Chapter 2. Affected Environment

This section describes the existing conditions at Fort Greely and Donnelly Training Area including information regarding the environmental components that may be affected by the proposed action (implement the 2002-2006 INRMP) and the current management / no action (do not implement the 2002-2006 INRMP) alternatives.

2.1 Facilities

Fort Greely and Donnelly Training Area includes approximately 501,022 acres of maneuver land, 147,463 acres of impact areas, and 1,117 acres of built-up area. The varied terrain makes Fort Greely and Donnelly Training Area a favorite training area for the 172nd Brigade, Army Special Forces, Navy Seals, and British Commandos (U.S. Army Alaska undated). Figure 2-1 shows the general layout and facilities of Fort Greely and Donnelly Training Area.

2.1.1 Range Facilities

All areas outside of urban areas are defined as range facilities. Range facilities can be further broken down as follows:

- Firing Ranges
- Impact Areas
- Training Areas
- Drop Zones / Landing Zones
- Artillery Firing Points

2.1.1.1 Firing Ranges

Fort Greely and Donnelly Training Area has 13 firing ranges, which are briefly described (U.S. Army Alaska 1995 and Creig Sharp personal communication):

Alabama Range is used to zero privately owned weapons. It includes eight firing tables with benches and target frames at 25, 50, 100, 150, 200, 250, and 300 meters.

Arkansas Range is a qualification range for small arms, including M16, 9 mm, and .45 caliber at 25 meters, and 7.62 mm (M60) munitions at 10 meters.

Colorado Range is designed for testing and qualifying with small arms and direct fire weapons requiring 50 meters or more. Targets are set at known distances, with 10 firing berms spaced 100 yards apart.

Georgia Range is designed for multi-purpose testing/training and qualification with small arms, direct fire weapons, and aerial gunnery. This range is equipped with one refueling Forward Area Arming and Refueling Point (FAARP), one arming FAARP, and four helicopter pads.

Lampkin Range is utilized for multi-purpose testing/training and firing of small arms, direct fire weapons, and limited engineer demolitions.

Mississippi Range, a former combination mortar range and helicopter rearm point, is used by the Cold Regions Test Center (CRTC) for testing.

Oklahoma/Delta Creek Range is primarily used by the Air Force for bombing and gunnery.

Texas Range is a firing test range, capable of supporting large caliber direct and indirect fire weapons, and defensive missile systems. In recent years it has primarily been used by CRTC.

Washington Range can accommodate the Area Weapons Scoring System (AWSS) for evaluating air to surface firing, surface-to-air fire for any TOE air defense battery with target drone equipment, and surface-to-surface direct and indirect fire weapons systems.

Bondsteel CALFEX is a building site combined arms live-fire range.

CALFEX Bowl is a small arms defensive or tactical live fire area. It lies between OP 7 and OP 8 and is used for combined arms live fire exercises.

OP Lake Assault Course is an unimproved small arms tactical live fire area.

Simpsonville Maneuver Range is a building site combined arms live-fire range (CALFEX).

2.1.1.2 Other Range Facilities

Other significant training facilities include ten drop zones and two combat assault strips that support airborne and air-land operations. Donnelly Drop Zone can support a battalion-sized airborne operation. Eight of these drop zones are located in the Donnelly East Training Area and two are located in the Donnelly West Training Area. All are used primarily as non-firing maneuver areas. CRTC utilizes Fort Greely and Donnelly Training Area for experimental airdrops, airborne training, and testing of clothing, vehicles, and equipment.

A $9.4 million, self-contained training facility was completed at Black Rapids in 1994. This facility supports cold regions training in winter and mountain glacier training in summer. In 1991, a $6.2 million test facility was completed at Bolio Lake to conduct natural environment cold weather testing of military equipment by the CRTC.

2.1.2 Transportation Systems

Most roads serving Main Post are paved or gravel, and in good condition. Several main access roads mostly serving the firing ranges, firing points, and observation points are gravel and kept graded and in fair shape. Many non-maintained trails also provide varying degrees of access to the training areas (Figure 2-2).

Donnelly East Training Area contains the 33-mile and 11-mile vehicle test loops used to test wheeled and tracked vehicles under extreme temperature conditions and varying snow depths. There is also a good network of roads and trails between the Delta River and the Richardson Highway, and around the cantonment area (built-up Main Post area). Donnelly West Training Area is only accessible to ground vehicles when the Delta River is frozen and the minimal network of winter trails are frozen and groomed.

The Richardson and Alaska highways serve Fort Greely and Donnelly Training Area and the Delta Junction area. Both are maintained year-round. The Richardson Highway is a two-lane primary road that connects the port of Valdez to the south, with Fairbanks to the north. It intersects the Glenn Highway at Glenallen, providing a direct link with Anchorage. Thus, the Richardson Highway links Fort Greely and Donnelly Training Area to both Fort Richardson and Fort Wainwright, and it links with the Alaska Highway, connecting Alaska with the Canadian road system.

There is no rail service to Fort Greely and Donnelly Training Area , nor are there navigable waterways for waterborne transportation. The nearest rail service is at Eielson AFB, about 70 miles north. The Alaska Railroad provides year-round passenger, freight, and vehicle service between Anchorage and Fairbanks. Most northbound freight arrives by sea at either the port of Anchorage or the port of Whittier for transfer to the railroad. The Alaska Railroad provides a connection to Seward, 80 miles to the south of Anchorage, the nearest port with intermodal capability.

Allen Army Airfield at Fort Greely and Donnelly Training Area can support C5/C141 aircraft in winter and C130 aircraft at all other times. Ladd Army Airfield at Fort Wainwright and Eielson AFB can support any type of military aircraft. In addition, there is a small, unpaved light aircraft landing strip north of Delta Junction (Anonymous 1979).

2.1.3 Water Supply

The built-up areas of Fort Greely and Donnelly Training Area are served by independent water systems. Most of the Old Post system has been abandoned. All that remains of the Mid Post water system is a 100,000-gallon storage tank, two wells, two 3,000-gallon pressure tanks, and distribution lines to three active buildings. The Main Post water system was installed in 1954. The two primary wells are numbers 8 and 9, and an 188,000-gallon storage reservoir is housed in Building 606.

2.1.4 Projected Changes To Facilities

Changes to facilities that would affect natural resources will be determined by changes in the military mission. If Fort Greely and Donnelly Training Area were to be tasked with alternate missions, additional ranges could possibly be needed. Such new missions have not been identified. Facility development that would likely affect natural resources include new ranges, impact and target areas, and buildings constructed in areas that are currently undisturbed. All would require completion of appropriate NEPA documentation. At this time, only one new facility is planned. A year-round MPRC (Multiple Purpose Range Complex) is proposed in the vicinity of Big Lake and Texas Range, and would be a necessary component of an Intermediate Brigade.

2.2 Physical Resources

2.2.1 Climate

Fort Greely and Donnelly Training Area has the northern continental climate of interior Alaska, which is characterized by short, moderate summers; long, cold winters; and low precipitation and humidity. Weather is influenced by mountain ranges on three sides that form an effective barrier to the flow of warm, moist maritime air during most of the year. Surrounding upland areas tend to aid drainage and the settling of cold Arctic air into Tanana Valley lowlands.

The Alaska Meteorological Team (AMT) at the Central Meteorological Observatory, Fort Greely and Donnelly Training Area, monitors weather at the post to support CRTC projects. Average monthly temperatures range from -6.4ºF in January to 60.0ºF in July, with an average annual temperature of 27.4ºF. The record low temperature is -63ºF, and the record high is 92ºF. The average frost-free period is 95-100 days (27 years of AMT data). Prevailing winds are from the east-southeast from September through March and from the west, southwest, or south from April through August. Average wind velocity is 8.2 miles per hour (mph). The greatest wind speeds occur during winter, with a high of 104 mph recorded in the month of February. Winds are 5 mph or less only 13.6 percent of the time, and wind

speeds greater than 60 mph have been recorded in every month. Thunderstorms are infrequent and occur only during summer (20 years of AMT data).

Average annual precipitation is 11.12 inches, which falls over 90.4 days, mostly during summer and early fall. Average monthly precipitation ranges from a low of 0.24 inches in April to a high of 2.38 inches in June. Average annual snowfall is 40.5 inches, with a record 99.7 inches in 1945 (27 years of AMT data).

Average annual relative humidity is 55 percent with lowest levels occurring during spring and early summer (38 percent during mid-afternoon in May). Heavy fog is relatively common during December and January, with three or more foggy days occurring each month. Temperature inversions can be pronounced in the Delta Junction area, especially when temperatures drop below - 25°F. Ice fog can be expected any time that temperatures drop to -30°F or lower, but ordinarily ice fog will only occur in areas near human settlements where moisture is exhausted by burning fuels (Anonymous 1979).

2.2.2 Topography

Fort Greely and Donnelly Training Area lies north of the Alaska Range, in the Tanana River watershed. The area has a number of features associated with past and present glacial activities, including terminal moraines, outwash fans, braided streams, kettle lakes, and loess deposits. The Main Post, as well as the Donnelly East Training Area and the northern half of the Donnelly West Training Area, lies within the Tanana-Kuskokwim lowland. The entire lowland area is a structural basin. It subsided as the Alaska Range rose to the south and then filled with materials eroded from those mountains. The area consists of alluvial fans that slope northward from the mountains and drop 20 to 50 feet in elevation per mile until they reach the floodplain along the Tanana River. The terrain consists of generally flat lowlands, ranging from 1,200 to 1,600 feet above sea level (Figure 2-3).

