

World Heritage Sites

Protected
Areas and
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Heritage



KLUANE / WRANGELL-ST ELIAS / GLACIER BAY / TATSHENSHINI-ALSEK UNITED STATES OF AMERICA & CANADA

This is the largest transboundary protected area in the world, ranging from coastal and taiga forests and alpine meadows to arctic and glacial wilderness, displaying a vast and scenic range of natural processes. The four parks are remote and of immense size: large-scale ecological processes exist there relatively undisturbed. The Wrangell - St. Elias Mountains contain the highest coastal range and ten of the fifteen highest peaks in North America, the four highest peaks in Canada and the second highest peak in the United States, over 380 glaciers, the world's largest non-polar icefield, the longest valley glacier and the largest piedmont glacier on the continent. The salmon-rich Tatshenshini-Elsek rivers make the only ice-free vegetated link between the Pacific and the interior. Glacier Bay is a deeply dissected land of dynamic retreating and advancing glaciers, with an ecological range from a marine continental shelf to arctic summits. The parks are a refuge for large self-regulating populations of grizzly bear, Dall's sheep, mountain goats and many other species.

COUNTRIES

United States of America and Canada

NAME

Kluane / Wrangell-St Elias / Glacier Bay / Tatshenshini-Elsek

NATURAL WORLD HERITAGE TRANSBOUNDARY SERIAL SITE

- 1979: Kluane National Park Reserve in Yukon Territory, Canada and Wrangell-St Elias National Park and Preserve in Alaska, U.S.A. inscribed on the World Heritage List as a joint site under Natural Criteria vii, viii, ix and x;
- 1992: Glacier Bay National Park, Alaska, U.S.A., inscribed on the World Heritage List as an extension to the above parks under the same criteria;
- 1994: Tatshenshini-Elsek Provincial Park, British Columbia, Canada, inscribed on the World Heritage List as an extension to the above parks under the same criteria.

STATEMENT OF OUTSTANDING UNIVERSAL VALUE [pending]

The UNESCO World Heritage Committee issued the following statement at the time of inscription.

Statement of Significance

The Kluane/Wrangell-St. Elias/Glacier Bay/Tatshenshini-Elsek national parks and protected areas along the boundary of Canada and the United States of America are the largest non-polar icefield in the world and contain examples of some of the world's longest and most spectacular glaciers. Characterized by high mountains, icefields and glaciers, the property transitions from northern interior to coastal biogeoclimatic zones, resulting in high biodiversity with plant and animal communities ranging from marine, coastal forest, montane, sub-alpine and alpine tundra, all in various successional stages. The Tatshenshini and Elsek river valleys are pivotal because they allow ice-free linkages from coast to interior for plant and animal migration. The parks demonstrate some of the best examples of glaciation and modification of landscape by glacial action in a region still tectonically active, spectacularly beautiful, and where natural processes prevail.

Criterion (vii): The joint properties encompass the breadth of active tectonic, volcanic, glacial and fluvial natural processes from the ocean to some of the highest peaks in North America. Coastal and marine environments, snow-capped mountains, calving glaciers, deep river canyons, fjord-like inlets and abundant wildlife abound. It is an area of exceptional natural beauty.

Criterion (viii): These tectonically active joint properties feature continuous mountain building and contain outstanding examples of major ongoing geologic and glacial processes. Over 200 glaciers in the ice-covered

central plateau combine to form some of the world's largest and longest glaciers, several of which stretch to the sea. The site displays a broad range of glacial processes, including world-class depositional features and classic examples of moraines, hanging valleys, and other geomorphological features.

Criterion (ix): The influence of glaciation at a landscape level has led to a similarly broad range of stages in ecological succession related to the dynamic movements of glaciers. Subtly different glacial environments and landforms have been concentrated within the property by the sharp temperature and precipitation variation between the coast and interior basins. There is a rich variety of terrestrial and coastal/marine environments with complex and intricate mosaics of life at various successional stages from 500 m below sea level to 5000 m above.

Criterion (x): Wildlife species common to Alaska and Northwestern Canada are well represented, some in numbers exceeded nowhere else. The marine components support a great variety of fauna including marine mammals and anadromous fish, the spawning of which is a key ecological component linking the sea to the land through the large river systems. Populations of bears, wolves, caribou, Dall sheep and mountain goats that are endangered elsewhere are self regulating here. This is one of the few places remaining in the world where ecological processes are governed by natural stresses and the evolutionary changes in a glacial and ecological continuum

INTERNATIONAL DESIGNATION

1986: Glacier Bay - Admiralty Island designated a Biosphere Reserve under the UNESCO Man and Biosphere Programme (1,515,015 ha).

IUCN MANAGEMENT CATEGORY

Kluane National Park and Reserve:	II National Park
Tatshenshini-Alsek Provincial Park:	Ib Strict Nature Reserve
Wrangell-St Elias National Park & Preserve:	II National Park
Glacier Bay National Park & Preserve:	II National Park

BIOGEOGRAPHICAL PROVINCES

Yukon Taiga (1.3.3) / Sitkan (1.1.2)

GEOGRAPHICAL LOCATION

The composite site is in the area where southeast Alaska becomes the Alaska panhandle, which divides the Yukon and British Columbia from the Pacific coast:

Kluane National Park and Reserve is in the southeast corner of the Yukon, 160 km west of Whitehorse, between 60°00' to 61°20'05"N and 137°00'30" to 141°00'W. Wrangell-St Elias National Park borders it on the west, Tatshenshini-Alsek Park borders it on the south;

Tatshenshini-Alsek Provincial Park is in the northwesternmost corner of British Columbia, in the Haines Triangle between Kluane & Glacier Bay Parks, between 58°54' to 60°00'N by 136°29' to 139°03'W.

Wrangell-St Elias National Park & Reserve, 300 km east of Anchorage, is in the interior of southeastern Alaska but includes 200 km of coast, including the Malaspina glacier. It borders Kluane Park on its east and lies between 59°40' to 62°45'N and 139°00' to 145°20'W;

Glacier Bay National Park & Preserve is in the northern fiord coast of the Alaska panhandle, 145 km west of Juneau bordering Tatshenshini-Alsek Park, between 58°10' to 59°24'N and 135°20' to 138°18'W.

DATES AND HISTORY OF ESTABLISHMENT

Canada:

Kluane

1942: Kluane Game Sanctuary established;

1976: Kluane National Park Reserve proclaimed;

1979: Kluane National Park & Reserve with Wrangell-St Elias National Park & Preserve designated a joint National Monument under the 1976 Canadian National Parks Act, and a joint World Heritage site;

1993: Use of the Canadian Parks approved by the Champagne & Aishihik First Nations Agreement: Kluane National Park established on 5,900 ha in the southeast, the remaining area becoming the Reserve;

2004: The Kluane First Nations Final Agreement signed: a Kluane National Park Management Board cooperative regime set up between Parks Canada and the Champagne and Aishihik peoples.

Tatshenshini-Alsek

1993: Tatshenshini-Alsek Provincial Park established under the British Columbia Parks to forestall the development of a major copper mine at the Windy-Craggy site;

1994: Tatshenshini-Alsek Provincial Park inscribed as an extension to the World Heritage site.

