USDA Forest Service, Alaska Region
DESIGNATION ORDER
for the
Copper Sands Research Natural Area
on the
Chugach National Forest
Cordova Ranger District, Alaska

Background:
In September 2000, the Forest Supervisor recommended establishment of four new Research Natural Areas (RNAs) in his Preferred Alternative for the Revised Land and Resource Management Plan of the Chugach National Forest. The Record of Decision for the Revised Forest Plan, [which I] signed in May 2002, documented the decision to follow the Forest Supervisor's recommendation to designate four Research Natural Areas on the Forest.

Among these is the Copper Sands RNA southeast of Cordova, Alaska. That decision was the result of an analysis of the factors listed in 36 CFR 219.25 and Forest Service Manual 4063.41. Results of that analysis are documented in the Revised Land and Resource Management Plan for the Chugach National Forest, the Final Environmental Impact Statement for the Chugach National Forest Land Management Plan Revision, and the Establishment Record for the Copper Sands RNA. All of these documents are available to the public from the Chugach National Forest, 3301 "C" Street, Suite 300, Anchorage, AK 99503-3998. The Forest Plan documents are also available on the internet at: http://www.fs.fed.us/r10/chugach/forest_plan/plan_docs1.html

Designation:
Accordingly, by virtue of the authority delegated to me by the Chief of the Forest Service in Forest Service Manual 4063, and under regulations at 7 CFR 2.42, 36 CFR 251.23, and 36 CFR Part 219, I hereby establish the Copper Sands Research Natural Area. It shall be comprised of 1,500 acres (607 hectares) of land on the Cordova Ranger District of the Chugach National Forest, Alaska. The Copper Sands RNA shall include part or all of T17S R2W Sections 28, 29, 32, 33; T18S R1W Sections 7, 18, 19; and T18S R2W Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24 on the U.S. Geological Survey 1:63,360 scale topographic maps for the Cordova B-4 and B-5 quadrangles, Alaska, as described in the section of the Establishment Record entitled "Legal Description."

This is an administrative step to implement the decision to designate this area as RNA as discussed in the Record of Decision for the Revised Land and Resource Management Plan.

The Copper Sands RNA will be managed in compliance with all relevant laws, regulations, and Forest Service Manual direction regarding RNA's, and in accordance with the management direction identified in the Revised Forest Plan.

Designated by /s/ Paul K. Brewster 9/14/07
for DENNIS E. BSCHOR Date
Regional Forester, Alaska Region

Concurrence of /s/ Bov B. Eav 9/7/07
DR. BOV B. EAV Date
Station Director, Pacific NW Research Station

SIGNATURE PAGE
for

RESEARCH NATURAL AREA ESTABLISHMENT RECORD

Copper Sands Research Natural Area

Chugach National Forest

Alaska

The undersigned certify that all applicable land management planning and environmental analysis requirements have been met and that boundaries are clearly identified in accordance with FSM 4063.21, Mapping and Recordation and FSM 4063.41, Establishment Record Content, in arriving at this recommendation.

Prepared by /s/ Robert L. DeVelice Date 8/6/07
Robert L. DeVelice, Forest Ecologist, Chugach National Forest

Prepared by /s/ Glenn Patrick Juday Date 8/8/07
Glenn Patrick Juday, Professor of Forest Ecology, University of Alaska Fairbanks.

Recommended by /s/ Daniel W. Logan Date 8/15/07
Daniel W. Logan, District Ranger, Cordova District

Recommended by /s/ Joe L. Meade Date 8/17/07
Joe L. Meade, Forest Supervisor, Chugach National Forest

Concurrence of /s/ Bov B. Eav Date 9/7/07
Dr. Bov B. Eav, Station Director, Pacific Northwest Station

Establishment Record for the

Copper Sands
Research Natural Area within the

Chugach National Forest, Alaska

August 6, 2007

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IDENTIFICATION

Location Map

Copper Sands Research Natural Area (RNA) is located in the Copper River Delta area on the Cordova Ranger District of the Chugach National Forest in southcentral Alaska (Figure 1). The RNA is about 15 miles (25 kilometers) southeast of the city of Cordova. No roads or established trails exist on the RNA or to its boundary. The closest road is the Copper River Highway Highway which comes to within 10 miles (16 kilometers) of the RNA. The most common access to the RNA is by floatplane or wheeled plane (for beach landings) or by riverboat. Further details in regard to access to the RNA are described in the section of the Establishment Record entitled "Access".

Boundary Map[1]

The location of Copper Sands RNA within the public land survey system (PLSS) is shown in Figure 2.

Legal Description[1]

An area within the Copper River Delta Fish and Wildlife Management Area of the Chugach National Forest, comprising portions of T. 17-18 S., R. 1-2 W., Copper River Meridian as shown on the attached map (Figure 2) entitled “Copper Sands RNA”, said map being made herewith a part of this description, and said area being more particularly bounded and described as follows:

All lands above mean high tide within the following PLSS locations.

Unsurveyed Township 17 South, Range 2 West, Copper River Meridian.

Section 28	all,
Section 29	all,
Section 32	all,
Section 33	all.

Unsurveyed Township 18 South, Range 2 West, Copper River Meridian.

Section 1	West ½,
Section 2	all,
Section 3	all,
Section 4	all,
Section 5	all,
Section 8	all,
Section 9	all,
Section 10	all,
Section 11	all,
Section 12	all,
Section 13	all,
Section 14	all,
Section 15	all,

[1] Prepared by Randy D. Schrank, Professional Land Surveyor, Chugach NF, Anchorage, AK.

Section 16 all,
Section 17 all,
Section 20 all,
Section 21 all,
Section 22 all,
Section 23 all,
Section 24 all.

Unsurveyed Township 18 South, Range 1 West, Copper River Meridian.
Section 7 West ½,
Section 18 West ½,
Section 19 West ½.

The upland area of this RNA comprises approximately 1,000 to 2,000 acres (see the "Introduction" section of this Establishment Record).

References to PLSS locations herein above were obtained by observations of the above referenced map being a portion of the US Forest Service 2000 Single Edition Quadrangle Cordova (B-5) and 1994 Single Edition Quadrangle Cordova (B-4), Alaska Map at a scale of 1:63,360 in original and according to the Department of the Interior, Bureau of Land Management (BLM) Township List Program, version 2.11 protraction calculation software.

End of Description

INTRODUCTION

The Copper Sands Research Natural Area (RNA) is located on the Cordova Ranger District of the Chugach National Forest in southcentral Alaska (Figures 1 and 2). The RNA contains recently emerged shifting offshore barrier islands (Photo 1), high densities of dusky Canada geese seeking refuge during their semi-flightless molting period, extensive tide flats that provide food resources for migrating shorebirds, nesting colonies of glaucous-winged gulls (Photos 2 and 3), plants and animals of sandy coastal regions (Photos 4 and 5), and examples of ecological successional processes on small and rapidly changing sandy islands (Photo 6).

Copper Sands was a name applied by mariners and fishermen to the series of bars and barrier islands at the mouth of the Copper River Delta in the eastern portion of the Chugach National Forest. The U.S. Geological Survey first published the name Copper Sands in 1951 (Orth 1967).

Maps based on aerial photos of the area taken in the 1950's depict a series of narrow, crescent-shaped offshore barrier islands. The islands were uplifted by the Great Alaska 1964 earthquake and have increased in size since the uplift. However, some portions of the old island cores are subject to erosion by long shore drift and are disappearing into the sea. The estuary behind the barrier islands includes many islets that are emerging above high tide level by trapping windblown sand.

The Copper Sands RNA boundary fluctuates with the mean high tide line and changes as the islands move, expand, and contract. The land area has changed and continues to change as erosion removes portions of islands, as land surfaces emerge from earthquake uplift, and as sedges (*Carex* spp.) and alkali grasses (*Puccinellia* spp.) colonize intertidal mud flats and accelerate sediment buildup[2]. Within the approximately 16,000 acre (6,475 hectare) polygon containing the Copper Sands RNA (Figure 2) the area to be managed as RNA (and under federal ownership) varies in extent from 1,000 to 2,000 acres (405 to 810 hectares) depending on the vagaries of accretion and erosion. When land surface changes are sufficiently great, ownership of the land may pass from state to federal or vice versa. The Record of Decision of the Forest Plan (USDA Forest Service 2002a) currently accedes to state regulation of submerged lands. The state of Alaska manages areas below mean high tide line and the bed of navigable rivers as state public trust lands. Areas on the Delta above the high tide line are within the Chugach National Forest. When sediment is deposited that makes a surface above the bed of the Copper River, it accretes to the upland (National Forest in this case) owner. When erosion removes land it is lost to upland ownership. Thus, the ownership boundaries of the RNA will change with time.

None of the RNA is designated wilderness or wild/scenic river. The area is in the portion of the Forest designated under Section 501(b) of the Alaska National Interest Lands Conservation Act (ANILCA). The area is located within the Copper River Delta Management Area, a cooperative project of the USDA Forest Service and the Alaska

[2] These changes are summarized in Juday (1992).

