moderately rapid
Parent material: glacial outwash, alluvium
Soil depth: deep or very deep

Inclusions: Cryods occur sporadically on older surfaces (often hemlock plant associations). Gravel and cobbles occur sporadically on the younger surfaces (with nonforest communities such as shrubs or graminoids). Lower floodplain terraces are subject to flooding on a seasonal basis. Higher terraces are either not flooded or they are flooded only during periods of high stream flows.

Plant Association or Community:
Sitka Spruce-Cottonwood Series
Sitka Spruce Series
Western Hemlock/Rusty Menziesia on footslopes only
Mixed Shrub Communities on lower terraces only

Management Considerations: Flooding in this unit may present problems for trail location and maintenance. Hemlock forest indicates the most stable portion of the unit.

Representative plots in KLGO for this map unit: 5261, 5506.

Floodplains
Unit Mapping Symbol: 53I

Landform: Floodplains
Slope: 0-5%

Soil Taxa:
CRYOFLUVENTS on lower terraces of active floodplains, making up 75% of the unit.

Sample soil pedon description (cm):
5-0 - peat
0-1 - grayish brown loamy sand
1-5 - black sandy loam
5-10 - grayish brown loamy sand
10-13 - muck
13-70 - dark yellowish brown and dark brown sandy loam
70-143 - dark grayish brown loamy sand
Soil drainage: somewhat poorly to well drained
Permeability: moderately rapid
Parent material: glacial outwash, fine glaciomarine sediments, alluvium
Soil depth: deep or very deep

RIVERWASH adjacent to stream channels, making up 10% of the unit.
Parent material: Gravel and sand bars

Inclusions: Cryaquepts occur sporadically away from stream channels. Lower terraces are subject to flooding on a seasonal basis. Higher terraces are either not flooded or they are flooded only during periods of high stream flows. Soils are generally extremely stony throughout in the upper ends of the drainages and range to sandy in the lower ends of the drainages.

Plant Association or Community:
Sitka Spruce-Cottonwood Series
Sitka Spruce Series
Riverwash mostly unvegetated

Management Considerations: Flooding in this map unit may present trail hazards.

Representative plots in KLGO for this map unit: 5058, 5060, 5258, 5500.

Uplifted Estuary MUD

The uplifted estuary unit occurs only in the Dyea area. It is a nearly flat landform with deep soils. Disturbance by flooding is frequent in the lower portion. The lower portions of the unit are dominated by graminoids. Forbs are more common in the upper portions, and spruce is beginning to colonize in the more elevated portions of the unit, near existing forest. The uplifted estuary is mapped as unit 75.

Uplifted Estuary
Unit Mapping Symbol: 75

Landform: Uplifted estuaries
Slope: 0-5%

Soil Taxa:
CRYOFLUVENTS on all positions, making up 90% of the unit.
Sample soil pedon description (cm):
7-0 - muck
0-9 - dark brown gravelly very coarse sand
9-18 - dark brown coarse sand
18-27 - dark brown loamy sand
27-34 - muck
34-38 - grayish brown fine sand
38-93+ - grayish brown very gravelly coarse sand

Soil drainage: poorly to well drained
Permeability: rapid
Parent material: fine glaciomarine sediments, alluvium
Soil depth: very deep

Inclusions: Cryorthents occur on beaches with beach fringe forb-graminoid vegetation. Cryaquents occur on active estuary, subject to tidal inundation. Flooding occurs on the lower (seaward) portions of this unit from storm tides. Flooding also occurs when the Taiya River shows high flows.

Plant Association or Community:
Graminoid-Forb Communities

Management Considerations: Plant communities in this unit are early seral and easily disturbed. Flooding, offroad vehicles, hikers and campers can disturb these communities beyond recovery. The Dyea estuary already shows damage from offroad vehicles, in the form of ruts and lines of trampled and sparse vegetation within more lush communities.

Representative plots in/near KLGO for this map unit: 5253, 5254, 5255, 5256, 5257.

Open Water MUDs

Salt and freshwater units are also mapped: ocean, and ponds/lakes respectively. Rivers are included in floodplain units, and are classified by channel type in the aquatic MUDs.

Saltwater
Unit Mapping Symbol: SW
Landform: Ocean, Bay
Plant Association or Community:
Unvegetated

Freshwater
Unit Mapping Symbol: W
Landform: Pond, Lake
Plant Association or Community:
Mainly Unvegetated

Vegetation Communities

Specific vegetation communities in the Park are not restricted to single terrestrial ecological units, but may occur in several of the units described above. For example, the western hemlock forest with blueberry understory plant association occurs at both lower and higher elevations, on several types of mountainslopes. Moreover, communities typically do not have distinct boundaries, but grade into each other. The major vegetation types sampled during field work are described in this section. These types are subsets, smaller scale and more specific types, of the vegetation categories listed for each ecological unit above. It is very possible that there are other vegetation types present in KLGO, probably variants of the types described here. More extensive sampling would be required to identify and describe all types, which is beyond the scope of this project.

The vegetation types described here were classified based on previous work on plant associations in the Chatham Area portions of Admiralty, Baranof, and Chichagof (ABC) Islands. In some cases, the KLGO communities are somewhat different in both vegetation composition and structure from that average, probably due to the location of KLGO at the northern end of the Tongass, in an area transitional to the Alaskan Interior. The descriptions provided in this report are for the KLGO type, not the ABC Island average. For some KLGO communities, there is no similar type in the established descriptions, since work on the mainland types has not been completed. For these communities, the name and description are provided specifically for KLGO, but may become part of future Chatham Area plant community descriptions.

The terms plant association and community type may appear to be used interchangeably, but this is only the case for late seral vegetation. Plant association refers to the **potential** natural vegetation on a site, that is, the "climax" vegetation, while community type refers to the **existing** vegetation. In the case of late seral stands, the existing vegetation is the same as the potential vegetation, but in early seral stands, the two are different. The Chatham Area has developed keys to identify existing late seral forest types for the ABC Islands, keys which in some cases may be also used for early seral stages of vegetation. These keys have been applied to late seral vegetation in KLGO. For early seral types, no established Chatham Area characterizations are available and descriptions apply specifically to KLGO. Thus, community type descriptions are given for these early seral vegetation types while plant association descriptions are given for the late seral types.

Detailed vegetation data summaries are provided in Appendix 1.

Forested Vegetation Types

Western Hemlock Series

Western hemlock is the most widely distributed tree species in Southeast Alaska. It dominates the best upland sites where mineral soil is not exposed and where drainage is mainly unrestricted. Trees are typically taller on these sites than on more poorly drained sites. However, trees in KLGO are generally much shorter than trees in more southern parts of the Tongass National Forest. Canopy closure is usually high, and there are a variety of understory shrubs, forbs, and ferns. In the KLGO map units, there are two main western hemlock plant communities, distinguished by understory type. The western hemlock types are the most common of the forested vegetation types sampled in KLGO.

Western Hemlock/Blueberry
Tsuga heterophylla/Vaccinium ovalifolium-Vaccinium alaskense

Composition

In KLGO, western hemlock dominates the overstory in this community type, with Sitka spruce typically also present. Paper birch may also occur, particularly at higher elevations. The overstory canopy cover averages 56% and the understory averages 31%. The majority of conifer regeneration is hemlock.

The shrub layer in this type is not extensive. Blueberry is the most common and abundant shrub, with Sitka alder also abundant when it occurs (only in 43% of the sampled stands). Rusty menziesia is often present.

Forb, fern, and graminoid cover and species were quite variable in the sampled stands. When it occurred, bunchberry was the most abundant forb. One-sided wintergreen and oak fern showed the greatest constancy, but were not found in all the sampled stands. Average cover, range, and constancy (in percent) are shown in Table 4 for species which were found in sampled stands in more than trace amounts.

Structure

In the seven stands sampled in this association, spruce and western hemlock were the main tree species. Spruce trees averaged greater diameter and height than western hemlocks, at 15 inches (38 cm) and 73 feet (22 m) versus 13 inches (33 cm) and 57 feet (17 m) respectively. Overall canopy average height per stand ranged from 40 to 90 feet (12-27 m). Several of the sampled stands were second growth.

Sitka alder was the tallest shrub in the sampled stands, averaging 20 feet (6 m). Willows, occurring in 43% of the plots, averaged 14 feet (4 m) while blueberry and menziesia averaged 2 and 3 feet (0.6 and 0.9 m) respectively.

Nearly all the large woody debris in the sampled stands was western hemlock. Average diameter was 10 inches (25 cm) and average length 9 feet (2.7 m). The pieces of wood were mostly well decayed, averaging 4 on a scale of 1 to 5, with 1 indicating retained bark and needles and 5 indicating sloughed bark, crumbly heartwood and general loss of shape (see glossary for more information). Snags were uncommon in this type, with only two western hemlock snags recorded in seven sample plots.

Environmental characteristics

The sampled western hemlock/blueberry stands occurred primarily on mountain sides, with slopes of 50% or less and elevations less than 1150 feet (350 m). Aspects were generally western or southwestern, but this is probably a sampling artifact, since more of our field work occurred on the trail side of the Taiya River. The stands were all well drained.

Table 4. Percent Cover and Constancy Data for Western Hemlock/Blueberry

Species	Overstory				Understory			
Trees	Aver.	Min.	Max.	Const.	Aver.	Min.	Max.	Const.
Paper Birch	0	0	20	71	2	0	0	3
Sitka Spruce	16	7	25	100	2	1	3	86
Lodgepole Pine	2	1	3	29	1	1	1	14
Black Cottonwood	3	2	4	29				
Western Hemlock	39	10	60	100	22	1	50	100
Mountain Hemlock	3	2	3	29				

	Cover			
Shrubs	Aver.	Min.	Max.	Const.
Sitka Alder	6	2	9	43
Rusty Menziesia	2	0	6	57
Devil's Club	2	0	4	43
N. Black Currant	0.5	0	1	29
Barclay Willow	1	1	1	29
Willow	2	2	2	14
Sitka Mountain Ash	3	1	4	29
Tall Blueberry	5	0	20	86
Mountain Cranberry	2	2	2	14
Highbush Cranberry	3	3	3	14
Forbs, Ferns, Graminoids				
Comandra	1	1	1	14
Goatsbeard	3	3	3	14
Bunchbery	7	0	15	43
Alpine Heuchera	0.5	1	1	14
Single Delight	0.5	0	1	29
Liverleaf Wintergreen	0.5	0	1	29
One-sided Wintergreen	0.5	0	1	57
Five-leaf Bramble	3	0	7	43
Bluejoint Grass	0.5	0	1	29
Lady Fern	5	1	9	29
Shield Fern	1	0	4	57
Oak Fern	2	0	5	71
Stiff Clubmoss	0.5	1	1	14
Licorice Fern	0.5	0	1	29
Northern Beech-fern	3	3	3	14

Western Hemlock/Rusty Menziesia
Tsuga heterophylla/Menziesia ferruginea

Composition

Western hemlock dominates the overstory in this community type. Sitka spruce is often present in limited amount. Paper birch may be abundant in some stands, particularly younger seral stage stands at higher elevations (for example, plots 5064-5065). The overstory averages 58% cover and the understory 14%. Conifer regeneration is less abundant than in the hemlock/blueberry type, and is nearly all western hemlock.

The tall shrub layer in this type is much more extensive than in the hemlock/blueberry type. Menziesia was present in all eight stands sampled in this type, and averaged 31% cover. Blueberry and devil's club were also present in most sampled stands but in limited amount.

Forbs are limited in this vegetation type. Bunchberry and five-leaf bramble were present in most sampled stands, averaging 4% and 2% cover respectively. Shield fern was the most abundant and frequently occurring fern. Average cover, range, and constancy are shown in Table 5 for species which were found in sampled stands in more than trace amounts.

Structure

In the eight stands sampled in this community type, paper birch, western hemlock, and Sitka spruce occurred in the variable plots. Spruce and hemlock averaged similar heights and diameters, 14 inches (36 cm) DBH and 50 feet (15 m) and 13 inches (33 cm) and 47 feet (14 m) respectively. Birch was smaller, at 7 inches (18 cm) DBH and 36 feet (11 m). Overall canopy average height per stands ranged from 25 to 55 feet (8-17 m). Several of the sampled stands were second growth.

Barclay willow was the tallest shrub recorded for this type, averaging 11 feet (3 m), but only occurring in 38% of the sampled stands. Of the shrubs present in all or most of the sampled stands, menziesia averaged the greatest height, at 5 feet (1.5 m), with devil's club averaging 3 feet (0.9 m) and blueberry averaging 2 feet (0.6 m).

All the woody debris in the sampled stands was western hemlock. Average diameter was 13 inches (33 cm) and average length 12 feet (3.6 m). The pieces of wood were well decayed, averaging decay class 4. Snags were not abundant in the sampled stands, with four western hemlock and one birch snag occurring in the eight plots in this community type.

Environmental characteristics

The sampled western hemlock/blueberry-menziesia stands occurred primarily on mountain sides, with one stand on a footslope and one on a floodplain. Slopes ranged from 30 to 80%. Elevations were higher for this vegetation type than for the hemlock/blueberry type, ranging from 650 to 1560 feet (200-475 m). Aspects were variable. The stands were all moderately or well drained.

Table 5. Percent Cover and Constancy Data for Western Hemlock/Menziesia

Species	Overstory				Understory			
Trees	Aver.	Min.	Max.	Const.	Aver.	Min.	Max.	Const.
Paper Birch	25	3	55	63	4	0	8	50
Sitka Spruce	4	1	7	75	1	0	4	63
Western Hemlock	40	5	70	100	11	1	40	100
Mountain Hemlock	6	6	6	13	1	1	1	13
	Cover							
Shrubs	Aver.	Min.	Max.	Const.				
Sitka Alder	5	1	9	25				
Rusty Menziesia	31	10	65	100				
Devil's Club	1	0	6	100				
N. Black Currant	0.5	0	1	50				
Barclay Willow	2	1	3	38				
Willow	0.5	0	1	25				
Sitka Mountain Ash	2	0	5	38				
Tall Blueberry	3	0	8	88				
Mountain Cranberry	3	3	3	13				
Highbush Cranberry	0.5	0	1	38				
Forbs, Ferns, Graminoids								
Bunchbery	4	1	7	88				
Alpine Heuchera	0.5	0	1	25				
One-sided Wintergreen	0.5	0	1	25				
Five-leaf Bramble	2	0	8	88				
Bluejoint Grass	0.5	0	1	38				
Sedge	1	1	1	13				
Lady Fern	2	0	3	25				
Shield Fern	3	0	15	100				
Oak Fern	1	0	4	75				

Mountain Hemlock Series

In the Chatham Area, mountain hemlock becomes the dominant tree on well drained sites at higher elevations (subalpine zone) and codominates on poorly drained sites in a mixed conifer vegetation type. In KLGO, mountain hemlock replaces western hemlock in the subalpine zone, but is rarely found in the mixed conifer type since most of the Park's soils are well drained. Mountain hemlock becomes progressively stunted in the subalpine zone, occurring as scrub forest under better conditions and as "krummholz"--twisted, bent, dwarf woodland--where wind and cold conditions become limiting to the normal growth form. In KLGO, mountain hemlock occurs with subalpine fir in the subalpine zone, a species not found in much of the Tongass.

During field work, we sampled in one mountain hemlock forested plant association: mountain hemlock/menziesia. The particular stand sampled was a scrub forest type but it is likely that there are more productive stands of this type in the Park. Species composition is expected to be similar but tree sizes and plant cover would probably be greater. (The krummholz type is not considered forest, and is therefore discussed in a later section.)

Mountain Hemlock/Rusty Menziesia
Tsuga mertensiana/Menziesia ferruginea

Composition

In KLGO, mountain hemlock dominates the overstory in this community type. Western hemlock, Sitka spruce, subalpine fir, and paper birch may also occur. The overstory canopy cover averages 60% and the understory averages 25%. The majority of conifer regeneration is mountain hemlock.

Menziesia is the most abundant shrub, with blueberry also present.

Five-leaf bramble and bunchberry were the dominant forbs, and shield fern the only fern. Cover is shown in Table 6 for species which were found in the sampled stand in more than trace amounts.

Structure

In the one stand sampled in this vegetation type, both mountain hemlock and subalpine fir occurred. They averaged similar heights and diameters, 7 inches DBH (18 cm) and 29 feet (9 m) and 6 inches (15 cm) and 28 feet (9 m) respectively.

Menziesia averaged 4 feet (1.2 m) and blueberry averaged 2 feet (0.6 m) in height.

There were two pieces of woody debris, both western hemlock, with average diameter 7 inches (18 cm) and average length 5 feet (1.5 m). One piece was rotten, the other fairly fresh. One subalpine fir snag was recorded in the variable plot.

Environmental characteristics

The sampled mountain hemlock/menziesia stand occurred on the mountain sides, on a gentle slope (17%), below and between avalanche chutes. Elevation was 1360 feet (41 m) and aspect west. The soil was well drained and shallow to bedrock.

Table 6. Percent Cover and Constancy Data for Mountain Hemlock/Blueberry

Species	Overstory	Understory
Trees	Average	Average
Paper Birch	10	1
Sitka Spruce	2	0
Subalpine Fir	5	1
Western Hemlock	15	2
Mountain Hemlock	40	25
	Cover	
Shrubs	Average	
Rusty Menziesia	30	
Tall Blueberry	10	
Forbs, Ferns, Graminoids		
Bunchberry	6	
Heart-lvd. Twayblade	0.5	
One-sided Wintergreen	0.5	
Five-leaf Bramble	20	
Clasp. Twisted Stalk	0.5	
Arctic Starflower	0.5	
Shield Fern	3	

Transitional Western Hemlock-Mountain Hemlock/Rusty Menziesia
Tsuga heterophylla-Tsuga mertensiana/Menziesia ferruginea

One stand was sampled that is intermediate between the two hemlock types, occurring at the transition zone where mountain hemlock begins to replace western hemlock. It had a mixed western and mountain hemlock overstory and a menziesia-dominated understory. It is similar to, and intermediate between, the western hemlock/menziesia and the mountain hemlock/menziesia types described above. We consider it to be a mountain hemlock plant association, but to represent the transition zone and not the modal type. Hence it was not averaged in with the other mountain hemlock stand, described immediately above. These two stands, plot 5259 the transitional, and plot 5263 the scrub plot, represent the extremes of the mountain hemlock/menziesia type. Unfortunately, no sampling occurred in a more representative stand.

Sitka Spruce Series

Unlike western hemlock, Sitka spruce requires mineral soil for germination, and spruce is less shade tolerant than hemlock. Consequently it is found on sites where soils are periodically disturbed, such as by flooding or avalanche. In KLGO, spruce is found mainly in floodplain areas, often with black cottonwood and various shrubs. It is also found in alluvial fan areas, in second growth stands where windthrow, logging, or clearing exposed mineral soils, and in the Dyea estuary area on uplifted, young soils. In cases where the disturbance factor does not persist (such as historically logged areas, now protected from logging), the spruce stands are expected to gradually be succeeded by the shade tolerant western hemlock vegetation types. In periodically disturbed areas such as floodplains, spruce stands are expected to persist.

During our field work, we sampled in two spruce types: the upland spruce type and the floodplain spruce-black cottonwood type.

Sitka Spruce/Devil's Club
Picea sitchensis/Oplopanax horridum

Composition

Sitka spruce dominates the overstory in this vegetation type. Western hemlock is typically present and may dominate the regeneration, being more shade tolerant than spruce. In the one, mid-seral, stand sampled, the overstory averaged 60% cover and the understory 10%.

The tall shrub layer in this type is not extensive. Devil's club dominated at 10% cover, with menziesia and highbush cranberry also present.

Forb abundance was low, with bunchberry and clasping twisted stalk the dominants. Oak fern was extremely abundant at 65% cover. Average cover is shown in Table 7 for species which were found in the sampled stand in more than trace amounts.

Structure

Sitka spruce and western hemlock occurred in the variable plots. Spruce and hemlock averaged similar diameters and the same height, 14 and 13 inches (36 and 33 cm) DBH respectively and 105 feet (32 m). However, the hemlocks had much more extensive crown ratios, averaging 70% as opposed to 25%.

Rusty menziesia was the tallest shrub recorded for this type, averaging 6 feet (1.8 m). Highbush cranberry averaged 5 feet (1.5 m) and devil's club 4 feet (1.2 m).

All the woody debris in the sampled stands was spruce. Average diameter was 8 inches (20 cm) and average length 8 feet (2.4 m). The pieces of wood were well decayed, averaging decay class 4. One spruce snag was recorded in the variable plot.

Environmental characteristics

The sampled stand occurred on an alluvial fan, 22% slope, western aspect, and 160 feet (49 m) elevation. The soil was well drained and mineral.

Table 7. Percent Cover and Constancy Data for Sitka Spruce/Devil's Club

Species	Overstory	Understory
Trees	Average	Average
Sitka Spruce	45	0
Western Hemlock	20	10
	Cover	
Shrubs	Average	
Rusty Menziesia	7	
Devil's Club	10	
Highbush Cranberry	2	
Forbs, Ferns, Graminoids		
Bunchberry	3	
One-sided Wintergreen	0.5	
Clasp. Twisted Stalk	2	
Shield Fern	0.5	
Oak Fern	65	

Sitka Spruce-Black Cottonwood/Red-osier Dogwood-Sitka Alder
Picea sitchensis-Populus trichocarpa/Cornus stolonifera-Alnus crispa sinuata

This community type has a mixed overstory type with both spruce and cottonwood dominating in varying proportions depending on the site. It occurs along the floodplain and requires disturbance to persist. On older terraces it is likely to be succeeded by a western hemlock type.

Composition

Spruce and cottonwood codominate the overstory in this community type, averaging 22 and 18% respectively across the four sampled stands. The overstory averaged 36% cover and the understory 10%. Conifer regeneration is nearly all spruce.

The tall shrub layer in this type is extensive and is dominated by Sitka alder and red-osier dogwood in varying proportions. Devil's club and highbush cranberry were also present in most sampled stands.

Forb diversity is higher in this vegetation type than in the hemlock types. Liverleaf wintergreen occurred in all four stands. Enchanter's nightshade, clasping twisted stalk, and marsh violet were also common forbs. Oak fern was the most abundant and frequently-occurring fern.

Average cover, range, and constancy are shown in Table 8 for species which were found in sampled stands in more than trace amounts.

Table 8. Percent Cover and Constancy Data for Sitka Spruce-Black Cottonwood/Red-osier Dogwood-Sitka Alder

Species	Overstory				Understory			
Trees	Aver.	Min.	Max.	Const.	Aver.	Min.	Max.	Const.
Red Alder	5	5	5	25	1	1	1	25
Paper Birch	6	1	10	50				
Sitka Spruce	22	7	50	75	10	7	15	100
Black Cottonwood	18	15	25	100				
Western Hemlock					1	1	2	50

	Cover			
Shrubs	Aver.	Min.	Max.	Const.
Sitka Alder	28	15	45	100
Red-osier Dogwood	43	30	55	75
Devil's Club	6	0	15	75
N. Black Currant	1	0	3	75
Swamp Gooseberry	0.5	0	1	50
Pac. Red Elderberry	0.5	1	1	25
Tall Blueberry	2	2	2	25
Highbush Cranberry	5	1	10	100
Forbs, Ferns, Graminoids				
Baneberry	1	1	1	50
Goatsbeard	2	1	3	50
Enchant. Nightshade	4	1	7	75
Sweetscented Bedstraw	0.5	0	1	75
Cow Parsnip	0.5	1	1	50
Rattlesnake Root	0.5	0	1	75
Liverleaf Wintergreen	3	0	7	100
One-sided Wintergreen	1	1	1	25
Buttercup	2	2	2	25
Clasp, Twisted Stalk	8	1	20	75
Marsh Violet	8	0	15	50
Bluejoint Grass	0.5	0	1	50
Lady Fern	2	1	3	50
Oak Fern	29	7	55	75
Meadow Horsetail	4	0	8	50
Horsetail	0.5	1	1	25

Structure

Cottonwood trees were larger than spruces, averaging 21 inches (53 cm) DBH and 105 feet (32 m), while spruces averaged 17 inches (43 cm) DBH and 87 feet (27 m). Spruces had larger crown ratios, however, averaging 75% while cottonwood averaged 39%. Overall canopy average height per stands ranged from 90 to 120 feet (27-37 m).

Sitka alder was the tallest shrub recorded for this type, averaging 21 feet (6 m). Highbush cranberry, also present in all 4 stands, averaged 4 feet (1.2 m), while red-osier dogwood and devil's club averaged 7 feet (2 m) and 2 feet (0.6 m) respectively.

Spruce and cottonwood woody debris was similar in size, averaging 11 inches (28 cm) diameter and 17 feet (5 m) length and 12 inches (30 cm) and 16 feet (5 m) respectively. The spruce pieces of wood were more decayed, averaging decay class 4, while the cottonwoods averaged decay class 3. No snags were recorded in the sampled stands.

Environmental characteristics

The sampled Sitka spruce-black cottonwood stands occurred on floodplains. Slopes were negligible. Elevations ranged from 80 to 330 feet (24-100m). Aspects were variable. Three stands were well drained, one somewhat poorly drained.

Subalpine Fir Series

Subalpine fir is limited in range extent to northern southeast Alaska. No Chatham Area ABC Island vegetation types including this species have been described. Subalpine fir is most prevalent in KLGO in the White Pass Unit, particularly at higher elevations. Two understory types were sampled in the subalpine fir stands in KLGO.

Subalpine Fir/Rusty Menziesia
Abies lasiocarpa/Menziesia ferruginea

Composition

Subalpine fir dominates the overstory in this community type. Sitka spruce is typically present and may be abundant. Western hemlock and paper birch may also occur. The overstory averages 59% cover and the understory 7%. Conifer regeneration may be abundant and is mostly hemlock or fir.

The tall shrub layer in this type may be extensive. Menziesia dominates and blueberry and devil's club are also usually present but not abundant.

Forbs are limited in this vegetation type. Five-leaf bramble is abundant. Bunchberry was present in all four sampled stands in varying amount. Shield fern was the most abundant and frequently occurring fern. Average cover, range, and constancy are shown in Table 9 for species which were found in sampled stands in more than trace amounts.

Table 9. Percent Cover and Constancy Data for Subalpine Fir/Menziesia

Species	Overstory				Understory			
Trees	Aver.	Min.	Max.	Const.	Aver.	Min.	Max.	Const.
Subalpine Fir	40	30	50	100	7	1	15	100
Paper Birch	10	10	10	25				
Sitka Spruce	16	8	30	100	1	1	2	75
Western Hemlock	11	6	15	50	3	1	8	75
	Cover							
Shrubs	Aver.	Min.	Max.	Const.				
Sitka Alder	2	1	3	50				
Rusty Menziesia	30	6	60	100				
Devil's Club	2	1	3	75				
N. Black Currant	0.5	1	1	25				
Sitka Mountain Ash	0.5	0	1	50				
Tall Blueberry	6	1	15	100				
Forbs, Ferns, Graminoids								
Bunchberry	4	1	10	100				
Heart-lvd. Twayblade	0.5	0	2	75				
Single Delight	0.5	0	1	50				
Liverleaf Wintergreen	0.5	1	1	25				
One-sided Wintergreen	0.5	1	1	25				
Five-leaf Bramble	13	3	20	100				
Clasp. Twisted Stalk	1	1	1	25				
Shield Fern	9	0	15	100				
Oak Fern	0.5	1	1	25				
Stiff Clubmoss	1	0.5	2	50				

Structure

In the four stands sampled in this community type, subalpine fir, western hemlock, and Sitka spruce occurred in the variable plots. Spruce and fir averaged similar heights and diameters, 14 inches (36 m) DBH and 58 feet (18 m) and 13 inches 33 cm) and 64 feet (20 m) respectively. Hemlock was smaller, at 8 inches (20 cm) DBH and 40 feet (12 m). Overall canopy average height per stands ranged from 55 to 75 feet (17-23 m).