1996: Tatshenshini-Alsek Park Agreement between the First Nations and the Province of British Columbia;

1998: A MoU signed between the NPS and Parks Canada to cooperate on management & operations;

U.S.A:

Glacier Bay

1925: Glacier Bay National Monument created by Presidential Proclamation by the 1906 Antiquities Act;

1939: Glacier Bay doubled in area by proclamation; expanded again in 1978 to its present area: managed as part of Tongass National Forest to provide bear habitat;

1980: Glacier Bay designated a National Park. Glacier Bay National Preserve on the Alsek River created by the Alaska National Interest Lands Conservation Act (ANILCA). About 85% of the Park is an NPS Wilderness (IUCN: Ib);

1986: Glacier Bay recognised as a UNESCO Biosphere Reserve;

1986: Glacier Bay inscribed as an extension to the serial World Heritage site;

Wrangell-St.Elias

1978: Wrangell-St Elias National Monument created by Presidential Proclamation;

1980: Wrangell-St Elias National Park and Preserve established under the Alaska National Interest Lands Conservation Act. About 67% of the area is a National Park Service Wilderness (IUCN category Ib);

1995: First MoU between the NPS and the Hoonah Tlingit on cooperative management of the Park;

1998: A MoU signed between the NPS and Parks Canada to cooperate on management & operations;

LAND TENURE

Kluane National Park & Reserve: Federal Government of Canada; co-administered by Parks Canada Agency (PCA) and the Champagne and Aishihik First Nations.

Tatshenshini-Alsek Provincial Park: co-administered by British Columbia Parks under the B.C. Ministry of the Environment and the Champagne and Aishihik First Nations, except for various small sites managed under Park status and administered under Park use permits.

Wrangell-St. Elias National Park & Preserve: US Federal Government except for some inholdings; administered by the US National Park Service under the US Department of the Interior.

Glacier Bay National Park and Preserve: US Federal Government, except for about 80 ha of patented mining claims in Brady Icefield west of Glacier Bay, about 80 ha in two private tracts on the shoreline near Gustavus, and 4,000 ha of tentative native allotment claims which 10 people have identified for subsistence uses under the Alaska Native Claims Settlement Act of 1972 (Chapman, 1982; USDI, 1991). Administered by the US National Park Service under the US Department of the Interior.

AREA

Total World Heritage Area:	9,839,121 ha	(UNESCO WHC, 2007)
Kluane National Park & Reserve:	2,198,000 ha	(PCA, 2007)
Tatshenshini-Alsek Provincial Park:	958,000 ha	
Wrangell-St. Elias National Park:	3,368,332 ha	(NPS, 2007)
Wrangell-St. Elias Preserve:	1,963,882 ha	(NPS, 2007)
Glacier Bay National Park:	1,312,424 ha	

Glacier Bay National Preserve: 23,068 ha

This is largest contiguous transboundary protected area complex in the world.

ALTITUDES

Kluane National Park & Reserve:	600m - 5,959m (Mt. Logan)
Tatshenshini-Alsek Park:	50m - 4,663m (Mt. Fairweather)
Wrangell-St. Elias National Park:	0 - 5,489m (Mt St. Elias)
Glacier Bay National Park:	500m - 4,663m (Mt. Fairweather)

PHYSICAL FEATURES

This immense property was inscribed for its extensive glaciers, range of superlative and undisturbed natural phenomena and many habitats for rare and endangered species. The Parks contain several very high wilderness mountain ranges: the Wrangell and Chugach Mountains in Alaska, the St. Elias Mountains in Alaska and Canada, and their continuation in coastal ranges to Glacier Bay in the south. It is the widest expanse of protected areas in the world, some 690 km long by an average of 140 km wide, to a great extent inaccessible and inhospitable to man and therefore undisturbed. Moist Pacific air blankets these with the largest icefield outside the polar region. There are over 350 valley glaciers and an estimated 31 surge-type glaciers, several of which reach the sea, though many are thinning at the rate of 1.8m a year. There are many small lakes, streams and glacier-fed rivers (PCA, 2004).

The area is among the most geologically diverse and active in the world. The bedrock geology is complex. The ranges were created by the successive accretions of Pacific plates against and subducted under the North American plate. A volcanic arc formed in the tropics over a stratum of preCambrian rocks 300 million years ago. With vast accompanying lava fields later covered by extensive mid-Devonian marine sediments, this moved northward to form what is now the St. Elias fold belt in southern Alaska and northwestern Canada. The ranges have continued to be moulded by vulcanism. The area is also part of the most seismically active region in North America. The superficial geology is variable, comprising glacio-fluvial, lacustrine and aeolian deposits and loess.

Kluane National Park: This is an extensive mountain wilderness which includes Canada's highest mountain, Mount Logan in the St. Elias Range, which covers over half the area of the Park. These are geologically young mountains and have the greatest concentration in Canada of peaks over 4,400m; four are over 5,000m high. They also carry the most extensive subpolar ice-fields in the world, dating back to the last Ice Age and maintained by the moist Pacific air that flows over the mountains. Cliffs and steep slopes, stream erosion, glacial scouring and bare outwash plains are everywhere evident.

Tatshenshini-Alsek Provincial Park: The wide and little modified scenery of this Park contains the southern end of the St Elias mountains and three smaller mountain chains, and 95% remains wilderness. Mount Fairweather near the coast, is the highest point in British Columbia. Glaciers and icefields dominate the Park's western half. The eastern half consists of the lower Alsek Ranges and large expanses of alpine tundra. The geology, elevational range and natural habitats and processes displayed are very diverse. The wide U-shaped valleys of the braided Alsek River and its tributary the Tatshenshini, are part of a wholly protected catchment. At the coastal mountains the Alsek cuts a spectacular gap through which oceanic air masses reach the interior. Floods, landslides and avalanches are frequent.

Wrangell-St. Elias National Park: The Wrangell, Chugach and St. Elias Mountains form a vast landscape of high peaks, glaciers and valleys; Mount St. Elias is the second highest peak in the United States. The Park is covered by 3 million square kilometres of glacial icecap, 25% of its area, including the 121 km-long Nabesna glacier on its north slope, the 127 km long, 914m deep and 9.5 km wide Bagley Icefield in the Chugach Mountains and, on the coast, the Hubbard tidewater glacier and Malaspina Glacier, the largest piedmont glacier on the continent (3,855 sq.km). In the Malaspina foreland long straight piedmont glacial beaches are cut through by numerous wide glacial-melt drainage ways. It is protected as the Malaspina Glacier National Natural Landmark. The Park has 200 km of coastline.

The region overlies a subduction zone and is tectonically active. Mt. Wrangell (4,371m), one of twelve volcanoes in the western end of the range, is an immense shield volcano with fumaroles steaming from the summit. On the lower northwestern slopes is a 3 to 150mm sub-surface layer of volcanic ash dating from some 1,200 years ago. Elsewhere there are mud volcanoes and during the last decade there have

been nine volcanic episodes. In 2002 a 7.9 earthquake in the Alaska Range to the west rocked the north of the Park. In the north two lower mountain ranges, the Mentasta and Nutzotin Mountains, are the eastern end of the great central Alaska Range. They are the major life zone of the Park, being more densely vegetated. Extensive lowlands occur only on its northwestern fringes, in the centre of the Park, as narrow valleys and plateaux grading into the highlands, and sandwiched between mountains and sea. The principal drainages include the Copper, Chitina and White River catchments. The Copper River valley cuts a gap through the Chugach Mountains into the interior.

Glacier Bay National Park: This ocean-dominated wilderness is a superlative example of the ice-sculpted central segment of the Sitkan biogeographical province (NPS, 1984). It has been deeply dissected by glaciation and contains a wide range of landscapes and ecosystems - high mountain ranges, freshwater lakes and wild rivers, 16 tidewater glaciers and deep fiords, sea cliffs, coastal beaches and estuaries. These provide a laboratory for the study of glacial erosion and movement during a period of marked isostatic rebound (50 cm rise a year), and glacial retreat. Glacier Bay itself is a wide fjord 105 km long, which has experienced four major advances and retreats in recent time; in 1750, the Bay was only 5 km deep, being almost completely filled with the Grand Pacific Glacier. Since then it has retreated a 100 km, creating 16 tributary glaciers, many of them reaching the sea. Its six-hourly tidal range is 7.5 metres.

