CHAPTER 3: AFFECTED ENVIRONMENT

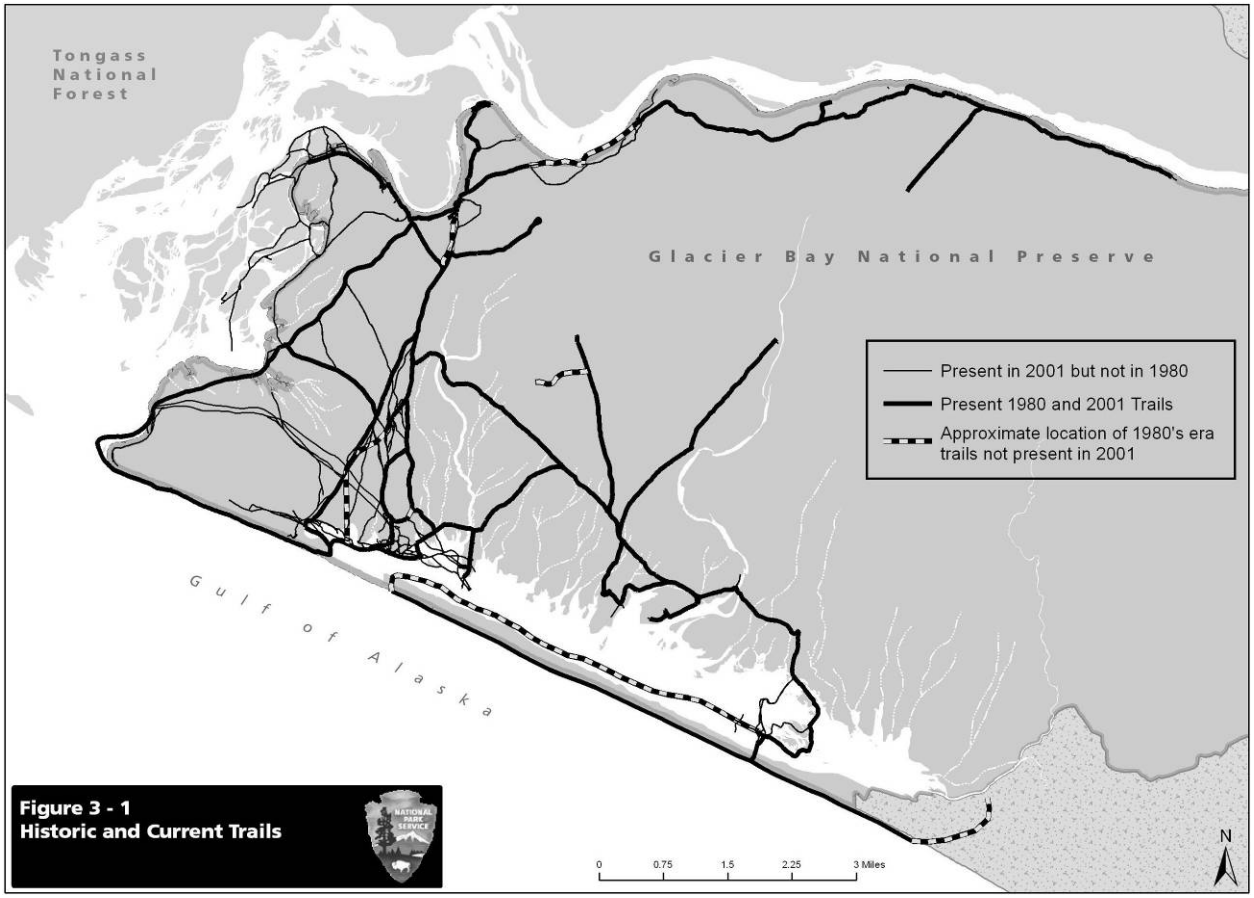
The Dry Bay area originated as a braided glacial outwash plain more than 200 years ago. Today, the Alsek River still dominates the landscape and many of the extant stream and wetland features originated from this river system. Early exploration maps dating from 1796 through 1901 (Molnia, 1979) provide evidence that suggests many of today's streams and wetlands were derived from five preexisting Alsek River distributaries.

The landscape is dynamic. Coastal sandy areas are affected by massive storms from the North Gulf of Alaska, including wave surges and strong winds. Tsunamis from earthquakes, such as the 1964 Great Alaska Earthquake, could have also affected the coastal area. Glaciers and ice dams have blocked the Alsek and Tatshenshini Rivers, sudden breaches of the natural blockages has subsequently breached the dams and flooded the lowlands in the Dry Bay area during recent times geologically. Furthermore, heavy rains in the area provide tremendous moisture to the soils and sediments, which feeds drainages such as East Alsek River, Doame River, Dog Salmon Creek, and other smaller streams in the preserve. Numerous north-south oriented stream channels drain wetlands throughout the Preserve. These streams all discharge into the common East Alsek River/Doame River estuary. The East Alsek River and Doame River historically disgorged into the Gulf through separate estuaries. Seismic activity in 1959 caused a significant change in estuarine morphology and habitat. The East Alsek and Doame Rivers coalesced into a common estuary during the early 1960s following the Lituya Bay earthquake and tidal wave. The outlet to this common estuary has been migrating northwest since that time and evidence of past estuary mouth locations are visible as deeper shoreline areas in recent aerial photography as a consequence of estuarine discharge, offshore scouring and longshore sediment transport.

Recent research (Larsen *et al.*, 2004, 2005) indicates area uplift rates approaching 25 millimeters per year (0.25 meters per decade). Similar stream incision rates are thought to occur in order to accommodate this uplift and maintain stream base level. An increase in the elevation of stream-associated floodplains would result in a decrease in groundwater elevation as streams maintain their base level. Declining groundwater elevations relative to soil surface elevations impose drier conditions for wetlands and changes in associated wetland vegetation communities over time.

3.1 EXISTING TRAILS

ORV trails in the Dry Bay area of the Glacier Bay National Preserve developed primarily as a result of a combination of commercial fishing activities, hydrocarbon exploration, and U.S. Forest Service road building. Figure 3-1 shows the approximate location of trails present in the early 1980s. In the un-vegetated portions of the Preserve trails do not show on historic photographs, therefore the map is a compilation of data from aerial photos and from a 1985 paper map of the trails. The paper map data is approximate and the 61.1 miles of trail in the Preserve shown in Figure 3-1 probably represents the minimum extent of the 1980's era trails.



Historically, most ORV traffic for commercial fishing purposes occurred between the temporary commercial fishery camps and the fish processing facility near the main airstrip. Currently, most traffic occurs between permanent fishing camps and fishing sites and between dwellings or lodges and the main airstrip near the fish processing facility where people and supplies are transported in and out of Dry Bay. Existing trails and routes provide access to commercial fishing areas on the Alsek and East Alsek Rivers, commercial fish camps, boat haulout areas, fish processing plant, airstrips and permitted lodges. Vehicles in use in Dry Bay ranged in size from a motorcycle to a 5 ton truck and a military half-track, with four-wheeled ATVs being the most common. There are approximately 55 ATVs, 12 highway vehicles and 8 heavy vehicles in the Preserve at present.

Figure 3-2 shows the location and names of existing trails in the Preserve. A few trails in the Preserve have widely used common names, many do not. To facilitate discussion, trail names were created for this EA based on the trail proximity to existing structures or physical features. Trails generally run parallel to the Alsek River, north/south from the main airstrip to fishing locations along the East Alsek River, and east/west from the Main Trail South to the Doame River. ORV track names end as either Trail or Route. ORV trails have a fixed linear location that is clearly visible from year to year. Routes differ from trails in that ORV routes vary in exact location seasonally, or from year-to-year depending on climatic and environmental condition.

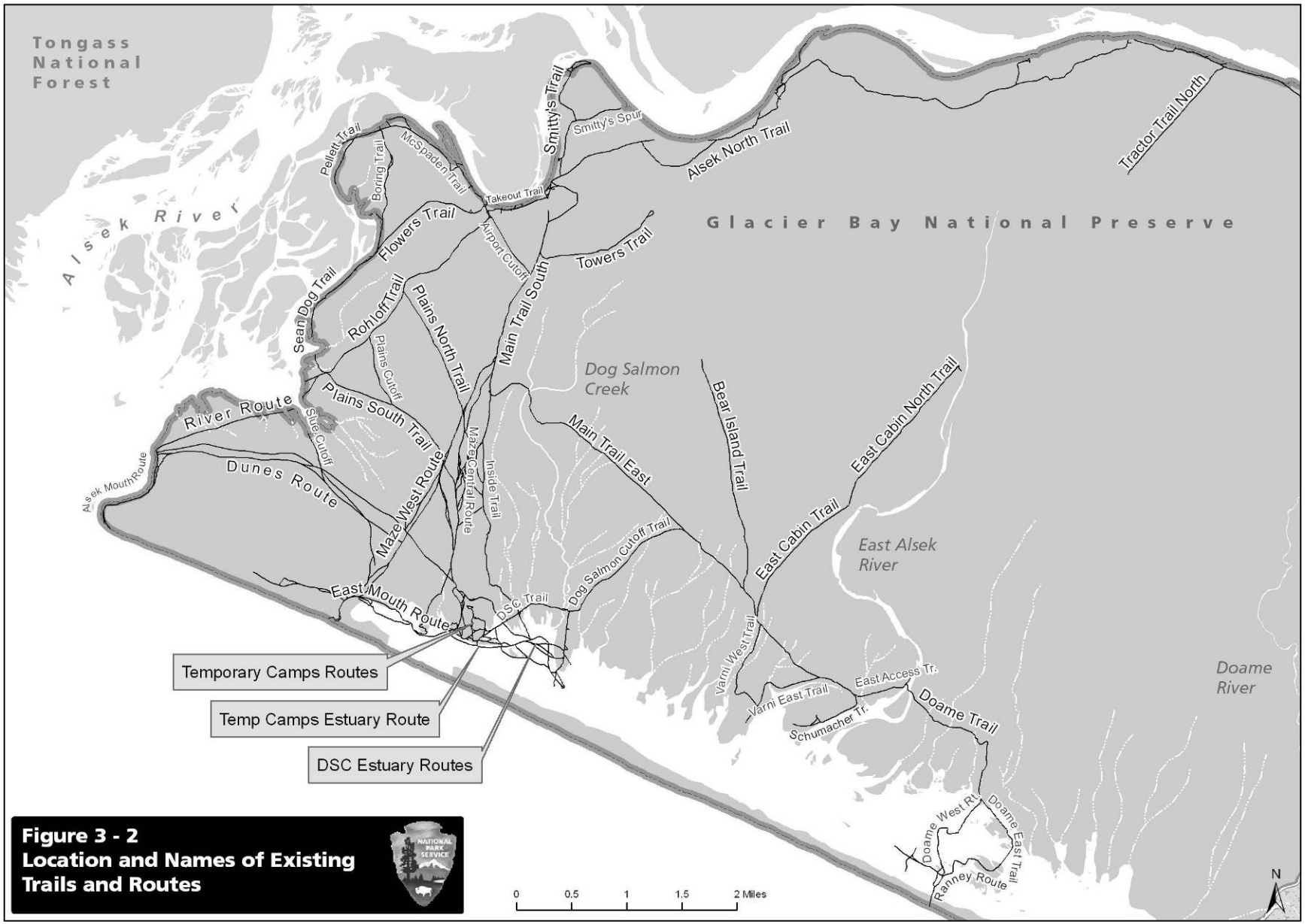


Figure 3 - 2
Location and Names of Existing Trails and Routes

Many Dry Bay ORV trails are ephemeral in nature; sometimes the trail is there, and sometimes it is not. In the dunes and plains areas (south of the Plains South Trail & west of the Maze Central Route) blowing sand and sheeting runoff obscure or obliterate trails each fall/winter. Tidal flux and occasional river flooding events regularly obscure or obliterate trails in the low-lying areas of the East Alsek Estuary. Both the Alsek and East Alsek have significantly changed course at the mouth of their estuaries over time, eroding the bank and removing trails. The trails mapped east of the Alsek mouth and west and north of the East Alsek mouth in 2001, 2003 and 2005 no longer exist. Some trails may not be needed or used for several seasons depending on fishing closures. When necessary, the Dry Bay Patrol Ranger drives ephemeral trails in the spring to re-establish them.

The Dry Bay area is experiencing one of the fastest rates of uplift in the world. Every year the land rises about 25 millimeters. Hence the vegetation is changing rapidly. Areas clear of alder a few years ago now show thick alder. Areas clearly visible as the Alsek River flood channels in 1966 aerial photos are now dry much of the year. The Inside Trail used to be open with little vegetation, now it is nearly impassable due to the thick alders. With time all trails in Dry Bay will experience changes in vegetation and potential changes in trail condition.