The southern half of the Donnelly West Training Area primarily lies within the northern foothills of the Alaska Range. The area is characterized by flat-topped ridges that are oriented west to east and range from 2,000 to 4,500 feet in elevation. Ridges are three to seven miles wide and five to twenty miles long, and are separated by rolling lowlands ranging from 700 to 1,500 feet in elevation, and spans two to ten miles in width. The foothills are largely unglaciated, although glaciers from the Alaska Range widened valleys. In the southwestern portion of the Donnelly West Training Area, elevations range from 4,000 to 6,200 feet, and some valley glaciers extend onto the installation (Anonymous 1979).

2.2.3 Geology

Climatic fluctuations during the Quaternary Period caused glacial expansion and recession (Racine and Walters 1991). While central Alaska was not glaciated, glaciers during glacial advances surrounded the area. Rivers flowing from glaciers deposited several hundred feet of silt, sand and gravel in the Tanana and Yukon valleys. Most northern portions of Fort Greely and Donnelly Training Area are composed of these Quaternary deposits. A complex assemblage of Precambrian and Paleozoic-aged metamorphic rocks of the Yukon-Tanana crystalline complex (formerly known as Birch Creek schist) characterizes bedrock of the northern foothills. These rocks were later intruded by Cretaceous and Tertiary-aged igneous rocks, resulting in a few exposed areas of granite and quartz diorite (Anonymous 1979). Surface geology is shown in Figure 2-4.

2.2.3.1 Seismicity

Even though seismic activity in Alaska exceeds that found in any other state, few shocks have caused severe damage because of the absence of large population centers. Fort Greely and Donnelly Training Area lies in a 200-mile wide seismic zone that extends from Fairbanks southward through Prince William

Sound. Since the 1960s, several minor seismic events occurred on the Donnelly East and West Training Areas. Although this is not a sufficient time span to assess seismic hazard, there is no record of damage sustained from these events. The Denali Fault extends through the Alaska Range just south of the installation, and slip on this fault is on the order of 1 cm per year Beikman (1980). The Uniform Building Code has special requirements for buildings within 10 km of an active fault.

2.2.3.2 Petroleum and Minerals

Petroleum and mineral rights management on withdrawn lands is the responsibility of the BLM. Many glacial deposits in the area are good sources of sand and gravel for aggregate or base course materials. They were used for construction of the Richardson and Alaska highways and the Trans Alaska Pipeline. In 1942, a gold and molybdenum deposit was found along Ptarmigan Creek in the southwestern portion of the West Training Area. Ore was mined from this deposit, but it was never shipped. Other deposits of gold, lead and tin have been reported from areas surrounding the post (BLM and U.S. Army 1994). Portions of the withdrawn lands have moderate to high potential for placer gold deposits. Localized placer deposits may also occur in streams draining the Granite Mountains and Tertiary-age gravel benches (CEMML 1998).

The Jarvis Creek coalfield is located southeast of Donnelly East Training Area. Coal resources in that area are estimated to be 76 million tons; two-thirds of which occur at depths of less than 1,000 feet. A few hundred tons of coal were extracted from one small mine in the Jarvis Creek field in 1958. The mine provided all the coal requirements at Fort Wainwright and Eielson Air Force Base for at least one year and was active from 1966 to 1972 (Anonymous 1979).

Four areas of Fort Greely and Donnelly Training Area are described in the *Resources Management Plan/Final Environmental Impact Statement* (BLM and U.S. Army 1994) as having mineral potentials. They include: (1) the Middle Tanana Basin, which occupies the northern and northeastern strip of the installation and encompasses approximately 30% of the post; (2) the Nenana Coal Basin, which lies in the southern and southwestern portions and encompasses about 40% of Fort Greely and Donnelly Training Area; (3) a nonbasin area occupies a strip between the Middle Tanana Basin and the Nenana Coal Basin, about 20% of the post; and (4) igneous/metamorphic rock outcrops occupy two areas in the southwestern corner of the post (BLM and U.S. Army 1994). Coalfields are scattered throughout the Nenana Coal Basin, and it has a high potential for producing coal. Whereas the central nonbasin area has low potential, the northern Middle Tanana Basin has moderate potential, and the outcrops have no potential (BLM and U.S. Army 1994). The potential of finding economic deposits of Tertiary coal on Fort Greely and Donnelly Training Area is unknown due to poor outcrops, a lack of subsurface information, the extensive erosion of Tertiary sediments, and structural deformation of the bedrock (CEMML 1998).

Coal and organics within the Tertiary sediments could generate and trap gas under suitable geologic conditions. The Nenana Basin, with its known coal deposits, has moderate potential for producing gas (CEMML 1998).

Granitic plutons occur near the eastern and western borders of Fort Greely and Donnelly Training Area. Elsewhere in Alaska, these features are associated with thermal springs. Fort Greely and Donnelly Training area is classified as having moderate potential for geothermal resources (BLM and U.S. Army 1994).

The rock outcrops have no potential for phosphate, sodium, potassium, or gilsonite, while other areas have low potential for these minerals.

The Fort Greely Resources Management Plan (BLM and U.S. Army 1994) prohibits mining in drop zones and landing fields, and within one mile of existing roads and major trails to maintain safe military operations and training. Mineral material sites are an exception to the one-mile off-limits designation. The military may mine sand and gravel for its own purposes.

Measures to safeguard resource values outlined in 43 CFR 3100, 43 CFR 3600, and 43 CFR 3809 apply to mineral development on withdrawn lands. Under terms of the Defense Appropriations Act of 2000, should withdrawn lands be opened to mineral location, mineral patents could convey title to locatable minerals only. These patents would carry the right to use as much of the surface as necessary for mining under guidelines established by the Secretary of the Interior by regulation (BLM and U.S. Army 1994).

The Fort Greely Resource Management Plan (BLM and U.S. Army 1994) continues the exemption of withdrawn lands from provisions of the 1872 Mining Law, the 1920 Mineral Leasing Act (as amended), the 1947 Mineral Leasing Act for Acquired Lands, and the 1970 Geothermal Steam Act. Withdrawn lands are closed to all forms of mineral material disposal, both sale and free use, other than to support military activities.

2.2.4 Soils

Knowledge of soil characteristics and classification forms the foundation for establishing effective management and rehabilitation programs for natural resources. A comprehensive soil survey for Fort Greely and Donnelly Training Area has not been completed. Soils information is needed to plan future development. For example, permafrost can create a myriad of problems for construction and military activities, but permafrost cannot be mapped without soil data. USFWS has stated concern over the effects of erosion on wetland. Soils information could be used to determine risk levels.

Few soils on Fort Greely and Donnelly Training Area have been mapped in detail, with the exception of areas near the cantonment area. In general, soils are derived from glacial actions and modified by streams and discontinuous permafrost. The NRCS (formerly the Soil Conservation Service) identified 12 soil associations in the area of Fort Greely and Donnelly Training Area (Figure 2-5, Table 2-1). Soils in the northern, west-central, and eastern portions of the West Training Area are silt loam associations, while the East Training Area is predominantly shallow silt loam over gravelly sand. Soils in the river floodplains consist of alternate layers of sand, silt loam, and gravelly sand. Highly organic wet soils and a high water table characterize muskeg soils, or they are underlain by permafrost. Upland foothills have moist, loamy soils, while mountain soils are rocky, steep, and unvegetated. Lowland soils have moderate erosion potential, while foothill soils have moderate to high erosion potential (Anonymous 1979).

In 2000, the NRCS initiated a soil survey in the Donnelly East Training Area. Data and summary information has not yet been analyzed, although when received it should help with the various natural resources planning and programs requiring soils information. Soils in the Donnelly West Training Area will also be mapped at a broad exploratory level during 2002-2006.

Table 2-1. Brief Description of the Identified 12 Soil Associations found in the area of Fort Greely and Donnelly Training Area (Rieger et al. 1979).

Soil Map Unit	Soil Type	Location	Description
1	Typic Cryochrepts in association with Aeric Cryaquept	High terraces, outwash plains, and footslopes - north part of Fort Greely and Donnelly Training	Silt loams, moderately to well-drained with underlying gravelly sand.