The Park surrounds four north-south trending mountain ranges: on the west, the Fairweather Range, the highest coastal range in the world, culminating in Mount Fairweather, the southern end of the St Elias Range; the Takhinsha Range to the north-east; and the Chilkat Range to the east. The landscape falls into three broad categories: land covered by snow, ice or bare rock (35%); tundra and successional vegetation (30%); and mature vegetation (35%). On the east and north the Park is contiguous with Tongass National Forest. The Gustavus foreland, a large glacial outwash plain near the mouth of Glacier Bay, is the largest in Alaska. The Alsek River, to which the Tatshenshini River in Canada is tributary, is one of very few rivers to breach the coastal range from the subarctic interior and its delta is the confluence of several smaller rivers. The Park has 1,415 km of coastline and its marine area covers 252,000 ha. It includes an inshore portion of the continental shelf, fiord systems of various depths and isolated saltwater bodies or 'salt chucks'. The glaciated bays have morainal sills which contribute to productive upwelling currents.

The bedrock geology shows a wide variety of depositional, intrusive and tectonic features ranging from early Palaeozoic to Tertiary which are categorised in six geological sub-provinces. One major and several lesser faults run through the Park and Preserve and earthquakes occur regularly. In 1899 an 8.4 earthquake on the coast shattered the glacier into extensive calving; in 1958 an 8.0 earthquake devastated Lituya Bay on the coast (NPS, 1984; USDI, 1991). Seventeen areas have been identified as either containing important mineral deposits or being favourable for their occurrence.

CLIMATE

The climate of the area is very varied, being the product of three contrasting regimes. Cyclonic storms from the Gulf of Alaska result in very high coastal precipitation with cool mild temperatures but with intense wind storms over the coastal mountains. In the high mountains the climate is severely arctic and the combination of permanent cold and moist air have created immense ice-fields. Annual snowfall in the icefield ranges exceeds that received anywhere else in North America. In their rain-shadow, the interior is sub-arctic, dominated by drier, more stable air, and intense winter cold. An exception to the pattern is the Alsek gap in the coastal mountains which channels moist oceanic air into the interior. Over the last 250 years climatic warming has caused glaciers to retreat dramatically. Summer days are long and light, winter days, long and dark. Frost may occur all year round.

Kluane National Park: The climate is dry continental, the area being in a rainshadow except in the southeast where changeable Pacific air surges in. Rainfall ranges from 0 to 700mm, falling all year round. Snowfall in the mountains can exceed 1,800mm; Average temperatures in the brief warm summers average 11°C (maximum 33°C); in winter, -21°C (minimum -50°C) (PCA, 2007). **Tatshenshini-Alsek Wilderness:** Rainfall: 2,000mm in the coastal ranges to 500mm inland. Temperatures vary from mild on the coast to very cold in the interior (BCPS, 2007).

Wrangell-St. Elias National Park: Winters are long, cold and dark, and the summers, warm for Alaska. The coast is wetter but the average rainfall at Gulkana on the northwest edge of the Park is 277mm, and the snowfall, 1,280mm, rising in the mountains to 1,800mm. Average temperatures vary with altitude and distance from the coast but at Gulkana they average -25°C in January and 20°C in July

(NPS, 2007b). Glacier Bay National Park. The coastal climate is mild and very wet with an average rainfall of 2,870mm. Temperatures range between a January mean high of -2°C and mean low of -7°C to a July mean high of 17°C and mean low of 8°C. Upper Glacier Bay is progressively colder with far heavier snowfall. The wind prevails from the south-southeast, but strong gales also blow from the north.

VEGETATION

The Parks have strong altitudinal zonation resulting in a typical montane-subalpine-alpine succession: from coastal and interior boreal forests through extensive alpine meadows, south slope steppes and tundra to immense icefields and arctic conditions on the peaks. There are also unusual plants on unusual types of rock and soil types: saline flats, sand dunes and volcanic ash.

Kluane National Park: The overlapping of Pacific and arctic air masses above this park results in the greatest diversity of Pacific and arctic flora north of the 60th parallel, with over 200 species although only about 18% of the park is vegetated and only 7% is forested. There are five major biomes: coastal, western mountain, arctic, northern prairie and steppe. The small area of more luxuriant vegetation in the moist southeast is a forest of western hemlock *Tsuga heterophylla* and Sitka spruce *Picea sitchensis*. The montane zone of lower valleys and slopes up to a 1,050-1,200m treeline are covered by a boreal montane forest of white spruce *Picea glauca* with balsam poplar *Populus balsamifera* and trembling aspen *P. tremuloides* interspersed with marsh, fen, and shrubland. The understorey is predominantly buffaloberry *Shepherdia rotundifolia*, dwarf or scrub birch *Betula glandulosa*, hypnum moss *Hypnum subimponens* and red bearberry *Arctostaphylos uva-ursi*. Grasslands occur in some valleys. The transitional subalpine zone above 1,400m is dominated by low-growing greyleaf willow *Salix glauca*, Barclay's willow *S. barclayi* and alder *Alnus crispa* which provide protection for smaller plants; there are also meadows of fescue grass.

Alpine tundra between 1,400 and 2,000m and in the northern area of the Park is, dominated by meadows of white dryas *Dryas octopetala*. Also prominent are Altai fescue *Festuca altaica*, Lapland cassiope *Cassiope tatrazona*, with netleaf willow *Salix reticulata*, dwarf birch, shrubby crowberry *Empetrum nigrum* and white mountain avens *Dryas integrifolia*. Summer meadows and rock ledges are showy with Arctic poppies, purple saxifrage, mountain heather, and moss campion.

Tatshenshini-Alsek Provincial Park: A number of biomes meet in the Park so it is unusually species-rich, containing 45 rare vascular plant species with many plants being at their northern or southern limits of distribution. The Park has three biogeoclimatic zones: moist ocean-influenced lower reaches with spruce-willow-birch forest and scrub; both wet and drier boreal forests of white and black spruce *Picea glauca* and *P. mariana*; and alpine tundra. Other habitats include relatively warm dry river bottoms, wet meadows, and rock. In the middle and upper Tatshenshini valley, there is an unusual sub-alpine forest with balsam poplar, an understorey of Sitka or slide alder *Alnus sinuata* and a carpet of northern ground cone *Boschniakia rossica*, a grizzly bear food. Amongst the less common shrubs are Alaska nagoon berry *Rubus articus stellatus*, fragile sedge *Carex membranacea*, wedge-leaved primrose *Primula cuneifolia saxifragifolia*, and Wright's golden saxifrage *Chrysosplenium wrightii*. A list of rare vascular plant species in the Park is given in Peepre (1992).

Wrangell-St.Elias National Park: The great diversity of sub-arctic plant communities in this Park is due to its size, its three climatic zones, maritime, transitional and interior, and its wide variety of elevations, landforms and rock types. Pleistocene glaciation over most of the area except the north has had a major effect on the distribution and composition of its flora. The dominant taxa are generally widely distributed but there are considerable differences between species in the north and south of the Park. There are three major vegetational subdivisions: coastal coniferous forest, northern coniferous forest, and alpine tundra. These subdivide further into coastal forest, Pacific coast mountains, coastal and interior lowlands and wetlands, the sub-alpine to alpine Wrangell volcanoes, the Copper plateau and the Mentasta and Nutzotin Mountains in the interior. The 929 recorded species of vascular plants comprise 56% of the Alaskan flora and includes 8 species of trees. There are also 133 lichen and 187 bryophyte species (NPS, 2007a).

The Park has over 400 ha of intertidal communities along its 200 km of coastline. The coastal lowlands are dominated by spruce-hemlock forests, tall shrub thickets, bogs and marshes. The southern mountains in the interior experience a strong coastal influence. Along the Bremner River in the interior this forest includes occasional Alaska cedar *Chamaecyparis nootkatensis* and mountain hemlock *Tsuga mertensiana* with an understorey of devil's club *Cladothamnus horridus* and menziesia *Menziesiana ferruginea*. Tall shrub thickets above 600m are dominated by alder *Alnus crispa*, copper

flower *Cladothamnus pyrolaeiflorus* and salmonberry *Rubus spectabilis*; bogs and marshes by *Poa* spp. grasses and sedge *Carex* spp. as well as by stunted hemlock.