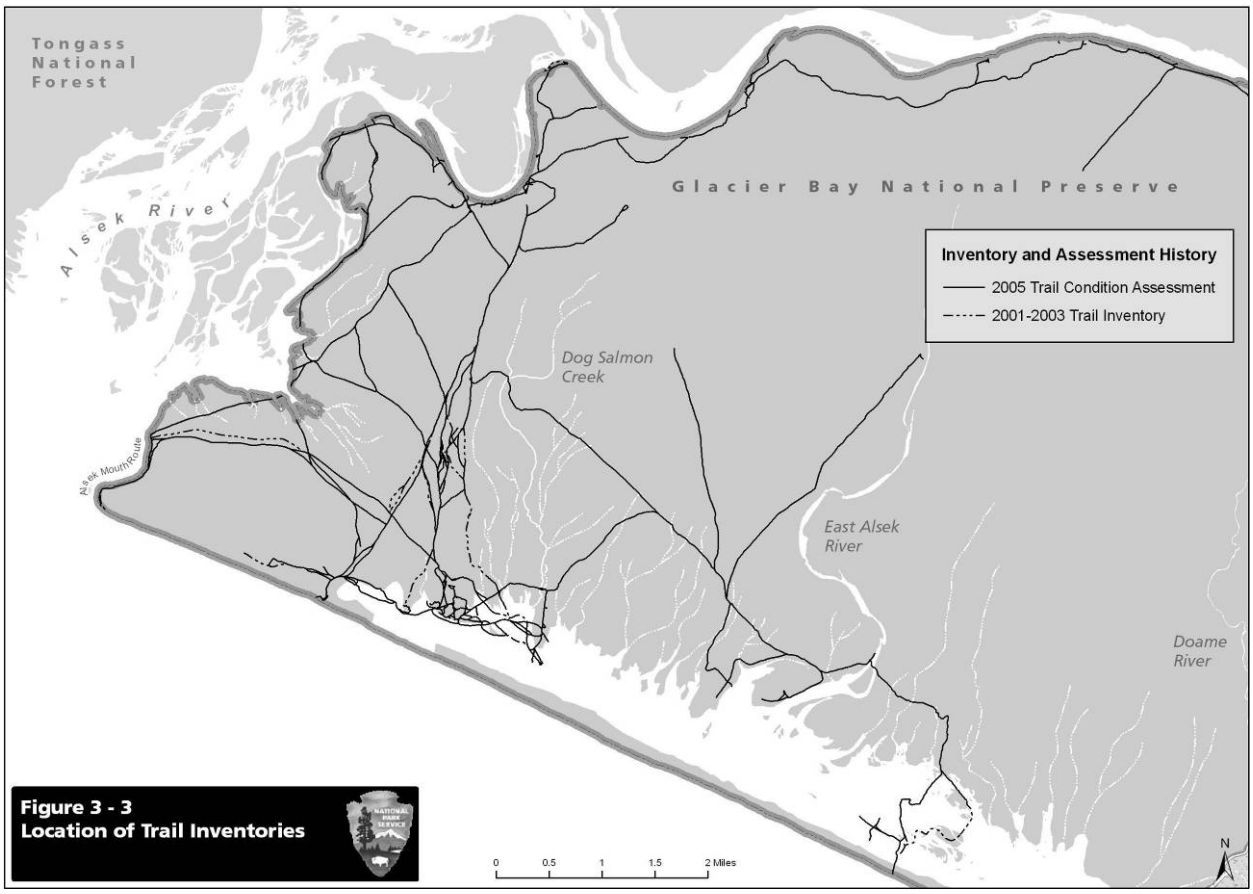
3.1.1 Trail Inventory and Condition

There have been two trails inventory efforts to collect information about the trails in the Dry Bay area of Glacier Bay National Preserve: (1) 2001-2003 NPS Trail Inventory and the (2) NPS 2005 Trails Condition Assessment (Fig. 3-3).

The NPS 2001-2003 Trail Inventory conducted during August 2001 and 2003 inventoried trails in the Preserve and adjacent lands. This inventory collected precision GPS trail lines with photographic documentation of trail condition. This data was used to create the first accurate maps of the trail system. A database interface enables park managers to view all the approximately 2,300 photos taken at 730 photo points along the trails.

The NPS 2005 Condition Assessment, conducted by the NPS Alaska Regional Office's ORV Technical Assistance Team, evaluated the ORV trails in the Preserve. The assessment was based on a methodology developed to be applied Alaska Region wide (Appendix B). The Assessment categorized 83.5 miles of trails. Location information for an additional 9.97 miles of ephemeral trail present during the 2001-2003 NPS Trail Inventory but not present in 2005 are presented in the analysis where appropriate.

In addition, the 2005 NPS Condition Assessment was conducted during the dryer part of the year at Dry Bay. Many trails ranked as 'moderately well drained' or 'well drained' are under 6 or more inches of water from mid August until winter (or perhaps spring the following year). If these trails had been assessed in the wetter season, they would have received a more degraded rating. Also, measurements did not include consideration of alder overgrowth since brushing overgrowth would be a common maintenance practice and would not be considered a degradation parameter. Some trails which are difficult or nearly impossible to use due to the low overhanging alder branches ranked higher than one might expect. Examples of trails with heavy alder overhangs include the Inside Trail and Airport Cutoff Trail.



Dry Bay is a nearly flat glacial outwash plain of sand and gravel. The condition assessment methodology was developed to address all parks within the region and thus includes areas with steeper slope, more organic soils and higher degrees of stoniness. All of which tend to add to trail degradation. Hence the rankings of Dry Bay trails should not be directly compared with rankings for other Alaskan locations. That is, a trail ranked as 'Degraded' in Dry Bay would most likely rank out as 'Fair' or maybe even as 'Good' in the region wide ranking methodology.

The 2005 Condition Assessment methodology divided 83.5 miles of assessed trail into individual segments which exhibit specific track conditions. Trail segments varied from .001 miles to 1.676 miles in length. In each segment the attributes of 10 key trail features were assessed. Key trail features included track usage, type, track width, track grade, side slope, surface characteristics, drainage, muck/mud present, impact rating, and stoniness. To provide an objective means of summarizing this information, numeric ratings were assigned to each value. Conditions with higher amounts of environment damage received higher numeric scores. Appendix C shows the weighing factors for all measurement attributes. The weighting factors for all attributes were then added together for each segment, producing a single numeric value which reflects the overall condition of the trail segment. The Jenks Method, a natural breaks algorithm (Jenks and Caspall, 1971) was applied to the data set to further aggregate the data into one of four possible condition classes: "Good, Fair, Degraded or Very Degraded."

Table 3-1 lists the condition rankings of 83.5 miles of trails assessed in the Preserve. About 95 percent of the trails ranked as Good or Fair while only about 5 percent ranked as Degraded or

Very Degraded. Eighty-two percent of the trails are 12 feet or less in width and rank as either Good or Fair.

Table 3-1 Summary of Trail Condition Classes for Existing Trails

Trail Condition Class	Miles (%)	Acres (max)[1]	Acres (min)[1]
Good	58.6 (70.2)	61.10	30.94
Fair	20.4 (24.5)	39.03	23.49
Degraded	2.9 (3.5)	10.05	6.10
Very Degraded	1.6 (1.9)	7.06	3.84
Totals:	83.5 (100)	117.25	64.37

[1]Acres (max) and Acres (min) are the maximum & minimum acreage of the trail or trail segment. Acres (max) & Acres (min) are calculated by multiplying the maximum & minimum trail width for each trail segment in the same trail condition assessment inventory class. The segment acreages are added together to calculate the total acreage for the condition class.

Photos 3-1 through 3-4 provide examples of each trail condition class ranking. Figure 3-4 shows track width data for all trails while Figure 3-5 and Appendix C shows all assessed trails and their overall condition class ranking.

Photo 3-1 Rohloff Trail (good condition)

Photo 3-2 South Plains Trail (fair condition)

Photo 3-3 Main Trail East (degraded condition)

Photo 3-4 Varni East Trail (very degraded condition)

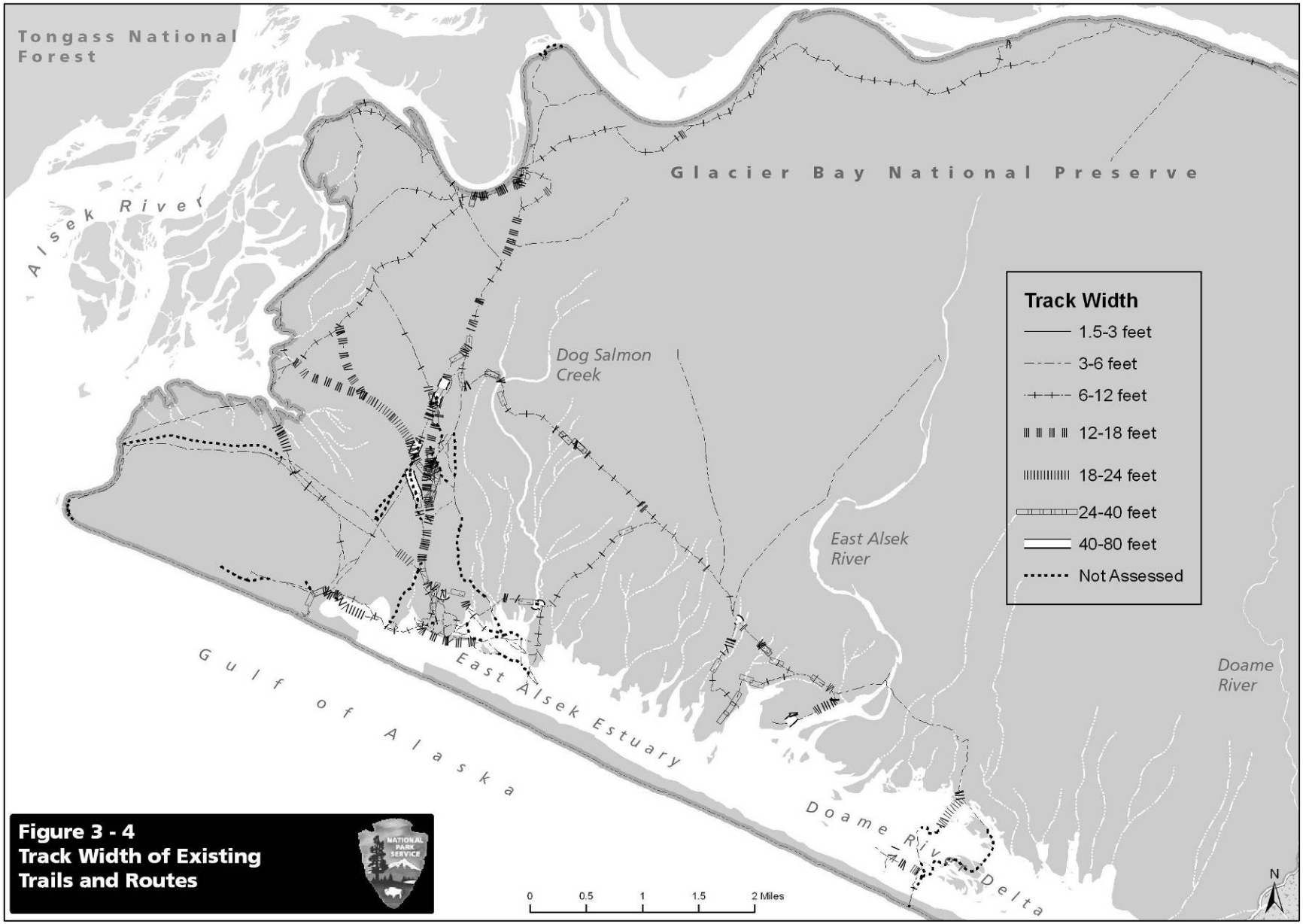


Figure 3 - 4
Track Width of Existing Trails and Routes

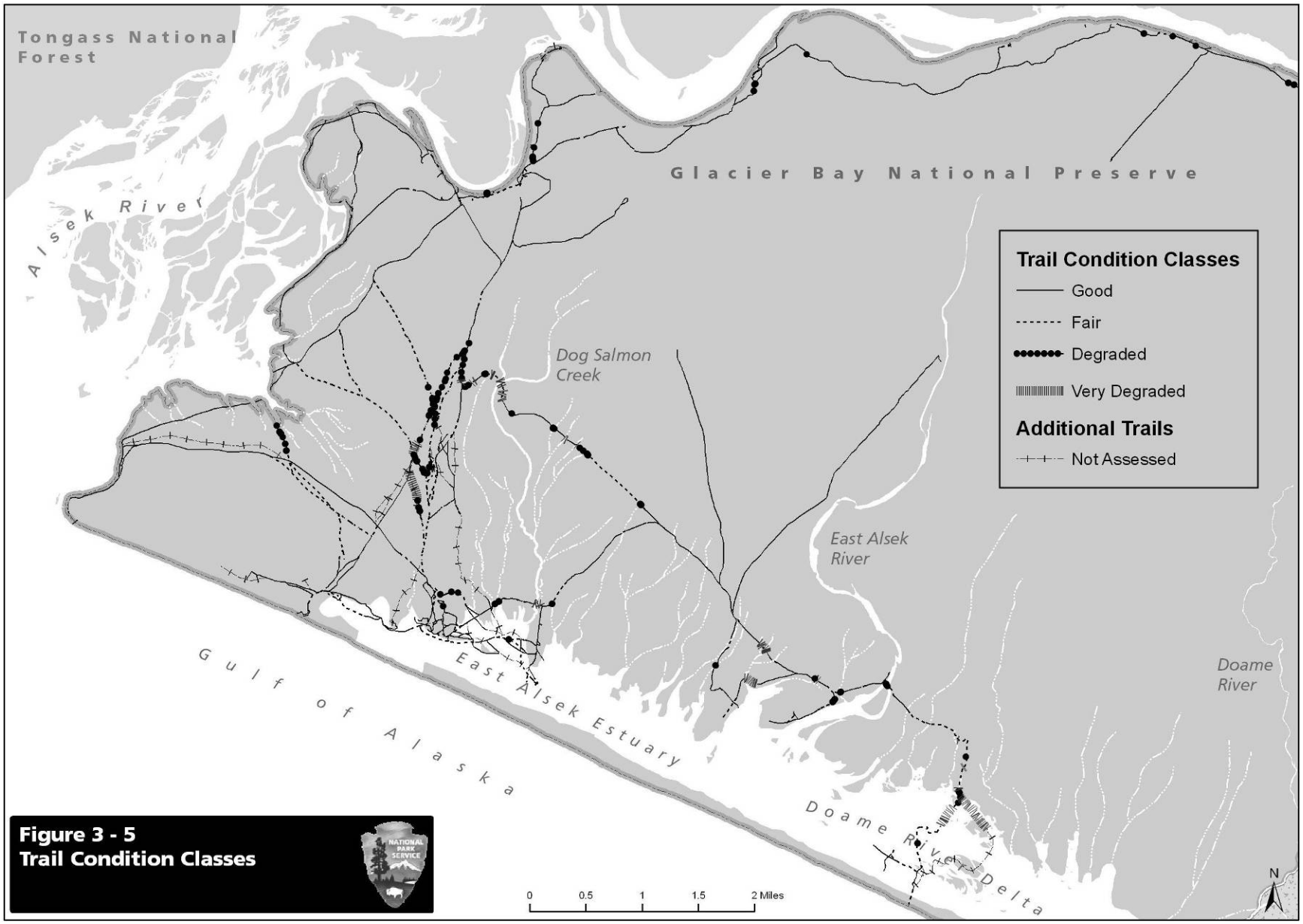
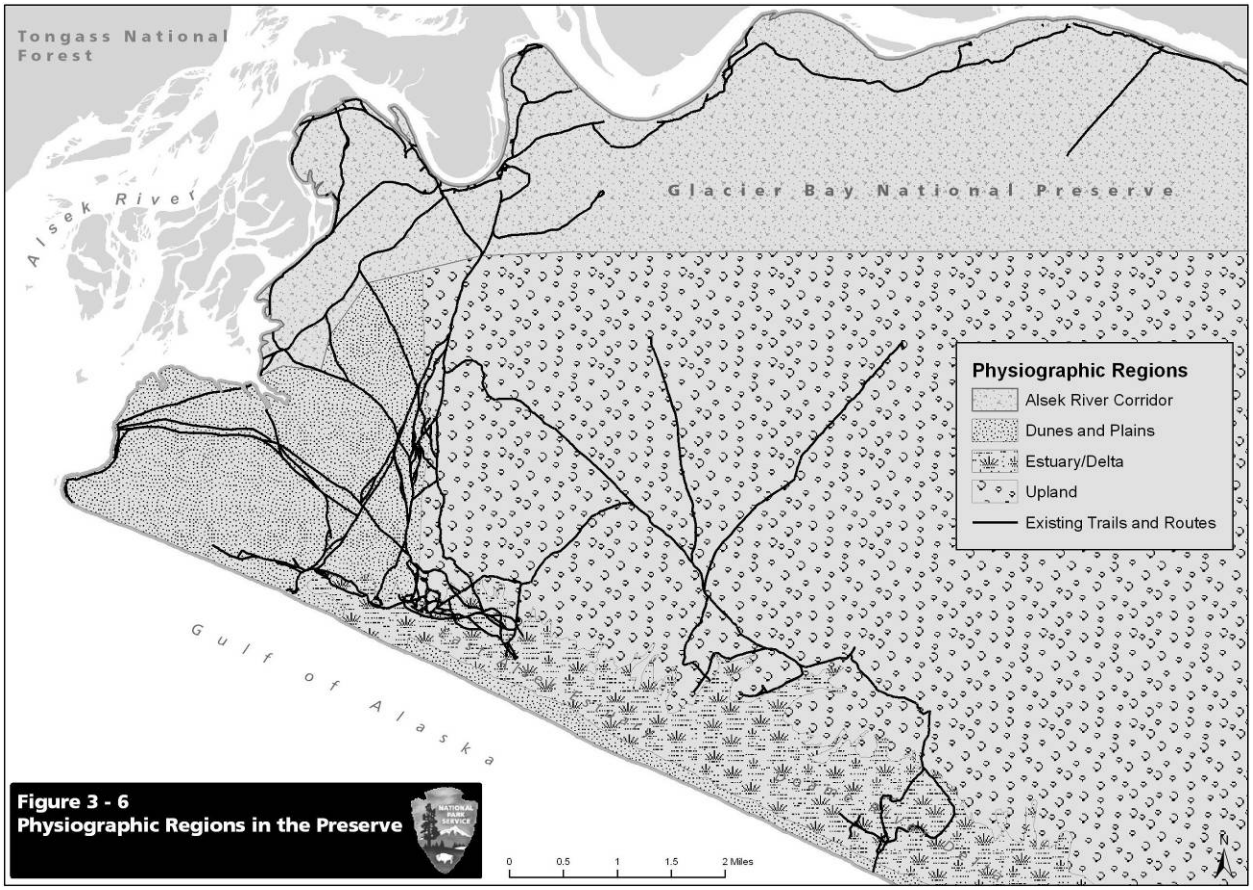