Soil Map Unit	Soil Type	Location	Description
		Area.	
2	Histic Pergelic Cryaquepts	Broad rolling hills and valleys in the northwest portion of Fort Greely and Donnelly Training Area.	Poorly-drained silt loam soils with textures ranging from sand loam to clay loam and are fairly gravelly in areas.
3	Histic Pergelic Cryaquepts in association with Typic Cryofluvents	Level floodplains along the Delta and Tanana rivers.	45% - poorly-drained loams with textures of either silt loam or sandy loam. 35% - alluvial soils of stratified silt loam and sand. Remainder of the soil consists of peat deposits with shallow loam materials over very gravelly sand located in depressions within the floodplain.
4	Afic Cryochrepts in association with Histic Pergelic Cryaquepts	Uplands north of Fort Greely and Donnelly Training Area	35% - well-drained deep silt loams. 20% - poorly-drained silt loams with an overlying peat layer and a shallow permafrost table. 10% - moderately-drained silt loams and well-drained shallow silt loams over bedrock. Remainder – poorly-drained shallow silt loam underlain by permafrost (north facing).
5	Typic Cryochrepts in association with Histic Pergelic Cryaquepts	Uplands to the north of Fort Greely and Donnelly Training Area.	30% - very gravelly silt loam or very gravelly loam. 25% - poorly-drained silt loams with overlying peat. Remainder - a mixture of soil types including gravelly and stony silt loams to silt soils.
6	Pergelic Cryaquepts in association with Pergelic Cryochrepts	Foothills and moraines of the Alaska Range in the southern part of Fort Greely and Donnelly Training Area.	40% - poorly-drained gravelly and stony loams. 35% - well-drained gravelly and stony loams. Remainder – poorly-drained silt loams.
7	Histic Pergelic Cryaquepts	Low slopes subject to seepage and in drainageways in the southwestern and southeastern portions of Fort Greely and Donnelly Training Area.	Poorly-drained shallow loams with permafrost over very gravelly and stony loam. An overlying peat layer is also present.
8	Typic Cryochrepts in association with Histic Pergelic Cryaquepts	Hilly portions along the Delta River in the eastern portion of Fort Greely and Donnelly Training Area.	45% - well-drained silt loams. 30% - poorly-drained shallow silt loams. Remainder - a mixture of very gravelly loams and silt loams.
9	Typic Cryochrepts	Terraces, outwash plains, and low moraines along Jarvis Creek.	70% - shallow silt loams. 30% - shallow loams or gravels and poorly-drained silty to gravelly soils.
10	Typic Cryochrepts	Hilly and steep moraines northeast of the Air Drop Zone.	65% - shallow silt loams. Remainder - gravelly loams.
11	Rocklands	Mountainous areas and foothills of the Alaska Range in the southern portion of Fort Greely and Donnelly Training Area.	75% - rockland. Remainder - very gravelly shallow soils.
12	Typic Cryochrepts in association with Histic Pergelic Cryaquepts	Moraines and footslopes to the east of Jarvis Creek.	65% - gravelly silt loams over very gravelly loams. Remainder - gravelly, stony silt loam or sand loam.

Permafrost is defined as any ground that remains at or below freezing continuously for more than two years. It is a major factor influencing the distribution of vegetation and human activities. Permafrost is defined in seven categories in order of increasing ice content. The propensity for subsidence and frost action is proportional to the silt content of the soil.

Any activity that removes the insulating vegetation mat or destroys the active layer above the permafrost table allows the ice mass to melt and irregular subsidence to occur. Once started, the thawing process is difficult to control. Maneuver or construction activities could result in this type of damage. The preferred method for developing on permafrost lands is to clear the land of vegetation and then leave it undeveloped for a year to allow the ice to melt. Developed sites should have the lowest possible ice content, and steps should be taken to ensure adequate ground insulation (Nakata Planning Group 1987).

Isolated patches of permafrost exist under Fort Greely and Donnelly Training Area's sandy gravel from 2 to 40 feet below ground level. Thickness of permafrost varies between 10 to 118 feet. Existing and abandoned river channels, lakes, wetlands, and other low-lying areas are permafrost-free (Williams 1970).

2.2.5 Water Resources

2.2.5.1 Surface Water

Fort Greely and Donnelly Training Area's surface waters are diverse and include numerous rivers, streams, ponds, and lakes. Figure 2-6 indicates surface drainage on Fort Greely and Donnelly Training Area.

2.2.5.1.1 Rivers and Streams

Fort Greely and Donnelly Training Area lies entirely within the Tanana River drainage basin. Surface water from around the Main Post drains into the Delta River and Jarvis Creek. The West Training Area drains into the Delta River, Delta Creek, East Fork of Little Delta River, Buchanan Creek, and the Little Delta River. The Delta River, Delta Creek, and Little Delta River all drain directly into the Tanana River. Surface water from the East Training Area drains into the Delta River, and Granite, Ober, and Jarvis creeks. The Gerstle River Training Area drains into the Gerstle River and Sawmill Creek, both of which drain into the Tanana River.

Glaciers that lie along or just south of the installation's southern boundary feed most rivers, streams, and creeks. Glacial meltwaters feed the Delta River, Delta Creek, and the Little Delta River from the Alaska Range. Principal glaciers include Canwell, Castner, and Black Rapids (which drain into the Delta River); Trident and Hayes (which drain into Delta Creek); and Hayes and Gillam (which drain into the Little Delta River). Jarvis Creek is fed by meltwater from glaciers on Mt. Silvertip (Anonymous 1979). The volume of surface water flow fluctuates dramatically by season. From October to May, flow is limited to groundwater seepage from aquifers into streams, and many small streams freeze solid (zero discharge). Snowmelt typically begins in May and reaches its peak in June. Flows are greatest during June and July. After July, most of the snow has melted, and a steady flow during August and September is sustained by rainfall.

The state of Alaska has not designated streams on Fort Greely or Donnelly Training Area into water-use categories. Without such designations, fresh waters in Alaska are considered to be in their original and natural condition and suitable for all uses. The state of Alaska, Department of Natural Resources has claimed an interest in submerged lands on Fort Greely and Donnelly Training Area, and has sought cleanup. USARAK has respectfully declined taking cleanup action for a number of reasons including excessive land disturbance and habitat loss to ensure cleanup and because the areas in question are part of

the post's active ranges. The pH levels in the Delta River and Jarvis Creek are slightly alkaline, but they are within limits established by the state. Dissolved oxygen levels generally vary with water flow; oxygen levels are highest in June, July, and August and they may approach zero during periods of prolonged ice cover (Bonito 1980; Anonymous 1979).

2.2.5.1.2 Lakes and Ponds

Lakes are abundant on Fort Greely and Donnelly Training Area, but information on their water quality is scarce. Water samples collected from Bolio Lake had a pH of 8.8 to 9.2, a level beyond acceptable alkalinity as defined by the state. Most nitrogen in Bolio Lake is in organic forms (0.98 mg/l) with low concentrations of nitrates and nitrate nitrogen (0.02 mg/l). Samples collected from Bolio Lake in August 1975, had dissolved oxygen concentrations of 9.8 mg/l near the surface and 10.0 mg/l at a depth of 15 feet.

ADF&G stocks 16 lakes with sport fish. Most other lakes on Fort Greely and Donnelly Training Area are not suitable for stocking, due to poor accessibility or their susceptibility to freezing.

2.2.5.2 Groundwater

Although surface water is abundant in the Tanana Basin, most of Fort Greely and Donnelly Training Area's water is obtained from wells. Potential groundwater supply is greatest in the floodplain alluvium along the Little Delta River, Delta River, Delta Creek, and Jarvis Creek, and in the alluvial fans extending along the northern flanks of the Alaska Range (Figure 2-6). The surface to groundwater depth at Fort Greely and Donnelly Training Area is between 100 and 210 feet. Most wells on the post tap unconfined aquifers found in unconsolidated alluvial deposits. Groundwater recharge is from influent seepage of glacier-fed streams.

The quality of surface water has remained high throughout Army occupation. There has been no reason to suspect degradation (beyond localized, temporary sedimentation) to Fort Greely and Donnelly Training Area surface waters. Limited monitoring of these waters has occurred due to little indication of problems.

2.3 Biological Resources

2.3.1 Biodiversity

Most of the land was relatively undisturbed when it was withdrawn for military use. Because of limited data, it is not known whether the military mission has significantly affected biodiversity on Fort Greely and Donnelly Training Area. Biodiversity is difficult to quantify. There has been no evidence that Army occupation had a significant adverse effect on plant or animal species beyond specific locations. Changes to ecosystems have been localized. They may have affected species abundance for short periods, but probably have not affected species richness. Greatest losses of habitat occurred in the cantonment area due to construction and associated urban development and use. Army occupation has provided habitat protection against development over most of the post.

Effects of noise on wildlife from military activities at Fort Greely and Donnelly Training Area are unknown. Military activity does negatively affect individual animals and could affect populations. No studies have been conducted on Fort Greely and Donnelly Training Area to measure military activity disturbance on specific species.

Habitat management plans completed as a part of this INRMP identify sensitive wildlife habitats and implement management to protect these areas.

Effects of military-caused fires on biodiversity at Fort Greely and Donnelly Training Area are difficult to determine. Frequency of these fires exceeds natural fires in some areas, while other areas burn with less frequency than would occur naturally. Military-caused fires keeps portions of the range in an early- to mid-successional stage, while remote sites may go through normal or less frequent burn cycles.

2.3.2 Flora

Vegetation types of interior Alaska form a mosaic and reflect fire history, slope and aspect, and presence or absence of permafrost (Viereck and Little 1972). Fort Greely and Donnelly Training Area has five recognized cover types: ice and snow; alpine tundra; moist tundra; open, low growing spruce forests; and closed, spruce-hardwood forests. The white spruce-paper birch forest of interior Alaska is often called the boreal forest or taiga.