Department of Fish and Game. On May 5, 1990 the Copper River Delta (including the area of the RNA) was dedicated as a unit of the Western Hemisphere Shorebird Reserve System.

Primary human uses of the area have been occasional recreational visits and beachcombing.

JUSTIFICATION

Justification Statement

Representing barrier islands and breakwater sandbars, Copper Sands RNA is a unique and important addition to the national network of Research Natural Areas. It is a site of active vegetation succession in response to both shifting sand dunes and uplift from the 1964 earthquake. These dynamics have been recognized as a special element of natural diversity (Juday 1987). Also, the RNA and surrounding delta contain wildlife populations of exceptional ecological value that are the subject of many research and monitoring projects.

The Copper River Delta is the exclusive breeding grounds for the dusky subspecies of the Canada goose. Since the late 1970s the dusky Canada goose has experienced a decline in the number of nests and nesting success (Campbell 1990). Large numbers of semi-flightless molting dusky geese use the tide flats of Copper Sands as a habitat refuge from predators. In addition, many other species of bird, especially shorebirds, use the area as a seasonally important staging or resting habitat during migration. Harbor seals, another species of management concern because of a serious population decline, are attracted to the Copper River Delta by large spawning runs of salmon and eulachon and come ashore to rest in the RNA. An unusual occurrence of brown bears occurs seasonally in the area.

In contrast to many other coastal islands of the Chugach National Forest and other parts of Alaska, off highway vehicles are prohibited within the boundaries of the RNA, with the exception of use for subsistence hunting.

Principle Distinguishing Features

The principal element of natural diversity that Copper Sands RNA represents is shifting barrier islands at the mouth of the Copper River Delta. The Copper River Delta system, including its barrier islands, has attracted a great deal of scientific interest in the fields of sedimentology and coastal geomorphology. Barrier islands occur along only about 3,500 miles (5,650 kilometers) of the world's ocean-continent coastline, perhaps 10 percent or less of the total coastline (Schwartz 1973). More than half of the length of barrier islands worldwide is along the North American shoreline (Berryhill et al. 1969). By far the greatest amount of North American barrier island length is along the Atlantic and Gulf of Mexico coasts. Barrier islands are relatively uncommon along the Pacific coastline. The Copper River Delta system includes some of the best-developed barrier islands on the North Pacific coast (Hayes and Kana 1976). Figure 1 shows the location

of Copper Sands, one of these shifting barrier island systems, at the mouth of the Copper River Delta.

In addition to the dynamic forces of wind and waves that create and continuously modify all barrier islands, Copper Sands was greatly affected by uplift associated with the March 27, 1964 Great Alaska Earthquake. At a Richter Magnitude of at least 8.6, the earthquake had the highest magnitude recorded in North American history and caused the most extensive tectonic deformation of the 20th century. Earthquakes of comparable magnitude are estimated to reoccur on average every 600 to 850 years in the Copper River Delta region (Plafker 1990). The entire Copper River Delta region was uplifted approximately 6 feet (2 meters) and moved seaward about 65 feet (20 meters) (Plafker 1969; Reimnitz 1972).

The southerly portion of the RNA borders intertidal flats that were sub tidal before the earthquake. The northern shorelines of the RNA experience two unequal cycles of high and low tide daily that regularly exceed amplitude of 8.2 feet (2.5 m). The 1964 earthquake rearranged the shoreline, which interfered with the previous pattern of offshore littoral flow, causing greatly accelerated erosion and deposition at different locations in Copper Sands. The associated uplift also placed a significant amount of the formerly submerged shallows around Copper Sands above all but the highest tidal stages. As a result, wind deposition of sand inland of the outer beach of the barrier island is now effective in building land surfaces above the tidal zone.

More detailed information on the biophysical characteristics of the area is provided in the “Ecological Evaluation” section of this Establishment Record.

Objectives

The objectives of Copper Sands RNA are to:

1. Maintain and conserve (in a natural state) the barrier island ecosystem of Copper Sands to represent the variety of natural conditions in this system for the purposes of research, education, and maintenance of biological diversity; and
2. Provide a reference area for determining the effects of resource management activities applied to similar ecosystems outside the RNA.

LAND MANAGEMENT PLANNING

In 1984, the Copper Sands area was proposed as RNA in the first Land and Resource Management Plan of the Chugach National Forest (USDA Forest Service 1984). In 2002, the area was designated as RNA in the Record of Decision for the Revised Forest Plan (USDA Forest Service 2002a). That selection was the result of analyses documented in the Revised Forest Plan (USDA Forest Service 2002b) and the Final Environmental Impact Statement for the Revised Forest Plan (USDA Forest Service 2002c). No major issues or conflicts specific to the Copper Sands area were identified during the public review and comment period for the draft plan.

MANAGEMENT PRESCRIPTION

The Forest Plan (USDA Forest Service 2002b) prescription for Research Natural Areas is included in the Appendix of this Establishment Record. RNA management emphasizes non-manipulative research, monitoring, education, and the maintenance of natural diversity. Natural ecological processes dominate, largely undisturbed by human activity. Management for recreation uses, habitat improvement or restoration, and resource development are not emphasized. Recreation uses that interfere with the purpose of the RNA may be restricted. Any proposed action within the RNA must be coordinated with USDA Forest Service Pacific Northwest Research Station.

No need for vegetation manipulation is envisioned for the foreseeable future. No measures for control of native insects or diseases will be undertaken unless ecosystems on adjacent lands are threatened. If non-native (exotic) invasive plants or animals are found in the RNA control measures will be exercised to eradicate them, when practical.

Plastic waste, derelict fishing vessels and gear, and other trash introduced into the waters of the North Pacific makes its way onto the beaches of the RNA. The highly energetic shoreline environment has incorporated these wastes into the accumulating sand islands of Copper Sands. Items such as wooden posts with jagged metal objects attached, steel cables, and random debris are obstacles that can be hazardous to visitors or wildlife walking along beaches. It would be highly desirable to periodically schedule the removal of debris from the beaches of the RNA.

USE OR CONTROL OF FIRE AND GRAZING

No prescribed fires are planned in Copper Sands RNA, nor is the use of fire anticipated to accomplish RNA objectives. No grazing by domestic livestock is planned nor is there an existing or anticipated need for such grazing to maintain or restore ecological conditions.

ECOLOGICAL EVALUATION

Physical Site Description and Climatic Conditions

Location

Copper Sands RNA is within the Cordova Ranger District of the Chugach National Forest. The center of the RNA is approximately at 60° 20 minutes north and 145° 35 minutes west (Figures 1 and 2).

Size

Within the approximately 16,000 acre (6,475 hectare) polygon containing the

Copper Sands RNA (Figure 2) the area to be managed as RNA (and under federal ownership) varies in extent from 1,000 to 2,000 acres (405 to 810 hectares) depending on the vagaries of accretion and erosion. The acreage of the RNA in the Record of Decision of the Revised Forest Plan (USDA Forest Service 2002a) is 1,500 acres (607 hectares) and represents the approximate area of the land above mean high tide in 1983.

Elevation Range

Elevations within the Copper Sands RNA range from sea level to 20 feet (6 meters).

Access

Access to Copper Sands RNA is from the town of Cordova and its municipal airport (Figure 1). Cordova Airport has daily direct jet service from Anchorage. Cordova is not connected by land to the rest of the Alaska Highway system, but is served by the Alaska Marine Highway (passenger and car ferry) from Valdez. The local Cordova road network comes to within 10 miles (16 kilometers) of the RNA boundary.

Air access to the RNA is good. Visitors planning to use aircraft to visit or overfly the RNA should check with the Cordova Ranger District, the Alaska Department of Fish and Game, and charter operators.

Commercial floatplane or wheeled plane (for beach landings) charters can be arranged during the warm season near Cordova at Eyak Lake or at Cordova Airport. Occasionally during the summer helicopters can be chartered from the Cordova Airport, or (at considerably greater expense) from a permanent base in Valdez, 55 miles (89 kilometers) northwest of the airport. Essentially the entire RNA is suitable for helicopter landings. The area can be sampled efficiently and rapidly by helicopter. Some aircraft restrictions may be in effect seasonally to protect birds sensitive to disturbance.

The RNA is also accessible by riverboat. A public boat launch site is located at Alaganik Slough northeast of the RNA (shown on the right edge of Figure 1 at the location labeled “Picnic Area”). Boaters launching from the Alaganik Slough facility can reach the RNA by traveling down Alaganik Slough and then navigating the network of channels to Copper Sands. The flat, featureless landscape makes navigation of this route a challenge, and first-time visitors should use the services of a guide familiar with the route. The volume of freshwater feeding into the Copper Sands area has declined in recent years and deeper draft riverboats need a high tide stage to navigate the entire route.

Climatic Data

The nearest weather station to the RNA is Cordova Airport at approximately 60° 29 minutes north and 145° 27 minutes west. Copper Sands is one of the only Alaska RNAs located near a National Weather Service first order station with a

comparable microenvironment. This weather station is about 10 miles (16 km) north of the RNA at 38 feet (12 m) elevation. Records from the station (Table 1) are likely slightly wetter than the RNA but similar in temperature. Mean temperature and precipitation isohyte maps presented by Blanchet (1983) suggest mean annual precipitation of about 80 inches (205 cm) and mean annual temperature of about 40°F (4.5° C) within the RNA. The RNA is located closer to the relatively mild Gulf of Alaska than the Cordova Airport weather station. As a result, during the winter the RNA probably experiences slightly less extreme temperatures and more sustained coastal wind than the Cordova Airport station.

