

# HUMAN USES

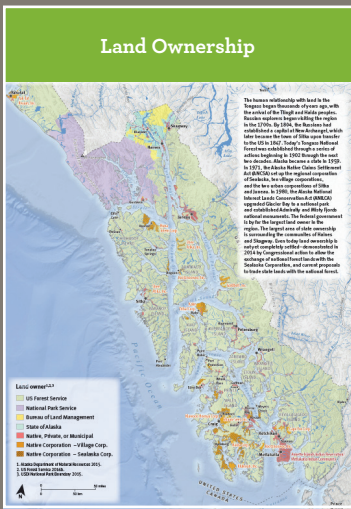
Humans did not arrive in Alaska's coastal rainforests until quite recently. The first colonists probably continued on southwards because at that time the area was mostly buried under massive glaciers. Archaeological data reveal human presence 13,000 years ago and evidence of continuous human occupation of the area is confined to the last 5,000 years. The first colonists were hunter/gatherers. They arrived without an agricultural tradition, and the cold, wet climate of Southeast Alaska was, in any case, unsuitable for agriculture development. However, the remarkably rich marine resources and the availability of massive trees whose trunks could be molded into seaworthy boats led to the development of one of the few human cultures with permanent villages and a hierarchical social structure without an agricultural base. Indigenous culture depended primarily on fish, marine invertebrates, and marine mammals (harbor seals, porpoises and whales that washed ashore). Terrestrial mammals (bears, deer, mountain goats, marmots) were eaten and were sources of fur for clothing. Baskets and clothing were woven from tree roots and bark, but the traditional culture had almost no impact on the terrestrial environment.

A major transition began with the arrival of Russians (1741), Spaniards (1775), French (1786), and English (1793) traders. Russians established a trading post at Sitka that marked the beginning of a culture based on exporting the region's natural resources. Mining was the first resource-based industry to develop in the region, followed by commercial fishing, timber and wood products, and tourism. A substantial timber and wood products industry was slow to develop because of the high operating costs in the cold, wet environment and the long distance to the mills and markets. But, owing to large governmental subsidies, a substantial timber harvest began in the 1960s and continued for several decades. Tourism and commercial fishing are today more important to the economy than mining or logging, but they are highly seasonal. The local natural resources that sustained indigenous people for millennia continue to make major contributions to the region's economic well-being but today, in marked contrast to the past, they must be managed in the context of a global economy and associated global environmental changes.

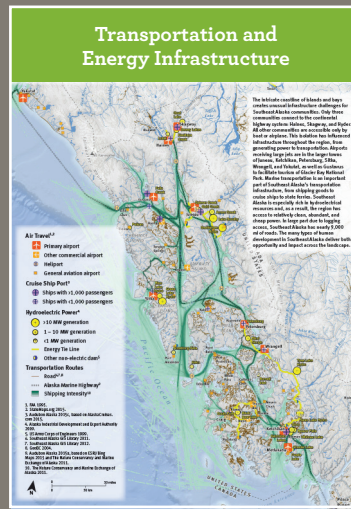
~ Gordon Orians



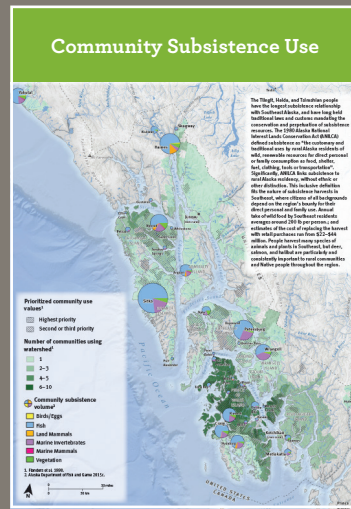
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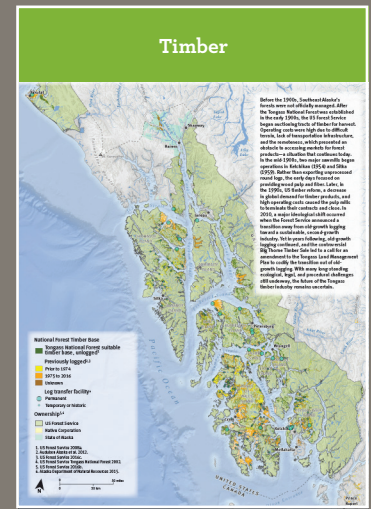
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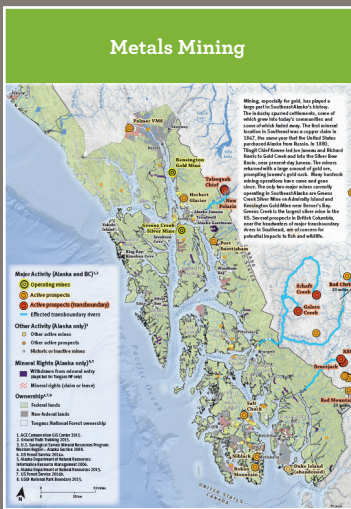
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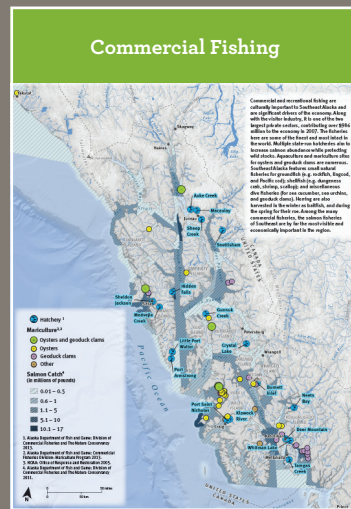
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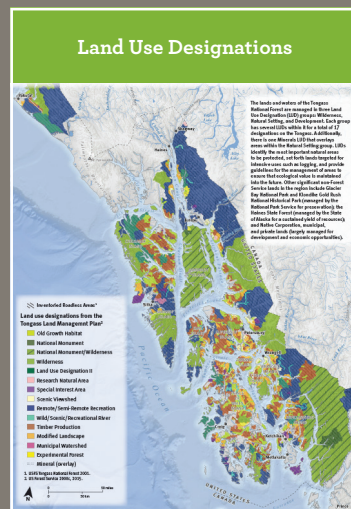
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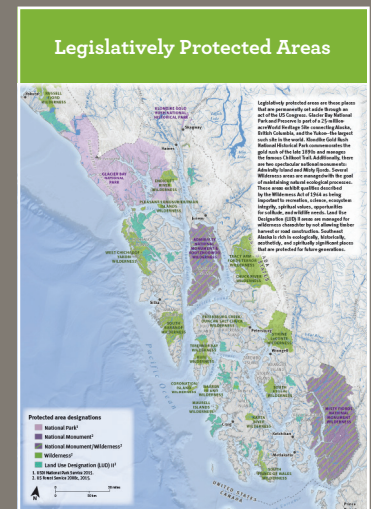
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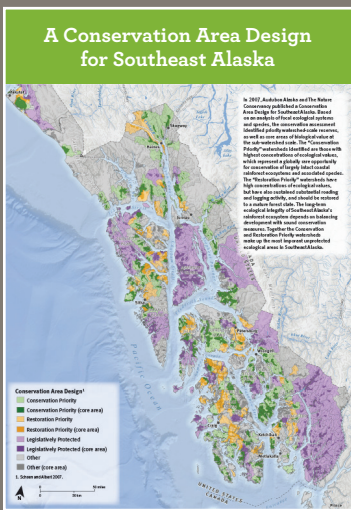
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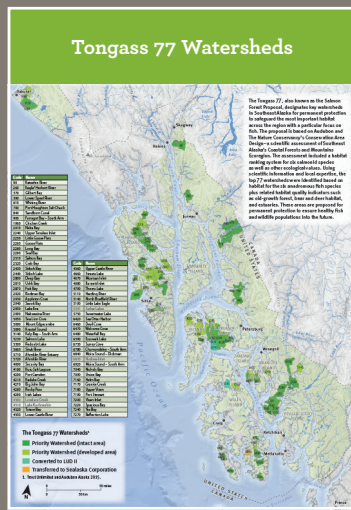
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# LAND OWNERSHIP

Susan Culliney

## HISTORY

### Land “Ownership” by Native Alaskans

The human relationship with land in the Tongass began thousands of years ago, with the arrival of the Tlingit and Haida peoples. The Tlingit occupied most of what is now the Tongass National Forest, and the Haida lived primarily on Prince of Wales Island and in areas beyond Southeast Alaska including Haida Gwaii, or the Queen Charlotte Islands (Voluck 1999). The two cultures are distinct, but share similar attributes. Both ascribed nuanced property concepts to tangible items (including land), as well as intangible items (such as names and oral histories) (Crone and Mehrkens 2013). The tribe itself exercised ownership over particular sites, including salmon streams and culturally significant locations. But individual clans or house groups held rights to actually using the physical locations for activities like fishing and gathering (Crone and Mehrkens 2013). For example, one clan or house group may have returned to using a particular berry picking location for over 2000 years (Crone and Mehrkens 2013).

Deeper understanding of the Alaska Native concept of land ownership arises from research of other Alaska cultures. Elders from the Yupiit tribe (an Alaskan tribe that occupied areas of coastal western Alaska) testified at Congressional hearings on Native land claims in the 1960s. Their remarks echo the southeast Native Alaskans’ notion that ownership is closely tied with physical use of the land. A respected Alaska anthropologist offered the following summary of the Yupiit elders’ congressional testimony:

The Native right to land . . . was not based on and could not be reduced to an isolatable relationship of possession between an individual man or group at any one point in time to a particular site. Rather, the concept of ownership expressed here is a relational one, where a man has a right to, and in fact an obligation to, use a site because of his relationship to previous generations of people who had a definite relationship to the species taken at the same place. In other words, you have a right to use a site not because you own the land, but because your grandfather hunted there and had a relationship with the animals of that area. (Case and Voluck 2012; Fienup-Riordan 1984).

Although modern property laws now impose more stringent notions of land title and ownership over Southeast Alaska, these aboriginal perspectives on land persist and are important to keep in mind when considering Alaska land ownership.

### Russian Presence

Russian explorers and colonists, drawn to Southeast Alaska by the abundance of sea otters, began visiting the region in the 1700s. By 1804, the Russians had established a capital at New Archangel, which later became the town of Sitka upon transfer to the United States. The Russians did not press land ownership claims far beyond their stockaded colonies. They chose instead to exercise dominion over the region through the export of natural resources, by harvesting sea otters (*Enhydra lutris*) and operating a few saw mills.

Whatever form of ownership Russia had over Alaska ended in 1867, when the Czar executed a Treaty of Cession to transfer the land to the United States in exchange for \$7.2 million. The treaty did not involve any Alaska Native peoples, nor did Russia or the US ever treaty directly with any Alaska tribes (Case and Voluck 2012). Some experts therefore view this land transfer as essentially a quit-claim deed, by which the United States acquired whatever property rights Russia held at the time (Case and Voluck 2012). Most Americans took a dim view toward their nation’s property acquisition, deriding the remote and chilly purchase as “Seward’s folly,” after Secretary of State William Seward who had promoted the deal.

### Early Federal Land Transfers

At first the American public’s humorous view on the Alaska purchase seemed accurate. The US did not know quite what to do with the enormous northern land mass, and attempted to open the tundra to homesteading. But the remoteness, the difficulty surveying the treacherous expanse, and the tundra’s relatively low farming quality deterred most would-be homesteaders, and the program was ultimately discontinued (Hull and Leask 2000).

But over time, Alaska’s natural value became apparent. The first half of the 1900s was marked by Congress and Presidents periodically selecting Alaskan lands for preservation as National Forests and National Parks (Hull and Leask 2000). Two of the very first Alaskan conservation land actions occurred in Southeast. In 1902 Congress established the Alexander Archipelago Forest Reserve, and in 1907 President Theodore Roosevelt established the Tongass National Forest, prior even to the establishment of Denali National Park in 1917. The two forest areas were later merged to become the Tongass of today.