The Park's bottomlands range from the coastal forests and Malaspina forelands to the taiga forests of the interior. Warmer soils are colonised by white spruce *Picea mariana*. Areas underlain by permafrost in lowland basins and north-facing slopes support muskeg of slow-growing black spruce *Picea glauca*. Common understorey shrubs in these areas include slide alder, dwarf birch, crowberry and Labrador tea *Ledum palustre*, several species of willows and marsh blueberry *Vaccinium fuliginosum*. Common mosses include *Hylocomium splendens*, *Pleurozium schreberi* and *Sphagnum tundrae*. Black spruce stands burn periodically, and trees of more than 100 years of age are uncommon. Wetland areas are common on the coast, in the open Copper and Chitina River basins, around Lake Ahtna, and north of the Alaska Range. The dominant wetland sedges and mosses, grasses, forbs and scattered shrubs are widespread. Wetland shrub species include leatherleaf *Chamaedaphne calyculata*, sweetgale *Myrica gale*, bog rosemary *Andromeda polifolia*, horsetails *Equisetum palustre* and *E. fluviatile*. (NPS, n.d.).

The northern coniferous biome includes closed tall spruce and deciduous forests, open, low mixed evergreen and deciduous forests, and both tall and low shrub thickets. These forests are found on floodplains, terraces and south-facing upland sites with white spruce, balsam poplar *Populus balsamifera* and paper birch *Betula papyrifera*. On drier south-facing sites there is quaking aspen *P. tremuloides* and shrubby steppe vegetation. Low open mixed evergreen and deciduous forests include permafrost forests in low land up to 1,200m in the Wrangell Mountains, with black spruce, tamarack *Larix laricina* and a shrub layer of Labrador tea, blueberry and willows. Tall shrub thickets up to 1,200m along glacial outwash rivers, beside upland streams and on steep hillsides include willow and alder. Low shrub thickets between the timberline and alpine tundra have resin birch and mosses. South-facing bluffs along the White, Nabesna, Chitina and Copper Rivers harbour rare and endemic plant species and may be unglaciated refugia. Other unique plant communities are associated with sand dunes, mud volcanoes, volcanic ash, limestone, lakes and wetlands. These rare, disjunct or refugial communities may be at the edges of their ranges and therefore more sensitive to environmental change.

The tree line varies considerably with aspect and local conditions, between 1,100m where the land is dry and rocky to 1,400m. In the more recently deglaciated Chugach mountains it is low. The alpine tundra is also very variable, depending on the site. It is extensive above the sub-alpine shrub tundra zone which varies between 1,400m on gradual slopes to 1,800 in some areas and shows the park-wide distinction between southern ocean-affected species and the species of the interior. It includes meadows of sedges and grasses interspersed with low shrubs such as blueberry and Labrador tea. Dry alpine tundra on steep and north-facing slopes and exposed ridges up to the perpetual ice line are covered with a low mat of heaths, principally *Cassiope tetragona*, mountain avens *Dryas alaskensis*, polar willow *Salix polaris* and netleaf willow *Salix reticulata*. Xeric alpine plant communities harbor numerous rare and endemic species, some of which only occur in the northern part of the Park (NPS, n.d.).

Glacier Bay National Park: The Park has four major terrestrial biomes: coastal forests, wet tundra, alpine tundra above 2,500m and glaciers with icefields. The coasts have saltmarshes, meadows then lowland forests of western hemlock and Sitka spruce with black cottonwood *Populus balsamifera* var. *trichocarpa* and Sitka alder along streams and beach fringes, and an understorey of moss, blueberry, devil's-club, skunk cabbage *Symplocarpus foetidus* and ferns (NPS, 1984). Wet tundra near Gustavus has a ground cover of sedges Cyperaceae and cottongrass *Eriophorum* sp. with lodgepole pine *Pinus contorta*, shrubby willows and Sitka alder. Forests at higher levels are dominated by mountain hemlock *Tsuga mertensiana*. Glacier and icefield moraines are colonised by pioneering communities of lichens and mosses, species of horsetail and willow, fireweed *Epilobium angustifolium* and mountain avens *Dryas drummondii*. These are followed by meadows with alder, willows, soapberry *Sapindus drummondii* and cottonwood. Above 1,750m is a mixed Alpine tundra of barren rock and rubble with woody herbaceous and shrub communities of willows and dwarf blueberry *Vaccinium caespitosum* (NPS, 1984).

Aquatic habitats include freshwater lakes, rivers, streams, muskets, and freshwater marshes. Marine habitats include subtidal meadows, neritic zones, estuaries, fiords and upper inlets. Characteristic marine algae are *Laminaria* spp., *Alaria* spp., *Ulva* spp., *Porphyron* spp., *Fucus districhus* and *Nereocystis* spp.

FAUNA

The immense size, relatively unaltered state, topographical range and remoteness of the four adjoining Parks cover an unparalleled display of natural processes where predators, migrants, and life cycles occur without disturbance by man. There are large self-regulating populations of uncommon wildlife including 14,000 Dall sheep *Ovis dalli dalli*, more than a quarter of the global population, 600 grizzly bears *Ursus arctos* and the only habitat in the world for the bluish glacier bear *Ursus americanus emmonsii*, a colour phase of the black bear found nowhere else in Canada, and rarely in Alaska (PCA, 2004a).

Kluane National Park: 29 mammals have been recorded in the Park, including the last major flocks of Dall sheep and the world's largest protected population of grizzly bear (600). There are also mountain goat *Oreamnos americanus*, moose *Alces alces* and woodland caribou *Rangifer caribou*. Other common species are arctic ground squirrel *Spermophilus parryi*, least chipmunk *Eutamias minimus*, jumping mice *Zapus* spp., snowshoe hare *Lepus americanus*, red fox *Vulpes fulva*, grey wolf *Canis lupus*, wolverine *Gulo gulo luscus*, black bear *Ursus americanus*, lynx *Lynx canadensis* and Sitka blacktailed deer *Odocoileus hemionus sitkensis*.

180 birds have been recorded, with 118 breeding species (PCA, 2004). Among them are arctic loon *Gavia arctica*, trumpeter swan *Cygnus buccinator*, harlequin duck *Histrionicus histrionicus*, white-winged scoter *Melanitta fusca*, merganser *Mergus merganser*, snow goose *Anser caerulescens*, golden eagle *Aquila chrysaetos*, gyrfalcon *Falco rusticolus*, willow and rock ptarmigan *Lagopus lagopus* and *L. mutus*, sandhill crane *Grus canadensis*, American golden plover *Pluvialis dominica*, whimbrel *Numenius phaeopus*, a variety of owls, mountain bluebird *Sialia currucoides*, Smith's longspur *Calcarius pictus*, snow bunting *Plectrophenax nivalis* and timberline sparrow *Spizella breweri*.

The streams are cold and not very productive. The fish include several species of salmon: a population of landlocked sockeye or red salmon *Oncorhynchus nerka kennerlyi* (in decline), pink or humpback *O. gorbuscha*, king or chinook *O. tshawytscha*, and silver or coho salmon *O. kisutch*, also arctic grayling *Thymallus arcticus signifer*, lake trout *Salvelinus namaycush*, round whitefish *Prosopium cylindraceum*, slimy sculpin *Cottus cognatus* and northern pike *Esox lucius*.

Tatshenshini-Alseck Provincial Park: The marginal flora harbours a parallel fauna where the conditions encourage adaptive evolution. About 53 northern interior mammal species occur (PCA, 2004). Notable species include wolverine and the bluish glacier bear. The area is one of the last strongholds of North America's grizzly bear population which is seen near rivers when the salmon are running. About 200 of the known 400 Dall sheep in British Columbia have their summer and winter range just west of the Alaska Highway and there are 300-400 mountain goats. Amphibians in the region include the western toad *Anaxyrus boreas*, and Oregon spotted frog *Rana pretiosa* (VU). Reptiles are not found this far north. Peepre (1992) provides a more complete list of the animals present.