Relative to other outer coastal south-central Alaska locations, precipitation is lower, cold and warm temperature extremes are greater, and more clear weather is experienced on the Delta (Farr and Hard 1987). Two major overall factors influencing the climate of the Copper River Delta region are 1) the maritime influence of the Gulf of Alaska and 2) the outflow of air from the cold, dry interior of Alaska down the Copper River Canyon. The Delta is warmed considerably by the Alaska Current, an offshoot of the Kurishio Current (Searby 1969) that transports warmth from the equatorial regions of the central Pacific. Detailed charts and tables of offshore Gulf of Alaska mean climatic conditions by month are available from Brower et al. (1988).

The RNA is located directly in the path of cold winter winds from interior Alaska that penetrate to the coastal region through the Copper River Canyon. The Copper River Canyon is the only low-elevation corridor between interior Alaska and coastal south-central Alaska. The predominant air pressure gradient is between high-pressure interior air masses and low pressure on the coast, which drives strong winds down the canyon. Interior air masses mixing with coastal air modify the Delta climate. Ice and snow persist on the ponds and ground surfaces of the RNA for 1 to 3 weeks longer than portions of the Copper River Delta that does not experience the canyon effect. This delay in spring can be a significant factor in the habitat suitability of the area for the large number of migratory birds that arrive as early as possible in the spring in order to claim and defend breeding territories.

Ecological Description

Eco-region

Within the ECOMAP (1993) hierarchy, the entire Copper Sands RNA occurs within the Humid Temperate Domain, Marine Division, Pacific Gulf Coastal Forest-Meadow Province, Northern Gulf Forelands Section, Copper River Delta Subsection (Bailey 1995; Davidson 1996)[3].

[3] Based on data from the "Ecosections and Sub-Sections" data theme of the Chugach National Forest GIS.

Table 1 – Climate records for Cordova Airport, Alaska[4].

	Mean Temperature		Record High Temperature		Mean Precipitation	
	°F	°C	°F	°C	inches	cm
January	24.6	-4.1	58	14.4	7.14	18.14
February	27.2	-2.7	58	14.4	6.51	16.54
March	31.1	-0.5	59	15.0	6.06	15.39
April	37.7	3.2	70	21.1	5.67	14.40
May	44.8	7.1	82	27.8	6.24	15.85
June	50.9	10.5	84	28.9	5.47	13.89
July	54.5	12.5	89	31.7	5.61	14.25
August	53.9	12.2	86	30.0	9.42	23.93
September	48.1	8.9	74	23.3	14.30	36.32
October	39.5	4.2	70	21.1	12.62	32.05
November	30.1	-1.1	55	12.8	7.60	19.30
December	26.7	-2.9	54	12.2	9.62	24.43
Mean Annual	39.1	3.9			96.26	244.50
Mean May-September	50.4	10.2			41.0	104.24
Mean October-April	31.0	-0.6			55.2	140.26
Maximum			89	31.7		
date			07/16/95			
Minimum			-30	-34.4		
date			01/10/72			

[4] Data obtained from the Alaska Climate Research Center (http://climate.gi.alaska.edu/). Mean temperature and mean precipitation records are from the 1971 through 2000 period. Record high temperature, maximum, and minumum records are from the period 1949 through 2004.

As shown in the following table[5], landtype association and landtype (ECOMAP 1993; Davidson 1998) mapping of the area identifies two associations and three landtypes in the polygon (Figure 2) containing the RNA:

LTA	Landtype	Acres	Hectares	Percent
Coastal	Beach	1,523	617	10
Coastal	Estuary	11,265	4,559	71
Salt Water	Marine Terrace	3,163	1,280	20
	TOTAL	15,951	6,455	100

The coastal landtype association includes beach and estuary landtypes. These landscapes are the result of marine processes such as tidal fluctuations, wave carving, and blowing sand. The beach landtype is the portion of the polygon to be managed as RNA. The beach landtype is dominated by shifting sands and occurs above mean high tide. The estuary landtype is normally inundated daily by ocean tides and is predominately mudflats at low tide.

The marine terrace landtype is the salt water dominated area that lies below the level of mean high tide.

Plant Community Types

Landcover of the Copper Sands RNA in September 2000 is shown in Figure 3. Based on Markon and Williams (1996) using the Alaska Vegetation Classification (Viereck et al. 1992), the following table[6] summarizes the acreage of generalized landcover classes of the RNA and a cross-walk to the National Vegetation Classification System (Federal Geographic Data Committee 1997):

Landcover Class	NVCS	Acres	Hectares	Percent
Water	non-veg.	10,397	4,208	65.2
Barren	non-veg.	5,086	2,058	31.9
Clouds and Shadow	N/A	380	154	2.4
Sparsely Vegetated	VII	42	17	0.3
Shrub	III.B.2.N.b	41	17	0.3
Herb	V.A.5.N	7	3	0.0
	GRAND TOTAL	15,954	6,456	100.0

[5] Data from the “Landsystem Types” data theme of the Chugach National Forest GIS.
[6] Data from the “Land Cover Classification” data theme of the Chugach National Forest GIS.

Generalizing from the table above, the extent of red (vegetated) patches in Figure 3, and field surveys, the currently vegetated area in the RNA is estimated at about 125 acres (50 hectares). Vegetation types (DeVelice et al. 1999) known to occur in the Copper Sands RNA are listed in the following table[7]. Acreage by vegetation type was estimated based on extrapolating from the landcover types and the field data:

Vegetation Type	Acres	Hectares
Salix alaxensis	20	8
Leymus mollis	65	26
Leymus mollis/Achillea millifolium var. *borealis*	20	8
Deschampsia caespitosa	8	3
Eleocharis palustris	2	1
other types	10	4
GRAND TOTAL	125	50

Values

Flora

The flora of Copper Sands RNA has not been thoroughly collected, described, or studied. The herbaceous and shrub species present reflect the dynamic condition of this island system. Trees are not present. To date, 71 vascular plant taxa that have been observed in the RNA (Table 2). The number of vascular plant species and the extent of continuous vegetation cover are greatest on the old island core sections of Copper Sands, lower on the newly emerging wind-deposited sand islands, and practically non-existent on intertidal flats. The overall low number of vascular species in the RNA reflects the very recent origin of the area.

Erosion is now removing species-rich portions of the old island core while deposition is lengthening the island on the downstream (of littoral flow) end. The effect of these natural forces may be to maintain low species richness in the RNA.

Fauna

Animal species have not been systematically studied or inventoried in Copper Sands RNA. The following species were observed during field surveys or are predicted to occur within the RNA based on the literature:

[7] 12 vegetation plots were sampled to document vegetation compositional variation. The data for these plots are on file with the Forest Ecologist, Chugach National Forest, Anchorage, Alaska.

Table 2 – Vascular plant taxa observed in Copper Sands RNA[8].

Scientific Name	Common Name
SHRUBS	
Alnus viridis ssp. *sinuata*	Sitka Alder
Myrica gale.	Sweet gale
Salix spp.	Willow
Salix alaxensis	Feltleaf willow
Salix barclayi	Barclay's willow
FORBS	
Achillea millefolium var. *borealis*	Boreal yarrow
Angelica genuflexa	Kneeling angelica
Angelica lucida	Seacoast angelica
Argentina anserina	Silverweed cinquefoil
Cakile edentula	American searocket
Caltha leptosepala	Marsh marigold
Chamerion angustifolium	Fireweed
Cornus canadensis	Bunchberry dogwood
Epilobium ciliatum (PM)	Fringed willowherb
Epilobium hornemannii ssp. *behringianum*	Hornemann's willowherb
Epilobium palustre	Marsh willowherb
Erigeron acris ssp. *politus*	Bitter fleabane
Euphrasia mollis	Subalpine eyebright
Fragaria chiloensis	Beach strawberry
Galium trifidum	Threepetal bedstraw
Glehnia littoralis	American silvertop
Honckenya peploides	Seaside sandplant
Iris setosa	Beachhead iris
Lathyrus japonicus var. *maritimus*	Beach pea
Ligusticum scoticum	Scottish licorice-root
Lupinus nootkatensis	Nootka lupine
Malaxis monophylla	Adder's mouth
Moehringia lateriflora	Bluntleaf sandwort
Parnassia fimbriata	Fringed grass of Parnassus
Parnassia palustris	Marsh grass of Parnassus
Platanthera hyperborea	Northern green orchid
Polygonum fowleri	Fowler's knotweed
Pyrola asarifolia	Liverleaf wintergreen
Ranunculus cymbalaria	Alkali buttercup
Rhinanthus minor	Little yellowrattle
Rorippa islandica	Northern marsh yellowcress
Rubus arcticus ssp. *acaulis*	Dwarf raspberry

[8] Nomenclature is standardized to the USDA PLANTS Database (http://plants.usda.gov), but is based on Hultén (1968) or in some instances Pojar and MacKinnon (1994) as designated by a "PM" appended to the scientific name. This species list is from collections made by C. Parker and G. Juday on August 15, 1986 at 60° 18 'N, 145° 28' W and 60° 23'N, 145° 20' W; and observations by R. DeVelice and E. Liebgold over August 6-9, 1996 at a number of locations within the RNA.