2.3.2.1 Vegetative Profile

The huge landscapes at Fort Greely and Donnelly Training Area encompass a wide array of physiographic settings. Patterns of vegetation are determined by a variety of natural influences, including climate, topography (slope, aspect, and elevation), glaciation, flooding, depth to water table, and most importantly, permafrost and fire. A typical vegetation profile from the north slope of the Alaska Range to the Tanana River floodplain includes: barren areas (rock, gravel, snow, and/or ice), alpine tundra, moist tundra, forests (black spruce, white spruce, deciduous, and mixed), tall shrubs, barren, and water (Anonymous 1979; Bonito 1980). This vegetation profile does not precisely match Viereck and Little's (1972) vegetation types, which were assessed on a statewide basis. Wetlands occur at various altitudes and sometimes only during early vegetation successional stages. Local conditions often result in combinations or the absence of a vegetation type when moving up or downslope. Each cover type is described below.

***Barren Land*:** These include glaciers, snowfields, bare and exposed rock in mountains, and recently deposited gravel bars in rivers. All barren land on Fort Greely and Donnelly Training Area occurs either at high altitudes or adjacent to rivers and streams. A small portion of Trident Glacier occurs on Fort Greely and Donnelly Training Area.

***Tundra (Alpine and Moist*):** Windy and cold tundra occurs above tree line, and supports only the hardiest vegetation in a short growing season. Vegetation in alpine and moist tundra is a low, dwarf, or procumbent growth form and is limited by severe weather. Vegetation in ecotones between alpine and moist tundra can be found in both types, including sparse and scattered grasses, dry land sedges, lichens, club mosses, and low mat-forming herbaceous and woody plants. Woody perennials rarely exceed three feet in height. This ecosystem is extremely sensitive to damage. In southern portions of Fort Greely and Donnelly Training Area, moist tundra grades into alpine tundra and then into glaciers (barren land).

***High Brush*:** The high brush type forms the transitional zone, or ecotone, between forests and barren areas or tundra. At lower elevations, it occurs between forests and barren areas adjacent to waterways. High brush normally occurs as a narrow vegetative band along floodplains or just above tree line. The size of the transitional zone varies dramatically, and in places where there is a well-defined tree line, it may be quite small. The high brush area is important ecologically. It sustains small to medium-sized woody plants (no larger than 20 feet in height) including alder, willows, cottonwood, birch, mountain ash, and prostrate white spruce. Along floodplains, high brush forms a thick, almost impenetrable barrier with little or no ground cover. In sub-alpine settings, stands may be thinner and more persistent. Ground

vegetation consists of grasses, mosses, forbs, low shrubs, and lichens that often form thick layers. Wildlife, particularly moose, from both alpine and forest communities use high brush for forage (Bonito 1980).

***Forest*:** The forests of Fort Greely and Donnelly Training Area range from pure stands of spruce or hardwoods to spruce/hardwood mixtures. Predominate hardwoods are birch, quaking aspen, and balsam poplar. Bottomland forest of white spruce/balsam poplar occurs on level floodplains, low river terraces, and south-facing slopes. Stands of black spruce occur where drainage is poor, such as flat valley bottoms, lakesides, and muskegs. Lowland forest of black spruce/hardwood is the most common type in interior Alaska. On colder northern aspects, black spruce stands may grow at altitudes of up to 2,500 feet.

***Wetland*:** Wetlands occur in a variety of forms, but on Fort Greely and Donnelly Training Area most are shrub wetlands. Shrub wetlands, also known as bogs or low brush, are associated with slightly higher relief of marsh edges and poorly-drained basins and depressions with cold, waterlogged soils. The surface primarily consists of a thick layer of peat over a mottled gray silt or silt loam. If not exposed, the water table is found only a few inches beneath the surface and during periods of heavy precipitation may form temporary lakes. Depth to ice-rich permafrost is often less than 30 inches. Ground cover is characterized by a dense accumulation of mosses, lichens, sedges, rushes, liverworts, mushrooms, and other fungi. Stunted black spruce occasionally occurs. Along the margins of bogs and in drier areas, grasses, small shrubs, and smaller trees, such as willow and dwarf Arctic birch, proliferate (Anonymous 1979).

2.3.2.2 Role of Fire

Interior Alaska's vegetative pattern is largely influenced by fire. On Fort Greely and Donnelly Training Area, fires are most frequent on northern portions of the Donnelly West Training Area. Between 1956 and 1987, 60 known fires burned over 150,000 acres in the Fort Greely and Donnelly Training Area/Delta Junction area. Particularly large fires included a 54,413-acre Carla Lake Fire in 1998; a 43,500-acre fire east of Jarvis Creek in 1987; a 35,450-acre fire near Delta Creek in 1971; the 18,000-acre Donnelly Flats Fire in 1999; and a 17,500-acre fire west of the East Fork of Little Delta River in 1971 (BLM-AFS 2000; BLM and U.S. Army 1994; Bonito 1980).

Bonito (1980) bases the following summary of post-fire succession on a literature review. The first year after a fire, grasses, fireweed, horsetail, and morel mushrooms are common. Grasses and sedges along streams recover quickly, and birch seeds germinate by the second year. In wet muskeg, a continuous cover of grasses usually can be found within three to five years after a fire. Willow, Labrador tea, and birch recover first, followed by black spruce, and perhaps 100-200 years later, spruce-dominated sites develop again into muskegs. Post-fire successional stages can differ from this based on the ecotype that burned, the intensity of the fire, and numerous other variables (Randi Jandt, personal communication).

Lichens may take 50-150 years to recover after a burn. On dry sites, aspen and birch replace willow. The birch may remain for 150 years and may be replaced by white spruce. Repeated burning tends to favor birch/aspen communities.

2.3.2.3 Floristics Inventory

During 1995-1996, CRREL conducted a floristic inventory for USARAK at Fort Wainwright (Tande et al. 1996). The inventory focused on vascular plants, so cryptogams (i.e., mosses and lichens) were not identified. This inventory was the basis for the less intensive inventory at Fort Greely and Donnelly Training Area (Racine et al. 2001).

During 1997 and 1998 CRREL conducted a floristic inventory in conjunction with other work at Fort Greely and Donnelly Training Area, and collected 723 specimens. These collections represented 497 vascular plant taxa from 64 families and 198 genera. Eleven of these species represent significant range extensions (>150 km). CEMML laminated one full set of collected plants for use by the Fort Greely and Donnelly Training Area ITAM program. A mounted set was kept at the Fort Greely and Donnelly Training Area natural resources office, and an incomplete mounted set was kept by CRREL (Racine et al. 2001).

The following established goals were met by the 1997-1998 inventory:

- Identify flora at Fort Greely and Donnelly Training Area
- Establish baseline data for the ITAM program
- Identify threatened or endangered plants, or species of concern

There are no plans for additional plant inventories within the next five years. Additions to the floristic inventory will occur as new plants are identified, usually through the LCTA monitoring program.

2.3.2.4 Threatened or Endangered, and Species of Concern Plants

Interior Alaska has no federally-listed threatened, endangered, or candidate plant species. This was expected because there are no listed or candidate species native to interior Alaska. Twenty-one of the species collected were vascular plants being tracked by the Alaska Natural Heritage Program's (AKNHP) Biological Conservation Database for interior Alaska. The following table (Table 2-2) provides information on species of concern found on Fort Greely and Donnelly Training Area (Racine et al., 2001). Rankings are listed on the AKNHP's Vascular Plant Tracking List, which was last updated April 4, 2000, by Robert Lipkin and published on their web site (Lipkin 2000).

Table 2-2. Global and Alaska Rankings for Fort Greely and Donnelly Training Area Plants being Tracked by the Alaska Natural Heritage Program.

Species	Common Name	Global Ranking*	Alaska Ranking**
Artemisia laciniata	lacinate sagewort	G5	S2
Carex crawfordii	Crawford's sedge	G5	S2S3
Carex deweyana	Dewey sedge	G5	SE?S1
Carex eburnea	bristleleaf sedge	G5	S2S3
Carex sychnocephala	manyhead sedge	G4	S1
Cryptogramma stelleri	fragile rock-brake	G5	S2S3
Dodecatheon pulchellum ssp. *pauciflorum*	few flowered shooting star	G5T5Q	S2
Draba incerta	Yellowstone draba	G5	S2S3
Glyceria pulchella	MacKenzie Valley mannagrass	G5	S2S3
Phlox hoodii	spiny phlox	G5	S1S2
Phlox sibirica ssp. *richardsonii*	Richardson's phlox	G4T2T3Q	S2?