The Park provides an important migratory route for waterfowl, with at least 125 bird species known to use the region. These include Pacific loon *Gavia pacifica*, trumpeter swan, king eider *Somateria spectabilis*, bald eagle *Haliaeetus leucocephalus*, golden eagle, northern goshawk *Accipiter gentilis*, northern harrier *Circus cyaneus*, peregrine falcon *Falco peregrinus*, gyrfalcon, ruffed grouse *Bonasa umbellus*, blue grouse *Dendrogapus obscurus*, willow ptarmigan, sandhill crane and great gray owl *Strix nebulosa*, wandering tattler *Heteroscelus incanus*, arctic tern *Sterna paradisea*, Smith's longspur and snow bunting. One recently identified butterfly new to science is a subspecies of the western meadow fritillary *Boloria epithore*; another insect, rare in British Columbia, is an Arctic yellow jacket wasp *Dolichovespula albida*, which is much darker than the common species (BCPS, 2007).

Wrangell-St. Elias National Park: Historically animal populations have been scarce in the mountains, due probably to the recentness of their deglaciation. However, there is now a great variety of fauna including 48 mammals, which reflects the diversity of habitats. Carnivores include grey wolf, coyote *Canis latrans*, red fox, short-tailed weasel *Mustela erminea*, mink *Neovison vison*, American marten *Martes americanus*, wolverine, river otter *Lutra canadensis*, brown and black bears *Ursus arctos* and *U. americanus* and lynx *Lynx canadensis*. The bluish glacier colour phase of the black bear *Ursus americanus emmonsii* is found on the coast near Yakutat. Other mammals include collared pika *Ochotona collaris* and snowshoe hare *Lepus americanus*. Rodents include arctic ground squirrel, hoary marmot *Marmota calligata*, beaver *Castor canadensis*, muskrat *Ondatra zibethicus* and porcupine *Erethizon dorsatum*. Moose and caribou range in lower elevations and mountain goat and Dall sheep range high mountainous areas. Bison *Bison bison* were introduced in 1950 and 1962. Sitka blacktailed

deer may occur along coastal fringes. On the coast are sea otters *Enhydra lutris* (EN), Dall's porpoise *Phocoenoides dalli*, Kurile harbor seals *Phoca kurilensis*, Steller sea lion *Eumetopias jubatus* (EN) and killer whales *Orcinus orca*.

The National Park Service has record of 239 species of birds for the Park, 53 being resident (PCA, 2004). The coast has many nesting shorebirds, migrating passerines and an abundant invertebrate fauna, which are the basis of a rich food chain. Two notable coastal species in decline are Kittlitz's and marbled murrelets *Brachyramphus brevirostris* (CR) and *B. marmoratus* (EN). Birds include trumpeter swan, bald eagle, peregrine falcon, spruce grouse *Canachites canadensis*, ruffed grouse, willow ptarmigan, rock ptarmigan, white-tailed ptarmigan *Lagopus leucurus*, and many song birds. 21 species of freshwater fish are found in the Park. All five species of Alaskan Pacific salmon spawn in these waters, including red salmon, chum *O. keta*, coho, humpback and chinook, also steelhead *O. mykiss*. Freshwater fish species include dolly varden char *Salvelinus malma*, lake trout *S. namaycush*, steelhead trout *Salmo gairdneri*, cutthroat trout *S. clarki*, arctic grayling, burbot *Lota lota*, round whitefish *Prosopis cylindraceum* and humpback whitefish *Coregonus oidschian*.

Glacier Bay National Park: Twenty-eight terrestrial mammals are found in the Park and Preserve, including grey wolf, increasing in number since the introduction of moose, brown bear and black bear. Other species are snowshoe hare, red squirrel *Tamiascurus hudsonicus*, short-tailed weasel, marmot, beaver and porcupine, wolverine, river otter, coyote and Canadian lynx. Sitka blacktailed deer, moose and mountain goat. Unique to Glacier Bay is the Glacier Bay water shrew *Sorex alaskanus*. Eight marine mammals include the (reintroduced) sea otter, harbour seal *Phoca vitulina richardsii* (in decline), Steller sea lion, harbor porpoise *Phocaena phocaena*, humpback whale *Megaptera novaeangliae*, grey whale *Escherichtius robustus*, minke whale *Balaenoptera acutirostrata* and killer whale.

There is a great variety of inland and coastal habitats and upwelling currents yield high seasonal levels of productivity. Of the 230 recorded bird species only 14 sea and 23 land birds are considered common. At least 65 species of seabirds migrate or breed along the outer coast of Glacier Bay National Park and Preserve and adjacent waterways. Food resources for birds are rich in invertebrates and schooling prey fish. Species include trumpeter swan, bald eagle, golden eagle, Kittlitz' and marbled murrelets (CR) and (EN). Neotropical warblers migrate through the Park

Over 237 species of fish have been recorded, many of commercial importance. These include all five species of Alaskan Pacific salmon: chum, red, silver, pink, and king. Marine fish include Pacific herring *Clupea pallasii*, Pacific cod *Gadus macrocephalus*, capelin *Mallotus villosus* and Pacific sandlance *Ammodytes hexapterus*. The finfish harvest includes Pacific halibut *Hippoglossus stenolepis* and various rockfish *Sebastes* spp. and *Sebastolobus* spp; the shellfish harvest includes red king crab *Paralithodes camtschatica*, Dungeness crab *Cancer magister*, blue king crab *Paralithodes platypus*, brown king crab *Lithodes aequispina*, and tanner crab *Chionoecetes biardi* (USA, 1991). The freshwater fish fauna is more limited and includes dolly varden char, cut-throat trout and three-spined stickleback *Gasterosteus aculeatus*, round whitefish and northern pike.

CONSERVATION VALUE

The aims of conservation are largely to reconcile the claims of local people with the growing recreational use and conservation of the integrity of the area. The four Park managers meet regularly and there is increasing cooperation with First Nation people in Canada and Alaska. The immense size, relatively unaltered state, topographical range and remoteness of these four adjacent Parks enclose an unparalleled display of natural processes and a refuge for large self-regulating populations of grizzly bear, dall sheep and mountain goats and other wildlife of all kinds. The complex of glaciers and high peaks in the St. Elias Range has the four highest peaks in Canada, the second highest peak in the U.S. and the largest non-polar icefield in the world; the Wrangell Mountains has three peaks over 5,000m in a park ranging from coastal and taiga forests to arctic wilderness. The salmon-rich Tatshenshini-Alsek rivers make the only ice-free vegetated link between the Pacific and the interior. Glacier Bay is a deeply dissected land of dynamic retreating and advancing glaciers, 16 being tidewater glaciers, with a 5,000m elevational range of stages in ecological succession from marine on the continental shelf to arctic mountain top. The whole area lies in a WWF-designated Global 200 Eco-region.

CULTURAL HERITAGE

Kluane National Park: There were settlers in southwest Yukon as long as 8,000 years ago and there is evidence for a late prehistoric culture between 1,600 and 150 years BP. Before the 19th century, the area was inhabited by the Southern Tutchone and Tlingit peoples whose descendents are the

Champagne, Aishihik and Kluane First Nations. The area was opened up to the West by fur traders and by the Klondike Gold Rush. In 1943-1944 during World War II, the North Alaskan (Haines) Highway and parallel pipeline which form the eastern boundary of the Park, were built from the port of Haines in panhandle Alaska to Haines Junction in the Yukon as a supply route for Alaska. The exclusion from the Park of the aboriginal people from the mid to late 20th century led to deterioration of the Park's ecology and of the native culture which was not passed on. However, the re-integration of these traditional inhabitants is now being funded by the government and the Southern Tutchone language is being used on signs.

