

AFFECTED ENVIRONMENT

NATURAL RESOURCES

Geology

General. The rugged Alaska Peninsula is today and has been for thousands of years an area of considerable volcanic and tectonic activity. It is a part of the great "rim of fire" which surrounds the Pacific Basin and is caused by drifting of the giant Pacific crustal plate up against the surrounding continental plates. The deep Aleutian trench off the Pacific coast of the Alaska Peninsula represents a zone of great stress and strains where the Pacific Ocean plate is being forced below the continental plate. Other regional structural features include a series of northeast-trending folds and faults.

The oldest exposed bedrock in the monument/preserve consists of a sequence of Jurassic and Cretaceous sedimentary formations of sandstone, shale, conglomerate, and limestone obviously deposited during a long period of tectonic stability. Tertiary time was marked by widespread uplift and volcanic activity throughout the region. The Aleutian Range was formed early in this period by a massive outpouring of volcanic material. Uplift, erosion, intrusion, and volcanism continued through the Tertiary, resulting in the deposition of thick sections of volcanic rock. Tertiary sedimentary and volcanic rock and much older sedimentary formations are evident throughout the Aleutian mountains east of the

Aniakchak caldera. A few scattered intrusives are exposed in the monument/preserve. Continued volcanic activity into recent times resulted in the volcanic rock, ash, and debris flows that form Aniakchak caldera, cover the caldera flanks, and are found in isolated outcrops. Surficial alluvial and glacial deposits mantle the Bristol Bay lowlands including the Meshik and Cinder River drainages.

Volcanic Features. Aniakchak caldera is a spectacular geologic feature and the most outstanding single resource in the monument/preserve (see Geologic Features - Aniakchak Caldera map). Aniakchak is unique among volcanic areas in the national park system in that it is larger than most, it is the site of extensive recent activity, and it is essentially a dry-bottomed caldera.

The caldera is the result of the collapse of a large andesitic structure and has a total internal relief of approximately 3,000 feet and a diameter of about 6 miles. The precaldera cone from which it was formed was approximately 7,000 feet high.

The basic caldera was probably formed more-or-less in a single massive eruption about 3,500 years ago. On a world-wide scale, the eruption ranks as one of the largest in such recent times, but there are nearly a dozen other calderas up and down the Alaska Peninsula that have a roughly similar geologic history. Since the initial formation of the caldera, a number of less spectacular volcanic events have occurred which have resulted in the varied modern features of the caldera floor: a large spatter cone called Vent Mountain dominates the southeastern half of the

area, several ash and lava flows of different ages cover the floor, collapsed small explosion pits pockmark its surface, and a substantial explosion appears to have blown out part of the northwest rim at Half Cone. The most recent explosion pit was apparently created in a 1931 ash eruption that blanketed not only the interior of the caldera with 1 to 2 feet of ash, but also deposited substantial ash layers as much as 40 miles away in the Chignik villages.

The caldera rim averages about 3,000 feet in elevation compared to its floor at 1,100 feet but rises ^{at its highest point to over 4,400 ft. (Aniakchak Peak)} ~~in places to nearly 4,500 feet.~~ It appears that initially the rim was complete and that probably the caldera filled to a substantial depth with water, creating a deep lake similar to Crater Lake in Oregon. Some of the post-caldera events appear to have taken place during that lake-filled period since some flows seem to have been erupted under water. Eventually a lower, weaker portion of the rim was breached by rising lake waters and in what appears to be very rapid erosion, the resulting outflow has cut through perhaps 1,500 feet of both fossil-bearing sedimentary and volcanic layers to create the modern-day "Gates" through which the Aniakchak River now exits the caldera.

Outside the caldera the Aniakchak area shows evidence of ash flowing over formidable topographic barriers (Miller and Smith 1977). Ash flow tuffs, probably emplaced during the period of caldera-forming eruptions, are found in thick continuous exposure near the caldera and in isolated outcrops at considerable distances from their source. Ash flows moved down the sides of the precaldern cone, filling glacial valleys next to the

volcano to a thickness of 220 feet or more. To the north and west no obstructions existed, and the ash flows swept across the Bristol Bay lowlands to the sea. To the south of the caldera ash flows were channeled down glaciated valleys, crossed the Meshik River lowlands, and continued on through mountain passes of the Aleutian Range into the Pacific Ocean. Just west of the Aleutian Range flows passed and filled intervening valleys to probable depths of 300 feet. Ash flow tuff outcrops indicate that originally the flows covered an area of at least 900 square miles.

Mineral, Oil, and Gas Resources

The monument/preserve and immediately surrounding area have no recorded mineral production. There are no recorded mineral claims within the monument or the preserve. The nearest valid and active mineral claims are approximately 15 to 18 miles southwest of the preserve. Five inactive claims are located east of these active claims in an area north of Chignik Bay about 12 miles south of the preserve.

The following evaluation of metallic mineral resources in Aniakchak is based on information provided by the U.S. Geological Survey (1981 and 1984). Rocks of Tertiary and Quaternary volcanic-intrusive environment are widely distributed in the area and may contain porphyry copper and molybdenum deposits. No such deposits have been discovered in either the monument or the preserve, although there is the potential for their existence. Mineralized areas containing anomalous copper and molybdenum

that have been identified as having considerable mineral potential occur within and near the boundaries of the preserve in three locations (see Mineral, Oil, and Gas Potential map). These areas also contain values of silver, lead, zinc, tungsten, bismuth, and arsenic. Another area with considerable mineral potential is the mountains between Pumice and Old creeks, where several small tertiary intrusives are known to be mineralized. Streams that drain the mountainous areas between these creeks contain sites that show high values of lead, zinc, copper, and silver. As a general conclusion however there are no known major mineral resource areas within the monument of the preserve.

Thin seams of coal-bearing rocks are known within the preserve but are not believed to be of minable quality (Geological Survey, U.S. Department of the Interior 1984). Coal deposits have been identified south of the monument/preserve in a belt 3 miles wide and 25 miles long on the west shore of Chignik Bay, where coal was mined for local use from 1899 to 1915.