Potamogeton obtusifolius	bluntleaf pondweed	G5	S1
Salix setchelliana	Setchell's willow	G3G4	S3
Saxifraga adscendens spp. *oregonensis*	small saxifrage	G5T4T5	S2S3
Sisyrinchium montanum	strict blue-eyed grass	G5	S1
Stellaria alaskana	Alaska starwort	G3	S3
Viola selkirkii	Selkirk's violet	G5?	S3

* Alaska Natural Heritage Program Rare Species Global Rankings

G3 Either very rare and local throughout its range or found locally in a restricted range (typically 21-100 occurrences)

G4 Apparently secure globally

G5 Demonstrably secure globally

G#G# Global rank of species uncertain; best described as a range between the two ranks

G#T# Global rank of species and global rank of the described variety or subspecies of the species

Q Taxonomically questionable

? Inexact

** Alaska Natural Heritage Program Rare Species State Rankings

S1 Critically imperiled in state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state (typically 5 or fewer occurrences, or very few remaining individuals or acres)

S2 Imperiled in state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (typically 6 to 20 occurrences, or few remaining individuals or acres)

S3 Rare or uncommon in the state (typically 21-100 occurrences)

S4 Apparently secure in state, with many occurrences

S#S# State rank of species uncertain; best described as a range between the two ranks

SE possibly introduced

2.3.2.5 Ecological Land Classification

US Army Cold Regions Research and Engineering Laboratory (CRREL) contracted ABR, Environmental Research and Services, Inc., to produce ecological land classification maps for Fort Greely and Donnelly Training Area. Gerstle River, Black Rapids and Whistler Creek were not included in the ecological land classification study. The maps delineate ecodistricts, ecosubdistricts, and ecotypes (Figure 2-7).

Ecodistricts are physiographic units within a climatic region that influence moisture availability and exposure to radiant solar energy and have similar geology, geomorphology, and hydrology. Names of ecodistricts are based on prominent geographic features and broad physiographic land forms. Ecosubdistricts are small physiographic regions having distinct, repeating associations of vegetation, soils, permafrost characteristics, water bodies, and fauna. West Donnelly Training Area is located in the Hayes Mountains, Delta Highlands and Delta Lowlands ecodistricts. East Donnelly Training Area and Fort Greely are located in the Delta Lowlands and are dissected by the middle Tanana Floodplain (Delta River floodplain and Jarvis Creek floodplain). The southern portion of East Donnelly Training Area extends into the Delta Highlands with a small portion (Donnelly Dome) included in the Gakona ecodistrict. By extension from the Fort Greely and Donnelly Training Area ecological land

classification, it can be inferred that Gerstle River is located in the Delta Lowlands ecodistrict and Black Rapids is located in the Hayes Mountains ecodistrict.

2.3.2.6 Wetlands

Shrub wetland is the dominant wetland variety found on Fort Greely and Donnelly Training Area. A map of wetlands found at Fort Greely and Donnelly Training Area is shown in Figure 2-8. The Little Delta Training Area, located in the northwest portion of Donnelly West Training Area, is predominantly covered by scrub-shrub or forested Palustrine wetland systems. Approximately 13% (of the area surveyed) of Fort Greely and Donnelly Training Area is covered with these types of wetlands. A small northern portion of the Lakes Impact Area was surveyed for wetlands. This area contains saturated palustrine scrub-shrub wetlands systems. Even though approximately half of the Impact Area (54%) was not inventoried, it is likely that this type of wetland is dominant throughout this training area. Wetlands located along Delta and Little Delta rivers and Jarvis Creek are riverine systems, having unconsolidated bottoms. Very few wetlands other than those along Jarvis Creek are found on the Donnelly East Training Area. Wetland may or may not qualify as jurisdictional wetlands as defined in Section 404 of the Clean Water Act. The Corps of Engineers determines jurisdictional wetlands on the basis of hydric soils, vegetation, and hydrology.

2.3.2.7 Forest Resources

2.3.2.7.1 Forest Stand Types - Characteristics and Potential Use

A 1993 draft forest management plan for Fort Wainwright (unpublished) described important forest stand types and discussed their potential use. Much of this description is applicable to Fort Greely and Donnelly Training Area. The stand type descriptions were obtained from the 1993 Fort Wainwright plan and have been modified for this INRMP.

White Spruce Type: White spruce is a late successional species for much of interior Alaska, including Fort Greely and Donnelly Training Area. It usually occurs on well-drained upland sites, and is rarely found on waterlogged sites or extremely dry, sunny slopes. On north and east-facing slopes, white spruce is confined to drainage ways and the tops of slopes. Although pure stands do occur, white spruce is usually found in association with deciduous species. Over time, white spruce can dominate these sites.

Early successional-stage forests and mixed stands are essential moose habitat. Many neotropical migratory birds also require early successional stages for nesting and foraging. Some species nest in "shrubby" thickets and require a hardwood component. Other species require dense stands of young conifers. Silvicultural practices for obtaining and maintaining mixed stands are ideal for most wildlife species. Potentially, anything done to favor white spruce stands/sites will also favor hardwood establishment.

On good sites, the diameter breast height (dbh) of white spruce can average 16 to 18 inches in less than 150 years, although the dbh of some trees exceeds 24 inches at 125 years. Mature stands usually do not exceed 85 to 100 feet in height. On upland sites, mature white spruce commonly range from 14 to 18 inches dbh, with the best sites producing trees with 15 to 16 inches dbh within 50 years. White spruce is highly valued for construction and for firewood.

Paper Birch Type: Paper birches are found primarily on upland sites. Trees are about 70 feet tall at 50 years of age with heights seldom exceeding 80 feet. Most stands are even-aged, except when they are over matured. The dbh of over-mature paper birch commonly range from 12 to 16 inches, with some decadent stands having a dbh of over 18 inches. Heart rot weakens many trees.

Birch, after harvest, can regenerate naturally, but not as readily as aspen. Stem density and distribution of the harvested stands limit tree regeneration. Seeding is often necessary to produce adequately stocked stands. Birch trees produce large quantities of seed that can disperse over long distances; thus, clearcutting is one option. A key aspect of birch seed germination is seedbed condition. Mineral soils are best because seeds may remain viable for up to a decade. Birch occurs on all exposures (although only rarely on north-facing slopes) and can tolerate sites underlain by discontinuous permafrost. Birch wood is considered by many to be the best firewood in Alaska due to its high BTU content and clean-burning characteristics. It also has potential to be used for veneer or pulp. In its sapling stage, birch has browse value to wildlife.

Quaking Aspen Type: Aspen is predominantly limited to uplands on relatively dry, south or southwest-facing exposures. Dense stands mature after approximately 60 years and begin to open up. Heights in mature, pure stands seldom exceed 60 feet. Average dbh of aspens is 10 to 11 inches. In sites that support older trees, a dbh of 18 inches may be obtained. The most vigorous stands occur on warm, dry slopes; conditions unsuitable for other tree species. It is almost completely absent from cold, wet, north-facing slopes and lowlands where black spruce dominates.

Following harvest or fire, aspen produces abundant root suckers that grow rapidly and form dense patches. Aspen can dominate a site within a few weeks after a fire. It is managed through clearcutting and vegetative reproduction.

While aspen has limited value as fuelwood, it is an important habitat and food source at various successional stages, particularly for moose and ruffed grouse. Commercial values of aspen could increase if a pulpwood industry develops in interior Alaska.

Balsam Poplar Type: Balsam poplar stands are found along alluvial river deposits. On the best sites, poplars can be more than 20 inches dbh at 30 years and may eventually increase to 48 inches. This species is well adapted to river bars, stream bends, and lakeshores, where they may form nearly closed stands. As the height of river terraces increases, flooding becomes less frequent, therefore allowing white spruce to become established and increase in size and density. Eventually, white spruce becomes codominant, and balsam poplars show signs of decline. Aspen is a rare associate, and sometimes birch is a minor one. Occasionally, balsam poplar regenerates on upland burns and usually is replaced by white spruce over time.

The timber value of balsam poplar is not high. Utilization is limited to low-grade saw lumber and firewood.

Black Spruce Type: Stands of black spruce cover large areas of Fort Greely and Donnelly Training Area. Usually, they are found on poorly-drained sites where permafrost is near the soil surface. Sites are cold, wet, and poorly aerated, often due to deep continuous mats of moss that insulate the permafrost and prevent summer thaw. Black spruce stands occur in relatively flat valley bottoms or on flat to gently rolling land on northern exposures. Permafrost often limits other vegetation. Higher, dry hummocks may support islands of hardwoods, and lower wet sites can support tamarack or willow. On better sites, stand densities are high; trees are of even height, and rarely exceed 11 inches in dbh. Pure stands of short, narrow-crowned black spruce are common around lake and bog margins.

Black spruce stands will yield to tree crushing equipment or hydro-ax cutting to allow for reproduction and growth of willows, aspen, and other browse species. Prescribed burning will set stands back to the shrub/herb stages of succession. Commercial uses of black spruce are similar to those of white spruce if tree size and stand volume permit.

Brush Type: Brush fields occur at high mountain elevations, in small stream-valley bottoms, and as "pioneer" vegetation on disturbed sites. Brush fields include alder, willow, and dwarf birch. There is little evidence that commercially viable forest stands have or will occupy higher elevation sites. The presence of scattered spruce at these sites, either in the brush fields or along their borders, is evidence that the land will not support commercially viable forest growth. Willow and alder along floodplains or in disturbed sites often form dense thickets for 10 to 20 years. Alder is often associated with disturbed sites, such as gravel pits, road shoulders, rights-of-way, and military trails.

Alder provides important cover for a variety of wildlife and plays a significant role in fixing nitrogen. Early successional stages of willow are important moose habitat and can be very productive. Annual biomass production of 43 to 86 cubic feet per acre in 5 to 20 year-old alder/willow stands on floodplains has been reported.