Tatshenshini-Asek Provincial Park: The Tatshenshini-Asek Rivers were used as major travel and trading routes by the Tutchone of the interior and the coastal Tlingits. The village of Nesketahin, near Dalton Post, Yukon, was an important focal point. The Champagne and Aishihik First Nations who lived until recent times in fishing villages along these rivers are the descendants of these people and the land is still theirs.

In 1897 Jack Dalton, a fur trader, established the first white trading post in the Tatshenshini Basin on the Dalton trail to the Klondike goldfields, based on the old Indian routes, now the Haines or Alaska Highway. Mineral exploration, mainly for copper and placer gold, has occurred sporadically during the 20th century. In the 1980s a very large copper deposit in the Park (Windy Craggy) was discovered in the head waters of the Tatshenshini River which could have become the hemisphere's largest open-pit copper and gold mine. The establishment of Tatshenshini-Asek as a Class A Wilderness Park prevented further mineral exploration or development, and has led to all other mineral claims within the Park being extinguished.

Wrangell-St.Elias National Park: Humans entered the area as the glaciers retreated: the Park contains important Athabaskan prehistoric and historic sites 8,000 years old. There is evidence of settlement and caribou hunting in the middle Copper basin for the past 1,000 years. The Ahtna were the dominant people along the river; the coastal cultures came mainly from the southeast: first the Eyak, then the Tlingit along the coast who began to displace them between 1,500 to 500 years ago. Copper was a local item of trade for at least 1,600 years. Russian fur traders arrived in 1783, ranging over the area for 85 years. The mountain names commemorate Baron von Wrangel, arctic explorer and Russian governor of Alaska (1829-35), and St.Elias, the saint's day when they were first sighted by the Russian explorer Bering. In 1867 Alaska was purchased by the United States. The Klondike and later gold rushes in the late 19th to early 20th centuries opened the area up. In 1900 cliffs of 70% pure copper were discovered in the southern Wrangell Mountains and the rich seam was worked between 1911 and 1938 by the Kennecott Copper Corporation. Its exhaustion left a ghost town now appreciated as a relic industrial site, the Kennecott Mines National Historic Landmark. Other historical gold mining sites are the Bremner Historic Mining District, Chisana Historic Mining Landscape and the Copper Bluff segment of the Valdez Trail.

Glacier Bay National Park: The earliest evidence of occupation in the area dates back to about 10,000 years ago, though many coastal settlements have been demolished by tidal waves, storms and advancing glaciers. In the 18th and 19th centuries the territory was occupied by the Tlingits among whose main settlements were near Excursion Inlet east of the present town of Gustavus, and a permanent village at Dry Bay at the mouth of the Asek River, indicating its local importance (NPS, 1984). The Tlingits also had seasonal food gathering camps, 21 of which have been found in the Park and Preserve. The area was visited by navigators, explorers and fur-traders such as Chirikoff in 1741, first of the Russians who dominated the area until 1867 from their capital at Sitka. Cook followed in 1778, Laperouse in 1786, Vancouver, who discovered and charted the Bay in 1794, when the glacier extended to the sea. The conservationist John Muir who visited in 1879 popularised the area during the 1880s and 1890s. Later settlements rose around Western mining, fur-trading, logging, commercial fishing and pioneering. However, the damp climate and rapidly growing vegetation of the region have obliterated most of these. Two Park structures are classified as historic monuments: Harbeson cabin and woodshed (1930s-1940s) on the east shore of Dundas Bay, and Dundas Bay cannery which was active from 1900 to 1931. Cape Spencer lighthouse is listed on the National Register of Historic Places (NPS, 1984).

LOCAL HUMAN POPULATION

Kluane National Park: The Park is on the traditional lands of the Champagne and Aishihik First Nations in the southeast and the Kluane First Nation in the northwest, although on the Park's creation in 1943 they were excluded from it and the indigenous culture was ignored. Only their village of Klukshu in the

Yukon is now inhabited. Their land claims were recognised in 1993 and they now exercise a legal right to use protected areas for sustenance hunting, fishing, gathering and ceremonial and spiritual practices. The surrounding area has 1,000-1,200 inhabitants; Haines Junction just outside the Park has a population of 400 and there are a few other small settlements along the Alaska Highway (PCA, 2004a).

Tatshenshini-Alsek Provincial Park: None of the former fishing villages of the Champagne and Aishihik people along the Tatshenshini River is now inhabited. But they have successfully filed a land claim with the federal government defining most of Tatshenshini-Alsek as their traditional territory. Most now live in the Yukon but fish and hunt in the Park, mainly near the Alaska Highway. There are no roads nor, except for five roadside cabins, permanent residents in the Park (PCA, 2004a).

Wrangell-St.Elias National Park: The Ahtna are the dominant native people along the Copper River, especially in the more fertile region north of the Wrangell mountains. The Upper Tanana live on the Park's northern edge. The coast is peopled by the Eyak and Tlingit. Since the Alaska Native Claims Settlement Act was passed in 1971 the native peoples have legally acquired 364,200 ha within the Park and are permitted their customary subsistence use of its resources. The area has more than 725 mining claims on abandoned gold and copper workings, but is now thinly populated with only 200 people living on Park inholdings and some 300 along the boundary.

Glacier Bay National Park: More than 200 people live in Dry Bay during the summer for commercial and subsistence hunting and fishing in the Preserve. There is a fish processing plant and related support facilities there. At present, there are no permanent Native American settlements in the Park or Preserve, except for a summer population of about 30. The NPS does not concede that the local people have rights within the Park: there is currently no subsistence use of the 4,000 hectares of tentative native allotment claims, and portions may revert to federal ownership as land claims are resolved (USA, 1991). The local centre of Gustavus has some 400 inhabitants, the number doubling in summer. An administrative site at Bartlett Cove employs 13 people year-round and 135 in the summer. Four communities, at Hunah, a Tlingit settlement, Elfin Cove, Pelican, and Gustavus, rely on commercial fishing in and around Park waters (NPS, 1984).

VISITORS AND VISITOR FACILITIES

Kluane National Park: In 2003, an average of 66,400 visitor days were recorded for the Park. There is a seasonal visitor centre at Sheep Mountain on the Alaskan Highway, with 21,000 visitors in 2003, and another at the town of Haines Junction, with an average of 40,000 visitors by 2007, where the Park's headquarters and good hotels and restaurants are located. Controlled access to water and by horse are permitted. Camping is possible at 63 campsites. There are 200 km of trails of all degrees of difficulty, 50 km being accessible from the Alaska Highway, and 400 km of unmaintained routes. There are also guided touring, fishing and ice-fishing, mountain biking, swimming, boating, kayaking, rafting, climbing, mountaineering, cross-country skiing, snow-shoeing and dog-sledding. Kathleen Lake is a focus for water-based recreation with a 40-site campground and receives some 1,400 parties a year. Snowmobiling within the Park is permitted only there (PCA, 2004a). There are new interpretive programs for the waterways, culture and winter recreation. There is an airport at Whitehorse 130 km east and flightseeing is available. The interpretation of First Nation culture and a wider range of visitor experiences are being developed (PCA, 2007)

Tatshenshini-Alsek Provincial Park: This is a wilderness park and there are very few facilities in 2006 except for simple campsites. In 2003, 2-3,000 people rafted the Tatshenshini and Alsek rivers, paying a fee either in Kluane National Park for the upper reaches, or in Glacier Bay National Park for the trip to the coast (PCA,2004a). The rivers are icy and the Alsek is challenging, becoming impassable at Turnagain Canyon. In addition to commercial river rafting, non-commercial river rafters, kayakers and canoers use the rivers. There are 25 campsites along the two main rivers for which maps are available, hiking along old mining tracks, a number of mountain bike trails and wildlife viewing from the Alaska Highway which gives good views of the country. Guided hunting is permitted, also limited snowmobiling in an area alongside the Highway. Grizzly and black bears are common in the fall: maps are issued giving and grading bear-contact zones.