Figure 3 - 5
Trail Condition Classes

3.1.2 Overview of Trail Conditions

The Dry Bay area is divided into 4 areas of similar physical characteristics for purposes of discussion: Alsek River Corridor, Dunes and Plains Region, Uplands Region, and Estuary/Delta Region (Fig. 3-6).



Alsek River Corridor

Trails along the Alsek River Corridor are generally confined to narrow passages by the tall willow, alder and cottonwood upland vegetation. These trails are generally less than 12 feet wide, unbraided, gravel surfaced and rate as Good to Fair. Short segments of degraded trail occur where low-lying areas fill with water during high rainfall events. There are very few stream crossings along the trails which parallel the Alsek River. This contributes to their overall good condition.

Where the Alsek and East Alsek Rivers have eroded their banks, old trails have been washed away. The remnant spurs from these trails are abandoned and in some cases have already been barricaded off to direct traffic along the new routes. Other abandoned trails exist near the Dry Bay Airstrip where trails were rerouted in the late 1990's to eliminate ORV traffic on the busy airstrip. Short sections of duplicate parallel braided trail exist on the Boring Trail.

Dunes and Plains Region

The bare sand and gravel in the Dunes and Plains region enable ORV traffic to easily depart from the principal track. In the eastern portion of the Dunes and Plains area the Maze Central and Maze West Routes pass through a flat, bare area that often floods in late summer. In these areas the water may be 1-8 inches deep for hundreds of feet. ORV riders drive through these areas when in flood but because the existing route is under water and visibility in the driving rain may be poor, ORV operators often stray from the principle alignment. Hence, short sections of duplicate parallel braided trail exist on many of the trails in the Dunes and Plains area. Short sections of 'Y' type trail duplicate access at various intersections in the Dunes and Plains area. Maze Central and Maze West trails are generally 3 to 80 feet wide and rated between Good to Very Degraded. Trail braiding and higher widths are the principle factors causing excessive degradation of Maze trails. Other Dunes and Plains trails receive less traffic and some are less impacted by periodic flooding. The Dunes Route and the Plains South and Plains North Trails vary between 3 to 40 feet wide and generally rate as Good to Fair.

Directly south of the Dunes Route is an area containing the highest sand dunes in Dry Bay. The highest dune is over 30 feet higher than the mean high tide. Unauthorized ORV driving for recreational purposes occurs in these dunes with tracks riding up steep dune slopes and across areas of rye grass. These tracks, noted during hikes across the dunes, are infrequent and often obscure. They were not assessed for this EA.

Uplands Region

The trails in the Uplands region are generally confined to narrow corridors by the tall upland vegetation. Most of the surface water in the central uplands drains south through a series of intermittent streams and wetlands. The Main Trail East and the Doame Trail cut across the upland intermittent drainage system. Habitats and vegetation communities alternate between upland and wetland areas along the Main Trail East depending on elevation, soils, and hydrology. Where these trails cross wetlands rutting occurs. Rutting, poor drainage, and stream crossings are the principle factors contributing to trail degradation in the Uplands region. Trails which parallel the intermittent drainage system have few degraded areas; they include the Dog Salmon Cutoff and the East Cabin Trail.

The most significant trail impacts in the Uplands region occur where the Dog Salmon Creek crosses the Main Trail East and the DSC Trail. Both these areas were classified as Very Degraded. The Dog Salmon Creek crossing of the Main Trail East rarely dries up. Water depth varies from a few inches to 2 or more feet. There are times when the Main Trail East is not passable due the high water in the Dog Salmon and adjacent intermittent streams.

Where the DSC Trail crosses Dog Salmon Creek the river is perennial, braided and runs through a complex wetland. The trail is multi-braided, deep ruts are present and the trail width is between 40 to 80 feet. Water depth is often higher than can be forded with an ATV and the trail showed little use in 2005 and 2006. The Doame Trail crosses the East Alsek River in a broad shallow stretch of the river. The crossing is approximately 150 feet long and when the river is high the crossing is not passable.

Most of the short East Access Trail ranks as Good or Fair. Where the trail crosses a small perennial stream wetland plants have been impacted and the trail it is ranked as degraded.

Short sections of duplicate parallel braided trail exist on the Main Trail East. Short sections of 'Y' type trail duplicate access at the intersection on the East Access Trail with the Main Trail East.

Estuary/Delta Region

Trails in the Estuary/Delta region are usually open with little or no vegetation to create a defined corridor. Trails in the lower estuary areas tend to be washed away or obscured by the high tides. Short sections of duplicate parallel braided trail exist on some trails in the Estuary area. The trails west of the Dog Salmon airstrip were generally rated as Good to Fair. Trails rated as Fair were typically wider and multi-braided compared to the Good trails.

In the1980's and early 1990's a trail existed along the south side of the East Alsek Estuary between the mouth of the East Alsek and the Ranney fish camp (Fig. 3-1). The Ranney fish camp has been unused since the late 1990's and most the trail is no longer visible and was not assessed. On the north side of the estuary east of the Dog Salmon airstrip no trails were detected or assessed, however, Dry Bay Rangers report that unauthorized recreational ATV's use occasional occurs in this area.

South of the Dog Salmon Airstrip the trail crosses the East Alsek River. The location of this deep water crossing varies each year with the changing river bottom. The crossing can occasionally be driven at low tide when the river flow is down. Some ATV operators cross at low tide by wading and floating the ATV. Boats are often used to ferry ATVs across the river. Because of the difficulty of crossing the estuary, some operators leave an ATV on the south side of the estuary during fishing season. The access trail to and from the deep water crossing site varies each year.

The Varni East Trail crosses a small stream with an adjacent estuarine wetland. The track is multi-braded, deeply rutted and ranked as Very Degraded (See Photo 3-4).

The south eastern portion of the Doame Trail, the northern portions of the Doame East and Doame West trail are rutted, cross wetlands and are multi-braided. These sections of trail were rated as Degraded to Very Degraded.

Both the Doame East and the Dome West Trails cross the Doame River. The exact location varies from year to year due to the shifting riverbed.

3.2 WATER QUALITY

A diverse array of aquatic habitats exist throughout the four main areas (i.e., Alsek River Corridor, Dunes and Plains Region, Uplands Region, and Estuary/Delta Region) of the Preserve. The Alsek River and associated lower estuary comprise the Alsek River Corridor and dominate the landscape. Numerous perennial streams with well defined channels and year round flowing water typically drain the Uplands Region from north to south discharging into the East Alsek/Doame River Estuary Delta Region. These include Dog Salmon Creek, the East Alsek and Doame rivers as well as many smaller unnamed stream systems. The estuary portions of the East Alsek/Doame River estuarine delta as well as the lower reach of the Alsek River are tidally influenced through their connection with the Gulf of Alaska. Numerous wetlands are interspersed throughout the landscape including the Dunes and Plains and Uplands Regions.

The Alsek River channel defines the north and western boundary of the Preserve landscape (Fig. 3-2). Approximately 40 km of river channel exist within the Preserve and the south and east bank of this river system approximately defines the northern- and western-most Preserve boundary. The Alsek River is fed by two major tributaries including the upper Alsek River (20,400 km^2) and the Tatshenshini River (6,508 km^2). Discharge for this large transboundary river system exceeds 100,000 cubic feet per second (cfs) with summer flows strongly influenced by glacial meltwater and high sediment contributions (Deschu et al., 1995). The river is characterized by relatively steep gradient, shifting, braided channels and cold water temperatures. River and estuary substrate ranges in size from sand and glacial silt to cobble.

Periodic water sampling has occurred in the Alsek River by USGS since 1991. Turbidity, a measure of suspended sediment in the water column, often exceeds 400 NTUs during peak summer discharge (http://alaska.usgs.gov/science/water/index.php) when glacial contributions in this large, cold water river are most significant. Sample results also exist online for nutrients and major and minor inorganics (including metals). Celewycz, A.G. and A.C. Wertheimer (1997) noted high turbidity (secchi disc visibility typically 8-12 cm) and very limited saltwater intrusion (salinity $\leq$ 2.6 ppt) within 1 km of it's mouth during an investigation of salmon rearing habitat in the lower Alsek River.

Numerous north-south oriented perennial stream channels drain seasonally flooded wetlands throughout the Preserve (Fig. 3-2). These streams all discharge into the common East Alsek /Doame River estuarine delta. Dog Salmon Creek, the East Alsek River and Doame River are the main freshwater drainages south and east of the Alsek River. Numerous unnamed channels also exist. The East Alsek River and Doame River historically disgorged into the Gulf through separate estuaries. Seismic activity in 1959 caused a significant change in estuarine morphology and habitat. The East Alsek and Doame Rivers coalesced into a common estuary during the early 1960s following the Lituya Bay earthquake and tidal wave. The Doame River estuary is more correctly defined as a delta since this feature is typically not influenced by saltwater intrusion.

The outlet to the East Alsek/Doame River estuarine delta has been migrating northwest over time and evidence of past estuary mouth locations are visible as deeper offshore waters in recent aerial photography as a consequence of estuarine discharge, shoreline scouring, longshore sediment transport and changing channel morphology. Although tidal elevation influences water

surface elevation throughout the lower estuary and upper delta, saltwater intrusion during high tide probably only rarely extends into the upper reaches of the estuary (above Steve's Island) except perhaps during spring tide series (NPS unpublished data). But in contrast with the Alsek River, saltwater intrusion extends a much greater distance (ca 3-4 km) up the East Alsek/Doame estuary in comparison.

A bottom water salinity of approximately 20 ppt was documented during a 6.8 ft. high tide August 30, 2006 in the estuary adjacent to the temporary camp zone. Water sampling conducted in the estuary upstream of Dog Salmon Creek on July 8, 2005 documented a salinity of 7.2 ppt during a -1.4 foot tide. However, this was attributed to bank storage (Soiseth et al. 2005).

Numerous tributaries and wetlands characterize the Dog Salmon Creek drainage. Dog Salmon Creek is a relatively small, shallow (< 1 m), low gradient stream (Table 3-2). Although discharge for this system is not known, channel morphology suggests discharge in this drainage to be significantly less than that in the East Alsek River. However, Dog Salmon Creek is a relatively important drainage within the Preserve because ORV trails cross this drainage at three locations including upper, middle, and lower reaches (Fig. 3-7). Approximately 4 km of stream reach occurs downstream of the upper trail crossing to the East Alsek estuary. Streambed substrate at this location is comprised primarily of small gravel, sand, course gravel, and fine sediment. Fine sediment is particularly evident in downstream areas.

Very little water quality monitoring has occurred in Dog Salmon Creek. No turbidity monitoring has occurred although suspension of fine sediment may be visually evident along the upper ORV crossing following vehicle passage. Bacteria counts from water samples collected during the summer of 2005 and 2006 periodically exceeded state standards along the lower reach of Dog Salmon Creek. However, the source of these high bacteria levels was determined to be other vertebrates and not human in origin based on sampling above and below human habitations during 2006.

The East Alsek River drainage is relatively unique within the Preserve. This stream system exhibits few tributaries and very limited wetland contribution compared with Dog Salmon Creek. Channel morphology consists of relatively long (ca. 100 m or more) pools separated by short riffles. The stream lies at low elevation, is extremely low gradient (Table 3-2), and deep pools (ca. 2.5 m) exist along it's lower reach. Summer discharge ranges between 50 and 250 cubic feet per second (Soiseth et al., 2005). A single stream crossing along the lower reach of this river system occurs approximately 1.5 km above Johnny's East River Lodge. This crossing was historically used to access the Doame River and associated delta (remnant estuary) area. Approximately 750 m of stream reach occurs downstream of the East Alsek River stream crossing. Streambed substrate at this location is comprised primarily of small and large gravel, cobble, and sand.

