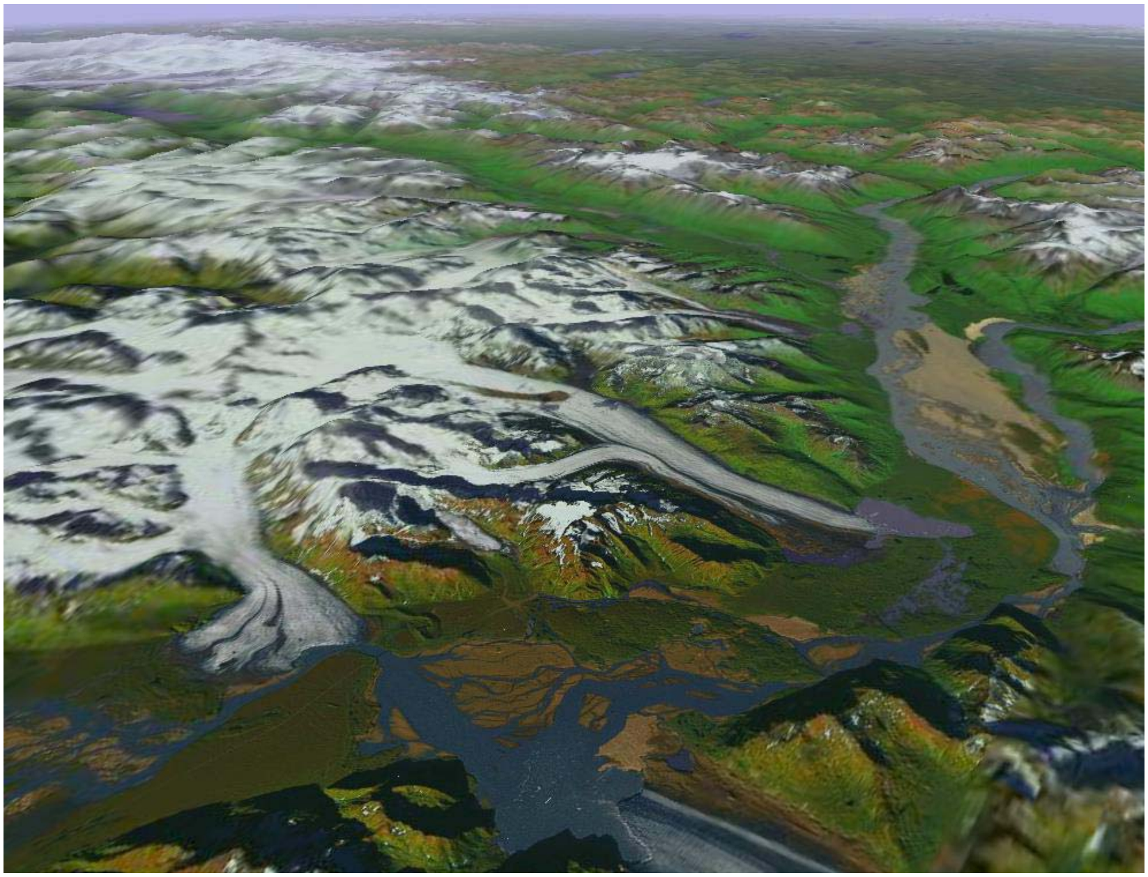
North Copper -Tasnuna Landscape Assessment
Cordova Ranger District
Chugach National Forest

June 27, 2006



Copper River (from Google Earth)

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Executive Summary

The North Copper-Tasnuna Landscape Assessment is an ecosystem analysis at the landscape scale that involves both information gathering and analysis. The purpose is to document and develop an understanding of the processes and interactions occurring in the North Copper and Tasnuna River area of the Cordova Ranger District of the Chugach National Forest in Alaska. The analysis covers 508,676 acres as displayed in Figure 1.1.

This report identifies the important issues and key questions and describes the biological, physical, and social features for the area. Information included in this document describes water uses, vegetative patterns and distribution, disturbance factors, fish and wildlife species and habitats, hydrology, soils, and cultural, socio-economic, subsistence, and recreational human use patterns.

Landscape analyses are a step between a forest plan and project implementation. They provide a means of refining the desired condition of the landscape given the Forest Plan goals and objectives, management prescriptions, and standards and guidelines, current policy, and other applicable State and Federal regulations. They provide an opportunity for managers and users to brainstorm monitoring and inventory needs and projects to help reach the desired future condition. The end result is not a decision document but a report that can be used in future site-specific analyses and planning.

A team of resource specialists from the Chugach National Forest Cordova Ranger District and Supervisor's Office prepared this assessment with input solicited from other federal and state agencies, the communities of Cordova, Chitina, and Valdez, local Tribal Governments, landowners, and the general public.

The following are the steps used to conduct the analysis and corresponding chapters in this report.

- Step 1 – Delineate analysis area and describe desired conditions (Chapter 1)
- Step 2 – Describe the current conditions of the landscape (Chapter 2)
- Step 3 – Identify key issues and questions (Chapter 3)
- Step 4 – Describe trends and information gaps (Chapter 4)
- Step 5 – Recommend monitoring needs and projects (Chapter 5)

Chapter 1

Purpose

The purpose of this landscape scale ecosystem assessment is to develop and document an understanding of the processes and interactions occurring in the analysis area and determine how we can achieve our desired future condition described in the revised Chugach National Forest Land and Resource Management Plan (Forest Plan) and Record of Decision (ROD) signed in May 2002. The North Copper-Tasnuna analysis area is defined by the watershed associations that comprise the northern most portion of the Cordova Ranger District of the Chugach National Forest including the Allen Glacier, Childs-Goodwin Glaciers, Cleave Creek, Heney Glacier, Schwan Glacier, Tasnuna River North, and the Woodworth Glacier watershed associations (Fig 1.1 and Fig. 2.2).

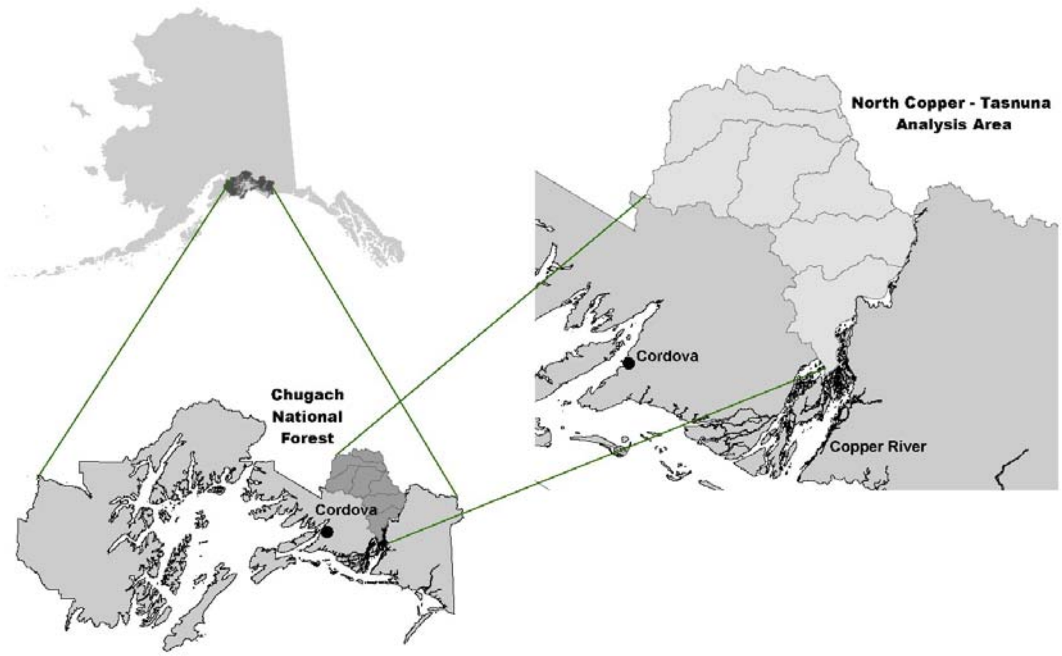


Figure 1.1 - Location of the North Copper-Tasnuna landscape analysis area.

The Analysis Area

This analysis area of approximately 508,676 acres (795 square miles) is located in southcentral Alaska east of Cordova, Alaska in the Copper River drainage. It is bounded by BLM lands to the north, Wrangell-St. Elias National Park and Preserve to the east, State of Alaska lands to the southwest and by the lower Copper River to the south. Access is by off-highway vehicles, foot, aircraft, or boat. There are no maintained roads in the area.

Users of this area enjoy river rafting, kayaking, jet boating, camping, hiking, snowmachining, and heliskiing. However, the area is lightly used by recreationists due to its remoteness and limited accessibility. No developed recreation facilities are present on National Forest System lands within this analysis area.

Most of the river valley bottoms in the analysis area are lands owned by Native corporations, while most of the upland habitat is National Forest System land (62% of the area). Table 1.1 and Figure 1.2 summarize and display the land ownership of the area.

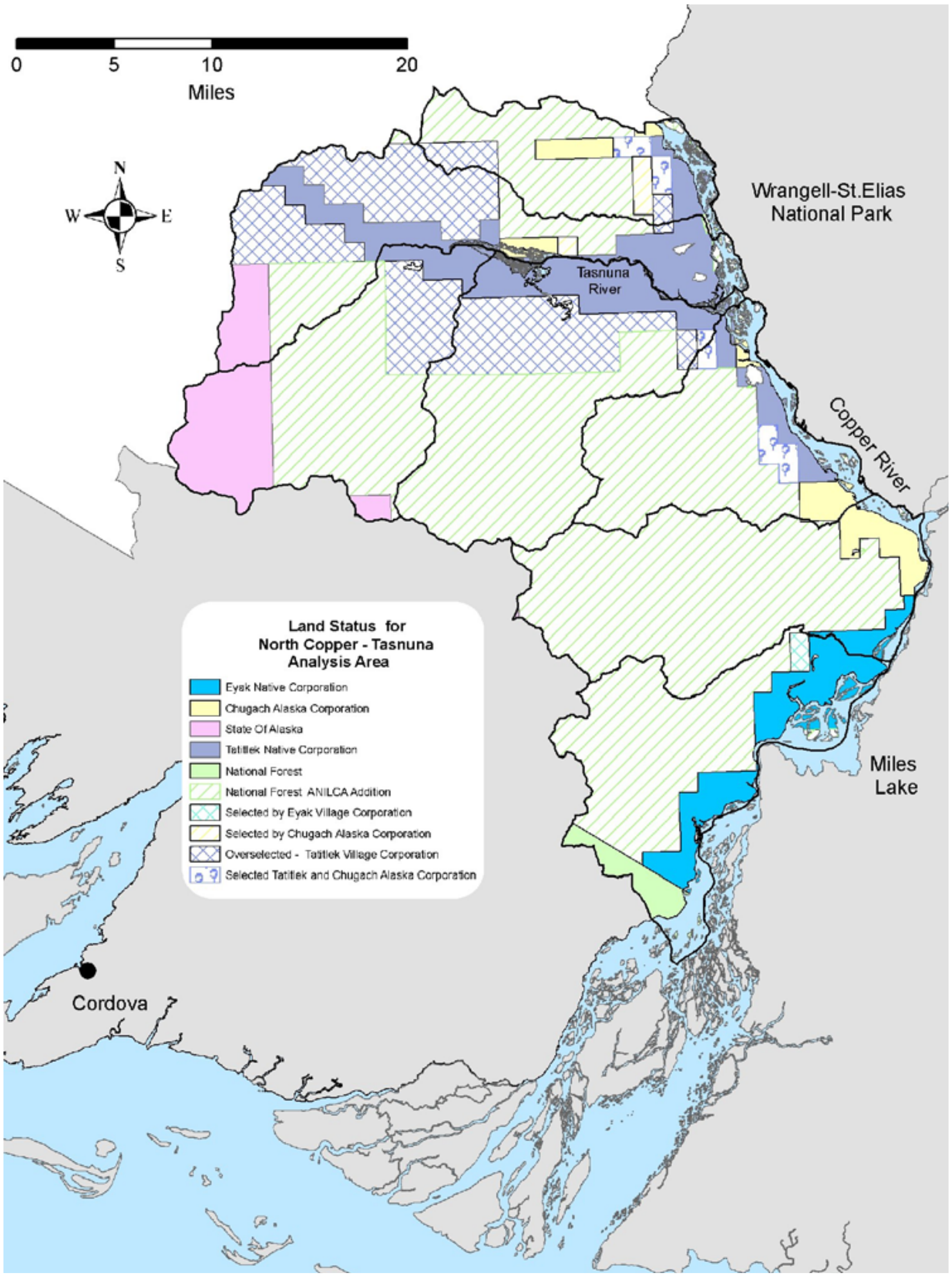


Figure 1.2 - Landownership patterns for the North Copper-Tasnuna analysis area.

Table 1.1 - Summary of land ownership for the analysis area

Ownership	Acres	% of area
National Forest	5,815	1.1 %
National Forest – ANILCA Addition	307,767	60.5 %
State of Alaska	28,312	5.6 %
Chugach Alaska Corporation (CAC)	14,627	2.9 %
Tatitlek Village Corporation	48,173	9.5 %
Eyak Village Corporation	21,604	4.2 %
Selected by Eyak Village Corporation	1,279	0.2 %
Selected by Chugach Alaska Corporation	2,797	0.6 %
Selected by Tatitlek Village Corporation	71,943	14.1 %
Selected by both CAC & Tatitlek Village Corp	6,356	1.2 %
Total	**508,676**	**100 %**

Under the Alaska Native Claims Settlement Act (ANCSA), the Native Corporations were all granted land selections including "over select" lands which are present in the analysis area. The Eyak Corporation has received their full entitlement and conveyance of selected lands. The Chugach Alaska Corporation has received 92% of their entitlement, and the Tatitlek Corporation has received approximately 93% of their total entitlement. This means additional parcels may be conveyed within this analysis area.

Most of the analysis area is characterized by glaciated peaks with steep topography and glacially carved valleys. Besides glaciers, the Copper River and its tributaries are the major driving forces that control the landscape in the area. The most common streams in the uplands are high gradient channels too steep to provide fish habitat. These channels transport sediment and woody debris to the lower reaches and may create small pockets of salmon spawning and rearing habitats near their junctions with the larger glacial rivers. Vegetation is generally sparse with scattered conifer stands in the lower elevations with willow, alder, cottonwood and shrub dominated landscapes. Wildlife populations are likely more characteristic of interior Alaska than populations to the south on the Copper River Delta.

Legislative History

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) includes specific language in Section 501(b) pertaining to the management of the Copper River Delta. The North Copper-Tasnuna Landscape analysis area is included in this area designated for special management. ANILCA states:

> *"...That the conservation of fish and wildlife and their habitat shall be the primary purpose for the management of the Copper/Rude River Addition and the Copper-Bering River portions of the existing Chugach National Forest ... Provided, that the taking of fish and wildlife shall be permitted within the zones established by this subsection pursuant to the provisions of this Act and other applicable State and Federal law. Multiple use activities shall be permitted in a manner consistent with the conservation of fish and wildlife and their habitat..."*

Due to its exceptional nature in terms of wildlife and fisheries habitat, the Copper River Delta has continued to hold people's interest at the local, state and national level. In 1991, final rule 36 CFR 241 was issued pertaining to the conservation of fish and wildlife and their habitat. It re-emphasized that the federally administered lands were to be managed for multiple use in a manner consistent with the primary management goal of conserving fish and wildlife and their habitats.

Desired Future Condition

Chugach Forest Plan management direction

The Record of Decision for the revised Chugach Forest Plan was signed in May 2002. Chapter 3 of the Forest Plan outlines forest wide direction, goals and objectives, and standards and guidelines. It also describes the desired future condition for the forest as a whole with regards to each resource. Chapter 4 of the Forest Plan provides a detailed description of the management area prescriptions and desired future condition for ecological and social systems, and allowed activities, standards, and guidelines. Chapter 5 of the Forest Plan includes monitoring, evaluation, information and research needs, and potential projects.

With regards to the fisheries and wildlife habitat for the forest as a whole, the Forest Plan in Chapter 3 states:

> "Natural processes with active management in selected locations will sustain fish and wildlife habitat. Fish and wildlife will continue to flourish in their current abundance with stable populations and abundant habitat. Threatened and endangered species will have populations moving toward recovery. Sensitive species will have appropriate habitat conditions with stable or improving population trends. Management indicator species and species of concern will have stable population trends, providing a continuing subsistence resource. Brown bear/human confrontations will be minimal in important seasonal feeding areas and travel corridors, resulting in limited risks to brown bears through "defense of life and property" mortality. Species used for subsistence will continue to be available for subsistence uses. (USDA Forest Service 2002c)"

Chapter 3 of the Forest Plan outlines the desired conditions for the Copper River geographic area on pages 3-18 and 3-19. It specifically addresses anadromous fish runs and resident fish populations being sustained. It states that the major anadromous runs of sockeye and king salmon that spawn upstream of the Chugach National Forest boundary continue to pass through the lower Copper River and that subsistence and commercial fishing be sustained at high levels without adversely affecting the fish resource (USDA Forest Service 2002c).

It is desired that Atlantic salmon and American shad not establish breeding populations in the freshwaters of the analysis area. It is desired that an aggressive approach be taken toward the prevention and extirpation of exotic species through coordination with State agencies and Native organizations.

It is desired that commercial fishing and hatchery production in the Copper River be done in an ecologically sound manner that promotes the long-term sustainability of wild salmon populations. Genetically distinct wild populations will be protected and genetic diversity of populations will be maintained throughout the region. Protection of wild stock fish populations and fisheries resources will be ensured through cooperative research and management strategies employed by federal, state, and native organizations.

The entire analysis area has a 213 ANILCA 501(b)-2 prescription (Fig 1.3). This prescription was developed to address the "Management of Fish and Wildlife Habitat" and "Natural Quiet" interests. This theme emphasizes the conservation of fish and wildlife and their habitats, while providing opportunities for backcountry recreational activities in a natural appearing landscape. The desired future condition is that ecological processes, largely unaffected by human activity, dominate the area. Vegetation will be mostly late successional unless regenerated by resource projects or natural processes. Projects to restore or enhance fish and wildlife habitat or other multiple use activities may be allowed if consistent with the conservation of fish and wildlife or their habitats (USDA Forest Service 2002c).

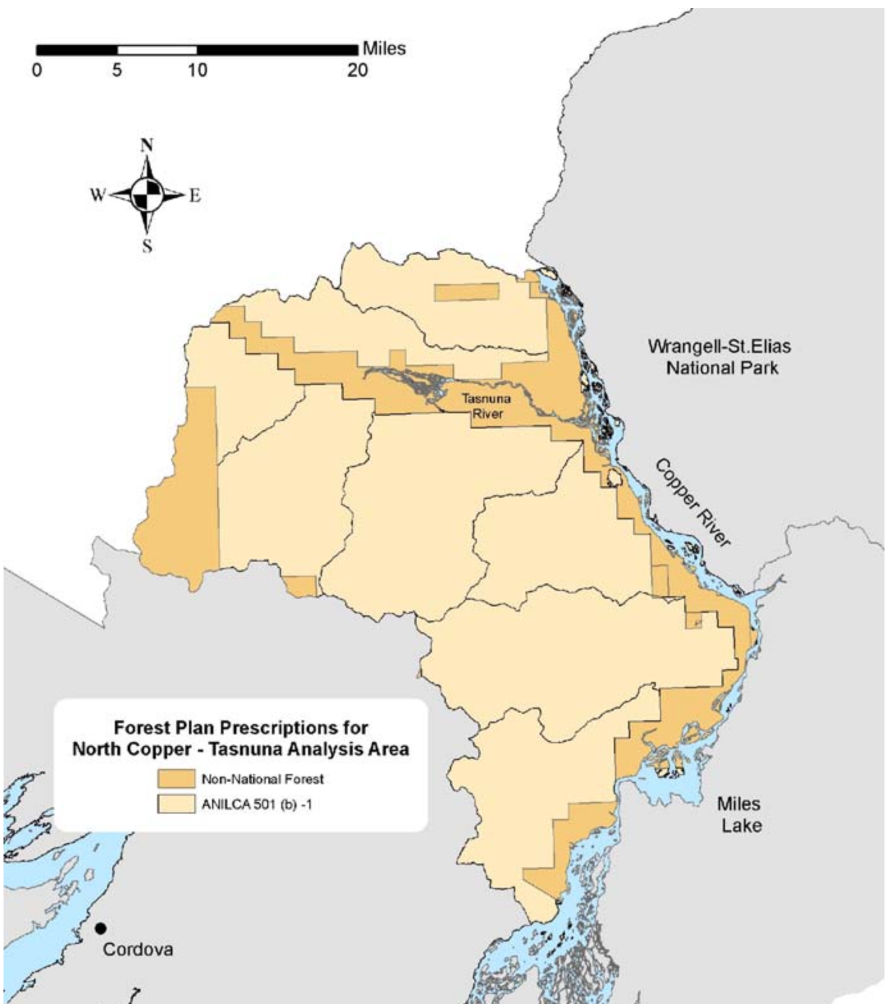


Figure 1.3 - Forest Plan direction for the North Copper-Tasnuna analysis area

The Forest Plan states that the Recreation Opportunity Spectrum (ROS) will range from Primitive to Semi-Primitive Motorized. There will be evidence of human use such as trails, hardened campsites and historic structures. Recreation cabins may be present and new cabins may be constructed. Facilities such as small campgrounds, viewing sites or interpretive signs may be constructed. Tourism related activities should be restricted to small groups with limited facilities. Development and larger groups should be concentrated in recreation concentration areas, minimizing the effects on the overall management area. Existing roads may be present to provide access to trailheads, camping areas or recreation nodes. Trails offer some solitude, tranquility, challenge, and a degree of risk. Heritage resources will remain in an undisturbed state, with data recordation as the preferred method to mitigate the loss of heritage resources. Cabins and other historic, above ground features will be present in their natural state, with minimal on-site interpretation (USDA Forest Service 2002c).

No new roads will be constructed. Reasonable access, including roads, for conducting mineral operations shall be approved under a mining plan of operations. Aircraft access is allowed for mineral exploration and will be coordinated with the responsible line officer to minimize impacts to other users and, to the extent possible, be consistent with the theme of the prescription (USDA Forest Service 2002c). Additional guidelines for minerals activities are presented on page 4-26 of the Forest Plan.

The type of motorized use allowed varies by season. In the summer, National Forest System lands are open to use by helicopters, but not by Off-Highway Vehicles (OHV). From December 1 through April 30, all types of motorized recreation access are allowed, including snow machines, helicopters, and OHVs.

Research Natural Area proposal history

The previous land and resource management plan for the Chugach National Forest (USDA 1984) proposed establishing a 12,000 acre Research Natural Area (RNA) at the terminus of the Schwan Glacier. The proposal stemmed from an analysis of a potential RNA network that would represent the range of ecological features across the Forest (Juday 1981). Specifically, the Schwan Glacier terminus area was selected to represent glaciers, forest, and tundra plant communities within an area of continental climate unlike most of the rest of the Forest. The area was never formally established as an RNA and was not one of the four areas selected for designation as an RNA in the revised Forest Plan (USDA Forest Service 2002b).

Chapter 2 – Analysis Area Description

Physical Characteristics

Climate

The North Copper - Tasnuna analysis area has a mountainous climate with generally cold temperatures and heavy precipitation. No weather stations are located in the analysis area, but weather stations at the Cordova Airport and Thompson Pass define general conditions in the analysis area. The average daily temperature in the analysis area ranges from about 28 to 39^{o}F (Table 2.1) (Western Regional Climate Center 2005). Average maximum July temperatures range from 58^{o}F at the Cordova Airport to 61^{o}F at Thompson Pass, and minimum January temperatures range from 16^{o}F at the Cordova Airport to -1^{o}F at Thompson Pass. Temperatures decrease dramatically with increasing elevation. Temperatures can also be lower along the Copper River corridor, where strong winds commonly bring colder air from the interior Copper River basin.

Table 2.1 - Climate summary for weather stations near the analysis area.

		Cordova FAA Airport, AK	**Thompson Pass**
Location	Station Number	502177	509146
	Elevation (ft)	40	2500
	Latitude	60º 30'	61º 08'
	Longitude	145º 30'	145º 45'
	Number of years of data	56	22
Temp	Average daily temperature (ºF)	38.7	28.1
	Average max July temperature (ºF)	61.4	57.7
	Average min January temperature (ºF)	15.9	-0.7
Precip	Average annual precipitation (inches)	92.6	77.3
	Average annual snowfall (inches)	118	552
	Average March snow depth (inches)	11	no data

Low pressure storms generally circulate counterclockwise in the Gulf of Alaska, with weather and winds in the area coming from the southeast. Precipitation increases dramatically with elevation, as the higher elevation areas capture moisture from these storms. The mean annual precipitation is 77 inches at Thompson Pass and 93 inches at the Cordova Airport (Fig 2.1) (Western Regional Climate Center 2005). Precipitation increases to about 180 inches at the higher elevation, glaciated portions of the analysis area (USDA Forest Service 1983). The heaviest rainfall generally occurs in the late summer and fall, and the lowest precipitation occurs in the spring and summer. Snow generally falls at all elevations of the analysis area between mid-October and mid-May, although winter rain can occur in the lower elevations. Snowfall and snowpack increase dramatically with elevation. Some places on the Copper River Delta receive about 120 inches of annual snowfall, whereas the Thompson Pass area and higher elevations of the Tasnuna watershed receive over 500 inches of annual snowfall (Western Regional Climate Center 2005). Snowfall accounts for less than 20% of the total annual precipitation in the lower portion of the analysis area and over 50% of the total in the higher elevations.

The Copper River creates a gap in the mountains that form a barrier between the Copper River Basin of interior Alaska and the Gulf of Alaska. Because of the strong pressure gradient that commonly forms in the winter between the low pressure in the Gulf of Alaska and high pressure in the interior, strong downriver winds are common, often reaching sustained velocities of 60 miles per hour with gusts of over 120 miles per hour (Thilenius 1990). These cold winds create a microclimate along the Copper River, affecting temperatures, snowpacks, vegetation, and creating sand dunes. The Bremner Flats area is known for persistent winds.

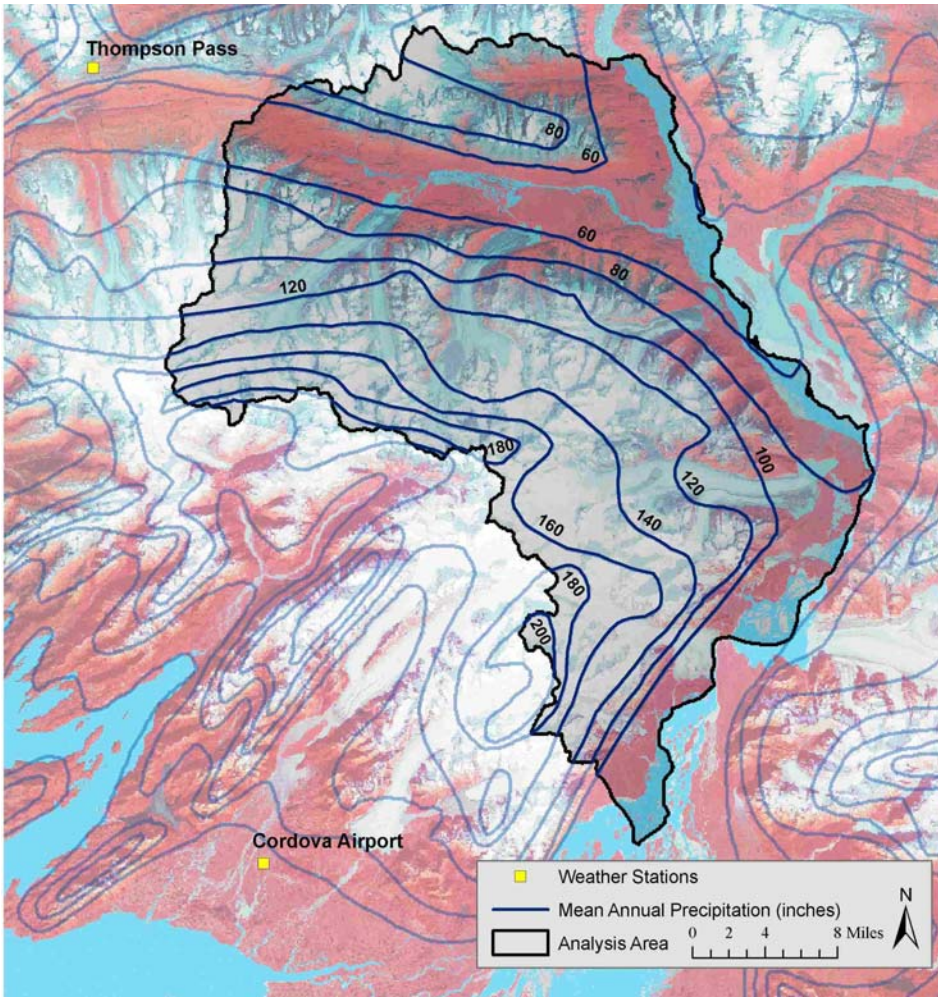


Figure 2.1 - Weather stations and mean annual precipitation, in inches, for the North Copper -Tasnuna analysis area. Precipitation data from USDA FS.

Watershed Morphology

The North Copper - Tasnuna analysis area is defined by the area drained by the Woodworth Glacier, Cleave Creek, Tasnuna River North, Schwan Glacier, Heney Glacier, Allen Glacier, and Childs-Goodwin Glaciers watershed associations. Most of the area lies within the

Tasnuna River (1902010405), South Copper River (1902010413), and Cleave-Copper River (1902010404) 5th-level watersheds (Fig 2.2). The entire analysis area drains into the Copper River upstream of the Copper River Delta.

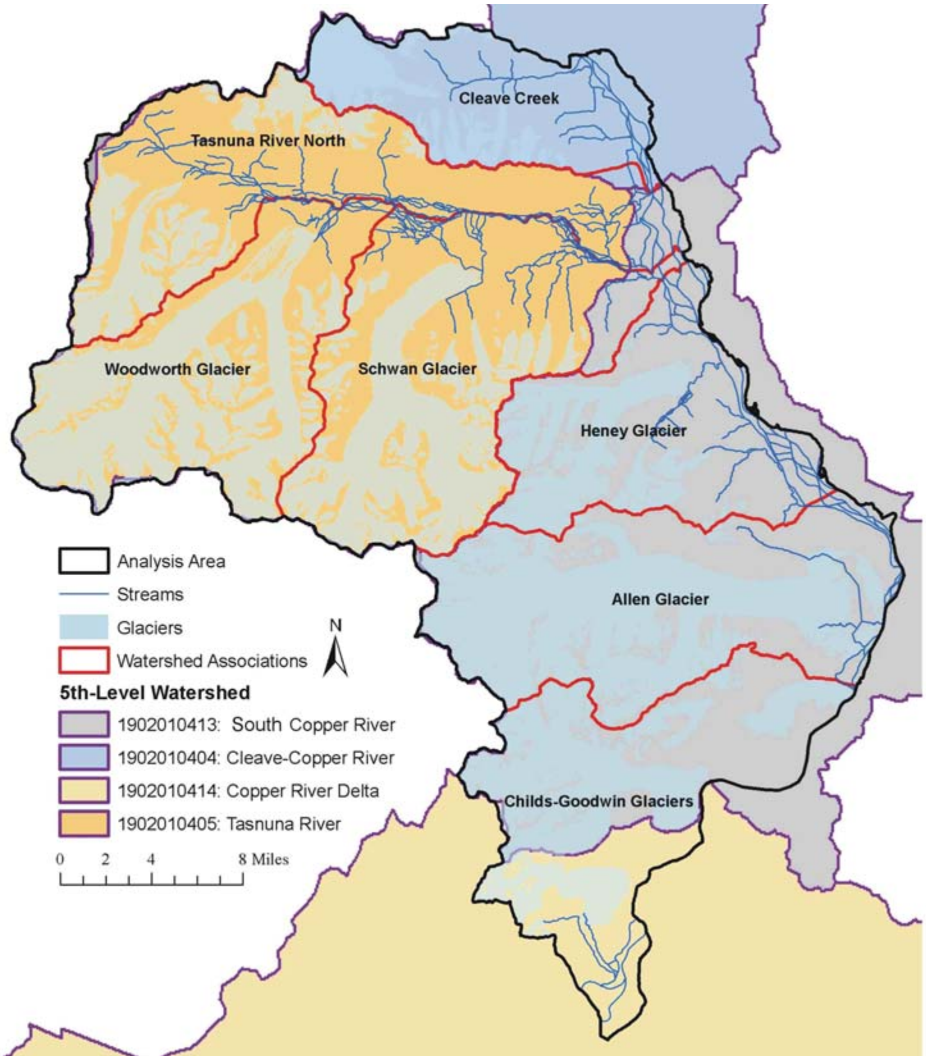


Figure 2.2 - Watersheds of the North Copper -Tasnuna landscape analysis area.