The federal government also spent the years after the Alaska purchase attempting to provide land for the numerous Alaska Native tribes. During an 80 year time span, from 1891 to 1971, the US government created what were essentially Indian reservations for Alaska Natives (Case and Voluck 2012). Although these reservations were not technically reservations in the eyes of the law, the government intended that the set-aside lands provide Native Alaskans with space and resources. Additionally, the federal government granted small numbers of acres to native peoples through the Alaska Native Allotment Act of 1906 and the Alaska Native Townsite Act of 1926 (Case and Voluck 2012). The Alaska Native Claims Settlement Act (ANCSA) in 1971 ultimately extinguished these actions by providing 44 million acres to Native Alaskans in exchange for releasing claims to other lands.

The only enduring reminder of the reservations time period is the Metlakatla community on Annette Island in the Alexander Archipelago of Southeast Alaska. The story begins in Canada, where a group of native Tsimshian lived in their village of Metlakatla and ascribed to the religious teachings of an Anglican missionary named William Duncan. The group encountered difficulty with the Canadian government, and in 1887, Duncan asked the US for help in relocating the peoples who had become known as the Metlakatlans. In 1891, Congress established a reservation on Annette Island, and in 1916 President Woodrow Wilson added the coastal waters up to 3000 feet offshore (Case and Voluck 2012). The reserve was unique in that it provided land for a native group originating from outside Alaska, but regulation remained under the auspices of the federal Department of the Interior.

Metlakatla was the first federal Indian reservation established in Alaska, and remains in existence today in Southeast Alaska, as the only reservation to persist following the passage of ANCSA.

### Native Land Claims and Statehood

Alaska became a state in 1959. The Alaska Statehood Act allowed the new state to select 104 million acres for its use, which constituted almost a third of the Alaska land area. But the State selections were ultimately subservient to federal decisions and to Native land claims. First, the Act instructed the State to choose land that was “vacant, unappropriated, and unreserved” by any federal option (Alaska Department of Natural Resources 1987). Second, the State could not select “any lands or property (including fishing rights), the right or title to which may be held by any Indians, Eskimos, or Aleuts...or is held by the United States in trust for said Natives.” (Case and Voluck 2012).

At the time of statehood, some Native Alaskans had already begun filing their own land claims, with varying results (Case and Voluck 2012). In Southeast Alaska, the Tlingit and Haida tribes had already



filed a land claim in the federal court of claims. The court held that the native peoples had used and occupied their Southeast Alaskan territories such that Russia had owned those lands subject to aboriginal title, and therefore transferred only such encumbered title to the United States in 1867 (Tlingit and Haida Indians of Alaska v. US 1959; Case and Voluck 2012). Previous case law developed in the 1940s and 50s had held that Native Alaskans did not own tracts of land on an individual basis, and therefore did not have a right to monetary compensation for extractive activities such as timber sales, but these decisions did not close the issue of aboriginal title (Miller v. US 1947; Tee-Hit Ton Band of Indians v. US 1955; Case and Voluck 2012). The Tlingit-Haida ruling in 1959 essentially meant that these Alaska Natives did hold aboriginal land rights to the areas that President Roosevelt had already previously established as the Tongass National Forest in 1907. Other native tribes responded to the Statehood Act's land grant by pressing their own land claims.

Thus, only a few years after statehood, the problem of who owned Alaska had become increasingly complicated. Native claims competed with prior federal withdrawals, and there loomed the prospect that the State's land selections could add further fuel to the fire. In 1966, the US Secretary of the Interior halted the State's land selection process, pending resolution of the complex network of Native claims. The coincident discovery in 1967 of oil in Prudhoe Bay simultaneously galvanized the State to cooperate and quickly settle Native claims in order to move forward with oil production (Case and Voluck 2012; Hull and Leask 2000). The result of such fast-paced and dramatic historic events was the relatively quick passage of ANCSA.

#### ANCSA and ANILCA

In 1971, the federal law ANCSA terminated nearly all of the prior land grants made to Alaska Natives (the only exception being the Metlakatla reservation) and extinguished any remaining aboriginal claims to title. In return, the law granted 44 million acres and \$1 billion to Alaska's native peoples.

The law also imposed a complex corporate structure on Alaska Natives, organizing the tribes into more than 200 Native corporations. In Southeast Alaska, the Native corporate structure is organized into the regional corporation of Sealaska, ten village corporations, and the two urban corporations of Sitka and Juneau (Case and Voluck 2012). The law did not create village corporations for five mostly non-native communities that currently are seeking new retroactive land selections (Haines, Petersburg, Wrangell, Ketchikan, and Tenakee), but did place these villages under the regional Sealaska corporation. Tribal leaders allocated the 44 million acres from ANCSA to village and regional corporations on the basis of population, with lesser numbers of acres given to the smaller urban corporations.

The Southeast corporations chose their allotted acres from the Tongass National Forest. With a corporate eye toward revenue sharing, the corporations gravitated toward the most profitable lands (Nie 2006). The Southeast allocation ended up with fewer acres than calculated by the population-based method, perhaps in part because the Tongass land grants represented particularly lucrative opportunities in large-scale logging operations (Case and Voluck 2012).



Sheldon Museum and Cultural Center

Interior of Klukwan Whale House, circa 1895. Tlingit clan houses were rectangular in shape with a post and beam construction. The more important houses were partly subterranean with one or two step-like platforms descending to a central square enclosure from 4-6 ft below the surface of the ground. This photo of the Klukwan Whale House of the Gaanaxteidi (Raven) Clan shows many Clan and House treasures.



As a result of ANCSA, Native Alaskans have a markedly different relationship with their land when compared with Native Americans in the Lower 48 states. Unlike the reservation system, by which the US federal government occupies a sort of trustee or fiduciary role for native tribes, Alaska Native corporations hold land ownership directly as title owners.

ANCSA also included a land preservation goal. The law intended for the federal government to withdraw 80 million acres as conservation lands. But the slow pace of Congress and a lawsuit filed by the State of Alaska over conflicts between state selections and federal withdrawals prevented this provision from occurring. The conservation aim of ANCSA was finally fulfilled in 1980, when the Alaska National Interest Lands Conservation Act (ANILCA) followed through with the conservation objective.

ANILCA added 104 million acres to conservation, 56 million of which were designated as wilderness. ANILCA also placed a priority for subsistence on federal lands. Several parcels of conservation land in Southeast benefited from ANILCA's preservation objective. The law enlarged what was then Glacier Bay National Monument and established it as a national park and preserve; created the Admiralty Island National Monument; and statutorily established the Misty Fjords National Monument, thereby putting to rest a prior political struggle between the federal government and the State of Alaska over the Misty Fjords lands.

#### Final Selections & Transfers

After ANCSA cleared the way for the State of Alaska to proceed with its land selection, the State began to choose properties with an eye toward settlement, natural resources, and recreation (Alaska Department of Natural Resources 2000). The State strategically gravitated toward lands with maximum benefits, aiming for lands offering several resource values, and focusing on profitable natural resources and opportunities for economic development (Alaska Department of Natural Resources 1987). But the State would still find itself occasionally constrained in its selections, as it vied with federal withdrawals and competing Native selections. In Southeast Alaska, many of the acres the State selected came out of the Tongass National Forest, and were aimed at expanding existing towns or promoting the development of budding communities (Alaska Department of Natural Resources 1987).

Portions of the State's property eventually transferred to municipalities or to private individual ownership (Hull and Leask 2000). Today, the Alaska Department of Natural Resources grants Alaskan citizens opportunities to acquire a wide variety of property rights on state land, including staking mining claims for certain minerals, establishing trapper cabins, and obtaining shore fishery leases. And if one needed further evidence that Alaska still embodies the frontier spirit, the State of Alaska also offers land sales at sealed bids (limited to Alaska residents), "over-the-counter" sales (for those parcels not sold in the previous sealed bid), as well as a remote cabin site staking program (Alaska Department of Natural Resources 2015b). Land parcels in Southeast Alaska are particularly popular. In Southeast, sites offered in 2015 all sold quickly in the residential sealed bid (Alaska Department of Natural Resources 2015a).

Alaska land ownership is not yet completely settled. The State and the Native tribes have yet to receive the entire acreage allotted to them (Bureau of Land Management 2015). In Southeast, the Native corporation Sealaska only recently acquired all the land promised to them (Brehmer 2015), in an amended land selection process that required congressional action to allow the corporation to select outside of ANCSA-approved areas. This controversial land selection process gave the corporation ownership of very valuable timber lands previously under management by the Tongass National Forest. In 2015, a House Bill proposed to grant additional acres to the "landless natives" groups that did not receive separate village corporation status under ANCSA. It remains to be seen whether the bill will become law.

**TABLE 7-1** Summary of current land ownership in Southeast Alaska.

Landowner	Sum of Acres	Percent
Bureau of Land Management	386,260	2%
National Forest Service	16,745,197	78%
National Park Service	2,695,270	13%
Native Corporation	625,952	3%
Native, Private, Municipal, Other	629,527	3%
State of Alaska	457,577	2%
<b>Grand Total</b>	<b>21,539,783*</b>	

\*Note that due to status of various land selections and transfers, different entities choosing to include or exclude submerged lands from acreage compilations, precision of land ownership layers, and alternate definitions of the northern extent of Southeast Alaska, these acreages are not exact.

#### Current Ownership

Southeast Alaska is comprised of approximately 22.9 million acres (9.2 million ha). Today, the three top land holders in Southeast Alaska are the federal government (21.2 million ac; 8.6 million ha), Native corporations (0.6 million ac; 253,000 ha), and the State of Alaska (0.5 million ac; 185,000 ha). See Table 7-1 for more information.

Federal ownership comprises over 90% of the land in Southeast. More specifically, the US Forest Service (USFS) owns the Tongass National Forest, which at 16.7 million acres (6.8 million ha) encompasses nearly 80% of the land area of Southeast. Glacier Bay National Park & Preserve, managed by the National Park Service, covers about 2.7 million acres (1.1 million ha), or 13% of the region. The State of Alaska also owns a substantial portion of the land in Southeast, including the Haines State Forest, at 286,000 acres (115,740 ha), as well as navigable waters, tidelands, other smaller holdings. Native corporations (primarily Sealaska) own approximately 625,000 acres (253,000 ha) of land in Southeast. Municipal governments and private individuals own the remaining acres.

#### CONSERVATION ISSUES

Given the varied ownership patterns, lands in Southeast Alaska vary widely between having many restrictions and protections to having almost no restrictions on development. Understanding plans for the future development of the region is important for creating good conservation planning and policies for the people and wildlife that live there. Understanding the history of land ownership can also aid conservation managers in navigating the complex perspectives that arise in the relationship between Alaska's land and its people.

#### MAPPING METHODS

This map depicts TNF ownership using a USFS layer that details status of inholdings within the Forest boundary (US Forest Service 2016b). Lands outside of the TNF were mapped using two data sources. (1) the Alaska Department of Natural Resources (ADNR), Information Resource Management division's general land status information, at the Public Land Survey System section level, and clipped to the coastline (1:63,360 scale) This dataset is current as of October 2015. and (2) the National Park Service's official boundary dataset. This dataset is current as of December 2015.