Soiseth *et al.* (2005) conducted baseline water quality monitoring within the East Alsek River and estuary during 2005 and 2006. However, turbidity was not monitored and no baseline exists although this system typically runs clear with no visually detectable suspended sediment. Water quality indicators suggest a well buffered and productive stream system with high levels of dissolved organic carbon, possibly contributed as a result of spawned out salmon carcasses and/or aquatic vegetation decomposition. Stable isotope signatures for groundwater, surface

water, and precipitation samples indicate local precipitation events likely influence area hydrology.

Several small unnamed streams and wetlands drain the area east of the East Alsek River. These north-south oriented drainages are similar in morphology to those drainages west of the East Alsek River. The ORV trail trends approximately 1.6 km E-SE from the East Alsek River crossing and then trends S-SW for a comparable distance to the lower Doame River delta crossing. The upper portion of the lower 1.6 km S-SW trending trail has captured stream flow in this area and is wet most of the year. The ATV-track derived stream channel here is relatively narrow (i.e., ATV width), shallow (< 1 m), and low gradient. Streambed substrate along this reach ranges in size from small gravel to sand.

The Doame River exhibits a much larger drainage basin and several headwater lakes occur at elevations exceeding 300 m (Table 3-2). Because much of this watershed occurs within the Deception Hills area at much higher elevations, snowmelt likely exerts considerable influence on the amount and timing of discharge. Water temperatures are also likely much colder for this system compared with other Preserve streams. Two ORV crossings have historically occurred along the lower Doame River delta. The uppermost stream crossing, which accesses the Ranney cabin, occurs approximately 3.2 km above the confluence with the East Alsek estuary. The lower crossing occurs approximately 2.2 km above the confluence. The delta morphology here is relatively wide (ca. 50-400 m depending upon recent precipitation events), shallow ($\leq$ 1-2 m), and extremely low gradient (< 0.5%). Streambed substrate throughout the lower reach of the delta is comprised almost entirely of sand.

Table 3-2. Estimated Stream And Watershed Characteristics For Selected Dry Bay Area Streams

River	Estimated basin size ($km^{2)}$	Stream length (km)	Maximum elevation (m)	Estimated gradient (%)
Dog Salmon	10-13	5	12	< 0.01
East Alsek	13-16	10	18	< 0.01
Doame	104-116	17	700	0.04

Based on measurements from 1:63,360 scale USGS topographic maps (contour interval equals approximately 30 m).

Several different types of wetlands exist within the Dry Bay area and are subsequently defined in section 3.3.2. Palustrine wetlands typically occur throughout the Uplands Region and are characteristically vegetated and comprised of relatively well-developed organic soils. Other types of wetlands exist that are typically unvegetated or sparsely vegetated with varying hydrological regimes. Some are tidally inundated, some are flooded by or communicate with perennial streams, and others are primarily influenced by precipitation events. Precipitation events, particularly during fall, cause seasonal flooding throughout many wetlands and, depending on surrounding topography and gradient, result in either standing or flowing water. Although many wetlands often communicate with or discharge into perennial streams and the Estuary/Delta Region, some occur within isolated subbasins and are characterized by little or no water movement. Despite relatively sparse vegetation and poor soils, seasonal flooding in the Dunes and Plains region creates wetland conditions.

3.3 VEGETATION (INCLUDING WETLANDS)

Vegetation in the Dry Bay area of Glacier Bay National Preserve is controlled by the wet, cool, coastal maritime climate and dynamic geomorphologic processes. Natural and human-caused fires generally do not occur in this park and preserve (NPS, 1984). The area is bound by the Alsek River to the north and west, the North Gulf of Alaska to the south/southwest, and the Deception Hills to the east. The vegetation in the area is generally young in terms of primary and secondary succession except in the hills, where vegetation is generally more mature and has escaped recent glacial cover and massive floods.

Vegetation and wetlands in the study area are changing due to rapid uplift from isostatic rebound after deglaciation, which has been measured at rates approaching 25 millimeters per year (0.25 m per decade) in recent research (Larsen *et al.*, 2004, 2005). As streams incise at rates to accommodate this uplift and maintain stream base level, an increase in stream-associated floodplains results in a decrease in groundwater elevation. Declining groundwater elevations in soils result in drier conditions for wetlands and changes in associated wetland vegetation communities over time. Shifts in vegetation community composition and distribution from wetland to drier (shrub) communities, based on land cover changes evident in aerial photos dating back to 1948, corroborate these patterns of change.

ORV trails in the area traverse various vegetation and wetland vegetation types, but the trails do not penetrate the Deception Hills to the east. The ORV trails provide access through vegetation along the Alsek River, through young forest, shrub, and herbaceous/graminoid vegetation, across estuarine areas, sand dunes, palustrine wetlands, to fishing sites near East Alsek River, and across riparian zones of the East Alsek River, Doame River, and other drainages. Where needed, the trails are periodically brushed to keep the passageways clear. Vegetation in the area was sampled by NPS Fire-Pro teams in 1985 and land cover mapping teams in 2001. The NPS now has a draft land-cover map, which includes National Wetlands Inventory (NWI) mapping units (Grunblatt, et al., in progress). Vegetation cover types generally follow the Alaska Vegetation Classification (Viereck et. al., 1992) and wetlands mapping units follow the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et. al., 1979). In summer 2005 NPS trail condition assessments provided some data on trail condition, generally relating to wetland status. In summers 2004 to 2006 botanists surveyed the Dry Bay area for exotic plant species and documented several such species along ORV trails. Furthermore, an NPS team conducted ground-truth surveys of wetland classifications along ORV trails in the study area in July 2006. Survey methods followed those in the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). Land cover mapping, based on 1996 aerial photography, is generally accurate, but the minimum mapping unit size is 5 acres. The 2006 field team found a few locations where the ORV trails traverse wetland units smaller than 5 acres or a small upland site near a larger wetland unit was mapped as wet. In some cases, registration of GPS coordinates with features on aerial photographs are not well matched, however, the relatively flat terrain reduces this problem. Also, photo-interpretation is rarely as accurate as on the ground surveys for assessing vegetation types.

The ORV trails traverse vegetation and wetland types in the study area as described below. Vegetative cover in the preserve is shown in Figure 3-7. Appendix G provides a summary

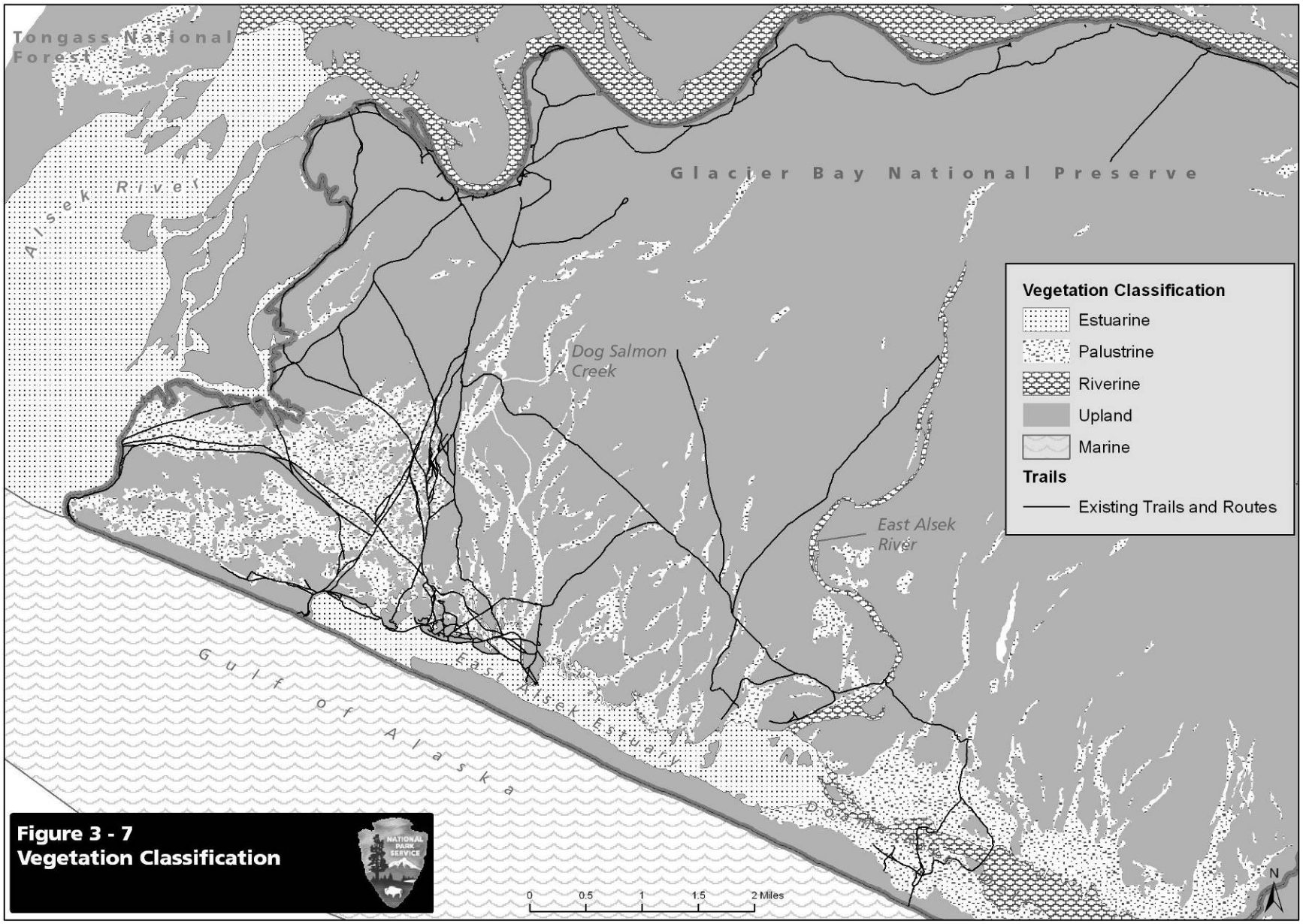


Figure 3 - 7
Vegetation Classification

matrix of wetlands habitat classifications. A summary table of length and area of vegetation type traversed by the existing trails is provided in Table 3-3.

Table 3-3 Summary of Trail Condition and Cover by Vegetation Class

Vegetation Class	Trail Condition[1]	Miles (%)	Max, Acres[2] (%)	Min. Acres[2] (%)
Palustrine	Good	6.47	6.85	3.47
Palustrine	Fair	4.31	10.77	6.71
Palustrine	Degraded	0.98	3.88	2.47
Palustrine	Very Degraded	1.30	6.03	3.26
Palustrine Total:		**13.07 (15.7%)**	**27.53 (23.5%)**	**15.91 (24.7%)**
Riverine	Good	1.18	0.90	0.45
Riverine	Fair	0.22	0.16	0.08
Riverine	Degraded	0.04	0.03	0.02
Riverine Total:		**1.44 (1.7%)**	**1.09 (0.9%)**	**0.55 (0.9%)**
Estuarine	Good	0.89	0.92	0.45
Estuarine	Fair	1.24	1.73	1.08
Estuarine	Degraded	0.02	0.01	0.01
Estuarine Total:		**2.15 (2.6%)**	**2.66 (2.3%)**	**1.54 (2.4%)**
Upland	Good	50.05	52.43	26.56
Upland	Fair	14.66	26.37	15.63
Upland	Degraded	1.85	6.12	3.60
Upland	Very Degraded	0.28	1.04	0.58
Upland Total:		**66.84 (80.0%)**	**85.96 (73.3%)**	**46.37 (72.0%)**
Grand Total:		**83.49**	**117.25**	**64.37**

[1] Trail Condition integrates several trail characteristics: width, depth, uses, surface condition, stoniness, muddiness, percent grade, drainage, and number of braids.
[2] Acres (max) and Acres (min) are the maximum and minimum acreage of the trail or trail segment. Acres (max) and Acres (min) are calculated by multiplying the maximum and minimum trail width for each trail segment in the same trail condition assessment inventory class. The segment acreages are added together to calculate the total acreage for the condition class.

3.3.1 Upland Vegetation

Dominant upland plant species in the project area include the following trees:

- Sitka spruce (*Picea sitchensis)*
- black cottonwood (*Populus balsamifera* ssp. *trichocarpa*);

The following shrubs:

- Sitka alder (*Alnus sinuata*),
- Sitka willow (*Salix sitchensis),*
- Scouler's willow (*Salix scouleriana*),
- Felt-leaf willow (*Salix alaxensis*);

The following grasses:

- reed bent grass (*Calamagrostis canadensis),*
- beach rye (*Elymus arenarius),*
- red fescue *(Festuca rubra),*
- and numerous other species;

And the following herbs:

- cow parsnip (*Heracleum lanatum),*
- beach strawberry (*Fragaria chiloensis*),
- yellow oxytrope (*Oxytropis campestris*),
- purple vetch (*Astragalus alpinus),*
- yellow Indian paintbrush *(Castilleja unalaschensis*),
- and numerous other species.

These plants assemble in various mixtures to form the following vegetation types through which ORV trails traverse:

Cottonwood forest
Open cottonwood forest
Open cottonwood and closed tall alder forest
Cottonwood woodland and with open low willow shrubs
Closed spruce-cottonwood forest
Open spruce-cottonwood woodland with closed tall alder forest
Closed tall alder forest/shrubs
Spruce-cottonwood woodland with open low willow shrubs and herbs
Closed tall alder shrubs with mesic herbaceous understory
Open low willow shrubs with mesic herbs
Mostly bare ground with mesic herbs
Mostly bare ground with grasses
Mostly bare ground with scattered alder and willows
Cottonwood woodland with mesic herbs
Alder-willow shrubs with grasses and sedges
Alder-willow shrubs with mesic herbs
Open low willows and other low shrubs

Example photographs of the more common upland vegetation types are provided below (Photos 3-5 through 3-12).

Photo 3-5 Cottonwood woodland with open low willow shrubs

Photo 3-6 Closed tall alder shrubs with herbs

Photo 3-7 Open spruce-cottonwood woodland with closed tall alder forest

Photo 3-8 Open low willow shrubs with herbs

Photo 3-9 Mostly bare ground with mesic herbs

Photo 3-10 Mostly bare ground with scattered alder and willows


Photo 3-11 Mostly bare ground with grasses


Photo 3-12 Alder-willow shrubs with mesic herbs

3.3.2 Wetland Vegetation

Dominant wetland plant species in the project area include the following shrubs: sweet gale (*Myrica gale),* willows (*Salix ssp.*), and Sitka alder (*Alnus sinuata*), which like some willows is facultative neutral for wetland areas (i.e. the plants can survive in wetland or upland areas). Common wetland herbs and wetland grasses or grass-like species in the project area include: water horsetail (*Equisetum fluviatile*), seaside arrow grass (*Triglochin maritimum*), sticky false asphodel (*Tofieldia glutinosa*), Pacific silverweed (*Potentilla Egedii*), hoary sedge (*Carex canescens*), Lyngbye's sedge (*Carex Lyngbyei*), seaside plantain (*Plantago maritima*), creeping spikerush (*Eleocharis palustris*), hairgrass (*Deschampsia beringensis*), Nutka alkali grass (*Puccinellia nutkaensis*), western water hemlock (*Cicuta Douglasii*), and other less common plants.