The Alaska Peninsula lies within two petroleum provinces (see Oil and Gas Potential - Bristol Bay Region map). The north side of the peninsula is in the Bristol Bay province and the south side is in the Alaska Peninsula province. Virtually all of the monument and preserve lies in the latter province. Due to a general lack of data and some conflicting earlier analysis, it is difficult to evaluate the potential for finding oil and gas resources on the Alaska Peninsula. Based on limited information to date, the petroleum potential is considered low to moderate for onshore and out to the 3-mile limit offshore in the Bristol Bay province, and low

to unknown for onshore and out to the 3-mile limit offshore in the Alaska Peninsula province (Alaska Department of Natural Resources 1983). This conclusion is in agreement with the BBCMP text description of oil and gas potential, but the BBCMP map of such potential is apparently derived from earlier studies which suggest a "low to moderate" potential on the Pacific side of the peninsula.

Specifically, when asked to comment on the potential in Aniakchak the U.S. Geological Survey has identified only one area within the boundaries that they believe has some oil and gas potential. This area includes a portion of the Meshik River drainage and extends into the southwest section of the preserve, all of which is on federal land (see Mineral, Oil, and Gas Potential map). The extent of potential oil and gas resources offshore has not been determined, but most interest has been focused on the Bristol Bay province.

Topography/Soils

The Pacific coastline of the preserve is rugged, with numerous cliffs and offshore rocks and islands. Peninsulas jut into the ocean creating large bays and protected coves. Rising abruptly from the Pacific shoreline and more gradually from the Bristol Bay side, the Aleutian Range passes generally east of the centerline of the Alaska Peninsula. Peaks in this range seldom exceed 3,000 feet. To the northwest of these mountains and almost isolated from them lies Aniakchak caldera, the rim of which ranges from 2,000 to 4,000 feet in height. The northern and western flanks of

the caldera grade gently down to the Bristol Bay lowlands. Several small streams wash and erode the far steeper southern flank of the caldera, creating extraordinarily rugged terrain characterized by deep ravines, steep escarpments, and waterfalls.

In contrast to the mountainous upland terrain are the Meshik and Aniakchak River valleys that interrupt the Aleutian Range. The Aniakchak drainage is a narrow, rocky corridor near its origin at the caldera, but gradually widens out and changes into a flat tundra/shrub-covered valley. The valley of the Meshik River, a more mature stream, is quite broad, flat and marshy. The other major river drainage in the monument/preserve, the northward-draining Cinder River, originates on the caldera's northeastern flanks and in the mountains to the east and descends immediately into the Bristol Bay lowlands (see Topography and Soils map).

The majority of soils within the monument/preserve have been formed in well-drained, gravelly layered volcanic ash. The deepest, most developed soils occupy the footslopes of Aniakchak caldera as well as below drainages in steep mountainous areas and in the nearby coastal plains. The shallowest soils occur on recently deposited volcanic ash and cinder flows primarily on the western and northern slopes of the caldera. This loose ash is easily disturbed by wind because there is little or no vegetative covering. Deep, very poorly drained organic soils occur along the wide, flat Meshik River valley. These soils consist of fibrous peat derived mostly from sedges and moss interspersed with several layers of

volcanic ash. Little or no soil can be found on mountain peaks and ridges, rock escarpments, and talus slopes, which includes much of the higher elevation of the caldera and other mountainous terrain of the Aleutian Range. There are no prime or unique farmlands in the monument/preserve (Soil Conservation Service, U.S. Department of Agriculture 1983).

Climate

The two sides of Aniakchak lie within two different climatic zones, a maritime one and a transitional one. The Aleutian Range has a major influence on local climate, acting as a barrier to the prevailing moist winds off the Pacific Ocean from the south. As a result, weather along the Pacific side of the Alaska Peninsula is maritime, i.e., characterized by heavy precipitation, moderate temperatures, and strong winds. Annual precipitation at the coastal community of Chignik averages 127 inches, including the moisture derived from 59 inches of snowfall. Annual snowfall at higher elevations averages more than 100 inches. Temperatures are relatively mild. The average summer temperatures at Chignik range from 39°F to 60°F, and the average winter temperatures range from 21°F to 36°F. High winds are common along the coast and in mountain passes and valleys.

The climate along the Bristol Bay side of the Alaska Peninsula is transitional between maritime and continental; the weather typically exhibits a wider temperature range, less precipitation, and clearer skies.

Annual precipitation at Port Heiden averages 13 inches, including moisture from 29 inches of snowfall. Average summer temperatures range from 40°F to 59°F, and average winter temperatures range from 13°F to 31°F.

Summers are characterized by fog, drizzle, and protracted cloud cover on both coasts. Weather records for Port Heiden show a 45 to 60 percent frequency of fog and a 70 to 80 percent frequency of rain or drizzle during the summer. Cloud ceilings obscure the caldera rim for most of the summer, and even on days when it is possible to see the caldera from the air, turbulence and strong downdrafts can occur. Because of its topography and location, the caldera creates its own microclimate. As strong downdrafts form over the caldera rim, a phenomenon known as "cloud niagaras" frequently occurs, with clouds rapidly flowing over the rim and down onto the caldera floor. The interior of the caldera is subject to violent windstorms, even when the weather is relatively calm outside. Particularly strong winds may channel through the narrow "Gates," making entry by aircraft extremely hazardous.

Hydrology

Surprise Lake is nestled in the Aniakchak caldera on the north side. It is fed by several iron-soda springs issuing from northwest of the lake and by snowmelt from surrounding highlands. The lake is the major identifiable source of the Aniakchak River.

The Aniakchak River is the only major watercourse within the monument/preserve that drains eastward into the Pacific Ocean. Originating in Surprise Lake, it flows through the 2,000-foot Gates and runs approximately 31 miles to its mouth on Aniakchak Bay. The river is shallow, rocky, and has low falls as it drops 70 feet per mile for the first 13 miles. The remaining 18 miles of the river meander slowly through flatlands to Aniakchak Bay. Surprise Lake and the Aniakchak River form the primary passageway through which animal life finds its way from outside into the caldera.