The analysis area lies within the Chugach Mountain Range and contains large glacial valleys and high peaks. The area is defined by the Tasnuna River valley, a major tributary of the lower Copper River and a portion of the lower Copper River. Elevations range from about 50 feet at the southern end of the analysis area to about 8000 feet at the head of the Schwan Glacier. Vertical relief is high, with peaks steeply rising 4000 to 6000 feet from the valley floors of the Tasnuna and Copper River valleys. The valley floors are relatively flat, and the valley sides are steep. Glaciers occupy most of the valleys draining north into the Tasnuna River. Small lakes cover about 2500 acres (0.5% of the analysis area), including proglacial lakes at the ends of the Woodworth, Schwan, Heney, and Allen Glaciers. Small wetland ponds are present in the flat valley floor of the Tasnuna River valley. Additionally, the eastern half of the 700-acre Miles Lake on the Copper River lies within the analysis area.

Ecological Classification

Map units on the Chugach National Forest are delineated using the National Hierarchal Framework of Ecological Units (ECOMAP 1993). This system stratifies land masses into progressively smaller areas of increasingly more uniform ecological similarities. The subsection is the largest delineation used for management on the Chugach National Forest. This landscape analysis area includes the Tasnuna and the St. Elias Icefields Subsections.

Tasnuna Subsection - This subsection includes the glacial outwash deposits from the rivers and the steep glaciated sideslopes of the inland portion of the Copper and Tasnuna Rivers. The annual precipitation ranges from 40 inches in the north to 80 inches in the south. The average annual snowpack is about 70 inches. The characteristic vegetation is dominated by closed tall shrubs on disturbed sites or sites recently exposed by glacial recession with patches of closed needleleaf forests on the undisturbed sites on the sideslopes. The valley bottoms consist of either bare ground actively being deposited by glacial rivers or open broadleaf woodland on temporarily stabilized sites.

St Elias Icefields Subsection - This subsection includes the ice fields, glaciers, and rugged mountains located north of the deltas of the Copper and Bering Rivers.

Geomorphology

The present form of the Chugach Mountain Range was shaped primarily by Pleistocene glaciation. Large valley glaciers resulted in the large U-shaped valleys of the Tasnuna and Copper Rivers. Rapid glacial melting occurred in the Holocene, beginning about 12,000 years ago, accompanied by numerous episodes of small advances and retreats.

The Copper River drains a 24,200 square mile basin, predominantly in interior Alaska. At some point during the Pleistocene glaciation, the glacial Lake Ahtna formed as a result of a glacial dam in the Copper River canyon. The catastrophic flood that occurred about 9000 years ago when this lake drained resulted in the incipient formation of the Copper River Delta. The Copper River continues to transport abundant sediment to the Delta, with a current annual suspended sediment load of 69 million tons (Brabets 1997).

Glaciers in the North Copper – Tasnuna analysis area currently cover about 240,000 acres or 45% of the analysis area. Seven large glaciers drain north into the Tasnuna River and east into the Copper River from the high peaks south of the Tasnuna River. These glaciers have been thinning and receding for the last 100 years since the last small-scale glacial advance. Moraines from this most recent glacial advance are present in the valley floors, and proglacial lakes have formed on the Woodworth, Schwan, Heney, and Allen Glaciers. Old glacial morainal material from the Allen and Miles Glaciers to the north of Miles Lake consists of vegetated glacial moraine material covering buried glacial ice. The Childs Glacier terminates at the Copper River, where the river is constricted and the constant flow of the river against the calving face of the glacier maintains the position of the glacial terminus.

Glacial outburst floods occur where glaciers dam unglaciated tributary valleys, forming lakes that periodically fill and burst, sending surges of water downstream. Small glacial outburst systems may currently exist along the Allen Glacier (Post and Mayo 1971), but these small systems have little effect on flow quantity in the Copper River. The Van Cleve Lake outburst system on the Miles Glacier lies outside of the analysis area, but can greatly affect flows in the Copper River downstream of Miles Lake. These floods generally occur about every 6 years, releasing flows of about 150,000 to 200,000 cubic feet per second (cfs) into the Copper River (Brabets et al. 1997). This is addressed in the East Copper River Delta Landscape Assessment (Kesti et al. 2004).

Landtype Associations

Landtype Associations (LTA) are part of the National Hierarchal Framework used to delineate landscapes. Ecological units at this level are defined by the "geomorphic process and how it affects the topography, surficial geology, local climate, soils, and potential natural plants community patterns" (Davidson 1997). Soils in the analysis area can be described in terms of where they lie on the landscape because the geomorphic processes that formed the landtypes are intricately related to the pedogenic processes that form the soil on those sites (USDA Soil Conservation Service 1993). Table 2.2 and Figure 2.3 display the distribution of landtypes in the analysis area.

Table 2.2 - Acreage of each Landtype Association in the Analysis Area.

Landtype	Acres
Glaciers	323,928
Mountain Summits, Rugged	40,267
Mountain Sideslopes, Disturbed	30,745
Moraines, Undifferentiated	27,836
Glacial Water	27,060
Flood Plains	26,419
Mountain Sideslopes, Broken	23,765
Alluvial Fans	12,606
Mountain Sideslopes, Frequently Dissected	9,925
Hills, Low Relief	8,932
Mountain Summits, Rounded	2,580
River Bars	1,013
Clear Water	798

Alluvial Fans - This mapping unit includes the fan shaped alluvial landform located at the mouth of valley streams where the slope gradient decreases resulting in the deposition of transported sediment. This landform is very unstable because of the constant migration of the stream channel due to the continuous deposition of sediments and high water events resulting from heavy precipitation at higher elevations at the upper portions of the contributing valley. The alluvial soil is deep, moderately to somewhat excessively drained sand, gravel, and cobbles with very high permeability. Slope gradient is usually less than 25% and external relief less than 100 vertical feet.

Glacial Water – This unit includes streams and lakes at the toe of glaciers that contain high amounts of glacial silt, so very little, if any, light penetrates the water.

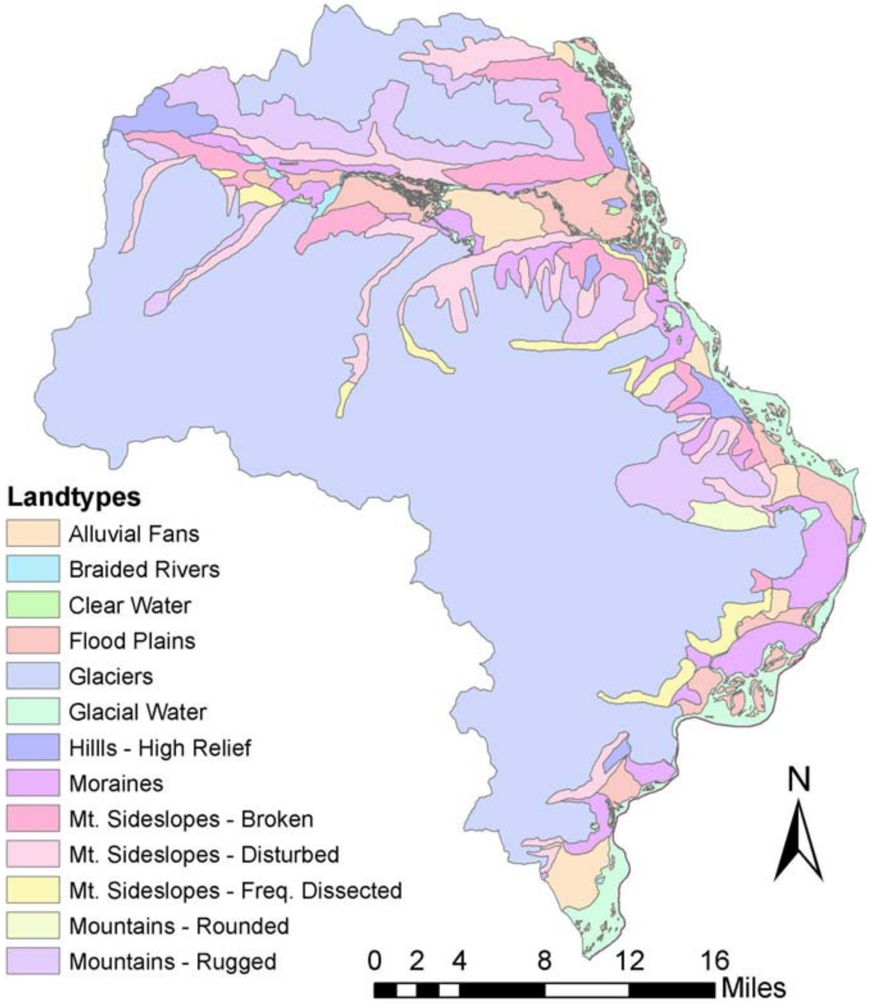


Figure 2.3 - Landtype Associations for the North Copper-Tasnuna analysis area.

River Bars - This unit includes the large constantly changing, aggrading glacial river channels and the river bars and terraces that are flooded annually. The river transports large quantities of silt and fine sand, which is deposited in areas of less movement causing the river to constantly change channels. The slope gradient is less than 5 percent and external relief is less than 20 feet. The soil is undeveloped, poorly to excessively drained sand, gravel and cobbles, with moderate to rapid permeability. The vegetation consists of pioneer species as willow, cottonwood, fireweed, other herbs, and grasses.

Flood Plains - This unit includes the broad plains susceptible to periodic spring and early summer floods from snow run off in adjacent non-glacial clear water streams. The slope gradient is less than 5%. The stream pattern is typically meandering or braided. The soils are typically young, poorly to well drained, loamy to loamy skeletal, with moderate to rapid permeability.

Glaciers – This association is the most prevalent type found in the analysis area. It includes those landscapes that are covered by glaciers or perennial snowfields where the only exposed ground is typically bedrock nunataks, peaks, ridges, or loose talus. The slope gradient ranges from flat to vertical with external relief from hundreds to thousands of feet. There is rarely any exposed soil or vegetation.

Moraines, Undifferentiated - This map unit includes terminal, lateral and medial glacial moraines left by receded glaciers. These landforms typically form in the valley bottoms previously occupied by glaciers. The slope gradient ranges from 35 to 65%, and the external relief is usually less than 200 feet. The soils are deep, well drained, and have loamy-skeletal textures with moderate to rapid permeability. The vegetation ranges from shrubs to well developed spruce/hemlock forests depending on the age of the landform.

Mountain Sideslopes, Broken - This association includes the long sideslopes that occur below alpine landscapes where the parallel drainage pattern is broken by bedrock benches or knobs. These slopes may or may not be frequented by avalanches, rock falls, etc. The slope gradient is greater than 65% except on the benches or knobs where the slope may be less than 35%. External relief is usually greater than 1000 feet. The soils range from shallow on the upper slopes to deep on the lower slopes and are typically well drained, loamy to loamy-skeletal, with moderate to rapid permeability. The vegetation ranges from subalpine forbs, grasses and shrubs to well developed spruce/hemlock forests on the lower protected slopes.

Mountain Sideslopes, Disturbed - This unit located below alpine landscapes includes the long sideslopes of high relief dominated by rock fall, slides, and avalanches. The slope gradient ranges from 35 to 75%, and the external relief is greater than 1000 feet. Greater than 40% of this mapping unit is dominated by avalanches and slides. The soils range from moderately deep on the upper slopes to deep on the lower slopes and are well drained, loamy to loamy-skeletal, with moderate to rapid permeability. The vegetation consists of shrubs, grasses and forbs in areas of frequent slides and mature spruce/hemlock forests in areas protected from slides.

Mountain Sideslopes, Non-disturbed - This mapping unit includes the long sideslopes of high relief that occur below alpine landscapes that are not dominated by rock fall, slides, and avalanches. The slope gradient ranges from 35 to 75%, and the external relief is greater than 1000 feet. Less than 40% of this mapping unit is dominated by avalanches and slides. The soils range from moderately deep on the upper slopes to deep on the lower slopes and are well drained, loamy to loamy-skeletal, with moderate to rapid permeability. The vegetation consists of shrubs, grasses, and forbs in areas of frequent slides and mature spruce/hemlock forests in areas protected from slides.

Mountain Sideslopes, Frequently Dissected - This mapping unit includes the long sideslopes of high relief that occur below alpine landscapes that are dominated by rock fall, slides, and avalanches. The slope gradient ranges from 35 to 75%, and the external relief is greater than 1000 feet. Less than 40% of this mapping unit is dominated by avalanches and slides confined mostly to deeply incised, parallel drainage channels. The deeply incised channels are the sites of intensive weathering on highly fractured or soft bedrock and the subsequent channelization of water and erosion of soil. The soils range from shallow on the upper slopes to deep on the lower slopes and are well drained, loamy to loamy or sandy-skeletal, with rapid permeability. There is usually minimal vegetation in the dissections. The vegetation consists of shrubs, grasses, and forbs in areas of frequent slides and mature spruce/hemlock forests in areas protected from slides.

Mountains, Rounded - This mapping unit includes the rounded ridges and summits and associated shoulder slopes that have been smoothed by glaciers or frost wedging and weathering. This unit does not include glaciers or perennial snow fields greater than 40 acres. The slope gradient is usually less than 65%, and internal relief is less than 100 feet. The soils are shallow to moderately deep, loamy or loamy-skeletal, with moderate permeability. The vegetation consists of grasses, sedges, forbs, and low shrubs.

Mountains, Rugged - This mapping unit includes the jagged rocky ridges, peaks, associated sideslopes, cirque basins, headwalls, and rock glaciers that are the result of past or present alpine glaciations and frost wedging and weathering. It does not include glaciers or perennial snow fields greater than 40 acres. The slope gradient is usually greater than 65% and the internal relief is greater than 100 feet. Exposed bedrock and unvegetated talus comprise greater than 50% of the mapping unit. The soils are shallow, well drained, loamy or sandy skeletal, with rapid permeability. The vegetation is typically sparse, consisting of low grasses, sedges, forbs, and shrubs.

Hills Low Relief - This association includes bedrock controlled undulating hills and shallow basins, frequently formed by glaciers. It is not common in the analysis area and located in a few areas along the Copper River. The slope gradient is usually greater than 35% and external relief ranges from 50 to 200 feet. The soils range from poorly drained, moderately deep, fine to coarse loams, and organic soils in the basins to moderately well to well drained, deep, loamy to loamy skeletal soils on the slopes. Soils are formed from glacial till or ice-scoured bedrock knobs. Soil type is highly dependent on landscape position. Soils on knobs and shoulder slopes will be shallower and less developed than those on sideslopes. Soils in toe slope positions and basins where water collects will tend to develop organic soils and may support wetland vegetation.

Geology

The bedrock of the analysis area is primarily undivided sedimentary rocks of the Cretaceous Valdez Group, a thick sequence of deformed interbedded metasedimentary and metavolcanic rocks. This group is part of a belt of Cretaceous marine rocks 1000 miles long and as much as 60 miles wide that extends along the Gulf of Alaska margin from Chatham Strait in southeastern Alaska to Kodiak and Shumagain Islands in southwestern Alaska. The Valdez Group is part of the Chugach Terrane as defined by Dumoulin (1972). These rocks typically include sandstone, siltstone, argillite, slate and phyllite. The entire sequence is folded and deformed and metamorphosed to grades ranging from zeolite to amphibolite facies. It is in fault contact (Bagley and Gravina faults) with the Orca Group in the southern end of the analysis area. Metamorphosed granodiorite and granite occur to the west. The Orca Group is part of an accretionary belt of Paleocene age rocks called the Prince William

Terrane that extends across Prince William Sound westward through the Kodiak Island area, underlying much of the continental shelf to the west.

Vast Quaternary deposits occur in the analysis area, primarily along the Tasnuna and Copper Rivers. Quaternary deposits are recent deposits composed entirely of clastic material (clay, silt, sand, gravel, and talus). These deposits within the analysis area are predominately alluvium deposited by non-glacial streams and outwash deposited by glacial melt water. The deposits consist of sand and gravel. Quaternary deposits can include terminal, lateral, and ground moraine composed of unsorted deposits of boulders, cobbles, gravel, and sand left by the retreat of alpine, valley, and regional glaciers and talus and landslide deposits consisting of coarse angular rock debris derived from adjacent bedrock.

Valdez Group Units: *Kvs, Kvvs*, and *Kvgr* - These three Late Cretaceous units occur in the analysis area (Fig 2.4). The most abundant unit is *Kvs*, a thick sequence of metasedimentary rock consisting of sandstone, siltstone, argillite, slate, phyllite, and rare beds of pebbly argillite. Layers are generally a few inches to a few feet thick, but massive sandstone as much as several tens of feet thick is locally present.

The second must abundant unit, *Kvvs* occurs north of Childs Glacier, on the east side of Heney Glacier, between Sheridan and east arm of Woodworth Glaciers, and several other locales. It consists of approximately equal proportions of interbedded metavolcanic and metasedimentary rocks.

Smaller amounts of *Kvgr* are present in the analysis area, mostly along the central western boundary. It consists of massive greenstone, metamorphosed pillow basalt, and mafic dikes exposed near the heads of Woodworth and Schwan Glaciers. There are several other small exposures of this unit throughout much of the analysis area.

Orca Group Unit: *Tos* - *Tos* is a sedimentary unit of the Orca Group which makes up a monotonous sequence of thin- to thick-bedded sandstone, siltstone, and mudstone showing abundant sedimentary structures indicative of deposition from turbidity currents. Sandstone is more abundant than finer-grained rocks. Minor amounts of hemipelagic[2] mudstone occur throughout the Orca Group. Limestone lenses or concretions are found locally, and these, along with conglomerates, are characteristic of sedimentary rocks belonging to the Orca Group. This unit is the dominant bedrock unit in the southernmost part of the analysis area.

Orca Group Units: *Toc, Tots* - Very minor exposures of these units occur in the analysis area, south of the contact fault. They do not show up at the scale of the Geology Map (Fig 2.4). *Toc* consists of conglomerate and *Tots* consists of tuffaceous sedimentary rocks. There is an exposure of *Tots* on the south side of Goodwin Glacier, near the Copper River.

Eocene-age Unit: *Tgg* – Minor exposures of this granite and granodiorite unit occurs in the analysis area south of the contact fault.

[2] Sharing deep sea and shallow sea characteristics.

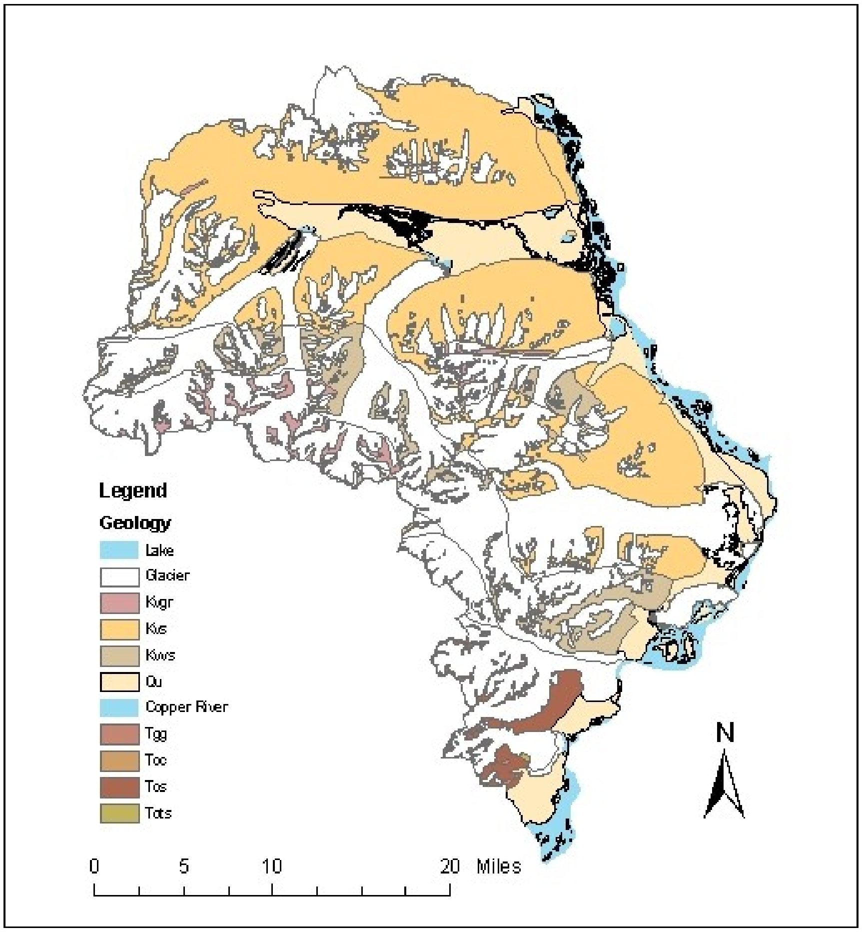


Figure 2.4 - Geology of the North Copper-Tasnuna analysis area. USDA FS, 1996-2000. Chugach NF Corporate GIS Data Layers.

Soils

This area has been shaped extensively by numerous glaciers over the last couple of million years. Many of the upper sideslopes and uplands are now in the early stages of soil development, which is severely limited by the harsh climate. The soils on the lower sideslopes and the valley bottoms are also young and formed by the recent recession of the glaciers and subsequent exposure of the gravels and dirt to soil developing processes. The sideslopes tend to be underlain by compact glacial till, which can restrict water movement and is able to support wetlands and associated hydric soils. The bedrock lithology can be the primary influence on soil characteristics in areas not overlain by colluvium, alluvium, or glacial deposits. It will also result in soils with properties different from those in alluvial soils. In areas where geologic or geomorphic characteristics restrict water movement, their influence on soils will be indirect by creating anaerobic conditions that support the formation of organic soils.

The three ways soil and landform characteristics are measured relative to impacts from various management activities are soil productivity, erosion potential, and mass movements. Soil productivity is measured by the thickness of the surface soil organic layer and the amount and type of vegetation supported on the soil. The decomposition which makes nutrients available for plant growth occurs in this layer. Other factors common to the more productive sites include soils that are at least moderately deep and well drained. These soils usually produce stands of large trees. Soils become less productive with thinner organic surface layers, poorer drainage, shallower depths or they have disturbance site characteristics such as avalanches, bedrock outcrops, or landslides. These soils will most often be vegetated with shrubs and herbaceous species. Some soils are located on active floodplains where continual erosion will likely erode them prior to vegetative development. Other soils have low productivity due to poor drainage or saturation by water. They are normally vegetated with herbaceous and hydric vegetation. Alpine areas with rock outcrops, snowfields, and glaciers have a climate and other ecological conditions that are too harsh and unsuited for abundant vegetative growth; they are usually unvegetated or have minor amounts of moss or alpine vegetation.

Erosion can be looked at in terms of landslides and surface erosion. Surface erosion occurs on soils that are not vegetated. This erosion is dependent on slope, soil texture, cohesion, exposure to wind and water. These areas will be located on exposed talus and bedrock, slopes recently exposed from receding glaciers, and on floodplains and terraces. Avalanches can also contribute to erosion through removal of the protective vegetative cover or the physical movement of the soil or rock. Erosion also occurs on the exposed river bars that have not yet been covered with vegetation.

Most of the analysis area is remote and the occurrence of active landslides is unknown. There are critical slope stability factors that must be evaluated when a management activity is considered. The major factors include slope, topographic position, soil texture and drainage, and any subsurface restrictions that impair the flow of water. These criteria are individually rated and the total score of a particular site can be used as a relative indication of the slope stability (Appendix C). Naturally occurring landslides due to high precipitation, steep slopes, and continuous undercutting of sideslopes by streams may occur in the study area. The potential increases as slope increases and may become serious on slopes over 72% that have had vegetation removed. They may also be accelerated where roads are constructed across slopes where soils are poorly drained, have fine texture, or have a high amorphous component.

Wetlands

Wetlands cover about 48,000 acres, or 9% of the analysis area. The majority of these are Riverine wetlands along the braided channels of the Tasnuna and Copper Rivers. Lacustrine wetlands exist at Miles Lake, the proglacial lakes at the front of the larger glaciers, and the scattered lakes in the valley floors. Palustrine wetlands are located in the Tasnuna River valley, in areas between the Woodworth and Schwan Glaciers, and at the lower end of the Copper River valley. Groundwater commonly seeps out of the bases of the valley sides of the Tasnuna River valley, at times resulting in clear-water ponds and wetlands along the valley margins.

Streams

A total of about 442 miles of mapped stream channels lie within the analysis area (Fig 2.5). Channel types were assigned to these streams based on aerial photo interpretation and using the Channel Type User Guide (USDA Forest Service 1992). No field verification of these channel types has been conducted in this area.

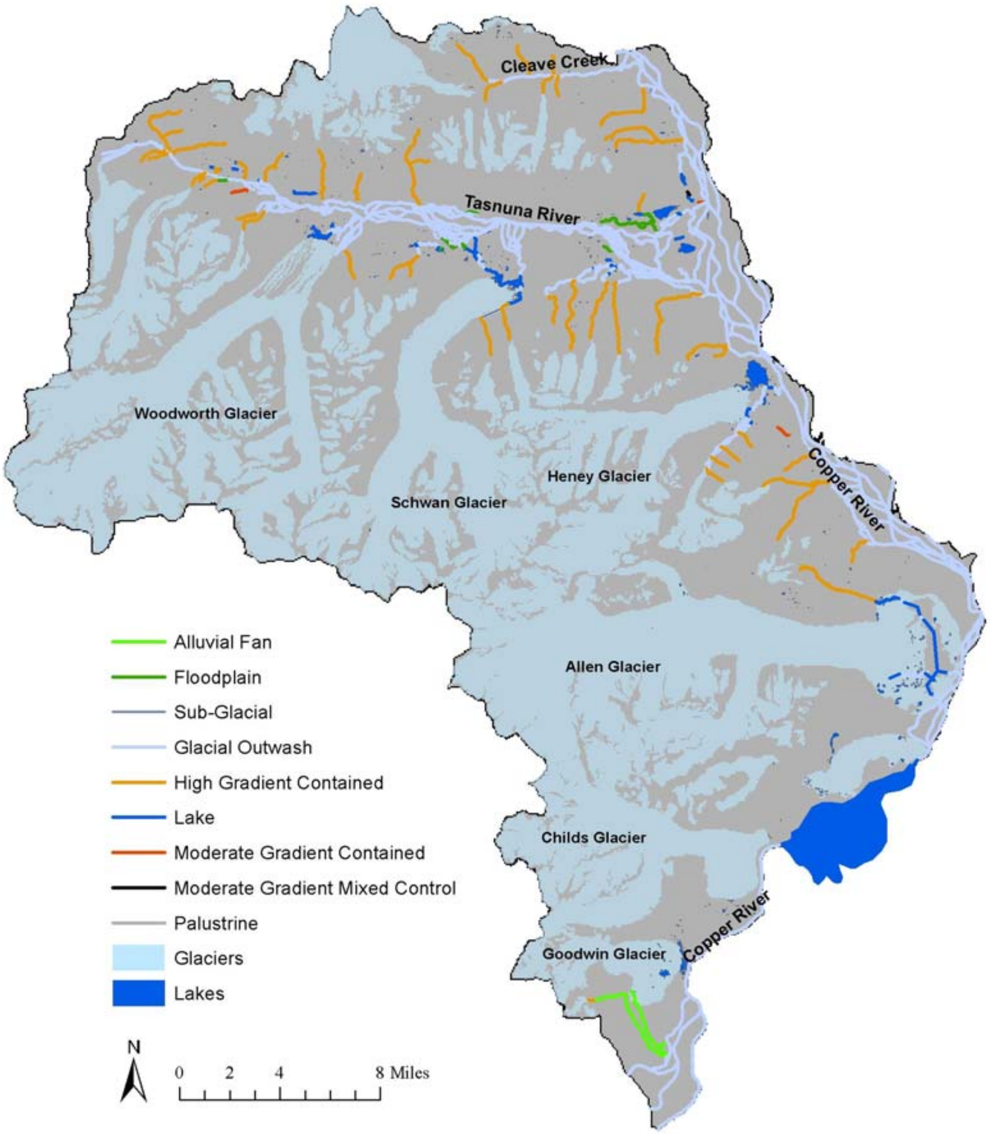


Figure 2.5 - Channel type process groups for streams in the North Copper-Tasnuna analysis area.

Glacial Outwash channels are the most common channel type in the North Copper – Tasnuna area, comprising 67% of the mapped stream channels. The majority of these Glacial Outwash channels are the many braided channels of the Copper and Tasnuna Rivers that occupy the valley floors. Most of the remaining streams in the analysis area are High Gradient Contained channels, comprising 19% of the channels in the area. These short, steep streams drain the valley sides. A small percentage of the channels are palustrine, alluvial fan, and floodplain channels.

The Copper River drains the sixth largest basin in Alaska (Brabets 1997). Because 18% of the Copper River watershed is glaciated, the river carries very high sediment loads. The river is primarily a braided gravel and cobble-bed river through the Copper River canyon, although it is constricted in areas, and dynamic changes commonly occur in the channel configuration as a result of high flows, scour, and sediment deposition. Abercrombie Rapids, just upstream of Miles Lake, are formed by the constriction of the river between glacial moraine deposits on the west and the valley side on the east. The gradient ranges from about 4 to 8 feet per mile from the Tasnuna River to Miles Lake.

Streamflows

Streamflow data in the North Copper - Tasnuna analysis area are limited. Historic streamflow data exist for the Copper River at Chitina (1950-1987) and at the Million Dollar Bridge (1988-1995). No stream gauges are currently in operation. Flows in the Copper River primarily reflect the flow regime that is occurring in the interior Copper River Basin, where climate and geomorphology are considerably different than conditions on the Delta.

Flows in the Copper and Tasnuna Rivers are largely influenced by glaciers. Flows generally begin to rise in May, dramatically increasing in late May and early June during snowmelt runoff (Fig 2.6). Peak flows generally occur in July and early August, during the peak of glacial melting. Flows decrease from August to October, and winter flows remain at low levels because of cold temperatures and ice. Although glacial melting has the largest influence on peak flows, fall rainstorms are capable of producing large peak flows, especially when they occur during times of elevated streamflows from glacial melting.