Menziesia averaged 4 feet (1.2 m), while Sitka alder averaged 11 feet (3 m) but was only present in half the stands. Blueberry averaged 1 foot (0.3 m).

The woody debris in the sampled stands was subalpine fir and Sitka spruce. Average diameters and lengths were similar, with fir averaging 8 inches (20 cm) and 13 feet (4 m) and spruce averaging 7 inches (18 cm) and 12 feet (3.6 m). The pieces of wood were well decayed, averaging decay class 4 and 3 respectively. One subalpine fir snag was recorded in the variable plots.

Environmental characteristics

The sampled subalpine fir stands occurred on mountain sides. Slopes ranged from 32 to 60%. Elevations ranged from 1411 to 2080 feet (430-630 m). Aspects were north or west, but this is likely a trend of limited sampling and stand accessibility. The stands were all well drained.

Subalpine Fir/Devil's Club
Abies lasiocarpa/Oplopanax horridum

Composition

Subalpine fir dominates the overstory in this community type. Sitka spruce is typically also present. Western hemlock, paper birch, or black cottonwood may also occur. The overstory averages 45% cover and the understory 5%. Conifer regeneration is limited and is mostly fir.

The tall shrub layer in this type may be extensive. Devil's club averaged 20% cover in the 2 stands sampled in this type. Blueberry and Sitka mountain ash were also present in limited amounts in both stands. In one stand, menziesia was abundant.

Forbs are limited in this vegetation type. Five-leaf bramble was abundant, and bunchberry and clasping twisted stalk were present in both stands. Both shield and oak ferns were common. Average cover, range, and constancy are shown in Table 10 for species which were found in sampled stands in more than trace amounts.

Structure

In the two stands sampled in this community type, subalpine fir and Sitka spruce occurred in the variable plots. Spruce was less common but larger, averaging 17 inches (43 cm) DBH and 75 feet (23 m), while fir averaged 11 inches (28 cm) and 60 feet (18 m). Overall canopy average height per stand ranged from 50 to 70 feet (15-21 m).

Sitka alder was the tallest shrub, averaging 14 feet (4 m), while mountain ash averaged 10 feet (3 m), devil's club 3 feet (0.9 m) and blueberry 2 feet (0.6 m).

Most of the woody debris in the sampled stands was subalpine fir. Average diameter was 11 inches (28 cm) and average length 11 feet (2.8 m). The pieces of wood were moderately decayed, averaging decay class 3. Two subalpine fir snags were were recorded in the sampled stands.

Environmental characteristics

The 2 subalpine fir stands occurred on a mountainslope and a footslope. Slopes ranged from 7 to 47%. Elevations ranged from 1500 to 1880 feet (460-570 m). The stands were both well drained.

Table 10. Percent Cover and Constancy Data for Subalpine Fir/Devil's Club

Species	Overstory				Understory			
Trees	Aver.	Min.	Max.	Const.	Aver.	Min.	Max.	Const.
Subalpine Fir	35	35	35	100	4	2	5	100
Paper Birch	3	3	3	50	0.5	1	1	50
Sitka Spruce	9	7	10	100	1	0	2	100
Black Cottonwood	3	3	3	50				
Western Hemlock					1	1	1	50
	Cover							
Shrubs	Aver.	Min.	Max.	Const.				
Sitka Alder	3	3	3	50				
Rusty Menziesia	60	60	60	50				
Devil's Club	20	15	25	100				
Currant	0.5	1	1	50				
N. Black Currant	1	1	1	50				
Sitka Mountain Ash	1	1	1	100				
Tall Blueberry	2	1	3	100				
Forbs, Ferns, Graminoids								
Bunchberry	2	1	3	100				
Heart-lvd. Twayblade	0.5	1	1	50				
Five-leaf Bramble	11	6	15	100				
Clasp. Twisted Stalk	2	1	3	100				
Foamflower	5	5	5	50				
Arctic Starflower	1	1	1	50				
Sitka Valerian	0.5	1	1	50				
Shield Fern	13	6	20	100				
Oak Fern	8	6	10	100				
Meadow Horsetail	30	30	30	50				
Stiff Clubmoss	0.5	1	1	50				

Nonforest Vegetation Types

Within KLGO, there are several vegetation types which are non-forested, due to their location in an area of ongoing disturbance or above timberline. A brief description for each type follows. These types are inclusions in most of the map units, since they are small and uncommon. However, nonforest types make up much of terrestrial ecological units 12A, 21, and 75: alpine summits, avalanche slopes, and uplifted estuary units.

Beach Fringe

On the seaward boundary of the Chilkoot Unit uplifted estuary terrestrial ecological unit (unit 75), there is a small amount of a beach fringe plant community. This is a sparse collection of salt and flooding tolerant herbs, such as sea-beach sandwort, goose-tongue, and silverweed, which grow above the intertidal zone. The community could be eliminated by a major storm or shifting sands.

With continued uplift of the Dyea estuary, the community may develop further and be succeeded by a vegetation community similar to those currently present on the Dyea flats.

Uplifted Estuary

The dominant estuarine plant communities in Dyea Flats are somewhat atypical in that uplift of the area has restricted flooding. Succession is occurring on the flats, whereas estuarine communities are usually perpetuated by continual disturbance. Vegetation in the Dyea Flats (map unit 75) is primarily salt and flooding tolerant herbs and graminoids, with shrubs and spruce encroaching on the forestward side. Yarrow, silverweed, beach pea, sedges, and grasses are common components. With continued uplift, succession may be expected to proceed from meadow toward brushfield and eventually toward forest where drainages and human use of the area do not impede plant community development.

Alpine Meadow, Heath, and Krummholz

Near and above timberline, soil conditions such as soil depth and productivity and environmental conditions such as wind exposure and aspect affect vegetation distribution and structure. In more protected, lower sites, krummholz forest occurs. In higher, more exposed sites, the scrub trees are replaced by low shrubs in the heath family. In other sites, alpine meadows with an abundance of small forbs occur (map unit 12A). In the harshest sites, particularly on the White Pass unit, lichens dominate, forming communities that are mainly rock and lichen (map units 11 and 12A).

In KLGO, alpine meadows are dominated by fireweed, burnet, bluejoint grass, long-awn sedge, and lady fern. Alpine heaths are dominated by crowberry, luetkea, mountain heather, and starry cassiope. Krummholz sites are dominated by subalpine fir and mountain hemlock, with crowberry, starry cassiope, mountain heather, and bunchberry common below the stunted trees.

Disturbed Sites: Avalanche Chute, Talus Slope, River Bar

In KLGO, there are several disturbance factors which affect vegetation distribution and abundance, including snow pack and snow avalanche, flooding, and mass wasting of rock or soil. Field work was conducted in some of the disturbance plant communities. The two sampled talus slopes (in map unit 21) were dominated by Sitka alder, crowberry and willow species. Three avalanche chutes (map unit 21) were dominated by Sitka alder, menziesia, Barclay willow, Sitka mountain ash, bunchberry, bluejoint grass, and shield fern. The sampled gravel bar community was dominated by Sitka alder, willows, and dwarf fireweed (minor component in map unit 53).

PLANT SPECIES LIST

Plant species recorded or collected by the project botanist, recorded by terrestrial sampling teams, or recorded during 1960s collections by botanist Dr. Stanley Welsh as occurring in KLGO were compiled into a plant list for the Park (Table 11). This list reflects the most current taxonomy available.

Life form codes: T = tree, S = shrub, F = forb, G = graminoid, P = pteridophyte (ferns and fern allies), M = moss, L = Ascomycota (lichens).

Table 11. Vascular and Non-vascular Plant Species List for KLGO

Species (Family, Order or Division)	Vernacular Name	Life Form
Abies (Pinaceae)		
lasiocarpa	Subalpine fir	T
Acer (Aceraceae)		
glabrum var. douglasii	Douglas maple	T
Achillea (Asteraceae)		
millefolium var. borealis	Yarrow	F
Aconitum (Ranunculaceae)		
delphinifolium	Monkshood	F
Actaea (Ranunculaceae)		
rubra	Red baneberry	F
Agropyron (Poaceae)		
caninum	Wheatgrass	G
Agrostis (Poaceae)		
exarata	Spike redtop	G
scabra	Ticklegrass	G
stolonifera	Bentgrass	G
tenuis	Colonial bentgrass	G
Alectoria (Ascomycota)		
sarmentosa	Common witch's hair	L
Alnus (Betulaceae)		
crispa	Green alder	S
crispa ssp. sinuata	Sitka alder	S
rubra	Red alder	T
Amelanchier (Rosaceae)		
alnifolia	Saskatoon, serviceberry	S
florida	Pacific serviceberry	S
Amsinckia (Boraginaceae)		
menziesii	Menzies' fiddleneck	F
Anaphalis (Asteraceae)		
margaritaceae	Pearly everlasting	F
Andreaea (Andreaeidae)		
rupestris	Black rock moss	M
Anemone (Ranunculaceae)		
richardsonii	Yellow anemone	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Angelica (Apiaceae)		
lucida	Sea coast angelica	F
Antennaria (Asteraceae)		
alpina	Alpine pussytoes	F
Aquilegia (Ranunculaceae)		
formosa	Western columbine	F
Arabis (Brassicaceae)		
drummondii	Drummond rockcress	F
hirsuta	Hairy rockcress	F
lyrata var. kamchatica	Kamchatka rockcress	F
Arctagrostis (Poaceae)		
latifolia	Polargrass	G
Arenaria (Caryophyllaceae)		
lateriflora	Blunt-leaved sandwort	F
Arnica (Asteraceae)		
latifolia	Mountain arnica	F
lessingii	Arnica	F
Artemesia (Asteraceae)		
norvegica	Mountain sagebrush	F
tilesii ssp. gormani	Aleutian mugwort	F
Aruncus (Rosaceae)		
sylvester	Goatsbeard	F
Astragalus (Fabaceae)		
alpinus	Alpine milk-vetch	F
Athyrium (Polypodiaceae)		
filix-femina	Lady fern	P
Atriplex (Chenopodiaceae)		
patula var. obtusa	Spearscale	F
Barbarea (Brassicaceae)		
orthoceras	Wintercress	F
Bartramia (Bryidae)		
pomiformis	Apple moss	M
Betula (Betulaceae)		
glandulosa	Resin birch	T
papyrifera	Paper birch	T
Boschniakia (Orobanchaceae)		
rossica	Ground-cone, broomrape	F
Brachythecium (Bryidae)		
albicans	Short-capsuled moss	M
Bryoria (Ascomycota)		
nitidula	Horsehair lichen	L

Species (Family, Order or Division)	Vernacular Name	Life Form
Bryum (Bryidae)		
creberrimum	Moss	M
stenotrichum	Moss	M
Calamagrostis (Poaceae)		
canadensis var. langsdorffii	Bluejoint reedgrass	G
Caltha (Ranunculaceae)		
biflora	Broadleaf marsh marigold	F
leptosepala	Mountain marsh marigold	F
Campanula (Campanulaceae)		
lasiocarpa	Mountain harebell	F
Cardamine (Brassicaceae)		
bellidifolia	Alpine bittercress	F
cordifolia	Bittercress	F
oligosperma	Western bittercress	F
pensylvanica	Pennsylvania bittercress	F
umbellata	Bittercress	F
Carex (Cyperaceae)		
anthoxanthea	Yellow-flowered sedge	G
aquatilis ssp. aquatilis	Water sedge	G
brunnescens	Brownish sedge	G
canescens	Silvery sedge	G
disperma	Soft-leaved sedge	G
enanderi	Enander sedge	G
laeviculmis	Smooth-stem sedge	G
lenticularis	Sedge	G
lyngbyei	Lyngbye sedge	G
mackenziei	Mackenzie sedge	G
macrochaeta	Long-awn sedge	G
mertensii	Mertens sedge	G
nigricans	Blackish sedge	G
pluriflora	Many-flower sedge	G
pyrenaica ssp. micropoda	Pyrenaean sedge	G
saxatilis	Russet sedge	G
scirpoidea	Single-spike sedge	G
sitchensis	Sitka sedge	G
stylosa	Variegated sedge	G
subspathacea	Hoppner sedge	G
Cassiope (Ericaceae)		
lycopodioides	Mountain heather	S
mertensiana	Mertens mountain heather	S
stelleriana	Starry cassiope	S
Castilleja (Scrophulariaceae)		
unalaschcensis	Unalaska Indian paintbrush	F
Cerastium (Caryophyllaceae)		
beeringianum	Bering mouse-eared chickweed	F
vulgatum	Chickweed	F
Ceratodon (Bryidae)		
purpureus	Red roof moss	M

Species (Family, Order or Division)	Vernacular Name	Life Form
Cetraria (Ascomycota)	Lichen	
ericetorum		L
islandica		L
laevigata		L
nivalis		L
Chenopodium (Chenopodiaceae)		
album	Lambsquarter, pigweed	F
leptophyllum	Narrow-leaved goosefoot	F
Chrysanthemum (Asteraceae)		
arcticum	Arctic daisy	F
leucanthemum	Ox-eye daisy	F
Cinna (Poaceae)		
latifolia	Woodreed grass	G
Cinclidium (Bryidae)		
stygium	Moss	M
Circaea (Onagraceae)		
alpina	Enchanter's nightshade	F
Cladina (Ascomycota)	Reindeer or caribou lichen	
mitis		L
portentosa ssp. pacifica		L
rangiferina		L
stellaris		L
sp.		L
Cladonia (Ascomycota)		
bellidiflora	British soldiers	L
deformis	Pixie cup lichen	L
ecmocyna	Lichen	L
ecmocyna ssp. intermedia	Lichen	L
fimbriata	Pixie cup lichen	L
floerkeana	Lichen	L
gracilis	Lichen	L
squamosa	Dragon cladonia	L
uncialis	Lichen	L
sp. (large squamules)	Lichen	L
Cochlearia (Brassicaceae)		
officinalis	Scurvy grass	F
Collomia (Polemoniaceae)		
linearis	Small collomia	F
Conioselinum (Apiaceae)		
chinense	Western hemlock-parsley	F
Cornus (Cornaceae)		
canadensis	Bunchberry	S
stolonifera	Red-osier dogwood	S
suecica	Swedish cornel	S
Cryptantha (Boraginaceae)		
torreyana	Torrey's cryptanth	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Cryptogramma (Polypodiaceae)		
acrostichoides	Parsley fern, rock brake	P
crispa	Parsley fern	P
Cystopteris (Polypodiaceae)		
fragilis	Fragile fern	P
Danthonia (Poaceae)		
intermedia	Timber oatgrass	G
Dicranum (Bryidae)		
fuscescens	Dusky fork moss	M
howellii	Broom moss	M
Diphasiastrum (Lycopodiaceae)		
alpinum	Alpine clubmoss	P
sitchensis	Alaskan clubmoss	P
Dodecatheon (Primulaceae)		
jeffreyi	Shooting-star, birdbill	F
pulchellum var. alaskanum	Pretty shooting star	F
Dryas (Rosaceae)		
octopetela	White mountain avens	F
Dryopteris (Polypodiaceae)		
austriaca	Spinulose shield-fern	P
Eleocharis (Cyperaceae)		
palustris	Creeping spikerush	G
Elymus (Poaceae)		
trachycaulus	Slender wheatgrass	G
Empetrum (Empetraceae)		
nigrum	Crowberry	S
Epilobium (Onagraceae)		
adenocaulon	Northern willowherb	F
alpinum	Alpine willowherb	F
angustifolium	Fireweed	F
ciliatum	Purple-leaved willowherb	F
latifolium	Dwarf fireweed	F
Equisetum (Equisetaceae)		
arvense	Meadow horsetail	P
variegatum	Variegated scouring rush	P
Erigeron (Asteraceae)		
acris	Fleabane daisy	F
lonchophyllus	Spear-leaf fleabane	F
peregrinus	Strange or wander daisy	F
purpuratus	Fleabane daisy	F
Eriophorum (Cyperaceae)		
polystachion	Tall cottongrass	G
angustifolium	Narrow leaved cottongrass	G

Species (Family, Order or Division)	Vernacular Name	Life Form
Festuca (Poaceae)		
altaica	Rough fescue	G
arundinacea	Tall fescue	G
rubra	Red fescue	G
Fragaria (Rosaceae)		
chiloensis	Beach strawberry	F
Galium (Rubiaceae)		
triflorum	Sweet-scented bedstraw	F
Geocaulon (Santalaceae)		
lividum	Bastard toad-flax	F
Geranium (Geraniaceae)		
erianthum	Northern geranium	F
Geum (Rosaceae)		
calthifolium	Caltha-leaf avens	F
macrophyllum	Large-leaf avens	F
Glaux (Primulaceae)		
maritima	Sea milkwort	F
Gymnocarpium (Polypodiaceae)		
dryopteris	Oak-fern	P
Heracleum (Apiaceae)		
lanatum	Cow parsnip	F
Heterodermia (Ascomycota)		
sp.	Lichen	L
Heuchera (Saxifragaceae)		
glabra	Alpine alumroot	F
Hieracium (Asteraceae)		
albiflorum	White hawkweed	F
gracile	Slender hawkweed	F
triste	Woolly hawkweed	F
Hierochloe (Poaceae)		
odorata	Vanilla grass	G
Honkenya (Caryophyllacae)		
peploides var. major	Sea-beach sandwort	F
Hordeum (Poaceae)		
brachyantherum	Meadow barley	G
Huperzia (Lycopodiaceae)		
haleakalae	Fir clubmoss	P
Hypogymnia (Ascomycota)		
enteromorpha	Beaded bone	L
physodes	Hooded bone	L
sp.	Bone lichen	L
Icmadophila (Ascomycota)		
ericetorum	Fairy barf	L

Species (Family, Order or Division)	Vernacular Name	Life Form
Iris (Iridaceae)		
setosa	Wild iris	F
Juncus (Juncaceae)		
alpinus	Alpine rush	G
balticus	Baltic rush	G
biglumis	Two-flowered rush	G
bufonius	Toad rush	G
drummondii	Drummond rush	G
mertensianus	Mertens rush	G
triglumus	Three-glume rush	G
Lathyrus (Fabaceae)		
japonicus var. glaber	Beach pea	F
palustris var. pilosus	Wild pea	F
Ledum (Ericaceae)		
groenlandicum	Labrador tea	S
Lepraria (Ascomycota)	Dust lichen	
finkii		L
neglecta		L
Leptarrhena (Saxifragaceae)		
pyrolifolia	Leather-leaf saxifrage	F
Leucolepis (Bryidae)		
menziesii	Menzies' tree moss	M
Leymus (Poaceae)		
mollis	Beach rye	G
Linnaea (Caprifoliaceae)		
borealis	Twin flower	S
Listera (Orchidaceae)		
cordata	Heart-leaved twayblade	F
Lobaria (Ascomycota)		
linita	Lichen	L
oregana	Lettuce lung	L
scrobiculata	Lichen	L
Loiseleuria (Ericaceae)		
procumbens	Alpine azalea	S
Luetkea (Rosaceae)		
pectinata	Luetkea	S
Lupinus (Fabaceae)		
nootkatensis	Nootka lupine	F
Luzula (Juncaceae)		
campestris	Field woodrush	G
parviflora	Small flowered woodrush	G
rufescens	Hairy woodrush	G
wahlenbergii	Wahlenberg Woodrush	G
Lycopodium (Lycopodiaceae)		
annotinum	Stiff clubmoss	P
clavatum	Running clubmoss	P

Species (Family, Order or Division)	Vernacular Name	Life Form
Madia (Asteraceae)		
glomerata	Tarweed	F
Malaxis (Orchidaceae)		
monophyllos var. monophyllos	White adder's tongue	F
Matricaria (Asteraceae)		
matricarioides	Pineapple weed	F
Menziesia (Ericaecae)		
ferruginea	Rusty menziesia	S
Mertensia (Boraginaceae)		
maritima var. maritima	Sea lungwort, oysterleaf	F
Mitella (Saxifragaceae)		
pentandra	Alpine mitrewort	F
trifida	Three-toothed mitrewort	F
Moneses (Pyrolaceae)		
uniflora	Single delight	F
Monotropa (Pyrolaceae)		
hypopitys	Indian pipe	F
Nuphar (Nymphaeaceae)		
polysepalum	Yellow pondlily, spatterdock	F
Nephroma (Ascomycota)		
arcticum	Kidney lichen	L
Ochrolechia (Ascomycota)	Lichen	
androgyna		L
laevigata		L
Oplopanax (Araliaceae)		
horridum	Devil's club	S
Osmorhiza (Apiaceae)		
purpurea	Sitka sweet-cicely	F
Oxyria (Polygonaceae)		
digyna	Mountain sorrel	F
Oxytropis (Fabaceae)		
campestris var. varians	Field oxytrope	F
Parnassia (Saxifragaceae)		
fimbriata	Fringed grass-of-parnassus	F
palustris	Northern grass-of-parnassus	F
Parmelia (Ascomycota)		
saxatilis	Lichen	L
squarrosa	Lichen	L
sulcata	Waxpaper lichen	L

Species (Family, Order or Division)	Vernacular Name	Life Form
Pedicularis (Scrophulariaceae)		
parviflora	Small-flowered lousewort	F
oederi	Oeder's lousewort	F
Peltigera (Ascomycota)	Frog pelt	
aphthosa		L
canina		L
collina		L
Petasites (Asteraceae)		
frigidus v. palmatus	Arctic sweet coltsfoot	F
Philadelphus (Hydrangeaceae)		
lewisii	Littleleaf mockorange	S
Phleum (Poaceae)		
alpinum	Alpine timothy	G
Phyllodoce (Ericaceae)		
empetriformis	Pink mountain-heather	S
glanduliflora	Yellow mountain-heather	S
Picea (Pinaceae)		
glauca	White spruce	T
sitchensis	Sitka spruce	T
Pilophorus (Ascomycota)		
acicularis	Devil's matchstick	L
Pinus (Pinaceae)		
contorta	Lodgepole pine	T
Placopsis (Ascomycota)		
gelida	Bull's-eye	L
Plagiobothrys (Boraginaceae)		
scouleri	Scouler's popcorn-flower	F
Plagiothecium (Bryidae)		
undulatum	Wavy-leaved cotton moss	M
Plantago (Plantaginaceae)		
major	Broadleaf or common plantain	F
maritima var. juncoides	Goose-tongue	F
Platanthera (Orchidaceae)		
dilatata	White bog orchid	F
hyperborea	Northern bog orchid	F
obtusata	Small bog orchid	F
saccata	Slender bog orchid	F
Platismatia (Ascomycota)		
glauca	Ragbag	L
herrei	Tattered rag	L

Species (Family, Order or Division)	Vernacular Name	Life Form
Poa (Poaceae)		
cf. alpina	Alpine bluegrass	G
annua	Annual bluegrass	G
arctica	Arctic bluegrass	G
eminens	Large-flower speargrass	G
glauca	Glaucous bluegrass	G
lanata	Bluegrass	G
palustris	Fowl bluegrass	G
pratensis	Kentucky bluegrass	G
pseudoabbreviata	Bluegrass	G
Pogonatum (Bryidae)		
alpinum	Haircap moss	M
alpinum var. sylvaticum	Haircap moss	M
urnigerum	Grey haircap moss	M
Polemonium (Polemoniaceae)		
pulcherrimum	Showy Jacob's ladder	F
Polygonum (Polygonaceae)		
aviculare	Knotweed	F
boreale	Northern knotweed	F
prolificum	Proliferous knotweed	F
viviparum	Alpine bistort	F
Polypodium (Polypodiaceae)		
glycyrrhiza	Licorice fern	P
Polytrichum (Bryidae)	Haircap moss	
formosum		M
sexangulare		M
strictum		M
Populus (Salicaceae)		
trichocarpa	Black cottonwood	T
Porpidia (Ascomycota)		
flavocaerulescens	Crust lichen	L
Potamogeton (Potamogetonaceae)		
natans	Floating pondweed	F
Potentilla (Rosaceae)		
anserina var. grandis	Common silverweed	F
fruticosa	Shrubby cinquefoil	S
gracilis	Slender cinquefoil	F
hyparctica	Artic cinquefoil	F
norvegica ssp. monspeliensis	Rough or norwegian cinquefoil	F
pensylvanica	Pensylvanica cinquefoil	F
villosa	Villous cinquefoil	F
Prenanthes (Asteraceae)		
alata	Rattlesnake root	F
Pterospora (Pyrolaceae)		
andromeda	Pinedrops	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Pyrola (Pyrolaceae)		
asarifolia var. purpurea	Liverleaf wintergreen	F
minor	Lesser wintergreen	F
secunda	One-sided wintergreen	F
chlorantha	Greenish wintergreen	F
Racomitrium (Bryidae)		
canescens var. ericoides	Roadside rock moss	M
lanuginosum	Hoary rock moss	M
Ranunculus (Ranunculaceae)		
acris	Tall buttercup	F
cooleyae	Cooley buttercup	F
cymbalaria var. cymbalaria	Shore buttercup	F
eschscholtzii	Eschscholtz buttercup	F
lapponicus	Lapland buttercup	F
macounii	Macoun buttercup	F
nivalis	Snow buttercup	F
pedatifidus var. affinis	Northern buttercup	F
pygmaeus	Pygmy buttercup	F
Rhinanthus (Scrophulariaceae)		
crista-galli	Rattlebox	F
Rhizocarpon (Ascomycota)	Map lichen	
geographicum		L
superficiale		L
Rhizomnium (Bryidae)		
glabrescens	Fan moss	M
Rhodiola (Crassulaceae)		
integrifolia	Roseroot, king's crown	F
Rhytidiadelphus (Bryidae)		
loreus	Lanky moss	M
Ribes (Saxifragaceae)		
hudsonianum	Northern black currant	S
lacustre	Swamp gooseberry	S
laxiflorum	Trailing black current	S
Romanzoffia (Hydrophyllaceae)		
sitchensis	Mist maid	F
Rorippa (Brassicaceae)		
islandica	Marsh yellowcress	F
Rubus (Rosaceae)		
idaeus	Raspberry	S
pedatus	Five-leaf bramble	S
spectabilis	Salmonberry	S
Rumex (Polygonaceae)		
acetosella	Sheep sorrel	F
salicifolius var. salicifolius	Beach dock	F
Sagina (Caryophyllaceae)		
crassicaulis	Beach pearlwort	F
saginoides	Arctic pearlwort	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Salix (Salicaceae)		
alaxensis var. longistylis	Felt-leaf willow	S
arctica	Arctic willow	S
barclayi	Barclay willow	S
commutata	Undergreen willow	S
glauca	Diamond or glaucous willow	S
reticulata ssp. reticulata	Netleaf willow	S
rigida	Rigid willow	S
rotundifolia	Round-leaf willow	S
sitchensis	Sitka willow	S
stolonifera	Stoloniferous willow	S
Sambucus (Caprifoliaceae)		
racemosa var. arborescens	Pacific red elderberry	S
Sanguisorba (Rosaceae)		
stipulata	Sitka burnet	F
Saxifraga (Saxifragaceae)		
bronchialis	Spotted saxifrage	F
cernua	Nodding saxifrage	F
ferruginea	Alaska saxifrage	F
lyallii var. hultenii	Red-stem saxifrage	F
mertensiana	Wood saxifrage	F
punctata	Brook saxifrage	F
rivularis	Brook saxifrage	F
tricuspidata	Three-tooth saxifrage	F
Senecio (Asteraceae)		
triangularis	Arrow-leaf groundsel	F
viscosus	Viscid groundsel	F
vulgaris	Common groundsel	F
Shepherdia (Elaeagnaceae)		
canadensis	Soapberry	S
Sibbaldia (Rosaceae)		
procumbens	Sibbaldia	F
Silene (Caryophyllaceae)		
acaulis	Moss campion	F
Siphula (Ascomycota)		
ceratites	Waterworm	L
Solidago (Asteraceae)		
canadensis var. subserrata	Canada Goldenrod	F
multiradiata	Northern goldenrod	F
Solorina (Ascomycota)		
crocea	Lichen	L
Sorbus (Rosaceae)		
sitchensis	Sitka mountain-ash	T
Sparganium (Typhaceae)		
hyperboreum	Northern burreed	F
Spergularia (Caryophyllaceae)		
canadensis	Canada sand spurry	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Sphaerophorus (Ascomycota)		
fragilis	Lichen	L
globosus	Common Christmas-tree	L
Sphagnum (Sphagnidae)	Peat moss	
fuscum		M
girgensohnii		M
teres		M
Spiraea (Rosaceae)		
stevenii	Beauverd spiraea	S
douglasii var. menziesii	Menzies spirea	S
Stellaria (Caryophyllaceae)		
crispa	Crisp starwort	F
humifusa	Low chickweed	F
longifolia	Long-leaved starwort	F
longipes	Long-stalked starwort	F
media	Common chickweed	F
sitchana	Northern starwort	F
Stereocaulon (Ascomycota)	Lichen	
alpinum		L
grande		L
rivulorum		L
tomentosum		L
sp.		L
Streptopus (Liliaceae)		
amplexifolius	Clasping twisted-stalk	F
Symphoricarpos (Caprifoliaceae)		
albus	Snowberry	S
Taraxacum (Asteraceae)		
ceratophorum	Horned dandelion	F
officinale	Common dandelion	F
Tellima (Saxifragaceae)		
grandiflora	Fringe-cups	F
Thalictrum (Ranunculaceae)		
sparsiflorum	Few-flower meadowrue	F
Thamnolia (Ascomycota)		
subuliformis	Lichen	L
Thelypteris (Polypodiaceae)		
phegopteris	Beech fern	P
Tiarella (Saxifragaceae)		
trifoliata	Trifoliate foamflower	F
Tofieldia (Liliaceae)		
coccinea	Northern asphodel	F
Tortella (Bryidae)		
tortuosa	Moss	M
Trientalis (Primulaceae)		
europaea	Arctic starflower	F