There are six basic wetland types in the study area with assemblages of the plant species and others noted above:

1) broad-leaved palustrine scrub-shrub,
2) palustrine areas with emergent vegetation,
3) palustrine areas with unconsolidated bottom sediments,
4) intertidal estuarine areas with unconsolidated shore substrates,
5) perennially flooded riverine areas with unconsolidated bottoms or shores, and
6) tidally influenced riverine areas with unconsolidated bottoms.

The intertidal estuary and tidally influenced riverine areas occur near the East Alsek River, Dog Salmon Creek, and sandy low-lying areas draining into the Alsek River. The perennially flooded riverine areas occur along the East Alsek River, Doame River, Dog Salmon Creek, and sloughs of the Alsek River connecting to islands. None of the trails enter or cross the main stem of the Alsek River. Palustrine wetlands generally occur more inland and along abandoned stream channels and low lying areas, which are seasonally flooded by heavy rains or overflow from nearby streams and rivers. Example photographs of wetland types are provided in Photos 3-13 through 3-18.

Photo 3-13 Broad-leaved palustrine scrub-shrub

Photo 3-14 Palustrine area with emergent vegetation

Photo 3-15 Palustrine area with unconsolidated bottom sediments

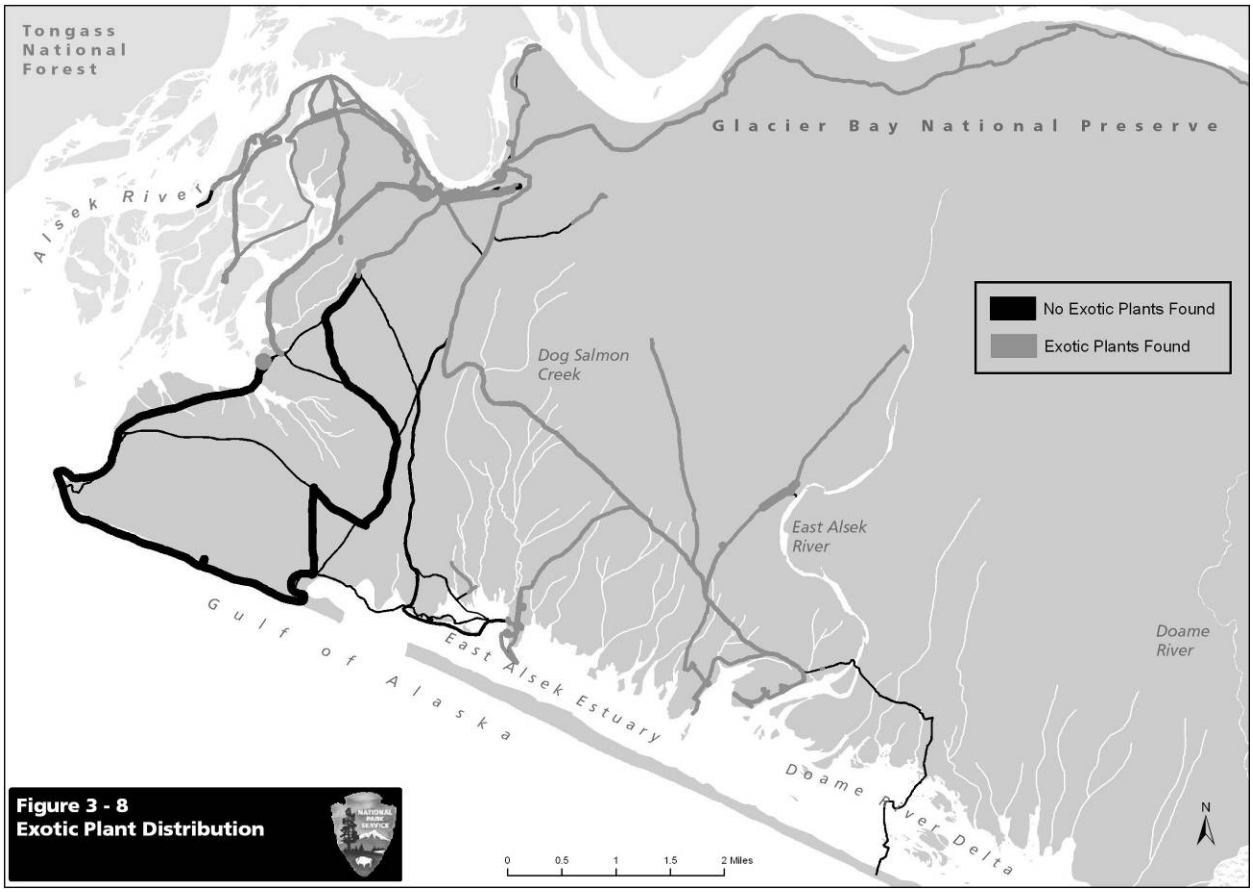
Photo 3-16 Intertidal estuarine area with unconsolidated shore substrates

Photo 3-17 Perennially flooded riverine area

Photo 3-18 Tidally influenced riverine area

3.3.3 Exotic Plant Species

Several non-native plants species have been documented in the Dry Bay area of Glacier Bay National Preserve (Rapp, 2006). NPS botanists surveyed most of the trunk ORV trails and temporary camp areas, and over half of the trail segments contain exotic (non-native) species of plants. Some of these species are aggressive and invasive. Some of these species thrive in disturbed ground, such as ORV trails. Examples of such species are common plantain (*Plantago major)*, common dandelion (*Taraxacum officinale ssp. officinale)*, and pineapple weed (*Matricaria discoidea*). Other species get started along trails and rapidly spread into adjacent areas such as the bigleave lupine (*Lupinus polyphyllus)* and oxeye daisy (*Leucanthemum vulgare*). Figure 3-8 shows the distribution of exotic plants for surveyed areas in Dry Bay (Rapp, 2006). The NPS has initiated an Alaska region-wide plan to address invasive plant control options. The plan is anticipated to be completed by summer 2007.



3.4 AQUATIC BIOTA AND HABITAT

The majority of stream habitat within the Preserve is a permanent feature on the landscape with good connectivity between spawning and rearing areas. However, because this area originated as a glacial outwash plain and is extremely flat, fall flooding events seasonally inundate wetland habitat throughout the Preserve. Seasonally flooded wetland habitat is often only periodically accessible to fish which can become stranded in these areas during low water periods. Stranded fishes, including juvenile salmonids and threespine stickleback can suffer high mortality during periods of drought as water temperature increases and dissolved oxygen concentrations in warming pools decline.

Eight streams and river systems within the Preserve are state-designated anadromous salmonid habitat important for the spawning, passage, and rearing of various salmonid species (Table 3-4 and Fig. 3-9). The majority of streams within the Preserve are accessed by salmonids through the East Alsek/Doame River estuarine delta with the exception of the Alsek River. Estuarine passage is critical for access to stream spawning habitat and for access to marine habitat by juvenile salmonids upon smoltification.

Table 3-4 Known Dry Bay Area Salmonid Presence

ADFG#	Stream Name	Reach Length Surveyed (km)	ADFG Documented Species[1] & Life Stage[2]	Additional Known Spp[3]
181-30-10100	Alsek River	26.6	Ss, Kp, COp, Pp, CHs, SHp, DVp	EUs
182-20-10500	Dog Salmon Ck.[4]	7.7	Ss, CHs	
182-20-10300	Unnamed	6.2	Ss, CHs	
182-20-10100	East Alsek River	12.3	Sps, Kp, COp, Pp, CHps, DVp	CTps, EUs (estuary)
182-20-10050	Unnamed	6.7	Sp, Kp, COs, Pp, CHs,	
181-10-10100-2003	Unnamed	5.7	Sp, Kp, COp, Pp, CHp	
181-10-10100-2009	Unnamed	3.4	Sp, Kp, COs, Pp, CHp	
181-10-10100	Doame River	12.8	Sps, Kp,COps,Pps,CHp,DVp	EUs

All data from Alaska Department of Fish and Game Fish Distribution Database interactive stream map viewer (http://gis.sf.adfg.state.ak.us/AWC_IMS/viewer.htm). Additional known species are from ongoing NPS and UAF School of Fisheries study.
[1]Species codes: Sockeye (S), king (K), coho (CO), pink (P), chum (CH), steelhead trout (SH), Dolly Varden (DV), cutthroat trout (CT), and eulachon (EU).
[2]Life stage codes: spawning (s), present (p).
[3]Data from Faber *et al.* 2005 and from pers. comm. with Jim Capra, Dry Bay Ranger.
[4]Dog Salmon Creek is the locally known and recognized name for this stream.

Sockeye, pink, chum, and coho salmon occur seasonally within many of the area streams with Dolly Varden char also documented as occurring in this area (Table 3-4). Cutthroat trout have been documented only within the East Alsek River. Steelhead trout have been reported within the Alsek River and anecdotal reports also exist for the Doame River system. King salmon run up the Alsek River to spawn primarily in the Yukon, Canada. In fact, the Alsek is a major producer of king salmon in Southeast Alaska (Celewycz and Wertheimer, 1997). A small

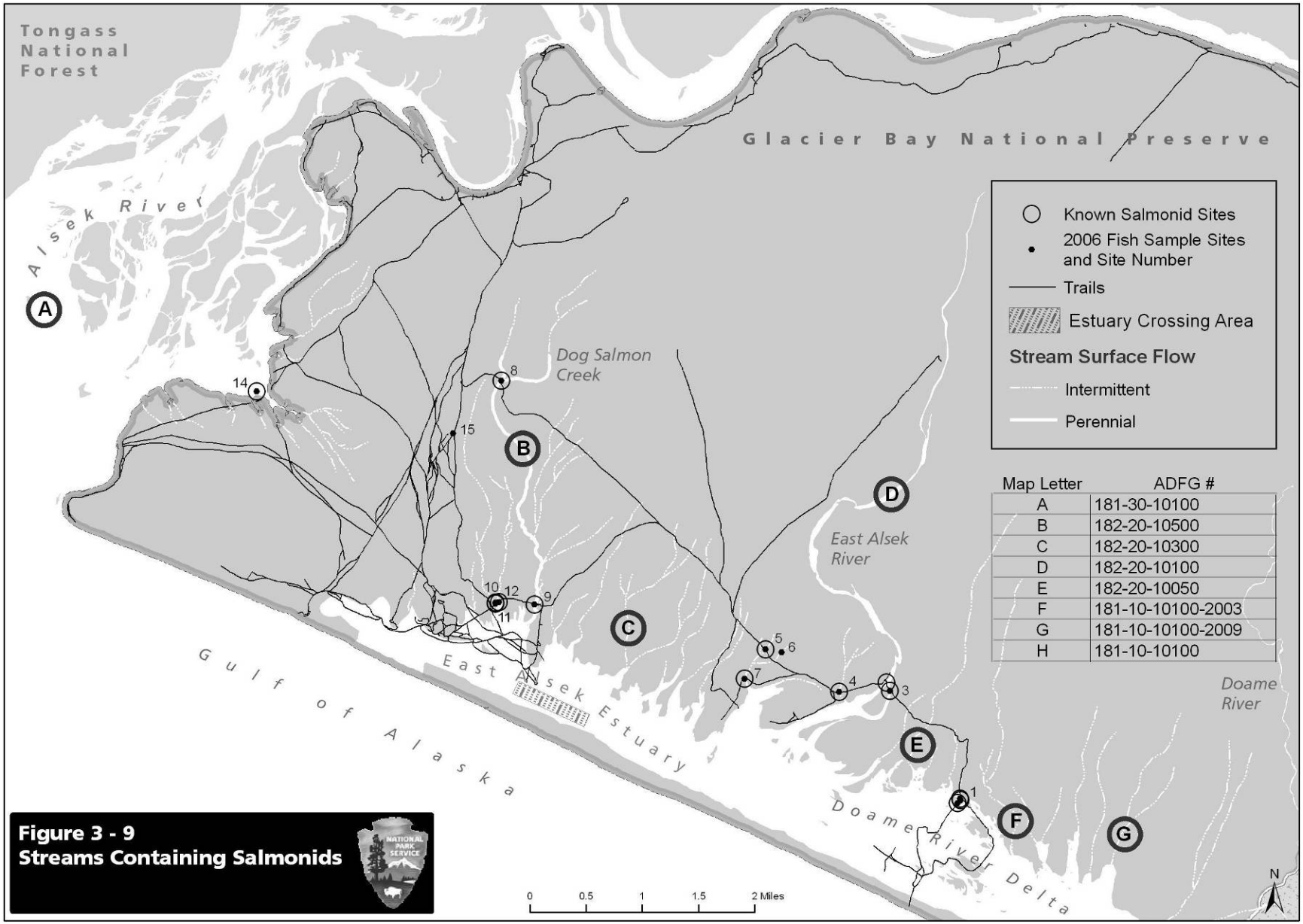


Figure 3 - 9
Streams Containing Salmonids

population is also known to spawn within the Doame River (pers. com. Gordie Woods, ADFG fisheries biologist, Yakutat) but actual spawning location remains unknown.

A wide variety of anadromous salmonids, marine, and estuarine species are known to occur within Preserve estuary habitat). Salmonids use estuarine habitat for rearing and fish passage and many of the species occurring within freshwater can be found within estuarine habitat during at least some portion of their life cycle. Adult salmonids typically access spawning habitat along estuarine corridors and juvenile fish, particularly sockeye and coho salmon, are known to rear within or migrate through estuarine areas prior to entry into the Gulf of Alaska as smolt. Adult chinook salmon are periodically observed within the East Alsek/Doame River estuary enroute to as yet unidentified but presumed spawning habitat in the Doame River. Eulachon are known to spawn within both the East Alsek River and Alsek River estuarys. Dogfish have been observed feeding on eulachon within the East Alsek River estuary. Other marine and estuarine species include starry flounder, threespine stickleback, sandlance, juvenile kelp greenling, rainbow smelt, and staghorn and coastrange sculpin. Estuarine invertebrate species include Dungeness crab, at least one unknown shrimp species, various copepods, and Corophiid and Gammarid amphipods. However, even basic inventories of invertebrate species in the East Alsek/Doame River estuarine delta are lacking and species presence is poorly known.