#### MAP DATA SOURCES

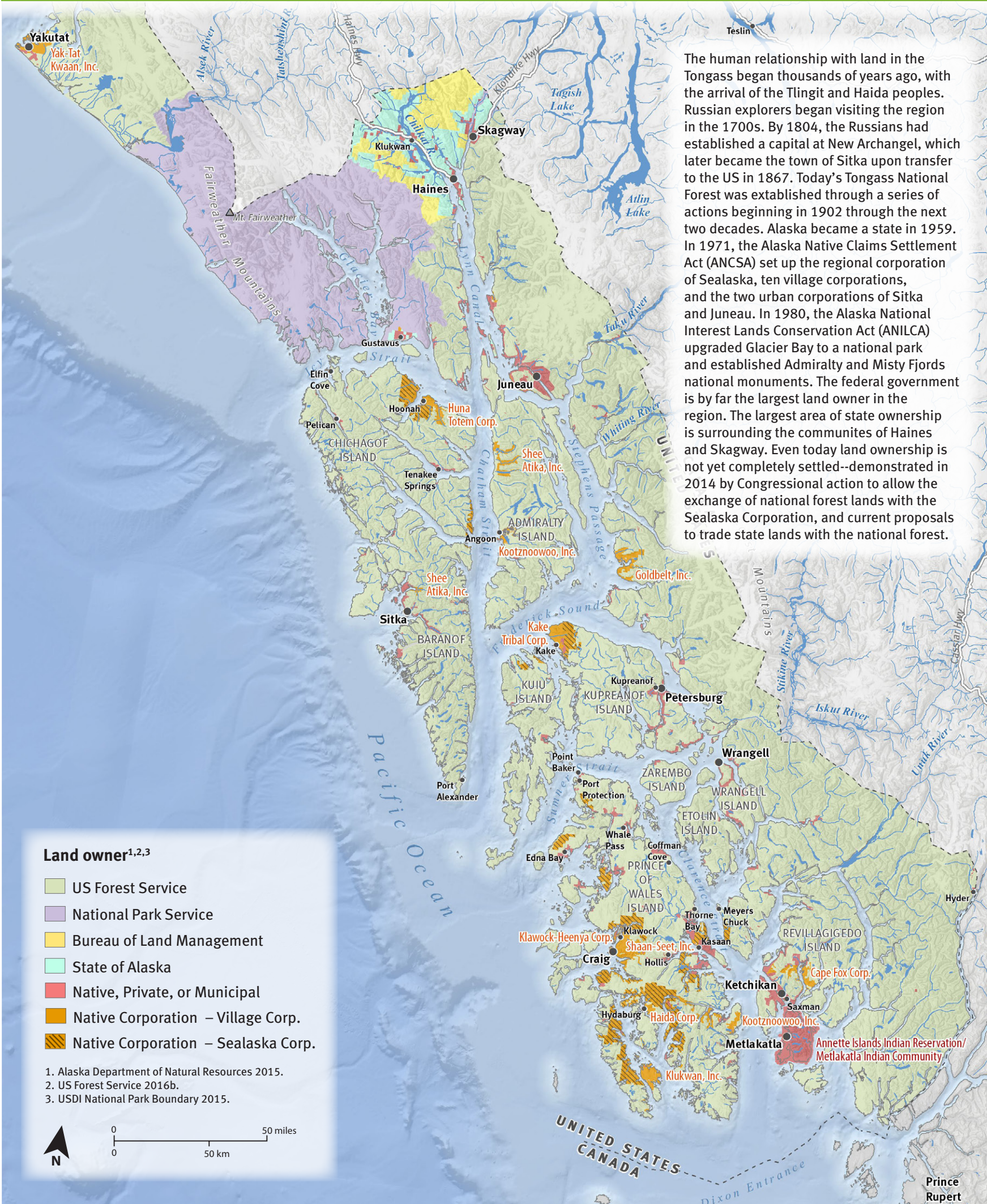
- Ownership: US Forest Service (2016b), USDI National Park Service (2015), Alaska Department of Natural Resources: Information Resource Management (2015).





# Land Ownership

The human relationship with land in the Tongass began thousands of years ago, with the arrival of the Tlingit and Haida peoples. Russian explorers began visiting the region in the 1700s. By 1804, the Russians had established a capital at New Archangel, which later became the town of Sitka upon transfer to the US in 1867. Today's Tongass National Forest was established through a series of actions beginning in 1902 through the next two decades. Alaska became a state in 1959. In 1971, the Alaska Native Claims Settlement Act (ANCSA) set up the regional corporation of Sealaska, ten village corporations, and the two urban corporations of Sitka and Juneau. In 1980, the Alaska National Interest Lands Conservation Act (ANILCA) upgraded Glacier Bay to a national park and established Admiralty and Misty Fjords national monuments. The federal government is by far the largest land owner in the region. The largest area of state ownership is surrounding the communities of Haines and Skagway. Even today land ownership is not yet completely settled--demonstrated in 2014 by Congressional action to allow the exchange of national forest lands with the Sealaska Corporation, and current proposals to trade state lands with the national forest.



**Land owner<sup>1,2,3</sup>**

- US Forest Service
- National Park Service
- Bureau of Land Management
- State of Alaska
- Native, Private, or Municipal
- Native Corporation – Village Corp.
- Native Corporation – Sealaska Corp.

1. Alaska Department of Natural Resources 2015.  
 2. US Forest Service 2016b.  
 3. USDI National Park Boundary 2015.



Map 7.1: Land Ownership



# TRANSPORTATION AND ENERGY INFRASTRUCTURE

Beth Peluso and Susan Culliney

The intricate coastline of islands and bays creates unusual infrastructure challenges for Southeast Alaska communities. Only three communities connect to the continental highway system: Haines, Skagway, and Hyder (through Canada). All other communities, including Alaska's capital city Juneau, are accessible only by boat or airplane. This isolation has influenced infrastructure throughout the region, from generating power to transportation.

## Airports

Air travel, whether by commercial jet or private float plane, is a staple in Southeast Alaska despite the often rainy weather. There are 16 airports with commercial service in Southeast Alaska. Of those, ten are considered primary commercial airports (10,000 or more passenger boardings per year), and six are non-primary commercial airports (2,500–10,000 passenger boardings per year). Airports receiving large jets are in the larger towns of Juneau, Ketchikan, Petersburg, Sitka, Wrangell, and Yakutat, as well as Gustavus to facilitate tourism of Glacier Bay National Park. Small jets service Haines, Skagway, Hoonah, Angoon, Kake, Craig, Thorne Bay, Hollis, and Metlakatla. In addition, there are 7 heliport sites, and about fifty general aviation airports in Southeast Alaska, the majority of them floatplane facilities (FAA 1995).

## Marine Vessel Traffic

Marine transportation is an important part of Southeast Alaska's transportation infrastructure, from shipping goods to cruise ships to state ferries. A recent report about marine vessel traffic examined the make-up of large vessel traffic in the Inside Passage. Based on the number of weeks operating per year, the following describes traffic by type of vessel: Ferries 28%, overnight passenger vessels (ships from 125–200 or more feet in length that carry 30–90 passengers) 21%, cruise ships 19%, freight barges 18%, tank barges 11%, log carriers 2%, and ore carriers 1% (Nuka Research and Planning Group LLC. 2012). Ferries, source of

the highest vessel traffic, recorded 327.9 operating weeks in Southeast Alaska in 2012, while ore carriers had the least number of operating weeks at 6.7 (numbers from 2011). Some of this traffic is highly seasonal, however, "vessel activity that is dominated by cruise ships, ferries and small passenger vessels in the summer months declines dramatically in the winter" (Nuka Research and Planning Group LLC. 2012). Some freight traffic passes through on the way to ports in other parts of Alaska and does not stop at Southeast Alaska ports.

## Ferries

One of the main methods of intercommunity transportation is by commercial or state ferry. From school sports teams to people traveling for medical appointments, the Alaska Marine Highway System (AMHS) connects people throughout the region. Steve Homer and Ray Gelotte started the precursor of the AMHS—the Chilkoot Motorship Lines—out of Haines in 1948. Their former navy landing craft the MV *Chilkoot* sailed weekly between Juneau, Haines, and Skagway, connecting the territorial capital to the road system. Although the company provided a valuable service, it ran into financial difficulties because it could not operate year-round. In 1951, as word spread that the service was faltering, the territorial government agreed to purchase the company (Alaska Marine Highway System 2015).

Demand increased in the growing territory, and by 1957, a new, larger ship, the MV *Chilkat*, ran daily service between Juneau, Haines, and Skagway. In Alaska's first year of statehood in 1959, residents of the new state voted for a bond to expand the ferry system to include four new vessels that would extend service to more of Southeast Alaska and up to the Kenai Peninsula. In 1967, AMHS began service to Seattle, connecting Alaska to the Lower 48; the port changed to Bellingham, Washington in 1989 (Alaska Marine Highway System 2015). In 1998, the MV *Kennicott* came online. In the wake of the *Exxon Valdez* oil spill



John Schoen

Large cruise ships in the Juneau harbor bring thousands of tourists each day during summer.



disaster in 1989, this ship was specially designed to serve as a mobile command center for emergency response to an oil spill. It includes a helipad, a floating dock stored below deck, additional communications, and decontamination showers (Alaska Marine Highway System 2015).

As of the AMHS's 50th anniversary in 2013, it provided service to 35 communities (Alaska Marine Highway System 2015). In 2014, the state ferries carried nearly 243,000 passengers and more than 78,000 vehicles (Alaska Marine Highway System 2014). With service along the spectacular Alaska coastline from Southeast Alaska to the Aleutian Islands, the AMHS is the only marine route to be designated a National Scenic Byway and All American Road (Alaska.org 2016). Additionally, the commercial Inter-Island Ferry Authority runs daily round-trip service between Ketchikan and the Prince of Wales Island community of Hollis. During the summers of 2006–2008, they also had round-trip service from Coffman Cove to Wrangell and Petersburg, but that service has been suspended. In 2014, the State of Alaska started construction on two new ferries in a shipyard in Ketchikan. The “Alaska Class” ships will hold 300 passengers and 53 vehicles. They are scheduled for completion in 2018 (Alaska Marine Highway System 2015).

### Cruise Ships

Tourism is a major economic force in the region; total visitor industry spending in the region brought in \$1.09 billion in 2013–2014 (McDowell Group 2015a). Cruise ships bring in a large number of visitors, ranging from small ecotourism boats that carry two dozen passengers to enormous vessels carrying more than 3,000 passengers. As of 2016, there are about 17 cruise lines plying the waters of Southeast Alaska. Some start their tour in either Seattle, Washington or Vancouver, British Columbia. A few smaller boats start in Juneau or Sitka and spend the entire time exploring bays and inlets. Ketchikan and Juneau have the highest number of cruise ships that dock there (AlaskaCruises.com 2015).

### Hydropower

Southeast Alaska is especially rich in hydroelectrical resources and, as a result, the region has access to relatively clean, abundant, and cheap power. Alaska Electric Light and Power Company (AELP) is a major operator of hydroelectric power in Southeast. The company began its operations in 1893 with a single water wheel and electric generator at Gold Creek in Juneau (Alaska Electric Light and Power Company 2015). This early facility supplied electricity to a few dozen of Juneau's commercial and residential customers, and generated enough power to light up to 2,500 incandescent bulbs (Alaska Electric Light and Power Company 2015). Thomas Edison had only recently invented the electric lightbulb 14 years prior, and AELP's entrepreneurial endeavors swept Juneau into an energetic modern world. Today, the operation at Gold Creek remains as a run-of-the-river facility, meaning the power plant generates electricity for Juneau seasonally, when the river runs, and ceases operations when winter temperatures freeze the flow of water.

Hydropower development in Alaska had a close relationship with mining. Mining operations needed easy access to power and provided the motivation behind many of Alaska's early hydropower plants. By 1908, there were 30 hydropower sites in Southeast, primarily established by private developers to supply the power needs of nearby gold mining operations in Juneau and Douglas Island (Alaska Center for Energy and Power 2015a). Juneau's electricity generation truly blossomed with the 1910 completion of the Sheep Creek plant, driven in large part by the energy demand of the local Treadwell mines (Alaska Electric Light and Power Company 2015). The Alaska Gastineau Mining Company, headed by entrepreneur Bart Thane, further galvanized hydropower development in Southeast by establishing the Salmon Creek Dam and the Annex Creek plant, both of which ran year round, an innovative step from the prior seasonal facilities (Alaska Electric Light and Power Company 2015).

Over the century, the industry has proven resilient. Some of the region's historic hydro facilities continue to operate reliably today (Alaska Center for Energy and Power 2015a). For example, in 1914, a power plant replaced AELP's simple water wheel at Gold Creek in downtown Juneau (Susitna-Watana Hydro 2015). Now, over 100 years later, Gold Creek remains in operation.