Species (Family, Order or Division)	Vernacular Name	Life Form
Trifolium (Fabaceae)		
repens	White clover	F
Triglochin (Juncaginaceae)		
maritimum	Maritime arrowgrass	F
Trisetum (Poaceae)		
cernuum	Nodding oatgrass	G
spicatum	Spike trisetum	G
Tsuga (Pinaceae)		
heterophylla	Western hemlock	T
mertensiana	Mountain hemlock	T
Umbilicaria (Ascomycota)		
hyperborea	Rock tripe	L
torrefacta	Punctured rock tripe	L
Vaccinium (Ericaceae)		
alaskaense	Alaska blueberry	S
caespitosum	Dwarf blueberry	S
ovalifolium	Early blueberry	S
uligonosum	Bog blueberry	S
vitis-idaea	Mountain cranberry	S
Vahlodea (Poaceae)		
atropurpurea	Mountain hairgrass	G
Valeriana (Valerianaceae)		
sitchensis	Sitka valerian	F
Veratrum (Liliaceae)		
viride	False hellebore	F
Veronica (Scrophulariaceae)		
americana	Speedwell	F
peregrina var. alpensis	Neckweed	F
wormskjoldii	Alpine speedwell	F
Viburnum (Caprifoliaceae)		
edule	Highbush cranberry	S
Viola (Violaceae)		
palustris	Marsh violet	F
Xanthoria (Ascomycota)		
fallax	Lichen	L

WILDLIFE OBSERVATION LIST

As requested by KLGO, signs of wildlife were recorded during field work in the Park units. The results are listed below, by species and plot number for terrestrial team observations, and by species and general location for project botanist and aquatic team observations. This list should not be regarded as comprehensive: none of the field observers are wildlife biologists and none were conducting any formal wildlife survey. Hence there are likely to have been wildlife signs not observed in a given plot or area, and species identifications can only be general.

Table 12. Wildlife Observation List for KLGO

Plot Number/ Location	Animal	Type
5058	Chestnut-bk. Chickadee	Sighting, sound
5057	Bear[1]	Sound, scat, trail[2]
5058	Bear	Trail
5061	Bear	Scat
5058	Mountain Goat	Scat
5068	Bear	Scat, trail
5058	Bear	Scat, trail
5069	Bear	Scat
5068	Bear	Trail
5069	Mountain Goat	Scat, trail
	Bear	Scat, trail
5068	Tern	Sighting, sound
	Gulls	Sighting
5256	Song Sparrow	Sighting
5256	Sparrow	Sighting
5256	Songbirds, unidentified	Sighting, sound
5260	Red Squirrel	Sound
5260	Bear	Scat
	Harlequin Duck	Sighting
	Sandpiper	Sighting
5262	Warbler	Sighting
5263	Red Squirrel	Sighting, sound
5265	Red Squirrel	Sighting, sound
5267	Bear	Scat
5068	Pika	Sighting, sound
5267	Gull	Sighting
	Pika	Forage[3]
5273	Stellar Jay	Sound
	Moose	Scat, forage
	Porcupine	Forage

Plot Number/ Location	Animal	Type
5502	Bear	Trail
5503	Red-breasted Sapsucker	Forage
	Bear	Trail
5507	Mountain Goat	Scat
Dyea	Great Blue Heron	Sighting
	Bear	Forage
Lower Taiya floodplain	Harlequin Duck	Sighting
	Merganser	Sighting
	Dipper	Sighting
Canyon City trail	Porcupine	Sighting
	Bear	Scat
Pleasant Camp floodplain	Harlequin Duck	Sighting
	Dipper	Sighting
Sheep Camp floodplain	Harlequin Duck	Sighting
Chilkoot Pass area	Mountain Goat	Scat
	Ptarmigan	Sighting, scat
Heney, below RR tracks	Caribou	Trail, scat
White Pass summit	Ptarmigan	Sighting, scat
	Caribou	Scat
	Bear	Trail

[1]Probably black bear but not known for certain whether brown or black
[2]Includes single to few tracks as well as obvious trail
[3]Any signs of foraging such as browsed vegetation, diggings, chewed fish, excavations for insects, etc.

RECOMMENDATIONS FOR FUTURE RESEARCH AND MONITORING

Water Quality Monitoring

Use of macroinvertebrate indices is a viable technique for measuring water quality in KLGO. More information on the effect of sediment-laden glacial runoff on macroinvertebrate diversity and bio assessment protocols should be developed. Site 0130 is recommended as a potential, longterm biomonitoring site. This non-glacial stream has excellent water quality based on macroinvertebrate samples collected during this survey. Future development of the nearby Sheep Camp campground makes this a good site to monitor the potential effects of Chilkoot Trail users on surface water quality. Much of the Taiya River valley is underlain by deep alluvial gravel. There is a potential for human waste disposal in pit toilets to impact shallow ground-water aquifers associated with these alluvial deposits. Shallow ground-water wells could be used to assess this risk.

Channel Stability

Many of the streams in the survey area have high stream power and sediment transport competency. Structures in the vicinity of unconfined glacial floodplain channels and alluvial fan channels are particularly at risk for flood damage. High risk facilities (trail crossings, cabins, etc.) should be identified based on their proximity to the most unstable channel type segments. These facilities should be programmed for more intensive maintenance, and in some cases relocation of the facility should be considered.

Channel migration in the Dyea area continues to threaten cultural resources in the Taiya floodplain. Major channel engineering structures to protect these areas are probably not viable due to high cost, questionable effectiveness, and impacts to other resources. It is recommended that permanent channel cross-sections be installed above and below the main Taiya bridge to monitor the rate and trend of channel adjustments. These data will be useful in developing long range management plans for the area.

Aquatic Habitat Inventory

This survey provides only cursory information on aquatic habitat capability for the Lower Taiya River. The Taiya below Canyon City contains significant amounts of salmonid habitat with floodplain and footslope stream segments. More extensive habitat unit measurements along with fish population censuses are recommended for this area to better establish the location of key spawning and rearing habitats. Future aquatic survey design should utilize the channel type map unit stratification developed during this survey.

Air Quality Monitoring

Lichens have been used as bioindicators for air quality in various parts of the world. The inclusion of lichen species in the plant list provides qualitative baseline data for possible biomonitoring use of lichens in KLGO. Quantitative research on lichen distribution and abundance would be necessary to use lichens in monitoring and for preparation of a monitoring plan. The Alaska Region of the USDA Forest Service is currently conducting studies on lichen biomonitoring, including placement of lichen plots in both the Tongass and Chugach National Forests, and could assist KLGO if desired.

Dyea Flats Wetlands Protection

The Dyea Flats area is an important estuarine wetland resource, providing valuable habitat for a variety of wildlife, freshwater, and marine biota. Vehicle use on the estuarine meadow has resulted in significant impact to wetland vegetation. It is recommended that a land use/vehicle access plan be developed in cooperation with local land owners and recreation users to mitigate damage to wetland resources.

Vegetation monitoring in this area may be used to track vehicle impacts. Three to four transects across the Flats in areas of high and low impact could be established, with vegetation cover and height measurements taken in several quadrats per transect at annual or less frequent intervals. Monitoring protocol and critical thresholds for action should be detailed in the land use plan for the area.

As discussed earlier in this report, Dyea Flats is undergoing succession concomitant with landform uplift. This is a natural process and the landward, higher elevation parts of the estuary meadow can be expected to proceed toward brushfield and eventually toward forest. In order to meet National Park Service landscape goals, this process may be monitored or manipulated. Monitoring would take the form of transects from the open water toward established forest, with species composition, abundance, and structure measurements taken periodically. With time, meadow forbs and grasses are likely to be replaced by shrubs and colonizing trees such as the Sitka spruce currently present near the existing forest edge. If Park Service objectives include maintaining Dyea Flats as nonforested land, monitoring will serve to show areas of rapid succession where tree and shrub inhibition (pruning, herbicide) could occur.

Hiker/Camper Vegetation Impact Monitoring

As wilderness and parks use increases, many land managers are becoming concerned over the impacts of human use of these areas and wish to estimate recreational "carrying capacity" for given areas. Human impacts on vegetation can be readily monitored through periodic species composition, canopy cover, and structure measurements in high use and low/no use areas. Trends in species composition or size are used to assess damage and to develop critical thresholds for acceptable/sustainable use.

The new campground near Sheep Camp is a potential site for this type of monitoring since baseline measurements can be taken before heavy use. Also, baseline measurements taken during this survey can be used to compare pristine areas (plots off trail) with impacted areas (trails, vistas, and campsites) by plant community. A comprehensive list of plants should be developed for this area, and other heavily impacted areas, to determine composition of native and non-native weedy species for monitoring purposes. A list of native species would be useful for revegetation purposes and would assist the National Park Service in meeting President Carter's Executive Order 11987 on use of exotic plant species. Impact monitoring may become a greater concern for KLGO in the future if recreational use of the Park shows a large increase.

Comprehensive Botanical Survey

The KLGO area is a transitional area with reduced precipitation and different climatic conditions from the rest of Southeast Alaska. These conditions allow for higher plant diversity. The current list of plants (this report) includes approximately one-half to two-thirds of the total

plants expected for the KLGO. Additional surveys are needed, particularly in those areas identified earlier (see botanical survey/sampling methods). These surveys should be completed during all seasons of the year over a multi-year period, and should include both vascular and non-vascular plants.

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Abundance - The quantity of a plant species occurring on a plot, usually measured as percent canopy cover.

Alien species - Plant or animal species other than those occurring naturally; introduced intentionally or unintentionally by human actions.

Alluvial - Pertaining to material or processes associated with transportation or deposition by running water.

Alluvial Cone - The material washed down mountain and hill slopes by ephemeral streams and deposited at the mouth of gorges or V-notch ravines in the form of a steep conical mass descending equally in all directions from the point of issue.

Alluvial Fan - A body of alluvium, with or without debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley (or V-notch) onto a plain.

Alluvial plain - A floodplain or a low-gradient delta. It may be modern or relict.

Alluvium - Consists of sediment deposited by streams and rivers. It may occur on terraces well above present streams or in the normally flooded bottom land of existing streams. Along many old established streams lie a whole series of alluvial deposits in terraces--young deposits in the immediate floodplain, up step by step to the very old deposits on the highest terraces. In some places recent alluvium covers older terraces.

Anadromous Species - Species of fish, particularly Pacific salmon, trout and char, that ascend rivers and streams to breed.

Aquatic Habitat Capability - Synopsis of the ability of a channel type to support anadromous fish species (provide spawning and rearing habitat).

ARA (Available Rearing Area - habitat) - The place or site in a stream where fish live during their growth period.

ASA (Available Spawning Area - habitat) - The place or site in a stream where fish breed and eggs are incubated. Available refers to making the assessment of spawning area during a particular stream flow stage.

Backwater - A pool type formed by an eddy along channel margins from obstructions such as bars, root wads, and boulders, or resulting from back-flooding upstream from a blockage. The backwater is sometimes separated from the channel by sand/gravel bars.

Bankfull Depth - The mean water depth which occurs during a bankfull stream flow event.

Bankfull Width - The mean water width which occurs during a bankfull stream flow event.

Barrier - A vertical falls, steep cascade, or high velocity chute in a stream channel that prevents migration of anadromous species.

Basal area - For trees, the area of the cross section (measured outside bark at DBH [see below]) of a single tree, or of all trees in a stand, expressed in square meters/hectare or square feet/acre.

Batholith - A great mass of intruded igneous rock that for the most part stopped in its rise a considerable distance below the surface.

Beach - The unconsolidated material that covers a gently sloping zone, typically with a concave profile, extending landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation; the relatively thick and temporary accumulation of loose water-borne material (usually well-sorted sand and pebbles, accompanied by mud, cobbles, boulders, and smoothed rock and shell fragments) that is in active transit along, or deposited on the shore zone between the limits of low water and high water.

Beach deposits - Beach deposits mark the present or former shorelines of the sea or lakes. These deposits are low ridges of sorted material and are commonly sandy, gravelly, cobbly, or stony. Deposits on the beaches of former glacial lakes are usually included with glacial drift.

Bedrock Control - A section of a stream channel that is composed of bedrock material. Stream bed and banks consist of the underlying bedrock.

Bed Scour - The erosion of the channel bed substrate.

Biota - The flora and fauna of a region or habitat: e.g., stream biota.

Boulders - Large stream bed material, 25.4 centimeters to .914 meters (10 inches to 3 feet) in diameter.

Braided channel or stream (floodplain landforms) - A channel or stream with multiple channels that interweave as a result of repeated bifurcations and convergence of flow around interchannel bars, resembling in plan the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and steep gradient. At a given bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams.

Breast height (BH) - A standard height for measurement of tree diameters: 4.5 feet (1.37 m) above average ground level.

Canopy - (1) More or less continuous cover of branches and foliage formed collectively by crowns of adjacent trees, shrubs, or herbs depending upon the type of vegetation. (2) the cover of leaves and branches formed by the tops or crowns of plants as viewed from above.

Canopy closure - In a stand, the progressive reduction of space between crowns as they grow and spread laterally. A canopy in which the individual crowns are nearing general contact is termed a close canopy; and having achieved contact, a closed canopy. In general, closure indicates a process, while cover indicates a condition.

Cascade - A stream flow condition and habitat type characterized by swift current, exposed rock and boulders, high gradient, considerable turbulence and surface agitation, and consisting of a stepped series of drops.

Channel - A natural waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks which serve to confine the water.

> Aggrading channels - Stream channels that are subject to higher than normal sediment loads (sediment loads exceed the carrying capacity of the stream). These channels are experiencing long term increase in sediment load.
>
> Degrading channels - Stream channels that are experiencing a long term decrease in sediment load and/or an increase in flow volume and velocity. Bed scour and loss of sediment deposits are characteristic.

Channel Gradient - The angle between the water surface and the horizontal plane, expressed in percent.

Channel Pattern - The configuration in plan-view of a stream channel. Patterns used in Region 10 are braided, multiple, and straight.

Channel Sideslope - Refers to the lower and upper banks of the stream channel. The sideslope differs from the stream bottom in material composition and gradient. Normally the sideslope is the first significant slope break from the wetted stream bottom, in the cross sectional profile of the channel.

Channel Stability - The sensitivity of a channel area to disruptions in its physical structure. Under undisturbed conditions, natural channels demonstrate wide variability in withstanding physical disruptions without experiencing changes in their ability to pass streamflow, process sediment, or provide habitat. Stable channels are capable of withstanding an appreciable amount of disruption with little effect on function. In contrast, unstable channels are ones which respond readily to significant disruptions.

Channel Type - Stream segments which have fairly consistent physical characteristics.

Cirque - A semicircular form found in glaciated mountains. Described as an armchair hollow possessing three elements - a steep, nearly vertical headwall, a concave floor meeting the headwall in a sharp slope break, and a lip or threshold at the entrance which may be bedrock, glacial moraine, or both.

Cobble - Stream bed material ranging in size from 6.1-25.4 centimeters (2.4-10 inches) in diameter.

Codominant - (1) One of several species which dominate a plant community, no one to the exclusion of the others. See dominant and dominance . (2) Trees with crowns forming the general level of the forest canopy and receiving full sunlight from above but comparatively little from the sides; usually with medium sized crown.

Coho Spawning and Rearing Capability - The capacity of habitat in a stream to support the breeding (spawning) of adult coho salmon, incubation of their eggs, and the growth (rearing) of immature coho salmon.

Community - (1) A general term for an assembly of plants living together and interacting among themselves in a specific location, no particular ecological status being implied. (2) A unit of vegetation that is relatively uniform in structure and floristic composition and consisting of competing plants of one or more species in a common location. The basic unit of vegetation.

Community-type - (1) An abstract community, or a group or class of similar abstract communities, that is relatively stable and recurs in similar habitats. Successional status is uncertain. (2) A generalized category comprising a number of similar units of vegetation.

Constancy - How often a species occurs in a given community type: its site fidelity. For example, if western hemlock is found in 5 of 10 plots sampled, it has 50% constancy.

Containment - Refers to the degree of rigidity of the stream channel's banks. A bedrock channel is well contained due to the high erosion resistance of its banks. A glacial channel is normally poorly contained as its banks consist of alluvial material that is easily eroded by the stream flow.

Cretaceous - The last period of the Mesozoic era; about 65 million to 140 million years ago.

Crown - The upper portion of a tree or shrub, including the branches and foliage.

Crown class - Any class into which the trees forming a stand may be divided on the basis of both their crown development and crown position relative to other trees and the general canopy. Crown classes usually distinguished are: open grown, dominant, codominant, intermediate, and overtopped (or suppressed).

Crown closure - (1) The closing together of the crowns of trees in a forest as they age and grow. (2) By extension of the term, the projection of all the tree crowns in a crown cover. Expressed as a percent of area.

Debris Torrent - Mass erosion process which occurs when a debris avalanche enters a high gradient stream channel, mixes with water, and continues downstream as a slurry of mud, large woody debris, and water. Debris torrents often scour the channel through which they pass, then deposit debris and sediment on the footslope or valley floor.

Decay Classes - Single-digit codes for the degree of decay in a piece of down woody debris. Classes are an arbitrary division of a continual process. Classes loosely adapted from various sources:

1 Recently dead; all limbs and fine branches present; 100% bark remaining; shape is round, elevated on support points.
2 Early decay; fine branches missing; some bark missing or loose; wood intact or partly pieces, slightly sagging, shape is round.
3 Moderate decay; limb stubs only; missing bark; wood large hard to soft blocky pieces, may be round, may be sagging.
4 Few or no stubs; shorter tree; most bark missing; wood is small, soft and powdery, shape is round.
5 No stubs, 20% or less bark remaining; wood is soft and powdery (when dry), log shape is oval (sometimes hard to see actual shape of log).

Depauperate - Describing an unusually sparse growth of plants.

Diameter at breast height (DBH) - The diameter of a tree, measured outside the bark, at 4.5 feet (1.37 m) above average ground level.

Disturbance - Any mechanism which limits plant biomass by causing its partial or total destruction, e.g. avalanche, windthrow, logging.

Diversity - An expression of the variety of species that exists in a community, or of the variety of communities in a landscape. Diversity is a property which varies greatly between communities, and its definition also varies between authors.

Dominance - The degree of influence that a plant species exerts over a community as measured by its mass or basal area per unit area of cover, mass, or basal area of the community.

Downcutting - Fluvial process by which stream flow scours bed material, thereby lowering channel

Drift (glacial geology) - A general term applied to all rock material (clay, silt, sand, gravel, boulders) transported by a glacier and deposited directly by or from the ice, or by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines, and stratified glaciofluvial deposits that form outwash plains, eskers, kames, varves, and glaciolacustrine sediments. The term is generally applied to Pleistocene glacial deposits in areas (as large parts of North America and Europe) that no longer contain glaciers.

Ecotone - (1) A transition zone between two well defined plant communities or units of vegetation. Does not apply to seral stages of an adjacent community. (2) Any zone of intergradation or interfingering, narrow or broad, between contiguous types of vegetation including seral stages. Recognition of ecotones may depend on the scale at which one is working.

Endangered species- a species found by the Secretary of the Interior to be threatened with extinction because its habitat is threatened with destruction, drastic modification, or severe curtailment, or because of over-exploitation, or other factors which threaten its survival.

Ephemeral stream - A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is at all times above the water table.

Epipedon - A soil horizon that has formed at the surface, requiring at least the dissolution of rock structure and additionally, either darkening by organic matter or a lightening caused by eluviation or lack of development. The epipedon may include the O, A, and B master horizons; it is a diagnostic horizon used in soil classification.

EPT ratio - Proportions of clean water aquatic insect groups: the Ephemeroptera (mayflies), the Plecoptera (stoneflies), and Trichoptera (caddisflies), indicative of water quality. See also Appendix 4.

Estuarine (area) - The environmental system of an estuary and those transitional areas which are consistently influenced or affected by water from an estuary.

Estuary - All or part of the mouth of a river or stream having an open, natural connection with the sea and within which sea water is measurably diluted by freshwater runoff (the tide meets with river currents or flows).

Even-aged - A stand of trees with individuals originating at nearly the same time and thus having essentially the same age. The maximum difference in age permitted in an even-aged stand is usually 10 to 20 years.

FBI ratio - See Appendix 4.

Fines (fine sized bed material) - Bed material less than 4 mm (0.16 in) in diameter.

Fish Passage Hazard - This refers to the potential for creating conditions with bridges or culverts that would prevent adult or juvenile anadromous fish from moving into areas where they breed or into sites that are necessary for their growth or survival.

Floodplain - That portion of a stream valley adjacent to the channel which is built by sediments of the stream and which is covered with water when the stream overflows its banks at flood stage. Also, the nearly level land situated on either side of a channel which is subject to overflow flooding.

Flora - (1) A list of all plant species living in a defined area at a particular time. (2) A book describing all the plant species of a specific area. (3) A collective term for all plant species in the same way that "vegetation" is a collective term for all plant communities.

Flow Containment - The ability of a stream channel to contain large stream flow events within the channel area.

Fluvial - Geomorphic processes associated with running water; of or pertaining to rivers.

Forb - An herb other than a graminoid.

Freshet - A rise or overflowing of a stream caused by heavy rains or melted snow.

Geomorphic surface - A geomorphic surface represents an episode of landscape development and consists of one or more landforms. A mappable part of the land surface that is defined in terms of morphology (relief, slope, aspect, etc.); origin (erosional, constructional, etc.); age (absolute, relative); and stability of component landforms.

Geomorphology - The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features.

Glacial - Of or relating to the presence and activities of ice and glaciers, as glacial erosion. Pertaining to distinctive features and materials produced by or derived from glaciers and ice sheets, as glacial lakes. Pertaining to an ice age or region of glaciation.

Glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and may occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glacial marine - Marine sediments that contain glacial material (also glaciomarine).

Glacial Outwash Plain - A broad, low relief landform formed by glacial deposits consisting of washed bedload materials (gravel and sand). Normally situated in a flat, glacial valley floor preceding a glacier or as a broad, flat foreland cut by braided, glacially fed streams.

Glacial till - Till is that part of the glacial drift deposited directly by the ice with little or no transportation by water. It is generally an unstratified, unconsolidated, heterogeneous mixture of clay, silt, sand, gravel, and sometimes boulders. Some settled out as the ice melted with very little washing by water, and some was overridden by the glacier and is compacted and unsorted. Till may be found in ground moraines, terminal moraines, medial moraines, and lateral moraines.

Glide - Very low velocity stream flow creating a calm surface condition with water flowing smoothly and gently.

Graminoid - A grass-like (linear-leaved) plant such as a grass, sedge, rush, woodrush, or bulrush.

Growing degree day - Day during the growing season when temperatures are sufficient to support plant growth.

Habitat - (1) The particular kind of environment in which a plant or plant community is living or the environment in which the life needs of a plant, population, or community are supplied. (2) The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Halophyte - A plant adapted to existence in a saline environment and more or less restricted to saline or alkaline soils or to sites that are influenced by saltwater.

Herb - Vascular plants that are not woody, at least above ground. Herbs include forbs and graminoids.

Hydrologic Function - The capacity of a stream to move or to store bedload material and suspended sediment. Stream gradient, the resultant stream power, and size of material are critical factors. Stream power is the rate of doing work or a measure of the energy available for moving rock, sediment, or woody debris in the stream channel, as determined by discharge, water surface slope, and the specific weight of water.

Incision Depth - The vertical distance between the channel bottom at the thalweg and the first significant slope break occurring above the bankfull stage point. Channels adjacent to floodplains typically lack any adjacent sideslope, and, by definition, have low incision depths.

Inclusion - a small percentage of a map unit which exhibits a different soil type or vegetation community from the rest of the unit.

Indicator Species - A species whose presence or absence and abundance are used as indicators of environmental conditions.

Jurassic - The period of the Mesozoic era between the Cretaceous and the Triassic periods; about 140 million to 220 million years ago.

Nickpoint - Any interruption or break in slope: a point of abrupt inflection in the longitudinal profile of a stream or of its valley.

Krummholz - Stunted forest found near timberline where tree shape is deformed by wind and weather, from the German for "elfin forest".

Large Woody Debris (LWD) - A term used to describe dead (usually fallen) logs, tree boles, rootwads, and limbs. Current usage of the term defines LWD as woody material greater than 10.2 centimeters (4 inches) in diameter. Hydrologists and channel surveys also use a minimum length of 3 meters (10 feet) in the definition.

Leaching - The removal of soluble material from a soil horizon in solution by percolating water.

Marine sediments - Sediments that settled out of the sea and were reworked by currents and tides. Locally they have been exposed by isostatic rebound.

Meltwater - Runoff flow produced by a melting mountain glacier, valley glacier, or mountain snowfield.

Moraine (glacial, geological) - an accumulation of drift, with an initial topographic expression of its own, built chiefly by the direct action of glacial ice. Examples are end, ground, lateral, recessional, and terminal moraines.