Table 2 – (continued)

Scientific Name	Common Name
Rumex aquaticus var. *fenestratus*	Western dock
Rumex arcticus	Arctic dock
Senecio pseudoarnica	Seaside ragwort
Spiranthes romanzoffiana	Hooded lady's tresses
Stellaria calycantha	Northern starwort
Viola renifolia	White violet
GRAMINOIDS	
Agrostis exarata	Spike bentgrass
Agrostis scabra	Rough bentgrass
Calamagrostis canadensis	Bluejoint
Calamagrostis stricta ssp. *stricta* var. *stricta*	Slimstem reedgrass
Carex aquatilis	Water sedge
Carex lenticularis var.*lipocarpa*	Kellogg's sedge
Carex lyngbyei	Lyngbye's sedge
Carex pluriflora	Manyflower sedge
Carex saxatilis	Rock sedge
Deschampsia caespitosa	Tufted hairgrass
Eleocharis acicularis	Needle spikerush
Eleocharis palustris	Common spikerush
Festuca rubra	Red fescue
Hierochloe odorata	Sweetgrass
Juncus alpinoarticulatus ssp.*nodulosus*	Northern green rush
Juncus arcticus	Arctic rush
Juncus bufonius	Toad rush
Juncus effusus	Common rush
Juncus falcatus	Falcate rush
Juncus filiformis	Thread rush
Leymus mollis	American dunegrass
Poa eminens	Largeflower speargrass
Poa macrantha (PM)	Seashore bluegrass
Puccinellia pumila	Dwarf alkaligrass
FERNS AND FERN ALLIES	
Athyrium filix-femina	Common ladyfern
Botrychium lunaria	Common moonwort
Equisetum arvense	Field horsetail
Equisetum variegatum	Variegated scouring rush

Mammals

Few mammal species are found in Copper Sands RNA and adjacent marine waters. Of the 10 mammal species that occur or may occur in the RNA (Table 3) eight are terrestrial species (see Hall 1981; Manville and Young 1965). The low number of terrestrial mammals is probably due to low habitat diversity, generally low vegetation cover, and the isolation of the islands. Two notable species in or immediately adjacent to the RNA are the harbor seal and brown bear.

Harbor seal--The RNA is used as a harbor seal haul-out area. Harbor seals regularly haul out onto land for resting and nursing pups. In 1973 Pitcher and Vania (1973) sighted harbor seals in the waters around or hauled out on the beach at Copper Sands. In 1988, the year before the Exxon Valdez oil spill, Pitcher (1989) reported counts of harbor seals around the Copper River Delta. Harbor seals consume salmon and eulachon, but in addition take significant amounts of cephalopods (octopus and squid). Harbor seals are present in the RNA in late winter/early spring (March). Harbor seals fall prey to orcas (killer whales) where the ranges of the two species overlap (Mate 1981).

Brown bear—Brown bears are seasonally important visitors to the RNA, arriving in late spring and frequently roaming the area until late fall when they leave for denning sites on the mainland. Brown bears were not known to be abundant on the Copper River Delta during the early studies of dusky geese in the 1950s (Trainer 1959). Campbell and Griese (1987) speculated that brown bear numbers in 1986 were higher on the Copper River Delta than at any time since the late 1800s. They estimated that the 1986 population of brown bear on the western portion of the Copper River Delta totaled 32.5±15 with an estimated density of 1 bear per 3.3 to 4.6 mile^2 (8.6 to 11.9 kilometer^2). Most of the bears on the coastal portion of the west Copper River Delta are immatures and females with young (Campbell 1991; Campbell and Griese 1987). These bears are probably avoiding dominant adult males and breeding females that occupy inland and mountain habitats (Campbell and Rothe 1986).

After emerging from their winter dens, brown bears arrive on the Delta just as sedges and other preferred forage plants emerge and begin to grow. The movement of bears is coincidental with the initiation of nesting by dusky geese, which is also probably related to plant emergence (Campbell 1991). Once on the Delta, bears prey opportunistically on dusky geese (Campbell 1990; 1991). A number of brown bears walk across the tideflats from Pete Dahl Slough to Copper Sands and prey on eggs, nests, and molting individuals of glaucous-winged gulls well into August.

Table 3 – Mammals species observed or potentially occurring in Copper Sands RNA.

Order & common name	Scientific name	Basis for Listing[9]
INSECTIVORA		
Masked Shrew	*Sorex cinereus*	literature
RODENTIA		
Meadow Vole	*Microtus pennsylvanicus*	seen in RNA
Singing Vole	*Microtus miurus*	literature
Meadow Jumping Mouse	*Zapus hudsonius*	literature
CARNIVORA		
Gray Wolf	*Canis lupus*	literature
Red Fox	*Vulpes vulpes*	literature
Grizzly Bear	*Ursus arctos*	seen in RNA
River Otter	*Lutra canadensis*	literature
Sea Otter	*Enhydra lutris*	very occasional offshore
Harbor Seal	*Phoca vitulina*	seen in RNA

[9] literature = Hall 1981; Manville and Young 1965

Birds

Copper Sands RNA provides habitat for a wide variety of bird species. Table 4 lists 100 species known or suspected to occur in the area. Copper Sands is a significant migratory staging and resting habitat for sandhill crane, American golden plover, sanderling, semipalmated sandpiper, western sandpiper, least sandpiper, and waterpipit. Sowls et al. (1978) reported 2 breeding colonies of glaucous-winged gulls in Copper Sands RNA estimated at 200 and 300 birds in 1975.

Tideflats of the Copper River Delta are an important stopover spot for migrating western and semipalmated sandpipers. During these stopovers, each sandpiper feeds, on average, 8.5 hours every tide period and may consume between 10 and 30 polychaete amphipods (tubeworms) per minute. Tubeworms occupy a key link in processes of carbon flux on mudflats and can comprise up to 86% of a sandpiper's diet. They tend to build their tubes in fine-grained sediments. The secretions (fecal pellets) used in tube making stabilize sediments by increasing their shear strength and reduce sedimentation of previously resuspended particles. Predominantly, the large tubeworm males go crawling across the surface of the mud in search of a mate. Where and when sandpiper abundance is high, crawling activity overall is markedly reduced.

Geology

The existence of any barrier island system (such as Copper Sands RNA) represents equilibrium between constructive factors of river sedimentation and destructive factors of marine processes, primarily tidal and wave erosion forces (Hayes and Kana 1976). The Copper River Delta has exceptionally high fluvial sediment input and very strong and equally balanced wave and tide energy, placing it on the boundary of a wave- versus a tide-dominated delta according to a classification by Galloway (1975).

In regard to sediment texture and mineralogy (Winkler et al. 1976), the outwash beaches of the Copper River Delta are quite immature (Folk 1968, 1974). A great variety of different sized sediment is present in the upper Delta. However, sorting processes on the Copper River Delta are efficient; the barrier island beaches are moderately sorted medium to fine sand and significantly more quartz rich than the sediment sources (Hayes and Kana 1976).

Table 4 – Bird species observed or potentially occurring in Copper Sands RNA[10].

Common name	Scientific name	Basis for Listing
Great Blue Heron	*Ardea herodias*	seen in RNA
Tundra Swan	*Olor columbianus*	b
Trumpeter Swan	*Olor buccinator*	b
Canada Goose	*Branta canadensis*	seen in RNA
Brant	*Branta bernicla*	b
Emperor Goose	*Philacte canagica*	b
White-fronted Goose	*Anser albifrons*	b
Snow Goose	*Chen caerulescens*	b
Mallard	*Anas platyrhynchos*	seen in RNA
Gadwall	*Anas strepera*	b
Pintail	*Anas acuta*	b
Green-winged Teal	*Anas crecca*	b
Blue-winged Teal	*Anas discors*	b
American Widgeon	*Mareca americana*	b
Northern Shoveler	*Anas clypeata*	b
Canvasback	*Aythya valisineria*	b
Greater Scaup	*Aythya marila*	b
Common Goldeneye	*Bucephala clangula*	b
Barrow's Goldeneye	*Bucephala islandica*	b
Bufflehead	*Bucephala albeola*	b
Harlequin Duck	*Histrionicus histrionicus*	b
Steller's Eider	*Polysticta stelleri*	b
White-winged Scoter	*Melanitta deglandi*	b
Surf Scoter	*Melanitta perspicillata*	b
Black Scoter	*Melanitta nigra*	b
Common Merganser	*Mergus merganser*	b
Red-brested Merganser	*Mergus serrator*	b
Rough-legged Hawk	*Buteo lagopus*	b
Bald Eagle	*Haliaeetus leucocephalus*	seen in RNA[c]
Marsh Hawk	*Circus cyaneus*	b
Gyrfalcon	*Falco rusticolus*	b
Peregrine Falcon	*Falco peregrinus*	b
Merlin	*Falco columbarius*	b
Sandhill Crane	*Grus canadensis*	b
Black Oystercatcher	*Haematopus bachmani*	b
Semipalmated Plover	*Charadrius semipalmatus*	b
Killdeer	*Charadrius vociferus*	b
American Golden Plover	*Pluvialis dominica*	b
Black-bellied Plover	*Pluvialis squatarola*	b

[10] Nomeclature follows USDA Forest Service (1979) and American Ornithologists Union (1957). The basis of listing codes are defined as follows:

b = Isleib and Kessel (1973) identified habitat as typically used by species;

c = an active nest on a dune was located during August 1996 surveys.