Operating and transmitting hydropower in Southeast is not without its obstacles. First, the balance between electrical supply and demand can be difficult to achieve, especially in the smaller towns and villages. Utilities therefore continue to use diesel powered systems as a backup, to supplement hydroelectric power generation when demand is greater than hydro supply (Alaska Center for Energy and Power 2015b). Second, energy interties between hydro projects remain uncommon, even though such interconnection would bring greater flexibility to the overall system. Ketchikan's Swan Lake facility connects to the Lake Tye facility, which primarily supplies electricity to Petersburg and Wrangell. This connection stabilizes energy production over a larger landscape. Various small projects also connect to each other, albeit on a localized level. Planning authorities recognize both the benefits of an interconnected energy system, as well as the limits and challenges to establishing interties in Southeast's wild landscape (Black & Veatch 2012).

Despite such challenges, Southeast Alaska continues to invest in hydroelectric systems to power its communities with this renewable and cheap energy source. Table 7-2 offers a list of the hydroelectric projects that presently power Southeast Alaska's human population. Future projects, which do not appear on the map, are in various stages of planning, funding, or construction, and may or may not come to fruition, depending on funding and support.

Interties connect various regional power systems, for example the Swan-Tyee intertie connects the Swan Lake power system in Ketchikan with the systems in Wrangell and Petersburg. There are a number of local interties that connect small communities, allowing them to share excess power.

The largest hydroelectric facility currently operating in Southeast Alaska is the Snettisham Hydroelectric project, located about 30 miles southeast of Juneau (Alaska Industrial Development and Export Authority 2016). The US Corps of Engineers built Snettisham in 1979 and sold the facility to the State of Alaska in 1998. Today, AELP operates Snettisham under contract with the Alaska Industrial Development and Export Authority (AIDEA), a public corporation of the State of Alaska that is legislatively mandated to promote growth and progress in Alaska. Snettisham generates 80% of the power used by Juneau and Douglas, with a capacity of 78 megawatts. In comparison, the Hoover Dam has a capacity of 2080 megawatts, but serves the power needs of some of the most densely populated areas of the western US.

Two of the facilities mentioned in Table 7-2 (the Black Bear Lake facility on Prince of Wales Island, and the Goat Lake project near Haines and Skagway), are certified as Low Impact by the Low Impact Hydropower Institute. The Institute's certification program assesses a facility based on standards for river flow, water quality, fish passage and protection, watershed protection, threatened and endangered species protection, cultural resource protection, and recreation (Low Impact Hydropower Institute 2015).

### Logging Roads

In the logging industry's early days in Southeast Alaska, there was little incentive to build roads in such a remote and challenging terrain. Instead, during the late 1800s and early 1900s, loggers accessed timber via the coastline, and felled giant trees directly into the water, where boats then tugged the logs to sawmills (Sisk 2007c). It was not until World War II, and the accompanying demand for Sitka spruce, that loggers began to require roads in order to access the timber beyond easy coastal reach (Sisk 2007c).

Even early on as people began constructing roads in the Tongass seeking materials for sawmills, it was difficult to locate and access trees that were large enough for lumber processing. The USFS and the timber industry instead began turning their attention toward pulp harvest (Sisk 2007c), in which smaller and excessively branching trees are reduced to pulp for paper and other products.

In the 1950s, the USFS drew up contracts for two pulp mill operations, one in Sitka and one in Ketchikan. The agency sold a third area of pulp timber near Wrangell, but no pulp mill materialized there. The two pulp



mills at Sitka and Ketchikan began building logging roads in order to access the raw timber.

Under their contracts, the pulp mills were responsible for road building costs. But the contracts also provided for reimbursement in the form of credits against the payment for timber (Sisk 2007c). The USFS essentially used road building as a form of currency in timber sales. Southeast's two pulp mills operated for close to 50 years, each finally closing permanently in the 1990s. But the pulp mill legacy remains written on the landscape in the form of logging roads.

Road building in the difficult terrain and climate is more expensive than almost anywhere else in the world where timber is produced. In 2008, road building cost \$185,000 per mile in the Tongass, with maintenance and repair costs estimated at \$50,000 per mile (US Forest Service 2008b). Prior to pulp mill operation in the 1950s, logging roads were rare in Southeast. By 2008, there were 4,941 mi (7,952 km) of roads within the National Forest, and 3,906 mi (6,286 km) of non-USFS roads in Southeast (US Forest Service 2008b). Once these publically funded roads are built, local use makes their closure or curtailment politically difficult (Person and Brinkman 2013), thereby making their impact on the landscape long-lasting.

## CONSERVATION ISSUES

### Airports

Airports provide an essential transportation service for communities in Southeast Alaska, but they also can have, sometimes literally, impacts on birds.

The Juneau Airport was built in the Mendenhall River wetlands because of the scarcity of flat ground in the city. The open lands and tidal flats around the airport provide habitat for many birds and the trails there are a favorite place for local birders. A major safety concern for the airport, both on land and floatplane airstrips, are bird strikes. If a plane runs into a large bird—such as a Bald Eagle (*Haliaeetus leucocephalus*), Common Raven (*Corvus corax*), goose, large gull, or duck—it can be fatal for the bird and very hazardous for the plane.

A report from Juneau Audubon discusses various methods for reducing risks of bird strikes. Knowledge of bird behavior is crucial. Hazing waterfowl, for instance, sometimes scares the birds into circling, crossing the runway multiple times, and possibly increasing the hazard temporarily (Carstensen and Armstrong 2004).

At the Juneau airport, clearing a segment of trees surrounding a stream to try to open the view for the control tower and to remove habitat for Great Blue Herons, waterfowl, and Bald Eagles had the opposite effect of drawing larger birds to the suddenly more open habitat. These larger birds are not as maneuverable as smaller birds, therefore tend to avoid tight spaces such as dense forest where they can't see predators and have trouble taking flight. In hindsight, the report suggests that an alternative plan that had been discarded, of simply topping the trees but leaving them standing, could have been more effective. Removing the tops of the trees would open the sight line for the tower, but still provided habitat unappealing for larger birds (Armstrong et al. 2009).

The report states that foraging habitat is the most attractive to birds, and that it's easier to deter birds from nesting or roosting habitat than feeding areas. A bird can abandon a nest or roost, but it always needs to eat. By that logic, creating the least attractive habitat for "hazard" birds closest to the runway and very attractive habitat further away might be a better strategy for dealing with birds. For example, planting evergreen shrubs that dissuade large birds close to the runway and using gravel instead of grass with seeds would make the runway more unappealing to waterfowl. A combination of allowing waterfowl hunting and also closing areas for hunting to draw waterfowl away from airport hazard areas could also be a tool (Armstrong et al. 2009).

Overall, these strategies for reducing risks of bird strikes are not one-size-fits all, but rely on knowledge of local ecology and bird behavior in conjunction with the safety needs of the particular airport.

### Marine Vessels

As cruise ship travel increases in Southeast Alaska, concerns over potential side effects of the sheer volume of visitors has reared up. Specifically, how and where do cruise ships, which can hold several thousand people, dispose of wastewater? State waters extend three miles off Alaska's coast, then beyond that the jurisdiction changes to federal waters. Cruise ship wastewater, depending on how thoroughly treated it is, can hold varying levels of heavy metals, such as copper and zinc, and ammonia that can be harmful to marine life. Copper, for example, may soak out of shipboard plumbing, and can harm a salmon's ability to navigate to spawning streams. Ammonia, a component of human waste, can be fatal for marine life (Demer 2014).

In 2006, several incidents of cruise ships releasing pollutants in Juneau and other places spurred a voter initiative calling for strict water quality regulation. The initiative would have required that treated wastewater had to pass water quality standards that it would not harm marine life at the point of discharge, but the regulations were never implemented (Demer 2014). A new state law in 2013 overrode the voter initiative, allowing cruise ships to discharge treated water in Alaska state waters or at dock. The idea was that treated wastewater would be diluted in mixing zones. Opponents say the law sacrifices water quality, while proponents say that wastewater treatment technology is high enough to eliminate concerns about water quality. Tests for water quality are not required at the site of dumping, however, but within 90 yd (82 m) of the source. As of the summer of 2015, 18 cruise ships had permits to dump wastewater either at the dock or in Alaska waters (Schoenfeld 2015).

Cruise ships have to record when they discharge wastewater, but don't have to provide notice to nearby fishermen or other marine area users. Conservation groups suggest that a good step forward would be to ban the discharges in sensitive habitat, such as fish and wildlife refuges and sanctuaries. At the very least cruise ships should provide notice to other users nearby when they will be discharging wastewater (Demer 2014).

Another hazard for marine wildlife is underwater noise produced by vessel engines. A National Park Service study in the marine soundscape of Glacier Bay gives a good set of recommendations for managing underwater noise pollution (Gabriele et al. 2011). Many marine mammals such as whales rely on sound for communication within their social groups, for locating prey, detecting predators, and for navigation. Noise from ships and private vessels can create a background din that is damaging to marine mammals, which are unable to avoid exposure. While removing vessels from an area is the only way to completely solve the problem, the study determined that a surprisingly simple step could reduce harmful noise pollution. Slower vessel speeds, and therefore lower decibel levels, made a surprising amount of difference. A marine mammal would have to listen to a cruise ships moving at 13 knots for 7.5 times longer than a ship moving at 20 knots to reach the same level of noise exposure. Slower vessel speeds in important marine mammal habitat could provide a good guideline for minimizing harmful effects of marine vessel traffic (Gabriele et al. 2011).

### Hydropower

Small hydropower projects have been a part of Southeast power generation since the gold rush. Rather than massive dam projects like on some Lower 48 rivers, dispersing these smaller projects, using mountainous terrain and lakes to assist in water flow, has less ecological impact than damming large river systems.

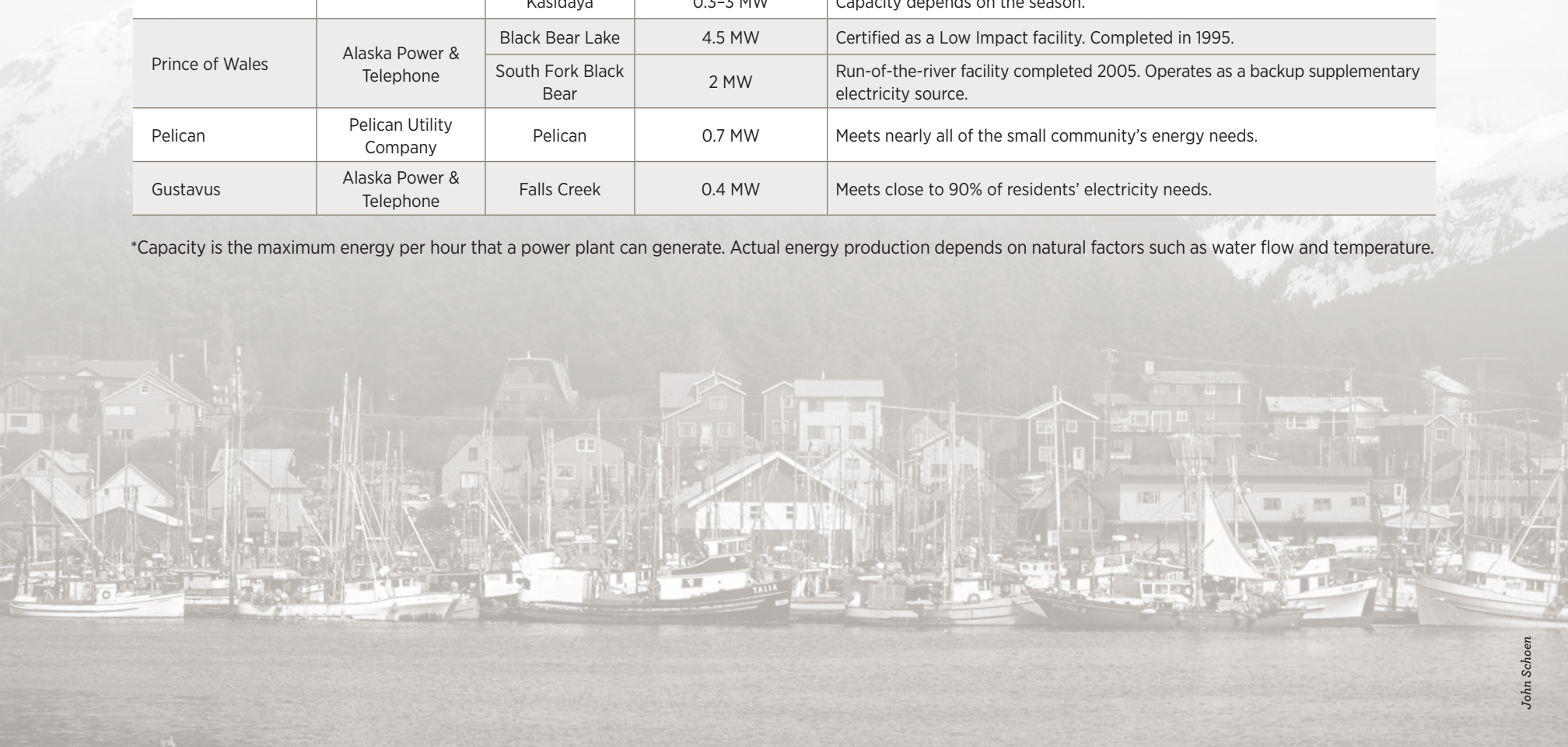
The Snettisham project, which provides about 65% of the power for Juneau's AELP, is an example of using terrain for lowering ecological impact. Instead of a large dam, this project consists of two mountain lakes and an 8,400-foot tunnel that brings water from the lakes to the hydropower turbines. The natural elevation drop provides the water current for the turbines. A 44-mi (71-km) transmission line delivers the power to Juneau. This facility started producing power in 1972 from Long Lake, and in 1990 the nearby Crater Lake facility added to the project's power generation. The excess power produced by this and other Juneau hydropower is sold both to the Greens Greek mine on