Most adult salmon enroute to spawning habitat occur with Preserve waters between June and October. One exception is king salmon which can be found in the Alsek River and East Alsek/Doame River estuary as early as May (Table 3-5). Fertilized eggs and developing embryos remain in stream gravels until emergence during late winter and early spring.

Table 3-5 Salmonid Run Timing In Dry Bay Area Streams

Species	**Alsek River**	**East Alsek River**	**Doame River**
King	May-July	June-July	June-July
Sockeye	June-September	July-October	June-August
Pink	July-August	July-August	July-August
Chum	July-October	June-September	June-September
Coho	August-October	July-October	June-September

Data summarized from ADFG Regional Information Reports.

Very little is known about the status of salmonid populations within streams other than the Alsek River, East Alsek River and Doame Rivers. However, fairly comprehensive quantitative estimates of run strength are available for commercial species including king, sockeye and coho salmon in the Alsek River as well as the East Alsek and Doame rivers. Recent Alsek River salmon runs consist of 1,500-3,000 kings, 15,000-70,000 sockeye, and 3,000-20,000 coho salmon (Table 3-6 and 3-7). Commercial harvest along the East Alsek River estuary targets both East Alsek River and Doame River sockeye stocks. Of these two stocks, the East Alsek River has historically been much larger. Although annual East Alsek River sockeye returns once ranged between 25,000 to 277,000 fish, far fewer fish have returned in more recent years (Table 3-8). In fact, this fishery was closed for 4 years beginning in 1999 due to inadequate returns. ADFG recently set the biological escapement goal at 13,000-26,000 fish for this run (Clark, Woods and Fleischman, 2003). Less than 300 coho and only a few king, pink, and chum salmon have been recently harvested from this river system. A relatively smaller run of sockeye but a

comparatively larger run of coho salmon exist within the Doame River. Peak escapement counts of East Alsek River sockeye have ranged from 50 to 3,200 sockeye annually since 1972 (Clark, Woods and Fleischman, 2003).

Table 3-6 Commercial Alsek River Set Gillnet Fishery Harvest

Year	King	Sockeye	Coho	Pink	Chum	Effort (# boats)
2000	677	9,522	5,103	5	130	14
2001	541	13,995	2,909	8	17	14
2002	700	16,918	9,525	0	1	16
2003	942	39,755	47	0	0	15
2004	656	18,030	2,475	0	2	24
2005	662	7,794	1,196	0	0	20

Data from Bachman *et al.* 2005.

Table 3-7 Klukshu River Weir (Yukon Canada)
Escapement Estimate

Year	King[1]	Sockeye[2]	Coho
2000	1,365	5,551	4,832
2001	1,825	10,290	748
2002	2,240	25,711	9,921
2003	1,671	32,120	3,689
2004	2,525	15,348	750
2005	1,070	3,373	683

Data from Bachman *et al.* 2005
[1]King salmon escapement goal is 1,100-2,300 fish.
[2]Sockeye salmon escapement goal is 7,500-15,000 fish.

Table 3-8 East Alsek River Set Gillnet Fishery Harvest[1]

Year	King	Sockeye	Coho	Pink	Chum	Effort (# boats)
2000	Closed					
2001	Closed					
2002	0	10	244	0	0	4
2003	0	2,617	1	0	22	8
2004	6	4,590	21	0	34	9
2005	8	5,099	27	36	0	13

Data from Bachman *et al.* 2005.
[1]Harvest data potentially includes fish from both the East Alsek River and Doame River.

Table 3-9 East Alsek River And Doame River Peak Aerial Escapement Counts

	East Alsek River		Doame River	
Year	**Sockeye**	**Date**	**Sockeye**	**Date**
2000	21,000	2-Aug	2,200	27-Jun
2001	17,000	27-Aug	1,545	25-Jun
2002	NA[1]	NA	NA	NA
2003	31000	22-Aug	NA	NA
2004	31000	15-Aug	NA	NA
2005	NA	NA	NA	NA

Data from Clark, Woods and Fleischman 2003 and Waltemyer et al. 2006.
[1]Aerial survey escapement estimates were not available (NA) for some years and locations.

The State of Alaska (Department of Natural Resources, Office of Habitat Management and Permitting and Alaska Department of Fish and Game) and NPS cooperatively surveyed Dry Bay ORV stream crossings during July 19-22, 2006, for fish species presence and to assess ORV effects. Survey methods and results are discussed in an attached summary report (Appendix H). Sampling sites (1-15) indicated in Figure 3-8 correspond to site numbers listed in this report.

3.5 WILDLIFE

The Yakutat Forelands area, including Dry Bay is part of a complex of mostly pristine tidal mudflats, sand beaches and dunes, deciduous shrublands, spruce forests, streams and freshwater wetlands, muskeg, and river estuaries. This diverse and dynamic ecosystem supports many species of migratory and resident wildlife. Some mobile wide-ranging species use many Preserve habitats while others are restricted to a specific type of vegetation or terrain. Specific movement patterns, distribution, population sizes, and detailed habitat use for almost all species is largely anecdotal or unknown. For purposes of discussion and consistency, wildlife habitats in Dry Bay are divided into the 4 regions described in Section 3.1.2.

3.5.1 Alsek River Corridor

The Alsek River supports significant salmon runs, but it also provides one of the few movement corridors for mammals and birds traveling from the interior to the coastal plain through the Saint Elias Mountains. Migratory raptors including peregrine falcon, sharp-shinned hawk, and gyrfalcon have been recorded all along the Alsek River drainage (Capra, pers. com.). The river drainage provides riparian migratory and breeding habitat for songbirds including Swainson's, gray-cheeked, and varied thrush, yellow-rumped and yellow warbler, fox sparrow, horned lark, and rufus hummingbird.

Mobile wide ranging mammals including brown bear, black bear, wolf, wolverine, red fox, lynx, river otter, pine marten, mink, snowshoe hare, beaver, and moose may have originally reached the Dry Bay area through the Alsek River corridor. Steller sea lion and harbor seal pursue

salmon upriver as far inland as Alsek Lake and haul out at several locations along the lower Alsek River (Capra, pers. com.).

Bald eagle, raven, and gulls can be found along most sections of the river depending on season however they range over much of the Preserve feeding on carrion, salmon, and the occasional stranded marine mammal. Eagles will roost and nest in larger diameter cottonwood trees along the river corridor. Ravens forage over the entire Dry Bay area.

The only amphibian documented in Dry Bay is the boreal toad which may have colonized from the interior into newly formed habitats along the river. Wood frogs have been documented along the Alsek River inland of the Preserve boundary (Soiseth, pers. com.).

Most ORV tracks proposed to be designated as *trails* are located in the Alsek River Corridor and Upland regions. They remain in basically the same position over time except for sections along the Alsek River main stem near the Alsek River Lodge. As the River channel shifts parts of this trail may be washed away. Thick willow, alder, and cottonwood encourage vehicle operators to keep to the primary track making their presence more predictable for wildlife. There are few riparian or stream crossings in the Alsek River Corridor. ORVs traveling through mature woodland habitats may be heard long before they are visible. Heavy brush along trails blocks the view of both riders and wildlife until the vehicle is close by. Trails here provide movement corridors for large animals and allow more light exposure for small flowering plants and grasses including nonnative invasive species. Scat and tracks of bear, moose and wolf are very common; evidence that they use the trail network frequently (Eichenlaub, pers. com.).

Flower buds, fruits, seeds and succulent non woody plants provide a diverse foraging area at trail edges for smaller upland mammals and birds. Raptors that prey on birds such as sharp-shinned hawk may hunt upland trail corridors more frequently compared to areas without trails however this has not been investigated in the Preserve. Thrushes, fox sparrow, and dark-eyed junco are commonly seen foraging in the trail tread and at trail edges. Fledgling birds are also common, and are sometimes hit by vehicles especially from late May until mid June (Soiseth, pers. com.). Red-backed vole, deer mouse, boreal toad, and shrews are also found dead on the trail. Ponded trail sections produce or attract insects which in turn attract foraging bats, insectivorous birds and toads. Without soil compaction from ORV traffic, moist depressions holding rainwater may not persist long enough to produce as much invertebrate prey for small animals.

The effects of ORV trails in this region may be compared to effects of established roads as some wildlife in this region will be attracted by easy travel, a diversity of small foods, and road killed organisms. The predictability of ORV encounters probably allows some species to become more tolerant to vehicles than they would be in areas without trails. Individual bears, especially males, may use roads or trails particularly if they lead to human habitations, burn pits, fish processing and net sites (Gibeau et al., 2002). Game animals using the trail or habitat on either side would be exposed to hunters more frequently than those that stay farther away from a trail as hunters tend to stay within 1 mile of their vehicle. Big game hunting parties use the Tractor Trail North and Alsek North Trails for moose and bear (Capra, pers. com.). Other resident wildlife ranging near the Tractor Trail North and the Alsek North Trail are disturbed more frequently by hunting activity.

3.5.2 Uplands

Bear, moose, and other mammals commonly use upland ORV trails and tracks and scat are frequently observed. ORV trails provide a network of movement corridors for terrestrial wildlife especially in areas where thick alder and willow brush has become established.

Riparian corridors and wetlands in this region provide important travel, foraging, and nesting areas for moose, bear, waterfowl, small mammals, and passerine birds. Small mammal species include white-footed deermouse, redback and long-tailed vole, meadow jumping mouse, little brown myotis, red squirrel, and shrew. Riparian habitats produce much of the invertebrate foods required by passerine birds, small mammals, and waterfowl (Soiseth, pers. com.). Beaver have colonized riparian and some wetland habitats around the Doame River and their activity has altered the condition of trails crossing the riparian area.

Passerine birds including Swainson's, varied, and gray-cheeked thrush, pine grosbeak, fox sparrow, yellow-rumped and yellow warbler, dark-eyed junco, and rufus hummingbird are common in upland woodlands (Capra and Soiseth, pers com.). Yellow-rumped warbler and ground foraging thrushes are very commonly heard and seen along ORV trails especially after young birds have fledged. Soiseth (pers. com.) observed a great number of juvenile thrushes along trails in 2006. Willow ptarmigan have nested in some open grassland areas but are becoming rare as grasslands convert to shrubland and deciduous woods. Breeding pairs of spruce grouse have been observed since 2004 (Capra, pers. com.). Predatory birds use the mature woodlands for roosting and nesting.

Sitka black tailed deer were introduced to the Yakutat Bay islands in the 1930s, and have been slowly expanding. Remains of a winter-killed deer were found in the Preserve in 1995. Two individuals were sighted in the Preserve in 2004 and tracks are becoming more common (Capra, pers. com.).

ORV tracks proposed to be designated as *trails* also occur in this region. Trails are generally similar to those in the Alsek River Corridor except the Main Trail East and the Doame Trail which frequently cross intermittent streams and wetlands. The Main Trail East is the primary east/west transportation corridor for Preserve users. The amount of traffic is relatively high (Capra, pers. com.). Wildlife dependent on riparian and wetland habitats is affected by ORV activity to a higher degree in this region because ORVs are encountered more often throughout the year.

Thick willow, alder, and cottonwood restrict vehicle operators to the primary track making their presence more predictable for wildlife. ORVs traveling through mature woodland habitats may be heard long before they are visible. Heavy brush along trails blocks the view of both riders and wildlife until the vehicle is close by. Trails here provide movement corridors for large animals and allow more light exposure for small flowering plants and grasses including nonnative invasive species. Scat and tracks of bear, moose and wolf are very common; evidence that they use the trail network frequently (Eichenlaub, pers. com.). Wetlands are extremely important for moose in spring and summer providing high quality foods and some security from

predators. Repeated disturbance, stress, and habitat damage from degraded crossings can reduce the fitness of individual animals near trails.

Flower buds, fruits, seeds and succulent non woody plants provide a diverse foraging area at trail edges for smaller upland mammals and birds. Raptors that prey on birds such as sharp-shinned hawk may hunt upland trail corridors more frequently compared to areas without trails. Northern harrier and short-eared owl concentrate hunting over open wetlands may be disturbed more frequently in this region. Thrushes, fox sparrow, dark-eyed junco, yellow and yellow-rumped warbler are commonly seen foraging in the trail tread and at trail edges. Wetland and riparian habitats produce a large amount of invertebrate foods so passerine bird and boreal toad populations are probably higher along these trail segments. Fledgling birds are common, and may be hit by vehicles especially from late May until mid June (Soiseth, pers. com.).

Waterfowl such as mallard, green-winged teal, Barrow's goldeneye, American widgeon, and gadwall commonly nest and raise broods in riparian wetlands. ORV trails crossing wetlands are not likely to crush nests hidden in dense vegetation, but adults may be separated from young resulting in abandonment and predation. Stream sedimentation resulting from ORV crossings damages or kills aquatic vegetation and invertebrates and reduces available foods for waterfowl.

Red-backed vole, deer mouse, boreal toad, meadow jumping mouse, and shrews are also found dead on trails. Ponded trail sections produce or attract insects which in turn attract foraging bats, insectivorous birds and toads. Beaver activity in the Doame River riparian area has affected the condition of trails there. ORV users attempting to avoid ruts and ponded segments expand the area of degradation reducing the habitat available to all wetland wildlife. Beaver are accessible to fur trappers from these trails.

The effects of ORV trails in this region may be compared to effects of established roads as some wildlife in this region will be attracted by easy travel, a diversity of small foods, and road killed organisms. The predictability of ORV encounters probably makes some species more tolerant to vehicles than they would be in areas without trails. Individual bears, especially males, may learn to use trails as they lead to human habitations, burn pits, and fishing sites (Capra, pers. com.). Game animals such as moose or bear using the trail or habitat on either side would be exposed to hunters more frequently than those that stay farther away from a trail as hunters tend to stay within 1 mile of their vehicles. The East Cabin and Cabin North Trails are often used by guided waterfowl and big game hunting parties. Parties are dropped off along the East Alsek River and raft or canoe the river south toward the estuary (Capra, pers. com.). Waterfowl, moose and bear using the East Alsek River drainage are exposed to hunting, fishing, and related disturbances more frequently than in other upland areas without trail access.

3.5.3 Dunes and Plains

Beach dunes provide resting areas for migratory sea and shorebirds that also feed in the estuaries. Birds present during breeding season include parasitic jaeger, Arctic tern, whimbrel, and glaucous-winged gull (Petersen et al., 1980). Short-eared owl and northern harrier range from open plains into the estuarine fringes foraging for small mammal prey. Moose may travel into the sand dune areas to calve (Capra, pers. com.). Brown bears are often seen along the dunes and

beach fringes searching for marine mammal and fish carcasses or digging for beach carrot and other favored tuberous plants.