2.3.2.7.2 Forest Condition

Upland Forest Condition: Upland forests include birch and aspen forests, mixed hardwood-white spruce, and white spruce forests on relatively well-drained, warm sites. Under natural conditions fire is common. Fire cycles are estimated to be 100 – 150 years. Fires occur in a wide range of sizes, often creating openings of hundreds to many thousands of acres. A variety of other disturbances can also occur, including storm breakage or windthrow, and insect and disease outbreaks. Hardwood stands are usually the first forest cover following fire, with spruce developing more slowly until mixed stands occur. Stands dominated by white spruce are the oldest and least common upland forest type, generally growing only where no severe natural disturbance has occurred for 100 years or more.

For the last 20 years, wildland fire has played an active role in determining forest stand structure and age distribution on portions of Fort Greely and Donnelly Training Area. Human-caused disturbance starting in the early 1900s and fire suppression since the 1950s have also affected the distribution of forest stand age classes towards the younger and older stands, with fewer intermediate age classes. It is important to maintain all stand classes for timber recruitment and wildlife habitat. Older forests are more susceptible to severe wildland fire and to insect and disease damage. More species and age diversity will result from the careful application of fire management techniques and harvest activities. In areas where private property and military infrastructure are not threatened, wildland fires will be allowed to burn.

Lowland Forest Condition: Lowland forests include balsam poplar, mixed balsam poplar-spruce, and white spruce stands. Mixed birch-spruce stands also occur, especially on older lowland sites. Lowland sites are subject to a variety of natural disturbances – erosion, flooding, and ice damage near active river channels; fire; insects and disease; windthrow; and themokarsting. From about 1900 to 1940, extensive harvesting occurred in lowland sites. Mining also disturbed lowland forests. These disturbances were typically smaller-scale than the large upland fires, and they created a complex mosaic of stand types and ages. Hardwoods are usually the first forest cover to develop, followed by mixed hardwood-spruce stands, and finally white spruce. As in the uplands, white spruce is the oldest and least common forest type, developing only in the absence of major disturbance for extended periods. Overall, disturbance is less common in lowlands than uplands, as evidenced by the presence of older stands and a greater range of stand ages, including stands greater than 180 years old. Because fire is only one of the many disturbances in the lowlands, fire suppression has had less effect on overall disturbance of lowland forests than on uplands.

2.3.2.7.3 Commercial Forest Harvest Feasibility

Mapping by the Joint Federal-State Land Use Commission indicated that about 20,800 acres of Fort Greely and Donnelly Training Area are covered by spruce-poplar forest. Only 27% of forests in the Tanana Valley have commercial timber potential. Many stands are unharvestable due to location in impact areas and contamination by unexploded ordnance. Current commercial potential for the remainder is limited to firewood and sawtimber and half log white spruce markets.

The Tanana Chiefs Conference, Inc. conducted an inventory of forest resources on military land withdrawals within interior Alaska for the BLM (Tanana Chiefs Conference 1993). The inventory included the Main Post area, the northern periphery of the West Training Area, the entire East Training Area, and GRTA for a total of 391,851 acres (about 60% of Fort Greely and Donnelly Training Area). Large tracts of unforested upland areas in the West Training Area were excluded from the inventory. Cover types were classified according to their commercial forest potential. Other types were classified as non-forested land, rivers, and other waters.

The total inventoried area determined to have commercial forest potential on Fort Greely and Donnelly Training Area was 158,487 acres or about 40%, while 54% was classified as non-forested land, 3% as rivers, and 3% as other waters. The minimum mapping unit was 15 acres. Considering areas not within the project definition, the 158,487 acres represents about 24% of Fort Greely and Donnelly Training Area and GRTA.

Sawtimber was defined as conifers more than nine inches in diameter at breast height (dbh) and deciduous trees greater than 11 inches in dbh. Poletimber was defined as conifers of 5-9 inches in dbh and deciduous trees of 5-11 inches in dbh. Table 2-3 shows the results of the Tanana Chiefs Conference inventory.

Table 2-3. Timber Resources on Fort Greely and Donnelly Training Area (Tanana Chiefs Conference 1993).

Species		Acreage	Area %	Volume*	Volume %
Sawtimber	White Spruce	1,227	2.1	12.39 mil	5.0
	Mixed White Spruce/Hardwood	328	0.5	6.068 mil	2.5
	Total Sawtimber	**1,555**	**2.6**	**18.458 million**	**7.5**
Pole Timber	White Spruce	26,640	44.7	159.839 mil	64.9
	Hardwood	13,311	22.3	7.99 mil	3.2
	Balsam Poplar	177	0.3	.249 mil	0.1
	White Spruce/Hardwood	7,523	12.6	27.08 mil	11.0
	Mixed White Spruce/Black Spruce	962	1.6	2.983 mil	1.2
	White Spruce /Balsam	2,495	4.2	14.469 mil	5.9
	Mixed Black Spruce/White Spruce/Hardwood	6,994	11.7	15.387 mil	6.2
	Total Pole Timber	**58,102**	**97.4**	**227.995 million**	**92.5**

* Board Feet

On Fort Greely and Donnelly Training Area, sawtimber stands cover 1,555 acres, and have a total volume of 4,900,000 cubic feet of lumber. White spruce accounts for 79% of the sawtimber (by acreage); mixed white spruce/hardwood is the remaining 21%. Poletimber stands comprise 58,102 acres, and have a total volume of 100,300,000 cubic feet of lumber. White spruce poletimber is found on 26,640 acres with a total volume of 58,600,000 cubic feet; about 69% of white spruce poletimber occur within restricted areas. Hardwood poletimber is about 16% of the total volume, followed by white spruce/hardwood at

12%, mixed black spruce/white spruce/hardwood at 8.4%, and white spruce/balsam poplar at 3.7% (Tanana Chiefs Conference 1993).

Approximately 132 acres of white spruce sawtimber could be harvested annually, yielding 223,080 cubic feet or 642,708 board feet of lumber. Hardwood harvest could occur on 219 acres/year, yielding 160,965 cubic feet or 65,919 board feet of lumber (Tanana Chiefs Conference 1993).

The West Training Area contains about 70% of the timber resources. Wind-driven silt in trees is a problem along major rivers. The main use of silt-contaminated wood is pulp, because trees are crushed, not cut. A portion of the GRTA may be unsuitable for timber harvest due to unexploded ordnance.

2.3.3 Fauna

"*What is man without the beasts? If all the beasts were gone, men would die from a great loneliness of the spirit. For whatever happens to the beasts soon happens to man.*"[1]

Fort Greely and Donnelly Training Area contains a variety of ecosystems, and due to its relatively unobtrusive military activities, most species indigenous to central Alaska can be found on the installation. A list of observed species on Fort Greely and Donnelly Training Area is provided in Appendix F. Fauna habitat is shown in Figure 2-9.

2.3.3.1 Mammals

Fort Greely and Donnelly Training Area is home to the largest variety of game mammals, furbearers, waterfowl, and upland game birds of any military area in the country (BLM and U.S. Army 1994). Some big game species are:

2.3.3.1.1 Moose

Moose are the most visible and economically important wildlife species on Fort Greely and Donnelly Training Area. ADF&G's Game Management Unit 20A has one of the state's largest moose harvests, part of which encompasses the Donnelly West Training Area. The south-central and northeastern portion of the Donnelly West Training Area and the far southern portion of the Donnelly East Training Area are fall concentration areas for moose. Spring and summer concentrations are found in the north-central portion of the Donnelly West Training Area. Winter concentrations are found in the northeastern portions of the Donnelly West Training Area, as well as the northern portion of the Donnelly East Training Area (Bonito 1980). Figure 2-10 shows known moose habitat on Fort Greely and Donnelly Training Area. A 1984, late-fall survey for moose indicated that the population was 384 animals (± 20%). The 1995 fall estimate was 700 to 1,100 moose on Fort Greely and Donnelly Training Area (Steve Dubois, personal communication). It is difficult to conduct meaningful moose surveys for Fort Greely and Donnelly Training Area alone because of the migratory habits of these animals. For all of GMU 20A, early winter aerial estimates of population size have ranged from 10,100 in 1990 to 13,300 in 1994, and were last estimated at 10,557 (+/-18%) in 2000 (Don Young pers. com.).

2.3.3.1.2 Bison

Bison were introduced into the Big Delta-Delta Junction area in 1928 after they were extirpated from the area 450-500 years ago. There are now four herds in Alaska; one at Fort Greely and Donnelly Training Area and the other three originating from this herd stock. In the 1950s, the Delta bison herd included

[1] Chief Seattle 1954.

more than 500 animals. By 1973, the herd was estimated to include 325 animals and by 1980 there were about 300 bison. The herd size was maintained through strict hunting regulations. In 1994, the number of bison in the herd was estimated at 446, with 70 bulls/100 cows and 53 calves/100 cows. During the 1994-95 season, 18 cows and 21 bulls were taken[9]. When winter food is plentiful, the cows have a high birth rate (70%), calf mortality is low (80% survival), and the herd's general health is good. Hunting is the main mortality factor. The Delta cows calve (April through July), primarily in the Delta River basin along terraces and gravel bars on or near the Texas and Washington ranges. Bison are generally off Fort Greely and Donnelly Training Area by late July-early August (Anonymous 1979; Kiker and Fielder 1980). DuBois and Rogers (2000) summarized the history, natural history, and management of the herd in the Delta Bison Management Plan 2000-2005. Figure 2-11 shows bison habitat on Fort Greely and Donnelly Training Area.