Originating on the south slopes of the caldera is the Meshik River, which turns westward to flow into Bristol Bay. The river is fed by a number of short tributaries that drain the southern flanks of the caldera and northwest slopes of the Aleutian Range as well as Meshik Lake, a shallow, circular lake approximately 1 mile in diameter. The other major watercourse in the monument/preserve is the Cinder River, which originates in the mountains northeast of the caldera. The river enters the Bristol Bay lowlands at the footslopes of Aniakchak caldera outside the monument/preserve boundaries. Numerous short, fast-running streams originate on the southeast slopes of the Aleutian Range and drop rapidly toward the Pacific Ocean.

The 100- and 500-year floodplains have never been mapped for any of these rivers. Until more hydrological data becomes available, suspected floodplains must be assumed, taking into consideration identifiable high water marks, areas of obvious erosion potential, and narrow river sections where ice jamming could occur.

Air and Water Quality

The air quality of the monument/preserve remains virtually unaffected by human activity. Aniakchak is currently a class II airshed under the Clean Air Act. This classification allows some degradation of air quality from its existing condition.

The water quality in streams and lakes of the monument/preserve is also essentially unaffected by human activities and is considered to be good. Springs feeding into Surprise Lake are known to have high iron-soda content. Comprehensive data on streamflow, chemical quality, or suspended sediment are not available for Aniakchak.

Vegetation

Over the past several years an extensive program to map the vegetation of the Bristol Bay region using satellite data was commissioned by the BBCMP (1983).

Information obtained from this land cover mapping project has provided assistance in evaluating the vegetative communities within Aniakchak, but the extremely broad range of the classifications adopted for the regional study makes it inappropriate to adopt either the classification or the map for the small specific area represented by Aniakchak. Continued field inventory efforts within the monument/preserve will eventually produce information to better interpret regionwide Landsat data.

Vegetation at Aniakchak can be divided into three major types--tundra, shrubland, and strand (beach). Tundra, which generally dominates over vast stretches of the monument/preserve, can in turn be subdivided into three separate plant communities--wet, moist, and alpine tundra. Shrublands and strand (beach) communities have a more limited distribution in Aniakchak.

Each of the five general plant communities encompasses a wide variety of individual plant species. Small differences in elevation, exposure, drainage, slope, or substrate may result in marked vegetational differences over small distances, commonly resulting in interspersed and overlapping of plant community types.

The wet tundra community occurs on poorly drained organic soils on level terrain or open depressions. Standing water is generally present. The dominant plants are typically water-tolerant wildflowers or sedges rooted in a mat of sphagnum moss. Slightly drier peat mounds support dwarf birch and heath shrubs such as crowberry and Labrador tea. Wet tundra primarily covers the broad flat lowlands of the Meshik and Cinder River drainages, with limited occurrence on Pacific Coast lowlands.

The moist tundra community occurs in areas of greater relief and better drainage than does wet tundra. It is found on level terraces, subalpine slopes, and coastal lowlands and is dominated by a plant mat of heath shrubs or grass-forb species. A kind of hummocky heath, generally 1 to 4 inches in relief, and most extensive on well-drained rocky soils is also found covering poorly drained peat mounds within the wet tundra habitat.

Terraces bordering the Aniakchak River commonly support this vegetation. Also found in moist tundra are bluejoint grass with various forbs; these are most extensive on well-drained subalpine slopes where they are often intermixed with tall shrub stands. Bluejoint/forb mixes also occur along coastal lowlands where drainage is moderate to poor.

The sparse, low vegetation of the alpine tundra community is found on exposed slopes and the summits of ridges and knolls near sea level, as well as at elevations above 1,000 feet in the Aleutian Range. Despite heavy rainfall, arid conditions may locally prevail due to strong drying winds and rapidly draining, poorly developed soils. Typical vegetation includes various dwarf forbs and heath shrubs such as aster, cinquefoil, mountain avens, bearberry, dwarf blueberry, and crowberry. Steep mountainous terrain and areas of recently deposited volcanic ash and cinder flows support some pioneering vegetation in protected areas and drainages, but are primarily barren.

Apparently devoid of vegetation after Aniakchak's eruption in 1931, the caldera and its flanks now display primary succession steps of revegetation on a barren volcanic landscape. Although much of the caldera floor remains unvegetated, plants have gained tentative inroads in favorable microenvironments. Pioneer plants such as mosses and lichens continue to spread and create more hospitable conditions for successive invasion by other floral associations. Plant cover is concentrated near moist areas around Surprise Lake, along the Aniakchak River, and on nearby low hills. Vegetation includes such species as lyme grass, sedges, and horsetail near the lake. Adjacent terrain is covered by

mosses, lichens, lupine, dwarf fireweed, Kamchatka rhododendron, aster, mountain bluebell, and some dwarf willow. In these extreme environmental conditions, areas undergoing only ecological succession are quite fragile and sensitive to disturbance. Soil recovery and vegetation regeneration of impacted areas is marginal and extremely slow.

The shrublands community covers moderately well-drained lowlands, slopes, and hilltops up to about 1,000 feet in elevation. Open stands of low willow are usually found lining streambanks and covering lowlands and gentle lower slopes. On rounded summits and progressively higher slopes, tall alder-willow becomes common and typically appears in a belt around mountainous areas, just below the alpine tundra. This coverage is most commonly a mosaic of shrub and grass-forb types.

In the strand (beach) community, very well drained coastal sand dunes support a vegetative cover of beach rye grass and forbs. A broad strip of this vegetation type stretches along the beach west of Kujulik Bay lagoon and occurs along other bay coastal strips as well.

Wildlife

Wildlife is varied and abundant in the Aniakchak area (see Wildlife Distribution map). Most human use of the area both past and present involves either sport or subsistence harvest of the area's wildlife resources. The monument/preserve includes habitat essential to the maintenance of a number of wildlife populations. These essential wildlife

habitats have been designated as "critical" by the Alaska Department of Fish and Game in recognition of their particular significance as wildlife areas. Use of the state's term "critical habitat" should not be confused with that same term used elsewhere in conjunction with the federal endangered species act.