Wrangell-St.Elias National Park: This Park is publicised as the Mountain Kingdom of North America and in 2006 there were 50,336 visitors (in 2004, 57,221). There is a main visitor centre near Copper Center and a Museum for Ahtna heritage is planned. There are ranger and visitor contact stations at Slana in the north, at Chitina, McCarthy and Kennecott in the Chitina watershed, and at Yakutat on the coast.

These provide information, books and interpretive programs. 17 hunting concessions employ 65-75 guides, offering air and shuttle transport, flightseeing, backcountry and glacier trekking, tours of the Kennecott mine site, mountaineering and rafting. Two roads lead into the Park, to Nabesna and up the Chitina valley to Kennecott. At Yakutat on the coast there is ocean kayaking and whale watching. Motorboats, snowmobiles and aircraft may be used and there are several air strips throughout the Park. Although the Park does not close, winter services are few. (PCA, 2004a; NPS, 2007).

Glacier Bay National Park: There were steamship excursions in the late 19th century but these stopped after the 1899 earthquake and until 1965 there were few other tourists. By 1983 however, there were 96,000 visitors, in 1984, 89 cruise ship entries, in 1992, nearly 200,000 visitors and by 2004, 408,143 (NPS, 2004). They come by cruise ship, tour boat, charter boat and small aircraft (USA, 1991). A Park interpretive programme, cruise ship naturalists and tour boats provide various formal and informal services. Facilities in the Park include an airstrip and visitors' centre near Gustavus, a ranger station, 5 km of marked trails, guided kayak tours and a boat fuel dock. The visitor centre is at Glacier Bay Lodge at Bartlett Cove, with 55 cabin units, and a 35-unit campground from mid-May to mid-September. A one-mile recreational zone exists around the campsite. Access to the back-country is usually by tour boat which drops off kayakers, hikers, campers and skiers. Aerial sightseeing and boat charters are available (NPS, 1984). In the Preserve where there are 24 fish camps airstrips and roads, sport hunting and fishing, trapping and commercial fishing are allowed. A joint US Forest Service/National Park Service visitor information station, giving detailed information about the Park, is operated from the Centennial Building in Juneau (NPS, 1984).

SCIENTIFIC RESEARCH AND FACILITIES

In **Kluane National Park** research has been carried out on glaciology, alpine ecology, grizzly bears, bear-human conflicts, breeding birds, Kokanee salmon, visitor use and cultural history. A Kluane Boreal Forest Project has concluded and some 15 later projects are amalgamated in the long-term Kluane Ecological Monitoring Project run by the Arctic Institute Research Station, Yukon Territorial Government Environment, Canadian Wildlife Service and Yukon College. These are studying especially the effect of climate warming on the spread of sprucebark beetle and on glaciers, moose, sheep, caribou and ground squirrels. In the **Tatshenshini-Alsek** Park a number of land use studies and faunal surveys have been conducted and NGOs have carried out biophysical and land-use research. Many animals of the area remain unstudied, except for grizzly-human interaction; but an ancient ice-preserved human cadaver (*Kwaday dan Tsinchi*) has been investigated. In **Wrangell-St. Elias National Park** research has centred on monitoring of glaciers, volcanic and seismic activity, fauna, flora and fire by scientists from the University of Alaska, and big game and aquatic surveys by the Alaska Department of Fish and Game. It has been found that the local glaciers contribute to the ocean twice as much meltwater than the Greenland ice-cap. Ethnographic, archaeological and anthropological studies are also being made. Information on the Park's taxa is supplied by the ongoing NPS Inventory and Monitoring programs; this also runs interpretive and educational programs on the park's natural and cultural values (PCA, 2004a).

Glacier Bay has been studied scientifically since the 1880s and the large Harriman Alaska Expedition called by in 1999. Glacier research began as early as 1890 and has continued since 1926 under Dr W.O. Field and a cadre of geologists, glaciologists and botanists inspired by his work (USA, 1991). The area is a natural and accessible laboratory for monitoring plant succession and animal recolonisation following glacial retreat - one of the main reasons for the establishment of the National Monument in 1925 (NPS,1984). Research into terrestrial revegetation was pioneered between 1916 and 1966 by W.S.Cooper and D.B.Lawrence, and continuous documentation for more than 70 years has provided one of the most complete descriptions of vegetative development in the world, the resulting insights greatly shaping plant succession theory (NPS, 1984). Five main research areas have been geology, glaciology and climatology; terrestrial ecosystems; marine and aquatic ecosystems; resource management; and history, ethnology and anthropology (Wood *et al.*, 1984). The humpback whale has been studied and monitored for 30 years (PCA, 2004). The endangered Kittlitz's murrelet and the decline of the harbour seal, sealions and sea otters are also studied. Present research covers nine marine mammal species, bird and fish inventories, oceanography, undersea acoustic monitoring, coastal mapping and bear habitat. The Alaska Science Center of the U.S.Geological Service is collaborating with the NPS in 12 mainly water management-related projects. The Glacier Bay Science Symposium, held every five years, provides a forum for scientists working in the region to exchange information on their work (USA, 1991). The National Park Service offers logistical and communication support to research groups; the Park has a research station and it hosts a large summer research program for students, especially for the Hoonah villagers to learn more about their culture. The Park office maintains a collection of 3,500 specimens and a reference library. Long term ecological

monitoring programs for each park determine the key indicators. The condition of these is used to inform park management.

MANAGEMENT

Kluane National Park Reserve: The Park is administered by Parks Canada. Management decisions are governed by a holistic view of the Park's complex and dynamic ecosystems to conserve natural diversity and cultural values, provide for backcountry recreation, wildlife viewing, scientific research and education. In 1998 an MoU confirmed international cooperation on management of the parks. The expanded and revised Management Plan approved in 2004 lays down a program of protection and conservation through regular patrols and the compilation of a resource inventory in the Kluane Ecological Monitoring project. Land claims by the Champagne and Aishihik and Kluane First Nations have been recognised since the 1993 and 2004 agreements on their customary use of the Park's resources for sustenance, and they now also participate in the Park's management. Fishing for sport is permitted. The Park is zoned as follows: Zone I: Special Preservation - 13 areas (14%); Class II: Wilderness - most of the Park (85%); Class III: Natural Environment - a limited area and Class IV: Outdoor Recreation - a limited area (1% together). Hunting is prohibited except in the Reserve (NPS, 2004b).

Tatshenshini-Alsek Provincial Park: Tatshenshini-Alsek is co-managed by the British Columbia Ministry of Water, Land & Air Protection and the Champagne and Aishihik First Nations. During the 1980s and 1990s a coalition of over 50 conservation groups, the Tatshenshini International, campaigned to protect the area from copper mining, resulting in its designation as a Wilderness Area. As a Class A Provincial Park, exploitation of all commercial resources is prohibited unless they enhance the area's natural values; settlements, roads and activities incompatible with wilderness are prohibited. To preserve the wilderness, 171 mineral claims which predate park designation are no longer recognised and mining is prohibited. A Management Plan was approved in 2001 through open consultation with the public. The Champagne and Aishihik First Nations filed a comprehensive land claim with the federal government defining their traditional territory, including most of the Park. Since aboriginal rights to land and sustenance resource use in British Columbia are respected in protected areas, subject to conservation objectives, their representatives were co-opted into the Park's management in 1996. Apart from the Alaska Highway corridor which occupies less than 5% of the area, the entire Park is zoned and managed for wilderness preservation, back-country recreation, research and education.