2.3.3.1.3 Dall Sheep

Dall sheep are found in the Molybdenum Ridge area in the southwestern portion of the Donnelly West Training Area. The population was estimated at less than 100 animals (Bonito 1980). Spiers and Heimer (1990) studied this herd and found five subpopulations. They noted that their movements included lands both on and off Fort Greely and Donnelly Training Area. This study found 150 sheep on Fort Greely and Donnelly Training Area in winter and 100 in summer. Figure 2-12 shows known ranges for Dall sheep on Fort Greely and Donnelly Training Area and surrounding areas.

2.3.3.1.4 Caribou

The Delta caribou herd is one of 13 distinct herds in Alaska, and it ranges throughout moist tundra habitat along the Alaska Range. This relatively small herd spends spring and summer on calving grounds in the Trident Glacier foothills and then moves to the west of Fort Greely and Donnelly Training Area for the winter (Anonymous 1995b). ADF&G identified the Donnelly Dome area as winter habitat for caribou. In 1963, the herd was estimated at 5,000 head that ranged over 3,000 square miles. By 1974, the herd dropped to 1,400-2,000 animals (Anonymous 1979). In 1979, the herd was estimated at about 4,000 animals with a high (63:100) calf/cow ratio (Spiers 1982). The herd is currently estimated at 4,600 animals and growing. Figure 2-13 shows known ranges for caribou on Fort Greely and Donnelly Training Area.

2.3.3.1.5 Other Mammal Species

Large predators include grizzly and black bears, wolves, foxes, martens, coyotes, and wolverines. Many of these species, in addition to mink, muskrat, Arctic hare, and beaver, are trapped for fur on Fort Greely and Donnelly Training Area. There are no accurate harvest or population data for these species.

Listed below are objectives of recent small mammal studies by ABO (Anderson et al. 2000).

- develop a list of mammal species that occur on Fort Greely and Donnelly Training Area;
- identify small mammal ecotype associations of use in ecological land evaluations of military lands in interior Alaska;
- document the occurrence of rare or poorly known mammals if possible;
- assess wildlife habitat associations for use in ecological land evaluations.

Small mammals play important ecological roles as secondary consumers and as prey for a variety of predators. The Alaska tiny shrew is newly described and apparently rare, found in small numbers in widely separated parts of Alaska. Small mammals that are potentially rare inhabitants of Fort Greely that

were not found in this study include the long-tailed vole, Alaska tiny shrew, yellow-cheeked vole, and water shrew (Anderson et al. 2000).

2.3.3.1.6 Small Game

Several small game and related species are found on Fort Greely and Donnelly Training Area, including willow and rock ptarmigan; spruce, sharp-tailed, and ruffed grouse; swans; ducks; geese; and cranes. Waterfowl nest on Fort Greely and Donnelly Training Area pothole lakes and are absent from the area during winter. There are no accurate harvest or population data for these species.

2.3.3.2 Birds

Anderson et al. (2000) conducted landbird surveys in 1998 on Fort Greely and Donnelly Training Area. Some common nongame birds observed on the installation include the alder flycatcher, American kestrel, hawk owl, great-horned owl, yellow-rumped and orange-crowned warbler, common and hoary redpoll, dark-eyed junco, hairy woodpecker, black-backed woodpeckers, red-tailed hawk, mew gull, gray jay, common raven, black-capped chickadee, American robin, varied thrush, hermit thrush, Swainson's thrush, gray-cheeked thrush, Bohemian waxwing, snow bunting, and cliff swallows (Anonymous 1979).

Sandhill crane habitat exists on Fort Greely and Donnelly Training Area (Figure 2-14). Appendix F includes a list of bird species known to occur (through sightings) on Fort Greely and Donnelly Training Area.

A survey for trumpeter swans in 1983 found only eight individual swans on the installation. Trumpeter swan surveys conducted by USFWS in 1990, 1995, and 2000 covered parts of Fort Greely and Donnelly Training Area including kettle lakes in the southwest portion of the Donnelly West Training Area, and along the Delta River.

Appendix F contains a list of bird species known to occur (through sightings) on Fort Greely and Donnelly Training Area (Anonymous, 1979; Anderson et al, 2000).

2.3.3.3 Fish

Species common in the Tanana River include year-round residents such as burbot, sheefish, humpback whitefish, and suckers; overwintering migrant species such as grayling, round whitefish, and northern pike; and migratory species such as salmon and Arctic lamprey. The Delta River is important to the fall chum salmon and is also home to coho salmon, although the latter is more common in the Clearwater River. Major streams on Fort Greely and Donnelly Training Area are generally silt laden and do not support fisheries. A few clear streams flowing into these larger streams provide summer habitat for grayling, but none are important for spawning grayling (BLM and U.S. Army 1994).

While some lakes and ponds on Fort Greely and Donnelly Training Area have naturally occurring populations of lake chub, northern pike, sculpin, and suckers, most are too shallow or oxygen deficient in the winter to support fish. Annual fishing visits averages about 1400 angler-use days on the 15 lakes ADF&G stocks with silver salmon, Arctic grayling, Arctic char, lake trout, and rainbow trout (PMO data, ERD 2000). Most of these lakes are readily accessible from the Richardson Highway. Koole Lake is west of the Delta River and is inaccessible by road (BLM and U.S. Army 1994). A list of fish species in Fort Greely and Donnelly Training Area waters is provided in Appendix F

2.3.3.4 Reptiles and Amphibians

Wood frogs (*Rana sylvatica*) are the only amphibians in the Alaska Interior, and they are found on Fort Greely and Donnelly Training Area. There are no reptiles.

2.3.3.5 Special Status Fauna

The American peregrine falcon (*Falco pergrinus anatum*) was de-listed from endangered species status in 1999. Though it is not known whether they nest on Fort Greely and Donnelly Training Area, the installation is within their breeding range. Peregrine falcons are known to nest within a few miles of the northwestern corner of the Donnelly East Training Area (Ritchie and Rose 1998). Although this raptor has been recently delisted, the USFWS requests that USARAK continue consultation on any projects that may hinder their recovery. Peregrine falcons do not winter in Alaska.

A federally-listed threatened species in the lower 48, the bald eagle (*Haliaeetus leucocephalus*), is locally common.

Two species confirmed on Fort Greely are considered sensitive by the U.S. Forest Service, the osprey (*Pandion haliaetus*) and trumpeter swan. The Forest Service lists species as sensitive when concerned about viability. Species are listed when populations and/or habitats have been reduced, restricted, or are vulnerable to resource development, or the species require special management to maintain viable populations (CEMML 1998).

Osprey nests are found in snags and living trees near waters with abundant fish populations. Osprey have been identified during the Breeding Bird Surveys on Fort Greely and Donnelly Training Area (CEMML 1998).

Trumpeter swans are known to nest on Donnelly West Training Area. Trumpeter swans require wetlands with dense vegetation for nesting. In Alaska they create nests of horsetail and sedges, and feed on a variety of marsh and aquatic plants (CEMML 1998).

Four passerines listed as species of special concern by the state of Alaska have been confirmed on Fort Greely and Donnelly Training Area. They are the olive-sided flycatcher (*Contopus borealis*), gray-cheeked thrush (*Catharus minimus*), Townsend's warbler (*Dendroica townsendii*), and blackpoll warbler (*Dendroica striata*). A species of concern listing was generated to bring attention to the needs of vulnerable species before they require more extreme and costly management actions. Alaska Department of Fish and Game created the new category in 1993. At this time there are no legal requirements for managing the species, but attention should be given to protecting habitats (CEMML 1998).

These migratory birds nest mainly in the coniferous forests of Alaska. The olive-sided flycatcher is also found in open woodlands, forest burns, boreal bogs, and muskegs. The gray-cheeked thrush nests in conifers and dense stands of alder or willow (CEMML 1998).

The U.S. Fish and Wildlife Service, Office of Migratory Bird Management maintains a list of *Migratory Nongame Birds of Management Concern in the United States*. Species listed for Alaska that may occur on Fort Greely and Donnelly Training Area are trumpeter swan, common loon, northern harrier, northern goshawk, olive-sided flycatcher, alder flycatcher, gray-cheeked thrush, and blackpoll warbler.

Anderson et al. (2000) conducted landbird surveys in 1998 on Fort Greely and Donnelly Training Area. Nine of ten birds listed as priority species by the Western Working Group, Partners in Flight (1998) were found. Anderson et al. (2000) discuss habitat associations of each of these species.

Eighteen species confirmed on Fort Greely and Donnelly Training Area are included on the Boreal Partners in Flight Working Group as target or priority species for monitoring because of declines in populations noted across the Americas. There are no legal requirements to manage these species although all migratory bird species are afforded some protection under the Migratory Bird Treaty Act (Ruth Gronquist, BLM personal communication).