Table 4 – (continued)

Common name	Scientific name	Basis for Listing
Hudsonian Godwitt	*Limosa haemastica*	b
Whimbrel	*Numenius phaeopus*	b
Greater Yellowlegs	*Tringa melanoleuca*	seen in RNA
Lesser Yellowlegs	*Tringa flavipes*	b
Solitary Sandpiper	*Tringa solitaria*	b
Spotted Sandpiper	*Actitis macularia*	b
Wandering Tattler	*Heteroscelus incanus*	b
Ruddy Turnstone	*Arenaria interpres*	b
Black Turnstone	*Arenaria melanocephala*	b
Northern Phalarope	*Lobipes lobatus*	b
Red Phalarope	*Phalaropus fulicarius*	b
Common Snipe	*Gallinago gallinago*	b
Short-billed Dowitcher	*Limnodromus griseus*	seen in RNA
Long-billed Dowitcher	*Limnodromus scolopaceus*	b
Surfbird	*Aphriza virgata*	b
Red Knot	*Calidris canutus*	b
Sanderling	*Calidris alba*	b
Semipalmated Sandpiper	*Calidris pusilla*	seen in RNA
Western Sandpiper	*Calidris mauri*	seen in RNA
Least Sandpiper	*Calidris minutilla*	b
Baird's Sandpiper	*Calidris bairdii*	b
Pectoral Sandpiper	*Calidris melanotos*	b
Rock Sandpiper	*Calidris ptilocnemis*	b
Dunlin	*Calidris alpina*	seen in RNA
Pomarine Jaeger	*Stercorarius pomarinus*	b
Parasitic Jaeger	*Stercorarius parasiticus*	b
Long-tailed Jaeger	*Stercorarius longicaudus*	b
Glaucous Gull	*Larus hyperboreus*	b
Glaucous-winged Gull	*Larus glaucescens*	seen in RNA
Herring Gull	*Larus argentatus*	b
Mew Gull	*Larus canus*	b
Bonaparte's Gull	*Larus philadelphia*	b
Black-legged Kittiwake	*Rissa tridactyla*	b
Sabine's Gull	*Xema sabini*	b
Arctic Tern	*Sterna paradisaea*	seen in RNA
Aleutian Tern	*Sterna aleutica*	b
Mourning Dove	*Zenaida macroura*	b
Snowy Owl	*Nyctea scandiaca*	b
Short-eared Owl	*Asio flammeus*	b
Belted Kingfisher	*Megaceryle alcyon*	b
Horned Lark	*Eremophila alpestris*	b
Violet-green Swallow	*Tachycineta thalassina*	b
Tree Swallow	*Iridoprocne bicolor*	b
Bank Swallow	*Riparia riparia*	b

Table 4 – (continued)

Common name	Scientific name	Basis for Listing
Barn Swallow	*Hirundo rustica*	b
Steller's Jay	*Cyanocitta stelleri*	b
Black-billed Magpie	*Pica pica*	b
Common Raven	*Corvus corax*	seen in RNA
Northwestern Crow	*Corvus caurinus*	b
Black-capped Chickadee	*Parus atricapillus*	b
Dipper	*Cinclus mexicanus*	b
American Robin	*Turdus migratorius*	b
Varied Thrush	*Ixoreus naevius*	b
Hermit Thrush	*Catharus guttatus*	b
Water Pipit	*Anthus spinoletta*	b
Starling	*Sturnus vulgaris*	b
Rusty Blackbird	*Euphagus carolinus*	b
Gray-crowned Rosy Finch	*Leucosticte tephrocotis*	b
Savannah Sparrow	*Passerculus sandwichensis*	b
Song Sparrow	*Melospiza melodia*	b
Lapland Longspur	*Calcarius lapponicus*	b
Snow Bunting	*Plextrophenax nivalis*	b

Soils
The entire Copper Sands RNA is in the earliest stages of soil development and would thus fall within the classification of Entisols. The principal soils are probably Typic Cryaquents (Soil Survey Staff 2003). Over a 2-month interval between mid-June and mid-August in 1986 over 15 inches (40 centimeters) of sand was deposited over a portion of the RNA (G. Juday, *personal observation*).

Topography
The Copper Sands RNA is a barrier island landscape of sandy elongate islands separated from the mainland by an estuary. Landforms include low gradient beaches, vegetated to unvegetated dunes, and level or low relief areas (Boggs 2000).

Aquatic / Riparian
Based on the National Wetlands Inventory[11], the entire Copper Sands RNA is classified as wetland. 75 percent of the area of the within the approximately 16,000 acre (6,475 hectare) polygon containing the Copper Sands RNA (Figure 2) is classified as estuarine wetland and 25 percent is classified as marine.

Rare, Threatened, Endangered or Sensitive Species
No endangered or threatened species are know or suspected within the Copper Sands RNA. The following two Alaska Region sensitive animal species[12] are known or suspected within the RNA: dusky Canada goose (known), trumpeter swan (suspected).

No Alaska Region sensitive plant species are known to occur in the RNA but the following potentially occur in the area based on the suitable habitat (Stensvold 2005): *Botrychium tunux* (no common name), *Botrychium yaaxudakeit* (no common name), *Puccinellia glabra* (smooth alkali grass), and *Puccinellia kamtschatica* (Kamchatka alkali grass).

In addition to the commonly observed plants (Table 2), the following species collected in the RNA represent the first record for the Prince William Sound - Copper River Delta region or were collected beyond their previously known distribution limits in Alaska (Hultén 1968):

> *Viola renifolia* - C. Parker 1974, 15 August 1986. This violet was previously known in Alaska principally from the Matanasuka River watershed north of Anchorage. This collection partially fills in a gap between that population and the main contiguous range of the

[11] The "USF&WS National Wetlands Inventory" data theme of the Chugach National Forest GIS.
[12] The Alaska region sensitive species lists are posted at the following USDA Forest Service intranet site: http://fsweb.r10.fs.fed.us/staffs/wfew/wfew_documents/sensitive_species_list.doc

species across the northern boreal forest region of North America.

Poa macrantha (Pojar and MacKinnon (1994) nomenclature) - C. Parker 1982, 15 August, 1986. This grass was found on the vegetated surfaces of the outer Copper Sands and is an addition to the flora of Alaska. It was known previously from the Queen Charlotte Islands in British Columbia where it was thought to be at the northern limit of its distribution (Taylor and Calder 1968). South of Alaska the species is an important part of coastal plant communities that stabilize active dunes. It plays the same ecological role at Copper Sands. The scarcity of extensive dune systems in south coastal Alaska may partly explain the fact that the species has been overlooked until now. Boggs (2000) reports the species from additional dune areas within the Copper River Delta.

Rare Elements & Rare Plant Communities

As summarized in the "Principle Distinguishing Features" section (above) shifting barrier islands as represented by Copper Sands RNA is not a common geologic feature worldwide. The Copper River Delta area includes some of the best-developed barrier islands on the North Pacific coast.

Resource Information

Minerals

There are no known mineral values within Copper Sands RNA and no present or historic mining activity (Tysdal 1978).

The Final Environmental Impact Statement (FEIS) for the Forest Plan (USDA Forest Service 2002c) states that oil and gas leasing is unavailable in the RNA and further notes that none of the areas designated as RNA (including Copper Sands) are within areas that have been identified as having potential for oil and gas development. Similarly, the FEIS and the Forest Plan (USDA Forest Service 2002c and 2002b, respectively) state that extraction of salable minerals (sand, gravel, hard rock for crushing, and landscape materials) will not be allowed in RNAs.

Grazing

No domestic livestock are on Copper Sands RNA and there is no history of grazing by livestock. Grazing by domestic stock will be prohibited.

Plants

The Copper Sands RNA does not include forest vegetation so commercial and personal use timber harvest is not an issue in the area. Special forest products such as wildflowers and ferns occur in the area but because of its status as RNA, commercial and personal use special forest products harvest in the RNA is not

allowed under the Forest Plan (USDA Forest Service 2002b).

Watershed Values
Establishment of the RNA at Copper Sands will not conflict with watershed values or uses. Establishment of the RNA would maintain current water quality and flow. There is no potable fresh water at the surface in the RNA. All of the lakes, ponds, and streams are brackish and are unsuitable as sources for drinking water. Contamination from superabundant bird droppings may be a problem as well.