**TABLE 7-2** List of hydroelectric projects powering communities in Southeast Alaska (Renewable Energy Alaska Project 2016).

Community	Owner/Operator	Hydro Project Name	Capacity (megawatts)*	Notes
Juneau	AELP	Snettisham	78 MW	Supplies 80% of the electricity demands in Juneau and the surrounding area.
		Annex Creek	3.6 MW	Established in 1915 by the Gastineau Alaska Engineers; automated in 1977. Supplies 10% of Juneau's power.
		Salmon Creek	6.7 MW	Hydro facility first established at the site in 1913, but the infrastructure present today was constructed in 1984. Supplies 10% of Juneau's power.
		Gold Creek	1.6 MW	Seasonal run-of-the-river facility built in 1914 in downtown Juneau.
		Lake Dorothy	14.3 MW	Also supplies energy directly to Princess Cruise Lines and the Greens Creek Mining Company.
Ketchikan	Ketchikan Public Utilities	Silvis Lake	2.1 MW	Built in 1968.
		Beaver Falls	5.4 MW	Three generators built 1947-1954.
		Ketchikan Lakes	4.2 MW	Three generators built 1923-1957.
	Whitman Lake	4.6 MW	Completed in 2014.	
	SEAPA	Swan Lake	22.4 MW	Connected to the Lake Tyee facility in Wrangell/Petersburg via the Swan-Tyee intertie.
Wrangell	SEAPA	Tyee Lake	20 MW	40 miles southeast of Wrangell. Supplies electricity for Wrangell and Petersburg; connected to Swan Lake facility via Swan-Tyee intertie.
		Blind Slough	2 MW	Operating since the 1920s. Water flow sometimes used at nearby hatchery. Supplies 20% of Wrangell's power.
Petersburg	Petersburg Municipal Light and Power	Petersburg	2 MW	
		Blind Slough	2 MW	Operating since the 1920s. Water flow sometimes used at nearby hatchery.
	SEAPA	Tyee Lake	20 MW	Supplies electricity for Wrangell and Petersburg; connected to Swan Lake facility via the Swan-Tyee intertie.
Sitka	City and Borough of Sitka, Electric Department	Green Lake	18.6 MW	Fills the majority of the city's power.
		Blue Lake	18 MW	Recently expanded from a 6 MW capacity.
Metlakatla	Metlakatla Power and Light	Chester Lake	1 MW	
		Purple Lake	3.9 MW	
Haines	Alaska Power & Telephone	Goat Lake	4 MW	Natural lake used without a dam. Certified as a Low Impact facility.
		Kasidaya	0.3-3 MW	Capacity depends on the season.
		Lutak	0.3 MW	Run-of-the-river facility began operating in 2002.
Skagway	Alaska Power & Telephone	Goat Lake	4 MW	Natural lake used without a dam. Certified as a Low Impact facility.
		Dewey Lakes	0.9 MW	Run-of-the-river facility built in the early 1900s.
		Kasidaya	0.3-3 MW	Capacity depends on the season.
Prince of Wales	Alaska Power & Telephone	Black Bear Lake	4.5 MW	Certified as a Low Impact facility. Completed in 1995.
		South Fork Black Bear	2 MW	Run-of-the-river facility completed 2005. Operates as a backup supplementary electricity source.
Pelican	Pelican Utility Company	Pelican	0.7 MW	Meets nearly all of the small community's energy needs.
Gustavus	Alaska Power & Telephone	Falls Creek	0.4 MW	Meets close to 90% of residents' electricity needs.

\*Capacity is the maximum energy per hour that a power plant can generate. Actual energy production depends on natural factors such as water flow and temperature.





Admiralty Island, reducing the mine's use of diesel generators. Power is also sold to cruise ships when they are docked, reducing air pollution while the ships are in port (Alaska Industrial Development and Export Authority 2016).

As interties are developed between small hydropower facilities in the region, siting of transmission lines to avoid roadless areas, protected lands, or old-growth forest reserves should be taken into consideration. In the 2008 Tongass Land Management Plan (TLMP), several land use designation categories are considered transportation and utility system "avoidance areas," which are defined as areas where "Transportation and utility sites [TUS] or corridors may be located within this LUD [land use designation] only after an analysis of potential TUS corridors has been completed and no feasible alternatives exist outside this LUD." The LUD categories where the TUS avoidance areas apply include: Wilderness, Non-Wilderness National Monument, Research Natural Area, Special Interest Area, Remote Recreation, Municipal Watershed, Old-Growth Habitat, Land Use Designation II, Wild River, Scenic River, Recreational River, Experimental Forest, and some Minerals use areas. The TUS LUD does specify that powerlines should be buried or submerged where feasible (US Forest Service 2008d). Although utility corridors are not absolutely prohibited in these areas of the Tongass, every effort should be made to find alternative, less disruptive routes and follow these recommended land use guidelines whenever possible. As currently proposed, the 2016 TLMP amendment does not carry these standards forward. Such areas should be avoided by development regardless of whether the TLMP keeps the standards in place.

#### Logging Roads

Ironically, the same qualities that make road building costly in the Tongass are the same attributes that are lost when another road conquers this ruggedly beautiful forest. Roads that cross forest streams may hamper anadromous fish movements. There is some indication that current bridge building standards do offer adequate fish passage, but older bridges may use culverts that are placed too high above the water level for migrating salmon to meaningfully access (Person and Brinkman 2013). Roads also offer easy access to hunters seeking legal and illegal harvest of wolves, bears, and deer.

Those wild areas that do remain in the Tongass National Forest may now retain their roadless character. In the last days of the Clinton administration, the Department of Agriculture promulgated the "Roadless Rule," which prevented new roads from being built in presently roadless areas within the Tongass and other national forests (US Forest Service 2001). The subsequent Bush administration delayed the rule's implementation and eventually negotiated with the State of Alaska to exempt the Tongass National Forest (US Forest Service 2003). However, in 2015, the Ninth Circuit Court of Appeals affirmed a lower court decision that the roadless rule does by law apply to the Tongass (Organized Village of Kake et al. v. USDA 2015, at 31). In March 2016, the US Supreme Court denied hearing an appeal from the lower court, leaving the rule in place that blocks new road building in the wild and roadless areas of the Tongass. Roads may, however, continue to appear in areas where roads already exist, and on land owned by other entities.

A high density of roads per square mile fragments the forest such that wildlife experience greater human traffic and less refuge in which to replenish their populations (Person and Brinkman 2013; Person and Russell 2008). Such a case was recently exhibited by the steep decline of the Prince of Wales Complex population of Alexander Archipelago wolves (*Canis lupus ligoni*). In 1994, there were an estimated 352 wolves in the Prince of Wales Island Complex (Person et al. 1996). In 2014, the Alaska Department of Fish and Game (ADFG) estimated there were 89 wolves remaining there (Alaska Department of Fish and Game 2015e). The drop from 352 wolves to 89 represents a 75% decline in the region's wolf population over 20 years. The direct take of wolves is the immediate issue facing the population. An estimated 87% of wolf mortality is human-caused through hunting, trapping, and illegal poaching (Person and Russell 2008). A recent Audubon Alaska (2015d) report determined much of the human-caused mortality can ultimately be indirectly attributed to six decades of aggressive old-growth clearcut logging and road-building on Prince of Wales and surrounding



Melanie Smith

Float planes are a common form of transportation in the region.

islands. The roads that are built to support the logging effort provide easy access points for poachers to enter the forest and kill wolves; the Prince of Wales Complex has over 4,200 mi (6,759 km) of roads. The report recommends that the Forest Service halt large-scale old-growth clearcut logging and road-building for the ongoing Big Thorne sale and end future large-scale old-growth sales in the Prince of Wales Complex. The Forest Service should also aggressively close and decommission existing logging roads to reduce human access to wolves.

#### Juneau Access Road

Juneau, the capital of Alaska, is only accessible by air or sea—there is no road connection to the mainland interstate system (Federal Highway Administration 2006). The Juneau Access Road, also called the Lynn Canal Highway, is a controversial proposed major infrastructure project that would build a highway connecting Juneau to Skagway and the mainland road system, although it would still require a day-boat ferry connection to complete the route (Moritz 2015).

Discussion of the road project began before 1972, but the state didn't acquire funding for the first feasibility study until 1987. In 2006, the Alaska Department of Transportation and Public Facilities' Environmental Impact Statement (EIS) announced the currently contested route that involves about 50 mi (80 km) of highway along the steep east side of Lynn Canal to the Katzechin River, where it would connect with a ferry terminal about 18 mi (29 km) south of Skagway. The ferry would take vehicles the rest of the way to Haines and Skagway (Alaska Department of Transportation and Public Facilities 2014; Wikipedia 2016a, b). In 2009 a US District Court decision, upheld in 2011 by the US Court of Appeals for the Ninth Circuit, ruled that the decision was invalid because it did not consider any alternatives that improved transportation using existing ferries. The State began a Supplemental EIS, which was still not released as of May 2016 (Alaska Department of Transportation and Public Facilities Southcoast Region 2016).



Lynn Canal is a steep-sided fjord. There are more than forty avalanche chutes along the proposed route (Alaska Department of Transportation and Public Facilities 2014). Possible ecological impacts include loss of wetlands and old-growth forest, including reduction of brown bear habitat and Bald Eagle nesting habitat. The preferred alternative in the 2014 Draft Supplemental EIS would cause the loss of about 61 ac (25 ha) of wetlands and about 32 ac (13 ha) of intertidal and subtidal habitat. The road bed would affect groundwater flow, potentially altering wetland function. The preferred alternative would affect more than 400 ac (162 ha) of old-growth forest and the road would fragment habitat by dividing the forest into inland and coastal sides. The route crosses along Berners Bay, and would cut through USFS LUD II areas, the roadless area category set forth in the Tongass Timber Reform Act of 1990. Building the road across this area requires the governor to designate the route an essential transportation corridor (Alaska Department of Transportation and Public Facilities 2014).

According to the Draft Supplemental EIS, the road “would substantially increase access to the east Lynn Canal coastline for recreation and tourism. Improved access to forest land is expected to increase use and thus the need for management and monitoring” (Alaska Department of Transportation and Public Facilities 2014). Increased access could have various effects, include increased human hunting and fishing pressure on wildlife, potential wildlife-vehicle collisions, and making animal movements from upland habitat to the coastline more hazardous. Mammals potentially affected by cutting off coastal access include mountain goat, moose, black bear, and possibly brown bear (Alaska Department of Transportation and Public Facilities 2014).