Terrestrial Mammals. Within this century, moose have extended their range onto the Alaska Peninsula. Populations apparently peaked during the mid-1960s and have declined by one-third to one-half since that time. Brown bear predation as well as habitat ^{changes} ~~deterioration~~ are thought to be the most important causes of moose population declines on the peninsula. Although during the period of peak abundance overuse of the available browse contributed to the decline in moose numbers, recent observations indicate that range quality is not currently a limiting factor. Consistently poor calf recruitment, primarily due to brown bear predation, seems to be the major factor limiting population expansion. Moose primarily range over the lower willow- and alder-lined slopes and valleys, with concentrations along the upper Meshik and Cinder River valleys and at the head of Amber Bay.

The Alaska Peninsula supports one of Alaska's major caribou herds. The peninsula herd is composed of three subherds. The largest, the Central Peninsula subherd, located between Naknek River and Port Moller, uses the monument/preserve and numbers about 17,000 animals. This herd ranges widely across most of the lowlands and follows general migratory routes in spring and fall. Calving normally occurs on the Bristol Bay lowlands, but within Aniakchak, calving is known also to occur south of Meshik Lake to the Aniakchak River drainage.

Brown bear move seasonally through many habitat types throughout the region. Within Aniakchak, spring bear concentrations occur along coastal grass flats at the heads of Aniakchak and Amber bays where they feed on newly emerging sedges. In late summer and early fall, concentrations shift to salmon-spawning streams. In the comparatively mild climate of the peninsula, the long period of food availability, and the abundance and quality of food, particularly salmon, are responsible for the large size and abundance of brown bear in Aniakchak. Areas of denning are usually located in alder, willow, or grassy areas on hillsides and mountain slopes. Denning within Aniakchak is known to occur on the slopes of the caldera and areas on the east side of the Aleutian Range.

Small numbers of wolves range throughout the region. Wolverines, lynx, and marten are also widespread but scarce. More common furbearers in the region include beaver, river otter, mink, short-tailed and least weasel, and red and Arctic fox.

Marine Mammals. Sea otters, harbor seals, and northern sea lions inhabit coastal waters along the Pacific side of the Alaska Peninsula and probably occur along Aniakchak's coast throughout the year. A high/medium density sea otter area has been identified within the waters off the southern coast of Cape Kumlik. Harbor seals haul out in small groups along portions of Cape Kumlik, Cape Kunmik, and small islands off Aniakchak. Northern fur seals are probably near the coast in small numbers during most months of the year, with peaks in abundance when they are migrating southward in winter and northward in spring.

Generally speaking, eight species of whales occur in Alaska waters, all of which happen to be endangered. Those species most frequently observed in coastal waters just outside the monument/preserve boundary are the humpback, gray, and fin whales. Sei, blue and Pacific right whales only occasionally occur near Aniakchak but sperm whales would be uncommon in these waters. The bowhead has not been reported in the Gulf of Alaska (National Marine Fisheries Service, U.S. Department of Commerce 1983).

Fish. The fresh and salt waters of the region support a number of valuable fish species that provide the basis for major commercial fisheries. Five species of salmon (sockeye, chum, pink, coho, and king) are harvested for commercial and subsistence use. The largest sockeye salmon run in the world occurs along the Bristol Bay coast of the Alaska Peninsula and into its lakes and rivers, primarily in June, July, and August.

On the Bristol Bay side on the peninsula, the Meshik and Cinder River systems support runs of sockeye, chum, coho, and king salmon. Other smaller streams support runs of sockeye and chum. On the Pacific side, sockeye salmon runs largely occur in the Chignik River system south of the preserve, although a small sockeye run exists in the Aniakchak River and its tributaries. In addition to sockeye salmon, the Aniakchak River system and other shorter Pacific side streams in the preserve provide spawning grounds for pink and chum salmon. Sockeye salmon are the only salmon species known to spawn in Surprise Lake. Streams on the Pacific side of the peninsula generally appear unsuitable for supporting

king salmon, with the Chignik River system being a notable exception. The freshwater systems to which salmon return are obviously essential to the maintenance of salmon populations and the health of the fishery on which most area residents depend. The majority of the streams in the monument/preserve have been designated by the state as critical salmon habitat (see map).

Freshwater streams in the Aniakchak region also support Dolly Varden, Arctic char, steelhead, and other freshwater species. Marine fish and shellfish that inhabit coastal waters off Aniakchak include halibut, cod, herring, flounder, crab (dungeness, tanner, king), shrimp, and clams. Most of these species are seasonally harvested and are very important elements in the area's commercial and/or subsistence economy.

Birds. The Bristol Bay side of the Alaska Peninsula provides habitat for some locally breeding bird populations but more significantly for the vast numbers of waterfowl (ducks, geese, and swans) and shorebirds that breed north of Bristol Bay. Millions of waterfowl and shorebirds migrate through the area, including ^{large} ~~most of the world's~~ population of emperor geese, cackling Canada geese, and black brant. Spring and fall nesting, feeding, and staging areas of highest density are generally associated with productive estuaries, lagoons, river deltas, and tidal flats where extensive tidal flats provide plentiful food and protective vegetation types are present. Some of these areas have been designated by the state as critical to the maintenance of waterfowl populations, including the Cinder River delta and Port Heiden Bay north and west of Aniakchak. Many shorebirds use this same habitat, although principally during fall

migration. The monument/preserve itself does not contain habitat designated critical to the maintenance of these populations.