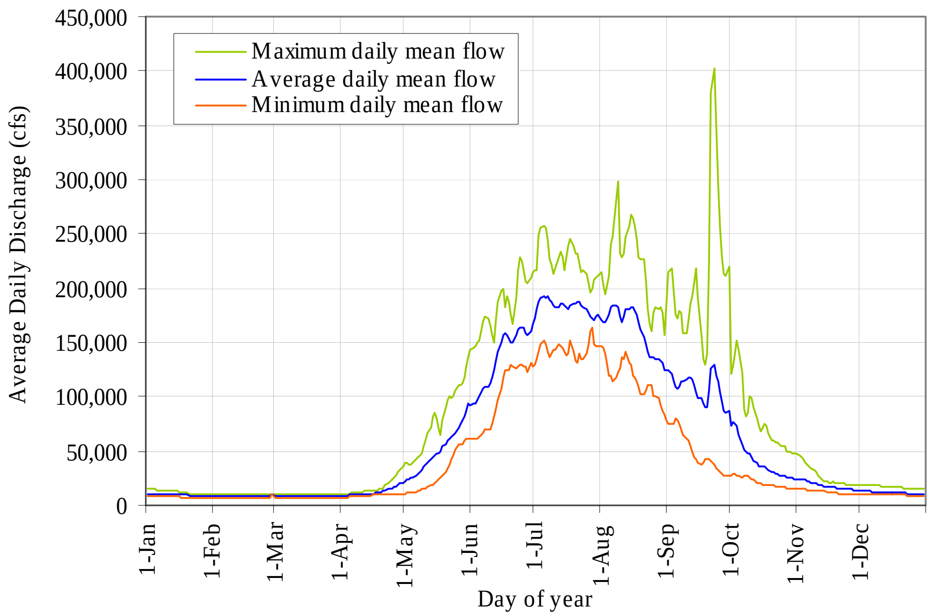


Figure 2.6 - Average daily streamflows for the Copper River at the Million Dollar Bridge, USGS gauging station #15214000. Record period 6/1/88 to 9/30/95 (USGS 2005).

High flows on the Copper River typically reach 150,000 to 200,000 cfs, and winter flows on the Copper River range from about 8,000 to 13,000 cfs (Table 2.3). The 1981 flood, with an estimated flow of 470,000 cfs, exceeded the 100-year flood event (Brabets 1997). Van Cleve Lake outburst floods can cause additional increases of 150,000 to 200,000 cfs (Brabets 1997). The median annual flow (2-year flow) on the Copper River is about 220,000 cfs, or 9 cfs per square mile of drainage area. This is a low unit discharge because most of the Copper River watershed lies in the more arid portions of interior Alaska. Although no gauge data exist, the Tasnuna River watershed likely produces median annual floods on the order of approximately 20,000 to 40,000 cfs, or 50 to 100 cfs per square mile of drainage area. These unit discharges are high because most of the watershed lies within high-precipitation glaciated areas of the Chugach Range.

Table 2.3 - Flow statistics for stream gauges in the North Copper-Tasnuna analysis area.

	Copper River at Million Dollar Bridge near Cordova, AK [2]
USGS Station Number	15214000
Latitude	60°40'18"
Longitude	144°44'41"
# of years data	46 (1950-1995)
Drainage area (sq miles)	24,200
Average daily flow (cfs)	57,400
Extreme minimum daily flow (cfs)	4100
Extreme instantaneous peak flow (cfs)	470,000
Average June flow (cfs)	135,370 [3]
Average March flow (cfs)	8,882 [3]
2-year flood (Q_2) (cfs) [1]	220,000
cfs/square mile	9
10-year flood (Q_{10}) (cfs) [1]	300,000
cfs/square mile	12

[1] Flood frequency statistics from Curran et al. (2003), weighted skew.
[2] Includes synthesized data based on flows from Copper River at Chitina (Station # 15212000) (from Brabets, 1997)
[3] Based on data from 1988 to 1995 only (Station #15214000)

Water Quality

Water quality data are very limited in the North Copper – Tasnuna analysis area. Suspended sediment loads on the Copper River at the Million Dollar Bridge average about 69 million tons per year (Brabets 1997), which is more than twice that measured on any other Alaskan river. This is the result of high flows, numerous glacial sources, and the presence of extensive, erodible late-Pleistocene lacustrine deposits in the Copper River basin. The Tasnuna River also carries high sediment loads from the numerous glaciers in the watershed. Because of the remote character and lack of development, water quality in the analysis area is largely unaffected by human activities.

Biological Characteristics

Fish

Physical characteristics influencing fisheries – Aquatic habitats in the river valley bottoms are dominated by large glacial rivers and lakes. These low gradient channels are highly braided, containing gravel and cobble dominated substrates. These channels generally do not provide spawning and rearing habitat for Pacific salmon (*Oncorhynchus spp.*) due to cold temperatures and high sediment loads. Salmon primarily use these channels as migration corridors to reach spawning and rearing habitats in the upper watershed (adults), or to reach the ocean (juveniles). However, some glacial outwash (GO) channel types (USDA FS 1992) on the valley floors can provide excellent spawning and rearing habitats. At low to normal flows these side channels are clear and possess complex pool and riffle habitats.

Most of the river valley bottoms in the analysis area is land owned by Native corporations (Fig 1.2), while the majority of the aquatic habitat in the uplands is National Forest System land. The uplands are dominated by glacial ice and steep terrain and streams that are high gradient contained channels (HC) too steep to provide fish habitat. These channels transport sediment and woody debris to the lower reaches and may create small pockets of salmon spawning and rearing habitats near their junctions with the larger glacial rivers.

Fish species present in the analysis area - Four species of Pacific salmon are present in the analysis area (ADFG 1998). The majority of these fish pass through the area during migrations up and down the Copper River. Species present in the Copper River include pink salmon (*O. gorbuscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*) and Chinook salmon (*O. tshawytscha*). The Tasnuna River watershed does have substantial spawning and rearing habitat for sockeye and coho salmon (ADF&G 1998, USDA FS GIS layer 1998). Salmon spawning and rearing habitat throughout the rest of the analysis area is limited and there may be no salmon habitat present on National Forest System lands (ADFG 1998, USDA FS 2002 GIS layer).

Trout and char species present in the analysis area include Dolly Varden (*Salvelinus malma*), coastal cutthroat trout (*O. clarkii clarkii*), and rainbow trout (*O. mykiss*) (ADFG 1998). Presumably both resident and anadromous forms of these species are believed to occur (Trotter 1997). These fish are known to occur in the Copper River (ADFG 1998), but little is known of their presence throughout the rest of the analysis area.

Eulachon (*Thaleichthys pacificus*) are another ecologically important anadromous species that occur in the lower Copper River but probably do not range above Abercrombie Rapids at the inlet to Miles Lake. They spawn and die in the main channels of the Copper River but probably cannot negotiate the high water velocities associated with the rapids. This species migrates into the river in the spring in large numbers and can be an important source of food for birds and subsistence users.

There are several other non-salmonid species of interest that might occur in the Copper River. Sturgeons have been harvested by the commercial fishing fleet of Cordova (Steve Moffitt, ADFG research biologist, personal communication). The two species of sturgeon that may occur in the Copper River are the green (*Acipenser medirostris*) and white (*Acipenser transmontanus*). A limited number of documented specimens of the green sturgeon have been taken from Southeast Alaskan waters (Mecklenburg et al. 2002). There was one possible occurrence in the Copper River (Evermann and Goldsborough 1907), but the specimen was not verified. White sturgeons are more commonly caught in Alaskan ocean waters. They can move great distances inland to spawn in large rivers, but are not known to spawn in Alaska (Mecklenburg et al. 2002).

American shad (*Alosa sapidissima*) have been caught by commercial fishers at the mouth of the Copper River (D. Lang, USFS Fisheries Biologist, personal observation). It is not known if they travel up the river or into the analysis area. These fish are native to the eastern U.S. coast, were introduced into the Sacramento River in 1871 (Skinner 1962), and have spread throughout the Pacific coast of North America, including Alaska (Page and Burr 1991; Mecklenburg et al. 2002). Most occurrences in Alaska are considered accidental and their presence in freshwater rivers of Alaska have not been documented.

Several whitefish species (*Coregonus spp. and Prosopium spp*.) have been documented in the upper Copper River watershed but it is not known if they are present in the analysis area. Both lake (*C. clupeaformis*) and Alaska (*C. nelsonii*) whitefish have been documented in the Copper River basin. Lake whitefish are believed to be more sedentary and primarily occur in lakes while the Alaska whitefish is thought to be mostly in stream habitats (Mecklenburg et al. 2002). Humpback whitefish (*C. pidschian*) may be in the watershed, but the difficulty distinguishing between the three species makes the current range of these whitefish unknown. A whitefish believed to be one of these three species has been documented on the Copper River Delta in McKinley and Eyak Lakes (USDA Forest Service, Cordova Ranger District, unpublished) and at Martin Lake (Steve Moffitt, ADFG research biologist, personal communication).

Additional freshwater fishes likely present in the area are round whitefish (*Prosopium cylindraceum*), pacific lamprey (*Lampetra tridenttata*), arctic grayling (*Thymallus arcticus*), three-spine stickleback (*Gasterosteus aculeatus*), coast range sculpin (*Cottus aleuticus*), slimy sculpin (*C. cognatus*), and prickly sculpin (*C. aster*). See Koenig (2002) for a more complete description of the species and their distributions in the Copper River, including run timing and life histories. There are no federally listed threatened or endangered fish species in the analysis area; however, coho salmon and Dolly Varden are Management Indicator Species (MIS) and cutthroat trout are listed as a Species of Special Interest (SSI) in the Forest Plan (USDA Forest Service 2002c).

Fish Distribution - The current GIS corporate stream layer for the Chugach National Forest may not include all streams present in the analysis area or contain current information on fish presence and distribution; therefore the true presence and distribution of the key species is likely underestimated. About 32.4 miles of streams are mapped on National Forest System lands in the analysis area and none of these are listed as having fish. The following fish distribution data refers to habitat on other lands in the analysis area. It also includes the main stem of the Copper River that fish use to migrate to the upper watershed.

Coho and sockeye salmon are the most abundant and widely distributed species in the analysis area (Figs 2.7 and 2.10; USDA Forest Service GIS 1998). Coho and sockeye salmon are the dominant species present in all of the watersheds (Fig 2.10), but most of the spawning and rearing habitat is located in the Tasnuna River watershed (ADFG 1998). The Heney Glacier watershed is mainly used by fish migrating up the Copper River. Coho and sockeye salmon are documented in approximately 226 and 218 miles of streams, respectively, in the analysis area.

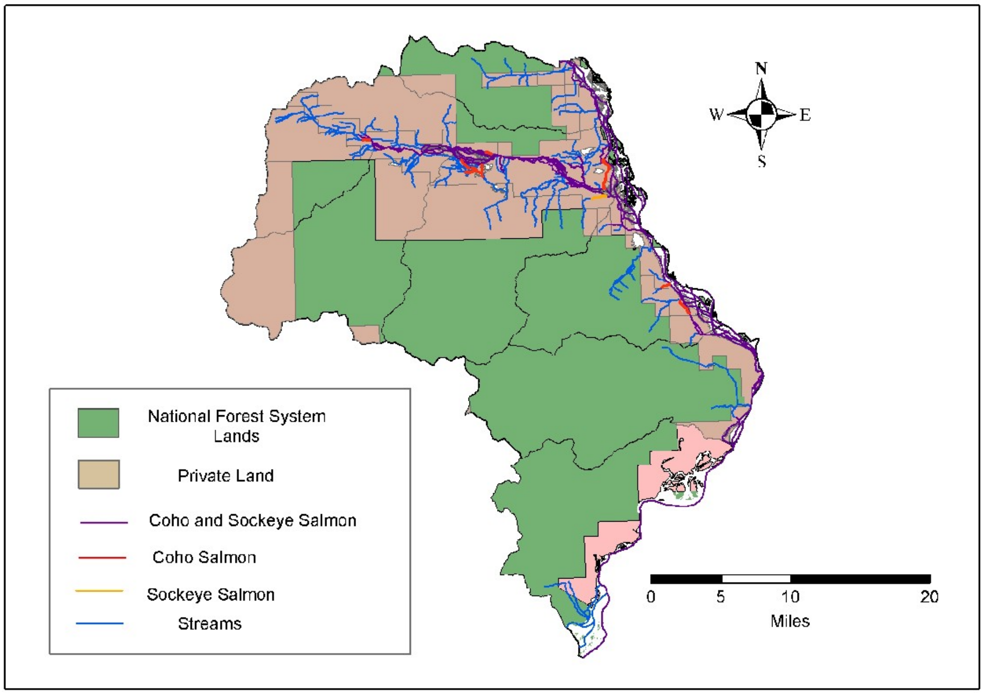


Figure 2.7 - Distribution of coho and sockeye salmon in North Copper-Tasnuna analysis area, based on current GIS corporate stream layer (USDA FS GIS 2002).

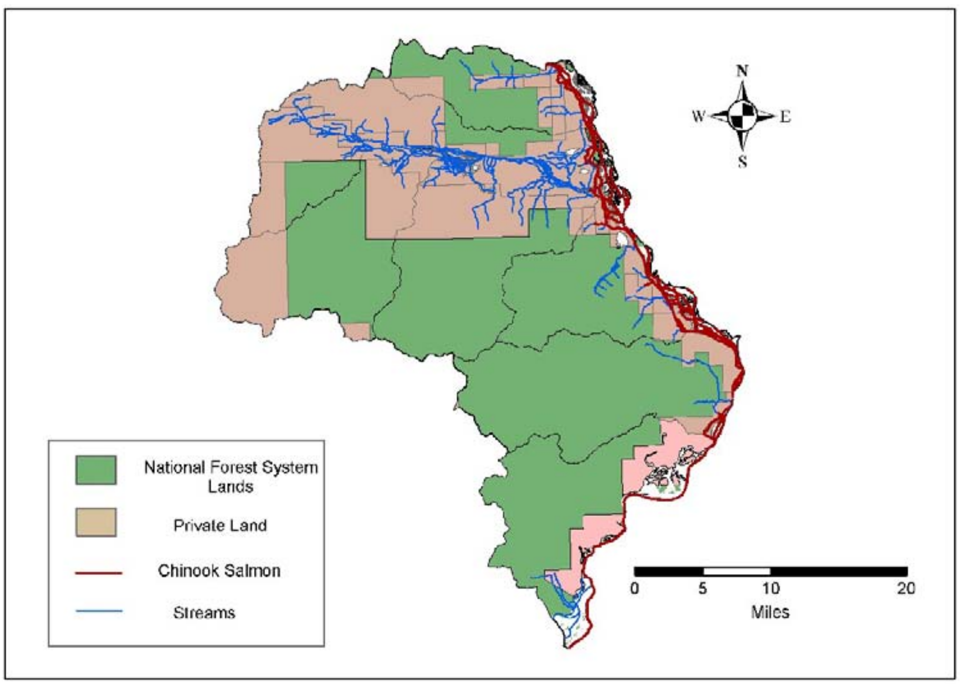


Figure 2.8 - Distribution of Chinook salmon in North Copper-Tasnuna analysis area, based on current GIS corporate stream layer (USDA FS GIS 2002).

Chinook salmon are the third most widely distributed species in the analysis area (Fig 2.8; Fig 2.10). They can be present in approximately 141 miles of streams in the analysis area (USDA Forest Service GIS 1998). Chinook salmon use the Copper River mainly for migration and probably do not use habitats in the analysis area for spawning or rearing (ADFG 1998). Distributions and key spawning habitats have recently been identified in the upper Copper River watershed through radio telemetry studies (Wootig and Evenson 2001). Coastal cutthroat trout and Dolly Varden are present in 138 miles of streams in the analysis area (Fig 2.9; Fig 2.10). They are only documented in the Copper River, but they may be more widely distributed. Little is known about these populations due to small population size and complex life history strategies. These species are probably present in the Tasnuna River watershed.

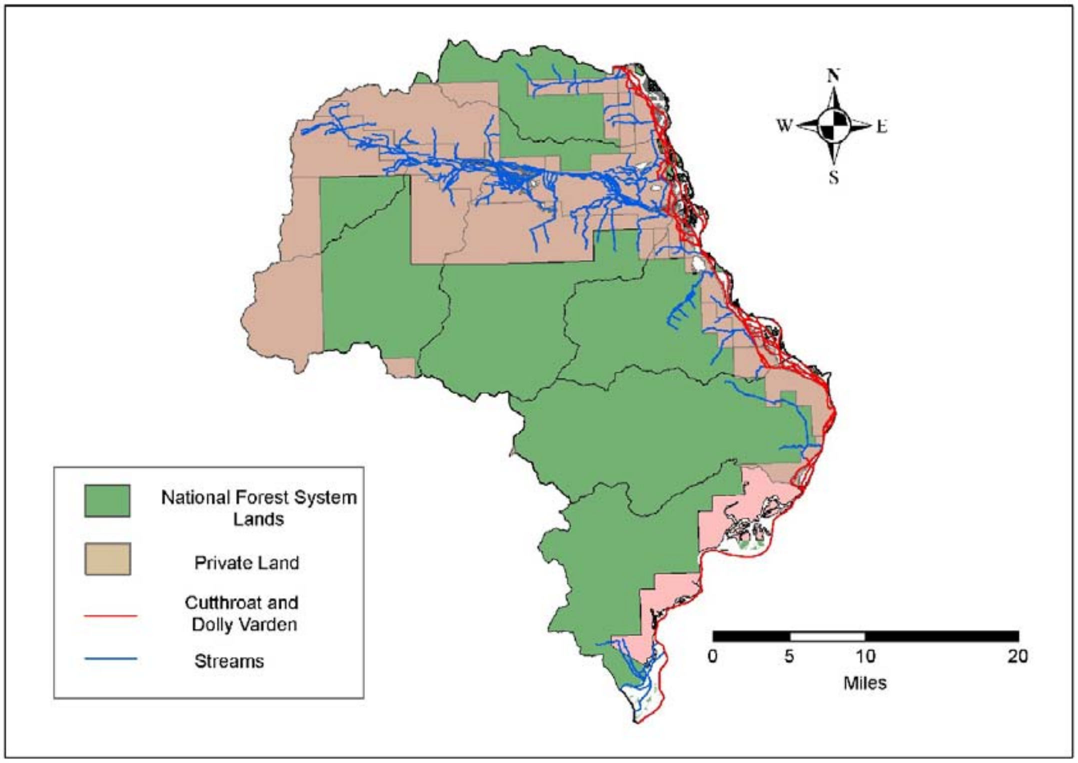
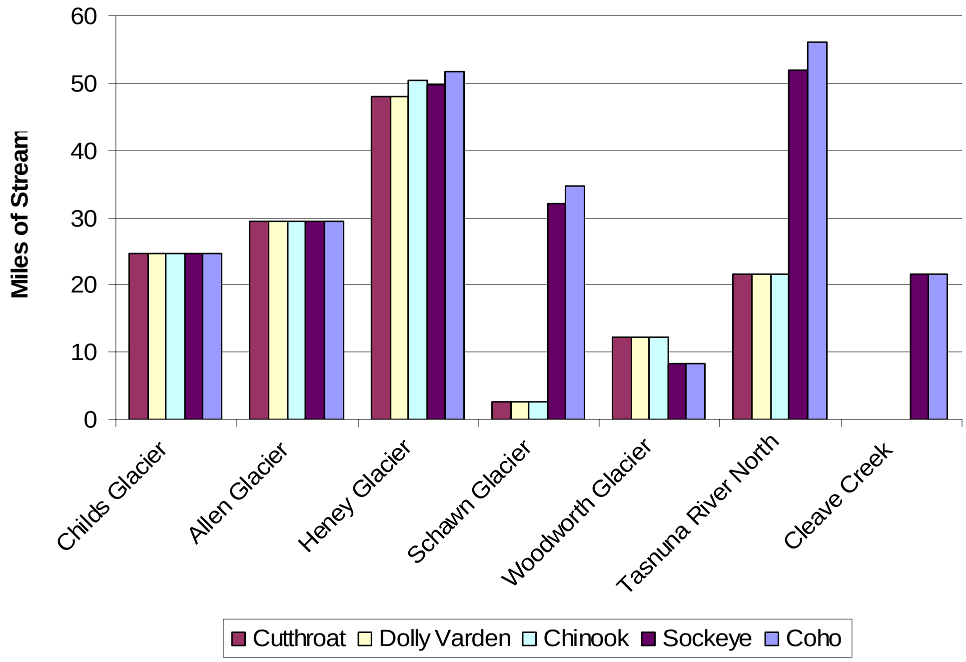


Figure 2.9 - Distribution of cutthroat trout and Dolly Varden in the analysis area based on current GIS corporate stream layer (USDA FS GIS 2002).

Pink salmon are present in only about 32 miles of the lower Copper River in the Childs and Allen Glacier watersheds. Approximately 221 miles of stream in the analysis area have no fish presence documented, 189 miles of which are adjacent to private lands.

(A)



(B)

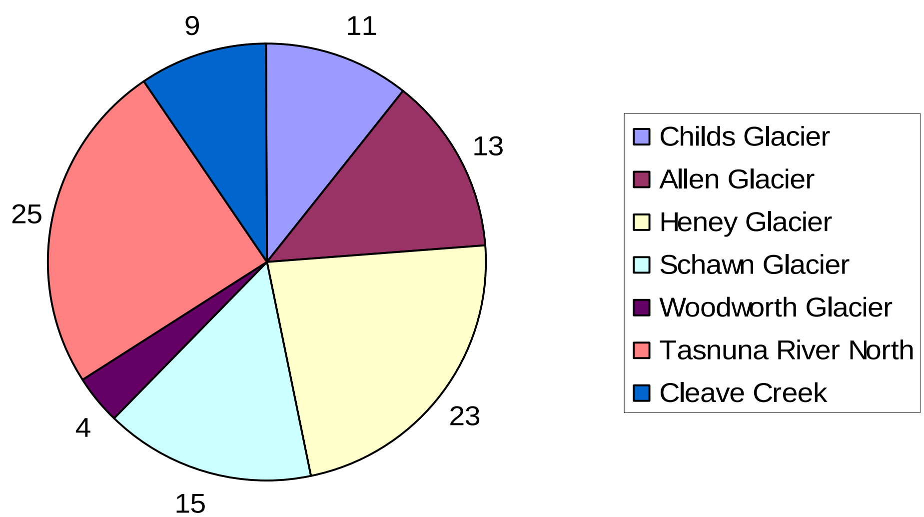


Figure 2.10 - Presence and distribution of selected salmonid species in the analysis area by location based on the GIS corporate stream layer. (A) shows the species presence in miles of stream for each of the watersheds. (B) shows the salmonid presence in each watershed as the percentage of total miles of stream in the analysis area with these species.

Vegetation

Around 14,000 years ago, the glaciers which covered the area began to recede and plants steadily moved in from the south and from glacial refuges in Alaska. Extrapolating from paleoecological evidence (Heusser 1983, Peteet 1986), Sitka spruce[5] and western hemlock forests became established about 3000 years ago.

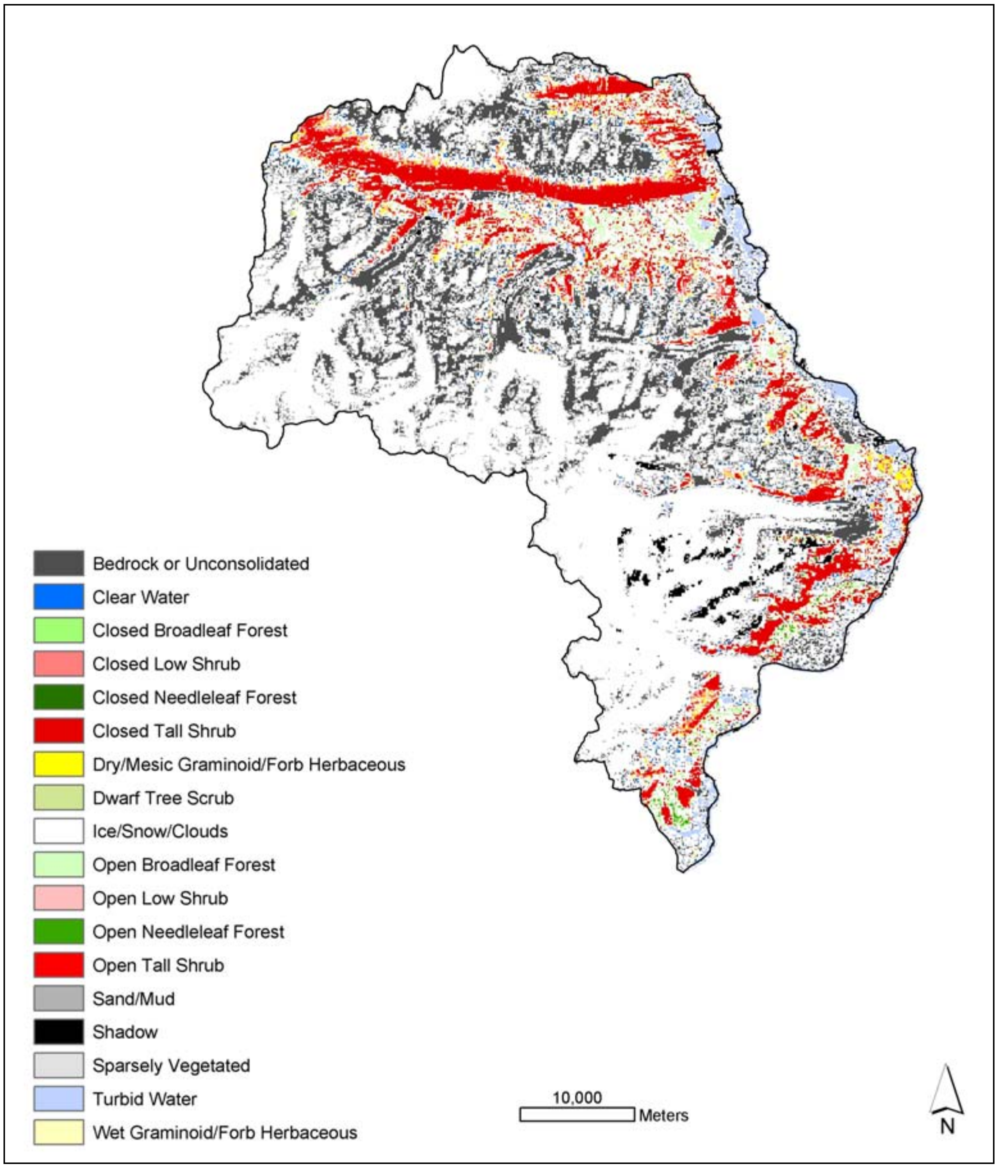


Figure 2.11 - Land cover classes for the North Copper -Tasnuna analysis area (from the classification of Markon and Williams 1996).

Almost 70% of the analysis area is non-vegetated according to a satellite image-based landcover classification (Markon and Williams 1996; Fig 2.11 and Table 2.4). Over half of the vegetated land is dominated by tall shrubs, particularly Sitka alder (*Alnus viridis* ssp. s*inuata)*. Six percent of the area is coded as forested, 16% as shrubland, 4% as herbaceous, 6% as water, and 68% as barren. The dense alder thickets of the Tasnuna drainage have been noted to impede cross country travel.

[5] The scientific names for the species listed are provided in Appendix A, Table A.1.

Table 2.4 – Acreage of each landcover class for the analysis area (from classification of Markon and Williams 1996).		
Landcover Class (the 3 most predominant classes are highlighted in yellow)	**Acres**	**Percent of Area**
Closed Needleleaf Forest	2,014	0.4
Open Needleleaf Forest	7,290	1.4
Closed Broadleaf Forest	0	0
Open Broadleaf Forest	21,290	4.0
Dwarf Tree Shrub	647	0.1
Closed Tall Shrub	64,459	12.0
Open Tall Shrub	304	0.1
Closed Low Shrub	19,521	3.6
Open Low Shrub	629	0.1
Dry/Mesic Graminoid/Forb Herbaceous	5941	1.1
Wet Graminoid/forb Herbaceous	5,941	1.1
Clear Water	220	0.0
Turbid Water	33,000	6.2
Bedrock or Unconsolidated	145,081	27.1
Sand/Mud	432	0.1
Ice/Snow/Clouds	199,690	37.3
Shadow	20,369	3.8
Sparsely Vegetated	753	0.1
Total	535,633	100

Limited vegetation and botanical survey has occurred within the analysis area. None of the 2293 sample plots representing vegetation communities on the Chugach National Forest (DeVelice et al. 1999) occur in the analysis area. Similarly, the Chugach National Forest sensitive plant database includes no records from the analysis area.

Of the 2753 vascular plant specimens from the Chugach National Forest in the University of Alaska Herbarium (ALA) in Fairbanks only 186 (representing 140 taxa) occur within the analysis area (Table A.1, Appendix A). Carolyn Parker of ALA collected 180 of these specimens from August 11-15, 1986. The Forest Inventory and Analysis (FIA) grid across coastal Alaska[6] includes 11 plots within the analysis area. On these plots, 120 vascular plant taxa were recorded (Table A.1, Appendix A). The combined ALA and FIA dataset documents 205 vascular plant taxa in the analysis area. Included in the list are 14 tall shrub species, 21 short shrub species, 16 fern and allies, 121 forb species, and 34 graminoid species. Tree species not listed in the ALA and FIA datasets that definitely occur within the area are *Picea sitchensis* and *Populus balsamifera* ssp. *trichocarpa*. Also, given its dominance in the forests in similar climates to the north, *Picea glauca* likely occurs.

One of the 11 FIA plots classifies as "sparsely vegetated". Based on the DeVelice et al. (1999) classification, the remaining 10 plots classify into the 9 vegetation types listed in Table 2.5. Numerous other vegetation types certainly occur, but sufficient sampling has not occurred to list their classification.

[6] Sampled by the Pacific Northwest Research Station of the USDA Forest Service.

Table 2.5 - The 9 vegetation types (based on DeVelice et al. 1999) represented among the 11 FIA plots within the North Copper–Tasnuna analysis area.

Scientific Name	Common Name
Alnus viridus ssp. *sinuata/Athyrium filix-femina*	Sitka alder/lady fern
Alnus viridus ssp. *sinuata/*undefined	Sitka alder/undefined
Carex macrochaeta	Long-awned sedge
Empetrum nigrum-Vaccinium uliginosum	crowberry-bog blueberry
Epilobium angustifolium	tall fireweed
Harrimanella stellariana-Luetkea pectinata	Steller's cassiope-luetkea
Phyllodoce aleutica-Harrimanella stellariana	Aleutian mountain heath-Steller's cassiope
*Salix barclayi/*undefined	Barclay willow/undefined
Salix reticulata/Festuca altaica	Net leaf willow/rough fescue

Wildlife

This analysis area represents a remote region of the Cordova Ranger District, of which only the southern portion is accessible by the Copper River Highway. The area, especially the Tasnuna River valley, represents the portion of the Cordova Ranger District for which we have the least knowledge of wildlife populations. Wildlife populations are likely more characteristic of interior Alaska than populations on the Copper River Delta.

Elevations range from less than 100 feet at the Copper River near Goodwin Glacier to 8498 feet near Cordova Peak. Likewise, habitat for wildlife varies greatly. About 60% of the analysis area is glaciated or covered with permanent snow and ice, and relatively devoid of wildlife. Winter weather is more characteristic of interior Alaska, as cold interior air drains through the Copper corridor, often at high velocities, producing temperatures much colder than nearby coastal areas.

The natural diversity of the area provides habitat for many species. Wildlife populations reflect the pristine vegetation that is present and the remoteness of the area. All native fauna is intact.

Following is a discussion of species of concern to the United States Fish and Wildlife Service (USFWS), ADFG, or the Forest Service, or have other notable issues surrounding them (i.e. hunting, viewing, etc.). Sensitive Species are those plant and animal species identified by the Regional Forester for which population viability is a concern on National Forest System lands within the region. Federally listed threatened and endangered species are those plant and animal species formally listed by the USFWS under authority of the Endangered Species Act of 1973, as amended. ADFG lists Species of Special Concern as any species or subspecies of fish or wildlife or population of mammal or bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance.

The Final Environmental Impact Statement (FEIS) for the Chugach Forest Plan (USDA Forest Service 2002a) outlines important habitat components and conservation options for selected species of concern in Table 3-39 on page 3-230 and lists management indicator species and species of interest in Table 3-50 on page 3-231.

Birds - Over 219 bird species have been documented within the North Gulf Coast-Prince William Sound Region of Alaska (Isleib and Kessel 1973). No data exists on birds inhabiting the analysis area; however, with the exception of sea birds and many shorebirds, the analysis area likely shares many of the species that have been documented in the North Gulf Coast-Prince William Sound Region.