The sound from explosive charges used to release avalanche danger could be disturbing to wildlife, including flushing Bald Eagles from nests and possibly causing them to abandon the nest. Up to 46 Bald Eagle nests fall within a half mile (1 km) of the avalanche blasting zone, although in a normal snow year not all of those nests would be affected. Avalanche control efforts could cause some mountain goat mortality because the animals sometimes forage in avalanche chutes in winter. Since the 2006 road plan, the preferred alternative route was adjusted to alleviate some of the effects on nesting Bald Eagles and Steller sea lions at haulouts (Alaska Department of Transportation and Public Facilities 2014).

#### Haines Highway Expansion

Audubon was instrumental in helping establish the Alaska Chilkat Bald Eagle Preserve in 1982, and it is currently a designated Important Bird Area. The Chilkat River is internationally important for Bald Eagles and other fish and wildlife resources. From an ornithological perspective alone, the Preserve is home for 200–400 Bald Eagles year-round, and in some years, hosts close to 4,000 birds—the densest concentration of Bald Eagles in the world (Audubon Alaska 2015b).

Since the Preserve’s establishment, Audubon Alaska and many other stakeholders have worked with various State and Federal agencies on issues threatening the integrity of the Preserve. Perhaps the most controversial issue over the past years has been addressing impacts that commercial jet boat tours have in the Preserve, especially with respect to spawning and out-migrating young salmon, as well as bank erosion in salmon habitat. In recent years the Haines Highway expansion project has generated extensive comments about potential effects on the Preserve (Audubon Alaska 2015b). The proposed highway changes within the Preserve would remove eagle roosting trees; allow an unspecified amount of disturbance to nesting, perching, feeding, and roosting eagles; impact salmon spawning habitat in the majority of the tributaries to the Chilkat River that provide salmon habitat; and affect wetlands that provide fish passage and rearing habitat (Audubon Alaska 2016). Mining companies like Constantine Metal Resources Ltd. are developing prospects around Haines which, if permitted, will result in significant additional truck traffic along the highway to Haines and may compromise water quality inside the Preserve.

The many types of human development in Southeast Alaska deliver both opportunity and impact. Infrastructure allows us to access communities, bring in goods and resources, obtain energy, travel to

wild places, and earn income. But with these developments come a responsibility to manage wisely. Related issues are varied and include pollution, aircraft and ship noise, fish passage, habitat fragmentation, game poaching, avalanche danger, and degradation of adjacent conservation lands. Even in a landscape as rugged as Southeast Alaska, oftentimes our ability to develop and change landscapes exceeds our knowledge of or ability to mitigate associated impacts. As Southeast Alaskans move forward with development of the region they should do so slowly and wisely, avoiding many of the mistakes made in other parts of Alaska and the Lower 48.

#### MAPPING METHODS

This map depicts the following datasets:

1. Air service, using airport and heliport location data from FAA (1995), classified into primary airports and other commercial air service based on the map of Southeast Alaska airports presented on State-Maps.org (2015).
2. Cruise ship ports, digitized by Audubon Alaska (2015c), based on cruise ship itinerary and ship size information summarized from AlaskaCruises.com (2015) and routes and docks visible on hybrid imagery from ESRI/Bing Maps (2015).
3. Existing hydroelectric power sites and energy tie lines, as of 2009, from AIDEA, acquired by The Nature Conservancy (TNC) (Alaska Industrial Development and Export Authority 2009; The Nature Conservancy: Alaska Field Office 2011).
4. Dam locations, from the National Inventory of Dams, developed by the US Army Corps of Engineers and the Federal Emergency Management Agency (The Nature Conservancy: Alaska Field Office 2011; US Army Corps of Engineers 1999).
5. Open roads including:
  - a. Southeast Alaska’s forest system roads, from the USFS (Southeast Alaska GIS Library 2012).
  - b. Southeast Alaska’s non-forest system roads from Alaska Department of Natural Resources (Southeast Alaska GIS Library 2011).
  - c. British Columbia’s Digital Road Atlas, the authoritative layer for road data in British Columbia (GeoBC 2004).
6. The Alaska Marine Highway system, digitized at a scale of 1:750,000 by Audubon Alaska (2015a), based on routes shown on hybrid imagery from ESRI/Bing Maps (2015) and vessel traffic patterns data from The Nature Conservancy and Marine Exchange of Alaska (2011).
7. Shipping intensity, analyzed by TNC from Marine Exchange of Alaska data in 2009. This analysis used locations from all tracked vessels, conducting a point density analysis with a 1 km search radius. (The Nature Conservancy and Marine Exchange of Alaska 2011; The Nature Conservancy: Alaska Field Office 2011).

#### MAP DATA SOURCES

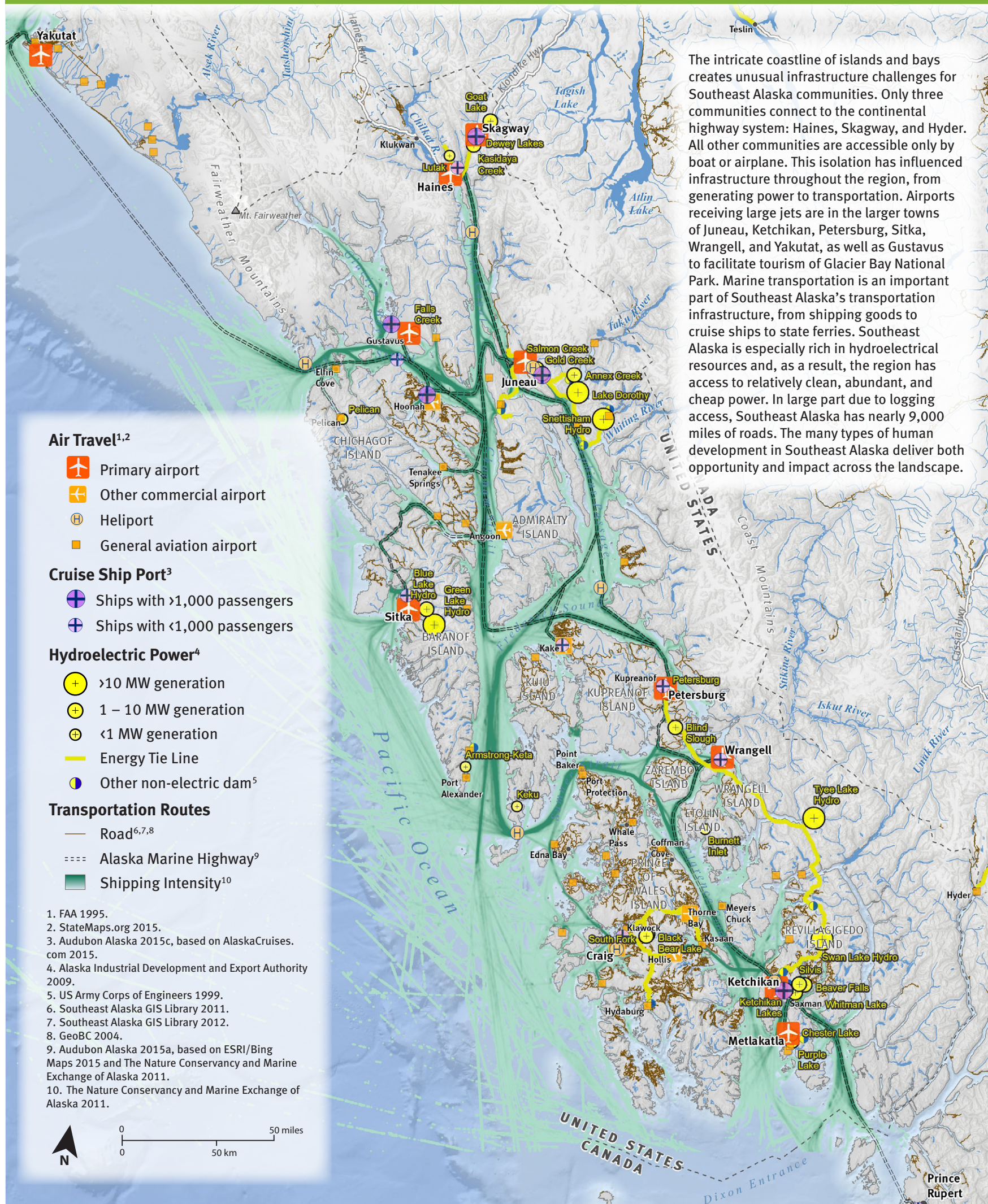
- Air service: FAA (1995) and State-Maps.org (2015)
- Cruise ship ports: Audubon Alaska (2015c), based on AlaskaCruises.com (2015)
- Hydropower sites and energy tie lines: Alaska Industrial Development and Export Authority (2009)
- Dam locations: US Army Corps of Engineers (1999)
- Roads: Southeast Alaska GIS Library (2011), Southeast Alaska GIS Library (2012), GeoBC (2004)
- Alaska Marine Highway: Audubon Alaska (2015a), based on ESRI/Bing Maps (2015), and The Nature Conservancy and Marine Exchange of Alaska (2011)
- Shipping intensity: The Nature Conservancy and Marine Exchange of Alaska (2011).



# Transportation and Energy Infrastructure

Audubon  
ALASKA

The Nature  
Conservancy



Map 7.2: Transportation and Energy Infrastructure



## COMMUNITY SUBSISTENCE USE

*Excerpted from John Sisk (2007)*

*Revised by Nils Warnock*

The 1980 Alaska National Interest Lands Conservation Act (ANILCA) identified subsistence as a priority use of federal lands in Alaska. ANILCA defines subsistence as “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife...; for barter, or sharing for personal or family consumption; and for customary trade.” Significantly, ANILCA links subsistence to rural Alaska residency, without ethnic or other distinction. This inclusive definition fits the nature of subsistence harvests in Southeast, where Tlingit, Haida, Tsimshian people, and other Alaska citizens all depend on harvesting the region’s bounty for their direct personal and family use.

In 1978, the State of Alaska passed its first subsistence statute (Alaska Statute 1978), which gave “priority” to subsistence uses of fish and game resources over other uses, with all Alaska residents eligible to participate. In contrast, federal passage of Title VIII of ANILCA gave a subsistence priority to rural residents only. The conflict in subsistence eligibility rules led to two parallel sets of management regulations, beginning in 1990 with the federal takeover of subsistence management on federal lands and marine mammals (Huntington 1992) and state management of state and private lands. ADFG Title 05 Regulations outline the State of Alaska subsistence statutes. Subsistence use includes the customary and traditional uses of fish and game in rural areas of Alaska (Alaska Department of Fish and Game 2014). Complex and varied subsistence regulations continue to be a source of debate.

The rainforest ecosystem of Southeast is rich in wildlife, fish, and other renewable resources that are used by local hunters, fishermen, and gatherers. These subsistence harvests constitute a significant portion of the food consumed by rural residents, and collectively the harvests represent one of the most fundamentally important uses of natural resources. The 17-million ac (6.9-million-ha) Tongass National Forest encompasses approximately 80% or more of the land area of Southeast, and a wide variety of subsistence activities takes place in the Tongass. Glacier Bay National Park and Preserve occupies an additional 3.3 million ac (1.3 million ha) of federal land and marine waters in the region. Only limited and largely ceremonial use of subsistence resources occurs within the National Park portion of Glacier Bay, although significant fishing and some hunting occur legally in the 57,000 ac (23,000 ha) designated as a National Park Preserve. Because of the extensive area and the richness of biological resources in the Tongass National Forest, the vast majority of subsistence harvests in Southeast occur there or on the immediately adjacent tidal lands.