The potential for tidal hydropower is limited on the RNA because of the unstable, shifting, narrow configuration of the island.

Recreation Use
Copper Sands RNA has recreational potential. The opportunity to view birds on the Copper River Delta during migration, especially the millions of western sandpipers and dunlins in the early spring, has become the source of an increasing commercial and personal tourist activity. The sand beaches and abundant driftwood on the Copper River Delta barrier islands make an attractive camping situation, although the lack of freshwater is a limitation. Sport hunting and fishing are not restricted in the RNA.

Under the Forest Plan (USDA Forest Service 2002b) no recreational developments will be constructed within the RNA nor will motorized recreational use be allowed. As stated in the FEIS for the Forest Plan (USDA Forest Service 2002c), existing nonmotorized use will be allowed as long as the use does not become a threat to the values for which the RNA was proposed.

Wildlife
Establishment of the RNA at Copper Sands will in no way adversely affect wildlife and plant values in the area. RNA designation will be beneficial in protecting wildlife and floristic values. As stated in the FEIS for the Forest Plan (USDA Forest Service 2002c), habitat manipulation for wildlife is not allowed unless specifically needed to restore natural ecosystem conditions or specifically designed for the protection of threatened, endangered, or sensitive species. Such manipulations are not presently anticipated in Copper Sands RNA.

Transportation / Road System
The Forest Plan (USDA Forest Service 2002b) does not allow new Forest Service roads to be built in RNAs and new trail construction is prohibited (unless the new trail contributes to the objectives or to the protection of the RNA). Establishment of the RNA would not affect any existing or proposed road access system on the Chugach National Forest.

Access to Copper Sands is by boat, helicopter, floatplane, or wheeled plane capable of beach landings. The island is very close to the Cordova Airport.

Policies for landing of small aircraft on the beach and helicopters throughout the RNA should be timed to minimize impact to migrating birds in the spring and fall.

Historical Information

Research / Education Use & Interest

The primary research activity at Copper Sands RNA is summarized in Juday (1992). The work focuses on documenting and interpreting the changes in the Copper Sands landscape in response to tectonic activity, subsidence, sea level rise, erosion, and sediment deposition.

Cultural / Heritage

There are no Native inholdings or allotments in the Copper Sands RNA. Little information is available on the native inhabitants of the RNA. In fact, the area may or may not have existed above sea level a century ago. Some evidence of native occupancy may have been destroyed in the periodic earthquake-induced shoreline rises and alternating periods of slow submergence. Waterfowl hunting, birding, and erection of informal navigation markers from driftwood are the only known uses of the area. Debris from boat wrecks and flotsam can be found along the beach.

Disturbance History

The primary natural disturbances affecting the Copper Sands RNA are tectonic activity, subsidence, sea level rise, erosion, and sediment deposition.

The RNA is located along the eastern end of the Aleutian Arc, a product of the subducting northern margin of the Pacific tectonic plate as it dives under the North American plate. This subduction zone is one of the world's most active seismic regions. The Pacific plate moves steadily northwestward at about 2 inches (5 centimeters) per year and gradually accumulates strain. Stored strain energy is released in a major earthquake in the Copper River Delta area every 600 to 850 years (Plafker 1990).

On March 27, 1964 the largest recorded earthquake in North American history, an estimated Richter Magnitude of at least 8.6, took place in the Copper River Delta-Prince William Sound region. It caused the most extensive tectonic deformation of the 20th century (Plafker 1990). The entire Copper Sands area was uplifted approximately 6 feet (1.9 meters) and moved seaward about 65 feet (20 meters) (Plafker 1969; Reimnitz 1972).

The Copper River Delta has an exceptionally complete record of multiple earthquake uplifts separated by intervals of gradual subsidence that exceed the total uplift (Plafker 1990). Two buried forest horizons on the mainland near the RNA were dated at 780 and 1,450 (± 140) years before present (Reimnitz 1972; Plafker 1990). Sitka spruces of 20 to 40 inches (50 - 100 centimeters) diameter

are the dominant trees in both buried horizons (Thilenius 1990). Between one and two centuries of relative land surface stability above sea level would have been required for the growth and development of trees that size.

The relative surface elevation of coastal wetlands is a shifting equilibrium among several factors in addition to tectonic adjustment. Over the last 5,000 years the north Gulf of Alaska coastal region has experienced isostatic subsidence of about .02 inches/year (0.5 millimeters/year) (Peltier and Tushingham 1989). During the past 5,000 years world sea level has risen about .03 inches/year (0.75 millimeters/year) (Bard et al. 1990). The accumulation of sediments on major river deltas compresses underlying rocks and sediment, resulting in gradual subsidence. Plafker (1990) cited tree stumps rooted in peat 6.5 to 10 feet (2 to 3 meters) below the highest tides at Pete Dahl Slough, 4.3 miles (7 kilometers) inland from the RNA, as evidence of an average subsidence rate of .28 inches/year (7 millimeters/year) on the Delta.

Subsidence is counteracted on the Delta by very high rates of sedimentation; the Copper River deposits over 107 million tons (97 million metric tons) of sediment into the sea annually (Hampton et al. 1987). Distributary channels on river deltas feed sediments into distinct zones where they build up, but channels are abandoned over time. As a result, the land surface and aquatic features of the Delta are ephemeral and constantly renewed.

Primary human use of the area has been occasional recreational visits and beachcombing. To date, the extent and intensity of human caused disturbance is small.

Occurrence of Exotic Species

Existing surveys on the Chugach National Forest (DeVelice et al. 1999; DeVelice 2003; Duffy 2003) found that most areas of exotic plant occurrence on the Forest are presently in areas of intensive human-caused disturbance such as road edges, visitor facilities, trailheads, and trails. Exotic plants are presently rare within natural communities on the Forest.

No exotic plant records were found within the Copper Sands RNA in a query of the Alaska Exotic Plant Information Clearinghouse database (AKEPIC[13]). In addition, exotic plants were not found during field surveys of the area in the development of this Establishment Record.

Other Information

Permanent Research Plots and/or Photo Points

Permanent plots for monitoring landscape cross sections, and vegetation composition and patch configuration on Copper Sands RNA are summarized in Juday (1992). The data are archived in the files of Dr. Glenn Patrick Juday,

[13] http://akweeds.uaa.alaska.edu/

Professor of Forest Ecology, University of Alaska Fairbanks.

Potential Research Topics
Among the research opportunities in the Copper Sands RNA are:

- Understanding ecosystem-level interactions in a large, intact, and naturally functioning terrestrial-freshwater-marine system.
- Documenting ecological succession on dune surfaces accumulating sand because of uplift in the 1964 Great Alaska Earthquake.
- Conducting research into migratory bird population dynamics in the Copper River Delta, an internationally significant wetland habitat seasonally supporting large portions of the total populations of western sandpiper and dunlin.
- Examining the importance of protected coastal habitats for flightless dusky Canada geese (a management indicator species on the Chugach National Forest) during molting season.
- Studying the effects of opportunistic brown (grizzly) bear predation on gulls and geese
- Studying and maintaining harbor seals in a delta haul out area
- Examining effects of recreational and development impacts in barrier island systems to natural processes and wildlife population dynamics using the Copper Sands RNA as an undisturbed baseline system.

Evaluation of Specific Management Recommendations

Potential or Existing Conflicts
See the “Resource Information” section above for a summary of potential and existing conflicts. In summary, there are no known conflicting uses within the Copper Sands RNA for minerals, grazing, commercial or personal timber harvest, watershed values, recreation use, wildlife and floristic values, and transportation systems.

Special Management Area
The Copper Sands RNA does not lie within or adjacent to any congressionally designated wilderness, wild and scenic river, or national recreation area.

The RNA is within an area of the Copper River-Bering River portion of the Chugach National Forest designated under Section 501(b) of the Alaska National Interest Lands Conservation Act (ANILCA) where:

> "... the conservation of fish and wildlife and their habitat shall be the primary purpose for the management..." "Multiple use activities shall be permitted in a manner consistent with the conservation of fish and wildlife and their habitat as set forth in special regulation which shall be promulgated by the Secretary." [of Agriculture]

The establishment of the RNA contributes to meeting this ANILCA objective.

The RNA is located within the Copper River Delta Management Area, a cooperative project of the USDA Forest Service and the Alaska Department of Fish and Game. On May 5, 1990 the Copper River Delta (including the area of the RNA) was dedicated as a unit of the Western Hemisphere Shorebird Reserve System.

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APPENDIX

Management Area Prescription

The following text is from the Revised Land and Resource Management Plan of the Chugach National Forest (USDA Forest Service 2002b) and summarizes the management area prescription for Research Natural Areas:

141 - Research Natural Area Management Area – Category 1

Theme - Research Natural Areas (RNAs) emphasize non-manipulative research, monitoring, education, and the maintenance of natural diversity, allowing natural physical and biological processes to prevail without human intervention. RNAs serve as baseline reference areas for measuring long-term ecological change. This management area prescription specifies management area direction for designated Research Natural Areas.