The conservation of birds is complex due to the migratory nature of many species. Additionally, bird species fall under various management authorities depending on their population trends and game status. Table 2.6 lists the bird species likely to be found in the analysis area that are a concern for the USFWS, USFS, ADFG, or the National Audubon Society (NAS). Following are species or groups of birds meriting special attention in the analysis area. Project specific environmental analyses would address how each of these species is affected by management actions.

Table 2.6 - Bird species likely occurring in the Analysis Area considered having special conservation concerns by the USFWS, USFS, ADFG, or NAS.

Common Name	Latin Name	Occurrence	Abundance	Conservation Concern
Loons and Cormorants				
Red-throated loon	*Gavia stellata*	Breeds, Winters	Common	A[7]
Waterfowl				
Trumpeter swan	*Cygnus buccinator*	Migrant, breeds, winters	Common	A, S[8]
Long-tailed duck	*Clangula hyemalis*	Winters	Uncommon	A
Raptors				
Bald Eagle	*Haliaeetus leucocephalus*	Resident	Abundant	I[9]
Peregrine Falcon	*Falco peregrinus*	Breeds, Migrant	Uncommon	A, C[10], S
Northern goshawk	*Accipiter gentilis*	Breeds, Winters	Common	I
Osprey	*Pandion haliaetus*	Migrant	Uncommon	S
Shorebirds				
Surfbird	*Aphriza virgata*	Migrant	Common	A
Wandering tattler	*Heteroscelus incanus*	Migrant, Breeds	Uncommon	A
Short-billed dowitcher	*Limnodromus griseus*	Migrant, Breeds	Common	A
Flycatchers and Songbirds				
Olive-sided flycatcher	*Contopus cooperi*	Migrant, Breeds	Rare	A, C
Rufous hummingbird	*Selasphorus rufus*	Migrant, Breeds	Common	A
Gray-cheeked thrush	*Catharus minimus*	Breeds	Uncommon	C
Townsend's warbler	*Dendroica townsendi*	Breeds	Common	C, I
Rusty blackbird	*Euphagus carolinus*	Winter, Breeds	Uncommon	A

Trumpeter Swan

The trumpeter swan is an Alaska Region sensitive species. In the 1930s, trumpeter swan populations were severely depleted. The majority of the world's population of trumpeter swans breeds in Alaska. They nest on the Copper River Delta and surrounding wetlands.

[7] A= Audubon Watch List
[8] S = USFS Sensitive Species
[9] I = USFS Species of Interest
[10] C = ADFG Species of Concern

Although no data exists, they are likely to breed on ponds in the Tasnuna River drainage and likely to be found on ponds on the Delta below Goodwin Glacier.

Northern Goshawk

The northern goshawk, the largest North American accipiter, is an Alaska Region species of special interest. It is a forest habitat generalist, breeding in coniferous, deciduous, and mixed forests across its holarctic range (Reynolds et al. 1992). The species is considered a non-migratory resident in the Prince William Sound area and is a fairly common resident of the North Gulf Coast and Prince William Sound (Isleib and Kessel 1973). No goshawk nests are known in the analysis area; however, they likely occur in the appropriate forest habitats.

While goshawks occur in a variety of forest successional stages, it is believed that nesting birds are most commonly associated with mature forests (Crocker-Bedford 1993, Titus et al. 1994, Titus 1996). Preferred habitat during the breeding season is mature and old growth forest with structural characteristics that allow goshawks to maneuver in and below the canopy while foraging and large trees for nesting (Reynolds et al. 1992). In Alaska, goshawks are most often associated with old growth forests (McGowan 1975, Crocker-Bedford 1993, Titus 1996).

Due to concerns about population declines, the northern goshawk is currently a species of management concern for the USFWS. Species of management concern are those species for which there is some evidence of vulnerability but not enough data to consider a listing proposal under the Endangered Species Act of 1973. In general, goshawk population declines may be associated with forest harvest activities and habitat loss associated with roads (Bosakowski and Speiser 1994, Bright-Smith and Mannan 1994).

Bald eagle

The bald eagle is an abundant and conspicuous resident of the North Gulf Coast and Prince William Sound region (Isleib and Kessel 1973). Bald eagles are year-round residents using old growth timber (spruce hemlock, cottonwood) for nest sites, and feeding in streams, lakes, and marine waters. Salmon spawning in streams can concentrate large numbers of eagles. The bald eagle is a species of special interest on the Chugach National Forest. The USFWS and USFS maintain an interagency agreement for bald eagle habitat management in the Alaska Region, which includes standards and guidelines for regulating human disturbance within identified bald eagle use areas. The minimum retention zone is 330 feet around known eagle nest locations. The active bald eagle nesting season is generally from March 1 to August 31. Bald eagles undoubtedly nest and are likely common within the analysis area; however, no data exist.

Osprey

The osprey is an Alaska Region sensitive species. It is an uncommon migrant and rare local breeder in the North Gulf Coast-Prince William Sound region (Isleib and Kessel 1973). It has probably always been uncommon in coastal southcentral Alaska, but is more common in interior Alaska. Therefore, osprey may be more common within the analysis area than in coastal areas.

Peregrine falcon

The Peale's subspecies of peregrine falcon (*F. p. pealei*) is an Alaska Region sensitive species. Other subspecies of the peregrine falcon, which may use the analysis area in migration, appear on the Audubon WatchList or are considered species of concern by ADFG (National Audubon Society 2002). The peregrine falcon is a rare resident of the North Gulf Coast and Prince William Sound region. Most birds in the region appear to be *F. p. pealei*, but some migrants and one winter observation appeared to be the rare *F. p. anatum* (Isleib and Kessel 1973).

During spring migration, peregrines appear most frequently between April 15 and May 5. Twelve to 20 pairs breed along the North Gulf Coast (Isleib and Kessel 1973). Eyries are on or in view of the coast and are generally associated with nesting seabird colonies or waterfowl breeding areas. No data exists for the analysis area.

Rufous Hummingbird

The rufous hummingbird is a National Audubon WatchList species, which means that their populations have shown a declining trend (National Audubon Society 2002). Causes for the declines in its populations are not well known. They are common breeders and migrants in the North Gulf Coast and Prince William Sound region (Isleib and Kessel 1973). This species does not inhabit interior Alaska, and likely becomes less common as one travels up the Copper River. Few data exists from the analysis area, although they are largely restricted to coastal area of southcentral Alaska.

Olive-sided flycatcher

The olive-sided flycatcher is a considered a species of special concern by the ADFG and is on the Audubon WatchList (National Audubon Society 2002). They are considered rare within Prince William Sound (Isleib and Kessel 1973), although they have been seen near Cordova during migration. Olive-sided flycatchers breed in interior Alaska, and likely become more common as one moves up the Copper River.

Townsend's warbler

The Townsend's warbler is a considered a species of special concern by the ADFG and is a species of special interest on the Chugach National Forest. It is a common, migratory breeder throughout southcentral Alaska. They usually arrive from mid-May through early June and leave Alaska in August (Isleib and Kessel 1973). Townsend's warblers likely inhabit spruce-hemlock/alder forest, spruce-hemlock forest, and alder habitats within the analysis area (Lance et al. 1996).

Gray-cheeked Thrush

The Gray-cheeked thrush is a considered a species of special concern by ADFG. Isleib and Kessel (1973) stated that this thrush is a rare migrant and rare local breeder in the Prince William Sound-North Gulf Coast region. Breeding bird survey data show this species to be fairly common north of Mile 30 of the Copper River Highway. Gray-cheeked thrush are likely to be more abundant inland.

Mammals – Much of the North Copper -Tasnuna analysis area is covered by glaciers and snowfields, but it also includes forest, alpine tundra, glacial outwash floodplains, and a small portion of the Copper River Delta. No comprehensive mammal list for the analysis area exists. Much of the habitat and the associated mammal species are in near pristine condition. Following are species meriting special attention in the analysis area.

Brown bear

Brown bears (*Ursus arctos*) are prevalent throughout the unglaciated portions of the North Copper River/Tasnuna analysis area; however no data exists on brown bear densities. In the spring, avalanche paths and tidal grass flats are important sources of herbaceous vegetation. Bears use berry patches during summer, and salmon streams are important to bears during summer and fall. Bears concentrate to fish for salmon in the main Copper River at Abercrombie Rapids and it is likely that other salmon streams important to bears are present throughout the analysis area as well. Many brown bears den in subalpine habitats along the Copper River (Bob Tobey, ADFG, pers. comm.).

The Forest Plan recommends that within a 750-foot brown bear management zone around bear feeding areas or between areas used by brown bears and areas used by humans, new road construction and vegetation management not intended to maintain or improve brown bear habitat is not allowed.

In the past, there were plans to develop a bear viewing site on private property at Abercrombie Rapids.

Moose

Moose (*Alces alces*) are an important big game species throughout Alaska, and although they were introduced to the Copper River Delta, they possibly inhabited the northern portion of the analysis area historically. Although a small population of moose inhabits the Tasnuna valley, little is known of their population status or harvest history. Moose inhabit the very southern end of the analysis area near Goodwin Glacier. Moose on the Copper River Delta are important to locals and visitors for viewing as well as for subsistence and hunting.

Mountain goat

The mountain goat (*Oreamnos americanus*) is a Management Indicator Species for the Chugach National Forest. The Cordova Ranger District contains vast areas of mountain goat habitat. Mountain goats are important to the local communities around the Chugach for sport harvest, subsistence harvest and wildlife viewing. Some of the areas that goats inhabit are important to both residents of Alaska and visitors for outdoor recreation. Under the revised Forest Plan, many of these areas are open to winter motorized access and summer use by helicopters. With increased interest in outdoor recreation in Alaska, an increased number of requests can be expected for commercial motorized operations in areas that have formerly seen little use. Recently a commercial helicopter skiing permit was granted for the remote area around the Tasnuna River valley. With this increase in motorized traffic, the potential for human disturbance of mountain goats can increase.

Winter is a period of severe nutritional deprivation and food scarcity for mountain goats (Fox et al. 1989). Quantity and quality of winter habitat are the most limiting factors for mountain goats in Southcentral Alaska (Suring et al. 1988). Mountain goats are sensitive to disturbance (Chadwick 1973) and when disturbed on a regular basis, they become highly stressed and can abandon ranges. Research conducted just south of the analysis area on the Chugach National Forest determined that the probability of any mountain goat in a group being disturbed by a helicopter was 62% at 1640 feet and 45% at 3280 feet (Goldstein et al. 2005). If managers wish to disturb goats less than 25% of the time when permitting helicopter traffic, then helicopter approach distance should be at least 4048 feet (Goldstein et al. 2005). Physiological responses to disturbance include elevated heart rate and metabolism. Continued disturbance may lead to poor physical condition during the kidding season from mid-May to mid-June.

The National Forest Management Act requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. Part of this process is to determine where and how many individuals occupy a given area and use this information with potential motorized activities to determine the best course of action. The Chugach Forest Plan (p 4-61) states that recreational activities may be seasonally restricted to meet wildlife habitat objectives or to reduce wildlife-human interactions in important habitat areas or movement corridors. However, these important habitat areas and movement corridors have not yet been identified for wintering goats over much of the Cordova Ranger District.

As a result of this management direction and the sensitivity of goats to disturbance in winter, the Forest Service began winter surveys in 2002 to identify key mountain goat winter range in areas potentially affected by helicopter skiing. These surveys were designed to cover portions of the District not normally covered by ADFG or USFS mountain goat population surveys. These surveys have continued through 2006 and will cover designated areas on 2 different years. Within the analysis area winter mountain goat activity has been identified on the north side of the Tasnuna River, on the north side of the Heney and Allen Glaciers, and between Childs and Allen Glaciers (Fig 2.12). South aspects and ridgelines near south aspects, sometimes at elevations over 6000 feet, have been identified as winter mountain goat habitat. Accordingly, when issuing permits for helicopter ski activity, the Cordova Ranger District designates specific ski runs that are located away from known winter goat habitat, as identified by these surveys.

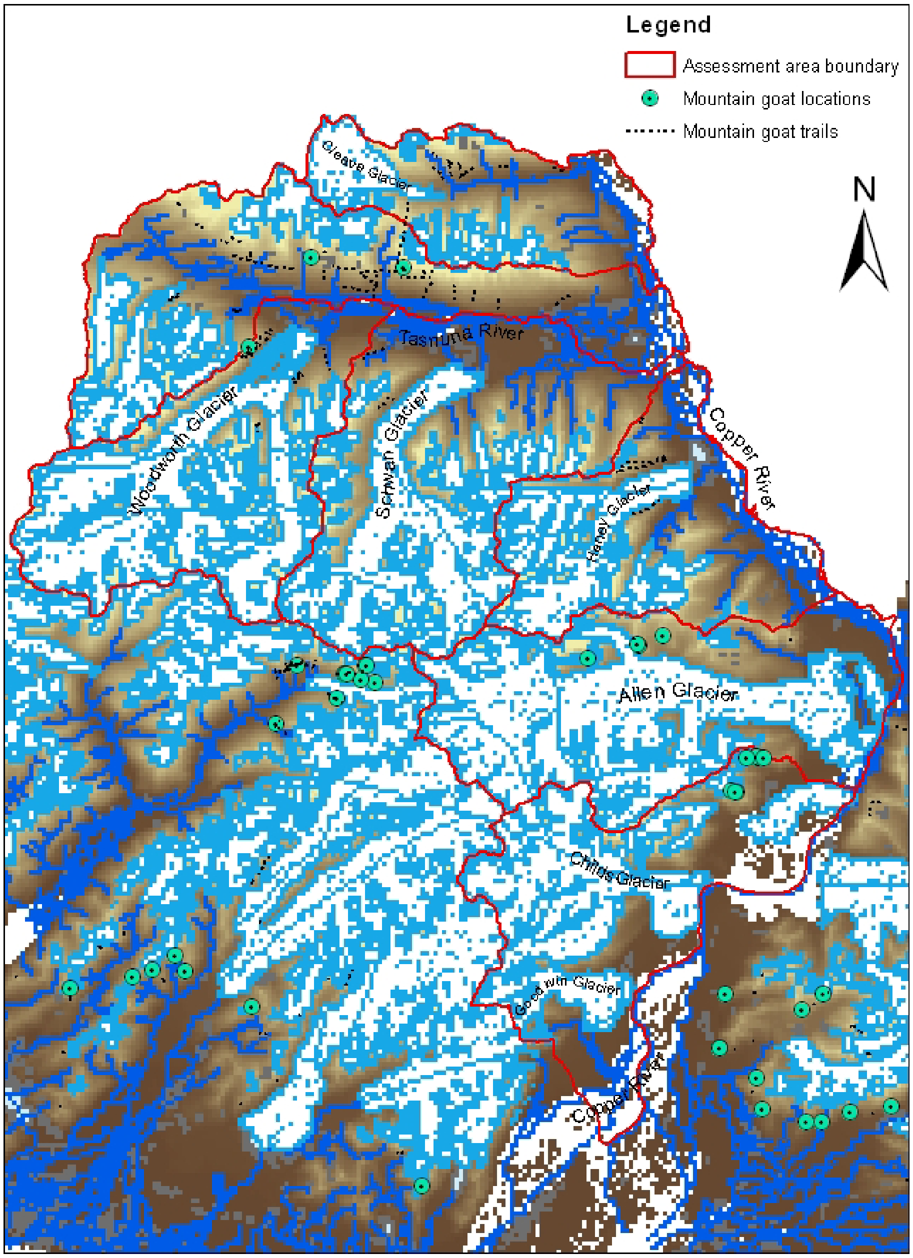


Figure 2.12 - Mountain goat sightings and trails located during winter surveys within the North Copper - Tasnuna River analysis area.

Amphibians - Only 2 amphibians are found in southcentral Alaska. The wood frog (*Rana sylvatica*) and the western toad (*Bufo boreas*) are uncommon residents of the area. Wood frogs inhabit diverse vegetation from grasslands to forest, muskeg, and tundra and are documented on the west Copper River Delta. Western toads are generally found in open, non-forested areas near fresh water. In Prince William Sound, they have been documented on Montague and Hawkins islands and on the mainland as far west as the Columbia Glacier and as far north as the Tasnuna River (MacDonald 2003). Declines in amphibian populations have been documented worldwide; no data exists on the status of amphibians on the Chugach National Forest.

Human Dimension

Human occupation

The Copper River drainage has been used historically as a railroad corridor and also as a potential road corridor and has undergone extensive study in recent years. Native use of the area is also documented in historical accounts and though oral histories and is evidenced by the discovery of native sites and artifacts. Archaeological survey of the area has been conducted in support of 17b easement trails and the potential future use of the area has prompted additional survey and study.

People have been part of the Copper River ecosystem both historically and prehistorically. The lower Copper River around the Pacific coast was the home of the Sugpiaq, or Chugach Eskimo, who included the Pacific coast as far east as Controller Bay in their hunting grounds until the late 1700s A.D. (Birket-Smith 1953:20). Traditionally located in the Malaspina-Yakutat Forelands area, and controlling territory as far east as Dry Bay, the Eyak spoke a language related to Athabaskan, which may be distantly related to Tlingit. The primary Native cultural group which used the Copper River area was the Ahtna. This Athabaskan group lived upriver on the Copper River, but came downriver from time to time to trade copper and caribou products for coastal goods (de Laguna 1990:190).

The Athabaskan Indians of the Tatlatan and Ahtna tribes occupied this area, although their population was dispersed. Trade was evident between the Copper River Indians and the Eyak that lived in the Copper River Delta and also the Sugpiaq.

The first indirect contact between Native Alaskans of the Copper River area and Europeans occurred in 1741, when Vitus Bering’s second Russian expedition reached Kayak Island (Steller 1988). The first direct contact between Eyaks and Russians occurred sometime after Captain James Cook’s contact with the Sugpiaq of Prince William Sound in 1778. Cook recorded landing on Kayak Island on May 12, 1778 and buried a bottle with a paper and two small pieces of silver given to him by Dr. Kaye, chaplain of King George III. The early historic period was characterized by violent clashes between the Eyak and the Russians, the Eyak and the Tlingit, and combined Eyak-Tlingit battles with the Chugach Eskimo (de Laguna 1990:195). In the late 1700s, the Eyak were pushed west by the expanding Tlingit into the Bering River-Controller Bay area. In 1819, after navigating the Copper River, the first Russian expedition established a trading post near what is now Chitina. This post was attacked by the local natives who forced the Russians to withdraw after losing many in battle.

By the early nineteenth century, the Eyak had moved into the Copper River area and the vicinity of what is now Cordova, forcing the Sugpiaq back into Prince William Sound (de Laguna 1990:189). By the end of the nineteenth century, the Eyak territory included the Copper River valley as far north as Childs and Miles Glaciers, the Pacific coast east towards Kayak Island, which was Tlingit territory, and west to Mountain Slough, Point Whitshed, and the edge of Prince William Sound.

For the past two centuries, the Copper River Delta has been home to the Eyak, (Birket-Smith and de Laguna 1938:17-18; de Laguna 1990:189). The Eyak in the Controller Bay area were called the Chilkat Eyak. Their mainland settlements included one at the head of Controller Bay, near the mouth of the Okalee River; a large village at Chilkat, near the mouth of the Bering River, which may have replaced a village upriver, or by Bering Lake; a village at Strawberry Point; Katalla; a village or intermittent settlement at Cape Martin, and Softuk (meaning "Behind the Cockles") Lagoon, northwest of Katalla and east of the mouth of the Martin River (de Laguna 1972:103-105; 1990:190). Settlements on islands in the Controller Bay area may have been seasonal or intermittent camping places, and some may have been Sugpiaq as well as Chilkat Eyak. Seton-Karr described a small settlement, "Kaiak", with houses which appeared to correspond to Sugpiaq -style summer houses. However, it is not clear if these were on Kayak Island, or Wingham Island, which was also known as "Little Kayak" (de Laguna 1972:104-105). These settlements were occupied into the late 19th and early 20th centuries.

Much of the history of, and many of the historic cultural resources in, the landscape area resulted from the initial gold rush to Valdez in 1898-1899. Curious prospectors who were unsuccessful in the interior, or wished to try their luck in other areas, explored the land east of the Copper River, and discovered coal fields near the Bering River, and oil near Katalla. However, the coal-rich lands were temporarily withdrawn from settlement in December 1906 (Janson 1975:110). At the time of the creation of the Chugach National Forest on July 23, 1907, the land east of the Copper River was outside the Forest Reserve. The area between the Copper River, and the current Forest boundary was added on February 23, 1909. One of the reasons given for this extension was wasteful cutting of commercially valuable trees by miners and railroad speculators (Rakestraw 1981:44, 48).

The Guggenheim-Morgan Syndicate decided against a Valdez terminal for their Copper River and Northwestern Railway (CR&NW) to interior Alaska and purchased Michael Heney's "Copper River Railway", on which construction had begun in August 1906 in Cordova. The Syndicate decided to suspend work on the Cordova line and instead, run their standard gauge track from Katalla to the interior of Alaska via the Copper River, with a branch line to the nearby Bering River coal field (Clifford 1981:145). The poor harbor, dangerous sea conditions, and unpredictable weather at Katalla ultimately led the Syndicate to return to the Cordova design (Clifford 1981:146-147). Work began in 1909 on the route east of the Copper River with the completion of bridges between Miles 27 and 34 across the Copper River and continued in 1910 with work on the "Million Dollar" bridge at Mile 47 (Clifford 1981:148-149). This railroad ran until 1938, and its bed became the base for the Copper River Highway in the 1950s. Currently no permanently occupied human residences exist within the analysis area.

Heritage resources

Cultural resources of the analysis area include prehistoric and historic remains and a variety of historic properties and property types that are either on or are eligible for the National Register of Historic Places (NRHP). The area covers lands owned or managed by private entities and the State of Alaska, and lands managed by the State, Chugach Alaska Corporation, and Eyak Corporation. During project analysis, archaeological surveys have been conducted on the Chugach National Forest, as required by Section 106, Part 800 of the National Historic Preservation Act of 1966 (NHPA). However, the entire analysis area has not been inventoried. Most identified cultural resources within the watershed remain formally unevaluated for the NRHP. Maps and charts from the early 1900s show numerous railroads, trails, and associated buildings suggesting that there may be many currently unrecorded historic sites throughout the analysis area.

Although historic Native Alaskan cultural resources are among those known to be present in the analysis area, none of the documented sites have firmly identified prehistoric components. This is, for the most part, likely due to the limited nature of surveys, which have mainly been done in support of projects on National Forest System lands, primarily along the Copper River Highway corridor or for easements and special use permits.

Known and documented remains of railroad ventures are present in the analysis area (Table 2.7). North of the Million Dollar Bridge and Childs Glacier, multiple recorded sites consisting of trestle and coaling station remains from the Copper River and Northwestern Railway are recorded. These are not listed individually due to repetition of description and association. Of these recorded sites, the Million Dollar Bridge is on the NRHP.

Table 2.7 - Native Alaskan and Railroad-related sites.

AHRS #	Site Name	Description	Eligibility
Native Alaskan Sites			
COR-00015	**IKHERKHAMUT (I-QER-QA-MUT)**	Former Eskimo camp or settlement listed in Hodge, F.W. (1907:596), BAE, as...meaning "end of river people." On National Forest System lands	**Not yet evaluated**
Railroad related sites			
COR-00005	**Million Dollar Bridge (Miles Glacier Bridge, Mile 49 Bridge)**	This bridge is a steel truss railroad bridge crossing the Copper River where the Childs and Miles glaciers face each other. Built in 1909-1910, the camelback style truss bridge is 1550' long & 30' high. It consists of 4 spans measuring (from N to S) 400', 300', 450' & 400'. It is built on concrete piers. Detached concrete islands just upstream protect the piers from ice bergs calving off Miles Glacier. In 1958, the bridge was decked & began service as a highway bridge. It was seriously damaged in the 1964 earthquake. The southern end of the north span dropped into the Copper River when the pier supporting it was damaged. The other truss spans were distorted & all of the piers were displaced on their foundations. As a result, a temporary ramp was installed linking the two northern-most spans to facilitate automobile and pedestrian traffic. In 2005 the bridge was repaired by AKDOT. Associated with the Copper River and Northwestern Railway. Also significant as an engineering feat.	On Register 3/31/2000
COR-00398	**Copper River & Northwestern Railway**		unevaluated

Heritage resources are inventoried under Section 106 of the NHPA in project areas proposed by the Forest Service. Other inventories of cultural resources on National Forest System lands outside identified project areas fall under Section 110 of the NHPA. Currently inventoried historic properties are documented with the State Historic Preservation Office.

Socio-economic

The management of resources and environmental conditions in the analysis area may affect the social and economic well being of people living in Cordova, Chitina, Copper Center, Valdez, and other forest users. The affected borough/census areas are described in the Final Environmental Impact Statement for the Forest Plan in Chapter 3, pages 3-508 to 570

(USDA FS 2002a), and includes the Valdez-Cordova Census Area. The Valdez-Cordova census area contains about 1% of the state's population and has a population density of 0.3 persons per square mile of the area as a whole, due to the large amount of federal land and the lack of road access to communities within the census area (Crone et al. 2002). This census area experienced population declines during the recession of the mid-1980s and had a slower recovery than the Anchorage or Kenai Peninsula census areas (Crone et al. 2002). Anchorage residents may use the area for a variety of recreational activities as river rafting and fishing in the upper Copper River.

Cordova, Chitina, Copper Center, and Valdez residents may use localized areas for a variety of economic, recreation and subsistence purposes. In general, the smaller communities in the Copper River Basin depend to some degree on resources from the forest and riverine environment for employment, recreation, and subsistence. Lifestyles are characterized by remote living conditions, seasonal and cyclical employment opportunities, and escape from the problems of crime, crowding, noise, and pollution often associated with urban environments. Table 2.8 displays the vital statistics for these communities, along with the statistics for the State of Alaska and the Nation as a whole, based on the 2000 US Census Bureau information.

Table 2.8 - Census Year 2000 Vital Statistics for nearby communities.

	Cordova	Chitina	Copper Center	Valdez	Alaska (Nation)
Population	2,454	123	362	4,036	626,932 (281,421,906)
1990-2000 Pct population change	+16.3*	+167	-15.0	-0.8	14.0 (13.2)
Population density (persons/mi^2)	40.0	1.45	26.4	18.2	1.1 (94.7)
Size –miles^2	61	84.64	13.73	222	671,951 (3,536,338)
Demographics:					
Male : Female Ratio	1.2	1.1	1.1	1.1	1.1 (1.1)
Mean Age	34.0	39.3	31	32.1	29.3 (35.3)
Pct Am. Indian-Alaska Native	11.1	33.3	46.7	7.5	16.5 (0.9)
Pct 4-year College Educated	21.4	17.6	14.5	21.9	24.7 (24.4)
Households:					
Pct Same house as 5 years Ago	58.0	15.1	56.4	45.1	46.2 (54.1)
Pct Family Households	62.4	57.7	66.7	69.8	68.7 (68.1)
Pct Owner Occupied Households	52.3	59.6	73.5	64.9	62.5 (66.2)
Median Household Income	$50,114	$26,000	$32,118	$66,532	$51,571
Pct Families below poverty level	4.3	3.3	18.5	5.0	6.7 (9.2)
Employment and Income:					
Pct Civilian Labor Force Unemployed	4.6	50	13.9	4.5	6.1 (3.7)
Pct with Private Wages/Salary	52.9	57.1	62.2	70.1	64.9 (78.5)

Table 2.8 - Census Year 2000 Vital Statistics for nearby communities.

	Cordova	Chitina	Copper Center	Valdez	Alaska (Nation)
Pct Government	28.7	31.4	31.1	21.8	26.8 (14.6)
Pct Self-employed	17.6		6.7	8.0	8.0 (6.6)
Pct Unpaid family worker	0.9	~	~	0.1	0.3 (0.3)
Pct Employed in Agri.Forest/Fishing/ Mining Sector	14.1	~	~	5.4	4.9 (1.9)
Pct Employed in Arts/Enter / Accomm/Food Services	6.3	~	14.4	18.9	8.6 (7.9)
Pct income w/retirement, change from 1990	+4.9 (8.1 - 13.1)	+17.3 (0-17.3)	-17.2 (29.3-17.5)	+1.1 (10.9-11.9)	1.9 (1.1) 12.8->14.7 (15.6-16.7)

* Cordova city limits expanded from 5 mi^2 to 61 mi^2

Cordova – The home rule city of Cordova is located 62 air miles southeast of Valdez on Orca Inlet in eastern Prince William Sound on the mainland. No roads connect Cordova with the rest of Alaska; however it is accessible by the state ferry system and commercial jet service. A new fast ferry provides daily service between Whittier, Valdez, Tatitlek, Chenega, and Cordova.

Cordova’s population has been relatively stable. The 2000 census estimated 2454 people lived in Cordova. It has a significant Eyak Athabascan population with an active Village council. Commercial fishing and subsistence are central to the community’s culture. Residents of Cordova rely heavily on the adjacent land and marine environment for recreational activities such as boating, camping, sightseeing, and subsistence harvest of a large variety of species.

The principal economic sector for Cordova is commercial fishing and seafood processing due to its proximity to prime fishing grounds which supports a large fishing fleet and several fish processing plants. In the past, over 50% of the community’s employment was directly related to commercial fish harvesting and seafood processing. Today, the community is more diverse; other sectors of the economy include transportation, communication and utilities, construction, retail trade and services, and local, state, and federal government. Nearly half of all households have someone working in commercial harvesting or processing and 343 residents hold commercial fishing permits. Red salmon, pink salmon, silver salmon, king salmon, herring, halibut, bottom fish, and other fish are harvested. Reduced salmon prices have affected the economy. The harbor accommodates 850 vessels.

Chitina – The village of Chitina, population 123, is located at Mile 34 of the Edgerton Highway, 53 miles southeast of Copper Center and 66 miles southeast of Glennallen on the west bank of the Copper River at its confluence with the Chitina River. Most residents of this village, which is half Alaska Native, engage in subsistence activities year-round. During the summer, dipnetting for salmon on the Copper River brings a large number of Alaskans from Fairbanks and Anchorage and other areas of the state. Gardening, berry picking, herb gathering, and other "wildcrafting" are popular pursuits, as are various arts and crafts. Winter activities include trapping, snowmachining, dog mushing, skiing, and ice fishing.

Employment is primarily with the village council, the Ahtna village corporation, Prince William Sound Community College, state fish & game and highway maintenance offices, and the National Park Service. Many residents are self-employed or work in retail establishments. The summer influx of fishermen, tourists and campers provides some cash income in fish guiding and other services.

Athabaskan Indians have occupied this region for 5,000 to 7,000 years. Chitina was historically a large Native village whose population was slowly decimated by the influx of people, disease, and conflicts. Rich copper deposits were discovered at the turn of the century along the northern flanks of the Chitina River valley, bringing a rush of prospectors and homesteaders. The Copper River & Northwestern Railway enabled Chitina to develop into a thriving community by 1914, with a general store, clothing store, meat market, stables, a tinsmith, five hotels, rooming houses, a pool hall, bars, restaurants, dance halls, and a movie theater. Almost all of Chitina was owned by Otto Adrian Nelson, a surveying engineer for the Kennecott Mines, which supplied electric power to all structures with a unique hydroelectric system. After the mines closed in 1938, support activities moved to the Glennallen area, and Chitina became a virtual ghost town with only the Natives and a few non-Natives staying on. In 1963, the Nelson estate was purchased by "Mudhole" Smith, a pioneer Bush pilot, who sold off the town site and buildings.

Copper Center - Copper Center, population of 362, is located along the Richardson Highway between Mileposts 100 and 105. It is on the west bank of the Copper River at the confluence of the Klutina River. It lies just west of Wrangell-St. Elias National Park Headquarters. Copper Center has long, cold winters and relatively warm summers. Temperature extremes have been recorded from -74^{o} to 96^{o}F. Snowfall averages 39 inches, with total precipitation of 9 inches per year.

The economy is based on local services and businesses, the National Park offices, and highway-related tourism. Several RV parks and river boat charter services operate from Copper Center. Many Native residents depend on subsistence hunting, fishing, trapping and gathering. Eight residents hold commercial fishing permits.