2.3.4 Special Interest Management Areas

Fort Greely and Donnelly Training Area has several areas with special natural features. They harbor sensitive or unique wildlife species or represent unique plant communities. The following are special area categories and accompanying restrictions. Most areas either have been or soon will be digitized in the GIS, and maps showing restricted areas will be available to project planners. These special interest areas are shown in Figure 2-15.

2.3.4.1 Delta Bison Area

A 1980 cooperative agreement (Bonito 1980) designated areas as important bison calving and summer range on the Donnelly West Training Area. The 1980 agreement also identified the Donnelly East Training Area as important late summer and early winter range. An agreement in 1986 with ADF&G (U.S. Army 1986) also identified bison calving and summer range. USARAK has imposed restrictions to limit disturbance to bison calving areas from 15 April through 15 June, if bison are present.

2.3.4.2 Sandhill Crane Roosting Area

The 1986 agreement with ADF&G (U.S. Army 1986) identified several areas along the Delta River on Fort Greely and Donnelly Training Area as important for migrating sandhill cranes. Consultation with ADF&G for the military Lands Withdrawal Renewal EIS identified additional areas along the Delta Creek wash, near the Delta Creek Assault Landing Strip, as important for migrating sandhill cranes (CEMML 1998).

The agreement limited disturbance in designated sandhill crane areas each year from 25 April through 15 May, and 1 September through 30 September when sandhill cranes are present. The Army can conduct military activities in these areas if they first consult with ADF&G.

2.3.4.3 Delta Caribou Calving and Post-Calving Areas

The cooperative agreement between the Army and ADF&G (U.S. Army 1986) identified 12 parcels on Fort Greely and Donnelly Training Area as important calving and post-calving areas for caribou. In the 1986 agreement, the Army agreed to suspend activities or operations that would adversely affect these areas during 15 May through 31 May without consultation with ADF&G. Restrictions in these areas are in effect only when caribou are present. In addition, all development and military actions in the caribou calving grounds will be conducted under winter conditions when there is sufficient snow cover and the ground is adequately frozen to minimize the damage to vegetation and soils.

2.3.4.4 Dall Sheep Habitat

The *Fort Greely Resource Management Plan* (BLM and U.S. Army 1994) requires that military training be minimized in crucial Dall sheep habitat, which was identified in a study conducted by Spiers and Heimer (1990). Military and recreational vehicular traffic is not allowed above 3,500 feet in the mountains between Buchanan and Delta creeks. Large ground exercises will not be conducted on crucial sheep habitat.

2.3.4.5 Water Body Protective Zones

The *Fort Greely Resource Management Plan* (BLM and U.S. Army 1994) requires establishment of protection zones around water bodies when special precautions are needed to protect habitat. Restrictions exist on the use of petroleum products near lakes and ponds.

2.3.4.6 Moist Tundra Areas

Moist tundra is one of the most easily damaged ecosystems on Fort Greely and Donnelly Training Area, especially during warm weather. On Fort Greely and Donnelly Training Area, moist tundra occurs above tree line on tops of hills, 2,500-5,000 feet above sea level. The Army provides protection for fragile moist tundra by requiring it to be frozen prior to military training. In addition, snow is pushed rather than plowed to bare ground when creating winter trails for military access. This prevents most damage to the protective vegetation mat.

2.4 Social Resources

2.4.1 Cultural Resources

"*Fort Greely and Donnelly Training Area is the richest military installation in terms of cultural resources of all ages."*[2]

In 2001, U.S. Army Alaska implemented the *Integrated Cultural Resources Management Plan 2001-2005 Fort Wainwright and Fort Greely*" This plan contains what is known concerning cultural resources on Fort Greely and Donnelly Training Area. The remainder of this section, unless referenced otherwise, is condensed from that document.

There have been 11 archeological investigations on Fort Greely and Donnelly Training Area that have identified 96 sites. The 11 archaeological investigations have resulted in only 2,211 acres (less then 1%), of the entire Fort Greely and Donnelly Training Area receiving some level of archaeological survey. Six surveys were small clearance surveys, which resulted in discovery of five sites. Frederick West conducted the first regional survey of the foothills of the Alaska Range in the 1960s (West 1967). His survey in the Donnelly Training Area included the Donnelly and Delta moraine topography. He located 20 sites that form the proposed Donnelly Ridge Archaeological District. This collection of sites is important in forming early concepts that Denali Complex material uncovered were part of a larger Beringian tradition in the interior of Alaska. In 1978, a reconnaissance-level survey was conducted in various areas of Fort Greely and Donnelly Training Area, resulting in the discovery of 60 sites (Holmes 1979). A 1979 survey located four sites (Bacon and Holmes 1980). Northern Land Use Research, Inc. conducted limited archaeological surveys in various areas of Donnelly Training Area, resulting in the identification of 16 additional sites (Higgs et al. 1999). These sites are located in one of three physiographic settings: high points, bluffs or terraces overlooking a major river or site drainage, or lake margins. There is an inherent bias in this conclusion because archeological investigations have emphasized these settings.

Three individual sites and the proposed Donnelly Ridge Archeological District (with 20 sites) have been determined eligible for inclusion in the National Register of Historic Places. Twenty-nine sites are

[2] Bacon et al. (1986) referring to military installations in Alaska.

considered “Not Eligible” for listing, and the remaining lack adequate information to determine eligibility.

Based on this limited archaeological information available for the Donnelly Training Area, it is difficult to highlight archaeologically sensitive areas with any confidence. Based on ongoing modeling, it appears that the northern foothills of the Alaska Range west of Delta River and the entire area east of the river may have high potential for site discoveries. Remaining areas appear to have a moderate to low potential for site discovery.

The Fort Greely and Donnelly Training Area areas have probably supported human populations for 10,000-12,000 years. Because it was ice free during the Wisconsin glaciation, interior Alaska contains the oldest verifiable prehistoric remains in the state. It also has significance for the understanding of the peopling of the New World.

The oldest radiocarbon date for any item found on the post is 8,555 (± 380) years Before Present (BP). Some undated material resembles artifacts dating back to 12,000 BP. The prehistory of interior Alaska has recently been divided into five chronological periods along environmental and cultural criteria (Holmes 2000) -- Beringian Period (>11,000 BP), Transitional Period (11,000 to 8,500 BP), Early Taiga Period (8,500 to 5,000 BP), Middle Taiga Period (5,000 to ca. 2,500 BP), and Late Taiga Period (ca. 2,500 BP to present). The archaeological record on Fort Greely and the Donnelly Training Area represents all of these periods. It is during the Late Taiga Period that the ethnographic Athapaskan population begins appearing as a distinct culture.

Indirect European contact with the native people began in the 1830s and 1840s, and direct trade began in the 1860s. During the 1860s, prospectors and explorers penetrated Tanana territory, and the discovery of gold in 1902 resulted in a great influx of white settlers. Shortly thereafter, the traditional way of life among the Tanana Athapaskan was a thing of the past.

There are three historic sites and a historic trail on Fort Greely and Donnelly Training Area: Sullivan Roadhouse Site; Gordon’s Roadhouse, which is in ruins; Ptarmigan Creek Cabin, which has been determined ineligible for inclusion in the National Register of Historic Places; and parts of the Washburn-Fairbanks winter sled trail, which was serviced by the two roadhouses. In 1996, the Sullivan Roadhouse was moved to Delta Junction, which alleviates the need to protect the former site from wildfires. No historic resources associated with early mining (1898-1942) that have been or may be identified on Donnelly Training Area have the potential of being eligible for inclusion in the National Register of Historic Places (Neely and Sackett 2001).

Salcha natives used the Delta River and Delta Creek for subsistence hunts in historic times, but most of these activities ceased by the 1920s. By 1945, the natives had virtually abandoned Salcha, and in 1962, there were no native settlements in the Tanana Valley between Healy Lake and Nenana. Fort Greely and Donnelly Training Area has been used little by natives for subsistence for many years.

Figure 2-1. Fort Greely And Donnelly Training Area Facilities.

Figure 2-2. Fort Greely And Donnelly Training Area Transportation System.

Figure 2-3. Fort Greely And Donnelly Training Area Terrain.

Figure 2-4. Fort Greely And Donnelly Training Area Surface Geology.

Figure 2-5. Fort Greely And Donnelly Training Area Soils.

Figure 2-6. Fort Greely And Donnelly Training Area Surface Waters.

Figure 2-7. Fort Greely And Donnelly Training Area Vegetation.

Figure 2-8. Fort Greely And Donnelly Training Area Wetlands.

Figure 2-9. Fort Greely And Donnelly Training Area Wildlife Habitat.

Figure 2-10. Fort Greely And Donnelly Training Area Moose Habitat.

Figure 2-11. Fort Greely And Donnelly Training Area Bison Habitat.

Figure 2-12. Fort Greely And Donnelly Training Area Dall Sheep Habitat.

Figure 2-13. Fort Greely And Donnelly Training Area Caribou Habitat.

Figure 2-14. Fort Greely And Donnelly Training Area Sandhill Crane Habitat.

Figure 2-15. Fort Greely And Donnelly Training Area Special Interest Areas.