ORV tracks proposed to be designated as *routes* are located in areas where conditions change from season to season or year to year. With the exception of the Plains North and Plains South Trails which are stable and well established, ORV tracks in this region are considered routes. The number and precise location of tracks also changes making them less predictable for wildlife. Any individual route may exist only until it is erased by water, wind or moving soil. The effects of routes in this region are much more temporary than in uplands. Routes are difficult to follow when flooded so many secondary tracks have formed (Capra, pers. com.), increasing the area where wildlife may encounter or be disturbed by an ORV. Traffic is more widely dispersed in this area and also visible at a greater distance. Depending upon wind conditions a vehicle may not be heard until it is quite close. Impacts here could be considered similar to the effects from unrestricted open recreational riding.

Most of the Temporary Camp Zone which includes camp locations and access tracks cross this region. Most ORV users stay on detectable routes however wildlife in the Temporary Camp Zone could encounter an ORV anywhere.

Wildlife impacts in this region are primarily disturbance to resting or nesting migratory birds. Bird colonies shift in response to water and soil conditions due to weather, flood events, or longer term changes in drainages as do ORV routes. Shorebirds migrating through the Yakutat Forelands in spring and fall can be disturbed by vehicles. Parasitic jaeger, Arctic tern, and glaucous-winged gull nest in this region and jaegers are commonly seen diving on ORV riders as they cross their breeding territories (Capra, pers. com.). If a route is established near a nesting territory the birds may be disturbed and flushed repeatedly, and nests and nestlings abandoned or crushed by a vehicle.

Moose occasionally calve in the dunes however calving takes place before much human activity begins in spring. The chance that an ORV route becomes established near a calving site is remote. Few if any small mammals occur here. Species such as bald eagle, short-eared owl, northern harrier, raven, bear, wolverine, or wolf using the dune and plain region are generally wide ranging, spend less time in this habitat, and not likely to be disturbed significantly by an ORV route.

3.5.4 Estuary/Delta

Along with the Copper–Bering River Delta the Forelands is the most extensive estuarine/wetland habitat on the eastern Gulf of Alaska coastline (Andres and Browne, 1998). The estuaries and marine shore provide significant stopover areas for migratory shorebirds including dunlin, black-bellied, Pacific golden, and semipalmated plover, greater and lesser yellowlegs, western and least sandpiper, red and black turnstones, short-billed and long-billed dowitchers, and common snipe. Common nesting species of waterfowl include northern pintail, Vancouver Canada geese, American widgeon, Barrow's goldeneye and trumpeter swan. Surveys in 1996 and 1997 estimated over 350,000 shorebirds using Forelands habitats qualifying it as a site of international

significance. The peak of the spring migration occurs in the first 10 days of May (Andres and Browne, 1998, and Petersen et al., 1980).

Photo 3-19 Migratory shorebirds in the East Alsek River estuary

Harvest records for seventeen species of migratory waterfowl exist for Dry Bay including Canada, snow, and white-fronted geese, Barrow's goldeneye, green-winged teal, mallard, red-breasted merganser, sandhill crane, northern pintail, American wigeon, and gadwall. In particular, the estuarine habitat at the mouth of the East Alsek River provides important feeding areas for migratory waterbirds (Petersen et al., 1981). Trumpeter swans winter in the estuaries (Capra, pers. com).

Salmon and eulachon spawning runs in the Alsek and East Alsek Rivers attract and concentrate many predatory and scavenger species from other parts of the Preserve including bald eagle, brown bear, raven, river otter, mink, and wolverine. Fish runs provide critical high calorie foods for predators building winter fat reserves. In particular, brown bear are observed feeding in the Doame River delta. Steller sea lion and harbor seal occasionally pursue spawning salmon up into the East Alsek estuary (Eichenlaub, pers. com.). There are no records of sea lion or seal haulouts along the Dry Bay beachfront.

ORV tracks to be designated as *trails* and as *routes* occur in this region. Trails occur in areas that change less frequently and include the DSC Trail, Varni East and Varni West, and the Doame East Trail. ORVs on these trails would be more predictable to wildlife as vehicles stay on the primary track when possible. Most other tracks are routes occurring in rapidly shifting tidal areas. Routes are often washed away by high tides or flood events. The number and precise location of routes also changes making them less predictable for wildlife. Any individual route may only exist for weeks or months until it is erased by water, wind or moving soil making some effects much more temporary than the same effects in uplands. ORVs are visible for longer periods at greater distances. Depending upon wind conditions a vehicle may not be heard until it is quite close. ORV use is more widely dispersed and less predictable as riders navigate shifting tidal channels, silt, sand and open water.

Access to the Temporary Camp Zone, fishing and net sites, boat launches, and cabins occurs throughout this region of the Preserve. When any particular site is unused for several years the route to it may disappear entirely. However, three of the trails that have caused the most significant habitat damage in the Preserve occur in the estuary region with large areas of braiding, deep ruts, and unstable wetland crossings.

Dry Bay estuaries and river deltas are extremely important for wildlife. Wildlife in this region is diverse including large numbers of migratory and breeding shorebirds, colonial waterbirds, bear,

wolf, wolverine, mink, river otter, bald eagle, northern harrier, short-eared owl, raven, breeding and migrating waterfowl, Steller sea lion and harbor seal. ORV routes have the potential to affect many more individual animals at specific periods. Bird colonies shift in response to water and soil conditions as do ORV routes. Attempting to locate a route to avoid them is more difficult.

Impacts here are comparable to effects from unrestricted open recreational riding including direct disturbance to waterbirds and shorebirds resting and feeding during migration. Vehicles can flush flocking birds and if they leave a previously used route may unintentionally crush camouflaged shorebird nests or chicks, separate adults from chicks, and injure or kill small mammals and boreal toads. ORV crossings cause water turbidity, sedimentation, and erosion of soils reducing the production of diatoms, algae, and invertebrates that are critical for adult and juvenile shorebirds and waterfowl.

During salmon and eulachon runs both wildlife and human activity are focused here. Bald eagle, bear, raven, river otter, mink, wolverine, Steller sea lion and harbor seal are attracted to spawning fish. The Doame River delta is particularly important for bears (Soiseth, pers. com).

3.6 VISITOR USE

In contrast to the National Park lands surrounding it, the National Preserve provides opportunities for hunting under state regulations, commercial fishing, and trapping. Visitor uses discussed in this section include hunting, sport fishing, trapping, wildlife viewing and photography, camping, and hiking. For a discussion of commercial fishing please see section 3.7. Subsistence use as defined under ANILCA Section 810(a) is discussed in Appendix E.

Permitted cabins and lodges, fishing camps, use of motorized vehicles, and aircraft landings on existing airstrips are also authorized. ANILCA specifies that use of cabins and campsites be compatible with the purposes of the Preserve and emphasizes the need to protect area resources by preventing land use expansion significantly beyond 1979 levels. The 1984 General Management Plan for Glacier Bay National Park and Preserve also restricts uses that were not present in 1979.

Almost all rafting groups coming down the Alsek River use the NPS-maintained take out point near the Dry Bay Ranger Station to meet air taxi and air cargo services at the fish buying station runway. Approximately 800 persons float the river annually either on commercially guided or private trips. Very few Alsek River rafters use ORV trails outside the immediate vicinity of the take out point and campground. Alsek River recreation activities are directed by the Alsek River Use Management Plan implemented in 1989. Rafting groups are scheduled by take out date; one group is scheduled to take out at Dry Bay per day. Weather delays on the river sometimes result in more than one group using the take out point and primitive campground located nearby at the same time. Some groups plan a night's stay in the campground while others camp waiting for flights delayed by weather. A DEC compliant sewage dump station and wastewater filter system serves rafting groups. One vault toilet and water supplied by a rainwater cistern is available near the campground.

Occasionally Dry Bay is used as a staging area for mountaineering expeditions into the Fairweather Range or for extended hikes along the coastline. ORV riders and hikers also use the Alsek North Trail to reach Alsek Lake and the Doame River Trail complex to reach the outer beaches, the Deception Hills, Grand Plateau Glacier and Lake outside of the Preserve.

Three small independent lodges operate in the Preserve under concession permits issued by NPS (Fig. 3-10). The lodges offer outfitting and guide services for sport fishing, big game and waterfowl hunting, photography, hiking and wildlife viewing. Visitation varies from year to year, but has ranged between 150 and 200 visits annually since 2000. Highest use occurs in August and September. A typical group of up to 12 clients stays at a lodge for one week. In addition to the lodges, two big game hunting guide services and nine air taxis operate in the Preserve. There is also one public use cabin on the East Alsek River available to rent through NPS.

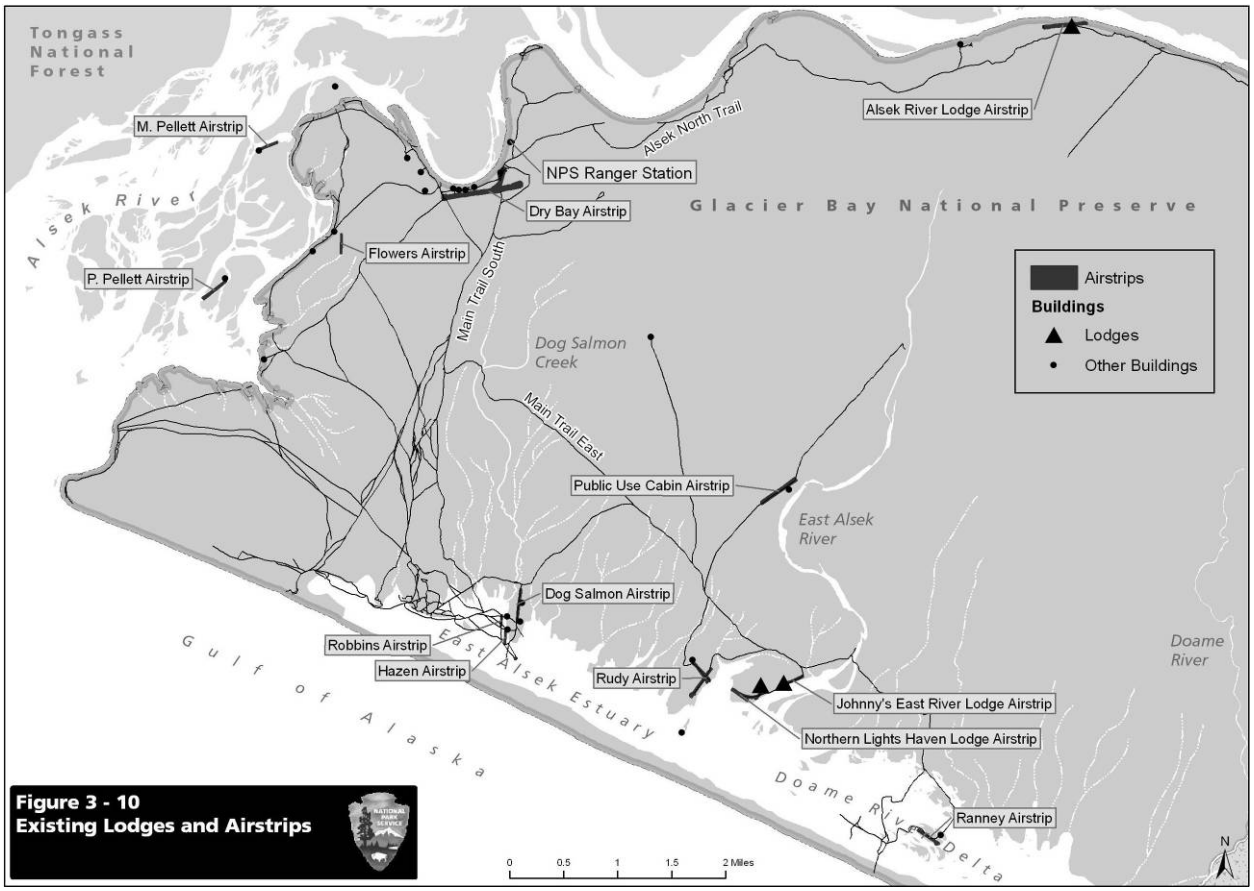


Figure 3 - 10
Existing Lodges and Airstrips

Access to Dry Bay is primarily by small fixed-wing aircraft. Air taxi services are available from Yakutat approximately 50 miles north. Several privately maintained gravel airstrips are open to public use (Fig. 3-10). Most recreational access is by ORVs on the existing trail network. ORVs are also used by lodge employees and guests and commercial outfitters. Very few river rafters or other visitors use ORV trails.

Big game species of interest include brown bear, black bear, moose, wolf, snowshoe hare, and mountain goat. Brown bear accounts for the majority of hunting harvest followed by moose and black bear. Commercial outfitters report 8-10 bears are harvested annually (ADF&G, pers. com.). Annual visits for bear hunting have been stable for some years. One or two black or glacier bears are also taken each year. Moose hunting is open to qualified rural residents only. Moose were "abundant" (USFS, 1973) in the Dry Bay area until several severe winters in the 1970s reduced the population. Rapid habitat succession in the Forelands probably limits moose populations today. Moose hunting has also declined. In 2004 and 2005 hunters harvested 5 and 6 animals. Approximately one wolf is harvested per year (ADF&G, pers. com.). A very limited amount of fur trapping occurs each year by one or two permittees. Furbearers harvested include wolf, beaver, red fox, pine marten, mink, and ermine (Soiseth, pers. com.).

Waterfowl hunting for mallard, green-winged teal, widgeon, gadwall, northern pintail, sandhill crane, Canada, white-fronted, and snow goose, and Barrow's goldeneye occurs in the estuary/delta region and along the East Alsek River corridor. Lodges report that interest in trips combining waterfowl hunting with sport fishing is increasing. Outfitters transport clients by vehicle or small motorized boats to the estuaries of the Dog Salmon, East Alsek, and Doame River delta for waterfowl. Outfitters also drive clients up the East Cabin and East Cabin North trails along the East Alsek River corridor for a canoe or raft trip downstream. Dry Bay visitors occasionally launch canoes or rafts on the East Alsek River for day floats downstream in conjunction with wildlife viewing, waterfowl hunting and fly fishing (Capra, pers. com.).

Sport fishing visits begin as early as June for East Alsek River Chinook salmon. From mid July until late October lodges provide services to anglers targeting coho and sockeye salmon. The East Alsek River and Doame River delta offers high quality fly fishing for sockeye and Chinook. Several outfitters in Yakutat offer occasional fly-in day fishing for coho dependent partly on catch activity on the Situk River near Yakutat (Soiseth, pers. com.). Most anglers visiting Dry Bay desire a high quality wild and remote experience. Sport fish harvest is mostly for immediate use rather than maximum poundage.