The rugged terrain and relatively deep inshore waters of the south side of the Alaska Peninsula are not as attractive to waterfowl and shorebird nesting and staging as the Bristol Bay side. In the fall, the Pacific bays' rocky shores are probably important for black oystercatchers, rock sandpipers, surfbirds, and black turnstones. Bays along this side of the peninsula are also used extensively by Steller's, king, and common eiders as wintering areas. In addition to waterfowl and shorebirds the region supports millions of seabirds, primarily on the Bristol Bay side of the peninsula. There are no major seabird colonies along Aniakchak's Pacific coastline. Species observed along the coastline and sometimes inland include black-legged kittiwakes, pelagic and red-faced cormorants, glaucous-winged gulls, murres, pigeon guillemots, and horned puffins. Nearby offshore islands also provide protected nesting habitat for a relatively small number of breeding pairs.

Bald eagles can be commonly found nesting and feeding along rivers and the coastline of Aniakchak. They have also been observed within Aniakchak caldera and on the cliffs north of Meshik Lake. Other raptors of the region include rough-legged hawks, gyrfalcons, ospreys, short-eared owls, and peregrine falcons. Peregrine falcons are probably present in the Aniakchak area but are likely to be of the nonendangered Falco peregrinus peali subspecies.

Endangered and Threatened Species

It is not very likely that any animals listed under the federal Endangered Species Act as a candidate, threatened, or endangered species occur in the Aniakchak area. There has been no positive identification of the endangered subspecies of peregrine falcon Falco peregrinus anatum or the threatened subspecies F. p. tundrius within the monument/preserve. The endangered Aleutian Canada goose (Branta canadensis leucopareia) nests on Aleutian islands far to the west and possibly migrates through Aniakchak, but no data exist to substantiate this. None of the 29 plant taxa being considered for possible future listing pursuant to the Endangered Species Act have been recorded from the area (Fish and Wildlife Service, U.S. Department of the Interior 1984).

Scenic and Wilderness Resources

Although great natural beauty can be found throughout the monument and preserve, the scenic focus is the caldera, the Aniakchak River, and the rugged Pacific shoreline (see "Introduction"). Spectacular in dimension, awesome in its record of volcanic power, Aniakchak caldera is far beyond the ordinary scenic experience of visitors from elsewhere in Alaska or the Lower 48. The Aniakchak River's origin within the caldera and tumultuous first miles are dramatic visual counterpoints to the river's gentle flatland nature as it approaches the Pacific.

Though a technical determination of wilderness is not being made here, wilderness^{like} character is a reality in Aniakchak. No modern structure stands within its 600,000-acre expanse, no human trail or track can be seen within or even approaching its boundaries. Access to the interior is only by aircraft or arduous overland backpacking, or to the Pacific Coast by boats that must come 50 miles or more through often difficult waters. Weather is a frequent and even life-threatening challenge to the unwary or unprepared; the need for self-reliance and self-sufficiency under both normal and emergency situations is extremely high.

Current impacts on wilderness character do exist: perhaps 10 aircraft flights annually enter and land within the monument and preserve (mostly in summer and fall), and commercial flights destined to the Chigniks and other southerly points routinely overfly various sections throughout the year. Commercial fishing activity is quite intense along the Pacific shore in summer and fall, and in those months one or more vessels are probably within sight of shore at all times.

CULTURAL RESOURCES

Archeology and Prehistory

Today, as apparently in the past, the Alaska Peninsula is a sparsely settled region. Geographic isolation and a harsh climate have limited formal scientific study; the scattered nature of early human occupation has meant few archeological sites are known and even fewer have been

well analyzed. This is particularly true in the central portion of the peninsula near Aniakchak; most survey work has been done farther north in the Katmai region, on Kodiak Island, or at the southern tip of the peninsula and southward in the Aleutians.

Although it is well accepted that the native peoples of the Aleutian Islands and Alaska Peninsula ultimately originate from forebearers in Siberian Asia, it is still uncertain as to the time and circumstances of arrival of the earliest groups.

Generally, up until European contact, the Aleutian Islands and the extreme western tip of the Alaska Peninsula were occupied by Aleut people; the central and eastern Peninsula contained Eskimo groups. The earliest physical evidence for occupation is about 8,000 years ago* for the Aleutian Islands and 9,000 years ago for the peninsula, but despite the similarity in dates it is probable that the Aleutian Islands and peninsula groups were not similar at that time.

More recent sites in the Aleutians are archeologically very distinct from the contemporary Eskimo sites on the northern peninsula. The modern

*This 8,000-year figure is far more recent than the 15,000 to 13,000 years commonly believed to be the most recent period when Alaska was connected to Siberia via the Bering Land Bridge. This suggests that the peninsula and the Aleutians were originally populated by proto-Eskimos (Eskaleutians) moving southward from their logical point of entry nearer the Yukon Delta or Seward Peninsula. However, some European and Russian archeologists maintain that the Aleut ancestors might have come by sea directly to the Aleutians even after the land bridge no longer existed.

Aleut language is also now very distinct from the southern Yupik spoken by peninsular Eskimo peoples. Although the two languages are related, it is estimated that divergence from a common ancestral language took place some 3,000 to 4,000 years ago.

The Eskimo component on the peninsula is derived from two major archeological traditions: a southern group of people who occupied the Pacific coast of the peninsula as well as Kodiak Island and eastward into the Kenai Peninsula area; and a northern-originating assemblage that occupied the Bering Sea Coast from the Bering Straits to the Alaska Peninsula. For several thousand years these two cultures coexisted on the peninsula yet remained distinct, with the boundary between them being the rugged Aleutian Range, mountainous backbone of the Alaska Peninsula. It was not until about A.D. 1000 that this boundary was fully breached and a convergence of the northern and southern cultural spheres took place. Although not obvious from archeological evidence, it is likely that the Eskimo language of the resultant convergent culture was derived from the northern component.

Though the Aleut and southern Yupik (Eskimo) languages are very distinct, and the geographic boundary between the two at the time of European contact can be drawn fairly clearly, there does not appear to have been such a clear line between the two based on their material

cultures.* In fact, it is the Aniakchak area--although no evidence has been discovered in the monument/preserve itself--which appears to be a zone of gradual transition from Aleut to Eskimo culture. An important site at Port Moller (southwest of Aniakchak) is apparently transitional in terms of physical artifacts, suggesting that trade and contact between Aleut and Eskimo peoples along the juncture between the two groups resulted at least in a sharing of skills in tool making and lifestyles, although not necessarily in language. Certainly both groups had a primary orientation toward coastal resource use and a secondary, but critical, dependence on terrestrial wildlife and berries. This tradition continues today.