Management Intent

Ecological Systems Desired Condition - RNAs are characterized by essentially unaffected environments in which natural ecological processes dominate, largely undisturbed by human activity. Management activities on other lands are compared to the RNA to measure the effectiveness of various standards, guidelines and mitigation measures in reducing or preventing adverse environmental effects. Specific management direction, consistent with the purpose, will be developed for each RNA as it is established.

Social Systems Desired Condition – Management for recreation uses, habitat improvement or restoration and resource development are not emphasized. Recreation uses that interfere with the purpose of the RNA may be restricted. RNAs will provide outstanding opportunities for research, study, observation, monitoring, and those educational activities that maintain unmodified conditions. The Recreation Opportunity Spectrum will range from Primitive to Semi-primitive Nonmotorized. While a pristine condition is the goal in the selection of an RNA, there may be some evidence of past human use in this area, such as primitive trails or historic structures. 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, aboveground features will be present in their natural state, with no on-site interpretation.

There will be no roads, trails, fences, or signs in these areas unless they contribute to the RNA objectives or the protection of the area. Mining activities may occur on existing claims. In order to implement this prescription as intended, the Forest Service may request that the Bureau of Land Management withdraw areas, subject to the establishment of valid existing rights, within this management area prescription from location and entry under the United States mining laws.

Research Natural Area Management Area - Activities Table

Physical Elements			
Soil/Watershed Projects	C		
Biological Elements			
Vegetation Management	N	Integrated Pest Management	C
Wildlife Habitat Projects	C	Management Ignited Prescribed Fire	C
Fish Habitat Projects	C		
Resource Production			
Forest Products		**Minerals/ Mining**	
Commercial Timber Harvest ASQ	N	Mineral Activities – Locatable	C
Commercial Timber Harvest - nonchargeable	N	Mineral Activities – Salable	N
Commercial Special Forest Products	N		
Personal Use Timber Harvest	N		
Personal Use Special Forest Products	N		
Use and Occupancy Activities			
Recreation/Tourism Activities			
Recreational Gold Panning	N	Forest Service Recreational Cabins	N
Maximum ROS Class [1]	SPNM	Campgrounds	N
Nonmotorized Recreation Use - Summer	C	Minimum SIO [2]	VH
Nonmotorized Recreation Use - Winter	C	Hardened Dispersed Camping Sites	N
Day-use Facilities	N	Viewing Sites	N
Transportation/Access			
Marine Transfer Facilities	N	New Roads Built by Others	C
Boat Docks and Ramps	N	New Trails	C
Mode Changes: Parking Lots at Trailheads, Ferry Terminals, etc.	N	Administrative and Permitted Motorized Access	C
New FS Built Roads	N		
Lands/Special Uses			
Electronic Sites	N	SUP Recreation Equipment Storage/Cache	N
Utility Systems	N	Outfitter/Guide Capacity Allocation (%)	NA
SUP Destination Lodges	N	Administrative Facilities	C
SUP "Hut-to-Hut" Type Recreation Cabins	N		

Y - the activity is allowed consistent with the management intent
C - the activity is allowed consistent with the management intent, standards and guidelines
N - the activity is not allowed in the management area
N/A - not applicable
[1] ROS (Recreation Opportunity Spectrum) classes: P - Primitive I and II; SPNM - Semi-primitive Nonmotorized; SPG - Semi-primitive Groups; SPM - Semi-primitive Motorized; RN - Roaded Natural; RM - Roaded Modified; R - Rural
[2] SIO (Scenic Integrity Objective) classes: VH - Very High; H - High; M - Moderate; L - Low; VL - Very Low

Standards and Guidelines

Soil/Watershed – Fisheries – Wildlife

Standards

1. Allow soil/watershed restoration projects and wildlife and fish habitat manipulation for the protection of threatened, endangered or sensitive species or where it is necessary to perpetuate or restore natural conditions for which the RNA was established.

Integrated Pest Management

Guidelines

1. Treatment measures may be taken on exotic plants and animals to minimize their impacts on ecological processes.

Fire and Fuels

Standards

1. Allow natural fires to burn to accomplish the objectives of the specific research natural area.
2. Use management prescribed fire as necessary to accomplish RNA objectives.

Minerals

Guidelines

1. RNAs may be withdrawn, subject to the establishment of valid existing rights, from mineral entry for locatable minerals.
2. Mineral activities may be limited, modified or restricted to maintain, to the extent possible, the natural values of the area.

Recreation

Standards

1. Allow non-vehicular recreation, except when it interferes with the purpose of the RNA.

Access and Transportation

Standards

1. Prohibit the construction of new trails unless they contribute to the objectives or to the protection of the RNA.

Guidelines

1. Close or obliterate existing roads, except where they provide necessary access for scientific or educational purposes.
2. Existing trails may remain unless they are not consistent with the purpose of the RNA.
3. Administrative and non-recreational motorized access (e.g., helicopter landings) may be allowed if such activities do not interfere with the objectives for which the RNA was established.

Access and Transportation (Continued)

Guidelines

4. If no other reasonable access exists, provide such access, including roads for conducting mineral operations under a mining plan of operations. Aircraft access is allowed for minerals exploration and will be coordinated with the responsible line officer to minimize impacts to the natural character of the area.

5. If no other reasonable access exists elsewhere, provide reasonable access to private lands.

Special Uses (Recreation)

Standards

1. No competitive group events are allowed.

Administrative Facilities

Standards

1. Administrative facilities are not allowed. Temporary facilities may be permitted to support approved research projects.

FIGURES

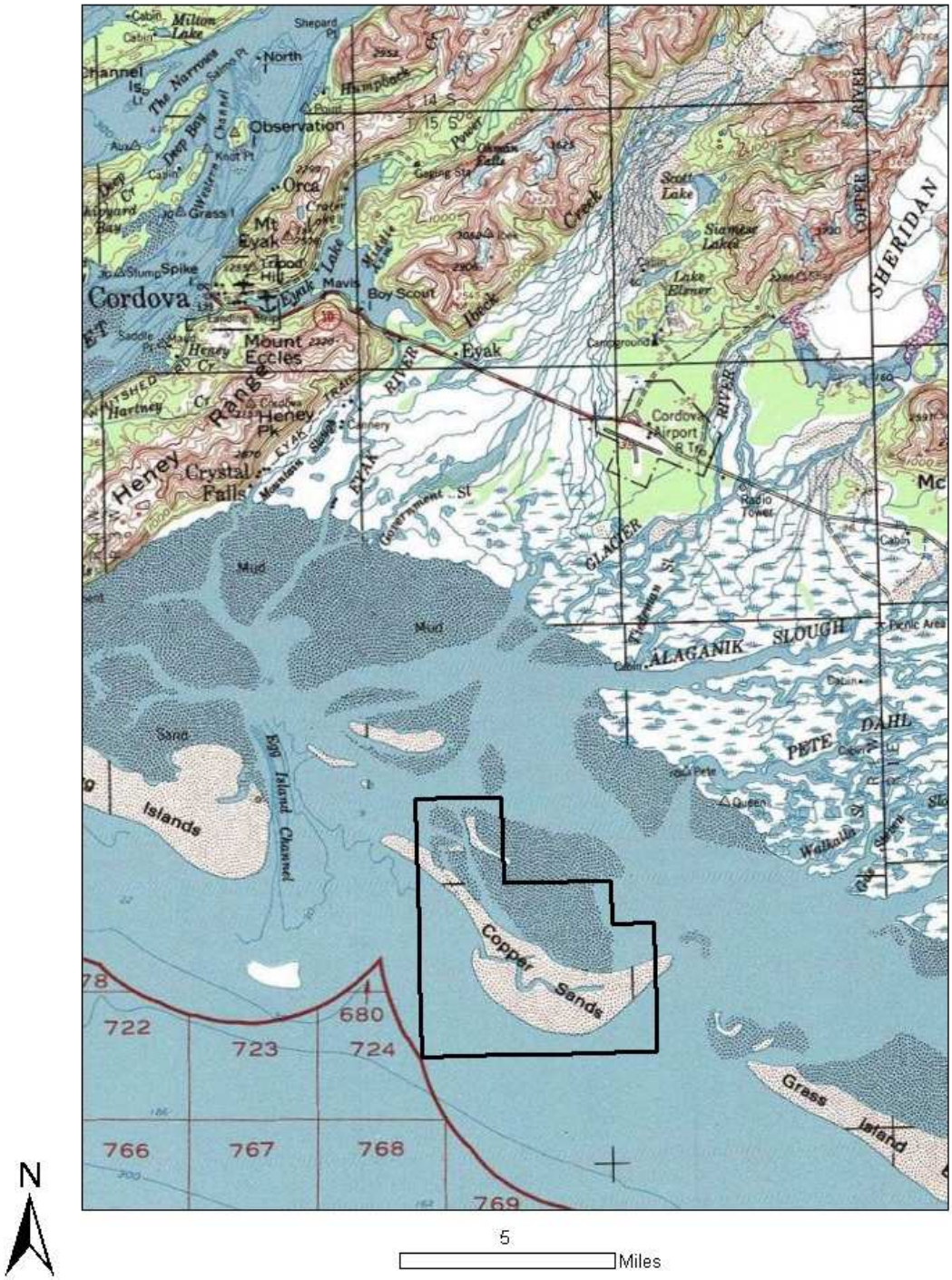

Figure 1 – Location of Copper Sands RNA southeast of the city of Cordova, Alaska.