The Richardson Highway connects Copper Center to Anchorage (via the Glenn Highway), Fairbanks and Outside year-round. A state-owned 2,500-foot gravel airstrip provides for chartered flights and general aviation. A federally recognized tribe is located in the community, Native Village of Kluti-Kaah. Half of the population is Alaska Native or part Native. Athabascan Indians represent the primary Alaska Native group. There are two distinct settlements, a Native village and a non-Native settlement.

The Ahtna people have occupied the Copper River basin for 5000 to 7000 years. They had summer fish camps at every bend in the river and winter villages throughout the region. Copper Center was a large Ahtna Athabascan village at one time. In 1896, Ringwald Blix built Blix Roadhouse, which was highly regarded for its outstanding services. The Trail of '98 from Valdez joined with the Eagle Trail to Forty Mile and Dawson. Three hundred destitute miners spent the winter here, and many died of scurvy.

Copper Center became the principal supply center for miners in the Nelchina-Susitna region. A telegraph station and post office were established in 1901. A school was constructed in 1905, which brought a number of Native families to Copper Center. In 1909, the settlement was designated a government agricultural experiment station. In 1932, the original roadhouse was destroyed in order to build the Copper Center Lodge. This lodge is on the National Register of Historic Roadhouses and is now considered the jewel of Alaskan roadhouses. In the late 1930s and early 1940s, construction of the Richardson and Glenn highways made the region more accessible.

The first church in the Copper River region, the Chapel on the Hill, was built here in 1942 by Vince Joy and U.S. Army volunteers stationed in the area. Joy built other churches and a Bible college in the area over the years.

Valdez – The home rule city of Valdez, population 4036, is located on the north shore of Port Valdez, a deep water fjord in Prince William Sound. It lies 305 road miles east of Anchorage and 364 miles south of Fairbanks. The state ferry, commercial and chartered aircraft, boats, and a highway provide access to Valdez. During the 1964 earthquake, a slide of unstable submerged land destroyed the original city waterfront killing several residents. The community was rebuilt on a more stable bedrock foundation 4 miles to the west. It is the southern terminus of the Trans-Alaska oil pipeline. As a result of significant oil taxation revenues, the City offers a variety of quality public services. Valdez has one of the highest municipal tax bases in Alaska due to the oil terminus. Four of the top ten employers in Valdez are directly connected to the oil terminus. Valdez is a major seaport with a $48 million cargo and container facility. City, state, and federal agencies combined provide significant employment. Seasonal commercial fishing and tourism have spurred the retail and service sectors; 42 residents have commercial fishing permits. In 2002, 27 cruise ships docked in Valdez. It has 3 fish processing plants and a small harbor for 546 vessels.

Subsistence

Subsistence plays a major role in the lives of people who live near the analysis area. Ninety-four to 100% of households in Cordova, Chitina, Copper Center, and Valdez use subsistence resources (Table 2.9). While fish plays a major role as food for coastal Alaskan residents, other wildlife, namely large mammals, play an important role as well. These resources are harvested under numerous and sometimes confusing harvest seasons, managed by various jurisdictions including ADFG sport harvest, ADFG subsistence harvest, federal subsistence harvest managed by the USFWS Office of Subsistence Management (OSM), and the National Marine Fisheries Service management of subsistence halibut fishery.

Communities were extensively surveyed between 1985 and 1988 and again between 1990 and 1997 (communities were surveyed in different years). The ADFG Subsistence Division collected information on historic and current use patterns, harvest areas, species used, pounds of resources collected and consumed and harvest methods. Table 2.9 displays the summary of use of subsistence resources by community. Information is from the ADFG Community Profile Database (Brown et al. 2001). Information collected in 1997 (Table 2.9), indicates that Chitina's per capita use was 342.4 pounds, Cordova's per capita use was 179.4 lbs., Copper Center's per capital use was 174.3 lbs. and the Valdez per capita use was 103 pounds.

Table 2.9 - Summary of use of subsistence resources by nearby communities

All resources	Copper Center 1987	Cordova 1997	Chitina 1987	Valdez 1992
% household using	100	97.6	94.4	97
% households harvesting	100	89.7	88.9	83
% households receiving	93	88.2	72.2	86
% households giving	44	78.7	50	68
Estimated pounds	85,895	449,841	11,925	386,078
Per capita pounds	174.34	179.4	342.38	103
Fish (both salmon and non salmon)				
% household using	90.6	93.7	94.4	95
% households harvesting	78.1	75.1	77.8	77
% households receiving	72.9	80.6	50	72
% households giving	29.9	68.4	33.3	62
Estimated pounds	54,323	263,712	9,239	286,399
Per capita pounds	110.26	105.2	265.26	77
Land Mammals (both large and small)				
% household using	82.8	79.0	66.7	62
% households harvesting	58.0	52.2	50.0	23
% households receiving	57.9	62.0	22.2	51
% households giving	11.5	47.8	11.1	16
Estimated pounds	28,743	136,612	2,115	71,227
Per capita pounds	58.34	54.5	60.72	19
Marine Mammals				
% household using	0	11.0	0	2
% households harvesting	0	5.1	0	0
% households receiving	0	7.1	0	2
% households giving	0	6.7	0	0
Estimated pounds	0	9,114	0	0
Per capita pounds	0	3.6	0	0
Birds and Eggs				
% household using	42.5	42.3	33.3	30
% households harvesting	34.0	30.4	33.3	26
% households receiving	10.1	18.2	0	6
% households giving	15.6	9.9	5.6	5
Estimated pounds	711	5,593	61	5,273
Per capita pounds	1.44	2.2	1.75	1
Marine Invertebrates				
% household using	7.8	51.7	0	49
% households harvesting	6.3	29.2	0	20
% households receiving	3.1	47.4	0	41
% households giving	4.7	27.6	0	14
Estimated pounds	207	13,844	0	11,915
Per capita pounds	0.42	5.5	0	3
Vegetation				
% household using	87.7	87.0	88.9	66
% households harvesting	87.7	85.4	83.3	60
% households receiving	35.1	42.7	16.7	31
% households giving	6.3	44.3	33.3	27
Estimated pounds	1,911	20,966	509	11,264
Per capita pounds	3.88	8.4	14.6	3.0

Subsistence fishing

Subsistence fishing in the North Copper - Tasnuna analysis area is minimal at this time. There are no permanent residents in this area. Some seasonal fisheries research camps and a few tourist rafting operations use this area in the summer months. In the fall and winter, an occasional big game hunter and a few snow machine riders use this area.

Neither the state nor the federal subsistence programs allow for the subsistence harvest of salmon from the Copper River or its tributaries below Haley Creek. All of the rivers and streams in this analysis area drain to the Copper River, therefore subsistence salmon harvest does not occur. The subsistence harvest of other fish species is allowed in the Copper River and its tributaries. Fish are available in many of the streams in this analysis area, but because of the remote location, few if any people use the area to harvest fish for subsistence. The portion of the Copper River below Childs Glacier is the most accessible part of this analysis area and the section of river near the 37-Mile bridge is occasionally used to harvest eulachon in late spring. There is a possibility of some sport harvest of salmon or trout occurring by people temporarily in the area, but there has not been any reported harvest of fish for subsistence use other than eulachon.

Future subsistence harvest of fish in this analysis area is expected to remain very low because of the remote location and poor access. Subsistence activity could increase in this area in the future if a road is built between Cordova and the Richardson Highway.

A customary and traditional finding of trout, char, whitefish, grayling, and burbot for Prince William Sound residents was made by the federal subsistence board in 2006. A similar finding had already been made for salmon. These findings restrict the harvest of these fish for subsistence to the qualified rural residents of Prince William Sound. Rural users not living in Prince William Sound cannot participate in the federal subsistence fishery in this area for these species.

The ability of these fish stocks to meet subsistence needs is unknown. Little or no data is available on population sizes, ranges or habitat carrying capacities. Fish population studies are needed to determine the exploitation rate that could take place and still maintain a sustainable harvest. However, since no subsistence fishing activity occurs in this area at this time and no subsistence activity is expected in the future, there does not seem to be any threat to the resource.

Sport and subsistence hunting

Moose season in Game Management Unit (GMU) 13 runs from September 1 through 20 and is open to bulls with spikes, forked antlers, or antlers over 50 inches wide, or antlers with 4 or more brow tines. Non-residents may not hunt moose in GMU 13. Moose inhabit the very southern end of the analysis area near Goodwin Glacier. This area falls within GMU 6C. This portion of the unit is relatively remote, not road accessible, and is probably not hunted. Moose are highly valued by the local community as a food source. In 2002, 683 local residents applied for the 20 subsistence moose permits.

There is no closed season for brown bear hunting in GMU 13D (most of the analysis area) and one brown bear may be taken every regulatory year. A small portion of the analysis area falls within GMU 6 which allows brown bears to be harvested from September 1 through May 31.

Hunting for mountain goats is allowed by State permit from August 10th – September 20th. There is no federal subsistence hunt for mountain goats in GMU 13D.

Timber harvest

There has been no commercial timber harvest in the analysis area. Trees may have been cut during the construction of the Northwestern and Copper River railroad in the 1900s.

Roads and access

There are no federal, state or forest roads in the analysis area. The Million Dollar Bridge underwent major reconstruction in 2004 and 2005. The span damaged in the 1964 earthquake was lifted and repaired. The bridge can now be crossed by vehicular traffic and the gravel road is passable for about 2 more miles to Grinnell Creek.

An easement to continue the Copper River Highway or a trail north to Chitina through mostly Native Corporation lands parallels the eastern border of the analysis area. Currently, there are no plans to continue the road or create a trail through the analysis area. There has long been political and economic interest in connecting Cordova to the southcentral Alaska Highway System with a road through the Copper River corridor. The Alaska Department of Transportation (DOT) initiated work on an Environmental Impact Statement (EIS) on the construction of a road in the early 1990s. The proposed alternatives included 3 possible routes: 1) from Chitna straight down the Copper River; 2) from the Richardson Highway down the Tiekel River valley; and 3) from the Richardson Highway down the Tasnuna River valley, which is in the analysis area.

The social, economic, and environmental effects of this road on Cordova and the natural resources of the Copper River created great controversy within the local community and the State. In 2000, the DOT announced that the EIS would not be completed, for this project (Federal Register 2000), and as of 2006, they have not attempted to resume the analysis for this project. Considering the amount of time needed for this process with such a controversial issue, it appears that road construction through the Copper River corridor will not likely occur within the next 10 years. Also the paving of the existing Copper River Highway has been dropped for the near future due to lack of funding (Dave Sanchez, Alaska DOT, personal communication). However, the discussion concerning this project will persist and if the political, social, and economic conditions change quickly in Cordova, DOT may resume work on the EIS to move the project forward again.

Recreation Use and Facilities

The North Copper – Tasnuna analysis area is generally undeveloped, has high scenic value, and provides the opportunity for recreation in a primitive and remote setting with plenty of solitude. Recreational development is limited to a combination of Class 1 & 3 easement trails (Fig 2.13). These trails and the natural features of the analysis area provide a variety of recreation activities including; hiking, hunting, wildlife viewing, glacier viewing, fishing, camping, sight seeing, and riding snow machines and OHVs. No Forest Service public recreation cabins are present in the analysis area.

Childs Glacier Trail is located approximately ¼ mile north of the Million Dollar Bridge. The trail is about 1.4 miles long and is an easement through Eyak Village Corporation lands. It was constructed by force account crews during the summer months of 2000 and 2001 and was designed to be maintained at the Class III level. Beaver activity has flooded approximately 1200 to 1500 feet of trail. At a minimum, hip boots are needed to traverse the flooded section. Current recreation use of the trail is low but expected to be moderate when the flooding problem is corrected. Currently, no decision has been made on whether to relocate or re-design the trail. The trail not only offers the opportunity for viewing scenery and wildlife but also provides the opportunity for extensive glacier trekking because it accesses Childs Glacier.

CNI and ANCSA 17(b) Easements

With the passage of ANCSA in 1971, the Forest Service and other federal agencies in Alaska were to establish trail, site and road easements across the new private land holdings in order to provide access to isolated parcels of public land. These site and trail easements are commonly referred to as 17(b) easements, a reference to section 17(b) of ANCSA. The federal agencies administer the 17(b) easements within their jurisdiction, and the BLM is responsible for the recording, final platting, and rule making. Trail and site easements are not recreational trails and sites. Trails are intended only for accessing public lands; they may not be used as hiking trails or for any other purposes unless authorized by the landowner. Similarly, sites may not be used for recreational purposes but may be used for day use or overnight camping if the user either intends to access public lands from the site and trail easement or is using a site for day use or overnight camping if it is adjacent to navigable waters.

The 1982 Settlement Agreement between Chugach Natives Inc. (CNI), now Chugach Alaska Corporation (CAC), and the Chugach National Forest established streamside, site, and trail easements similar to 17(b) easements for access across private lands, except that these easements were specifically for recreation purposes. Access beyond the trail corridor is not allowed without a corporation permit. These easements are commonly referred to as CNI easements.

The specific uses allowed on both CNI and 17(b) easements depend on the easement type. On 25-foot right of way trails, travel by foot, dogsleds, animals, snowmobiles, two and three-wheeled vehicles, and small OHVs less than 3,000 lbs gross weight is allowed. On one-acre sites, vehicle parking (e.g. aircraft, boats, OHVs, snowmobiles, cars, or trucks), temporary camping, loading or unloading shall be limited to 24 hours. On 60-foot road easements, travel by foot, dogsleds, animals, snowmobiles, small and large OHVs, four-wheel drive vehicles, automobiles and trucks is allowed. Streamside easements comprise the area of land constituting the bed and banks and area 50 feet upland of Ordinary High Water mark on both sides of the steam unless otherwise designated by agreement. These are all commonly used by boating, rafting, and kayak groups on the Copper River. Any changes to the legal reserved locations require consultation with the Native Corporation.

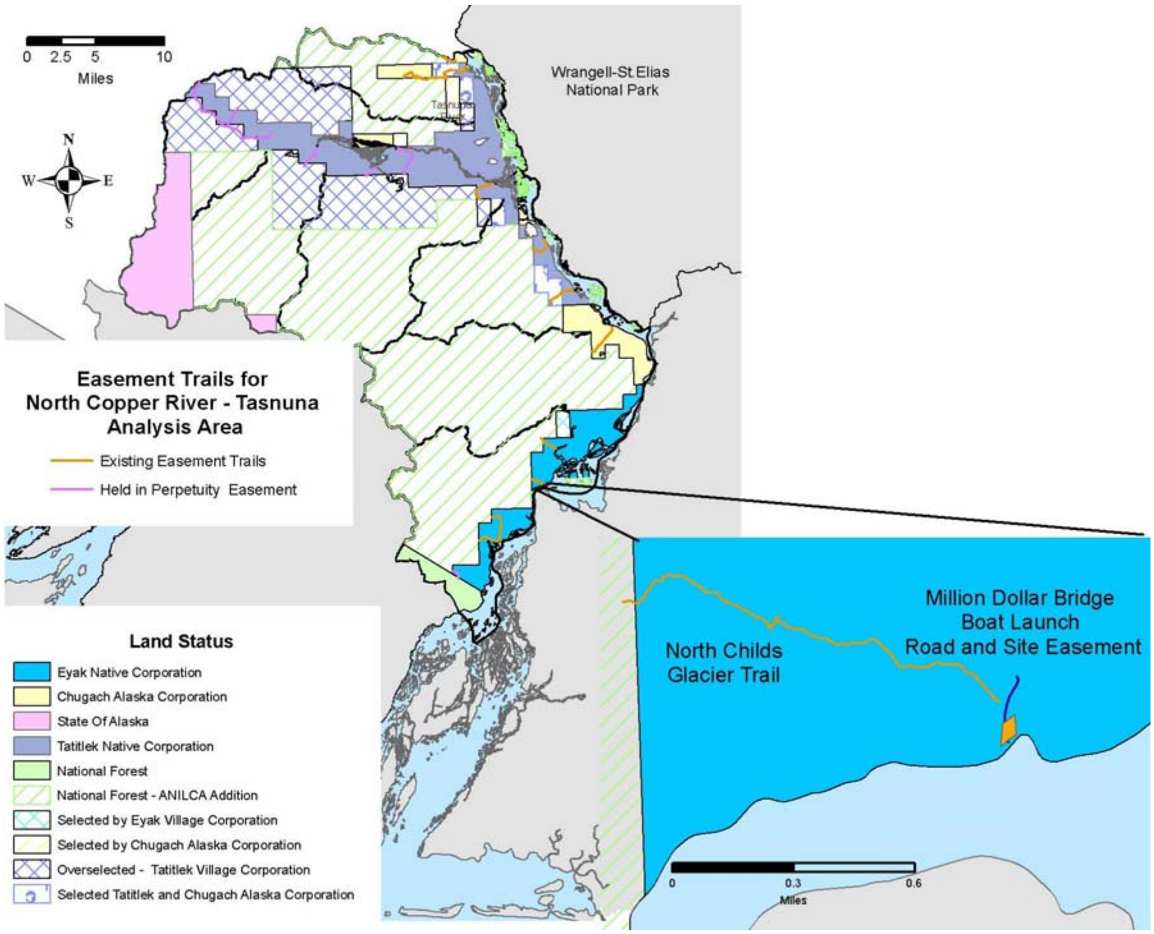


Figure 2.13 - Location of trail easements in the analysis area

The Tasnuna River drainage also contains numerous 17(b) site and trail easements but most of these, with the exception of the East Schwan and Whiting Falls site and trail easements have not been marked as the result of an agreement between the Tatitlek Corporation and the Forest Service. Because most of these reserved easements are in remote locations and the Tatitlek Corporation has not developed or implemented an access plan for the area, the two organizations have agreed it would be more realistic to wait until either an access plan is developed or public need and use levels develop that justify the time and expense of conducting the work. Even though unmarked, these easements are held in perpetuity (HIP).

Table 2.10 - Easements within the North Copper - Tasnuna analysis area.

Name & Length (mi)	Easement ID	Land Owner	Comments
ANCSA 17(b)Trails (Cordova RD office has plats for site and easement locations.)			
Cleave Creek 1.1 mi	EIN 69G	Chugach Alaska Corporation (CAC)	Trail only-Additional 1.7 mi extension cleared
Jackson Creek 7.1 mi	EIN 72b, EIN 72c, EIN 72G	Tatitlek and CAC	Cleared, marked & surveyed
Schwan Glacier East 3.0 mi	EIN 59C5	Tatitlek	Cleared, marked & surveyed
Whiting Falls 2.0 mi	EIN 62G	Tatitlek	Cleared, marked & surveyed
Heney Glacier 2.0 mi	EIN 50aD1	Tatitlek	Cleared, marked & surveyed
Sheils Glacier 2.55 mi	EIN 44c5	Tatitlek	Cleared, marked & surveyed
Allen Glacier 1.9 mi	EIN 33G C4C5	CAC	Contains CN145. Cleared & marked.
Grinnell Glacier est. 1.0 mi	EIN192G	Eyak	Cleared, marked & surveyed.
Childs Glacier 1.1 mi	EIN 176D1	Eyak	Cleared, marked & surveyed.
Childs Glacier south 3.0 mi	EIN 190C5	Eyak	Cleared, marked & surveyed
Goodwin Glacier 1.5 mi	EIN 189C5	Eyak	Additional 0.5 mi extension
Tasnuna Valley est. 17mi	EIN 42C5	Tatitlek	Not cleared, Held in Perpetuity
Schwan Glacier West, est 0.5 mi.	EIN 67aG & EIN 68G	Tatitlek	Not cleared, (HIP)
Woodworth Glacier est. 3 mi.	EIN 61G	Tatitlek	Not cleared, (HIP)
Tasnuna Glacier est. 8mi	EIN77C5,G,M	Tatitlek	Not cleared, (HIP)
Tasnuna Canyon est. 2.5 mi.	EIN79 C5,G,M	Tatitlek	Not cleared, (HIP)
Marshall Pass est. 2.5 mi.	EIN86 C5,G,M	Tatitlek	Not cleared, (HIP)
Unnamed Easement est. 6mi.	EIN 71G	Tatitlek	Not cleared, (HIP)
Copper R. Railroad est. 2.5mi.	EIN 45C5	Tatitlek	Not cleared, (HIP)
Old Boundary est. 1mi	EIN187C5,D1	Eyak	Not cleared, (HIP)
ANCSA 17(b) Roads			
Million Dollar Bridge Boat ramp road 0.12 mi	EIN 175a C5	Eyak	Cleared, marked & surveyed
ANCSA 17(b) Sites			
Jackson Creek	EIN 73a	CAC	Cleared, marked,& surveyed
Copper River	EIN 58L	Tatitlek	Cleared, marked,& surveyed
Whiting Falls	EIN54L	Tatitlek	Cleared, marked,& surveyed
Schwan Glacier E.	65D1,G	Tatitlek	Cleared, marked,& surveyed
Heney Glacier	EIN 50L	Tatitlek	Cleared, marked,& surveyed
Sheils Glacier	EIN 47L	Tatitlek	Cleared, marked,& surveyed
Allen Glacier	EIN 45a	CAC	Washed out
Grinnell Glacier.	EIN 193G	Eyak	Incomplete
Million Dollar Bridge Site and boat ramp	EIN 175 D9	Eyak	Cleared, marked,& surveyed
Childs Glacier. South/Goodwin Glacier	EIN 188C5	Eyak	Cleared, marked,& surveyed
Schwan Glacier West	EIN 67G	Tatitlek	Held in Perpetuity
Woodworth Glacier	EIN 60C5	Tatitlek	Held in Perpetuity
CNI Trail Easements			
Copper River 1.9 mi.	CNI 45	CAC	Cleared, marked & surveyed
CNI Road Easements			
Miles Lake est 0.25 mi	CNI 1	CAC	Connects two 40 ac. parcels at Childs Glacier Rec. Area
Copper River Railroad & trail est 9 mi.	CNI 44a & CNI 44b	CAC	Held in Perpetuity
CNI Streamside Easements			
Copper River Streamside est 2.5 mi.	CNI 4	CAC	S. side Miles Lk to E. side Copper R. opposite lower end of Childs Gl

Typically trail and site easements are marked with a mixture of signs, carsonite posts, 5x7” orange plastic diamonds, and chainsaw blazes on trees greater than 6” in diameter along trail easements. Adjacent to the Copper River easement sites are marked with large 24” white circles so that they may be seen from long distances up or downriver. Easement sites are normally marked and cleared along the site boundaries to 1 acre or less and located as near as possible to the legal reservation but with consideration for ease of public access, availability of fresh water and well drained, flat terrain for camping purposes. Easement trails are not constructed to normal Forest Service standards. They are cleared with chainsaws to a six-foot wide corridor and an 8-foot high clearing limit, do not have a tread, and are designed to 20% grades or less wherever possible. Most easements are surveyed. Corner monuments are placed at sites and at the beginning and ending of the easements. The District administers a total of 21 trail, 14 site, 4 road, and one streamside easements within the analysis area.

Over the years the Forest Service has experienced difficulty in keeping up with easement maintenance in this area due to the costs and logistics involved in accessing the area, the tremendous rate of vegetative growth, and extensive bear damage or vandalism to signs and postings. An interesting and unexpected problem with some trail locations is that active glacial moraines exist beneath what appears to be normal soil and alder component in some areas. In some cases the glacial ice has melted out and obliterated the trail. These problem areas have now been relocated.

Figures 2.14 and 2.15 - Easement marker and eroding easement site.

Special Uses

Four special use authorizations for commercial outfitter/guide activities and other uses exist in the analysis area. The following organizations or groups are authorized use of the National Forest System lands within the analysis area:

Sundog Expeditions (COR 81) - This permit holder conducts Copper River rafting activities from Cleave Creek at the northern border to 27-Mile on the Copper River. One campsite is authorized within this analysis area.

Copper Oar (COR 89) - This permit holder conducts Copper River rafting activities from Cleave Creek at the northern border to Mile 27 on the Copper River. One campsite is authorized within the analysis area.

Alaska Hunting Adventures (COR 104) - The Forest Service currently authorizes this single big game guide to operate within the analysis area. This guide uses public17(b) trail easements to access National Forest System lands for hunting brown bear and mountain goat.

H2O Heli-guides (COR 103) - This permit holder is the only authorized heli-ski guide on the District. The holder is authorized use on the mountainous terrain in the upper Tasnuna and Cleave Creek area within the analysis area from February 1 through May 1 annually.

Minerals

There are four types of minerals administered by the Forest Service; these are locatable minerals (36 CFR 228, Subpart A), salable minerals (38 CFR 226, Subpart C), leasable minerals (36 CFR 228, Subpart E), and reserved and outstanding minerals (36 CFR 251.15, FSM 2830). Both locatable minerals claimants and operators (under the 1872 Mining Law), and reserved and outstanding minerals owners, have a statutory right to develop the mineral resource. However, neither of these 2 types of minerals rights exists within most of the analysis area. The disposal of salable minerals (minerals materials) and leasing of the leasable minerals (includes oil, gas and coal; as well as hardrock minerals on acquired lands) are discretionary actions. The Forest Service determines whether to offer a mineral materials sale and administers these types of disposal under the salable regulations cited above.

Locatable Minerals – No placer or lode mining claims or mill sites exist in the analysis area. Additionally, most of the area is closed to mineral entry, so none will be located in the future on National Forest System lands. The Forest has no approved mining plans of operations within the analysis area, nor have any been submitted for approval.

The southern end of the analysis area open for mineral entry has low potential for mineral development. The U.S. Geological Survey assessed the mineral resource potential for the Chugach National Forest for the Forest Plan revision (Nelson and Miller 2000). The report focused strictly on metallic mineral resources. It did not cover leasable resources such as coal, oil and gas, or salable resources such as common variety rock, gravel, and sand. The four deposit types evaluated in Nelson and Miller's report are as follows: 1) Cyprus-type massive sulfide (copper, lead, zinc, gold and silver); 2) Chugach-type low-sulfide gold quartz veins (gold and silver); 3) placer gold; and 4) polymetallic veins (copper, zinc, lead, gold and silver).

Copper River Addition Tract

The mineral estate within the 801,600 acre ANILCA Copper River Addition (CRA) to the Forest is withdrawn from operation of the mining laws, but is available under the leasing laws (ANILCA Sec. 502). The CRA covers most of the analysis area (Fig 2.1). According to Nelson and Miller's report, the CRA tract is the largest tract in the Forest that is considered highly favorable for containing undiscovered mineral resources.

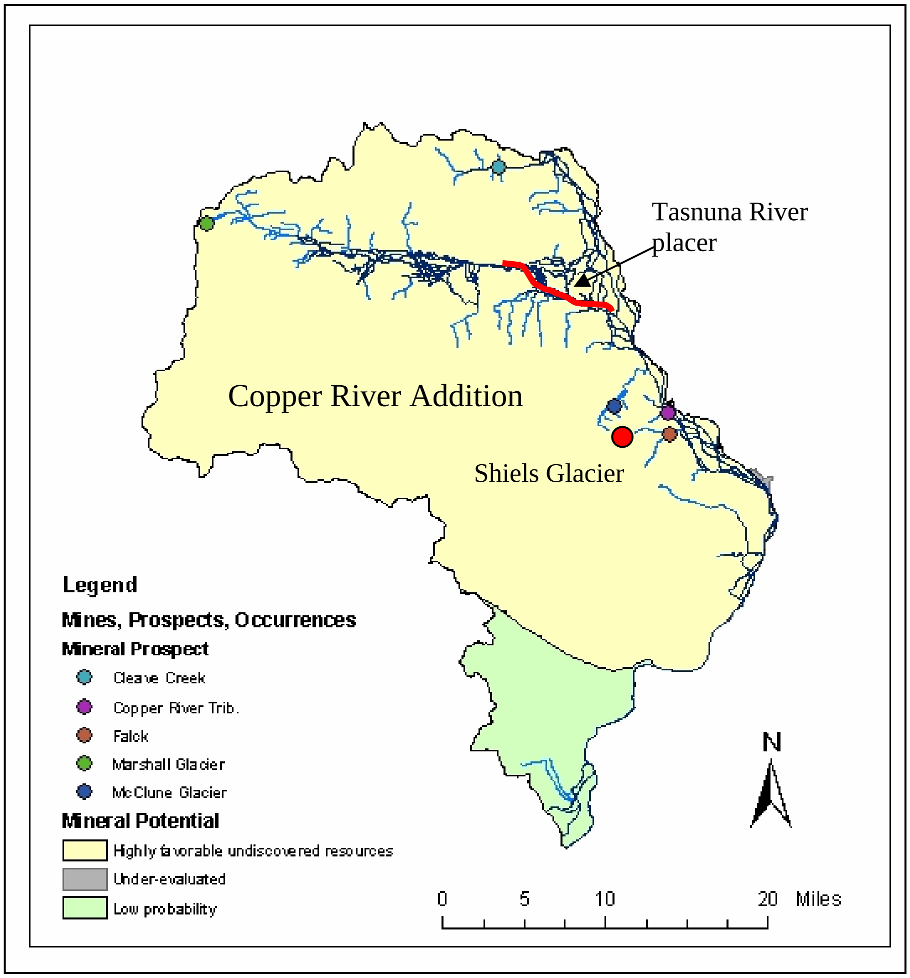


Figure 2.16 – Mineral potential tracts with mineral prospects and occurrences in the analysis area.

Mineralized belts outside of the Forest that contain mines and prospects defined by the Cyprus-type, Chugach gold, and placer gold deposit models, trend east into the CRA tract (Nelson et al. 1984). Based on the presence of favorable geologic units, known mineral occurrences, geochemical anomalies, and geophysical data, these mineralized belts likely continue into this tract, making it highly favorable for containing undiscovered resources. In this tract minerals are managed under ANILCA requirements (leasable), not under the 1872 Mining Law (locatable).

Undesignated and Under-evaluated Tracts

Nearly all of the analysis area outside the CRA tract is undesignated (area in green, Fig 2.16). This means the area lacks geologic criteria indicating potential for resources, contains resources not addressed in the report, or contains deposits having a low probability of future development activity. A very small area that lies along the east boundary is under-evaluated (area in gray, Fig 2.16) as to mineral potential. Areas that are under-evaluated contain rugged topography and/or glacial cover.

Prospects and Occurrences

The analysis area contains seven identified mineral prospects[11]/occurrences. They are summarized in Table 2.11 and shown in Figure 2.16. Only one is considered to have a high mineral development potential.

Cleave Creek, Copper River Tributary, Marshall Glacier, McClune Glacier, and Tasnuna River mineral occurrences consist of alluvial gravel derived from metasedimentary and metavolcanic rocks. In the early 1980s the US Bureau of Mines sampled these occurrences and made a determination on the mineral development potential (Jansons et al. 1984). The Tasnuna River occurrence is not in the Chugach National Forest GIS database. It is shown in Figure 2.16 by a red line.

Falck is a hardrock exploratory prospect also known as Copper Mountain 1-6, the identified commodities are copper, zinc and silver. Little else is known about this prospect.

Shiels Glacier occurrence consists of slates and greenstones that contain disseminations and lenses of pyrite, pyrrhotite, and disseminated galena and sphalerite. The US Bureau of Mines collected two samples from talus that yielded anomalous results for gold, silver and other minerals (Jansons et al. 1984).

Table 2.11 - Mineral Prospects and Occurrences

Name	Location	Type	Commodity	Development Potential
Cleave Creek	T9S, R2E, CRM	Placer - occurrence	Gold	Moderate
Copper River Tributary	Sec. 22, T11S, R4E, CRM	Placer - occurrence	Gold	Low
Falck	Sec. 27, T11S, R4E, CRM	Prospect	Copper, zinc, silver	Unknown
Marshall Glacier	T9S, R2W, CRM	Placer occurrence	Gold, copper	High
McCune Glacier	Sec. 24, T11S, R3W, CRM	Placer occurrence		Low
Tasnuna River	Sec. 24, T11S, R3W, CRM	Placer occurrence	Gold	Moderate
Shiels Glacier	Sec. 31, T11S, R4E, CRM	Occurrence	Gold, silver, zinc	Unknown

Salable Minerals (Mineral Materials, Common Variety Minerals) - According to the geology map significant Quaternary deposits (sand and gravel) occur within the analysis area. The sand and gravel occurrences are situated mainly on non-National Forest System lands. There is abundant resources of rock that could no doubt be used for general fill and road construction purposes. The potential for high quality crushed rock, rip rap and armor

[11] Prospects have workings (for example - shaft, adit, trench, etc) and occurrences do not.

stone is unknown, however massive metagraywacke deposits are known to have produced quality crushed rock, rip rap and armor stone in other areas. The remoteness of the area will likely preclude development of these resources in the near future.