Moraine (lateral) - A ridge-like moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from valley walls by glacial abrasion and plucking, or mass wasting.

Mountainslope - A natural elevation of the land surface, rising more than 300 meters (1000 feet) above surrounding lowlands and generally having a steepness of 25% slope or greater.

Muck - Highly decomposed organic material in which the original plant parts are not recognizable. May contain more mineral matter and is usually darker in color than peat.

Muskeg - Southeast Alaska term for a peatland such as a fen or bog, usually with sphagnum moss, sedges, a water table near the land surface and deep accumulations of organic material. The term is used for different plant communities in Interior Alaska and Canada.

Nonforested Community - A plant community of less than 10% crown cover by trees, less than 7.6 meters (25 feet) in height.

Nonvascular plant - Plant without a specialized internal vascular system that transports nutrients and water, such as a moss.

Old-growth stand - Old-growth stands contain trees of a wide range of sizes and ages and have a deep, multilayered canopy. They contain large snags (dead trees) and large fallen trees and other coarse woody debris. Nutrient cycling is low and much energy accumulates on the forest floor. The term is not synonymous with old-aged forest and must be recognized on the basis of stand characteristics rather than age of trees.

Outcrop - That part of a geologic formation or structure that appears at the surface of the earth.

Outwash - Stratified detritus (sand and gravel) removed or washed out from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or the margin of an active glacier.

Overstory - The portion of the trees forming the upper canopy in a forest stand of more than one story.

Palustrine - Pertaining to shallow, low velocity, backwater sloughs, swamps, bogs, and muskeg ponds and their outlet streams or any ponded environment. Ponded is a condition in which free water covers the soil surface and is removed only by percolation, evaporation, or transpiration.

Parent material - Refers to that great variety of unconsolidated organic and mineral materials in which soils form. Fresh peat and unconsolidated mineral matter are parent material by this concept, but consolidated bedrock is not.

Peak Flow Magnitude - The relative size of the annual flood event, represented by the estimated bankfull streamflow. Size classes used for describing relative magnitudes are Low (less than 500 cfs), Moderate (500 - 1000 cfs), High (1000 - 1750 cfs), and Very High (greater than 1750 cfs).

Pink Spawning Capability - The capacity of habitat in a stream to support the breeding (spawning) of adult pink salmon and the incubation of their eggs. Unlike coho salmon, pink salmon young migrate directly to the ocean after they hatch.

Placid Flow - A very, low velocity stream flow condition in a natural channel. Usually occurs in a deep, wide, low gradient segment of a stream channel.

Plant Association - The potential natural vegetative community in a given area. This is a concept developed for the inventory, mapping, and management of vegetative communities. A defined plant association is a discrete type of vegetation, based on the dominant overstory and understory species. Typically, the name consists of a tree and a shrub, but a dominant herb will often be named.

Plant Community - A unit of vegetation that is relatively uniform in structure and floristic composition and consists of competing plants of one or more species in a common location.

Plot - An area of land of any size that is studied or used for experimental purposes. A sample unit in an inventory.

Pond - An increase in water surface elevation upstream of a blockage or an obstruction. Ponds are often created by beaver dams. Flow velocity approaches laminar flow conditions.

Quaternary - The latest geologic period of the Cenozoic era which began about one million years ago and includes the Recent and Pleistocene epochs.

Rapid bio assessment - See Appendix 4.

Rearing Habitat Area - The place or site in a stream where juvenile fish live during their growth period.

Regeneration - Renewal of a tree crop, whether by natural or artificial means, also the young crop itself.

Resident Spawning and Rearing Capability - The capacity of habitat in a stream to support adult breeding (spawning), incubation of their eggs, and growth (rearing) of resident immature trout or char.

Resident Species - Species of fish that live in freshwater streams for their entire life cycle. Used in this field guide to refer to Dolly Varden char, rainbow trout, and cutthroat trout.

Riffle - A shallow extending across a stream bed causing broken water; a stretch of water flowing over a riffle; a small wave or succession of small waves

Riparian - Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.

Riparian Vegetation - Vegetation growing on or near the banks of a stream or body of water on soils that exhibit some wetness characteristics during some portion of the growing season.

Rootwad - The root mass of the tree, butt end.

Rubble - Stream bed material ranging in size from 6.09-25.4 centimeters (2.4 tp 10 inches) in diameter.

Secondary Channel (side channel) - Lateral channel with an axis of flow parallel to the mainstem and fed by the main stem. (AFS 1985)

Second growth - A forest which grows in after the removal of the old stand by cutting, windthrow, fire, or other causes. Since the overstory is all removed at one time, the new forest is generally even-aged.

Sedge - Perennial (rarely annual), grass-like herbs of wet and marshy places.

Sediment - Fragmented material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited in the stream bed.

Sediment deposition -,The process of sediment precipitating out of suspension in the water column. Heavier particles will drop out first, then the lighter particles. Normally, lower gradient reaches will be the zones of deposition as flow velocities are less, allowing for precipitation of particles to occur.

Sediment routing - Describes the entire process of transporting the sediment from the source area to the final zone of deposit (i.e estuary). Particles are routed through the stream network of a watershed. A normal progression would be from the steep mountainslope channels, where mass wasting is common, through the moderate gradient transport channels, and finally to the low gradient, alluvial or estuary channels.

Sediment storage - A stream will accumulate sediment in zones of low velocity, low gradient until high flow events occur to mobilize the stored deposits of sediment and transport them further down the system.

Sediment transport - The movement of sediment through the stream, from the source area to a point of deposition.

Sere - one of a series of ecological communities that succeed one another; synonym: seral community.

Series (Tree or Soil) - A taxonomic grouping that reflects higher order commonalities such as same dominant tree species or same basic soil horizons and characteristics. Variations between different types in the series occur in the shrub or herb layer for forest communities; for soils, in the texture and percent coarse fragments.

Shrub - A woody perennial plant, often having many stems and commonly found in the understory layer of a forest or in disturbed or open areas.

Sideslope - The slope which occurs directly adjacent to, and connected with, the channel lower bank. Upper banks, if present, will compose part, but not necessarily all, of this slope.

Slough - Normally a side channel to a mainstem channel, with low velocity stream flow. Occurs in a floodplain, delta, or glacial outwash plain.

Snag - Standing dead tree.

Soil Association - A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Soil profile - A vertical section through the soil. In practice, a description of a soil profile includes some soil properties that can be determined only by inspecting volumes of soil. A description of a pedon is commonly based on examination of a profile, and the properties of the pedon are projected from the properties of the profile.

Soil drainage classes - In Alaska, soil drainage classes are primarily based on the highest level the water table rises to during the growing season.

Very Poorly Drained: the water table remains at or near the surface a greater part of the time. Field evidence of very poor drainage is the presence of a water table above 10 inches for more than 2 weeks out of the growing season, a histic epipedon, or colors indicating saturated or reducing conditions.

Poorly Drained: The soil remains wet much of the time with the water table seasonally near the surface for prolonged intervals. Field evidence of poorly drained soils is the presence of a high water table above 20 inches for more than 2 weeks during the growing season but not above 10 inches for more than 2 weeks; a histic epipedon or colors as above within 20 inches of surface.

Somewhat Poorly Drained: Soil is wet for significant periods, but not all of the time usually because of a slowly permeable layer or high water table. Field evidence includes: Presence of a high water table above 30 inches for more than 2 weeks during the growing season but not above 20 inches for more than 2 weeks or colors as above within 30 inches of the surface.

Moderately Well Drained: Profile is wet for a small but significant part of the time usually because of a slowly permeable layer within or immediately below the solum or a relatively high or intermittently high water table. Evidence includes presence of a high water table above 60 inches for more than 2 weeks during the growing season but not above 30 inches for more than 2 weeks or indistinct mottling within 60 inches of the surface.

Well Drained: Water is removed from the soil readily but not rapidly. Soils are free of mottling within the usual depth of plant roots. Under natural conditions, soil aeration is not a problem associated with well drained soils. The water table is generally below 60 inches and does not extend above 60 inches for more than 2 weeks during the growing season.

Soil horizon - A layer, approximately parallel to the surface of the soil, distinguishable from adjacent layers by a distinctive set of properties produced by soil forming processes. The term layer rather than horizon is used if all of the properties are inherited from the parent material or no judgement is made as to whether the layer is genetic.

Spawning Habitat Area - The place or site in a stream where fish breed and eggs are incubated before hatching.

Stand - An aggregation of trees or other plants occupying a specific area and sufficiently uniform in species composition, age distribution, spatial arrangement, and condition to be distinguishable from the forest or other growth on adjoining areas.

Stratified - Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stratum (vegetation) - A horizontal layer in a plant community in which the plants are of the same lifeform and about the same height, such as the overstory stratum or the fern stratum.

Stream - A natural water course containing flowing water, at least part of the year, supporting a community of plants and animals within the stream channel and the riparian vegetation zone.

Stream Bed - The substrate plane bounded by the stream banks, over which the water column moves. Also called stream bottom.

Stream Bank - The portion of the channel cross section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank.

Lower bank - The periodically submerged portion of the channel cross section from the normal high water line to the water's edge during the summer low flow period.

Upper bank - That portion of the topographic cross section from the break in the general slope of the surrounding land to the normal high water line.

Stream Reach - Any specified length of stream or a relatively homogeneous section of stream having a repetitious sequence of physical characteristics and habitat types.

Stream terrace - One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the dissected remnants of an abandoned floodplain, stream bed, or valley floor produced during a former stage of erosion or deposition. Erosional surfaces cut on bedrock and thinly mantled with stream deposits (alluvium) are designated "strath terraces." Remnants of constructional valley floors are termed "alluvial terraces."

Substrate - The mineral and/or organic material that forms the bed of the stream.

Swale - (1) A slight depression, sometimes swampy, in the midst of generally level land. (2) A shallow depression in an undulating ground moraine due to uneven glacial deposition. (3) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

Thalweg - The line connecting the lowest or deepest points along a stream bed.

Till (glacial) - Dominantly unsorted and unstratified drift, deposited by and underneath a glacier, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders.

Torrent (glacial - Flow condition in high gradient stream channels produced by rapid snowmelt or glacial ice melt. Characterized by high stream flow velocity, near bankfull discharge, and standing waves.

Tributary Stream Habitat - Those unmapped channels (unclassified according to channel types) which join a larger, unmapped stream channel. In lower gradient landforms, such as floodplains and estuaries, these small channels can have important habitat value and management significance.

Uncontained Stream - Not confined to an entrenched or well defined channel.

Understory - That portion of the trees in a stand below the upper crown cover or overstory.

Vascular plant - A plant that has a specialized internal system of vascular tissue for the transport of nutrients and water, which includes the ferns and all the higher order plants.

Vegetation structure - (1) Defined by Dansereau as the organization in space of the individuals that form a stand and a vegetation type. The primary elements of vegetation structure are growth form, stratification, and coverage. (2) The spatial distribution pattern of life forms in a plant community (phytocoenose), especially with regard to their height, abundance, or coverage within the individual layers (synusia). (3) The three components of vegetation structure are (a) vertical structure (stratification into layer), (b) horizontal structure (spatial distribution of individuals and species populations), and (c) quantitative structure (abundance of each species).

APPPENDIX 1: VEGETATION DATA SUMMARIES

All diameters, heights, lengths and elevations are given in English units; conversion factors for the metric system are as follows: 1 inch = 2.54 cm; 1 foot = 0.305 m.

Table 1. Plant Assocation (PA) and Plant Community (PC) Codes

Code	Plant Assocation/Community Name
100	Western Hemlock Series
110	Western Hemlock/Blueberry
115	Western Hemlock/Rusty Menziesia
330	Sitka Spruce/Devil's Club
515	Mountain Hemlock/Rusty Menziesia
800	Sitka Spruce-Black Cottonwood/Red-osier Dogwood-Sitka Alder
915	Subalpine Fir/Rusty Menziesia
930	Subalpine Fir/Devil's Club
991	Beach Fringe communities
992	Estuarine communities
993	River bar communities
994	Alpine meadow
995	Alpine heath
996	Krummholz
997	Talus slope
998	Avalanche slope

Table 2. Species Codes, Scientific, and Common Names

Code	Scientific Name	Common Name
ABILAS	Abies lasiocarpa	Subalpine fir
ACEGLAD	Acer glabrum douglasii	Douglas maple
ACHBOR	Achillea borealis	Yarrow
ACODEL	Aconitum delphinifolium	Monkshood
ACTRUB	Actaea rubra	Baneberry
AGRSCA	Agrostis scabra	Bentgrass
ALNCRIS	Alnus crispa sinuata	Sitka alder
ALNRUB	Alnus rubra	Red alder
ANGLUC	Angelica lucida	Sea coast angelica
ARADRU	Arabis drummondii	Drummond rockcress
ARNICA	Arnica spp.	Arnica
ARTNOR	Artemisia norvegica	Mountain sagebrush
ARUSYL	Aruncus sylvester	Goatsbeard
ATHFIL	Athyrium filix-femina	Lady fern
BETPAP	Betula papyrifera	Paper birch
BOSROS	Boschniakia rossica	Ground-cone
CALCAN	Calamagrostis canadensis	Bluejoint
CAMLAS	Campanula lasiocarpa	Mountain harebell
CAREX	Carex sp.	Sedge
CARLAE	Carex laeviculmis	Smooth stem sedge
CARLYN	Carex lyngbyei	Lyngbye sedge
CARMACH	Carex macrochaeta	Long-awn sedge
CARNIG	Carex nigricans	Blackish sedge
CARPYR	Carex pyrenaica	Pyrenaean sedge
CARSAX	Carex saxatilis	Russet sedge
CARSIT	Carex sitchensis	Sitka sedge
CARSTY	Carex stylosa	Variegated sedge
CARUMB	Cardamine umbellata	Bittercress
CASMER	Cassiope mertensiana	Mertens cassiope
CASSTE	Cassiope stelleriana	Starry cassiope
CHRARC	Chrysanthemum arcticum	Arctic daisy
CINLAT	Cinna latifolia	Woodreed grass
CIRALP	Circaea alpina	Enchanter's nightshade
CONCHI	Conioselinum chinense	Western hemlock-parsley
CORCAN	Cornus canadensis	Bunchberry

Table 2. Species Codes, Scientific, and Common Names, Cont'd.

Code	Scientific Name	Common Name
CORSTO	Cornus stolonifera	Red-osier dogwood
CRYCRI	Cryptogramma crispa	Parsley fern
DODECA	Dodecatheon spp.	Shooting-star
DRYAUS	Dryopteris austriaca	Spinulose shield fern
ELEPAL	Eleocharis palustris	Creeping spikerush
ELYMOL	Elymus mollis	Beach rye
EMPNIG	Empetrum nigrum	Crowberry
EPIALP	Epilobium alpinum	Alpine willow-herb
EPIANG	Epilobium angustifolium	Fireweed
EPILAT	Epilobium latifolium	Dwarf fireweed
EPILOB	Epilobium spp.	Willow-herb
EQUARV	Equisetum arvense	Meadow horsetail
EQUISE	Equisetum spp.	Horsetail
ERIPER	Erigeron peregrinus	Subalpine daisy
FESARU	Festuca arundinacea	Tall fescue
FESRUB	Festuca rubra	Red fescue
GALTRIL	Galium triflorum	Sweet-scented bedstraw
GEOLIV	Geocaulon lividum	Northern commandra
GEUMAC	Geum macrophyllum	Large-leaf avens
GLAMAR	Glaux maritima	Sea milkwort
GRAMIN	(Graminae)	Grass
GYMDRY	Gymnocarpium dryopteris	Oak fern
HERLAN	Heracleum lanatum	Cow parsnip
HEUGLA	Heuchera glabra	Alpine heuchera
HONPEP	Honckenya peploides	Honckenya
HORBRA	Hordeum brachyantherum	Meadow barley
IRISET	Iris setosa	Wild iris
LATJAP	Lathyrus japonicus	Beach-pea
LEPPYR	Leptarrhena pyrolifolia	Leatherleaf saxifrage
LISCOR	Listera cordata	Heart-leaved twayblade
LOIPRO	Loiseleuria procumbens	Alpine azalea
LUEPEC	Luetkea pectinata	Luetkea
LUPNOO	Lupinus nootkatensis	Nootka lupine
LUZPAR	Luzula parviflora	Small-flowered woodrush
LUZRUF	Luzula rufescens	Hairy woodrush
LYCALP	Lycopodium alpinum	Alpine clubmoss
LYCANN	Lycopodium annotinum	Stiff clubmoss
LYCCLA	Lycopodium clavatum	Running clubmoss
LYCCOM	Lycopodium complanatum	Ground cedar
LYCOPO	Lycopodium spp.	Clubmoss
LYCSEL	Lycopodium selago	Fir clubmoss
MALMON	Malaxis monophylla	White adder's-tongue
MENFER	Menziesia ferruginea	Rusty menziesia
MITPEN	Mitella pentandra	Alpine mitrewort
MONHYP	Monotropa hypopitys	Indian pipe
MONUNI	Moneses uniflora	Single delight
OPLHOR	Oplopanax horridum	Devil's club
OSMPUR	Osmorhiza purpurea	Sitka sweet cicely
PARFIM	Parnassia fimbriata	Fringed Grass of Parnassus
PETHYP	Petasites hyperboreus	Sweet coltsfoot
PHLALP	Phleum alpinum	Alpine timothy
PHYGLA	Phyllodoce glanduliflora	Yellow mountain heather
PICSIT	Picea sitchensis	Sitka spruce
PINCONL	Pinus contorta latifolia	Lodgepole pine
PLAMAR	Plantago maritima	Goose-tongue
PLATAN	Platanthera spp.	Bog-orchid
POAEMI	Poa eminens	Large-flower speargrass
POAPAL	Poa palustris	Fowl bluegrass

Table 2. Species Codes, Scientific, and Common Names, Cont'd.

Code	Scientific Name	Common Name
POAPRA	Poa pratensis	Kentucky bluegrass
POLGLY	Polypodium glycyrrhiza	Licorice fern
POLVIV	Polygonum viviparum	Alpine bistort
POPTRI	Populus trichocarpa	Black cottonwood
POTANS	Potentilla anserina	Silverweed
PREALA	Prenanthes alata	Rattlesnake root
PYRASA	Pyrola asarifolia	Wintergreen
PYRCHL	Pyrola chlorantha	Greenish wintergreen
PYROLA	Pyrola spp.	Wintergreen
PYRSEC	Pyrola secunda	One-sided wintergreen
RANCYM	Ranunculus cymbalaria	Buttercup
RANNIV	Ranunculus nivalis	Buttercup
RANUNC	Ranunculus spp.	Buttercup
RHICRI	Rhinanthus crista-galli	Rattlebox
RIBES	Ribes spp.	Currant
RIBHUD	Ribes hudsonianum	Northern black currant
RIBLAC	Ribes lacustre	Swamp gooseberry
RUBPED	Rubus pedatus	Five-finger bramble
RUBSPE	Rubus spectabilis	Salmonberry
RUMACE	Rumex acetosella	Sheep sorrel
SALALA	Salix alaxensis	Feltleaf willow
SALARC	Salix arctica	Arctic willow
SALBAR	Salix barclayi	Barclay willow
SALIX	Salix spp.	Willow
SALRET	Salix reticulata	Netleaf willow
SALROT	Salix rotundifolia	Roundleaf willow
SALSIT	Salix sitchensis	Sitka willow
SAMRAC	Sambucus racemosa	Red elderberry
SANSTI	Sanguisorba stipulata	Sitka burnet
SAXFER	Saxifraga ferruginea	Alaska saxifrage
SAXIFR	Saxifrage spp.	Saxifrage
SAXLYA	Saxifraga Lyallii	Red-stem saxifrage
SAXMER	Saxifraga Mertensiana	Wood saxifrage
SAXPUN	Saxifraga punctata	Brook saxifrage
SAXTRI	Saxifraga tricuspidata	Three-tooth saxifrage
SENTRI	Senecio triangularis	Arrow leaf groundsel
SHECAN	Shepherdia canadensis	Buffaloberry
SIBPRO	Sibbaldia procumbens	Sibbaldia
SILACA	Silene acaulis	Moss campion
SORSIT	Sorbus sitchensis	Sitka mountain ash
SPHAGN	Sphagnum sp.	Peat moss
SPIBEA	Spiraea beauverdiana	Beauverd spiraea
STECRI	Stellaria crispa	Starwort
STELLA	Stellaria spp.	Starwort
STESIT	Stellaria sitchana	Starwort
STRAMP	Streptopus amplexifolius	Clasping twisted stalk
TAROFF	Taraxacum officinale	Dandelion
TELGRA	Tellima grandiflora	Fringe cups
THASPA	Thalictrum sparsiflorum	Fewflower meadowrue
THEPHE	Thelypteris phegopteris	Northern beech fern
TIATRI	Tiarella trifoliata	Foam flower
TRICER	Trisetum cernuum	Nodding oatgrass
TRIEUR	Trientalis europea	Arctic starflower
TRIMAR	Triglochin maritimum	Maritime arrowgrass
TRISET	Trisetum sp.	Oatgrass
TSUHET	Tsuga heterophylla	Western hemlock
TSUMER	Tsuga mertensiana	Mountain hemlock
VACCIN	Vaccinium spp.	Blueberry

Table 2. Species Codes, Scientific, and Common Names, Cont'd.

Code	Scientific Name	Common Name
VACULI	Vaccinium uliginosum	Bog blueberry
VACVIT	Vaccinium vitis-idaea	Mountain cranberry
VALSIT	Valeriana sitchensis	Sitka valerian
VERAME	Veronica americana	Speedwell
VERVIR	Veratrum viride	False hellebore
VIBEDU	Viburnum edule	Highbush cranberry
VIOPAL	Viola palustris	Marsh violet

Table 3. Overstory and Understory Cover Data in Percent by PA/PC*

PA/		Overstory					Understory				
PC	Species	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
100	BETPAP	2	20.0	7.1	15	25	2	1.5	.7	1	2
	PICSIT	2	22.5	10.6	15	30	2	12.5	3.5	10	15
	PINCONL	2	2.5	2.1	1	4	1	.5	.0	1	1
	TSUHET	2	3.0	1.4	2	4	2	5.0	2.8	3	7
110	BETPAP	5	9.4	7.2		20	3	2.0	2.0		4
	PICSIT	7	16.0	7.4	7	25	6	1.9	1.0	1	3
	PINCONL	2	2.0	1.4	1	3	1	.5	.0	1	1
	POPTRI	2	3.0	1.4	2	4	1	.1	.0		
	TSUHET	7	38.6	18.0	10	60	7	22.3	18.3	1	50
	TSUMER	2	2.5	.7	2	3					
115	BETPAP	5	24.6	20.5	3	55	4	3.5	2.6		6
	PICSIT	6	4.3	2.3	1	7	5	1.4	1.6		4
	TSUHET	8	40.4	27.5	5	70	8	11.3	13.1	1	40
	TSUMER	1	6.0	.0	6	6	1	1.0	.0	1	1
330	PICSIT	1	45.0	.0	45	45					
	TSUHET	1	20.0	.0	20	20	1	10.0	.0	10	10
515	ABILAS	1	5.0	.0	5	5	1	1.0	.0	1	1
	BETPAP	1	10.0	.0	10	10	1	1.0	.0	1	1
	PICSIT	2	1.3	1.1	1	2	1	.5	.0	1	1
	TSUHET	2	17.5	3.5	15	20	2	5.5	4.9	2	9
	TSUMER	2	27.5	17.7	15	40	2	22.5	3.5	20	25
800	ALNRUB	1	5.0	.0	5	5	1	1.0	.0	1	1
	BETPAP	2	5.5	6.4	1	10					
	PICSIT	3	22.3	24.0	7	50	4	10.0	3.5	7	15
	POPTRI	4	17.5	5.0	15	25					
	TSUHET						2	1.3	1.1	1	2
915	ABILAS	4	40.0	9.1	30	50	4	6.8	6.6	1	15
	BETPAP	1	10.0	.0	10	10					
	PICSIT	4	15.8	9.9	8	30	3	1.3	.6	1	2
	TSUHET	2	10.5	6.4	6	15	3	3.3	4.0	1	8
930	ABILAS	2	35.0	.0	35	35	2	3.5	2.1	2	5
	BETPAP	1	3.0	.0	3	3	1	.5	.0	1	1
	PICSIT	2	8.5	2.1	7	10	2	1.1	1.3		2
	POPTRI	1	3.0	.0	3	3					
	TSUHET						1	1.0	.0	1	1

Table 3. Overstory and Understory Cover Data in Percent by PA/PC*, Cont'd.

PA/		Overstory					Understory				
PC	Species	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
992	PICSIT						1	2.0	.0	2	2
993	PICSIT						1	.1	.0		
	POPTRI						1	1.0	.0	1	1
995	ABILAS	1	.1	.0							
996	ABILAS	2	44.0	50.9	8	80					
	TSUMER	3	48.5	41.6	1	75					
997	POPTRI						1	.1	.0		
998	ABILAS	1	1.0	.0	1	1					
	BETPAP	1	30.0	.0	30	30					
	TSUHET	1	2.0	.0	2	2					
	TSUMER	1	1.0	.0	1	1					

* Blanks indicate zero or trace values.