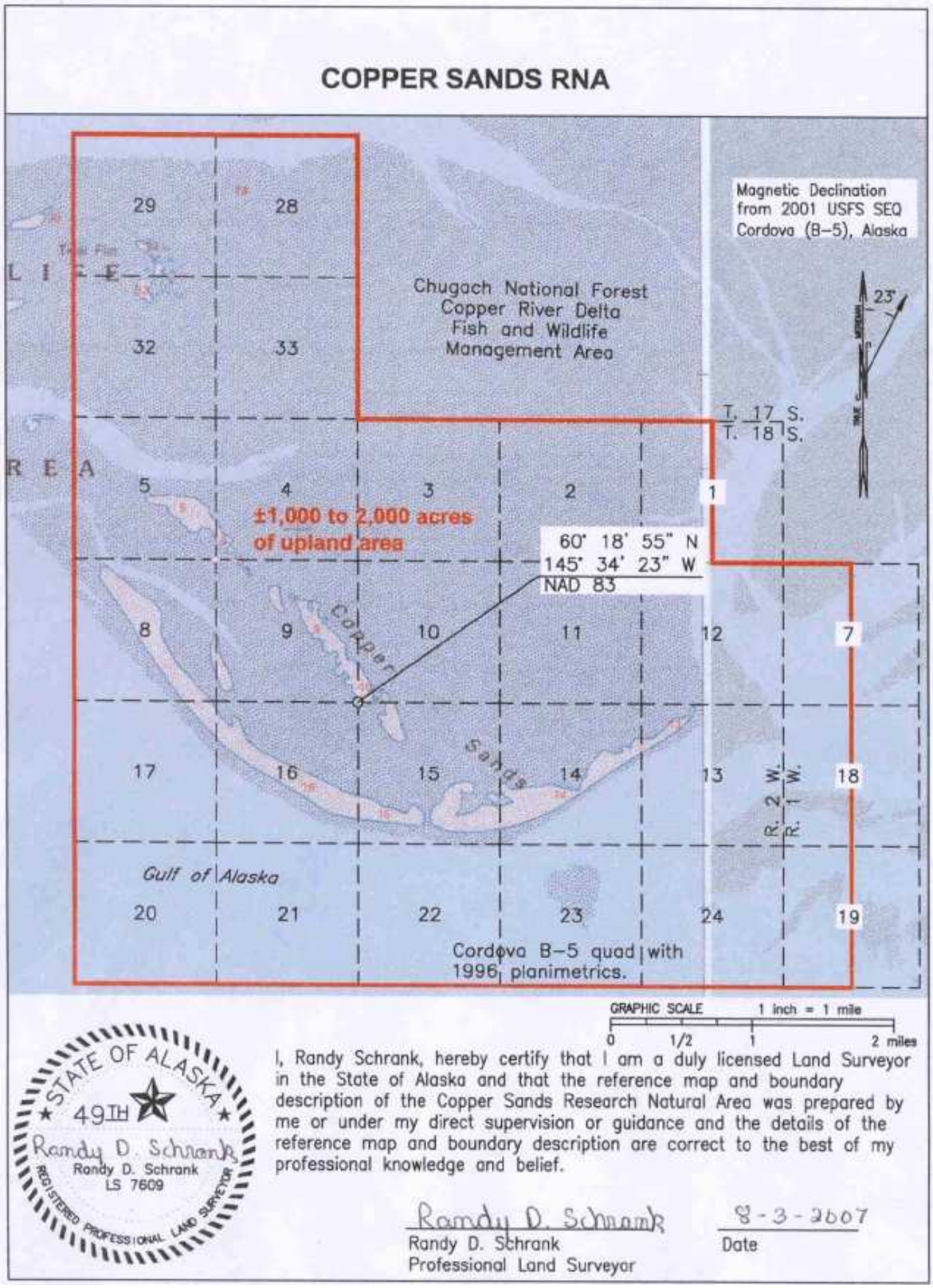

Figure 2 – Location of Copper Sands RNA within the public land survey system (with certification by licensed land surveyor).

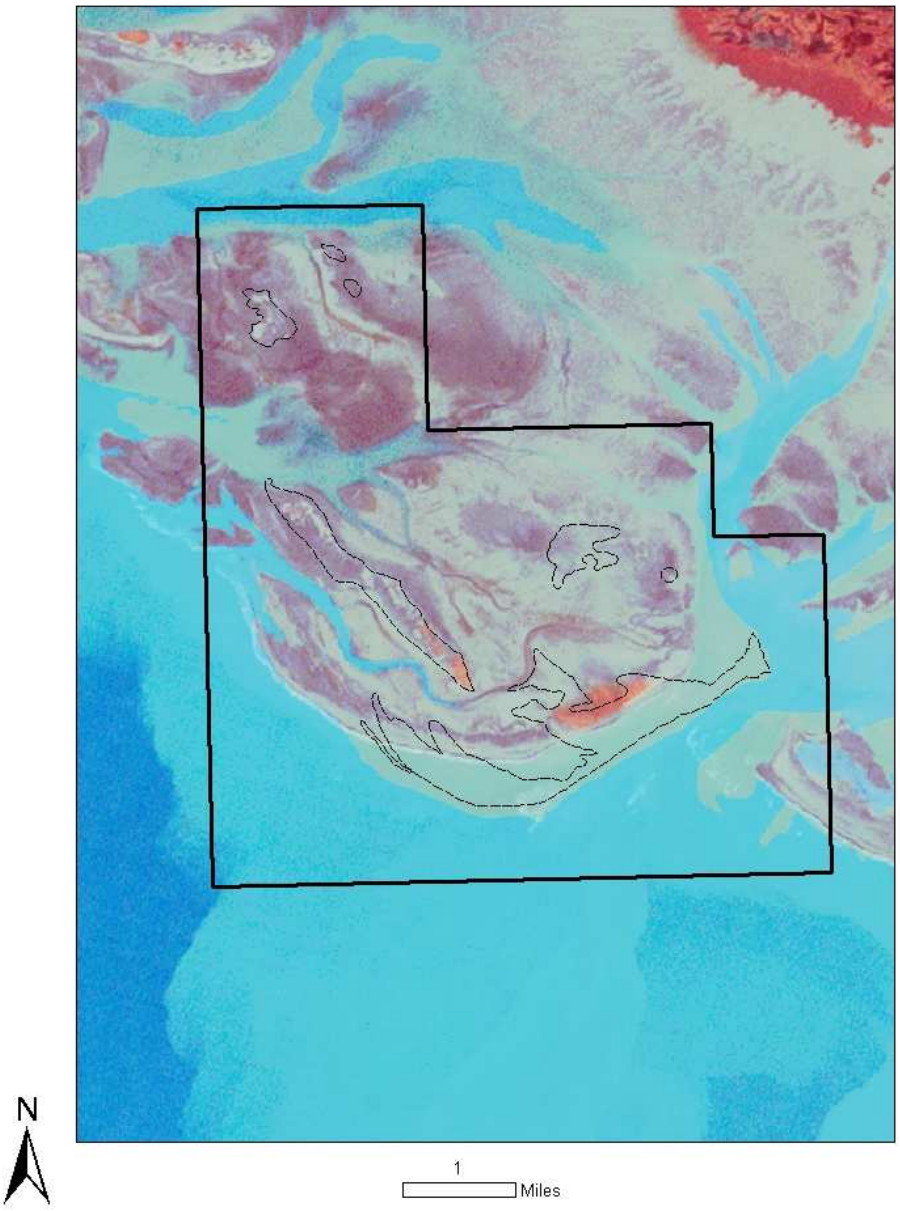

Figure 3 – Landcover of Copper Sands RNA[14]. The dashed line is the RNA boundary in the "Research Natural Areas" data theme of the Chugach National Forest GIS. The satellite image is a Landsat 7 scene from September 30, 2000. Live vegetation appears red.

[14] Satellite image is "chugach_satellite_georef1.ecw" in the Chugach National Forest GIS.

PHOTOGRAPHS[15]

Photo 1 – The most extensively vegetated portion of Copper Sands RNA as viewed from the air. This patch is also shown in the satellite image of Figure 3.

[15] These digital images are all archived with the Forest Ecologist, USDA Forest Service, Chugach National Forest, Anchorage, Alaska.

Photo 2 – *Leymus mollis* (American dunegrass) community. Note glaucose-winged gulls in the air.

Photo 3 – Glaucose-winged gull nest in a patch of *Leymus mollis* (American dunegrass).

Photo 4 – *Glehnia littoralis* (American silvertop), a species of coastal dunes and sandy beaches.

Photo 5 – *Puccinelia pumila* (dwarf alkaligrass) habitat with Sheridan Glacier and the Chugach Mountains in the background.

Photo 6 – Beach erosion of a dune stabilized by *Leymus mollis* (American dunegrass). Note the extensive root network.