Leasable Minerals - There is no potential for oil and gas, and coal deposits within the analysis area and high potential for as yet, undiscovered “hard-rock” leasable minerals. The analysis area is considered to be relatively unexplored for mineral resources, but the geology is favorable for the occurrence of certain types of mineral deposits.

Reserved and Outstanding Minerals - No reserved and outstanding minerals rights exist in the analysis area.

Chapter 3 – Issues and Key Questions

Following are the key issues and questions raised for the area. Information addressing these issues and key questions is provided in Chapter 2 and Chapter 4. Chapter 5 includes potential monitoring projects to answer the questions if there are data gaps and other potential projects.

Physical

1. How do glacial processes affect water quality, channel morphology, and streamflows as they relate to fisheries, wildlife, ecology, and human uses?
2. What effects will climate change and glacial recession have on the hydrology of the Copper River and the landscape of the North Copper – Tasnuna area? Glaciers play a large role in shaping the landscape of the North Copper – Tasnuna analysis area, commonly causing dynamic changes in channel configuration, lakes, and landforms. Each of the glaciers in the area has been receding and thinning over the past century. Changes resulting from glacial recession will be apparent within the near future. These changes can be evaluated and predicted using aerial photography.
3. Is soil erosion an issue in the area? Soil erosion is known to occur on some of the slopes that have been exposed by recent recession of the glaciers. This sediment is probably entering a glacial stream which will be minimal compared to the amount that is already in the stream.

Fish

1. How much and in what condition is the current fish habitat for the key species? See chapter 2, Fisheries.
2. Where are the major spawning and rearing habitats for the key species?
3. What are the effects of commercial fishing and hatchery production on the populations of sockeye and coho salmon in the analysis area?
4. How will climate change and glacial recession affect the quality and distribution of salmon habitat in the analysis area?
5. Are introduced species such as Atlantic salmon or American shad present in the Copper River and its tributaries in the analysis area? Will the continued warming trend create more favorable conditions for shad in these watersheds?
6. How much OHV and snow machine use is currently present in the analysis area and what are the impacts to fisheries resources?
7. What is the current level of boat use on the Copper River and is the trend in use increasing? What effect will increased use have on fish habitat and populations?

Vegetation

1. Could any Threatened, Endangered or Sensitive plant species occur in the area?
2. Are there any invasive plant species? Are exotic plant species being introduced on wheels and tracks of OHVs, aircraft, and shoes? It is unknown, but there is potential; see Chapter 4, Vegetation section.

Wildlife

1. What are the Threatened, Endangered and Sensitive species in the analysis area and what is their status? - See Chapter 2, Wildlife section.
2. What is the distribution of wildlife species in the analysis area?
3. What habitats are important to brown bears?
4. Will human activity disturb goats in their winter range?
5. There were concerns raised about the sensitive habitats present on the Bremner Flats and Abercrombie Rapids. These areas are not National Forest System lands. However this information can be used during consideration for any new easement locations or special use permit applications.

Heritage Resources

1. Inventory, analysis and public interpretation are concerns that are part of the Forest's legal mandate, to inventory National Forest System lands, analyze the results, and interpret them for the public. The history of the analysis area is quite rich, with active human settlement and use of area resources by Sugpiaq, Eyak and Ahtna and Euro-American settlement and development of mineral resources of the area continuing in the first four decades of the twentieth century. Individual sites in the area and various settlement and resource use related sites are somewhat known to the public, particularly those interested in Alaska history, or who are able to travel to the area and see the existing visible cultural resources. Off-site interpretation is addressed in Chapter 5 in recommendations, as is the development of Stewardship Agreements with outfitter/guides.

2. There is concern that the tribes be consulted on all heritage resource questions and projects. In accordance with Section 101(d)(6)(B) of the NHPA, the Forest Service consults with any Indian tribe or Alaska Native corporation that attaches religious and cultural significance to properties in the area of potential effects for an undertaking. In accordance with this requirement, the Forest Service consults with the Native Villages of Eyak and the Chugach Alaska Corporation regarding projects in the analysis area. Consultation will be for the purpose of eliciting views of Indian tribes on all aspects of the Section 106 compliance process during the earliest feasible steps of project planning. For new projects, this occurs initially through the quarterly Schedule of Proposed Actions, which is sent to each group approximately every three months, along with a letter requesting comments on any projects that are in areas with prehistoric or historic sites that are of religious and cultural significance. In addition, if projects will take place in the vicinity of known sites of Native cultural and religious significance, or within CAC 14(h)(1) selections, direct consultation regarding that particular project will occur.

Land Ownership

1. Concerns were raised that any recommendations for development consider potential impacts to the private lands in the area and include those landowners in the decision making process. This will be done during analysis of site specific projects. See Chapter 5.

2. Another concern raised was the potential for this assessment to result in decisions that limited access to private land requiring crossing public land. This analysis is not a decision document, so will not result in limiting access to private land.
3. Concerns were raised about potential trespass along easements crossing private land. The Forest Service has stepped up efforts to ensure that the public is better educated to the legal uses of easements through public information, maps, and signs.

Mining and Minerals Potential

1. Are the lands open to mineral entry? All public domain lands are open to mineral entry under the 1872 Mining Law unless specifically closed. Nearly all of the National Forest System lands in this analysis area are part of the Copper River ANILCA Addition (Fig 1.2) which is closed to mineral entry. The area shown in green in Figure 1.2 is open to mineral entry. Refer to chapter 2 Minerals section.
2. What is the potential for mineral development? The National Forest System lands in the analysis area open to mineral entry have low potential for mineral development. However, CAC believes there are possible high grade prospects worthy of investigating on their lands. See chapters 2 and 4, mineral potential.
3. Is there a demand for sand and gravel from National Forest System lands? The need for sand and gravel is generally nonexistent due to the remote nature of the analysis area. Additionally, if sand and gravel were to be needed for future projects, it could probably be obtained from private lands since these parcels contain vast alluvial deposits.

Recreation, Easements, and Special Uses

1. What is the public demand for recreation opportunities in the analysis area and how does it compare to capacity? See chapter 4 Recreation section. Concerns were raised about adequately maintaining the facilities already present on the District before building more. Comments were received about appreciating the easement sites and trails along the Copper River.
2. Concerns were raised about effects of increased traffic and use of the area if a road were constructed up the Copper River and including those impacts in this analysis. Construction of a road up the Copper River is a State decision rather than one made by the Forest Service. It is unlikely that a road will be constructed in the next 10 years since highway funds are scarce. The paving of the CRH is on hold and construction of a trail past the Million Dollar Bridge has been dropped (Dave Sanchez AK DOT, personal communication). The timeframe of potential construction is outside the scope of this landscape assessment.
3. There was concern that the 17(b) easements be actively managed to reduce human /bear conflicts, and trash and other human waste accumulation.
4. There is concern about loss of easements due to river channel changes and the erosion or accretion of riverbank material which reduces or adds to the land base upon which access rights to easement sites and trails exist. By normal legal definitions, if a site easement is eroded, it is lost and the landowner is not legally obligated to replace it with another. The Forest Service and Native Corporations are addressing this issue on a case by case basis.

5. There is concern about how to manage conflicting user groups, i.e. bear baiting stations and wildlife viewing.

6. There is concern about how to manage recreationists once carrying capacity is met.

Chapter 4 – Conditions and Trends

Disturbance Regimes and Geomorphic Processes

The disturbance regimes in the area include glacial and tectonic activity, wind and river action, insect and diseases, erosion processes, and minor amounts of human caused disturbance.

Climate

The climate throughout Alaska has gradually become warmer over the past century. Records show that the average annual temperatures at the Cordova airport have increased about 3°F over the past 50 years (Fig 4.1) (Western Regional Climate Center 2005). Climatic warming can have long-term effects on the hydrologic processes in the analysis area, including glacial recession.

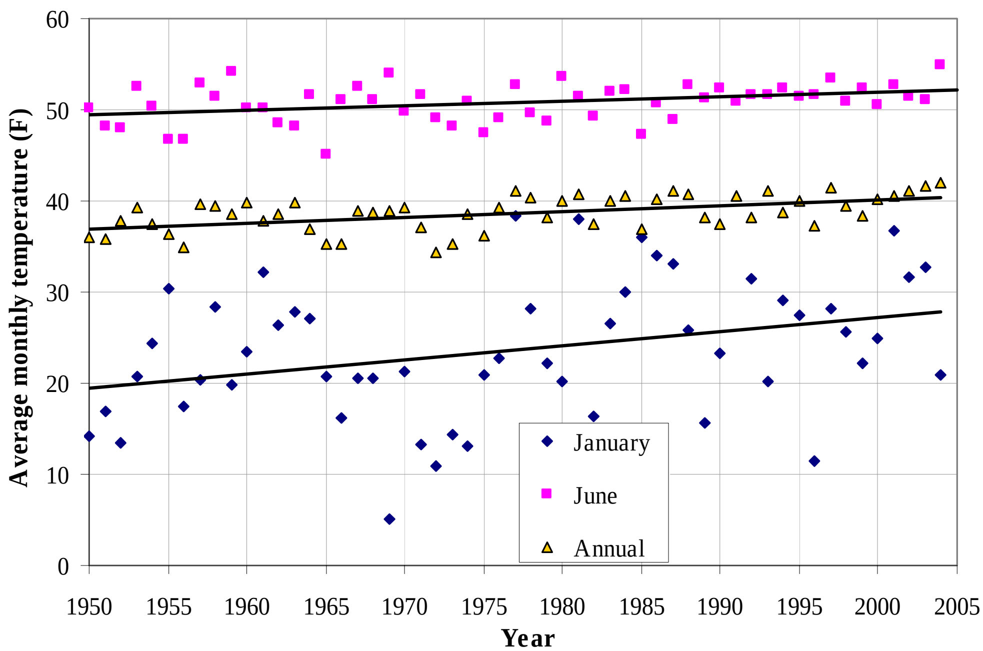


Figure 4.1 - Average monthly temperatures at Cordova Airport 1950 – 2004. Data from Western Regional Climate Center (2005)

Climatic effects also help shape the morphology of the Copper River. Persistent winds through the Copper River canyon and an abundant sediment supply result in sand dunes, particularly in the Bremner Flats area between the Bremner and Copper Rivers. Abandoned channel braids in this area are now occupied by unvegetated sand dunes, and some of the braided channels of the Copper River cut into this easily erodible material. The wind blows predominantly up-valley in the summer and down-valley in the winter.

Glaciers

During the most recent Pleistocene glaciation, glaciers covered most of the analysis area. Glacial recession began in the Holocene about 12,000 years ago. All of the glaciers in the analysis area are currently receding and currently cover only about half of the analysis area. Considerable glacial recession has occurred on the Woodworth and Allen Glaciers, with over one mile of recession on each of these glaciers in the past 25 years. The Schwan and Heney Glaciers have receded less than 0.5 mile in the past 25 years.

The proglacial lakes at the ends of the Woodworth, Schwan, Heney, and Allen Glaciers have grown in size in the last 50 to 100 years as the glaciers have receded. Proglacial lakes below these glaciers have the effect of capturing glacial sediment from the glaciers. This in turn reduces sediment loads in the rivers that drain the glaciers into the Tasnuna and Copper Rivers. As a result, the lake outlets have incised into the outwash, and some of the braided channels downstream of the glaciers have been abandoned.

The terminus of the Childs Glacier has remained relatively static over the last 50 years. However, in one area near the upstream end of the glacial terminus, the glacier has receded up to 1000 feet, causing the Copper River channel to widen at that location (Fig 4.2). Also, the downstream end of the glacier is receding away from the river, leaving areas of stagnant ice and moraine deposits along the bank. Further recession of the Childs Glacier is likely to result in a lake forming in the basin where the Childs Glacier is currently located, similar to that seen at Miles Lake just upstream.

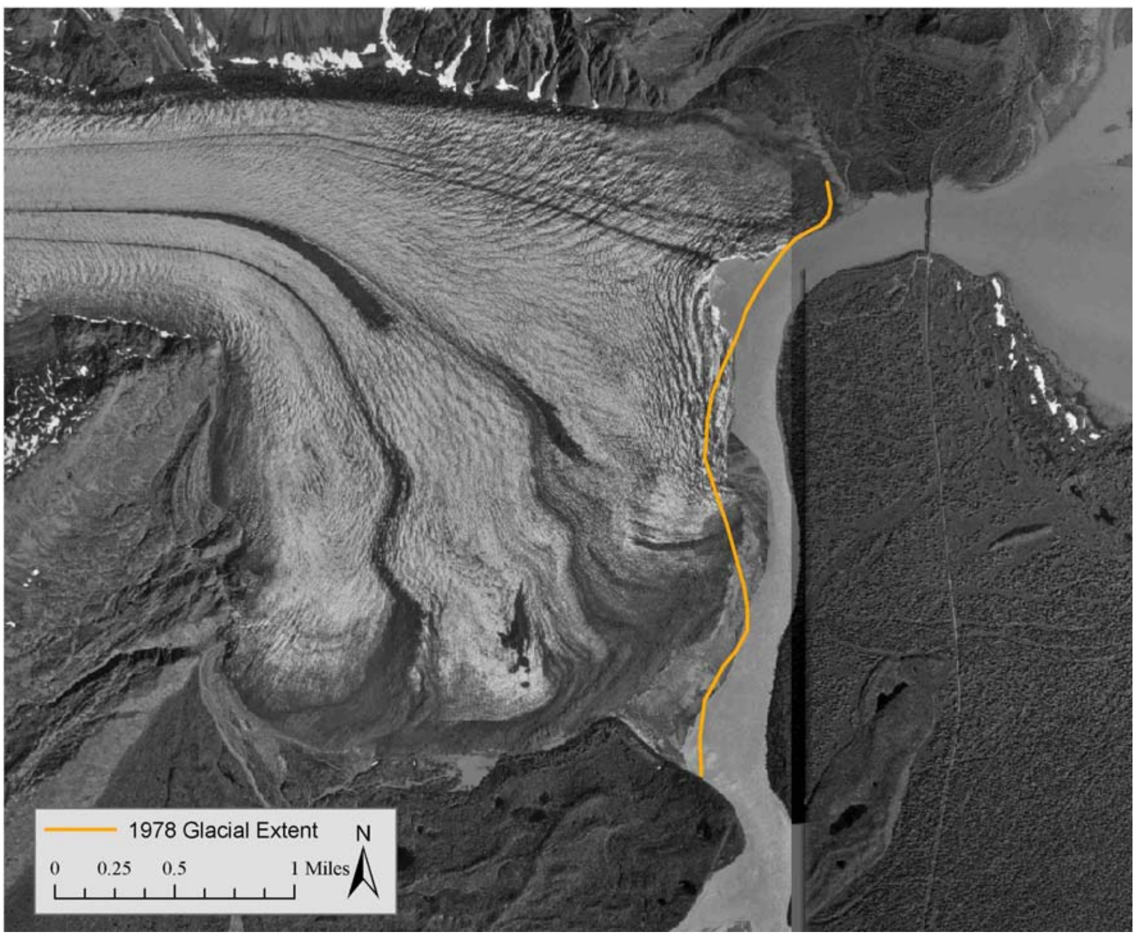


Figure 4.2 - Recent orthophoto of the Childs Glacier, showing the 1978 position of the glacier

The Grinnell Glacier is a small hanging glacier just west of Miles Lake. The glacial outflow from the Grinnell Glacier once ran into the old channel of the Copper River. Because the Copper River no longer occupies this channel, the outflow is creating a rapidly building alluvial fan at the base of the slope in the old channel.

Stream channels

The Copper River is very dynamic, with continuously changing channels resulting from high sediment loads, high flows, glacial outburst floods, receding glaciers, and wind. It is common for the main flow to shift from one side of the river to the other over time, causing bank erosion on one bank and sediment deposition on the other.

Dynamic channel changes have occurred in the Miles Lake area of the Copper River. During the last glacial advance of the Miles Glacier, the Copper River was forced against the east side of the valley, creating a constricted section called Abercrombie Rapids. After Miles Glacier receded, Miles Lake was formed in its basin, and the Copper River abandoned its channel at Abercrombie Rapids for a new channel on the west side of the valley. The "new" Abercrombie Rapids at this location is still constricted, and the old railroad grade occupies the old Copper River channel. The Million Dollar Bridge was constructed on a glacial moraine of the Miles Glacier, and the coarse material of this moraine provides a constricted outlet for the lake. Just downstream of the bridge, the river runs adjacent to the Childs Glacier. Future recession of the Childs Glacier will likely have the same result as recession of the Miles Glacier, and a lake will likely form in the basin carved out by the Childs Glacier. Constriction from coarse glacial moraine material at the south end of Childs Glacier will maintain the elevation of this future lake.

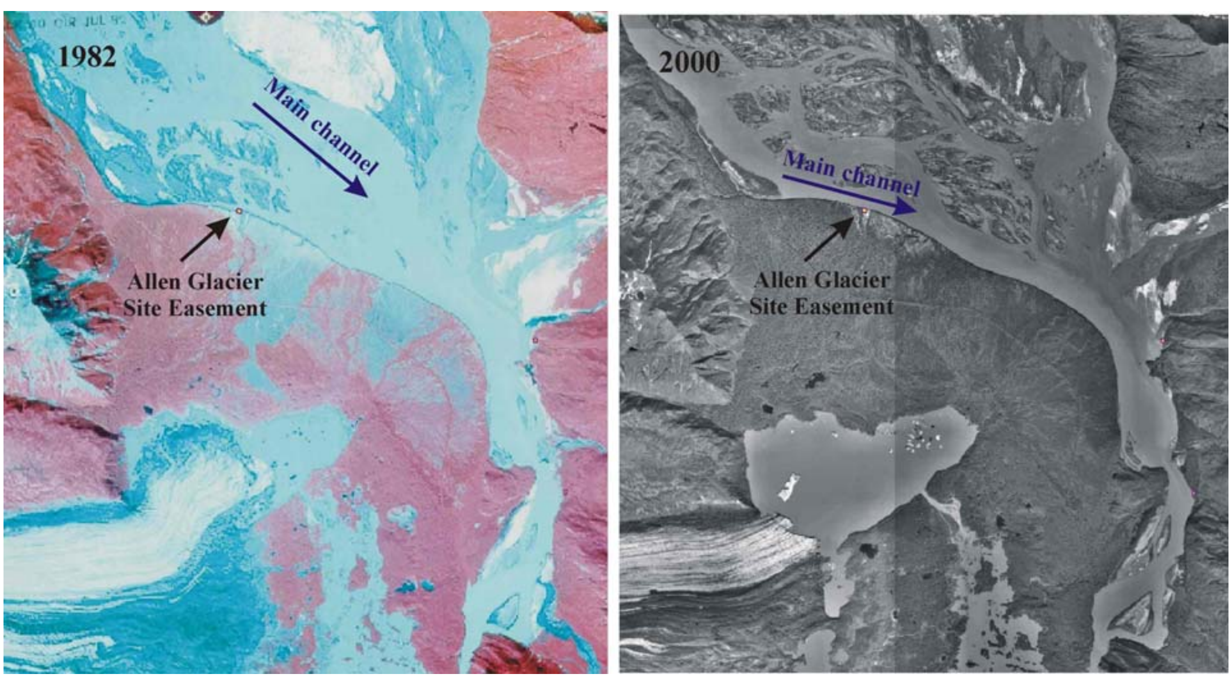


Figure 4.3 - Channel changes in the Copper River at the Allen Glacier site easement.

Site easements and easement trails are located along the Copper and Tasnuna Rivers to provide access to National Forest System lands from the river. Eleven easements are located in the analysis area, with six of these on the west bank of the Copper River, two on the east bank of the Copper River, and three on the Tasnuna River. Bank erosion is cutting into the Allen Glacier and Shiels Glacier Easement Sites, as they are located on cut banks of the Copper River where the main flow is against the east bank. Channel changes at the Allen Glacier Easement Site have resulted in a shift of the main flow from the east side of the river to the west side, with gravel bars building on the east side (Fig 4.3). Under the present channel configuration, these sites are likely to continue to erode and may have to be relocated. Rafting parties use these easements but find it difficult to land along these steep cut banks. Also, potential bank disturbance and trampling of riparian vegetation from people climbing up and down the banks can accelerate the rates of bank erosion at these sites. Other easements sites are located on side channels, sloughs, and in more protected areas.

Streamflows

A large portion of the streamflow in the Copper and Tasnuna Rivers is derived from glacial melt. Glacial recession will lessen the magnitude of these flows, as smaller glaciers will ultimately produce less runoff. With glacial thinning and recession, the Van Cleve Lake glacial outburst system and other small outburst systems on the Allen Glacier may no longer occur, leading to decreasing magnitudes of peak flows in the Copper River.

Effects of human uses on hydrology

Because of the very limited number of visitors in the analysis area, human activities will have very limited effects on water resources. Dynamic natural changes resulting from channel migration, glacial recession, floods, and wind overshadow the effects of the limited human use in this area. However, potential human use effects include bank erosion from rafting and boating groups. As the number of people floating the Copper River increases, increased bank erosion is likely to occur at the site easements. Such erosion can accelerate natural rates of bank erosion.

Hillslope erosion processes

The potential for landslides on forested lands is dependent on several factors. Douglas N. Swanston (1997) developed a rating system for slope stability on the Tongass N.F., which factored in topographic attributes, soil properties, geology, and hydrologic conditions. Areas are evaluated based on their slope, topographic position, and any subsurface restrictions. These criteria are individually rated and the total score of a particular site can be used as an indication of its stability. This system was modified for use on the Chugach NF by Dean Davidson (Appendix C). Slope gradient tends to be the most critical factor. Landslides most frequently occur on slopes greater than 72% (Swanston 1997). Between 72% and 56%, stability depends on other factors such as topographic position and restrictive layers. Slopes less than 56% are less likely to fail unless there are other critical limitations. The Mountain Sideslopes unit is particularly susceptible to landslides based on these criteria. Many of the soils in these units are underlain by compact glacial till that can serve as a slippery surface if water is restricted and starts to flow just above it.

Overlaying the Mountain Sideslopes LTA on areas with slopes greater than 56% gives a preliminary overview of potentially unstable sites (Fig 4.4). A large portion of the slopes steeper than 72% occurs above glaciers and are the result of glacial valley carving.

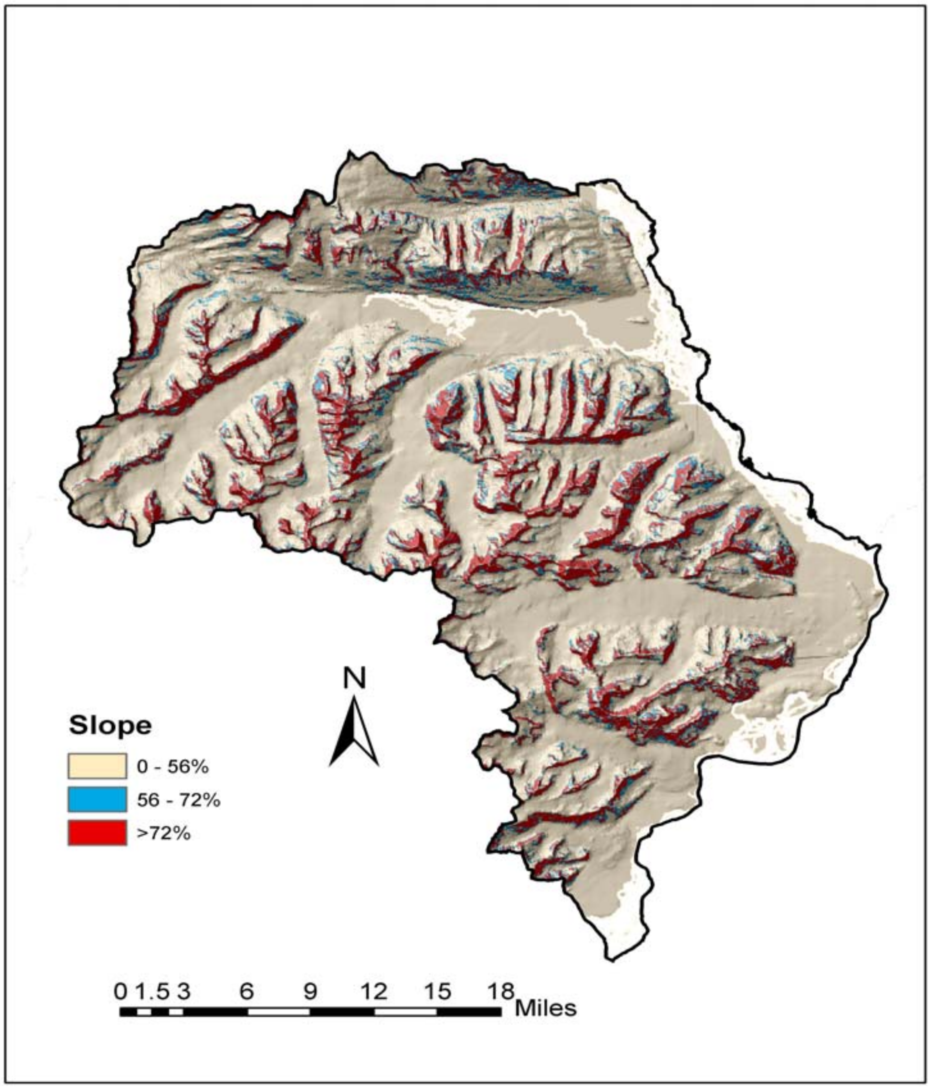


Figure 4.4 - Slopes greater than 56% in the analysis area.

Conditions and Trends of Fisheries Resources

Research indicates that management objectives at the landscape scale should stress the importance of maintaining a historical range of natural variability (Swanson et al. 1994, Kaufmann et al. 1994). The historic range of natural variability for fisheries resources is unknown for this analysis area; however, this analysis provides a recent, partial account by which to compare future fish population trends and habitat conditions.

The key fish species in the North Copper Tasnuna analysis area and their major importance are:

- Chinook salmon: Copper River commercial fishery; upriver subsistence, sport, and personal use fisheries
- Coho salmon: Copper River commercial fishery; upriver subsistence, sport and personal use fisheries, USDA Forest Service Management Indicator Species (MIS)
- Sockeye salmon: Copper River commercial fishery; upriver subsistence, sport, and personal use fisheries
- Cutthroat trout: USDA Forest Service Species of Special Interest (SSI)
- Dolly Varden: USDA Forest Service Management Indicator Species (MIS)

Population trends of the key fish species

Fisheries resource conditions have been, and are still, controlled by the dynamic climatic and geologic activity of the Copper River basin such as earthquakes, uplift and subsidence, glacial lake outburst flooding, and climate change. Twelve thousand years ago there were no freshwater fish in the analysis area because it was covered under a thick layer of ice during the last major glacial period. Since then, fish have colonized the many streams and lakes produced by the receding glaciers.

The current warming trend in the northern hemisphere may result in increased glacial recession. This change may increase the available spawning and rearing habitat for salmonids in the analysis area. Sockeye salmon are a species known to be associated with glacially influenced landscapes, especially those in recently deglaciated ecosystems with remnant glacial lakes. However, there may be unforeseen negative effects to salmon populations that are associated with the rapid warming trend. For instance, adult ocean survival may be affected by temperature changes in the Pacific Ocean. Other natural process such as floods, channel migration, and glacial retreat may also create new habitat for fish to exploit in the analysis area.

Historically, there has been very little human impact to fisheries habitat. The Copper River and Northwestern Railroad was constructed from 1906 – 1911 and operated until 1938. This railway followed along the Copper River through the analysis area, crossing all of the tributaries that flow into the river from the western bank. Many of these were crossed with trestle bridges. Since the dismantling of the railroad, much of the old footprint has been reclaimed by the rivers and surrounding landscape. No persistent impacts from the railroad on fisheries resources have been documented.

The desired future condition is for fish populations and habitats in the analysis area to remain at or above the current levels and that the populations continue to be self-sustaining so fisheries of the Copper River can continue to provide for the commercial, subsistence, and sport fish users throughout southcentral Alaska. Fish populations and habitats will be mostly controlled by natural processes. However, if necessary, proactive resource management will be used to promote the conservation of fish and wildlife and their habitats. Active management may be necessary because the fisheries resource economic, cultural and social values in the area are of great importance to the local human populations.

Human induced impacts can reduce the ability of streams to express their full range of variability and all possible habitat states (Ebersole et al. 1999). Under the current Forest Plan, there is little reason to believe human related impacts will inhibit fisheries resources from expressing their full range of variability. Most of the analysis area will remain as a large, pristine, unroaded area. The area has a high degree of natural integrity with most long-term ecological processes intact.

Human Influences on the fisheries resources

Commercial Fishing – Commercial fishing for sockeye, Chinook, and coho salmon occurs at the mouth of the Copper River. A brief history and description of this fishery was discussed in landscape assessments for the East and West Copper River Delta (Kesti et al. 2003, 2004). The fish populations in the analysis area that may be affected by commercial fishing are sockeye and coho salmon from the Tasnuna watershed. Little spawning or rearing habitat exists in other watersheds, although Chinook salmon adults and juveniles migrate through and some juvenile rearing exists in small side channel tributaries (ADFG 1998). The analysis area does not appear to be a significant part of the overall Copper River production for this species.

Commercial fishing directly impacts populations by killing individual fish. These fish may be harvested as the target species or be killed as by-catch during fishing for other species. Fishing can indirectly influence populations in many complex ways that are not fully understood. Some documented influences include size selection (Hamon et. al.2000), run timing (Merritt and Roberson 1986, Boatright et al. 2004), and age structure (Nordwall and Lundberg 2000).

The commercial catch of sockeye salmon at the mouth is substantial, with over 1 million fish being harvested in most years (Ashe et al. 2005). The effects on fish specific to the analysis area are not known, but a considerable percentage of all fish returning to the Copper River watershed are harvested annually (Ashe et al. 2005). The commercial harvest of sockeye salmon at the mouth of the Copper River has increased steadily since 1974 (Fig 4.5; Ashe et al. 2005). The harvest over this period has ranged from 18,908 to 2,955,431 fish with a recent ten-year average (1995-2004) of 1,521,641 fish.

Coho salmon harvests have increased since 1974, but the harvests have been more variable through time (Fig 4.5; Ashe et al. 2005). Harvests of coho salmon have ranged from 18,656 to 677,633 fish, with a recent ten-year average of 290,764 fish. It is not known what percentages of harvested fish of these two species were destined to go up the Copper River rather than into streams on the Copper River Delta. Thus this harvest data can only be used to examine general annual trends of returning fish to a widespread Copper River region.

The trend in sockeye salmon escapement into the Copper River is obtained from ADFG sonar counts using a sonar counter located at the outlet of Miles Lake, next to the Million Dollar Bridge. The sonar counts fish that escaped the fishery at the mouth and are heading up river to spawn throughout the basin. In recent years the inriver escapement objective for the Miles Lake sonar counter has been met. Sonar counts have ranged from 587,497 to

850,951 fish between the years 1999 - 2004 (http//www.cf.adfg.state.ak.us/ region2/pwshome.php).

The key spawning locations and the relative size of the population that spawns in the Tasnuna River are not known. In 2005, LGL Alaska Research Associates, Inc., under contract to the Native Village of Eyak, began a telemetry study to determine run timing and distribution of spawning sockeye salmon in the Copper River basin (Keith van den Broek, Native Village of Eyak Fisheries Biologist, personal communication). This information will help to identify key spawning locations and the relative percentage of the run entering the Tasnuna River drainage.