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*

PA/PC	Species	N	Mean	SD	Min	Max
100	CORSTO	1	1.0	.0	1	1
	SALIX	1	2.0	.0	2	2
	SHECAN	1	7.0	.0	7	7
	VIBEDU	2	.5	.0	1	1
	EPIANG	2	.1	.0		
	PYRASA	2	.1	.0		
	PYRSEC	2	.1	.0		
	CRYCRI	1	.1	.0		
	POLGLY	2	3.0	1.4	2	4
110	ALNCRIS	3	5.7	3.5	2	9
	EMPNIG	1	.1	.0		
	GEOLIV	1	1.0	.0	1	1
	MENFER	4	2.3	2.6		6
	OPLHOR	3	1.5	2.1		4
	RIBHUD	2	.3	.3		1
	SALBAR	2	1.0	.0	1	1
	SALIX	1	2.0	.0	2	2
	SAMRAC	1	.1	.0		
	SORSIT	2	2.3	2.5	1	4
	SPIBEA	1	.1	.0		
	VACCIN	6	5.4	8.1		20
	VACVIT	1	2.0	.0	2	2
	VIBEDU	1	3.0	.0	3	3
	ACODEL	1	.1	.0		
	ARUSYL	1	3.0	.0	3	3
	CORCAN	3	7.0	7.5		15
	EPIANG	2	.1	.0		
	HEUGLA	1	.5	.0	1	1
	LISCOR	1	.1	.0		
	MONHYP	2	.1	.0		
	MONUNI	2	.3	.3		1
	PYRASA	2	.3	.3		1
	PYRCHL	1	.1	.0		

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
110	PYRSEC	4	.5	.4		1
	RUBPED	3	3.4	3.5		7
	SANSTI	1	.1	.0		
	STRAMP	3	.1	.0		
	CALCAN	2	.3	.3		1
	CARMACH	1	.1	.0		
	ATHFIL	2	4.8	6.0	1	9
	DRYAUS	4	1.3	1.8		4
	GYMDRY	5	2.1	2.0		5
	LYCANN	1	.5	.0	1	1
	POLGLY	2	.3	.3		1
	THEPHE	1	3.0	.0	3	3
	LYCANN	1	.1	.0		
	SPHAGN	2	1.0	.0	1	1
115	ALNCRIS	2	4.8	6.0	1	9
	MENFER	8	30.6	20.9	10	65
	OPLHOR	8	1.3	2.0		6
	RIBHUD	4	.2	.2		1
	SALBAR	3	1.5	1.3	1	3
	SALIX	2	.3	.3		1
	SORSIT	3	1.9	2.7		5
	VACCIN	7	3.0	3.3		8
	VACVIT	1	3.0	.0	3	3
	VIBEDU	3	.5	.5		1
	CORCAN	7	3.8	2.4	1	7
	EPIANG	2	.1	.0		
	HEUGLA	2	.3	.3		1
	MONUNI	1	.1	.0		
	PYROLA	1	.1	.0		
	PYRSEC	2	.6	.6		1
	RUBPED	7	2.4	2.8		8
	STRAMP	2	.1	.0		
	CALCAN	3	.2	.2		1
	CAREX1	1	1.0	.0	1	1
	ATHFIL	2	1.6	2.1		3
	DRYAUS	8	3.3	5.0		15
	GYMDRY	6	1.1	1.5		4
	LYCCOM	1	.1	.0		
	EQUISE	1	.1	.0		
	LYCOPO	2	.1	.0		
	SPHAGN	3	1.8	1.3	1	3
330	MENFER	1	7.0	.0	7	7
	OPLHOR	1	10.0	.0	10	10
	RIBHUD	1	.1	.0		
	SAMRAC	1	.1	.0		
	VIBEDU	1	2.0	.0	2	2
	CORCAN	1	3.0	.0	3	3
	MONUNI	1	.1	.0		
	PYRCHL	1	.1	.0		
	PYRSEC	1	.5	.0	1	1
	RUBPED	1	.1	.0		
	STRAMP	1	2.0	.0	2	2
	DRYAUS	1	.5	.0	1	1
	GYMDRY	1	65.0	.0	65	65

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
515	GEOLIV	1	1.0	.0	1	1
	MENFER	2	47.5	24.7	30	65
	OPLHOR	1	.1	.0		
	SALBAR	1	.1	.0		
	SORSIT	1	.1	.0		
	VACCIN	2	8.5	2.1	7	10
	VACVIT	1	.5	.0	1	1
	CORCAN	2	6.0	.0	6	6
	LISCOR	1	.5	.0	1	1
	PYRSEC	2	.5	.0	1	1
	RUBPED	2	11.0	12.7	2	20
	STRAMP	1	.5	.0	1	1
	TRIEUR	1	.5	.0	1	1
	DRYAUS	2	1.6	2.1		3
	LYCANN	1	.1	.0		
	SPHAGN	1	.1	.0		
800	ACEGLA	2	.1	.0		
	ALNCRIS	4	27.5	13.2	15	45
	CORSTO	3	43.3	12.6	30	55
	OPLHOR	3	6.4	7.7		15
	RIBHUD	3	1.1	1.7		3
	RIBLAC	2	.6	.6		1
	SALBAR	1	.1	.0		
	SAMRAC	1	.5	.0	1	1
	VACCIN	1	2.0	.0	2	2
	VIBEDU	4	4.8	4.1	1	10
	ACTRUB	2	.8	.4	1	1
	ARUSYL	2	2.0	1.4	1	3
	BOSROS	3	.2	.2		1
	CIRALP	3	4.2	3.3	1	7
	CORCAN	1	.1	.0		
	GALTRIL	3	.5	.5		1
	HERLAN	2	.5	.0	1	1
	MALMON	2	.1	.0		
	PLATAN	1	.1	.0		
	PREALA	3	.4	.5		1
	PYRASA	4	2.9	3.2		7
	PYRSEC	1	1.0	.0	1	1
	RANUNC	1	2.0	.0	2	2
	SANSTI	1	.1	.0		
	STRAMP	3	8.2	10.4	1	20
	TIATRI	2	.1	.0		
	TRIEUR	3	.1	.0		
	VIOPAL	2	7.6	10.5		15
	CALCAN	2	.6	.6		1
	CINLAT	2	.1	.0		
	ATHFIL	2	1.8	1.8	1	3
	GYMDRY	3	29.0	24.2	7	55
	EQUARV	2	4.1	5.6		8
	EQUISE	1	.5	.0	1	1
	LYCOPO	1	.1	.0		

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
915	ALNCRIS	2	1.8	1.8	1	3
	MENFER	4	30.3	24.5	6	60
	OPLHOR	3	1.5	1.3	1	3
	RIBES	1	.1	.0		
	RIBHUD	1	.5	.0	1	1
	SORSIT	2	.6	.6		1
	VACCIN	4	5.6	6.5	1	15
	VIBEDU	1	.1	.0		
	CORCAN	4	4.3	4.0	1	10
	LISCOR	3	.7	1.1		2
	MONUNI	2	.3	.3		1
	PYRASA	1	.5	.0	1	1
	PYRSEC	1	.5	.0	1	1
	PYRVIR	1	.1	.0		
	RUBPED	4	13.3	8.3	3	20
	STRAMP	1	1.0	.0	1	1
	TIATRI	3	.1	.0		
	DRYAUS	4	8.8	6.2		15
	GYMDRY	1	.5	.0	1	1
	LYCANN	1	2.0	.0	2	2
	LYCANN	1	.5	.0	1	1
	SPHAGN	2	5.1	7.0		10
930	ALNCRIS	1	3.0	.0	3	3
	MENFER	1	60.0	.0	60	60
	OPLHOR	2	20.0	7.1	15	25
	RIBES	1	.5	.0	1	1
	RIBHUD	1	1.0	.0	1	1
	SALIX	1	.1	.0		
	SAMRAC	1	.1	.0		
	SORSIT	2	.8	.4	1	1
	VACCIN	2	1.8	1.8	1	3
	ACTRUB	1	.1	.0		
930	CORCAN	2	1.8	1.8	1	3
	EPIANG	1	.1	.0		
	GALTRIL	1	.1	.0		
	LISCOR	1	.5	.0	1	1
	MITPEN	1	.1	.0		
	MONUNI	1	.1	.0		
	RUBPED	2	10.5	6.4	6	15
	STRAMP	2	1.8	1.8	1	3
	TIATRI	1	5.0	.0	5	5
	TRIEUR	1	1.0	.0	1	1
	VALSIT	1	.5	.0	1	1
	CALCAN	1	.1	.0		
	DRYAUS	2	13.0	9.9	6	20
	GYMDRY	2	8.0	2.8	6	10
	EQUARV	1	30.0	.0	30	30
	LYCANN	1	.5	.0	1	1
991	GLAMAR	1	9.0	.0	9	9
	HONPEP	1	15.0	.0	15	15
	PLAMAR	1	10.0	.0	10	10
	POTANS	1	8.0	.0	8	8
	TRIMAR	1	1.0	.0	1	1
	CARLYN	1	.5	.0	1	1
	POAPRA	1	5.0	.0	5	5

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
992	ACHMIL	2	22.5	24.7	5	40
	ANGLUC	2	7.5	3.5	5	10
	CHRARC	1	.1	.0		
	CONCHI	1	2.0	.0	2	2
	DODECA	1	.1	.0		
	GLAMAR	2	6.5	4.9	3	10
	HONPEP	1	.5	.0	1	1
	IRISET	2	2.3	2.5	1	4
	LATJAP	2	23.0	31.1	1	45
	PLAMAR	3	2.5	2.3	1	5
	POTANS	3	20.0	20.0		40
	RANCYM	1	.1	.0		
	RHICRI	1	.5	.0	1	1
	RUMACE	1	4.0	.0	4	4
	STELLA	1	.1	.0		
	TRIMAR	1	1.0	.0	1	1
	AGRSCA	1	5.0	.0	5	5
	CARLYN	1	45.0	.0	45	45
	CARSAX	2	3.5	2.1	2	5
	ELEPAL	1	25.0	.0	25	25
	ELYMOL	3	37.7	33.6	3	70
	FESRUB	1	15.0	.0	15	15
	GRAMIN1	1	1.0	.0	1	1
	GRAMIN2	1	2.0	.0	2	2
	HORBRA	1	6.0	.0	6	6
	POAEMI	2	2.5	.7	2	3
	POAPRA	1	40.0	.0	40	40
	TRICER	1	3.0	.0	3	3
993	ALNCRIS	1	40.0	.0	40	40
	RIBHUD	1	.1	.0		
	SALALA	1	10.0	.0	10	10
	SALSIT	1	15.0	.0	15	15
	ARUSYL	1	.5	.0	1	1
993	CARUMB	1	.1	.0		
	CIRALP	1	.1	.0		
	EPILAT	1	45.0	.0	45	45
	GALTRIL	1	.5	.0	1	1
	GEUMAC	1	.5	.0	1	1
	HERLAN	1	.5	.0	1	1
	PREALA	1	.5	.0	1	1
	SAXMER	1	.1	.0		
	STECRI	1	.1	.0		
	THASPA	1	.1	.0		
	VIOPAL	1	.5	.0	1	1
	CALCAN	1	.5	.0	1	1
	CAREX	1	.1	.0		
	PHLALP	1	.1	.0		
	POAPAL	1	.1	.0		
994	ALNCRIS	1	2.0	.0	2	2
	LUEPEC	1	2.0	.0	2	2
	MENFER	1	2.0	.0	2	2
	OPLHOR	1	.1	.0		
	SALIX	1	6.0	.0	6	6
	VACCIN	1	.5	.0	1	1
	ACODEL	2	.6	.6		1
	ARTNOR	1	.1	.0		

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
994	ARUSYL	1	3.0	.0	3	3
	CARUMB	2	.3	.3		1
	EPIALP	2	1.3	1.1	1	2
	EPIANG	2	6.0	1.4	5	7
	EPILAT	1	2.0	.0	2	2
	ERIPER	1	.5	.0	1	1
	HEUGLA	1	.5	.0	1	1
	OSMPUR	1	.1	.0		
	POLVIV	1	.1	.0		
	PREALA	1	.5	.0	1	1
	RANNIV	1	.1	.0		
	RANUNC	1	3.0	.0	3	3
	SANSTI	2	18.5	23.3	2	35
	SAXPUN	1	3.0	.0	3	3
	SENTRI	1	15.0	.0	15	15
	STESIT	1	1.0	.0	1	1
	STRAMP	1	.1	.0		
	TELGRA	1	.1	.0		
	VERAME	1	.1	.0		
	VERVIR	1	15.0	.0	15	15
	VIOPAL	1	6.0	.0	6	6
	CALCAN	2	13.0	9.9	6	20
	CARMACH	2	32.5	3.5	30	35
	FESARU	1	1.0	.0	1	1
	LUZPAR	1	.1	.0		
	PHLALP	1	.1	.0		
	ATHFIL	2	8.0	1.4	7	9
	DRYAUS	1	.5	.0	1	1
	GYMDRY	1	.5	.0	1	1
	EQUISE	1	7.0	.0	7	7
	LYCANN	1	.1	.0		
995	CASMER	1	95.0	.0	95	95
	CASSTE	3	7.8	10.6	1	20
	EMPNIG	3	17.7	8.7	8	25
995	LOIPRO	1	.5	.0	1	1
	LUEPEC	3	17.3	9.3	7	25
	MENFER	1	7.0	.0	7	7
	PHYGLA	3	15.0	18.0		35
	SALARC	1	4.0	.0	4	4
	SALBAR	1	3.0	.0	3	3
	SALRET	1	2.0	.0	2	2
	SALROT	1	.5	.0	1	1
	SPIBEA	1	4.0	.0	4	4
	VACCIN	2	1.1	1.3		2
	VACULI	1	10.0	.0	10	10
	VACVIT	1	.1	.0		
	ARTNOR	1	.5	.0	1	1
	CORCAN	1	1.0	.0	1	1
	EPIALP	1	.1	.0		
	EPILOB	1	.1	.0		
	ERIPER	1	.1	.0		
	LEPPYR	1	.1	.0		
	LUPNOO	1	.1	.0		
	RANUNC	1	2.0	.0	2	2
	RUBPED	1	2.0	.0	2	2
	SAXIFR	1	.1	.0		
	SAXLYA	1	.1	.0		

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
995	SAXTRI	1	.1	.0		
	SIBPRO	1	1.0	.0	1	1
	TRIEUR	2	.6	.6		1
	CALCAN	1	1.0	.0	1	1
	CARLAE	1	1.0	.0	1	1
	CARMACH	2	1.5	.7	1	2
	CARNIG	1	30.0	.0	30	30
	CARPYR	1	.5	.0	1	1
	CARSTY	1	3.0	.0	3	3
	LUZRUF	1	.1	.0		
	TRICER	1	3.0	.0	3	3
	TRISET	1	.1	.0		
	ATHFIL	1	.5	.0	1	1
	DRYAUS	1	1.0	.0	1	1
	GYMDRY	1	.5	.0	1	1
	LYCALP	2	1.1	1.3		2
	LYCANN	1	.1	.0		
	LYCCLA	2	.1	.0		
	LYCSEL	1	.1	.0		
996	CASMER	1	1.0	.0	1	1
	CASSTE	2	9.0	8.5	3	15
	EMPNIG	3	13.4	15.2		30
	LUEPEC	1	.5	.0	1	1
	MENFER	1	8.0	.0	8	8
	PHYGLA	2	22.5	3.5	20	25
	VACCIN	2	1.5	.7	1	2
	VACULI	1	.5	.0	1	1
	VACVIT	1	1.0	.0	1	1
	ARNICA	1	1.0	.0	1	1
	CORCAN	2	9.0	1.4	8	10
	MITPEN	1	.1	.0		
	PARFIM	1	.5	.0	1	1
	PETFRI	1	.1	.0		
	PYRSEC	1	.1	.0		
	RANUNC	1	.1	.0		
996	RUBPED	3	.8	.3	1	1
	SANSTI	1	1.0	.0	1	1
	VALSIT	1	1.0	.0	1	1
997	ALNCRIS	2	7.0	4.2	4	10
	EMPNIG	2	5.3	6.7	1	10
	MENFER	1	3.0	.0	3	3
	RIBHUD	1	.1	.0		
	SALALA	1	15.0	.0	15	15
	SALARC	1	6.0	.0	6	6
	SALBAR	1	3.0	.0	3	3
	SALRET	1	1.0	.0	1	1
	SALSIT	1	8.0	.0	8	8
	SPIBEA	1	9.0	.0	9	9
	VACCIN	1	2.0	.0	2	2
	ARADRU	1	.1	.0		
	ARTNOR	1	2.0	.0	2	2
	CAMLAS	1	.1	.0		
	CORCAN	1	7.0	.0	7	7
	EPIANG	1	.5	.0	1	1
	HEUGLA	2	.8	.4	1	1
	PYRSEC	1	.1	.0		

Table 4. Cover Data in Percent for Non-tree Species by PA/PC*, Cont'd.

PA/PC	Species	N	Mean	SD	Min	Max
998	RUBPED	1	.5	.0	1	1
	SAXFER	1	.1	.0		
	SAXIFR1	1	1.0	.0	1	1
	SAXIFR2	1	.1	.0		
	SIBPRO	1	2.0	.0	2	2
	SILACA	1	3.0	.0	3	3
	TAROFF	1	.1	.0		
	TRIEUR	1	.5	.0	1	1
	CALCAN	1	5.0	.0	5	5
	CARSIT	1	.5	.0	1	1
	GRAMIN	1	.1	.0		
	LUZPAR	1	.5	.0	1	1
	CRYCRI	1	.1	.0		
	GYMDRY	1	4.0	.0	4	4
	THEPHE	2	.6	.6		1
	LYCALP	1	.1	.0		
	LYCCLA	1	.5	.0	1	1
998	ALNCRIS	2	27.8	38.5	1	55
	MENFER	2	15.0	.0	15	15
	OPLHOR	2	5.0	4.2	2	8
	RIBHUD	3	4.3	1.5	3	6
	RUBSPE	1	3.0	.0	3	3
	SALBAR	2	22.5	17.7	10	35
	SAMRAC	2	.5	.0	1	1
	SORSIT	2	10.5	6.4	6	15
	SPIBEA	2	1.5	.7	1	2
	VACCIN	2	4.5	4.9	1	8
	VIBEDU	1	10.0	.0	10	10
	ACODEL	1	.1	.0		
	ACTRUB	1	3.0	.0	3	3
	CORCAN	2	5.0	1.4	4	6
	EPIANG	1	6.0	.0	6	6
	EPILOB	1	3.0	.0	3	3
	GALTRIL	1	.1	.0		
	HERLAN	1	1.0	.0	1	1
	RUBPED	1	2.0	.0	2	2
998	STRAMP	2	1.6	2.1		3
	TRIEUR	1	10.0	.0	10	10
	CALCAN	2	18.0	17.0	6	30
	FESRUB	1	2.0	.0	2	2
	DRYAUS	3	27.3	37.2	2	70
	GYMDRY	2	4.0	1.4	3	5

* Blanks indicate zero or trace values.

Table 5. Stratum Cover Data in Percent for Tree Strata by PA/PC*

PA/	Overstory				Understory				Total Trees			
PC	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
100	45.0	7.1	40	50	20.0	7.1	15	25	57.5	10.6	50	65
110	55.7	16.2	35	75	30.7	24.4	5	70	73.6	22.5	35	95
115	58.1	13.3	40	75	13.8	11.9	3	40	66.9	13.1	45	80
330	60.0	.0	60	60	10.0	.0	10	10	65.0	.0	65	65
515	45.0	21.2	30	60	25.0	.0	25	25	62.5	17.7	50	75
800	36.3	18.0	20	60	10.3	3.4	7	15	42.5	18.5	25	65
915	58.8	13.1	40	70	9.5	4.9	3	15	65.0	14.1	45	75
930	45.0	.0	45	45	5.0	2.8	3	7	47.5	3.5	45	50
992					2.0	.0	2	2	2.0	.0	2	2
995									.1	.0		
996	76.7	5.8	70	80					76.7	5.8	70	80
998	30.0	.0	30	30					15.5	20.5	1	30

*Blanks indicate absence of stratum in that PA/PC.

Table 6. Stratum Cover Data in Percent for Non-tree Strata by PA/PC*

PA/ PC	Tall Shrub	Low Shrub	Forb	Fern	Sedge/ Grass
100	5.3		.5	3.0	
110	10.1	2.0	4.7	4.5	.3
115	34.4	1.0	5.2	3.9	.5
330	20.0		5.0	65.0	
515	52.5	.5	16.5	1.6	
800	58.8		16.3	32.3	.1
915	33.0		16.8	9.3	
930	52.5		15.0	20.0	.1
991			40.0		7.0
992			45.0		57.5
993	60.0		45.0		.5
994	10.0	2.0	45.0	12.0	45.0
995	4.5	65.0	1.8	1.1	10.0
996	5.5	33.3	7.3		
997	22.5	5.3	9.0	2.6	2.8
998	63.3		10.0	29.0	3.7

*Blanks indicate absence of stratum in that PA/PC.

Table 7. Variable Plot Tree Data by PA/PC

PA/PC	SPECIES	N	Diameter BH (in.) Mean	SD	Min	Max	Height (feet) Mean	SD	Min	Max	Crown Ratio (%) Mean	Min	Max
100	BETPAP	1	7.0	.0	7.0	7.0	45.0	.0	45	45	30.0	30	30
	PICSIT	9	10.3	3.3	5.5	16.5	51.8	17.6	25	70	67.1	40	80
	TSUHET	1	6.0	.0	6.0	6.0	30.0	.0	30	30	20.0	20	20
110	BETPAP	3	9.7	2.5	7.0	12.0	56.0	13.9	40	65	40.0	20	70
	PICSIT	18	14.6	5.5	5.0	23.5	73.2	26.1	40	110	53.8	30	80
	POPTRI	1	5.5	.0	5.5	5.5	45.0	.0	45	45	30.0	30	30
	TSUHET	26	12.6	5.4	5.0	22.0	56.7	22.5	25	105	55.2	20	90
	TSUMER	1	14.5	.0	14.5	14.5	60.0	.0	60	60	20.0	20	20
115	BETPAP	15	7.0	1.9	5.0	9.5	35.5	8.5	25	60	55.4	30	90
	PICSIT	8	13.7	9.3	5.0	35.0	50.1	17.8	20	75	63.8	20	90
	TSUHET	36	12.6	5.8	5.5	28.0	46.9	15.6	12	75	52.2	10	90
330	PICSIT	9	13.8	4.9	7.0	21.0	104.9	10.8	80	115	24.4		50
	TSUHET	1	12.5	.0	12.5	12.5	105.0	.0	105	105	70.0	70	70
515	ABILAS	2	6.3	.4	6.0	6.5	27.5	3.5	25	30	30.0	30	30
	TSUHET	4	11.8	3.7	8.5	17.0	36.5	2.4	35	40	75.0	60	90
	TSUMER	8	8.3	2.7	5.0	14.0	31.1	5.9	20	40	37.5	10	70
800	BETPAP	1	12.5	.0	12.5	12.5	55.0	.0	55	55	30.0	30	30
	PICSIT	6	16.8	4.0	10.0	20.0	87.0	6.8	75	95	75.0	60	90
	POPTRI	15	20.5	4.1	13.5	29.0	104.8	17.4	85	140	39.3	20	60
915	ABILAS	21	13.0	5.1	6.0	24.5	63.5	19.0	30	105	42.8	30	60
	PICSIT	7	13.6	3.0	9.0	17.5	58.0	17.9	35	85	57.1	40	70
	TSUHET	2	7.8	3.9	5.0	10.5	40.0	14.1	30	50	65.0	60	70
930	ABILAS	16	10.8	4.0	5.0	17.0	60.4	19.6	25	92	36.3		70
	PICSIT	4	17.4	3.1	14.5	21.5	75.3	9.8	70	90	55.0	50	60

Table 8. Woody Debris Plot Data by PA/PC

PA/PC	SPECIES	N	Diameter (in.) Mean	SD	Min	Max	Length (feet) Mean	SD	Min	Max	Decay Class Mean	Min	Max
100	PICSIT	2	11.0	1.4	10.0	12.0	9.0	1.4	8	10	4.0	4	4
110	BETPAP	4	6.0	.8	5.0	7.0	15.0	5.5	11	23	2.8	2	4
	PICSIT	2	11.0	1.4	10.0	12.0	1.5	.7	1	2	4.0	4	4
	TSUHET	20	10.1	4.9	5.0	20.0	8.6	8.7	1	35	4.1	2	5
115	TSUHET	26	12.7	7.2	5.0	29.0	12.3	9.7	2	45	3.9	2	5
330	PICSIT	11	8.3	7.3	5.0	30.0	7.9	5.3	1	17	3.6	3	5
515	TSUHET	5	7.6	2.3	5.0	11.0	9.2	5.8	4	16	3.8	2	5
	TSUMER	1	14.0	.0	14.0	14.0	8.0	.0	8	8	5.0	5	5
800	PICSIT	4	11.3	1.7	9.0	13.0	16.8	5.7	9	22	4.0	4	4
	POPTRI	5	11.8	3.6	6.0	15.0	16.0	14.1	4	40	2.6	2	4
915	ABILAS	16	8.3	3.1	5.0	14.0	13.3	8.5	3	30	3.6	2	5
	PICSIT	14	7.2	2.6	5.0	14.0	11.5	9.6	2	40	3.4	3	4
	TSUHET	1	6.0	.0	6.0	6.0	8.0	.0	8	8	4.0	4	4
930	ABILAS	21	11.2	5.4	5.0	25.0	10.4	9.2	3	45	3.0	1	5
	BETPAP	1	6.0	.0	6.0	6.0	20.0	.0	20	20	3.0	3	3
998	SALBAR	1	6.0	.0	6.0	6.0	8.0	.0	8	8	3.0	3	3
	TSUHET	1	5.0	.0	5.0	5.0	4.0	.0	4	4	3.0	3	3

Table 9. Shrub Heights by PA/PC

PA/ PC	Species	N	Cover (%)	Height (feet) Mean	SD	Min	Max
100	CORSTO	1	1.0	4.0	.0	4	4
	SALIX	1	2.0	5.0	.0	5	5
	SHECAN	1	7.0	5.0	.0	5	5
	VIBEDU	2	.5	2.0	1.4	1	3
110	ALNCRIS	3	5.7	20.0	13.1	11	35
	EMPNIG		.1				
	GEOLIV		1.0				
	MENFER	4	2.3	3.0	1.6	1	5
	OPLHOR	3	1.5	1.2	.8	1	2
	RIBHUD	2	.3	1.0	.0	1	1
	SALBAR	2	1.0	12.5	3.5	10	15
	SALIX	1	2.0	15.0	.0	15	15
	SAMRAC	1	.1	.5	.0	1	1
	SORSIT	2	2.3	11.3	8.1	6	17
	SPIBEA		.1				
	VACCIN	6	5.4	1.9	1.3	1	4
	VACVIT		2.0				
	VIBEDU	1	3.0	4.0	.0	4	4
115	ALNCRIS	2	4.8	9.0	2.8	7	11
	MENFER	8	30.6	4.8	.8	3	6
	OPLHOR	8	1.3	2.7	1.3	1	5
	RIBHUD	4	.2	.9	.3	1	1
	SALBAR	3	1.5	11.0	8.2	4	20
	SALIX	2	.3	7.8	6.0	4	12
	SORSIT	3	1.9	7.2	7.3	1	15
	VACCIN	7	3.0	2.4	1.1	1	3
	VACVIT		3.0				
	VIBEDU	3	.5	3.3	1.2	2	4
330	MENFER	1	7.0	5.5	.0	6	6
	OPLHOR	1	10.0	3.5	.0	4	4
	RIBHUD	1	.1	.5	.0	1	1
	SAMRAC	1	.1	.5	.0	1	1
	VIBEDU	1	2.0	4.5	.0	5	5
515	GEOLIV	1	1.0	.5	.0	1	1
	MENFER	2	47.5	4.0	.0	4	4
	OPLHOR	1	.1	.5	.0	1	1
	SALBAR	1	.1	15.0	.0	15	15
	SORSIT	1	.1	3.0	.0	3	3
	VACCIN	2	8.5	2.0	.0	2	2
	VACVIT		.5				
800	ACEGLA	2	.1	1.8	.4	2	2
	ALNCRIS	4	27.5	20.5	7.4	12	30
	CORSTO	3	43.3	6.5	.9	6	7
	OPLHOR	3	6.4	2.3	1.2	1	3
	RIBHUD	3	1.1	1.5	.9	1	2
	RIBLAC	2	.6	1.5	.7	1	2
	SALBAR	1	.1	12.0	.0	12	12
	SAMRAC	1	.5	4.0	.0	4	4
	VACCIN	1	2.0	.5	.0	1	1
	VIBEDU	4	4.8	4.0	.8	3	5

Table 9. Shrub Heights by PA/PC, Cont'd.