As another indication of the transitional character of the Aniakchak region between Eskimo and Aleut, there is archeological evidence that the Chignik area was peopled by Aleuts (i.e., people whose artifacts are clearly related to the Aleutian Island tradition) as late as A.D. 1000. Yet, by A.D. 1800 (European contact), the Chignik area was linguistically Eskimo, suggesting that up to the recent past the Eskimo culture was expanding southward down the peninsula.

*A confusion in terminology exists between native people who consider themselves Aleuts and Eskimos. The Russians, who occupied the Aleutians as well as the peninsula, failed to distinguish between Aleut speakers and southern Yupik (Eskimo) speakers and thus gave the generic (and foreign) name Aleut to both groups. Therefore, several generations of southern Yupik speaking people such as those in the Chigniks and Meshik have considered themselves Aleut even though their language and cultural heritage is quite distinct from the native peoples of the Aleutians.

Thus, the ancient history of the central Alaska Peninsula around Aniakchak involves the point of contact between at least two major groups. These groups, though archeologically quite distinct at the two ends of their territory (i.e., in the Aleutians for the Aleuts and the upper peninsula for the Eskimo) and linguistically distinct even into modern times, appear to have been transitional in material culture, reflecting similar lifestyles and relatively frequent contact. (Note: The principal references for this section were Dumond, n.d. and Dumond, Cotton, and Shields 1975.)

Eighteenth Century and Modern History

As elsewhere in Alaska, great changes began to occur on the peninsula soon after the Russians first began exploiting the Pacific Coast after Vitus Bering's initial voyage of discovery in 1741. The fur trade, focused at first on sea otter, was the driving force.

Until the 1780s, the Russian fur trade along the peninsula was based on independent traders and hunters sailing from Siberia's Kamchatka Peninsula. They roamed the Alaska Peninsula hunting, or forcing local natives to hunt. In 1783 the first permanent fur-trading company on the peninsula, a private operation called Shelikov-Golikov, was established on Kodiak Island. This corporation, later known as the Russian-American Company, exerted a tremendous influence over native life in villages throughout the Pacific coast of the peninsula far into the 19th century until Russia's sale of Alaska to the United States.

Despite movement of the colonial administrative center from Kodiak to Sitka in 1805, Kodiak's influence on the Pacific side of the mainland peninsula continued, both as the regional trading center and as the supporting center for the other major agent of change, the Russian Orthodox Church.

Specific details of Russian impact on Pacific coast villages in the Aniakchak area are not known for the early period. Permanent Russian settlement on the mainland peninsula was apparently resisted with some hostility, at least until a strong presence was established on Kodiak. Undoubtedly both missionaries and fur traders traveled throughout Aniakchak's Pacific Coast, bringing Christianity as well as gradual conversion from a truly subsistent lifestyle to one based on commercial hunting in exchange for trade goods. Though probably not directly influenced in the earliest years of Russian trading, the Chignik-Aniakchak coast villages show some definite signs of Russian ancestral heritage, suggesting permanent residence and integration of Russian traders at some point.

In the latter half of the 19th century, Russia experienced difficulty in maintaining its position in the eastern Pacific and eventually sold its Alaskan interests outright to the United States in 1867. The strong government-monopolized trading firm approach of the Russians was replaced by independent competitive U.S. merchants. The result was not

only an accelerated decline of the major furbearers,* but also a decline in social intermixing and integration between traders and natives. Competing economic attractions outside the peninsula (e.g., sealing in the Pribilof Islands, gold discovery in interior Alaska) began to provide stimulus for local residents to move away, or seasonally spend time away from their traditional villages; a cash economy began to replace what had become the traditional fur-based trading economy.

Following the decline of fur trading, the U.S. contribution to local socioeconomic change was in development of salmon and later crabbing fisheries and associated canneries. Though concentrated at first in southeastern Alaska (Sitka) or north in Bristol Bay, smaller operations began as early as 1890 in the Chigniks. Even though experiencing various up and down cycles, these cannery operations have persisted for the past 90 years, and are today the economic mainstay of Pacific coast villages. Because of a poor harbor situation, the Bristol Bay village of Meshik on Port Heiden has not become a cannery site, although many residents there have traditionally fished. Initially based on a fish-trapping technique involving nets on fixed poles at the mouths of spawning streams, the salmon fishery later shifted in Bristol Bay to the drift gill net (a floating net deployed from small boats). On the Pacific

*Although there is some evidence that the Russian American Company tried to maintain the fur trade by limiting hunting to sustained yields, the end result was severe scarcity even before 1867. The unorganized, competitive nature of the American independent traders left little opportunity for moderation in hunting. General conservation practices only came into effect after the U.S. Fish and Wildlife Service assumed control over sealing in 1910.

side in deeper waters the shift was to purse seines, which has led to present-day fleets of wide-ranging seining boats able to exploit fish populations far from shore.

Though canneries dominated the Chigniks economically, native village people typically did not participate very ^{actively} ~~heavily~~. Instead, much of the cannery labor was imported, and the resulting seasonal influx of Chinese, Mongolians, Hawaiians, Filipinos, and others has brought considerable cultural diversity to Chignik villages. Some newcomers stayed, married local native women and, as a result, descendants of many nationalities are found living today in the Chignik villages.

During the 1900-1930 period, while the canneries were expanding with imported labor, native lifestyles centered more on the limited fur trapping that was still available in the bays and lower drainages around Aniakchak. For a number of local families, fox farming supplemented a subsistence lifestyle, with small islands off the Chigniks and Aniakchak being used as unfenced farms where a few transplanted foxes were allowed to multiply and then trapped out. Trapping in winter and fishing in summer, either privately for subsistence or as a paid crew member, became and has continued to be a successful seasonal mix for many native Pacific Coast villagers.