### HISTORIC NATIVE SUBSISTENCE

The Tlingit, Haida, and Tsimshian people have the longest subsistence relationship with Southeast Alaska, and have long held traditional laws and customs mandating the conservation and perpetuation of subsistence resources (Voluck 1999). The Haida Nation is centered on the Queen Charlotte Islands (Haida Gwaii) of northern British Columbia; the northern or “Kaigani” Haida people have lived in Alaska on Prince of Wales Island since before European contact (MacDonald 2001). A major portion of Southeast was the ancestral home of the Tlingit people, today the most numerous Native residents of the region. The intact remains of Tlingit fishing structures hewn from wood have been carbon-dated to more than 3,000 years ago on Admiralty Island, a testament to the traditions of Native subsistence in Southeast (Newton and Moss 1984). Relative newcomers to Alaska, since 1887, Tsimshian people have lived on Annette Island in southern Southeast Alaska (Annette Island School District 2005).



Sheldon Museum and Cultural Center

Subsistence fishing using a gill net.

### CONTEMPORARY SUBSISTENCE

The majority of rural Southeast Alaska households continue to subsistence harvest fish and game to this day (Alaska Department of Fish and Game 2014). Annual take of wild food by Southeast residents averages around 200 lb per person (91 kg) (Alaska Department of Fish and Game 2000, 2014). In contrast, annual per capita harvests of rural communities range from 200 lb (91 kg) to 400 lb (181 kg) (Wolfe 2004). Annual estimates of the cost of replacing the wild food harvested by rural Southeast residents with retail purchases of equivalent food run from \$22–\$44 million (Alaska Department of Fish and Game 2000, 2014; Flanders et al. 1998). People harvest many species of animals and plants in Southeast, but deer (*Odocoileus hemionus sitkensis*), salmon (*Oncorhynchus spp.*), and halibut (*Hippoglossus stenolepis*) are particularly and consistently important to rural communities and Native people throughout the region (Naves et al. 2010; Wolfe 2004).

### MAMMALS

Nearly half of rural Southeast residents harvest game and almost 80% use the meat and other animal products (Alaska Department of Fish and Game 2014). Sitka black-tailed deer represent the most important subsistence food in Southeast, aside from fish. During the 20 years from 1983 to 2003, an average annual harvest of 12,361 deer was taken by an average of 7,994 hunters (Straugh 2004). Deer harvest levels vary substantially by rural community. The highest harvest rates occur on Admiralty, Baranof, and Chichagof islands (ABC islands) and Prince of Wales Island (US Forest Service 2008c). Residents of the rural communities of Edna Bay, Port Alexander, Pelican, Tenakee Springs, Hoonah, and Angoon harvested an average of 250 lb (114 kg) per household in 1987 (Kruse et al. 1988).

Other mammals are not so widely distributed as deer, but are also important. Moose (*Alces alces*) are hunted on the mainland, particularly in the large valleys carved by transboundary rivers such as the Taku and the Stikine. The towering cliffs and ridges alongside the great Taku and the Stikine river valleys are habitat for mountain goats (*Oreamnos americanus*). Tlingit weavers use mountain goat fur as the source of fiber for their beautiful and famous Chilkat and Ravens Tail blankets. Likewise, wolves (*Canis lupus*) are harvested in Southeast and their fur used mainly to trim clothing, blankets, and ceremonial objects such as masks (Turek et al. 2008). Hunters harvested the majority (72–83%) of wolves from boats, and the percentage of households harvesting wolves in four Southeast communities ranged from 1–10% (Turek et al. 2008).



Black bears (*Ursus americanus*) and brown bears (*U. arctos*) are abundant and widely distributed in Southeast Alaska (Flanders et al. 1998). Both bear species inhabit the mainland forests, but they are segregated on the islands. Although the brown bear is hunted by sportsmen as a trophy animal, most subsistence bear hunting focuses on the smaller black bear as a food resource.

Residents of Southeast also utilize various marine mammals. Native Alaskans are exempted from the Marine Mammal Protection Act for subsistence use of marine mammals. Native people harvest sea otters (*Enhydra lutris*) and use the fur for clothing and other handicrafts. The mean reported annual subsistence take of sea otters in Southeast from 2006–2010 was 447 animals (US Forest Service 2014). The harvest of pinnipeds in Southeast is more widespread than the sea otter harvest, but has been declining since the 1990s (Wolfe et al. 2013). The vast majority of seals captured are harbor seals (*Phoca vitulina*), with annual take in Southeast ranging from close to 1,900 seals harvested in 1995, to 595 seals harvested in 2012. In recent years (2005–2012) the largest numbers of harbor seals were taken by the Yakutat community (Wolfe et al. 2013). Hunters take a few Steller sea lions (*Eumetopias jubatus*) in Southeast as well (Wolfe et al. 2013).

### FISH

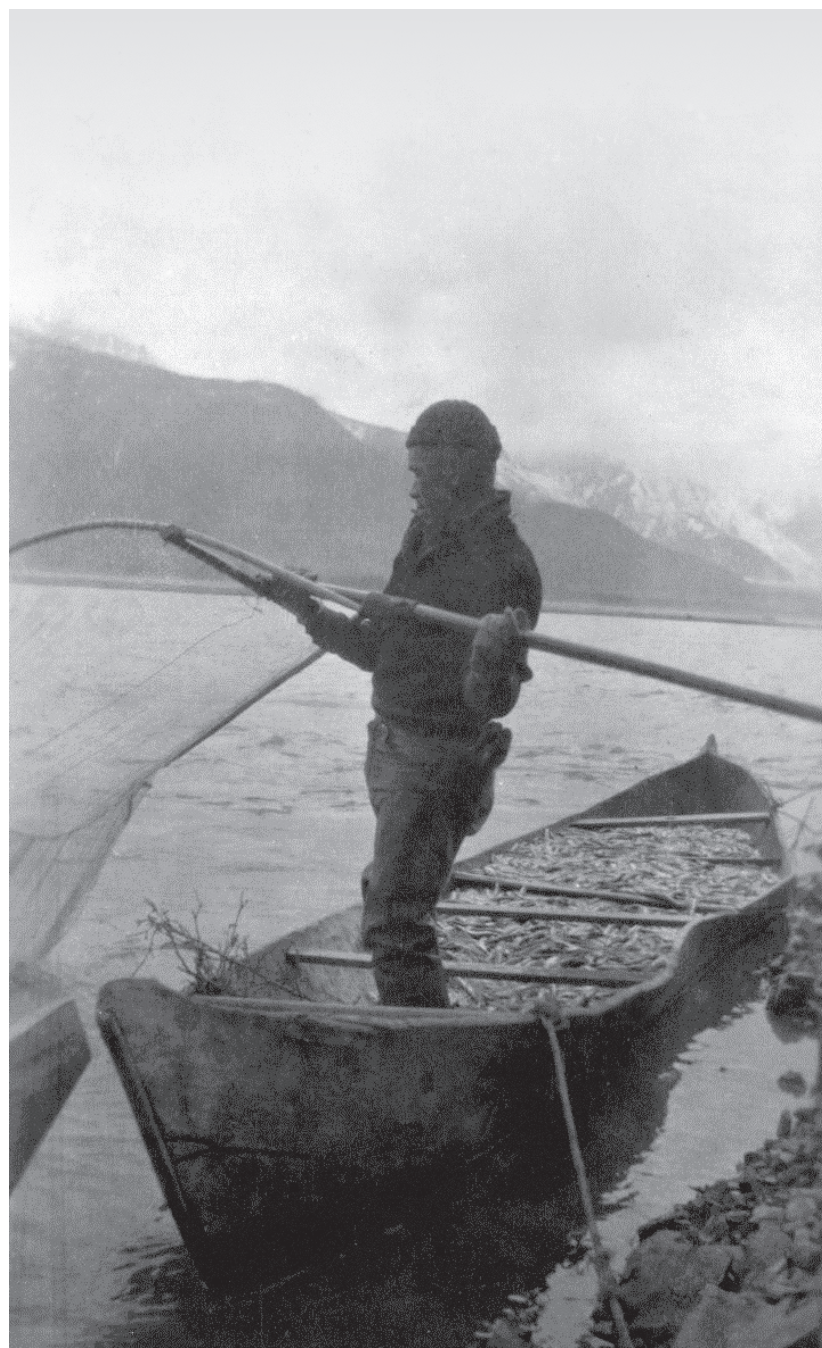
Eighty percent of rural Southeast households harvest subsistence fish (Alaska Department of Fish and Game 2014). In the Tlingit villages of Angoon and Hoonah, fish represented about 55%, by weight, of the annual subsistence harvests of residents. The mean subsistence harvest of salmon for personal use in Southeast from 1996–2006 was 67,703 salmon per year, of which 83% were sockeye (*Oncorhynchus nerka*), 6% pink (*O. gorbuscha*), 5% chum (*O. keta*), 4% coho (*O. kisutch*), and 2% Chinook salmon (*O. tshawytscha*) (Naves et al. 2010). Chinook and coho salmon have few formal subsistence fisheries and instead are obtained through participation in commercial and sport fisheries, as well as through incidental take when subsistence fishing for other species (Fall et al. 2003).

Subsistence fishing for halibut has a long history in Southeast, as evidenced by the carved halibut hooks used by Native people for centuries. In 2003, the federal government authorized a formal subsistence halibut fishery. Each year between 2003 and 2006, more than 3,000 Southeast subsistence fishermen landed greater than 600,000 lb (272,000 kg) of halibut (Fall et al. 2004; Fall et al. 2007).

Other fish are also important. Sitka Sound boasts a large herring (*Clupea pallasii*) spawn in early spring, and herring roe is a prized subsistence food. The annual harvest of herring spawn by subsistence users in Sitka Sound ranged from 72,000–381,000 lb (32,700–173,000 kg) a year between 2002 and 2014 (Sill and Lemons 2015). Herring roe harvest per capita was nearly 15 lb (6.8 kg). In the spring, eulachon (*Thaleichthys pacificus*) smelt, also called hooligan, swim up select large mainland rivers by the millions. Hooligan and their oil are prized foods in many Native families and villages (Turek 2009).

**Other animals** - Octopi (*Octopus dofleini*) are special delicacies and are most abundant on the outer ocean coasts, as are abalone (*Haliotis kamtschatkana*). Subsistence gatherers may find bird eggs on rocky, ocean islands and near glaciers where seabirds congregate to breed. Dungeness (*Cancer magister*), tanner (*Chionoecetes spp.*), and king crab (*Paralithodes spp.*) are harvested from specific marine habitats.

**Plants** - Plant harvests also make up an important component of the subsistence lifestyle. Gatherers may pick and preserve various delicious berries. Some of the most popular berries are blueberries (*Vaccinium spp.*), huckleberries (*V. parvifolium*), nagoon berries (*Rubus arcticus*), highbush (*V. edule*) and lowbush cranberries (*Oxycoccus Oxycoccus*), as well as currants (*Ribes spp.*). Kelp and seaweed are gathered and dried for use in cooking and special preparations. Sea vegetables are also rich in vitamins and minerals, and make a wonderful seasoning. Spruce (*Picea sitchensis*) roots and red cedar (*Thuja plicata*) bark are gathered for basketry. Subsistence harvesters may also collect plants such as devil's club (*Oplopanax horridus*) for their medicinal properties.



A Tlingit man netting eulachon (hooligan), 1927. The canoe is filled to almost overflowing with fish.

Sheldon Museum and Cultural Center

### CONSERVATION ISSUES

Subsistence harvesting success is sensitive to the deterioration or loss of fish and wildlife habitat, changes in accessibility, and increased resource competition. The state of Alaska identified logging, road construction, and mining as the development disturbances most likely to affect subsistence use in Southeast (Flanders et al. 1998). Harvest of old-growth forest habitat significantly affects the productivity of subsistence game harvest—in particular, deer. Old-growth forests constitute important deer winter habitat (Kirchhoff and Schoen 1987; Leopold and Barrett 1972; Schoen and Kirchhoff 1990; Wallmo and Schoen 1980). Because natural deer mortality is highest in winter, the quality of winter habitat can be a limiting factor. In areas where logging has diminished important forest habitat, severe winters with deep snows significantly reduce deer populations (Person and Brinkman 2013). Subsistence deer hunters have also noted that within a few years after a clearcut, regrowth tends to make the areas impassable (Galginaitis 2004 cited in US Forest Service 2008c).