PA/ PC	Species	N	Cover (%)	Height (feet) Mean	SD	Min	Max
915	ALNCRIS	2	1.8	10.5	6.4	6	15
	MENFER	4	30.3	3.9	.6	3	5
	OPLHOR	3	1.5	2.0	1.0	1	3
	RIBES	1	.1	1.0	.0	1	1
	RIBHUD	1	.5	1.0	.0	1	1
	SORSIT	2	.6	1.5	.7	1	2
	VACCIN	4	5.6	1.3	.6	1	2
	VIBEDU	1	.1	3.0	.0	3	3
930	ALNCRIS	1	3.0	14.0	.0	14	14
	MENFER	1	60.0	4.0	.0	4	4
	OPLHOR	2	20.0	2.8	.4	3	3
	RIBES	1	.5	1.0	.0	1	1
	RIBHUD	1	1.0	2.0	.0	2	2
	SALIX	1	.1	2.5	.0	3	3
	SAMRAC	1	.1	2.5	.0	3	3
	SORSIT	2	.8	10.0	7.1	5	15
	VACCIN	2	1.8	1.8	1.1	1	3
993	ALNCRIS	1	40.0	5.0	.0	5	5
	RIBHUD	1	.1	.5	.0	1	1
	SALALA	1	10.0	5.0	.0	5	5
	SALSIT	1	15.0	4.0	.0	4	4
994	ALNCRIS	1	2.0	5.0	.0	5	5
	LUEPEC		2.0				
	MENFER	1	2.0	2.0	.0	2	2
	OPLHOR	1	.1	2.0	.0	2	2
	SALIX	1	6.0	3.0	.0	3	3
	VACCIN	1	.5	.5	.0	1	1
995	CASMER		95.0				
	CASSTE		7.8				
	EMPNIG		17.7				
	LOIPRO		.5				
	LUEPEC		17.3				
	MENFER	1	7.0	.5	.0	1	1
	PHYGLA		15.0				
	SALARC		4.0				
	SALBAR	1	3.0	1.0	.0	1	1
	SALRET		2.0				
995	SALROT		.5				
	SPIBEA	1	4.0	1.0	.0	1	1
	VACCIN	2	1.1	1.5	1.4	1	3
	VACULI		10.0				
	VACVIT		.1				
996	CASMER		1.0				
	CASSTE		9.0				
	EMPNIG		13.4				
	LUEPEC		.5				
	MENFER	1	8.0	3.0	.0	3	3
	PHYGLA		22.5				
	VACCIN	2	1.5	2.0	1.4	1	3
	VACULI		.5				
	VACVIT		1.0				

Table 9. Shrub Heights by PA/PC, Cont'd.

PA/ PC	Species	N	Cover (%)	Height (feet) Mean	SD	Min	Max
997	ALNCRIS	2	7.0	3.0	.0	3	3
	EMPNIG		5.3				
	MENFER	1	3.0	2.0	.0	2	2
	RIBHUD	1	.1	.5	.0	1	1
	SALALA	1	15.0	4.0	.0	4	4
	SALARC		6.0				
	SALBAR	1	3.0	1.5	.0	2	2
	SALRET		1.0				
	SALSIT	1	8.0	2.5	.0	3	3
	SPIBEA	1	9.0	1.0	.0	1	1
	VACCIN	1	2.0	1.5	.0	2	2
998	ALNCRIS	2	27.8	9.0	1.4	8	10
	MENFER	2	15.0	3.8	1.1	3	5
	OPLHOR	2	5.0	2.5	2.1	1	4
	RIBHUD	3	4.3	1.3	.3	1	2
	RUBSPE	1	3.0	1.5	.0	2	2
	SALBAR	2	22.5	15.0	.0	15	15
	SAMRAC	2	.5	3.0	1.4	2	4
	SORSIT	1	10.5	8.0	.0	8	8
	SPIBEA	2	1.5	2.0	.0	2	2
	VACCIN	2	4.5	2.8	.4	3	3
	VIBEDU	1	10.0	5.0	.0	5	5

Table 10. General Environmental Data by Plot

Plot No.	Card	General Location	Landform*	Slope (%)	Elev. (ft.)	Aspect (o)	PA/PC Forest#		Drainage** Sere##	
5056	A	WEST CREEK-TAIYA CONFLUENCE	35	45	200	180	100	B	4	W
5056	B	WEST CREEK-TAIYA CONFLUENCE	35	45	200	180	100	B	4	W
5057	A	N OF WEST CREEK, TAIYA CONFLUENCE	36	120	170	100	100	S	3	W
5057	B	N OF WEST CREEK, TAIYA CONFLUENCE	36	120	170	100	100	S	3	W
5058	A	N OF WEST CRK TAIYA CONFLUENCE	53	1	100	180	800	P	5	SP
5059	A	CANYON CITY	36	50	360	280	110	H	3	W
5059	B	CANYON CITY	36	50	360	280	110	H	3	W
5060	A	CANYON CITY	53	1	330	110	800	S	5	W
5061	A	N OF SHEEP CAMP	36	20	1440	270	998		2	W
5062	A	N OF SHEEP CAMP	36	75	1560	280	115	H	5	W
5063	A	N OF SHEEP CAMP	35	55	1440	280	115	B	4	W
5064	B	.5 MI SW SHEEP CAMP	36	60	1400	120	115	B	4	W
5064	A	.5 MI SW SHEEP CAMP	36	60	1400	120	115	B	4	W
5065	A	.5 MI SW SHEEP CAMP	36	35	1000	100	115	BH	3	W
5066	A	.5 MI SW SHEEP CAMP	51	15	950	140	110	H	4	W
5067	A	HISTORIC CANYON CITY	36	30	450	186	110	H	3	W
5068	A	S FACING SS N OF OLD CANYON CITY	36	30	650	186	115	H	4	W
5069	A	GLACIER STOP ON TRAIN	21	60		210	998		2	W
5070	A	HENEY ON RR	32	45	1800	22	915	FS	4	W
5071	A	HENEY ON RR	32	45	1800	22	915	F	5	W
5072	A	100YDS NW OF HENEY SIGN	32	47		6	930	F	5	W
5254	A	DYEA ESTUARY BOTTOM BEACH FRINGE	72	1	8	172	991		1	W
5256	A	DYEA ESTUARY 1ST CT BACK FRM BEACH	71		20		992		1	W
5257	A	DYEA UPPER ESTUARY	75		25		992		1	W
5258	A	DYEA-JACOBI HOMESTEAD AREA	53	1	80	140	800	P	4	W
5259	A	PLEASANT CAMP W. SIDE R.	36	9	900	184	515	H	6	W
5260	A	X RIVER FROM PLEASANT CAMP TO N	36	33	880	210	110	H	3	W
5261	A	TAIYA BAR N OF PLEASANT CAMP	53		850		993		2	P
5262	A	N OF SHEEP CAMP ON BENCH	36	14	1180	260	998		2	W
5263	A	N OF SHEEP CAMP	36	17	1360	216	515	H	6	W
5264	A	LONG HILL E SIDE LOWER	36	60	1580	300	997		2	W
5266	A	LONG MILE X CRK, KRUMMHOLZ	36	30	1800	210	996	H	5	W
5267	A	W SIDE N OF LONG HILL AREA	36	20	1660	300	995		2	W
5268	A	WHITE PASS	12	3	2840	216	994		1	W
5273	A	LAUGHTON GLACIER	35	60	2080	20	915	F	6	W
5274	A	LAUGHTON GL. CABIN TRAIL	52	7	1880	40	930	F	5	W
5500	A	3 MI N OF DYEA CAMPGROUND	53	1	100	279	800	P	4	W
5501	A	3MI N OF DYEA CAMPGROUND	36	45	290	275	110	HS	4	W
5502	A	2.5MI N OF DYEA CAMPGROUND	36	43	160	290	110	H	6	W
5503	A	FINNEGANS AREA ALLUVIAL FAN	52	22	160	250	330	HS	4	W
5504	A	S OF SHEEP CAMP NEAR POND	52	30	800	320	115	H	6	MW
5505	A	.75MI S OF SHEEP CAMP	36	80	1100	295	115	H	6	W
5506	A	.75MI S OF SHEEP CAMP	53		880		115	H	3	W
5507	A	CHILKOOT PASS	12	10	3610	70	995			VP
5508	A	.4MI SW OF THE SCALES	32	30	2145	320	997		2	E
5509	A	CHILKOOT TRAIL S OF SHEEP CAMP	32	40	1150	292	110	H	4	
5510	A	HENEY SITE	32	32	1411	290	915	F	5	W

*See terrestrial ecological unit descriptions.
**E = excessively well drained, W = well drained, MW = moderately well drained, SP = somewhat poorly drained, P = poorly drained, VP = very poorly drained.
#H = western or mountain hemlock, B = paper birch, P = black cottonwood, S = Sitka spruce, F = subalpine fir.
##1 = early successional, 2 = shrub-seeding, 3 = sapling-pole young forest, 4 = young saw timber, 5 = mature, 6 = old growth.

APPPENDIX 2: SOILS DATA SUMMARIES

All depths are given in centimeters; the conversion to inches is 1 cm = 0.39 inch.

Table 1. Soil Classification by Plot Number

Plot No.	Particle Size*	Mineralogy Class	Reaction Class	Depth Class	Consistence Class	Subgroup	Great Group
5056A	64	mixed				Entic	Haplocryods
5056B			euic	micro		Lithic	Cryofolists
5057A	3	mixed				Lithic	Haplocryods
5057B			euic	micro		Lithic	Cryofolists
5058	2	mixed				Aquic	Cryofluvents
5059A	3	mixed				Lithic	Cryorthents
5059B	7	mixed				Typic	Haplocryods
5060	2	mixed				Typic	Cryorthents
5061		mixed				Dystric	Cryochrepts
5062	7	mixed				Typic	Cryumbrepts
5063	2	mixed				Typic	Cryorthents
5064A	3	mixed				Lithic	Cryochrepts
5064B	2	mixed				Lithic	Cryorthents
5065			dysic	shallow		Lithic	Cryofolists
5066	6	mixed				Lithic	Cryorthents
5067	5	mixed				Lithic	Cryorthents
5068	5	mixed				Lithic	Cryorthents
5069	3	mixed				Typic	Haplocryods
5070	6	mixed			ortstein	Lithic	Humicryods
5071	3	mixed				Typic	Humicryods
5072	3	mixed			ortstein	Typic	Humicryods
5254	5	mixed				Oxyaquic	Cryorthents
5256	2	mixed				Typic	Cryofluvents
5257	5	mixed				Typic	Cryofluvents
5258	5	mixed				Aquic	Cryofluvents
5259	7	mixed				Typic	Humicryods
5260	3	mixed				Lithic	Humicryods
5261	2	mixed				Aquic	Cryofluvents
5262	3	mixed				Lithic	Haplocryods
5263	5	mixed				Lithic	Cryochrepts
5264	2	mixed				Typic	Cryorthents
5266	2	mixed				Lithic	Cryorthents
5267	2	mixed				Typic	Humicryods
5268	2	mixed				Lithic	Cryorthents
5273	5	mixed				Typic	Humicryods
5274	2	mixed				Typic	Cryorthents
5500	5	mixed				Typic	Cryofluvents
5501	7	mixed				Lithic	Cryumbrepts
5502	2	mixed				Lithic	Haplocryods
5503	3	mixed				Typic	Haplocryods
5504	2	mixed				Dystric	Cryochrepts
5505			dysic	shallow		Lithic	Cryofolists
5506	2	mixed				Typic	Haplocryods
5507	3	mixed				Lithic	Cryumbrepts
5508	2	mixed				Typic	Cryorthents
5509	3	mixed				Typic	Haplocryods
5510	2	mixed				Typic	Haplocryods

*2 = sandy-skeletal; 3 = loamy-skeletal; 5 = sandy; 6 = loamy; 7 = coarse-loamy; 64 = loamy-skeletal over fragmental.

Table 2. Soil Horizon Data by Plot Number

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5056	A	Oi	5	0		BYX	PEAT		
	A	A	0	8		BYX	FSL		
	A	E	8	16		BYX	SL		
	A	Bs1	16	40		BYX	SL		
	A	Bs2	40	60		BYX	SL		
	A	C	60	+					
	B	Oi	0	6			PEAT		
	B	A	6	6			SL		
	B	R	6	+			UWB		
5057	A	Oi	6	3			PEAT		
	A	Oe	3	0			MPT		
	A	A	0	5		CBV	FSL		
	A	E	5	10		CBV	FSL		
	A	Bs	10	32		CBX	SL		
	A	R	32				UWB		
	B	Oi	0	5			PEAT		
	B	Oa	5	10			MUCK		
	B	A	10	14		GR	FSL		
	B	R	14				UWB		
5058	A	Oe1	12	8			MPT		
	A	Oe2	8	0			MPT		
	A	C1	0	12			VFSL		
	A	C2	12	28			VFSL		
	A	C3	28	50			COS		
	A	C4	50	100+		GRX	COS		
5059	A	Oi	20	14			PEAT		
	A	Oe1	14	10			MPT		
	A	Oe2	10	0			MPT		
	A	A1	0	2			SL		
	A	A2	2	16		CBV	SL		
	A	C	16	28		CBV	SL		
	A	R	28				UWB		
	B	Oi	7	4			PEAT		
	B	Oe	4	0			MPT		
	B	A	0	6		GR	SL		
	B	E	6	13		GR	SL		
	B	B	13	23		GR	SL		
	B	Bs	23	40		GR	SL		
	B	Bs	40	70		GR	COSL		
	B	R	70				UWB		
5060	A	Oi	15	11			PEAT		
	A	Oe	11	6			MPT		
	A	Oa	6	0			MUCK		
	A	A	0	4		STX	LS		
	A	C1	4	12		STX	COS		
	A	C2	12	30+		STX	COS		

Table 2. Soil Horizon Data by Plot Number, Continued

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5061	A	Oe1	29	20		BYX	MPT		
	A	Oe2	20	11		BYX	MPT		
	A	Oe3	11	0		BYX	MPT		
	A	A	0	6		BYX	SL		
	A	C	6	55		BYX	LS		
	A	R					UWB		
5062	A	Oi	27	18		BY	PEAT		
	A	Oe	18	10		CBV	MPT		
	A	Oa	10	0		CBX	MUCK		
	A	A	0	19		GRV	SL		
	A	C1	19	32		GR	SL		
	A	C2	32	60		GR	SL		
	A	R					UWB		
5063	A	Oi	10	5		BYX	PEAT		
	A	Oe	5	0		BYX	MPT		
	A	A	0	5		BYX	SL		
	A	C1	5	30		BYX	LS		
	A	C2	30	70		BYX	LS		
	A	R	70				UWB		
5064	A	Oi	14	8			PEAT		
	A	Oe	8	0			MPT		
	A	A	0	8		CBX	SL		
	A	BW1	8	24		CBX	SL		
	A	BW2	24	33		CBX	SL		
	A	R	33				UWB		
	B	Oi	12	6			PEAT		
	B	Oe	6	0			MPT		
	B	A	0	3		CBX	SL		
	B	C1	3	14		CBX	LCOS		
	B	C2	14	22		CBX	COS		
	B	R	22				UWB		
5065	A	Oi	0	4			PEAT		
	A	Oe	4	9			MPT		
	A	Oa	9	15			MUCK		
	A	C	15	20		GR	COS		
	A	R	20				UWB		
5066	A	Oi	5	3		BY	PEAT		
	A	Oe	3	0		BY	MPT		
	A	A1	0	7		BY	COSL		
	A	A2	7	12		BY	SL		
	A	R	12				UWB		
5067	A	Oi	6	5			PEAT		
	A	Oe	5	3			MPT		
	A	Oa	3	0			MUCK		
	A	A	0	3			S		
	A	C	3	8			S		
	A	R	8				UWB		

Table 2. Soil Horizon Data By Plot Number, Continued

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5068	A	Oi	5	3			PEAT		
	A	Oe	3	0			MPT		
	A	A	0	5			S		
	A	C1	5	11			S		
	A	C2	11	15		GRV	S		
	A	R	15				UWB		
5069	A	Oi	9	4		BYV	PEAT		
	A	Oe	4	0		BYV	MPT		
	A	A	0	13		CBX	SL		
	A	E	13	19		CBX	SL		
	A	Bs1	19	51		CBX	SL		
	A	Bs2	51	70		CBX	SL		
	A	Bs3	70	95		CBX	SL		
	A	C	95	105+		CBX	LS		
5070	A	Oi	27	24			PEAT		
	A	Oe	24	20			MPT		
	A	Oa1	20	8			MUCK		
	A	Oa2	8	0			MUCK		
	A	E	0	8		GR	FSL		
	A	Bh	8	17		GR	SL		
	A	Bhsm	17	20		GR	COSL		
	A	R	20				UWB		
5071	A	Oi	12	6			PEAT		
	A	Oa	6	0		GR	MUCK		
	A	A	0	13		CBX	L		
	A	E	13	28		CBX	SL		
	A	Bh	28	45		CBX	COSL		
	A	Bs	45	55		CBX	COSL		
	A	R	55				UWB		
5072	A	Oi	12	8			PEAT		
	A	Oa	8	0			MUCK		
	A	E	0	5		STX	COSL		
	A	Bh	5	12		STX	VFSL		
	A	E'B'h	12	30	SR	STX	COSL	STX	VFSL
	A	E''B''h	30	50	SR	STX	COSL	STX	VFSL
	A	Bhs	50	68		STX	SL		
	A	Bhsm	68	74		STX	COSL		
	A	R	74				UWB		
5254	A	A	0	10			LCOS		
	A	C1	10	20		GR	COS		
	A	C2	20	38			SL		
	A	C3	38	51			S		
	A	C4	51	90			FS		
	A	C5	90	110+			COS		
5256	A	A1	0	9			VFSL		
	A	A2	9	14			SL		
	A	B	14	24			LS		
	A	C1	21	47		GR	COS		
	A	C2	47	59			S		
	A	2C	59	100+		GRX	COS		

Table 2. Soil Horizon Data by Plot Number, Continued

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5257	A	A	0	7			SL		
	A	C1	7	22		GR	LS		
	A	C2	22	33		GRV	COS		
	A	C3	33	57			S		
	A	C4	57	62		GRX	COS		
	A	C5	62	79			COS		
	A	C6	79	105+		GRX	COS		
5258	A	Oa	7	0			MUCK		
	A	C1	0	9		GR	VCOS		
	A	C2	9	18			COS		
	A	C3	18	27			LS		
	A	Oab	27	34			MUCK		
	A	C1b	34	38			FS		
	A	C2b	38	93+		GRV	COS		
5259	A	Oe	20	9			MPT		
	A	Oa	9	0			MUCK		
	A	Bh	0	32		STX	L		
	A	Bs	32	53		CB	FSL		
	A	C	53	62			FSL		
	A	R	62	+			UWB		
5260	A	Oe	22	11			MPT		
	A	Oa	11	0			MUCK		
	A	A	0	3			L		
	A	E	3	18		CB	SL		
	A	Bh	18	32		CBV	SL		
	A	Bs	32	36			S		
	A	R	36	+			UWB		
5261	A	C	0	8			FS		
	A	2C	8	40+		GRV	COS		
5262	A	Oe	6	2			MPT		
	A	Oa	2	0			MUCK		
	A	E	0	2		CBV	FSL		
	A	Bhs	2	7		CBV	COSL		
	A	Bs	7	13		CBV	COSL		
	A	C	13	40		CBX	FSL		
	A	R	40	+			UWB		
5263	A	Oi	25	18			PEAT		
	A	Oe	18	9			MPT		
	A	Oa	9	0			MUCK		
	A	A	0	2			L		
	A	C	2	22		GR	COS		
	A	R	22	+			UWB		
5264	A	C1	0	11		STX	COSL		
	A	C2	11	28		GRX	LCOS		
	A	C3	28	57		GRX	LCOS		
	A	C4	57	90+		GRV	LCOS		

Table 2. Soil Horizon Data by Plot Number, Continued

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5266	A	Oi	4	2			PEAT		
	A	Oa	2	0			MUCK		
	A	C	0	4		GRV	LCOS		
	A	R	4				UWB		
5267	A	Oa	11	0			MUCK		
	A	E	0	2			FSL		
	A	Bh	2	16		STV	COSL		
	A	Bhs	16	30		CBX	LCOS		
	A	Bs2	30	60		CBX	LCOS		
	A	R	60				UWB		
5268	A	Oa	12	0			MUCK		
	A	A	0	3		CBX	LCOS		
	A	C	3	10		CBX	LCOS		
	A	R	18	+			UWB		
5273	A	Oi	34	28			PEAT		
	A	Oe	28	21			MPT		
	A	Oa	21	0			MUCK		
	A	E	0	4		GR	LCOS		
	A	Bh	4	16		CB	LS		
	A	Bhs	16	40		CB	LS		
5274	A	Oi	9	4			PEAT		
	A	Oe	4	0			MPT		
	A	C1	0	11		GR	COS		
	A	C2	11	20		GR	COS		
	A	2C	20	39+		STX	COS		
5500	A	Oi	1	0			PEAT		
	A	A1	0	5			SL		
	A	A2	5	9			COS		
	A	C1	9	22			COS		
	A	C2	22	36	SR		COS		SL
	A	C3	36	44			COS		
	A	C4	44	56			LS		
	A	Ab	56	57			L		
	A	C1b	57	68			S		
	A	C2b	68	89+		GRX	COS		
	A	C3b	89	100+		GRX	COS		
5501	A	Oi	14	12			PEAT		
	A	Oe	12	0			MPT		
	A	A1	0	9			L		
	A	A2	9	16			SL		
	A	C	16	23			SL		
	A	R	23	+			UWB		
5502	A	Oi	7	4			PEAT		
	A	Oe	4	0			MPT		
	A	A	0	7		CB	L		
	A	E	7	9		STX	LS		
	A	Bs1	9	20		STX	LCOS		
	A	Bs2	20	31		STX	LCOS		
	A	R	31	+			UWB		

Table 2. Soil Horizon Data by Plot Number, Continued

Plot No.	Card	Horizon Name	Upper Limit (cm)	Lower Limit (cm)*	Strat. Horiz. **	Texture Modifier #	Texture ##	Second Texture Modifier	Second Texture
5503	A	Oi	3	2					
	A	Oe	2	0			MPT		
	A	A	0	5			L		
	A	E	5	6			SL		
	A	Bs1	6	16		STX	SL		
	A	Bs2	16	28		STX	SL		
	A	C1	28	51		CBX	SL		
	A	C2	51	90		CBX	SL		
5504	A	Oi	26	23			PEAT		
	A	Oe	23	18			MPT		
	A	O'i	18	5			PEAT		
	A	Oa	5	0			MUCK		
	A	A	0	5			L		
	A	C1	5	52		STX	COS		
	A	C2	52	85		STX	LCOS		
5505	A	Oi	0	14			PEAT		
	A	Oe	14	20			MPT		
	A	Oa	20	25			MUCK		
	A	C	25	+					
5506	A	Oi	5	3			PEAT		
	A	Oe	3	0			MPT		
	A	A	0	3			L		
	A	E1	3	6			LS		
	A	E2	6	9			SL		
	A	Bs1	9	18			LS		
	A	Bs2	18	32			LS		
	A	C1	32	55		CBX	S		
	A	C2	55	80+		GRX	COS		
5507	A	Oi	1	0			PEAT		
	A	A1	0	6			SL		
	A	A2	6	24		CBX	SL		
	A	C	24	33		STX	COSL		
	A	R	33	+			UWB		
5508	A	C	0	10		STX	COS		
	A	C2	10	50+		STX	COS		
	A	R					UWB		
5509	A	A	0	9			L		
	A	Bhs	9	22			L		
	A	C	22	46			COSL		
	A	Bs	46	52			COSL		
	A	B	52	80			COSL		

Table 3. Soil Parent Material, Bedrock, Impermeable Layer, and Flooding Data by Plot Number, Continued

Plot No.	Card	Parent Material* 1	2	3	Bedrock Type** 1	2	Imperm. Layer Depth (cm)	Type#	Flooding## Freq.	Duration	Months
5268	A	OG	R	G	G	GR	18	B	N		
5273	A	OF	S	G	G	GR			N		
5274	A	AL	S	G	G	GR			N		
5500	A	AL							R	VB	5-10
5501	A	OF	R	G	G	GR	23	B	N		
5502	A	OF	R	G	G	GR	31	B	N		
5503	A	AL							N		
5504	A	OF	S						N		
5505	A	OS	OM	S	G	GR	25	B	N		
5506	A	OF	AL						R	VB	5-10
5507	A	OG	R	G	G	GR	33	B	C	VB	7-9
5508	A	S							N		
5509	A	AL							N		
5510	A	OF	S						N		

*OF = forest litter, OG = graminoid peat, OM = moss, OS = sphagnum peat, OX = shrub/forb litter, AL = alluvium, B = beach gravel and sand, G = granite bedrock, R = residuum, S = colluvium.
**Type 1: G = granitic; Type 2: DI = diorite, GD = granodiorite, GR = granite.
#Impermeable Layer Type: B = bedrock
##Flooding Frequency: C = common (groups occasional and frequent classes), F = frequent (>50% chance/year), N = none, O = occasional (5-50% chance/year), R = rare (0-5% chance/year); Duration: B = brief (2-7 days), VB = very brief (<2 days), VL = very long (>1 month); Months: months of year when flooding most likely to occur.

APPPENDIX 3: HYDROLOGY DATA SUMMARIES

Most data are given in metric units; conversion factors to English units are as followe: 1 m = 3.28 ft.; 1 m^2 = 10.76 ft^2; 1 m^3 = 1.31 yd^3.

A3.1 Skagway River, Channel Cross-Section, Site: 0011

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE SKGO4WP.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930801

CHANNEL SLOPE RANGE: 0.0500 to 0.0500

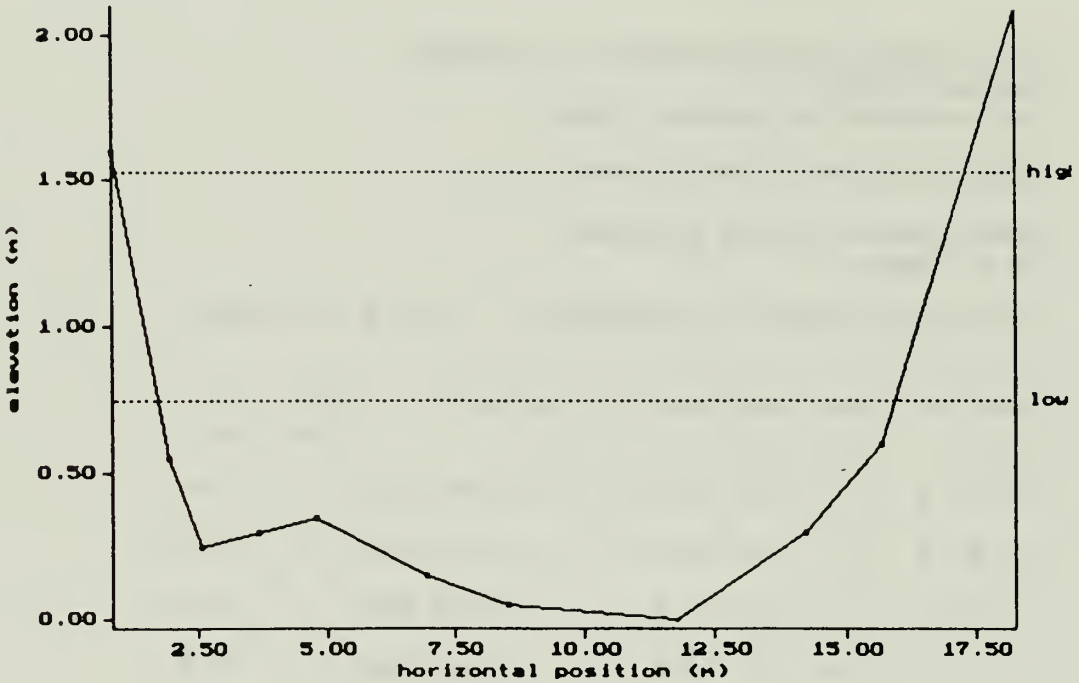
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 3.000 (ft)

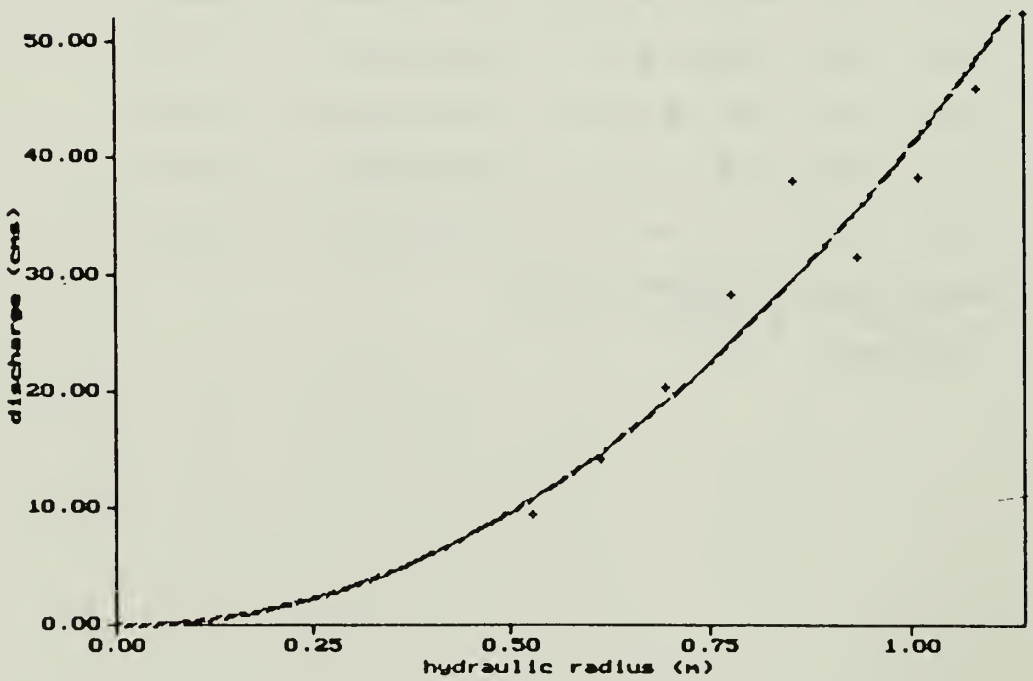
cross-section treated as one sectionSKAGWAY R., 2.5 MI. SE. OF WHITE PASS.