The inriver escapement goal (for salmon passing the Miles Lake sonar) is composed of both wild and enhanced (Gulkana hatchery origin) salmon. The inriver goal includes fish allocated to several categories including spawning escapement, subsistence harvest, sport fishery, hatchery brood, and hatchery surplus (Gray et al. 2003). The upriver biological escapement goal for wild stock sockeye salmon is 300,000 fish and an additional 17,500 "other salmon" are required to meet spawning escapement goals. The subsistence harvest numbers are expressed as a range and have been set annually based on recent harvest numbers. The hatchery brood and surplus inriver escapement categories are estimated annually based on projections. In 2002, the total inriver escapement goal for salmon was 651,500; the biological and allocative categories associated with the goal that year included 300,000 wild sockeye spawners, 200,000 for subsistence harvest, 15,000 for sportfish harvest, 17,500 "other salmon", 99,000 hatchery surplus sockeye salmon, and 20,000 hatchery broodstock sockeye salmon (Gray et al. 2003). The sonar counter is not operated in the fall, so there are no estimates for coho salmon in the Copper River.

The commercial harvest of Chinook salmon at the mouth of the Copper River has increased since 1974 and has ranged from 8,454 to 68,827 fish, with a recent ten-year average of 49,919 fish (Fig 4.6; Ashe et al. 2005). The Chinook salmon that are harvested in the commercial fishery are destined mainly for spawning habitats upriver. Harvest data has been the best indicator of general abundance of Copper River Chinook salmon return because the sonar counter does not distinguish between the Chinook and sockeye salmon. No historic escapement numbers for Chinook salmon have been documented.

In recent years, ADFG and the Native Village of Eyak (NVE) have been monitoring Chinook salmon escapement in the Copper River. ADFG has used radio-telemetry to estimate inriver abundance and identify key spawning locations throughout the river since 1999 (Savereide 2004). In 2002, NVE began using fish wheels and mark-recapture techniques to monitor Chinook escapement numbers. This monitoring project is funded through at least 2007 (Smith and van den Brock 2005). The Baird Canyon fish wheels and the crew field camp for this project are located in the analysis area, near the Allen Glacier terminus (Smith and van den Brock 2005). The population estimate for the 2004 season was 40,564 Chinook salmon (Smith and van den Brock 2005). The commercial harvest that same year was 38,191. No radio tagged Chinook salmon were observed spawning in the analysis area during the ADFG radio-telemetry study, although each year 32 – 36 radio tags were recorded as "failed", meaning they were never detected in the Chitna dip-net fishery upriver outside the analysis area (Savereide 2004). The fate of these "failed tags" is not known.

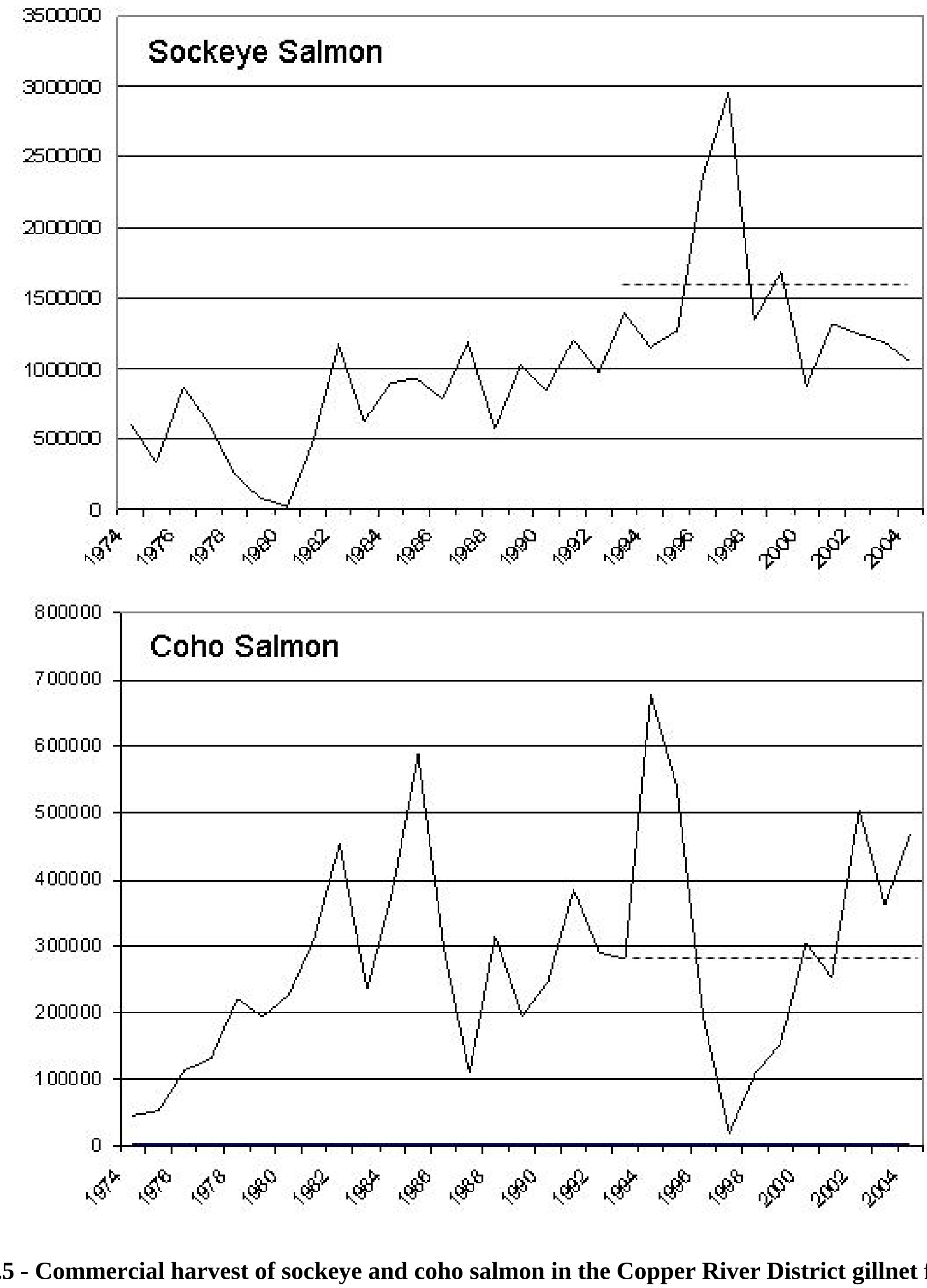


Figure 4.5 - Commercial harvest of sockeye and coho salmon in the Copper River District gillnet fishery from 1974 – 2004. Dashed line indicates the recent ten-year average harvest (1995 – 2004). Y-axis is number of fish harvested. Data from ADFG (Ashe et al. 2005).

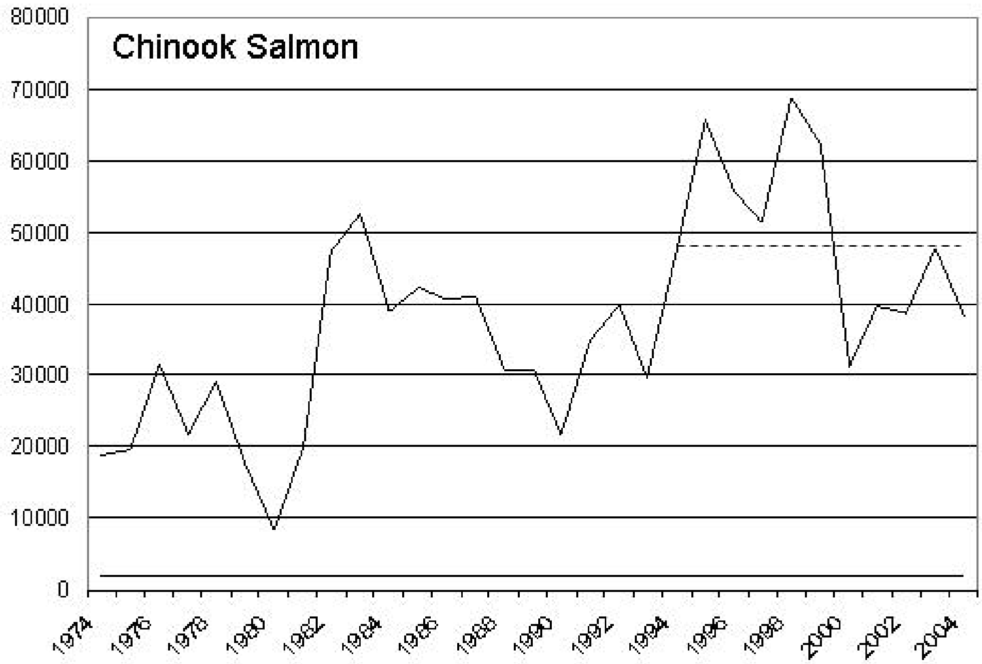


Figure 4.6 - Commercial harvest of Chinook salmon in the Copper River District gillnet fishery from 1974 – 2004. Dashed line indicates the recent 10 year ave. harvest (1995 – 2004). Data from ADFG (Ashe et al. 2005).

Salmon farming and hatcheries - Salmon farms in coastal British Columbia pose a great threat to wild salmon stocks in Alaska. Escaped fish can have detrimental effects on Alaska's wild salmon populations through competition, predation, disease spread, and hybridization. At least 90 farms operate in British Columbia, the most northern of which is in the Straight of Georgia at Bella Bella (ADFG 2002). Since 1991, hundreds of thousands of these fish have escaped from the net pens where they are raised and some have been captured in marine and freshwaters of Alaska.

The possible spread of Atlantic salmon (*Salmo salar*) in Alaskan waters is of great concern. Atlantic salmon have been farmed in the Pacific since the early 1970s and recently have become the most commonly farmed species because of their adaptability to captivity, fast growth, and wide spawning time band that ensures year round availability to the market. They are an exotic species in the Pacific Ocean. Farmed Atlantic salmon have successfully reproduced in streams in British Columbia (Volpes 2003). A Canadian government moratorium on new farms was lifted in 2002 and this industry is expected to expand in the future (ADFG 2002).

Since their introduction in the late 1800s, American shad have spread rapidly throughout the Pacific Ocean. They have been caught in ocean waters ranging from Mexico to Bristol Bay, Alaska; although no spawning populations are known to exist north of British Columbia. American shad are anadromous and migrate back to their natal streams for spawning. They can spawn more than once in a life time. The population of American shad in the Columbia River is currently over 4 million fish. Shad have replaced native salmon species as the largest biomass of anadromous fish in the Columbia River basin. Habitat modifications in the basin have helped to expedite this species proliferation. The large number of dams and reservoirs appear to be great rearing habitats for juvenile shad. The current warming trend may improve conditions for shad to expand further in the freshwaters of the north Pacific.

Atlantic salmon and American shad have been caught at the mouth of the Copper River in the commercial fishery. Two confirmed Atlantic salmon have been captured in the Copper River gillnet fishery over the last 3 years (Steve Moffitt, ADF&G research biologist, personal communication). Atlantic salmon were caught recently in a freshwater stream in the Yakutat area (NAS Database 2005). Escaped Atlantic salmon have successfully reproduced in a stream in British Columbian (Volpe et al. 2000) and juvenile Atlantic salmon can compete for resources with wild fish (Volpe et al. 2001). That no Atlantic salmon have been reported in the freshwaters of the analysis area may only be due to its remote nature. The Forest Service and ADFG have started an aggressive campaign to educate local sport and commercial fishers on how to identify of Atlantic salmon so that if encountered, these fish will be killed and handed over to ADFG.

The Prince William Sound Aquaculture Corporation (PWSAC) operates the largest sockeye salmon hatchery in the world on the Gulkana River, in the upper Copper River watershed (http://www.pwsac.com/gh.htm). Since 1990, fry releases have ranged from 5.6 – 30.9 million and returns of adults have ranged from 69,300 – 632,700 fish (returns only quantified to 2001). It is possible that straying hatchery fish could hybridize with wild sockeye salmon in the analysis area resulting in decreased genetic fitness of wild populations (Utter 2002). However, homing to clear water tributary streams by sockeye salmon may be quite precise, at least for wild populations (Young 2004). It is not known if the same holds true for the hatchery released sockeye salmon in the Gulkana system.

Sport fishing – There is limited sport fishing within the analysis area at this time. It is not a destination chosen for sport fishing, as are other areas further up river or on the Copper River Delta or in Prince William Sound.

Roads and OHV Use - At present, no Forest Service roads exist in the analysis area and no new roads are expected within the next 10 years. Approximately 2 miles of unimproved road exists from the Million Dollar Bridge up to the Grinnell Creek crossing. This road is an extension of the Copper River Highway and follows the old railroad route. At Grinnell Creek, the road is washed out by a 60-foot glacial outwash that cannot be crossed safely in a regular vehicle. Off Highway Vehicles can travel on the old railroad prism past this point, at least up to Abercrombie Rapids. OHVs may be able to harbor and spread seeds of exotic plant species that are trapped in mud or dirt on the tires and wheel wells.

There may be some erosion occurring at stream crossings along the old railroad corridor, however the relative amount of erosion compared to that caused by the natural glacial processes in the area is insignificant. Recreational use on the side tributaries such as camping, hiking, and fishing, could be a concern in the future if OHV use increases or access is improved.

In the winter, a small amount of snow machine use occurs in the analysis area. High winds and extreme cold weather probably limit the amount of use in this area. The potential impact of snow machine use to fisheries resources is low since the streams are mostly frozen and covered in snow. Gas and oil pollution could be an issue if the amount of use increased dramatically.

Recreational boat use - Jet boats, airboats, and non-motorized boats (rafts and kayaks) are used on the Copper River mainly in the summer months with the peak occurring in July and August. The general fisheries concerns with boat use are water pollution and habitat degradation. The type and size of the boats and of the river channels concerned will make a difference in the amount of potential impact to fisheries resources.

Direct impacts to habitat generally apply to motorized boat use, since water pollution can occur from gas and oil spills/leakage and the wave action created by motorized boats can lead to bank erosion and impact important shoreline rearing habitat (Hill et al. 2002). However, in the case of the Copper River, the damage from jet boat wave action would be far less than the natural erosive power occurring from the normal stream flow and glacial runoff. Little spawning and rearing habitat is present along the main Copper River where most boats travel.

Boats of all type provide access by recreational users that might impact fisheries resources in many ways including fishing, hiking, camping, and depositing trash and human waste. Recreational use on the side tributaries such as camping, hiking, and fishing, could be a concern if access is improved through increased boating of any type.

Factors Affecting Vegetation

River channel migration and its influences on vegetation succession

As the river changes course and active channels migrate, the vegetation is drowned in areas covered by water and allowed to re-establish in areas above the river channel. Succession along the river channels will most likely be early successional species as forbs, herbs, alder, willow, cottonwood with scattered conifer in areas of higher ground.

Wind Influences

Wind influences vegetation structure and composition to varying degrees depending on the extent and severity of the disturbance. Along the Copper River, wind has a cooling effect on temperatures creating more severe growing conditions than on the rest of the Delta. Often the wind generated from snow avalanches can blow trees over in front of the snow avalanche. Scattered windthrow commonly occurs along forest edges due to the high winds that frequent the area. The area has not been surveyed for extent of blowdown, but no large areas of blowdown have been reported.

Insects and Diseases

Insects and diseases are two other disturbance regimes that can shape forest composition, structure, and development. Generally, forest land cover types are not present in the analysis area. Land cover is predominately tall shrub, nonforest, or snow and glacier type. The spruce forests around Chitina, north of the analysis area, have been infested by spruce beetle

(*Dendroctonus rufipennis* (Kirby)) and the 2003-4 flights indicated an infestation in the Bremner River drainage east of the Copper River in Wrangell St. Elias National Park. No other infestations were noted in the analysis area (Wittwer 2004, 2005).

Non-Native Plant Species

No basic inventory for non-native plant species (including invasive species) has been conducted in the analysis area. However, surveys conducted along roads, at visitor facilities, and at trailheads in the Cordova/Copper River Delta area (Duffy 2003) indicate that the number and abundance of non-native plant species declines with distance from Cordova. Because of its remoteness and rigorous climatic conditions, the number and abundance of non-native plants is expected to be very low in the analysis area.

As of January 26, 2006, the Alaska Exotic Plants Information Clearinghouse database (AKEPIC; http://akweeds.uaa.alaska.edu/) had no records of non-native plants within the analysis area. The closest record of occurrence in the AKEPIC database is for *Poa annua* and *P. pratensis* at the Childs Glacier Recreation Area, located just outside the southeastern boundary of the analysis area. In addition to these *Poa* species, surveys in 2005 by Robert DeVelice, Forest Ecologist, at the Childs Glacier Recreation Area listed occurrences of *Plantago major*, *Ranunculus repens,* and *Taraxacum officinale*. FIA data (Table A.1) indicates the presence of *Achillea millefolium* in the analysis area, but *Achillea millefolium* includes both native and non-native taxa.

Given the present rarity of non-native plants in the analysis area, Forest managers are in a unique position to prevent invasive plant problems in the area before they occur. Of particular note is the potential for the highly invasive white sweet clover, *Melilotus alba*, to spread into the area via the Copper River corridor from populations to the north. This species has been expanding down many riverine systems of Alaska (Conn 2003) but has not yet been observed in the Tasnuna River watershed or Copper River Delta. Non-native seed could be introduced at site and trail easements along the Copper River and on private lands with lodges and residences.

Threatened, Endangered and Sensitive Plant Species

There are no known threatened or endangered plants within the analysis area. The only federally listed plant in Alaska is *Polystichum aleuticum*, which is listed as endangered. It is only known from Adak Island and is not expected to occur in the analysis area. The Regional Forester designated 19 vascular plants as sensitive in the Alaska Region. Of these, the following 12 species are known or suspected to occur on the Cordova Ranger District of the Chugach National Forest:

Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*)	known
Norberg arnica (*Arnica lessingii* ssp. *norbergii*)	known
Moonwort fern (*Botrychium tunux*)	suspected
Moonwort fern (*Botrychium yaaxudakeit*)	suspected
Goose-grass sedge (*Carex lenticularis var. dolia*)	known
Truncate quillwort (*Isoetes truncata*)	known
Calder lovage (*Ligusticum calderi*)	suspected

Pale poppy (*Papaver alboroseum*)	suspected
Smooth alkali grass (*Puccinellia glabra*)	suspected
Kamchatka alkali grass *(Puccinellia kamtschatica*)	suspected
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	known
Circumpolar starwort (*Stellaria ruscifolia* ssp. *aleutica*)	suspected

The bioenvironmental database used in the FEIS of the Revised Forest Plan (USDA Forest Service 2002a) provides predictions of rare and sensitive plant occurrences based on climatic, landcover, and landform features of the landscape. Based on this database and the presence of general habitats as listed in Stensvold (2002), the following 9 species potentially occur in the area in the following habitats:

Arnica lessingii ssp norbergii - tall shrubland, open forests, meadows, alpine and subalpine habitats
Botrychium tunux and *B. yaaxudakeit* - maritime beaches, upper beach meadows, well drained open areas
Carex lenticularis var. dolia and *Stellaria ruscifolia ssp. aleutica* - lake margins, marshy areas, alpine and subalpine habitats
Isoetes truncata - shallow freshwater
Ligusticum calderi - forest edges, wet meadows, alpine and subalpine habitats
Papaver alboroseum - well drained open areas, dry meadows, alpine & subalpine habitats
Romanzoffia unalaschcensis - forest edges, stream sides/riverbanks, rock outcrops

The predicted number of sensitive plant species (based on the bioenvironmental database) varies across the analysis area. About 90 percent of the area **is not** predicted as habitat for sensitive plant species (primarily non-vegetated rock and ice and areas with dense thickets of tall shrubs along the Tasnuna River and Cleave Creek). The most extensive areas of predicted habitat for sensitive plants are the southerly sideslopes above the Tasnuna River, lowland areas along the Copper River (but not in river channels) in the southern portion of analysis area, and in the rugged mountains between the Allen and Heney Glaciers.

Conditions and Trends of Wildlife Resources

Large-scale natural processes (earthquake, uplift and subsidence etc) will continue to influence wildlife resources in the analysis area. Under the current Forest Plan, there is little reason to believe human related impacts will inhibit wildlife resources from expressing their full range of variability. Most of the analysis area will remain as a large, pristine and mostly roadless area. The area has a high degree of natural integrity with most long-term ecological processes intact (USDA Forest Service 2002c).

Increased visitation of the analysis area by people river rafting, hiking, and boating is likely in the future and impacts of these human uses will need to be monitored and mitigated if necessary. The Whittier tunnel, the fast daily ferry to Cordova, and increasing ecotourism in general will likely bring more people to the Copper River area. Increased visitation, particularly from rafters along the Copper River corridor and by heli-skiers during winter are the most likely areas forms of disturbance in the near future.

Condition and Trends of Heritage Resources

Heritage resources have been increasingly protected over the past 50 years as non-renewable resources. The National Historic Preservation Act of 1966 (NHPA) requires the identification and preservation of significant historic and prehistoric sites on federal land, and the mitigation of both direct and indirect impacts of federal undertakings on sites that are eligible for the National Register of Historic Places (NRHP). Of the known cultural resources in the analysis area, only a few have been documented and evaluated for the NRHP. The remaining either need to be documented and evaluated, or need to have determinations of eligibility completed. Increased recreation tourism, and use from the residents of Cordova and other places can result in direct, as well as cumulative, and indirect impacts to cultural resources.

Prior to the exploration and subsequent railroad development and the spread of introduced Western European diseases, historic properties consisted of Native Alaskan residences and camps primarily in areas near biological and botanical subsistence resources, with defensive qualities related to pre-European technology. With the advent of prospectors and miners in the late1800s, and oil drillers in the early 1900s, historic properties illustrating human use of the land began to be associated with mineral resource occurrences. The establishment of railroad construction camps and mining/drilling camps in the early 1900s created a need for employees who would live in their vicinity, and so contributed to changes in settlement patterns from those in late prehistoric and early historic times.

Under the Programmatic Agreement between USDA Region 10, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation, the high sensitivity zones for cultural resources are identified using a predictive model that describes areas where proposed development may have an impact on heritage resources. These areas include:

- River valleys, lake and river systems providing passes or portages across larger land masses;
- All areas between mean high water and 150 ft. in elevation above mean high water, regardless of slope angle;
- Areas of former lode and placer mining activity;
- Elevated/fossil marine, river, and lake terrace systems; Lake and stream systems containing or known to have contained, anadromous fish runs, including barrier falls locations;
- Caves, rock shelters, and igneous rock formations known for caves and rock shelters;
- Known sources of potential raw materials;
- Other areas identified through literature or oral history research/sources.

Management of cultural resources is legislated by Acts of Congress and Executive Orders, which mandate inventories of cultural resources, and preservation and interpretation of all types of cultural resources for the benefit of the public for all federally funded undertakings. The NHPA requires consultation with Native tribes. In this area, that includes the Native Village of Eyak and Chugach Alaska Corporation. Other local interested parties may include groups such as the Cordova Historic Society.

Although the management prescription for the area calls for minimal development, the NHPA nevertheless requires that properties in the area which “may be eligible for the National Register are managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values in compliance with section 106 of this Act and gives special consideration to the preservation of such values in the case of properties designated as having National significance” (16U.S.C. 470-2(a)(2)(B)). Historic properties could not simply be neglected, because “Neglect of a property that causes deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe” is considered an adverse effect (CRF36 Part 800.5(2)(vi)).

Cultural resources in proposed project areas on National Forest System lands are inventoried under section 106 of the NHPA. Inventories of cultural resources on public land outside identified project areas are regulated under Section 110 of the NHPA. The majority of the analysis area remains to be inventoried for cultural resources. Of the known cultural resources in the analysis area, many still need to be documented and evaluated for the NRHP.

Increased recreation tourism and use by residents of Cordova and more people coming from other areas can result in direct, as well as cumulative and indirect impacts to cultural resources. The Forest Service is required by the rules and regulations that implement the NHPA to consider indirect effects, as well as direct effects, of projects and management actions on historic properties.

Conditions and Trends of Recreation Resources

Cordova’s tourism industry is growing at an estimated rate of 3 to 7% annually (Christensen and Mastrantonio 1999). Within the past 6 years a 35 bed lodge has opened as well as several bed & breakfasts and two rental car companies. With the advent of the daily high speed ferry connecting Cordova to Whittier and Valdez, it is anticipated that there could be a 600% increase in visitors to Cordova. Most use would be concentrated along the road system; however there may be more demand for remote cabins, camping, river trips, picnic sites, and the like. Visitors currently enjoy activities such as fishing, hunting, hiking, camping, bird watching, mountaineering, river rafting, sightseeing, and guided hiking.

Wildlife viewing, a recreational activity that has been occurring for years, has only recently been deemed viable as a commercial venture. For the most part viewing wildlife was a past-time of locals and visiting friends and relatives. As commercial development grew (outfitters, guides, and bed & breakfasts), watching wildlife became a secondary benefit to many primary activities.

The District is currently determining the recreation carrying capacity based on Forest Plan direction. The analysis will determine the capacity for the guided publics based on the 50% allocation from the Forest Plan.

Trails

Currently no Class III or higher trails exist in the analysis area. Class II trail easements are present and described in under easements. The State has pursued constructing a bike trail along the old railroad bed along the Copper River, but this proposal has been dropped (Dave Sanchez, AK DOT, personal communication).

Motorized and non-motorized opportunities

The Forest Plan identifies areas available to winter and summer motorized use. The area is open to summer motorized use by helicopters only and open to winter motorized use by helicopters, OHV, and snowmachines. Private lands along the Copper River require permission from the landowner to cross or use. The demand for motorized recreation use areas especially for OHV is growing and expected to continue to grow. Due to the fact that the analysis area is not the most desirable for OHV use due to its characteristics and has a summer closure, no major OHV issues are expected.

Winter snowmobile use has been increasing over the past 10 years but has not been a capacity issue as of yet. Currently there is a small contingent of local riders that travel in the area between the Million Dollar Bridge and the Allen Glacier area. An even smaller contingent, travel the Copper River/Tasnuna drainages as a route connecting Valdez and Cordova. Because the number of users is so minimal and suitable weather windows so limited, no capacity issues are expected in the near future.

Both motorized and non-motorized recreational boating on the Copper River have been increasing over the past ten years. Outside of the seven site easements between Jackson Creek and Baird Cannon, there are very little National Forests System lands in this analysis area impacted by boat users. From the available data, capacity on the Copper River or at easement sites is not an issue now.

An area of concern which has generated significant comment during special use permit scoping in recent years is the impacts of jet boat and airboat use. In general the use of jet boats has been unregulated and likely will remain so as the Forest Service does not have the authority to regulate navigable waterways nor the areas which occur below the Ordinary High Water (OHW) mark of freshwater systems. Air boats on the other hand have been regulated in part by State of Alaska statutes and Forest Service seasonal restrictions or motorized/non-motorized designations identified in the Forest Plan. Airboat and jet boat use on the Copper River from the Childs Glacier Recreation Area and up-river has been especially contentious. Outfitter/guides wishing to use the Copper River for sightseeing and/or fishing and hunting opportunities have been heavily targeted by environmental groups and concerned citizens who feel impacts to fish, wildlife and the pristine quiet character of the river is unacceptable. The situation is further aggravated by the lack of authority to administer river uses and multiple ownerships or administration of lands within the Copper River corridor. The affected parties include the Eyak Corporation, Tatitlek Corporation, Chugach Alaska Corporation, State of Alaska, BLM, National Park Service and the Forest Service. North of the National Forest boundary there are additional affected Native Corporations and Villages.

The Forest Service, National Park Service, State of Alaska, and several Native Corporations permit upland activities on their lands bordering the river as part of permitted commercial boat operations (National Park lands border the eastern shore of the river and are outside this analysis area). Monitoring use and determining who is permitted on which lands and who is not permitted on any lands needs to be more of a priority then it is currently. Another issue that needs clarification is whether non-profit rafting companies are required to be under permit or not.

Heliskiing is probably the fastest growing winter recreation activity on the Forest. The potential for premier/world class heliskiing in this analysis area is high. The demand in other areas on the Forest has been provided through the prospectus process which indicates that the list of interested providers is greater than available areas to conduct the activity. Since this analysis area is open to motorized use during the winter, evaluations of which locations are acceptable for heliskiing and which are not, are decisions that need to be addressed in the near future.

Under the current USFS land management plan, the entire analysis area has a 213 ANILCA 501(b)-2 prescription. This mandate emphasizes the conservation of fish and wildlife and their habitats, placing recreation as a secondary emphasis.

Due to a number of factors, this analysis area has not been identified as an area that would be modified to provide a wider range of developed or dispersed recreation opportunities. The most accessible portions of the analysis area border the Copper River and those lands are administered by Native corporations. National Forest System lands along the Copper River are minimal and even less public lands border the Tasnuna River. National Forest System lands are generally the higher elevation, more remote and the hardest to access portions of this analysis area.

Figure 4.7 – Floating down the Copper River.

Most of the analysis area will remain as a large pristine roadless area with high scenic value that provides the opportunity for recreation in a primitive and remote setting with plenty of solitude (USDA Forest Service 2002b).

Increased visitation to the North Copper-Tasnuna analysis area, hunting, fishing, camping, hiking, wildlife/scenery viewing, or other reasons is a certainty. Impacts of these human activities will need to be monitored and most likely mitigated. Activities with the highest potential to increase visitation and possible disturbance are river rafting in the summer and heliskiing in the winter.

Outfitters and Guides

The demand for special uses such as outfitter/guides, electronic sites, research, photography, and others is ever increasing. As the competition for use of National Forest System land increases so does the complexity of conducting environmental analyses and coordinating activities. However, of all the Cordova District, National Forest System land in this analysis area is the least accessible due to the remote location and prevalence of private land adjacent to the Copper River, the main access route.

Linked with demand are concerns with human carrying capacities especially relative to the outfitter and guide industry. In recent years public scoping conducted for various special use permit applications or amendments to existing applications which considered increases in consumptive uses such as hunting or fishing has resulted in strong public response opposing additional uses. Crowding, reduction in quality of recreation experience, impact to the guiding industry, and reduction of viable fish and wildlife populations are the four most common concerns raised. This year the Cordova Ranger District will begin a two year effort to conduct a Human Carrying Capacity Analysis of the East Delta and the Copper River corridor. An issue that can be addressed in the carrying capacity analysis is the perception that the Recreation Opportunity Spectrum (ROS) zoning of the Copper River corridor may be too restrictive as the corridor itself offers the primary access to the area via watercraft or aircraft. The ROS designation of Semi-Primitive Motorized could limit the amount of use.

Another on-going issue is the illegal, non-permitted use of National Forest System lands by a variety of outfitter/guides (river rafters, heli-skiers, big game guides and fishing guides). With the addition of a full-time law enforcement officer to the Cordova District we are seeing a great improvement in our ability to prosecute violators and provide a Forest Service presence in the field which serves to curb the incentive to operate illegally.

Potential for Mineral Resource Development

The overall potential for mineral development to occur in the analysis area is low. There is no history of minerals production. Several small, low-grade mineral occurrences are known, however, these are not encouraging. Although there is high potential for “undiscovered” deposits, no significant deposits have been discovered to date. There has been minimal interest in prospecting the analysis area over the years.

The potential for mineral materials or common variety mineral development on National Forest System lands is low and development of these resources will depend on the need for roads and infrastructure and the lack of local private sources of the material.

All public domain lands are open to mineral entry under the 1872 Mining Law unless specifically closed. Both locatable minerals claimants and operators (under the 1872 Mining Law), and reserved and outstanding minerals owners, have a statutory right to develop the mineral resource. However, neither of these types of minerals rights exists within most of the analysis area. A sliver of land is open to mineral entry on the south tip of the analysis area. Bona fide mineral development cannot be prohibited where lands are open to mineral entry. On lands open to mineral entry, mining claims can be located and the mineral resources can be developed. The statutes also provide for a mining claimant's rights to reasonable access for prospecting, locating mining claims, and developing the mineral resource. Such activities must conform to the rules and regulations of the Forest Service; however those rules and regulations may not be applied so as to prevent lawful mineral activities or cause undue hardship on bona fide prospectors and miners (FSM 2810). On lands closed to mineral entry, leasing or sales of mineral materials may still occur, but these sales are discretionary. The Forest Service may limit or prohibit such activities.