Most other recreational users in Dry Bay are commercial fishermen occupying camps or cabins during spring, summer and fall. With the exception of lodge clients or commercially guided parties, recreational use of ORV trails is incidental to commercial fishing.

Dry Bay has no developed interpretive sites, overlooks, viewpoints, or recreational facilities other than the campground used by Alsek River raft groups and the East Alsek River public use cabin. Some ORV trails are used primarily for recreation including the East Cabin, East Cabin North, Tractor North, and Doame River trail/route complex but the majority developed as a result of commercial fishing activity. Airstrips are maintained by permittees with the exception of the airstrip associated with the Alsek River rafting take out point and the East Alsek River public use cabin. The Dry Bay Ranger Station serves as a contact point and housing for NPS ranger and maintenance staff.

3.7 COMMERCIAL FISHING

In Dry Bay, only two rivers are commercially fished, the Alsek River and the East River. Both rivers are significantly different from one another. The Alsek River is a longer river (180-200 miles) with its headwaters coming from glaciers in the St. Elias Mountains in Canada. The Alsek has a swift current and is silty and cold from the glacial influence. In 1934, a channel of the Alsek River was cut off by uplift, creating the East Alsek River. In the 1940's, commercial fishermen began to fish the river. The East Alsek River is a much shorter river (14 miles), with water coming from surface runoff, groundwater and upwelling sources with discharge largely determined by local precipitation patterns. The water is also clear and warmer than the Alsek. The Doame River also had a commercial fishery before 1958, but the earthquake that year blocked the mouth and diverted the flow into the East Alsek River. However, because the commercial fishery in the East Alsek occurs below the confluence with the Doame River, fish from the Doame River are also caught in the East Alsek fishery.

Fishermen formed two separate communities in Dry Bay. Local fishermen often commuted by boat or charter plane from their homes in Yakutat, generally leaving their families in the village to minimize travel costs and going to the Dry Bay area for the few days of fishing per week allowed by state fishing regulations. Out-of-state fishermen came mostly from Seattle and lived at Dry Bay for three or four months each summer, often accompanied by their families. The local community mostly lived in tents, while the out-of-state fishermen lived in permanent cabins or portable, plywood shelters. The out-of-state fishermen tended to bring more supplies and equipment and require more living space since they were farther from home.

Before World War II, the fishery was primarily a drift gillnet fishery on the Alsek. A powerboat, usually owned by the cannery or processor would tow a line of skiffs up river and they would drift down in pairs with a net between them. After the war, the fishery started shifting to a set gillnet fishery where one end of the net is anchored to shore and the other end is pulled out perpendicular from shore and anchored to the bottom using a dory or skiff. With the advent of outboard motors, military surplus land vehicles, and a switch to more shore based, rather than tender based buying of fish, fishermen spread across the Dry Bay area to build camps closer to their net sites. They used ORVs to access their net sites, fish buyers, and neighbors over the largely unvegetated land that is now the Preserve.

Commercial fishing in Dry Bay began in 1910 with the construction of a cannery on the west side of Dry Bay by the St. Elias Packing Company. The cannery survived only four years when the company went bankrupt. However, the cannery brought many of the early Dry Bay commercial fishermen to the area and many stayed and continued fishing. After closure of the cannery, other fish processing companies began sending company tenders to Dry Bay until the 1960's, when the Bellingham Cannery Company stopped sending a tender to the area. The tenders often provided fishermen easy access to the Dry Bay area, as they often caught rides with the tenders and even bought supplies from the companies (Gmelch, 1982).

From 1945 until 1970 there were 10 to 15 summer long resident households in Dry Bay. Between early 1960's until the mid 1970's, commercial fishing declined in Dry Bay. This decline primarily occurred because there were no fish processors to buy the fish or to provide easy access to the area, the Situk River in Yakutat became more productive, so local fishermen stayed closer to home to fish, and a large earthquake in 1958 terrified residents and kept them from returning (Gmelch, 1982).

In 1973, the Dry Bay Fish Company built a fish processing plant on a slough of the Alsek River. An airstrip adjacent to the plant provided access for planes to haul fish to other destinations. For a period of time, the fish processing plant had a DC-3 airplane exclusively hauling fish to Yakutat and Juneau for shipment to world markets. Fishermen commonly transported the day's catch to the plant in a trailer hitched to a truck or ORV.

In 1974, commercial fishing was restricted to fishermen who qualified for a permanent permit, also known as limited entry. In the late 1970's, commercial fishing effort increased in the Dry Bay area, brought on by higher fish prices and an explosion of the sockeye salmon population in the East Alsek River. The sockeye salmon population continued at higher levels until 1995, when the populations declined to previous levels. During that time, up to 90 permits were fished in Dry Bay during the peak of the run.

With large catches and high prices during the late 1980s and early 1990s, more camps were built and fishermen could afford to buy vehicles and have them transported to Dry Bay by aircraft or landing craft. With the advent of three wheeled and then four wheeled ATVs around 1980, very few camps did not have a vehicle. Vehicles ranged in size from a motorcycle to a 5-ton truck and a military half-track. However, the most common vehicle type was the four wheeled ATV because they can be transported by aircraft and are economical to run. Because of the decrease in fish populations, the level of commercial fishing effort in Dry Bay decreased in recent years. The most recent estimate of the number of commercial fishermen in the area is 15 fishermen, compared to 110 fishermen in 1990 (ADF&G, 2006).

In 1980, Congress passed the Alaska National Interest Lands Conservation Act (ANILCA), designating the Dry Bay area as a National Preserve and incorporating the area into Glacier Bay National Park and Preserve. In passing ANILCA, Congress also recognized the importance of commercial fishing in Dry Bay and authorized the continuation of access and facilities in support of commercial fishing in the area. Congress deemed these activities vital to the economic well being of Yakutat, as well as to the several dozen non-local fishermen who lived in the area each summer. ORVs were recognized as an essential tool, along with fishing boats and gear for transporting supplies and equipment, as well as catch, to processors and departure points to remote markets.

Prior to the passage of ANILCA, the preserve was managed by the U.S. Forest Service as part of the Tongass National Forest. During that time a fish processing plant, several roads and airstrips, 40-50 temporary fish campsites, and about 20 permitted fish camps (cabins and outbuildings) were established in the area (NPS, 1984).

Commercial fishing in the Dry Bay area peaked at over a million pounds per year in the early 1990s, but has decreased to 200,000 to 450,000 pounds annually in recent years. Commercial fishing and support activities are authorized by the preserve's enabling legislation (ANILCA, 1980). The support activities occupying NPS lands (fish processing, buying, and transport, air taxi, associated storage and housing structures) are managed under special use permits. Figures 3-11 and 3-12 show existing trails and routes and their relationship to commercial fishing areas on the Alsek and East Alsek Rivers, commercial fish camps, boat haulout areas, fish processing plant, and airstrips in Dry Bay.

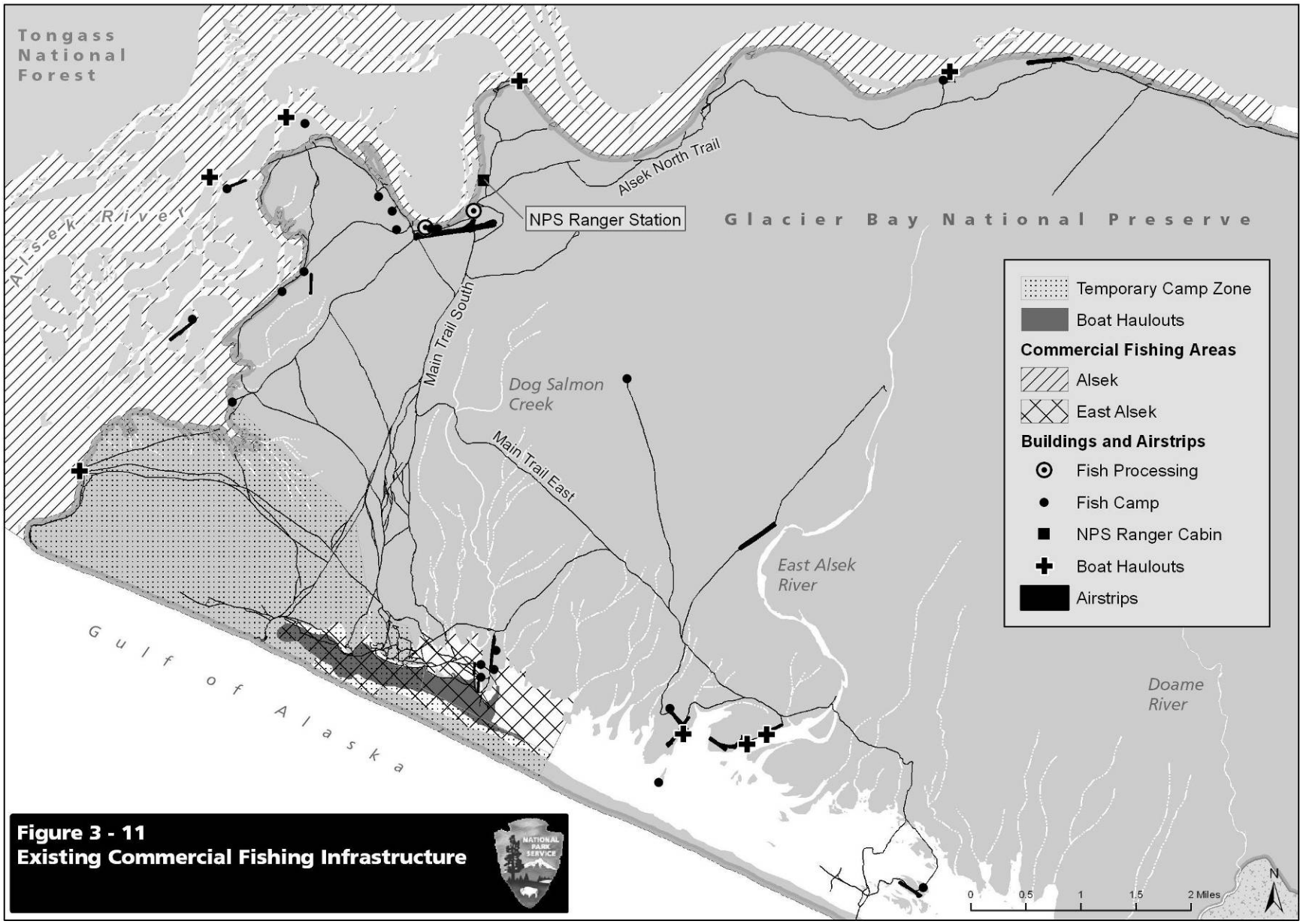


Figure 3 - 11
Existing Commercial Fishing Infrastructure

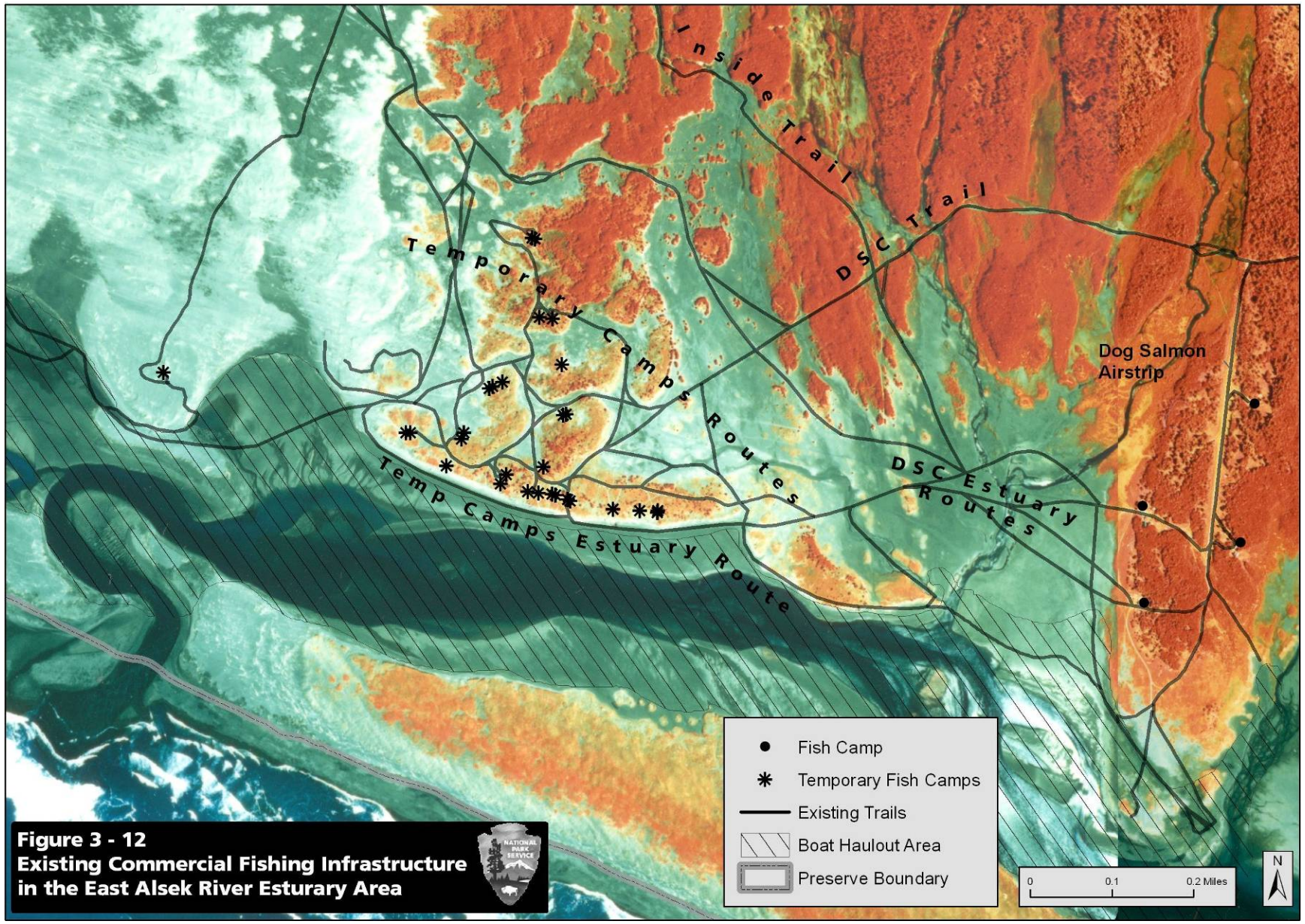


Figure 3 - 12
Existing Commercial Fishing Infrastructure in the East Alsek River Esturary Area

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