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.75	1	7.6	14.5	14.2	0.5	0.5	0.0500	0.118	4.1	9.52
0.85	1	9.1	14.8	14.5	0.6	0.6	0.0500	0.103	5.2	14.27
0.95	1	10.5	15.2	14.8	0.7	0.7	0.0500	0.091	6.4	20.45
1.05	1	12.0	15.5	15.0	0.8	0.8	0.0500	0.081	7.7	28.29
1.15	1	13.6	15.8	15.3	0.9	0.9	0.0500	0.072	9.2	38.02
1.25	1	15.1	16.2	15.6	0.9	1.0	0.0500	0.102	6.9	31.56
1.35	1	16.7	16.5	15.9	1.0	1.1	0.0500	0.098	7.6	38.47
1.45	1	18.3	16.9	16.1	1.1	1.1	0.0500	0.094	8.3	46.01
1.53	1	19.6	17.1	16.4	1.1	1.2	0.0500	0.091	8.8	52.49

DISCHARGE-TO-RADIUS RELATIONSHIP: Q = aR^b
a = 41.154, b = 2.089
r^2 = 0.9484, n = 9

A3.2 Skagway River, Channel Cross-Section, Site: 0011





$Q = 41.154 \quad R^{2.089}$

$r^2 = 0.9484, \quad n = 9$

A3.3 Lower Taiya River Tributary, Channel Cross-Section, Site: 0128

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE TTRPA3.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930728

CHANNEL SLOPE RANGE: 0.0025 to 0.0025

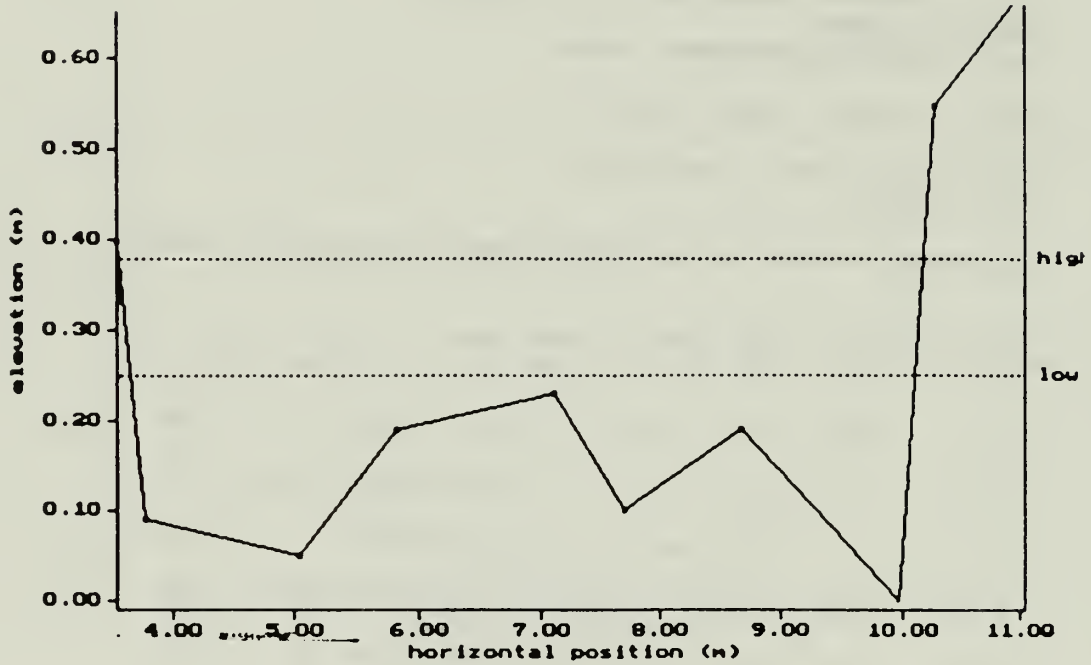
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 0.070 (ft)

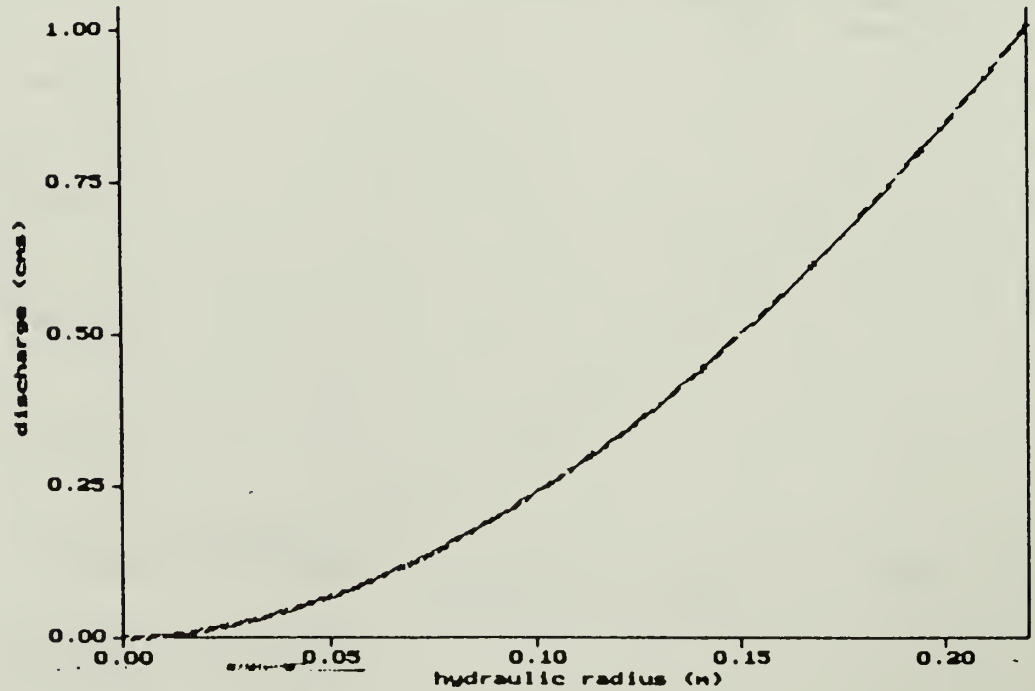
cross-section treated as one sectionSANDY-BOTTOMED PA3 E BANK DNSTR OF NOURSE JCT

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.25	1	0.8	6.7	6.4	0.1	0.1	0.0025	0.030	1.3	0.30
0.28	1	1.0	6.8	6.5	0.1	0.1	0.0025	0.029	1.5	0.45
0.31	1	1.1	6.9	6.5	0.2	0.2	0.0025	0.029	1.7	0.61
0.34	1	1.3	6.9	6.6	0.2	0.2	0.0025	0.028	2.0	0.80
0.37	1	1.5	7.0	6.6	0.2	0.2	0.0025	0.028	2.1	1.01

DISCHARGE-TO-RADIUS RELATIONSHIP: Q = aR^b
a = 15.905, b = 1.822
r^2 = 1.0000, n = 5

A3.4 Lower Taiya River Tributary, Channel Cross-Section, Site: 0128





Q = 15.905 R 1.822

r^2 = 1.0000, n = 5

A3.5 Upper Taiya River, Channel Cross-Section, Site: 0129

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE TG04SHCP.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930729

CHANNEL SLOPE RANGE: 0.0400 to 0.0400

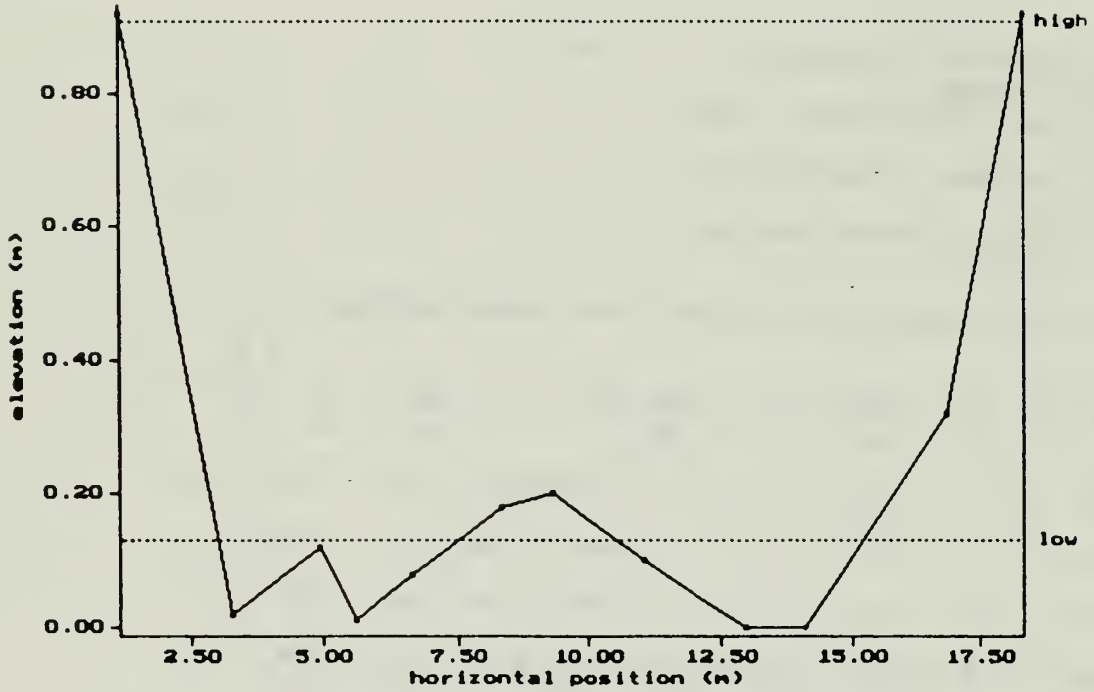
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 1.920 (ft)

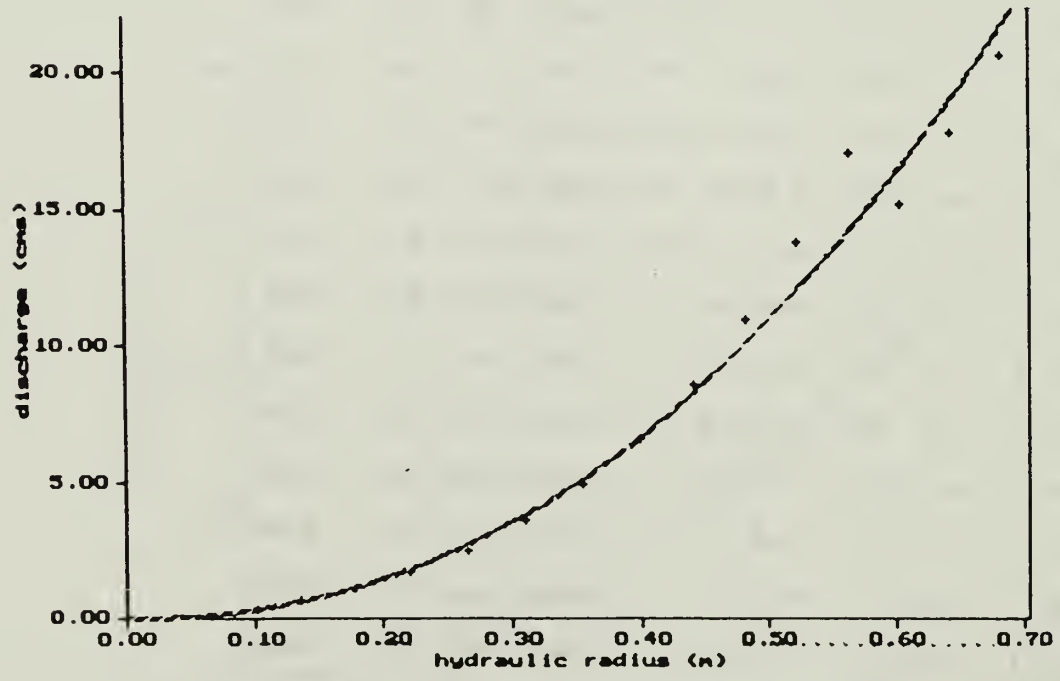
cross-section treated as one sectionTAIYA R. 1/4 MI. DNWSTR SHEEP CAMP

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.13	1	0.6	9.2	9.1	0.1	0.1	0.0400	0.143	0.8	0.15
0.18	1	1.2	11.5	11.4	0.1	0.1	0.0400	0.146	1.0	0.34
0.23	1	1.8	13.4	13.3	0.1	0.1	0.0400	0.146	1.2	0.65
0.28	1	2.5	13.9	13.8	0.2	0.2	0.0400	0.144	1.4	1.09
0.33	1	3.2	14.4	14.3	0.2	0.2	0.0400	0.137	1.8	1.70
0.38	1	3.9	14.7	14.6	0.3	0.3	0.0400	0.128	2.1	2.53
0.43	1	4.6	15.0	14.8	0.3	0.3	0.0400	0.118	2.6	3.61
0.48	1	5.4	15.2	15.0	0.4	0.4	0.0400	0.109	3.0	4.96
0.53	1	6.1	15.5	15.3	0.4	0.4	0.0400	0.101	3.5	6.61
0.58	1	6.9	15.7	15.5	0.4	0.4	0.0400	0.093	4.1	8.61
0.63	1	7.7	16.0	15.8	0.5	0.5	0.0400	0.086	4.7	11.00
0.68	1	8.5	16.3	16.0	0.5	0.5	0.0400	0.080	5.3	13.80
0.73	1	9.3	16.5	16.3	0.6	0.6	0.0400	0.075	6.0	17.05
0.78	1	10.1	16.8	16.5	0.6	0.6	0.0400	0.095	4.9	15.18
0.83	1	10.9	17.1	16.8	0.6	0.7	0.0400	0.092	5.3	17.80
0.88	1	11.8	17.3	17.0	0.7	0.7	0.0400	0.089	5.7	20.62
0.91	1	12.3	17.5	17.1	0.7	0.7	0.0400	0.087	6.0	22.40

DISCHARGE-TO-RADIUS RELATIONSHIP: Q = aR^b
a = 50.111, b = 2.188
r^2 = 0.9974, n = 17

A3.6 Upper Taiya River, Channel Cross-Section, Site: 0129





$Q = 50.111 \quad R^{2.188}$

$r^2 = 0.9974, \quad n = 17$

A3.7 Upper Taiya River Tributary, Channel Cross-Section, Site: 0130

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE SHCPMM1.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930730

CHANNEL SLOPE RANGE: 0.0200 to 0.0200

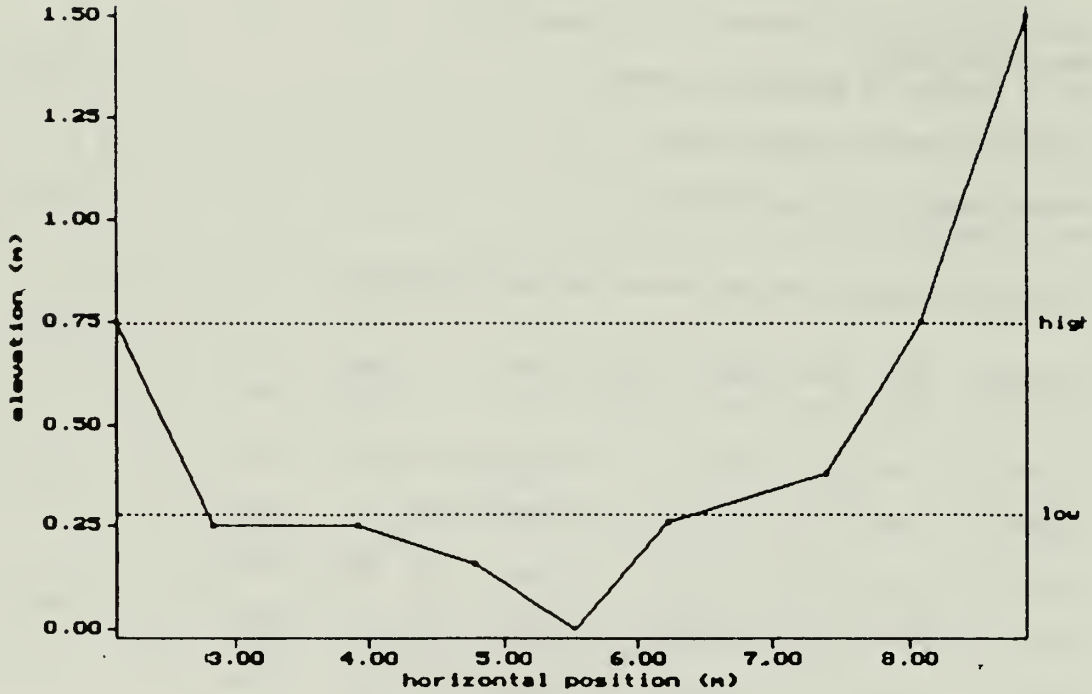
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 0.625 (ft)

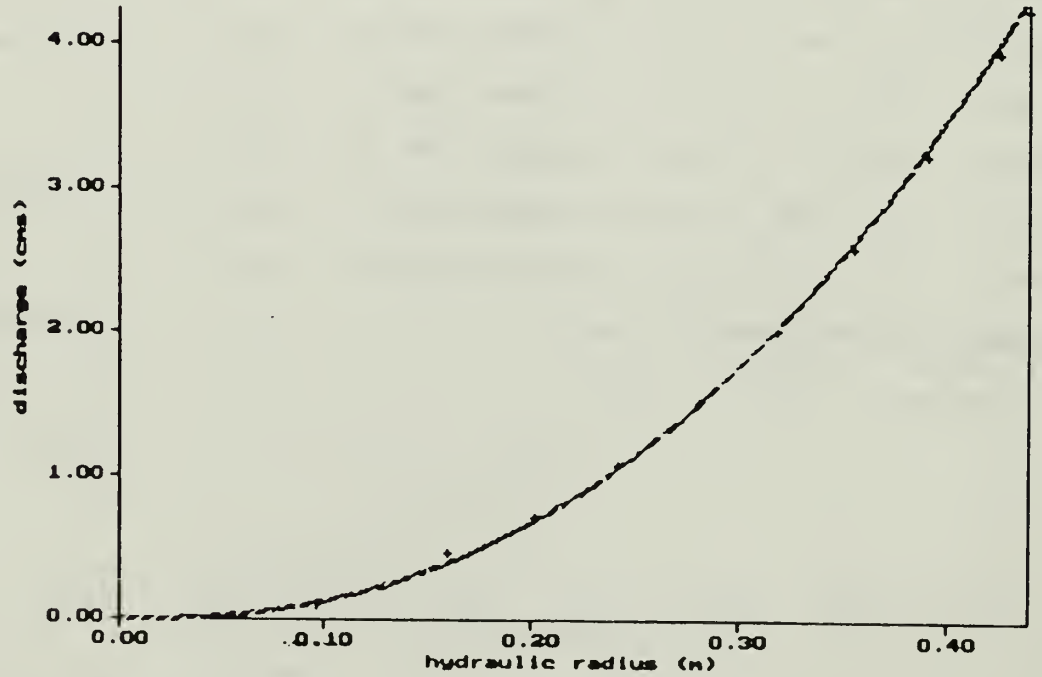
cross-section treated as one sectionSHEEP CAMP TRIB TO TAIYA MM1

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.28	1	0.4	3.7	3.6	0.1	0.1	0.0200	0.101	1.0	0.10
0.33	1	0.6	4.3	4.2	0.1	0.1	0.0200	0.082	1.4	0.24
0.38	1	0.8	4.9	4.8	0.2	0.2	0.0200	0.069	2.0	0.47
0.43	1	1.0	5.1	4.9	0.2	0.2	0.0200	0.069	2.3	0.71
0.48	1	1.3	5.3	5.1	0.2	0.2	0.0200	0.064	2.8	1.08
0.53	1	1.5	5.4	5.3	0.3	0.3	0.0200	0.061	3.3	1.52
0.58	1	1.8	5.6	5.4	0.3	0.3	0.0200	0.058	3.7	2.03
0.63	1	2.1	5.8	5.6	0.4	0.4	0.0200	0.056	4.1	2.60
0.68	1	2.4	6.0	5.7	0.4	0.4	0.0200	0.055	4.5	3.25
0.73	1	2.6	6.2	5.9	0.4	0.4	0.0200	0.054	4.9	3.96
0.75	1	2.8	6.3	6.0	0.4	0.5	0.0200	0.053	5.1	4.26

DISCHARGE-TO-RADIUS RELATIONSHIP: Q = aR^b
a = 30.624, b = 2.362
r^2 = 0.9968, n = 11

A3.8 Upper Taiya River Tributary, Channel Cross-Section, Site: 0130





$Q = 30.624 \quad R^{2.362}$

$r^2 = 0.9968, \quad n = 11$

A3.9 Lower Taiya River Tributary, Channel Cross-Section, Site: 0131

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE FINFAF8.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930731

CHANNEL SLOPE RANGE: 0.0600 to 0.0600

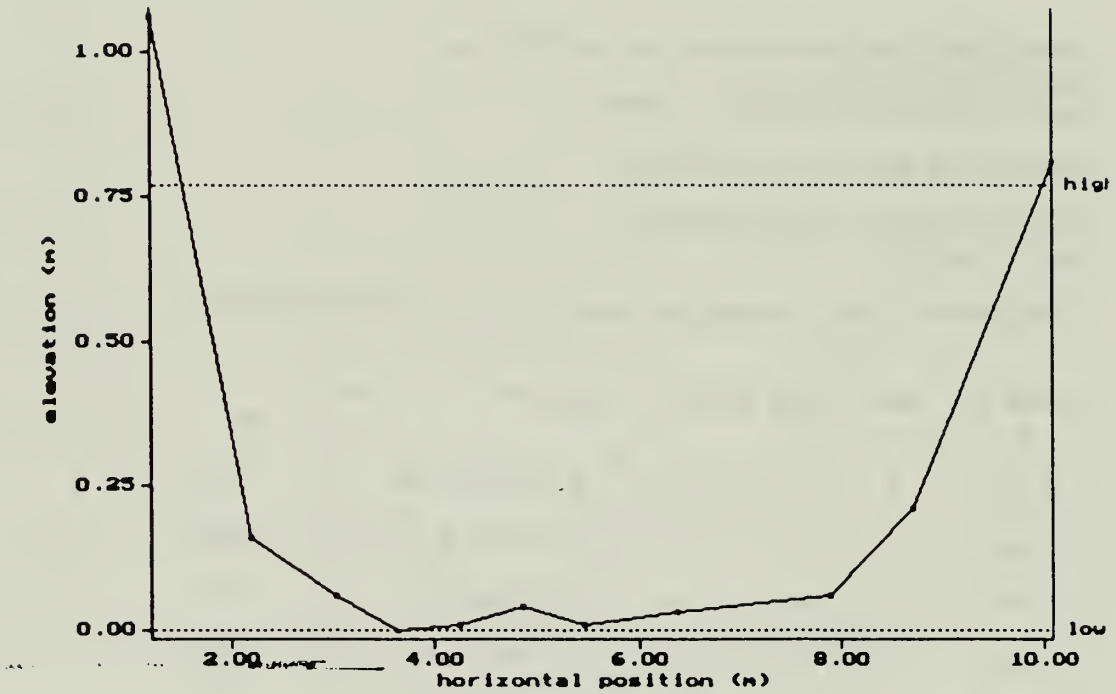
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 0.625 (ft)

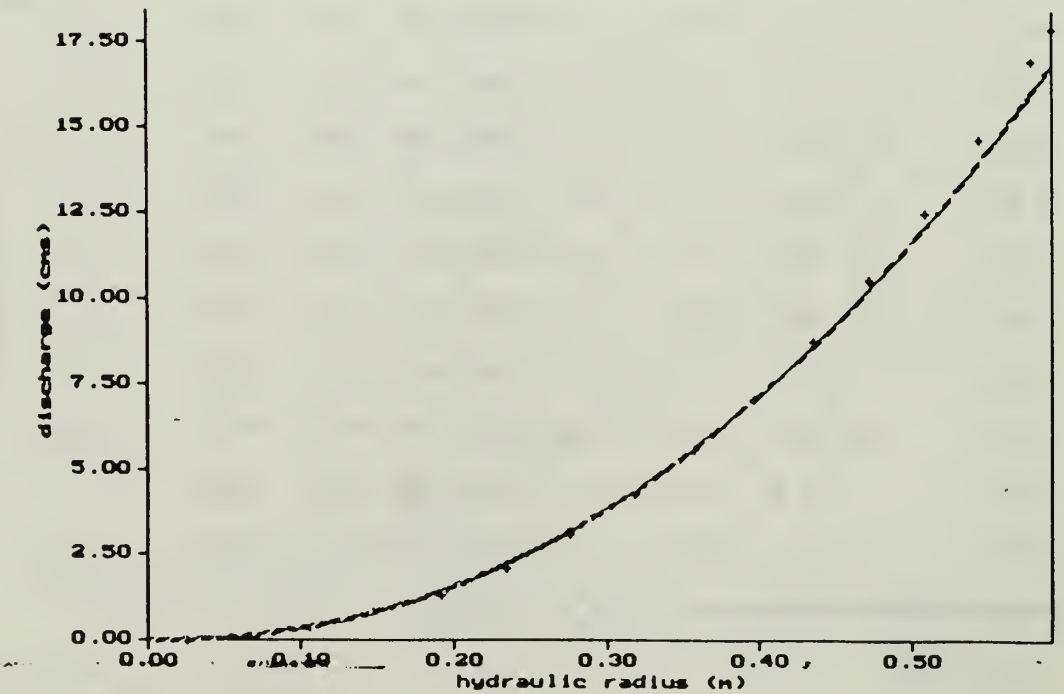
cross-section treated as one sectionFINNEGAN FAN AF8 THRU COTTONWOOD GROVE