Wrangell-St. Elias National Park and Preserve: These are administered by the National Park Service under the U.S. Department of the Interior under the Organic Act. About 67% of the area has been designated Wilderness. Hunting is permitted in the Preserve but not in the National Park. Agreements with the Ahtna people are being drawn up. The Park Service is to issue certificates of access to people with established and maintainable land holdings within the Park and Preserve if there are no unacceptable impacts to the park's resources. To ensure the protection and perpetuation of the region's transboundary ecosystems their cooperative management was agreed in an International Accord between United States of America, the Province of British Columbia, the Yukon Territory, the Government of Canada and the Canadian First Nations. Members meet regularly to agree common policies, joint procedures for management, search and rescue, law enforcement, employee training and the exchange and integration of data.

Glacier Bay National Park and Preserve are administered under the Organic Act by the U.S. National Park Service headquartered at Bartlett Cove, with administrative and policy guidance from the NPS regional and national directors. The designation of 85% of the Park as a wilderness area reinforces strict protection. The aims of the 1984 General Management Plan were ecosystem conservation, baseline study and monitoring, public recreation scientific research and education, and in the Preserve, the proper management of ongoing resource uses. Five zones were defined: Wilderness waters, Non-wilderness waters; Wilderness lands; Development; and Special Use. Guidelines were laid down for visitor use, land protection, natural and cultural resources and facility development in a Wilderness Visitor Use Management Plan in 1989. Both Plans are being updated. The less protected Glacier Bay National Preserve has a major commercial fishery (PCA, 2004a). Wildlife protection zones are closed during the nesting season from May 1 to September 1 and a mid-channel marine corridor in Glacier Bay is designated for motorised vessels between June 1 and August 31 to protect humpback whales from disturbance while feeding.

Although they have been heavily exploited in the past, especially at the mouth of the Alsek river, the Park's resources are now protected by law from consumptive uses such as hunting, trapping and

commercial fishing except in the Preserve though this also has Wilderness and Natural zones. Native seal-hunting is proscribed as may harvesting of marine fish and shellfish be unless they prove to be compatible with the conservation of the marine ecosystem (USA, 1991). Uniquely for the US, the establishing legislation gave management of the ocean waters, the outer coastal fringe and the bottom of the Bay to the National Park Service. Collaborating agencies include the US Forest Service, US Department of Agriculture; National Marine Fisheries Service & National Oceanic and Atmospheric Administration, US Department of Commerce; Fish & Wildlife Service, US Department of the Interior; the US Man & the Biosphere Program, US Department of State; and the Canadian Parks Service. The National Park Service cooperates with Canada to protect the watershed of the Alsek River, and provide for cooperative visitor use (USA, 1991).

MANAGEMENT CONSTRAINTS

The Parks are not yet under great stress except by comparison with the pristine quality of their wilderness. The effects of climate warming, poaching and the pressure of tourist boats and commercial fishing on Glacier Bay are the main problems. The displacement of native peoples has led to friction and the loss of traditional knowledge, and more ecologically sensitive measures are now followed.

Kluane National Park: Poaching, especially of Dall's sheep is troublesome and recently, climate warming has led to dieback of white spruce due to eruptions of spruce-bark beetles. The Alaska Highway pipeline route is close to the Park boundary and there is a pipeline right of way through the Park, although it is not in use. There are unsettled mining claims within the Park. Prospective mines and motorised tourism could become a threat to the wildlife and wilderness qualities of the Park.

Tatshenshini-Alsek Provincial Park: During the past decades the river has experienced an explosive growth in tourist use with the growing interest in rafting. Proper management and regulation are required to ensure that the wilderness is not damaged from overuse though this use is low at present. Use levels on the rivers are controlled by requiring users to hold a Park Use Permit.

Wrangell-St.Elias National Park: Senate Bill 5.49 has proposed that 9,720,000ha of the Park would be open to recreational trophy hunting. IUCN has no documentation on the significance of this threat. Mining is allowed to continue on valid existing claims but new locations are prohibited. Poaching of moose, Dall sheep and caribou, as well as the development of some inholdings is occurring.

Glacier Bay National Park: Many old land claims and rights to harvest marine resources by the Hunah Tlingits remain unresolved but remain under discussion (PCA, 2004a). Changes in natural conditions and patterns of land use, the increase in visitor pressures and number of cruise ships (now limited) may have affected the numbers of humpback whale which declined sharply in 1978 and have fluctuated at lower levels ever since (Chapman, 1982). A great but unknown amount of illegal commercial fishing takes place in wilderness waters but eventually, after several decades, 55% of the Park's marine waters will be closed to commercial fishing.

STAFF

Kluane National Park: 15 full-time plus 2 part-time employees: Park Warden and interpretive staff (graduates), administrative and technical staff, 10 seasonal and 7 term employees (PCA, 2004a).

Tatshenshini-Alsek Park: One seasonal employee located at Haines Junction and a seasonal part-time Area Supervisor (PCA, 2004a).

Wrangell-St.Elias National Park: 38 permanent full-time staff: Superintendent with Chief Ranger and planning, management, administrative, interpretive, protection and maintenance staff with 65 seasonal employees and 56 volunteers giving 2,576 hours (NPS, 2007).

Glacier Bay National Park: 51 permanent full-time staff: Superintendent, Chief Ranger, Chief Naturalist, Chief of Resources and a marine research biologist; 11 in administration, 14 in protection, 26 in resource management, 19 in interpretation, 29 in maintenance; also 48 seasonal employees. There are ranger stations at Bartlett Cove and Dry Cove. A range of expert assistance on training, conservation and management is available from several sources (PCA, 2004a).

BUDGET

Kluane National Park: Government funding for 2004: US\$3,000,000 (PCA, 2004a).

Tatshenshini-Alsek Provincial Park: Government funding US\$50,000 annually (PCA, 2004a). In 1993, river rafting generated about CDN\$2,000,000 in seasonal economic activity, most of which is split between Canadian and American outfitters (Adventure Travel Society, 1993).

Wrangell-St.Elias National Park: Government funding in 2005 was US\$4,003,000 for management, administration, interpretation, and protection (NPS, 2007).

Glacier Bay National Park and Preserve: Government funding in 2004 was US\$3,500,000 for administration, interpretation, maintenance and research (PCA, 2004a). Donations, grants and services from the Alaska Natural History Association were to be increased to \$40,000 by 2005 (NPS, 2007).

LOCAL ADDRESSES

Superintendent, Kluane National Park & Reserve, Box 5495, Haines Junction, Yukon Territory, Y0B 1L0, Canada.

Parks Canada, Yukon Field Unit, 300 Main Street, Whitehorse Y1A 2BS, Yukon Territory, Canada,

Champagne and Aishihik First Nations, Box 5309, Haines Junction, Yukon Territory, Y0B 1L0, Canada.

Director, Tatshenshini-Alsek Park, British Columbia Park Service, Ministry of Water, Lands & Air Protection, 3726 Alfred Street, Smithers. VOJ 2N0. British Columbia, Canada.

website: *Kluane Tatshenshini-Alsek (Parks Canada)*

Superintendent, Wrangell-St.Elias National Park & Preserve, PO Box 439, Copper Center, Alaska 99573, U.S.A.

website: *Wrangell-St. Elias National Park and Preserve (U.S. National Park Service)*.

Superintendent, Glacier Bay National Park and Preserve, PO Box 140, Gustavus Alaska 99826, U.S.A.

United States National Parks Service, Alaska Regional Office, 240 West 5th Street, Anchorage, AK 99501, U.S.A.

website: *Glacier Bay National Park and Preserve (U.S. National Park Service)*.

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The principal sources for the above information were the original nominations for World Heritage status and the Parks Canada Agency (PCA) (2004a). *Periodic Report on the Application of the World Heritage Convention. Section II. Report on the State of Conservation of Kluane/Wrangell-St Elias/Glacier Bay/Tatshenshini- Alsek*. Parks Canada Agency, Ottawa.

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DATES

Kluane & Wrangell-St.Elias: 1982, Updated 1994, 5-2011, January 2012.

Glacier Bay: 1986, Updated 1983-1992, 1994, 2007, 5-2011, January 2012.

Tatshenshini-Elsek: 1994, 5-2011, January 2012.