The BLM administers leasable minerals on National Forest System lands. The Forest Service may concur or consent to a lease, or withhold concurrence or consent. BLM regulations state that they will not lease over the Forest Service's objections. If the Forest Service concurs or consents, they may also offer stipulations to be included in the lease agreement that are designed to protect or mitigate surface resource disturbance. Under the authority of the Act of March 4, 1917, prospecting permits and leases may be issued for hard-rock minerals in the Copper River ANILCA Addition. These activities would be managed in accordance with Forest Plan direction which states that minerals activities are allowed consistent with the management intent, standards and guidelines.

Mineral development is often perceived as causing negative impacts to surface resources and conflicting with other uses of the land. It can be and is managed to minimize such impacts. Besides laws and regulations, the Forest Plan provides additional protection for wildlife and other resource values through standards and guidelines. In this analysis area, significant mineral development projects on National Forest fee and surface estate lands, private inholdings, or adjacent lands are unlikely given the current knowledge of mineral occurrences and prospects, lack of interest on National Forest System lands, lack of activity, remoteness of the area, and lack of infrastructure. Therefore, mineral development will likely not be an issue in the foreseeable future in the analysis area.

Still, the U.S. Geological Survey considers the area to have a high potential for as yet undiscovered mineral deposits. However, before mining could occur:

1. Prospecting and exploration must be first be done resulting in a discovery (mineralization must be of a character to encourage additional investment),
2. a newly discovered deposit would have to be evaluated and a feasibility study conducted (the outcome is a decision to abandon or proceed) ,

3. permits would have to be acquired (this can be a very long process complicated by appeals and lawsuits),
4. and infrastructure would have to be constructed (particularly expensive in remote areas).

This process generally takes years to complete, 20 years and longer is not uncommon.

Chapter 5 Recommendations for inventory, monitoring, and potential projects

Inventory and Monitoring

We have very limited information about the resources of the North Copper -Tasnuna analysis area. Baseline information for all resources would be beneficial to monitor the impacts of increased recreation in the area and changes triggered by natural events.

Hydrology

1. Collect data to quantify rates of bank erosion at site easements along the Copper River. This information should include baseline conditions of the bank, vegetation and soils data, and shear stress along the bank.

Fish

1. Identify current distribution and important spawning, rearing, and over-wintering habitat for sockeye and coho salmon in the Tasnuna River watershed. Identify presence of cutthroat, rainbow trout, Dolly Varden, and other species in the Tasnuna River watershed. Inventory potential fish habitat on National Forest System lands.
2. Monitor change in habitats. Place thermographs in stream systems to monitor warming trends. Use GIS and aerial photography to document changes in the extent or condition of habitat. Monitor changes in distribution of fish species and habitats over time to document whether new habitat is created by glacial recession.
3. Coordinate with NVE and ADFG to ensure the identification of Atlantic salmon and American shad. Distribute exotic species identification materials to commercial fishers, cannery workers, and sport fish users on the Copper River. Coordinate with ADFG to monitor commercial salmon harvest for exotic species.
4. Establish an accurate, updated stream layer for the corporate GIS database. Verify channel types for streams in this layer.
5. Inventory road and OHV crossings from the Million Dollar Bridge to Abercrombie Rapids.
6. Use LIDAR to assess channel types and habitat in the analysis area.
7. Work with other agencies and non-government organizations to assess threats to the Copper River Basin and establish baseline data (i.e. identify historical or popular fishing sites to monitor use and bank damage over time and assess risk and possible effects of an oilspill from the Alaska pipeline which is located outside the analysis area).

Vegetation Resources

1. Conduct a baseline survey along Copper River and easement sites for invasive, as well as TES species.

Wildlife

1. Identify presence and key habitats for breeding, feeding, shelter, and resting of wildlife species in the analysis area, with priority places on threatened and endangered species, species of special management concerns, and game species. Table 3-5 on page 3-28 of the Forest Plan describes important habitat sensitivity and seasonality for river otter, brown bear, Peale’s Peregrine, Bald eagles, goshawks, and waterfowl. Desired surveys include those for land birds, swans, moose, small mammals, and winter track surveys for mid-sized carnivores. Determine wildlife use of Bremner Flats and potential impacts by users.
2. Collect baseline data on timing of use by migratory species, such as shorebirds, and waterfowl.
3. Document presence of amphibians and in particular, wood frogs, within the analysis area.
4. Develop research studies to examine effects of human disturbance (on foot, by boat, or passes by airplanes, etc.) to brown bears at feeding sites.
5. Radio collar moose to identify possible movements between the analysis area and Copper River Delta.
6. Radio collar mountain goats to identify home range fidelity and seasonal movements between summer and winter habitat and to document significance of identified winter mountain goat habitat.
7. Document timing and use by brown bears at salmon feeding sites.
8. Document important early season feeding habitats for bears.

Heritage Resources

1. Inventory cultural resources in project areas proposed by the Forest Service per section 106 of the NHPA.
2. Inventories of cultural resources on National Forest System lands outside identified project areas fall under Section 110 of the NHPA. These inventories could involve partnerships. The State of Alaska’s Office of History and Archaeology staff has partnered with the Forest in the past and is a likely future partner for historic research, as are the departments of Anthropology and History of the University of Alaska. Depending on funding, two options to inventory the cultural resources of the area and develop a database are:
    a. **Option 1 (High funding)-** Showcase Forest Service management of historic sites, complete the inventory and evaluation of cultural resources of the analysis area over a period of 25 years, and refine the predictive model after completing archaeological survey of 25% of the analysis area. A complete inventory would allow better interpretation of the significant historic resources in the analysis area related to Native Alaskans, early European exploration and the CRNW railroad.
    b. **Option 2 (Moderate funding**)**-** Complete the inventory and evaluation of cultural resources of the analysis area over a period of 40 years and build a predictive model after 25% of the analysis area was surveyed. Project specific inventory of cultural resources would also continue, when projects would be initiated. Historic properties and cultural landscapes would be evaluated for the National Register for management purposes. Historic

properties would be avoided as much as possible. Interpret cultural resources only if necessary for mitigation of adverse effects. Evaluate and maintain historic properties, rehabilitate if necessary for maintenance.

Easements

1. Monitor conditions of easements and maintain on a 3-5 year rotation.

Special Uses and Outfitter/guides

1. Monitoring special use permits primarily through field inspections and information received from the public.

Potential Projects to Consider in the Analysis Area

No potential projects for this analysis area were listed in the revised Forest Plan, Appendix C. The IDT and public identified other potential projects for the analysis area. These projects would be further analyzed through the NEPA process and additional public involvement before a decision was made to implement or not.

Fisheries

1. On the north side of the Million Dollar Bridge where rafters and boaters enter/exit river, put interpretive signs and information signs about location of nearest trash and restrooms (which are on the south side of bridge) or provide facilities at this site.
2. Enhance spawning or over-wintering habitat if surveys indicate habitat is limited.

Wildlife

1. Place interpretive signs at places used for recreating, hunting or fishing such as USFS easements. Signs could educate visitors about avoiding disturbing wildlife, importance of habitats, or the history of local wildlife populations.

Heritage Resources

1. Partner with interested entities for documentation, preservation, and interpretation of prehistoric and historic sites, cultural landscapes, and rehabilitation of historic buildings.

2. Develop collaborative stewardship relationships for protection and interpretation of cultural resources; partner with university programs for research work to provide background information for management and interpretation. Because of the rich history of use by indigenous peoples, followed by railroad developers, there are numerous potential partners for a variety of cultural resource related projects. Stewardship partners have been established for historic sites in western Prince William Sound on Glacier Ranger District and have proven to be successful in monitoring archaeological sites. Similar stewardship partners could be established in the analysis area. The Native Village of Eyak is actively interested in their ancestral use of the area, and would be a potential partner for interpretation and documentation cultural resources. Other potential future partners in historic research and documentation are both the State of Alaska’s Office of History and Archaeology and the departments of Anthropology and History at the University of Alaska. Two

historical societies – Cordova, and Alaska, Historical Societies –have already demonstrated interest in partnering with the Chugach National Forest on documentation, preservation and interpretation of cultural resources on other parts of the District.

3. At the minimum, evaluate and maintain historic properties, but do not rehabilitate unless necessary for maintenance.

4. Because of limited access to the analysis area, interpret the history of the area in brochures available in the Cordova District and Chugach National Forest Supervisor's Offices.

5. Develop stewardship partnerships with outfitter/guides to monitor sites.

Recreation

1. A 1200 to 1500 foot section of the Childs Glacier Trail needs a major modification to counter the flooding caused by beavers. However, this is unlikely to occur soon because of the backlog of existing trail Capital Improvement Projects (CIPs) at the Regional level and the estimated $50,000 cost of the repair. The Region has made a decision not to submit any new trail related CIPs until the current five years' worth of backlogged projects has been completed. As a result, the Childs Glacier Trail may not meet FS standards for five to ten years.
2. Depending on final ownership boundaries and future user demands additional Class I trails (easements) may be constructed. Currently these trails are authorized but classified as "Held-in Perpetuity". If and when conditions change, these trails, mostly within the Tasnuna drainage will be constructed to provide the public access to public lands.
3. Collect baseline data concerning rafting on the Copper River; number of groups, size of groups, number of groups on the river at one time, campsite impacts, human/wildlife impacts, etc.
4. Increase Forest Service presence up river to educate river users on the purpose, location and intent of easements, trespass issues on private lands and Leave No Trace camping techniques.
5. Increase winter presence to monitor both authorized and unauthorized activities.
6. Create an Access database of all river use to help manage the Special Use program and carrying capacity analysis.

Project Implementation Recommendations

Heritage Resources

1. Manage cultural resources in conjunction with other resources. Human use of any area is generally due to the presence of various biological, botanical, geological, and hydrological resources. Managing and interpreting heritage resources simultaneously with other resources can provide a holistic view of the natural resources important to the people associated with the cultural resources of a site.

2. Consider indirect effects to cultural resources when designing and proposing projects. Indirect effects are those effects that may occur outside the direct footprint of a proposed project. An example is the creation of a new recreation trail which passes by a historic cabin or an archaeological site. By increasing the ease of access, and routing the public into the vicinity of the cultural resource, the integrity of the resource is put at risk of either purposeful vandalism or accidental disturbance by the public, and must be addressed by the project.

Minerals Development

1. It is recommended that if a request for a mineral material sale is made and private resources are readily available, that the sale be denied. Adequately demonstrating that private resources are not available would be the responsibility of the requester.
2. The Forest Plan does not address leasing on National Forest System lands. It is recommended a prospecting permit [under the leasing authorities] be allowed, if such activity can be accomplished consistent with the management area intent.
3. A lease should only be allowed following the issuance of a prospecting permit and upon sufficient evidence that a valuable mineral deposit likely exists. This evidence should be evaluated by a certified Minerals Examiner.

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Appendix A – Additional Tables

Table A.1 – The 205 vascular plant taxa documented in the analysis area based on the University of Alaska Herbarium database (ALA) and Forest Inventory and Analysis plots (FIA).

Scientific Name	ALA	FIA
Tall Shrubs		
Alnus viridis ssp. *sinuata*		x
Oplopanax horridus	x	x
Pentaphylloides floribunda	x	
Ribes glandulosum		x
Ribes laxiflorum	x	
Salix alaxensis		x
Salix barclayi	x	x
Salix brachycarpa		x
Salix commutata	x	
Salix pulchra		x
Salix sitchensis	x	
Sambucus racemosa	x	x
Sorbus sitchensis	x	x
Vaccinium ovalifolium	x	x
Subshrubs and Dwarf Shrubs		
Arctostaphylos alpina	x	x
Arctostaphylos rubra		x
Cassiope tetragona		x
Dryas integrifolia	x	
Dryas octopetala		x
Empetrum nigrum	x	x
Harrimanella stelleriana	x	x
Linnaea borealis		x
Loiseleuria procumbens		x
Luetkea pectinata	x	x
Phyllodoce aleutica		x
Phyllodoce aleutica ssp. *aleutica*	x	
Salix arctica	x	
Salix arctophila		x
Salix myrtillifolia		x
Salix reticulata		x
Salix rotundifolia	x	x
Salix rotundifolia ssp. *rotundifolia*		x
Sibbaldia procumbens	x	x
Vaccinium uliginosum	x	x
Vaccinium vitis-idaea		x
Forbs		
Achillea borealis	x	x

Table A.1 – The 205 vascular plant taxa documented in the analysis area based on the University of Alaska Herbarium database (ALA) and Forest Inventory and Analysis plots (FIA).

Scientific Name	**ALA**	**FIA**
Achillea millefolium		x
Aconitum delphinifolium	x	x
Anemone multifida	x	
Anemone narcissiflora		x
Anemone parviflora	x	
Angelica genuflexa		x
Angelica lucida		x
Antennaria media	x	
Antennaria monocephala		x
Antennaria rosea ssp. *pulvinata*	x	
Arabis lyrata	x	
Arnica griscomii ssp. *frigida*	x	
Arnica latifolia	x	x
Arnica lessingii	x	x
Artemisia arctica	x	x
Artemisia tilesii	x	x
Artemisia tilesii ssp. *unalaschcensis*		x
Aruncus sylvester	x	
Astragalus alpinus	x	
Caltha leptosepala	x	
Campanula lasiocarpa	x	x
Campanula rotundifolia	x	
Cardamine oligosperma var. *kamtschatica*		x
Cardamine umbellata	x	
Castilleja pallida var. *caudata*	x	
Castilleja unalaschcensis	x	x
Cerastium arvense	x	
Cerastium beeringianum	x	
Chrysosplenium tetrandrum	x	
Claytonia sarmentosa		x
Coeloglossum viride	x	
Crepis nana	x	
Diapensia lapponica		x
Draba stenoloba	x	
Epilobium anagallidifolium	x	x
Epilobium angustifolium ssp. *angustifolium*		x
Epilobium ciliatum ssp. *adenocaulon*	x	
Epilobium ciliatum ssp. *ciliatum*		x
Epilobium hornemannii	x	x
Epilobium hornemannii ssp. *hornemannii*	x	
Epilobium lactiflorum	x	x
Epilobium latifolium	x	x
Epilobium palustre		x

Table A.1 – The 205 vascular plant taxa documented in the analysis area based on the University of Alaska Herbarium database (ALA) and Forest Inventory and Analysis plots (FIA).

Scientific Name	**ALA**	**FIA**
Erigeron eriocephalus	x	
Erigeron humilis	x	
Erigeron peregrinus	x	x
Erigeron purpuratus	x	
Fauria crista-gallii	x	x
Galium triflorum	x	
Gentiana platypetala		x
Geranium caespitosum var. *eremophilum*		x
Geranium erianthum	x	x
Heracleum maximum		x
Heuchera glabra	x	x
Hieracium gracile	x	
Hieracium triste	x	x
Leptarrhena pyrolifolia	x	
Listera cordata	x	
Lloydia serotina		x
Lupinus nootkatensis	x	x
Mitella pentandra	x	
Orthilia secunda	x	x
Osmorhiza depauperata	x	x
Oxyria digyna	x	x
Oxytropis nigrescens		x
Parnassia fimbriata	x	
Parnassia palustris	x	x
Petasites frigidus	x	
Petasites frigidus var. *nivalis*		x
Platanthera obtusata		x
Platanthera stricta	x	
Polemonium acutiflorum		x
Polemonium boreale	x	
Polemonium pulcherrimum		x
Polygonum viviparum		x
Potentilla diversifolia	x	
Potentilla villosa	x	
Prenanthes alata		x
Prunella vulgaris	x	
Pyrola asarifolia	x	
Ranunculus eschscholtzii	x	
Ranunculus occidentalis	x	
Ranunculus uncinatus var. *parviflorus*		x
Rhinanthus minor ssp. *borealis*	x	
Rhodiola integrifolia	x	x
Romanzoffia sitchensis	x	

Table A.1 – The 205 vascular plant taxa documented in the analysis area based on the University of Alaska Herbarium database (ALA) and Forest Inventory and Analysis plots (FIA).		
Scientific Name	**ALA**	**FIA**
Rubus arcticus		x
Rubus arcticus ssp. *stellatus*	x	
Rubus chamaemorus		x
Sagina saginoides	x	
Sanguisorba canadensis		x
Sanguisorba stipulata	x	
Saxifraga bronchialis		x
Saxifraga bronchialis ssp. *funstonii*	x	
Saxifraga flexuosa	x	
Saxifraga lyallii	x	
Saxifraga mertensiana	x	
Saxifraga nelsoniana	x	
Saxifraga nelsoniana ssp. *nelsoniana*		x
Saxifraga nivalis	x	
Saxifraga oppositifolia		x
Saxifraga tricuspidata	x	
Senecio lugens	x	
Senecio triangularis	x	x
Silene acaulis	x	x
Solidago multiradiata	x	
Stellaria borealis ssp. *sitchana*	x	
Stellaria calycantha	x	x
Stellaria longipes		x
Streptopus amplexifolius	x	x
Tellima grandiflora	x	x
Tofieldia coccinea		x
Trientalis europaea	x	x
Valeriana capitata		x
Valeriana sitchensis	x	x
Veratrum viride		x
Veronica stelleri	x	
Veronica wormskjoldii	x	x
Viola langsdorffii	x	
Zygadenus elegans	x	
Graminoids		
Agrostis scabra	x	
Arctagrostis latifolia	x	x
Arctagrostis latifolia ssp. *latifolia*		x
Calamagrostis canadensis		x
Carex anthoxanthea		x
Carex circinata		x
Carex kelloggii	x	
Carex macrocephala		x

Table A.1 – The 205 vascular plant taxa documented in the analysis area based on the University of Alaska Herbarium database (ALA) and Forest Inventory and Analysis plots (FIA).

Scientific Name	**ALA**	**FIA**
Carex macrochaeta	x	x
Carex micropoda	x	
Carex nigricans		x
Carex pachystachya	x	
Carex phaeocephala	x	
Carex podocarpa		x
Carex scirpoidea	x	
Carex utriculata	x	
Danthonia intermedia	x	
Elymus alaskanus ssp. *latiglumis*	x	
Eriophorum angustifolium	x	
Festuca altaica	x	x
Festuca brachyphylla	x	
Hierochloe alpina		x
Juncus drummondii	x	x
Juncus mertensianus	x	
Luzula arcuata		x
Luzula parviflora	x	x
Luzula wahlenbergii		x
Phippsia algida		x
Phleum commutatum	x	x
Poa alpina	x	
Poa glauca	x	
Poa leptocoma		x
Trisetum spicatum	x	
Vahlodea atropurpurea	x	x
Ferns and Fern Allies		
Athyrium filix-femina	x	x
Botrychium lanceolatum	x	
Botrychium lunaria	x	
Cryptogramma sitchensis	x	x
Cystopteris fragilis	x	x
Dryopteris dilatata	x	x
Equisetum arvense		x
Equisetum pratense		x
Equisetum variegatum	x	
Gymnocarpium dryopteris	x	x
Huperzia selago	x	
Lycopodium alpinum	x	x
Lycopodium annotinum		x
Lycopodium clavatum	x	
Polystichum lonchitis	x	

Appendix B – List of available resource reports and GIS products

All reports and GIS products are electronically filed at the Cordova Ranger District office in J:\fsfiles\office\1900_planning\land_ass\ncoppertas\. Hard copy reports are also available at the district office.

Separate resources reports (\ncoppertas\resource_rpts\) include:
Fisheries Report – Dirk Lang
Heritage Resource report – Heather Hall
Hydrology Report – Bill MacFarlane
Lands Resource report – Bruce Campbell
Minerals and Geology report – Carol Huber
Recreation Report – Dixon Sherman
Soils and Erosion Processes report – Dean Davidson
Subsistence Fisheries input – Tim Joyce
Wildlife Assessment report – Milo Burcham
Vegetation, Sensitive Plant, and Invasive Plant Report – Rob DeVelice

GIS products: (ncoppertas\gis)
Several ArcMAP projects (xxx.mxd) are located in the GIS folder for the North Copper Tasnuna LA. The corporate database layers have been clipped to the analysis area boundary for lands status, Forest Plan direction, watershed boundaries, cover type, timber type, recreation polygon and point layers, streams, roads, trails, and bald eagles. JPEGs have been created from the information and the resulting maps are in the maps and figures folder.

Appendix C – Land Stability Analysis Process on the Chugach National Forest

Assembled by Dean F. Davidson, Forest Soil Scientist

A land stability analysis is done on all major land disturbing activities proposed for sites that contain properties that frequent landslides. Red flags are fine texture soils of lacustrine origin, soils in or underlain with glacial till or outwash, poorly drained soils on slopes over 56 percent, shallow soils over an impermeable layer such as bedrock or compact glacial till.

The Standards and Guidelines in the Chugach Land Management Plan state "an analysis will be done for all major soil-disturbing activities greater than one-half acre in size, proposed on slopes from 56 to 72 percent and one-tenth acre in size on slopes greater than 72 percent. Initially a preliminary analysis is done in the office using available information. If sufficient indicators are thought to be present on the site, the office analysis will be followed with an on-site inspection and analysis. The analysis process used on the Chugach NF was developed by Hicks, B.G. (1982). This system uses the presence of features characteristic of landslides for the identification of landslides of all relative ages.

The Hicks risk assessment consists of identification of the presence of past and present landslides or landforms and soils with characteristics that normally contribute to a landslide. Aerial photography and available soils and landform data are good sources for information to help make the determination. The following categories are used to identify the risk for a landslide. Some characteristics for landslide identification are also included in the definitions.

Levels of Landslide Activity and Indicators

Active — Currently active or active in the very recent past. May have fresh scarp or cracks. Leaning trees may indicate recent movements; such as a straight, healthy conifer leaning from the base can dictate recent movement. Broadly bowed, living conifer indicates movement over a period of time. Hummocky terrain with terrace-like slopes which are not deeply weathered may indicate recent movement.

Possibly Active — No clear indications of recent movement but landforms indicate movement in the past. Landslide features not so heavily weathered as to indicate long-term stability. Features are more subtle, often without obvious scarps or cracks. Possible low, constant creep rate that is currently creeping at a rate sufficiently slow that obvious cracks do not form.

Inactive No indication of movement is discernable from aerial photo interpretation or from field observation. However, significant soil removal, deep cuts from roads, tree removal or increase in water content because of management activities could accelerate or increase the potential for landslides or soil creep.

Stable No indication of movement is discernable from aerial photo interpretation or field observation. Landform and soil factors are not conducive to landslides or soil creep.

The more analytical Forest-wide standardization approach used by Douglas N. Swanston (1997) for hazard assessment for the Tongass Land Management Plan is used, with some minor adjustments, for on-site analysis on the Chugach NF. This system uses data that is easily collected in the field; such as soil properties including soil texture, parent material, depth, drainage; and specific topographic characteristics such as slope shape, length, gradient, and drainage density. The risk assessment weighs each of the characteristics as to their relative importance in landslide production and provides a relative numerical landslide failure rating for the site.

Risk Assessment Categories

High to Extreme Natural failures are often frequent and large, and there is a high risk of management-induced failure. Standard management practices can be expected to have only limited success, and on-the-ground assessment is necessary to determine the need for mitigating measures.

Moderate Natural failures are usually small and infrequent, but there is a moderate risk of management-induced failure. Standard and the best management practices are usually successful but on-the-ground investigation is still recommended. Mitigation measure may occasionally be needed.

Low Natural failures are usually rare or small. There is a low risk of management-induced failures except on unstable micro-sites such as scarps, V-notches, and stream banks. Standard best management practices that control stream flows and surface disturbances can be expected to be highly successful.

Used together, the Hick and Swanston risk assessment systems provide a solid basis to determine the potential for a landslide. One system is based on visual characteristics used to identify landslides and other system uses the analytical approach with data easily collected at the site.

The following spreadsheet shows the different criteria and the weighting that is used on the Chugach NF. The numerical rating is categorized into four ranges to give a relative potential derived from a repeatable process. The spreadsheet allows you to adjust a value and see what it would take to increase or reduce the potential for landslide occurrence, and hence estimate the effects of the proposed management activity.

Criteria	1	2	3	4	Criteria Value	Weighting Factor	Rating
Landform							
Slope Shape	Vertical	Broken	Convex	Concave-Straight	X	5	=
Slope length (ft)	0-300	301-700	701-1500	>1500	X	5	=
Slope gradient (%)	0-35	36-55	56-72	>72	X	20	=
Drainage Features							
Drainage density (% of area)	0-10	11-19	20-39	>40	X	10	=
Soils and Geology							
Soil drainage class	WD	MWD	SPD	VP, PD	X	10	=
Soil depth (inches)	>40	Not applicable	20-40	<20	X	5	=
Parent material	Carbonate, colluvium, alluvium	Noncarbonate, granitics, glacial till	Compact till, marine sediments	Volcanic ash	X	5	=
Textural class	Sand, gravel, fragmental loam	Loam	Silt	Silty clay	X	5	=
Total of Ratings							
Failure Hazard Rating (>63 = High, 62-50 = Moderate, 28-49 = low, <28 = none)							

Appendix D – Public Involvement

During this analysis effort, notices were posted in the local paper and letters and emails were sent to 110 individuals, organizations, landowners, and Native, State, Federal and City agencies soliciting input in the winter of 2005. Six responses were received and used to develop key questions, issues, and potential projects. Public comments received during the Forest Plan revision in 2002 were used as well to focus discussion and develop key questions, issues, and potential projects.

Request for input was sent to the following people and organizations:

Name

Native Village of Eyak
Chenega Corporation
Dan Hull
Cascadia Wildlands Project
Alaska Dept of Fish and Game – Cordova office
Alaska Association for Historic Preservation
Chitina Village Council
National Wildlife Federation
George Covel
Cordova ORV Group
Cordova District Fisherman United
Lonesome Dove Outfitters
City of Cordova – Mayor, City Planner, Museum
Ahtna Village IRA Council
Alaska Mountain Adventures
Alaska Miners Association
Points North
Alaska Pacific University
U.S. Geological Survey
Ahtna Corporation
Backcountry Safaris
North Star, Inc
Wilderness Alaska
Becky Chapek
Alaska Earth Sciences
State Historic Preservation Office
US Fish and Wildlife Service
North American Outfitters
Chenega Bay IRA Council
Bureau of Land Management
Jim McDaniel
Victor Hottinger
Woods Outfitting
Carl Becker and Nancy Bird
Alaska Wilderness Air

Name

Eyak Village Corporation
Cordova Historical Society
City of Valdez - Mayor
Tatitlek Native Corporation
Alaska State Department of Natural Resources
Forestry Sciences Lab, Bill Van Hees
Wilderness Society – Alaska
Dick Groff
Valdez H20 Heli-guides
Cordova Air
Glenn Juday, University of Alaska - Fairbanks
Lauren Padawer
Ellis Big Game Guides and Outfitters
Copper Oar, Inc
Vision Quest Adventures
Susan Ogle and Kelly Weaverling
Alaska Center for the Environment
Real Alaska Trophy Hunts
Ecotrust
Alaska Two Legged Tours
Cordova District Fisherman United
George Siavelis
Wilderness Ventures
Scott McRae
Wrangell St. Elias NPS
National Outdoor Leadership School
Alaska Conservation Alliance
Native Sun Charters
Alaska Historical Society
Alaska River Expeditions
Tatitlek Village IRA Council
Auklet Charter Service
Cordova Coastal Outfitters
Exposure

Name

Chugach Alaska Corp.
Cordova Audubon Society
Eyak Preservation Council
Cordova Chamber of Commerce
Cordova Fish and Game Advisory Committee
Prince William Sound Science Center
Copper River Watershed Project
Dick Shellhorn
Sierra Club – Alaska
Fishing and Flying
Copper Center, community Library Assoc.
Accord Guide Service
Larry Hancock, Copper River Air Taxi
Alaska Hunting Adventures
Fejes Guide Service
Exposure
Sundog Expeditions
Invasive Plant Group - UAF
Alaska Outdoor Adventures
Anadyr Adventures
The Nature Conservancy
Wilderness Adventures
Steve Johnson
Valdez Heliski Guides
Solstice, Inc
Alaska Safari and trading Company, LLC
Osprey Expeditions
Valdez Native Association
Clare Doig
Alaska Mountain Safaris
Warren and Theresa Chappell
Copper River Glacier Tours
Alaska Alpine Adventures
North Star Inc.

Table D.1 - Winter 2005 comment summary for North Copper Tasnuna Analysis

#	issue - type	issue/service/ project description	concern	level to address	how to address
1	maintenance	FS ability to maintain trails /facilities already present on the Delta, besides anything new.	Before embarking on building or expanding recreation facilities, insure that the sites currently in place are properly maintained.	Not in this LA.. Address in site specific project scoping	Consider ideas for maintaining alaganik road and sites and shelter on Crater Lake ridge. Info signs, redesign, patrols. Letter forwarded to Rec shop.
2	Interested in information we gather in assessment	Provide copy when done.	wants to know about activities in the area	Id in LA and contact during future project scoping	send copy of assessment/ e-mail where it is located. Contact in future project scoping.
3	shore access	trail easements are valuable asset for public & commercial operators, both motorized and nonmotorized	17(b) easements are important for ensuring public has access to uplands along this section of the Copper River	ID in LA,	keep adequate public access.
3	sensitive habitat	Bremner flats is sensitive habitat located at confluence of Bremner and Copper River. The sand dunes support several springs and essential habitat for migrating birds.	Motorized use and camping on the sand dunes of this region could have serious consequences to the flora and fauna of the area as well as adversely affecting the visual or aesthetic qualities of the region.	ID as concern in LA and use information when determining camping locations.	Forest Plan calls for non-motorized except for subsistence in the summer, open for motorized in the winter.
3	sensitive habitat	Western shore of Abercrombie Rapids	critical habitat for nesting birds and feeding bears.		not allow 17(b) easements or use of upland sites in this area
3	maintenance	17(b) easements need to be actively managed	signs needed to reduce trespass issues, trash removed from sites and sites monitored, problem bears if people not careful with camps and trash	ID in LA, potential projects for monitoring, patrolling, signs,	Improve public education along the Copper River and 17(b) easements. Monitor sites for adequate trash removal "pack it in-pack it out"
4	minerals potential	possible high grade prospects worthy of investigation	CAC is marketing select lands based on minerals potential	id as potential in LA	id as potential
4	private lands in assessment area	CAC has fee simple and subsurface estate along Copper and Tasnuna rivers. Eyak and Tatitlek also are landowners in area	recognize these rights CNI, ANSCA, ANILCA	Include in description of area	send cc of assessment. Contact in future project scoping.
4	sand,gravel, stone rights	Access above Miles Lake could attract new interest & development of these resources with the right market conditions	id as potential	in description of existing conditions and trends	in LA
4	Transportation corridor	LA recognize potential for highway to be constructed	effects of increased traffic should be included in assessment	Is outside scope and time span of LA, not FS activity. - a federal hwy or state DOT activity	id and get info on timeframe for hwy. Not planned for at least next 10 years.

#	issue - type	issue/service/ project description	concern	level to address	how to address
4	hunting/ guiding/ outfitting	only 1 outfitter permitted on CAC lands	for consistency sake and minimize trespass issues, support FS issuing permit to this person on NF lands in GMU 13D and GMU 6	id as support in LA, carry through to project level if request comes in	note
5	private lands in assessment area	mgmt of Corp lands for benefit of shareholders - includes commercial development	LA not result in decisions that limit access across public lands to private lands.	id in LA, & consider in project effects.	consider rights of adjacent landowners in decisions/alternatives
5	private lands in assessment area	consider effects, especially potential adverse effects on pvt land that could result from recommendations developed by team	consider impacts on private lands	LA/project level	display effects to private land when developing alternatives and management recommendations.
6	easements	nice to have easements and land status maps and camp spot	may have more clients in future so will need those areas	n/a - permit	permit