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.05	1	0.1	4.2	4.2	0.0	0.0	0.0600	0.102	0.7	0.02
0.10	1	0.4	5.4	5.4	0.1	0.1	0.0600	0.113	1.2	0.13
0.15	1	0.6	6.1	6.1	0.1	0.1	0.0600	0.096	1.9	0.37
0.20	1	1.0	6.5	6.5	0.1	0.1	0.0600	0.079	2.8	0.83
0.25	1	1.3	6.8	6.7	0.2	0.2	0.0600	0.080	3.3	1.31
0.30	1	1.6	7.0	6.9	0.2	0.2	0.0600	0.072	4.3	2.12
0.35	1	2.0	7.2	7.0	0.3	0.3	0.0600	0.066	5.2	3.11
0.40	1	2.3	7.4	7.2	0.3	0.3	0.0600	0.062	6.0	4.27
0.45	1	2.7	7.6	7.4	0.4	0.4	0.0600	0.060	6.8	5.60
0.50	1	3.1	7.8	7.5	0.4	0.4	0.0600	0.057	7.6	7.09
0.55	1	3.5	8.0	7.7	0.4	0.4	0.0600	0.056	8.3	8.74
0.60	1	3.8	8.2	7.9	0.5	0.5	0.0600	0.054	9.0	10.55
0.65	1	4.2	8.4	8.1	0.5	0.5	0.0600	0.053	9.7	12.51
0.70	1	4.6	8.6	8.2	0.5	0.6	0.0600	0.052	10.3	14.64
0.75	1	5.1	8.8	8.4	0.6	0.6	0.0600	0.051	11.0	16.92
0.77	1	5.2	8.8	8.5	0.6	0.6	0.0600	0.051	11.2	17.87

DISCHARGE-TO-RADIUS RELATIONSHIP: Q = aR^b
a = 52.524, b = 2.167
r^2 = 0.9983, n = 16

A3.10 Lower Taiya River Tributary, Channel Cross-Section, Site: 0131





Q = 52.524 R 2.167

r^2 = 0.9983, n = 16

A3.11 Lower Taiya River, Channel Cross-Section, Site: 0327

STAGE-DISCHARGE DATA FOR CROSS-SECTION FILE LOWTG04.DAT
CROSS-SECTION NUMBER 1
DATE OF CROSS-SECTION MEASUREMENT: 930727

CHANNEL SLOPE RANGE: 0.0025 to 0.0025

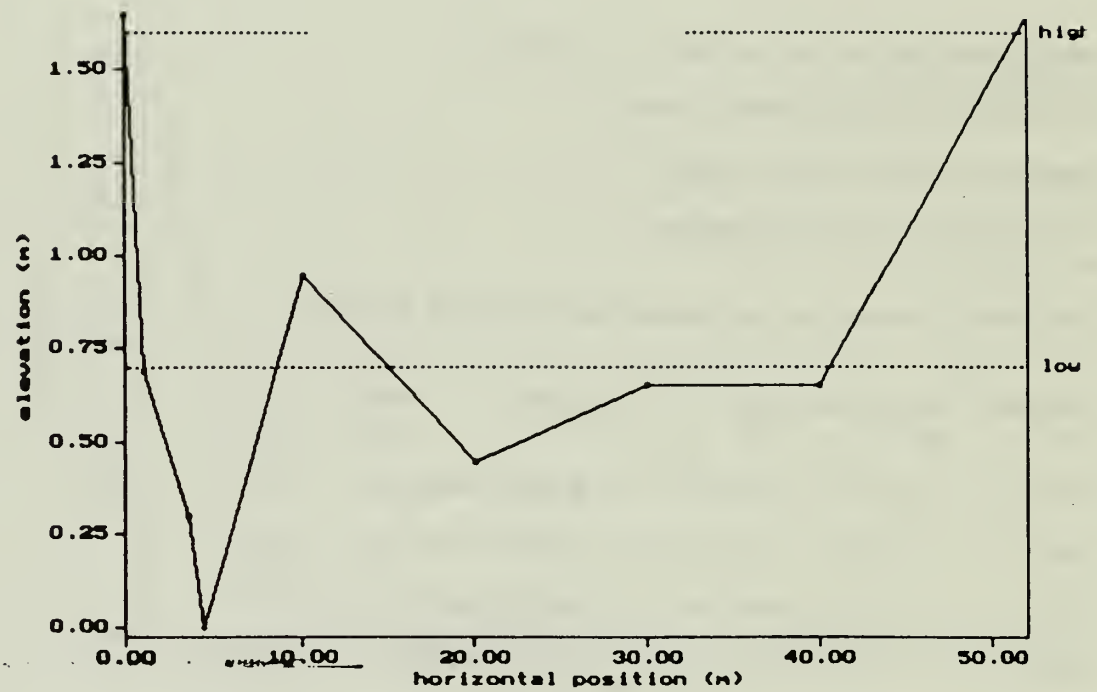
VELOCITY FORMULA: Thorne & Zevenbergen
D84 = 0.312 (ft)

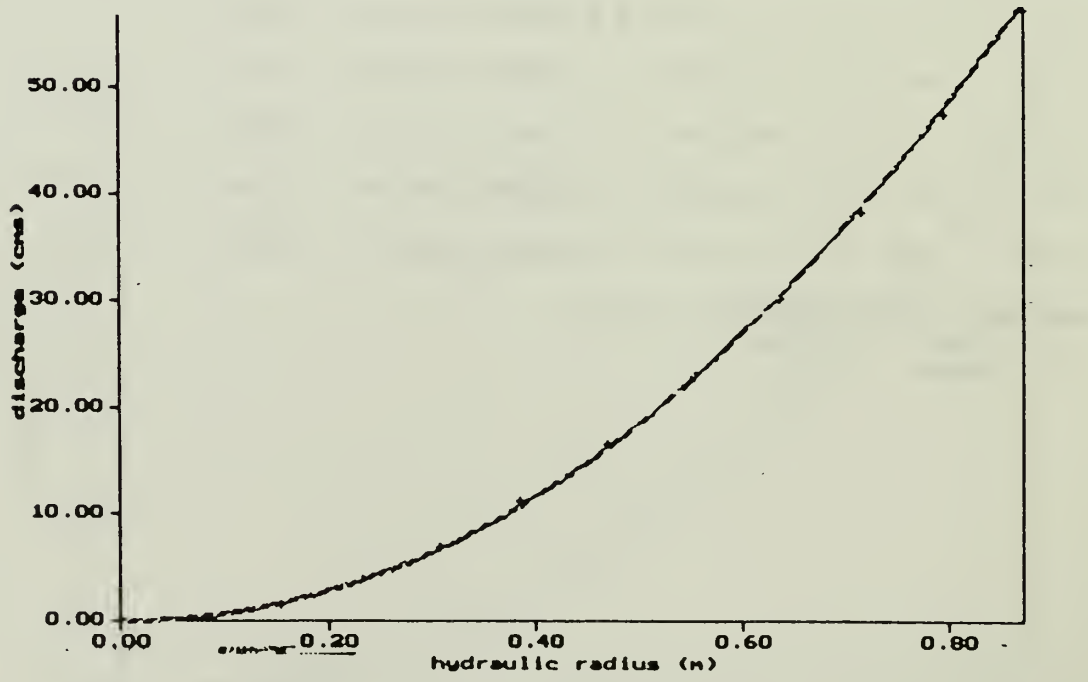
cross-section treated as one sectionLOWER TAIYA NEAR END OF NPS ROAD.

STAGE m	#SEC	AREA m^2	PERIM m	WIDTH m	R m	DAVG m	SLOPE	n	VAVG m/s	Q cms
0.70	1	5.1	33.3	33.1	0.2	0.2	0.0025	0.046	1.0	1.61
0.80	1	8.6	37.2	37.0	0.2	0.2	0.0025	0.042	1.5	3.84
0.90	1	12.5	41.2	40.9	0.3	0.3	0.0025	0.040	1.8	6.99
1.00	1	16.8	43.8	43.5	0.4	0.4	0.0025	0.039	2.2	11.27
1.10	1	21.2	45.2	44.8	0.5	0.5	0.0025	0.038	2.6	16.71
1.20	1	25.7	46.5	46.1	0.6	0.6	0.0025	0.038	2.9	23.07
1.30	1	30.4	47.9	47.4	0.6	0.6	0.0025	0.037	3.3	30.34
1.40	1	35.2	49.2	48.7	0.7	0.7	0.0025	0.037	3.6	38.48
1.50	1	40.1	50.6	50.0	0.8	0.8	0.0025	0.036	3.9	47.51
1.60	1	45.2	51.9	51.3	0.9	0.9	0.0025	0.036	4.2	57.39

DISCHARGE-TO-RADIUS RELATIONSHIP: $Q = aR^b$
$a = 77.342$, $b = 2.045$
$r^2 = 0.9996$, $n = 10$

A3.12 Lower Taiya River, Channel Cross-Section, Site: 0327





Q = 77.342 R 2.045

r^2 = 0.9996, n = 10

APPPENDIX 4: MACROINVERTEBRATE DATA

MACROINVERTEBRATE SUMMARY DATA FOR KLONDIKE GOLDRUSH NATIONAL PARK

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November 1993

CONTENTS

INTRODUCTION

This final report presents results of an analysis of macroinvertebrate samples conducted by the University of Alaska Anchorage's Environment and Natural Resources Institute (ENRI) for the U.S. Forest Service (USFS) under purchase order number 40-0114-3-0290 dated 8-23-93, ENRI W.O.#736. Samples were collected by USFS and provided to ENRI. The purpose of the project was to further USFS interests in assessing instream environmental qualities.

Macroinvertebrates are useful biological indicators of aquatic ecosystem health. They reflect the health of a system over a period of time rather than at one point in time as displayed by chemical analyses. The presence of certain groups of macroinvertebrates are used as indicators of water quality. The groups of particular significance are the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), (EPT). Unimpaired streams typically support a wide diversity of taxa. The EPT groups become reduced in number as water quality degradation increases. Chironomids commonly dominate samples as water quality degradation increases but are also found in pristine waters. Sample areas are generally selected according to substrate size and riffle areas to obtain metrics for the site based on the maximum number of macroinvertebrates that a site can support.

Samples were collected from Klondike Goldrush National Historical Park in July and August of 1993 by USFS personnel. The samples were sorted and identified to genera for the EPT taxa and to family for other taxa. Biotic metrics, including number of EPT genera present, EPT/total individuals ratio, percent dominant taxa, and Hilsenhoff's Family Biotic Index (FBI), were calculated for the data. A rapid bioassessment rating (RBA) for each site was calculated using the average values for these four metrics. It should be cautioned that the RBA rating was developed by Milner and Oswood (1990) to assess water quality in Anchorage streams and may not be applicable to this region. Table 1 provides the range

Table 1. Range of biotic metrics and their relationship to water quality.

Metric	Range	Water Quality
No. of EPT Genera	0 to ~14	Increasing
EPT/Total Individuals	0 to 1.0	Increasing
Average % Dominant Taxa	0 to 100	Decreasing
FBI	0 to 10	Decreasing

Table 2. Different tolerances of invertebrate families to changes in water quality on scale of 0 to 10 [0 = least tolerant, 10 = most tolerant] (Adapted from Hilsenoff 1988).

Scale	Plecoptera (Stoneflies)	Ephemeroptera (Mayflies)	Trichoptera (Caddisflies)	Diptera (True flies)
0	Leuctridae Pteronarcyidae		Glossosomatidae Rhyacophilidae	
1	Chloroperlidae Perlidae Capniidae	Ephemerellidae	Brachycentridae	
2	Nemouridae Perlodidae Taeniopterygidae			
3				Tipulidae
4		Baetidae	Limnephilidae	
5		Heptageniidae		
6				Chironomidae Simuliidae Empididae Ceratopogonidae
7				
8				Oligochaeta (not Diptera)
9				
10				Psychodidae

for the biotic metrics and their relationship to water quality. Table 2 exhibits the tolerance levels of different invertebrate families used in the calculation of the FBI of Hilsenoff (1988).

DISCUSSION

Three samples were collected for macroinvertebrate analysis at each of seven sites sampled in Klondike Goldrush National Park. Table 3 summarizes the biotic metrics calculated for each site. Samples SP1-7-27 and SP1-8-1 did not meet the minimum density of 300 organisms/m^2 considered necessary to determine biotic measures for evaluating water quality. These sites did support a wide variety of the EPT taxa and these taxa dominated the sample indicating these sites could support a diverse group of macroinvertebrates. Physical habitat data indicated site SP1-8-1 did contain some glacial silt.

All metrics at site SP2-7-27 suggested water quality impairment. There were few of the EPT genera represented at this site and the EPT/total individuals ratio was low. The percent dominant taxa was high mainly due to the presence of chironomids and FBI values were low. Depth and velocity measurements were all low. The substrate description was 50% sand and silt and 50% gravel, which may indicate the sample was collected in a pool area thereby explaining the high dominance of chironomids. Site SP3-7-27 displayed relatively high EPT/total ratios and percent dominant taxa. However, Ephemeroptera (a clean water group) was the dominant taxa. Low water depths were also present at this site but velocity measurements indicated a riffle area which typically supports the optimum numbers of macroinvertebrates.

Site SP1-7-29 supported a wide diversity of EPT genera. The EPT/total individuals ratio and other metrics indicate good water quality at this site.

Site SP1-7-30 is the most pristine of the sites examined based on the RBA rating. The site also supports the highest number of EPT genera found, a high EPT/total individuals ratio and low percent dominant taxa. The FBI rating was low and the RBA for this site was 4, which is the optimal rating for any site.

Table 3. Summary of average biotic measures.

Site	Date	No. of EPT Genera	EPT/Total Ratio	% Dominant Taxa	FBI	RBA
SP1-7-27*	7-27-93	7				
SP2-7-27	7-27-93	3	.08	91	5.7	1.5
SP3-7-27	7-27-93	6	.93	73	3.9	3.0
SP1-7-29	7-29-93	10	.55	44	4.4	3.3
SP1-7-30	7-30-93	12	.89	21	2.9	4.0
SP1-8-1*	8-1-93	7				
SP1-8-2	8-2-93	5	.24	76	5.4	1.8

* Sample did not meet minimum density requirements for evaluating water quality.

SP1-8-2 supported few EPT genera and displayed a low EPT/total ratio. These samples were taken from an area with low velocities and the physical habitat data indicated a turbid glacial river with a heavy sand and silt load. These biotic measures were not designed for turbid glacial rivers as these systems naturally support low numbers and diversity of EPT genera and selects for well adapted organisms such as chironomids.

REFERENCES

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family level biotic index. *Journal of the North American Benthological Society*, 7:65-68.

Milner, A.M., and M.W. Oswood. 1990. *Rapid bioassessment water quality monitoring results.* Institute of Arctic Biology, University of Alaska unpub. report to the Municipality of Anchorage.

Klondike Gold Rush Nat'l Hist. Park

MACROINVERTEBRATE SUMMARY DATA

SP-1-7-27 #012

SITE: _____ DATE 7-27-93

pH: _____ CONDUCTIVITY(umhos): _____ TEMPERATURE(°C): _____

COMMENTS: [illegible]

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% conf.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	10	4	7			7	78	
Ephemerellidae-Ephemerella (1)		1				.3	3	
-Drunella (1)								
Heptageniidae-Epeorus (4)		1				.3	3	
-Cinygmula (4)	5		3			3	33	
PLECOPTERA								
Nemouridae -Zapada (2)	2		4			2	22	
Chloroperlidae-Plumiperla (1)								
						.3	3	
Perlodidae-Isoperla (2)	1							
TRICHOPTERA						.3	3	
Rhyacophilidae-Rhyacophila (0)	1							
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)								
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperophylax (4)								
Hydropsychidae-Hydropsyche (4)								
DIPTERA						1.7	30	
-Chironomidae (6)	4	1	3					
[-pupae]								
-Empididae (6)								
-Simuliidae (6)								
-Tipulidae (3)								
OLIGOCHAETA (8)	5	7	3			5	11	
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	19	7	14			13.3	145	
TOTAL ORGANISMS	28	15	20				186	
EPT/TOTAL	.68	.47	.70			.62		
% DOMINANT TAXA	36	47	35			39		
FBI VALUE	4.6	5.8	4.5			4.9		

RBA RATING

TOTAL EPT GENERA 7 ____

AVERAGE FOR SITE:

EPT/TOTAL ____ ____

% DOMINANT TAXA ____ ____

FBI VALUE ____ ____

RBA for site: ____

MACROINVERTEBRATE SUMMARY DATA

SITE: Dyea AK DATE 7-27-93 #0227 SP2 7-27

pH: _____ CONDUCTIVITY(umhos): _____ TEMPERATURE(°C): _____

COMMENTS.

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% conf.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA		NONE						
Baetidae -Baetis (4)								
Ephemerellidae-Ephemerella (1)								
-Drunella (1)								
Heptageniidae-Ecdyonus (4)								
-Cinygmula (4)								
Leptohyphidae-Tricorythodes (2)	2		8			3.3	37	
PLECOPTERA								
Nemouridae -Zapada (2)								
Chloroperlidae-Plumiperla (1)								
Perlodidae-Isoperla (2)								
TRICHOPTERA								
Rhyacophilidae-Rhyacophila (0)								
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)								
-Onocosmoecus (4)			1			.3	3	
-Psychoglypha (4) Pycnopsyche			2			.7	7	
-Hesperophylax (4)								
Hydroptychidae-Hydroptyche (4)								
DIPTERA								
-Chironomidae (6)	34	53	50			46	507	
[-pupae]								
-Empididae (6)								
-Simuliidae (6)								
-Tipulidae (3)		1	1			.7	7	
OLIGOCHAETA (8)								
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	2	0	11				47	
TOTAL ORGANISMS	36	54	62				561	
EPT/TOTAL	.06	0	.18			.08		
% DOMINANT TAXA	94	98	81			91		
FBI VALUE	5.8	5.9	5.3			5.7		

		RBA RATING
TOTAL EPT GENERA	3	2
AVERAGE FOR SITE:		
EPT/TOTAL	.08	1
% DOMINANT TAXA	91	1
FBI VALUE	5.7	2

RBA for site: 1.5

Klondike Goldrush

MACROINVERTEBRATE SUMMARY DATA

SITE: Natl Hist. Park DATE: 7-22-93 SP3-7-27 GOS

pH: _____ CONDUCTIVITY(µmhos): _____ TEMPERATURE(°C): _____

COMMENTS: ... R1 like dense" sample - R1 R... #0327

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% con.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	3	2				1.7	19	
Ephemerellidae-Ephemerella (1)								
-Drunella (1)	—							
Heptageniidae-Epeorus (4)								
-Cinygmula (4)	24	36	46			35	407	
PLECOPTERA								
Nemouridae -Zapada (2)		3	1			1.3	15	
Chloroperlidae-Plumiperla (1)		7	1			2.7	30	
Perlodidae-Isoperla (2)			1			.3	3	
TRICHOPTERA								
Rhyacophilidae-Rhyacophila (0)								
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)	1	9	5			5	56	
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperophylax (4)								
Hydroptychidae-Hydroptyche (4)								
DIPTERA								
-Chironomidae (6)	4	1	3			2.7	30	
[-pupae]								
-Empididae (6)								
-Simuliidae (6)								
-Tipulidae (3)	1					.3	3	
OLIGOCHAETA (8)								
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	32	57	54			48	530	
TOTAL ORGANISMS	37	58	57				563	
EPT/TOTAL	.87	.98	.95			.93		
% DOMINANT TAXA	76	62	81			73		
FBI VALUE	4.2	3.6	3.9			3.9		

		RBA RATING
TOTAL EPT GENERA	6	3
AVERAGE FOR SITE:		
EPT/TOTAL	.93	4
% DOMINANT TAXA	73 - EPT Dom	2
FBI VALUE	3.9	3

RBA for site: 3

MACROINVERTEBRATE SUMMARY DATA

SITE: Natl Hist. Park DATE 7/29/93

pH: _____ CONDUCTIVITY(umhos): _____ TEMPERATURE(°C): _____

COMMENTS: Like samples labled R1 R2 R3. G04 / 0129 SPI-7-29

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% conf.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	12	18	8			13	144	
Ephemerellidae-Ephemerella (1)			1			.3	4	
-Drunella (1)	14	11				8	89	
Heptageniidae-Epeorus (4)	4	5	1			3	33	
-Cinygmula (4)	2		5			2.3	26	
PLECOPTERA								
Nemouridae -Zapada (2)	3	3	2			2.7	30	
Chloroperlidae-Plumiperla (1)	4	2				2	22	
Perlodidae-Isoperla (2)		1				.3	4	
TRICHOPTERA								
Rhyacophilidae-Rhyacophila (0)	1	1	1			1	11	
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)	1	10	15			8.7	96	
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperophylax (4)								
Hydroptychidae-Hydroptyche (4)		1				.3	4	
DIPTERA								
-Chironomidae (6)	62	28	21			37	411	
[-pupae]								
-Empididae (6)								
-Simuliidae (6)	1		1			1	11	
-Tipulidae (3)								
OLIGOCHAETA (8)								
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	41	52	33				463	
TOTAL ORGANISMS	104	80	55			80	889	
EPT/TOTAL	.39	.65	.60			.55		
% DOMINANT TAXA	60	35	38			44		
FBI VALUE	4.6	4.1	4.6			4.4		

		RBA RATING
TOTAL EPT GENERA	10	4
AVERAGE FOR SITE:		
EPT/TOTAL	.55	3
% DOMINANT TAXA	44	3
FBI VALUE	44	3

RBA for site: 3.3

MACROINVERTEBRATE SUMMARY DATA

SITE Natl Hist Park DATE 7-30-93 S. of Sheep Camp SP1-7-30

pH: _____ CONDUCTIVITY(µmhos): _____ TEMPERATURE(°C): _____

COMMENTS: Like Sample [illegible]

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% conf.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	11	9	7			9	100	
Ephemerellidae-Ephemerella (1)	1	2	1			1.3	15	
-Drunella (1)			3			1	11	
Heptageniidae-Epeorus (4)	3	5	3			3.7	41	
-Cinygmula (4)	10	11	6			9	100	
Simuliidae - Ameletus (1)		1				.3	3	
PLECOPTERA								
Nemouridae -Zapada (2)	2	2	3			2.3	26	
Chloroperlidae-Plumiperla (1)	9	13	2			8	89	
Perlodidae-Isoperla (2) Cultus	1					.3	3	
Capniidae - Capnia 1	4	3	2			3	33	
TRICHOPTERA								
Rhyacophilidae-Rhyacophila (0)	7	6	3			5.3	59	
Glossosomatidae-Glossosoma (0)	3							
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)								
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperophylax (4)								
Hydroptychidae-Hydroptyche (4)								
DIPTERA								
-Chironomidae (6)	7	9				5.3	59	
[-pupae]								
-Empididae (6)	1	1	1			1	11	
-Simuliidae (6)								
-Tipulidae (3)								
OLIGOCHAETA (8)	1					.3	3	
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	51	52	30			44	480	
TOTAL ORGANISMS	60	62	31			51	553	
EPT/TOTAL	.85	.84	.97			.89		
% DOMINANT TAXA	18	21	23			21		
FBI VALUE	2.9	3.0	2.7			2.9		

		RBA RATING
TOTAL EPT GENERA	12	4
AVERAGE FOR SITE:		
EPT/TOTAL	.89	4
% DOMINANT TAXA	21	4
FBI VALUE	2.9	4

RBA for site: 4

SITE: HC8 2.5 SE GRR x-ing MACROINVERTEBRATE SUMMARY DATA DATE 8-1-93

G04 / H0011

pH: _____ CONDUCTIVITY(umhos): _____ TEMPERATURE(°C): _____

COMMENTS:

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	95% conf.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	3		1			1.3	14.8	
Ephemerellidae-Ephemerella (1)								
-Drunella (1)								
Heptageniidae-Epeorus (4)			2			.67	7.4	
-Cinygmula (4)		5	4			3	33.3	
PLECOPTERA								
Nemouridae -Zapada (2)		1				.3	3.7	
Chloroperlidae-Plumiperla (1)	4	3	4			3.7	40.7	
Perlodidae-Isoperla (2)								
Capniidae - Capnia (1)	2					.67	7.4	
TRICHOPTERA								
Rhyacophilidae-Rhyacophila (0)	1					.3	3.7	
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)								
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperochyla (4)								
Hydropsychidae-Hydropsyche (4)								
DIPTERA								
-Chironomidae (6)	6	8	1			5	55.6	
[-pupae]								
-Empididae (6)								
-Simuliidae (6)								
-Tipulidae (3)								
OLIGOCHAETA (8)								
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								
TOTAL EPT	10	9	11			10	111	
TOTAL ORGANISMS	16	17	12			15	167	
EPT/TOTAL	.63	.53	.92			.69		
% DOMINANT TAXA	38	47	33			39		
FBI VALUE	3.4	4.3	3.2			3.6		

RBA RATING

TOTAL EPT GENERA 7 ____

AVERAGE FOR SITE:

EPT/TOTAL ____ ____

% DOMINANT TAXA ____ ____

FBI VALUE ____ ____

RBA for site: ____

SITE Skagway Warm Pass MACROINVERTEBRATE SUMMARY DATA DATE 8-2-93 downstream taught Fork G04 / # 0017

pH: _____ CONDUCTIVITY(umhos): _____ TEMPERATURE(°C): _____

COMMENTS:

Replicate	R1	R2	R3	R4	R5	MEAN	MEAN /M2	SE.R con.limits
VELOCITY (cm/sec)								
DEPTH (cm)								
TAXA (tolerance value)								
EPHEMEROPTERA								
Baetidae -Baetis (4)	3	2	5			3.3	37	
Ephemerellidae-Ephemerella (1)								
-Drunella (1)						.67	7.4	
Heptageniidae-Epeorus (4)	2					.33	3.7	
-Cinygmula (4)		1						
PLECOPTERA			4			1.3	14.8	
Nemouridae -~~Zapada~~ (2) (Podmosta								
Chloroperlidae-Plumiperla (1)								
Perlodinae-Isoperla (2)								
TRICHOPTERA						.33	3.7	
Rhyacophilidae-Rhyacophila (0)	1							
Glossosomatidae-Glossosoma (0)								
Brachycentridae								
-Brachycentrus (1)								
Limnephilidae-Ecclisomyia (4)								
-Onocosmoecus (4)								
-Psychoglypha (4)								
-Hesperophylax (4)								
Hydropsychidae-Hydropsyche (4)								
DIPTERA								
-Chironomidae (6)	40	9	14			34.	381.5	
[-pupae]								
-Empididae (6)								
-Simuliidae (6)								
-Tipulidae (3)								
OLIGOCHAETA (8)								
MOLLUSCA-Pelecypoda								
ARTHROPODA-Arachnida								
COLLEMBOLA								67
TOTAL EPT	6	3	9					449
TOTAL ORGANISMS	86	12	23					
EPT/TOTAL	.07	.25	.39			.24		
% DOMINANT TAXA	93	75	61			76		
FBI VALUE	5.8	5.5	4.9			5.4		

		RBA RATING
TOTAL EPT GENERA	5	2
AVERAGE FOR SITE:		
EPT/TOTAL	.24	1
% DOMINANT TAXA	76	2
FBI VALUE	5.4	2

RBA for site: 1.8