By the 1940s, the small animal fur industry had essentially collapsed in this area, and many families that had previously led a very mobile lifestyle with only a few extended periods of residence in the villages began a more permanent residential pattern. Schools became common in

the villages, and since the schools operated in the winter, this was a strong stimulus to establish permanent residence. Government assistance programs and seasonal employment with the fishing industry provided the necessary cash to exist within the cash economy, but subsistence activity to supplement cash purchases continued, as it does today.

The rugged Aleutian Range continued to exert a de facto separation between the events of the Pacific Coast and the Bering Sea side. On the Bristol Bay side, there was far less influence on the fur-trading industry simply because the marine furbearers did not occur there in large numbers. Historically, few villages existed on the Bristol Bay side of the lower and central peninsula at the time of first European exploration. In fact, Meshik village on Port Heiden appears to have been the westernmost Eskimo settlement on this side of the peninsula, with a large uninhabited gap extending farther west until the easternmost Aleut settlements are encountered.

The village of Meshik seems to have been incorrectly located on maps by a number of early Russian and American explorer/observers. Early reports had Meshik located as far west as Port Moller, but in reality Meshik has existed at its current location on Port Heiden since at least prior to first European contact. A reverse confusion surrounds the village of Unangashak, which was earlier reported to be on Port Heiden, but in fact (before being decimated during a flu epidemic) was some 20 miles west at the east end of the lagoon behind the Seal Islands. The name Port Heiden was adopted when the village was incorporated although there still remains a local distinction between the traditional Meshik village

development and the newer developments associated with the Port Heiden Airfield.

Port Heiden evolved in several phases. By the late 19th century it was an active participant in the Bristol Bay cod fishery. This activity attracted a number of Scandanavian immigrants, whose surnames still appear in modern families. But much of the modern population is derived from persons relocated to Port Heiden from other settlements (like Unangashak) that had suffered great losses in the influenza epidemics of the early 1900s.

Social influences on Port Heiden in historic times have derived mostly from other communities of the Bristol Bay region such as Naknek and farther north to Dillingham.

Though lacking its own cannery, salmon fishing has been an important element in Meshik's economic history, with the catch going to Egegik for canning or, in recent times, fresh frozen locally and sent out by air. As in the Chigniks, a pattern of trapping in winter (for land animals rather than marine species) and fishing in the summer became common for native people.

In the 1940s, an important airfield was established on Port Heiden a few miles east of Meshik village. This provided a service and refueling stop for aircraft supporting various military bases farther out on the Aleutians. Though considerable temporary development accompanied the airfield, most was abandoned following World War II. The 6,200-foot

gravel strip has been maintained and is the best such field in the lower third of the peninsula.

(Note: The major reference for this section was Tuten 1977.)

Archeological and Historic Sites and Structures

The National Register of Historic Places does not list any historic sites within Aniakchak National Monument and Preserve. However, a variety of sites have been identified for further study and evaluation for their national, regional, or local significance.

No prehistoric archeological sites are known within the monument/preserve, but such sites have been found in the Chignik drainage 40 to 60 miles to the southwest. The potential for future discoveries around Aniakchak at elevations below 1,000 feet is rated by the National Park Service as moderate to high. Obviously, many sites may have been buried by volcanic activity.

The Alaska Heritage Resource Survey does list three sites that are relatively recent--the Eskimo village of Kvivkak (year 1880) and an old Russian fur-trading station (year 1790), both on Sutwik Island; and the Eskimo village of Aniakchak, somewhere on the Aniakchak coast.

Two additional reported historic sites of potential significance are the ruins of an unsuccessful razor clam cannery operated about 1932-35 on

Aniakchak Lagoon, and the fish trap and Alaska Packers Association bunkhouse site at the mouth of the Aniakchak River. The latter operation began in 1917 and apparently was used seasonally until the 1940s. A native family living on Kumlik Island ran a tender between the traps and the cannery at Chignik, remaining in the Aniakchak area to trap small furbearers during the winter months.

These and other known historic cabin sites are shown on the Cultural Resources map, and their status is described in table 6.

SOCIOECONOMIC ENVIRONMENT

Regional Land Use, Economy and Future Development

In a socioeconomic sense, the Alaska Peninsula is usually considered part of the Bristol Bay ~~cooperative~~ region. An extensive study of that region has resulted in ~~a draft~~ ^{the} Bristol Bay ^{Area and Regional} ~~Cooperative Management Plans and Environmental Impact Statement~~ ^{by the} (1984) State of Alaska and U.S. Department of the Interior ^{(1985) respectively} (1984). Since Aniakchak National Monument and Preserve extends to the peninsula's Pacific shore, technically not included in the Bristol Bay region, some reference must also be made to the influence of Kodiak Island.

The BBCMP is a compendium of regional data on land use, population, and future development and is an excellent reference for understanding the regional context for the monument/preserve. Since Kodiak Island (a separate borough) ^{was} ~~is~~ ^{by} excluded ^{from} the BBCMP, it does not treat economic and social ties between Kodiak and the Chignik villages. The region also has been arbitrarily defined to exclude both Aniakchak National Monument and Preserve and Katmai National Park and Preserve, but much of the data presented ^[obviously?] includes these two federally managed areas, which are important and integrated elements within the region.

Regional land status, use, and village location are shown on the Adjacent Land Status and External Influences map in the "Land Protection Plan."

Though widely distributed, the population of the Bristol Bay region is relatively small (in 1980, 38 communities totaling 7,815 persons); the population of Kodiak Island Borough was 9,939 in 1980, most of whom resided in the town of Kodiak. From 1970 to 1980 both areas have shown a tendency for population to shift from the smaller villages to the largest towns (Dillingham in Bristol Bay, Kodiak on Kodiak Island) which are becoming regional centers in the sense of transportation and economy. The dominant ethnic background is native (Aleut, Yupik Eskimo, and Indian), although there are many Caucasians in the regional centers and in certain smaller villages where they are involved in the commercial fishing industry.

The traditional economic base and subsistence lifestyle orientation of regional residents has been towards the resources of land and sea. Despite many changes and pressures in the historical past, this orientation persists, modified by external influences and channeled into sectors of the regional economy that seem suited to the tradition. The fishing industry is the region's largest employment source; it is highly seasonal and attracts many transient workers from elsewhere in Alaska and especially the Pacific Northwest states of Washington and Oregon. The permanent residents of the smaller villages have a very substantial reliance on subsistence activities to supplement their seasonal cash income, whereas in the regional centers a more diversified economy provides at least a part of the population with year-round cash employment.

In the Bristol Bay region, the commercial fishing industry (1979) provides about 47 percent of the employment base, government provides 33 percent, and support services provide 19 percent. More than one-third of the world's entire annual sockeye salmon harvest comes from Bristol Bay and the south shore of the peninsula, with a value sold from the vessel (i.e. before processing) in excess of \$100 million.

For individuals actually owning and operating fishing vessels, a large capital investment is involved: several hundred thousand dollars may be invested in a seining vessel and nets for a Chignik family, but much less for a Port Heiden fisherman and his smaller drift gill net vessel. Such high investment in a seasonal industry leads to extremely intense activity for short periods (summer for salmon, fall for crab) and long winter periods of quieter equipment maintenance or alternative economic activities. For individuals working as crew members or in processing plants, the intense summer activity is similar, and for many families the entire yearly cash income is earned in a short two-month period. Boat owners have the highest household income, which is needed to support the capital investment of their industry. Chignik Bay village, with its large proportion of boat owners, and an extended season that shifts from salmon to crab, has the highest household income (over \$45,000 in 1980). Lowest household income in the immediate area is in Port Heiden (about \$5,000). King Salmon, with its combination of boat owners and year-round employment in state and federal jobs has an average household income of over \$55,000.

Future development in the region, as foreseen by the BBCMP, would concentrate on continued managed harvest of fish and wildlife resources both for commercial and subsistence purposes. Even if there should be major discovery and development of oil, gas, or hard-rock mineral resources, it is anticipated that the basic regional dependence on commercial fishing would continue. Whether village populations would continue to decline in favor of regional center growth is speculative.

The potential for finding commercially extractable quantities of oil and gas in some parts of the region (i.e., the Bristol Bay side) is rated moderate to high. Should discoveries be made, a considerable amount of associated development would likely occur although this would take place gradually over a period of years. In addition to physical aspects of the drilling operations (which would differ significantly if the reserves were under tidal, submerged, or on onshore lands), there would likely develop a support infrastructure for industry employees, including expanded housing and social services in some nearby villages. Transportation of the extracted product might well necessitate some sort of pipeline across the peninsula to a potential deep-water port on the Pacific side, the location of that pipeline and port being dependent on the actual location of the discovered reserves.

Though such discovery and extraction would undoubtedly bring economic change to some sectors of the regional population, it is unlikely that the majority of current small village inhabitants would benefit directly, nor would their lifestyles change as a direct result. Specific villages, however, might see substantial change if specific development happened to

occur in or near them. The Bristol Bay study ^{addresses the} ~~recommendations are~~ ~~sensitive, in general, to the underlying~~ long-term dependence of the region's residents on healthy renewable natural resources. The preferred oil and gas development alternative in the BBCMP would encourage leasing and development to avoid environmentally sensitive lands in accordance with guidelines that would minimize impacts on wildlife.

Some future expansion of existing settlements on the peninsula is foreseen in response to local requirements, with land needs to be met from state, municipal, or native corporation holdings. Development of new settlements on remote lands is a possibility, with lands provided by the state (Department of Natural Resources) or federal government (Bureau of Land Management). However, no new remote area settlement near Aniakchak is imminent, nor is any proposed in the BBCMP's preferred alternative. In a nonpreferred alternative, some 500 acres of state land on Cape Menshikoff, 15 miles west of the Ugashik village, would be made available for settlement.

One potential land exchange involving state lands in the northeastern corner of Aniakchak is a part of the BBCMP's preferred alternative (see "Land Protection Plan").

Transportation and Access

Similar to many remote Alaska situations which lack road connections, transportation and access among the villages around Aniakchak can be

costly and difficult. Bulky supplies and fuel must arrive by barge, having been anticipated and ordered well in advance. The deep water approaches to Chignik Bay and Lagoon allow fairly easy (monthly) barge service to these locations whereas lack of a port and shallow approaches limit larger boat access to Port Heiden. Travel by residents to outside the immediate area is by boat incidental to fishing operations, or by aircraft. Reeve-Air Aleutian links ^{Anchorage, &} King Salmon ~~to~~ Port Heiden with large prop-jet aircraft ~~several times a week~~, taking advantage of the 6,200 foot gravel runway. Small single engine, and twin engined nonscheduled wheeled aircraft offer ^{daily charter or} ~~fixed year round~~ "seat-fare" ~~(as opposed to charter service between King Salmon, Pilot Point, Port Heiden, and the Chigniks. daily on short dirt runways. Typical one way seat fare prices are \$30 among the Chigniks, \$50 from Chignik to Port Heiden, and \$100 from Port Heiden to King Salmon. Seat fare service from Kodiak to the Chigniks operates seasonally. has recently been started, at \$150 one way.~~ Charters on floats or with Goose and Widgeon amphibious aircraft are available from King Salmon. Charter costs are high (but similar to other Alaskan areas): \$200 to ^{\$400} ~~\$120~~ per hour for a 5-passenger floatplane or 10-passenger Goose, respectively. Aniakchak caldera is about 1½ hours' flying time from King Salmon, less than one-half hour from Port Heiden. King Salmon's modern instrumented runway is served ~~three times~~ daily from Anchorage by jet, ~~at a one-way cost of \$110.~~

Weather conditions frequently affect air transportation and access. At any time of year low cloud or fog can close these small runways, and adequate ground instrumentation is not available for low visibility landings.