Construction of roads in Southeast, mainly driven by logging, both aids and hinders subsistence efforts. Roads pose risks to salmon migration, spawning, and rearing habitat in freshwater streams. Before 1954, Southeast had only a few, scattered roads. The Tongass now has about 5,000 mi (8,000 km) of roads with new construction of more than 25 mi (40 km) a year on average (1997–2005) (US Forest Service 2008c). This expansive road network poses a major maintenance challenge. Some roads need to be restored to minimize



erosion damage to soils and salmon streams. Stream crossings need to be removed or improved to ensure they do not block salmon passage. An ADFG stream inventory suggested one to two thirds of stream crossings in Southeast need remedial work to ensure fish passage (Flanders and Cariello 2000).

Roads can also change access to established subsistence harvest areas, with complex results (US Forest Service 2008c; Wolfe and Walker 1987). Easy access to important hunting and fishing areas might appear to benefit the subsistence lifestyle, but it can also result in increased competition for prime fish streams or wildlife habitat areas. Possible impacts include displacement of subsistence hunters, reduced harvests by both subsistence and visiting hunters, and decline in deer populations. On Prince of Wales Island, the Alexander Archipelago wolf population has precipitously declined in recent years. An estimated 87% of the wolf mortality was caused by a combination of legal and illegal hunting and trapping (Person and Russell 2008), facilitated by increased hunter access along roads built for logging (Person and Brinkman 2013).

During preparation of the 1997 revision of the Tongass National Forest Land and Resource Management Plan (TLMP) (US Forest Service 1997a), the USFS cooperated with the ADFG to develop a region-wide assessment of rural subsistence harvest patterns and the use intensity in important places within the Tongass (Kruse et al. 1988; US Forest Service 1997b). In comments on the 1997 TLMP, the State of Alaska used an assessment of fish and game resources to identify the watersheds that are most important for meeting the harvest needs of local communities and rural residents. (Flanders et al. 1998). That assessment identified the watersheds with the highest “community

use values” and ranked watersheds for sensitivity to disturbance. The subsistence use areas of the ABC and Prince of Wales islands were ranked as having some of the highest sensitivities to disturbance in the Southeast Alaska (Flanders et al. 1998).

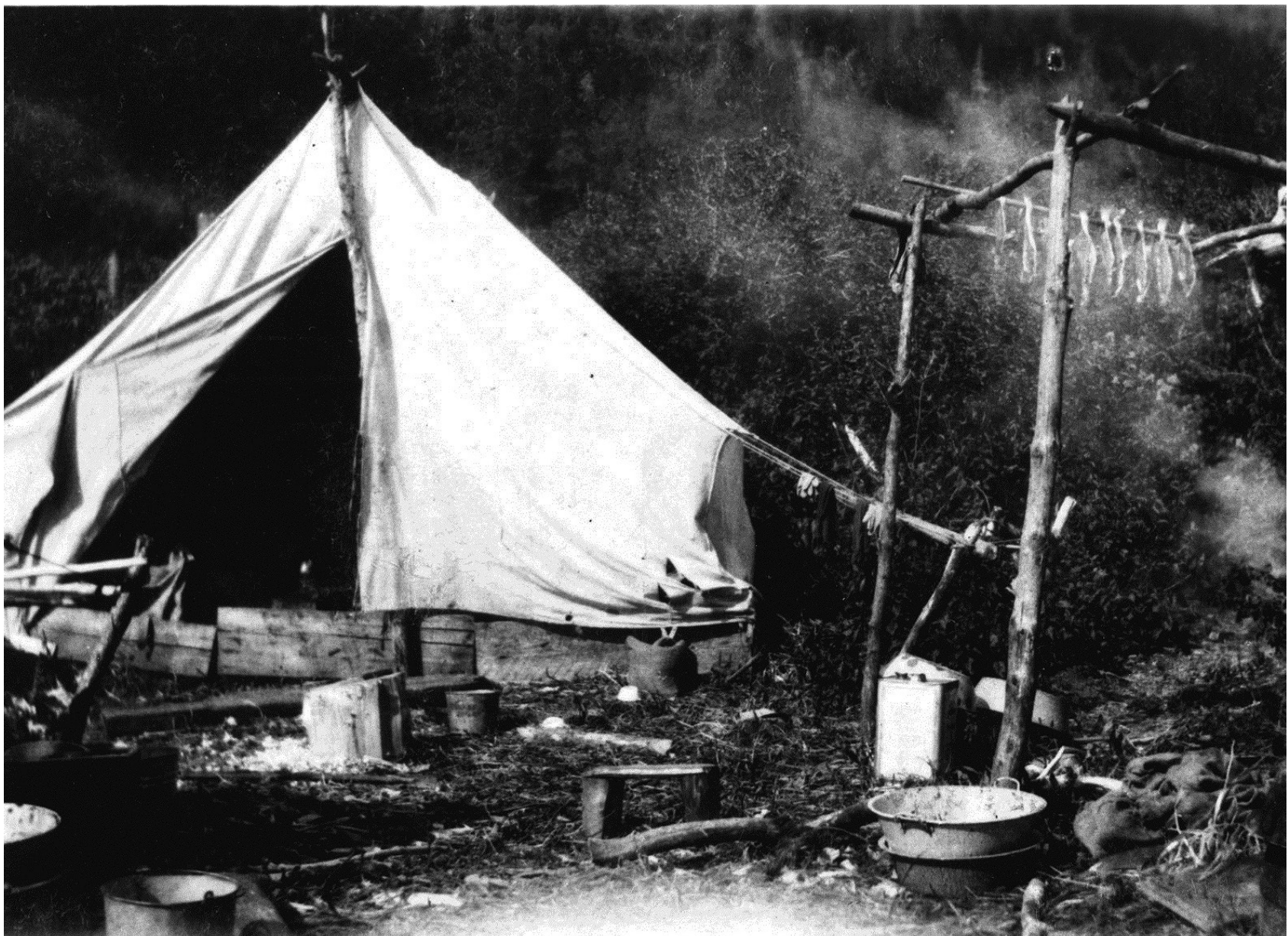
#### MAPPING METHODS

ADFG compiled information on fish and wildlife harvest by community. The mapping focused on salmon, bear, deer, and forest vegetation (Flanders et al. 1998). Watershed units were overlaid to account for the number of communities using an area for subsistence. The agency combined community use areas with additional data and expert knowledge on areas of high productivity for old-growth forest, fish, and wildlife to produce a prioritized list of community use values by watershed (VCU) (Flanders et al. 1998).

Pie charts representing the composition and total take of subsistence resources were compiled by community from ADFG’s subsistence survey data (2015c). For each community and each resource (birds and eggs, fish, land mammals, marine invertebrates, marine mammals, and vegetation), we selected most recent study, then joined Estimated Pounds Harvested to community location.

#### MAP DATA SOURCES

- Community use and priority areas: Flanders et al. (1998)
- Harvest by community: Alaska Department of Fish and Game (2015c).



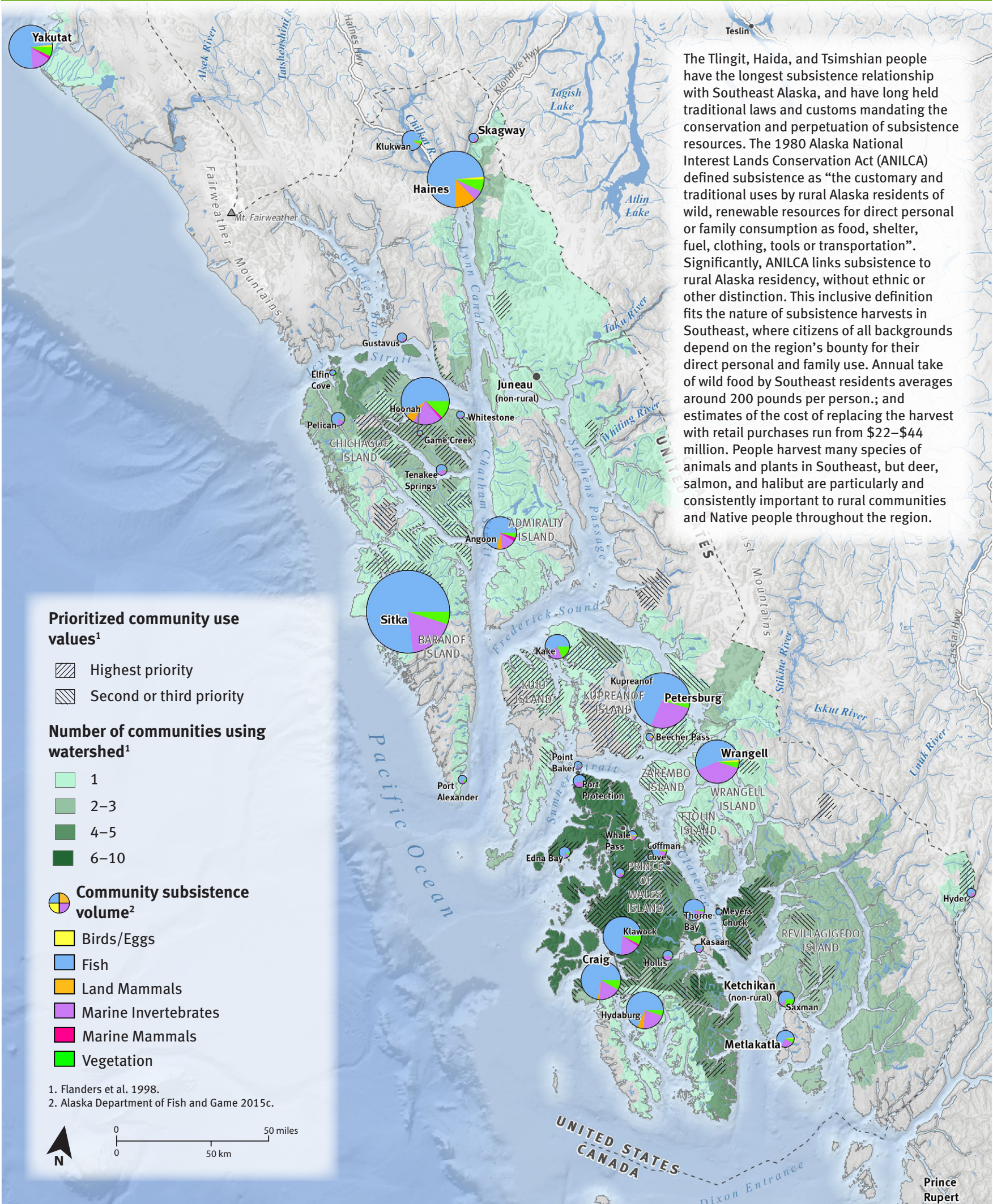
A 1920s Tlingit eulachon fish camp tent and fish-smoking rack.





# Community Subsistence Use

The Tlingit, Haida, and Tsimshian people have the longest subsistence relationship with Southeast Alaska, and have long held traditional laws and customs mandating the conservation and perpetuation of subsistence resources. The 1980 Alaska National Interest Lands Conservation Act (ANILCA) defined subsistence as “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation”. Significantly, ANILCA links subsistence to rural Alaska residency, without ethnic or other distinction. This inclusive definition fits the nature of subsistence harvests in Southeast, where citizens of all backgrounds depend on the region’s bounty for their direct personal and family use. Annual take of wild food by Southeast residents averages around 200 pounds per person.; and estimates of the cost of replacing the harvest with retail purchases run from \$22–\$44 million. People harvest many species of animals and plants in Southeast, but deer, salmon, and halibut are particularly and consistently important to rural communities and Native people throughout the region.



### Prioritized community use values<sup>1</sup>

- Highest priority
- Second or third priority

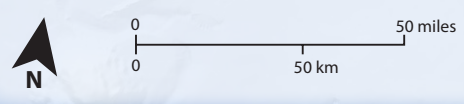
### Number of communities using watershed<sup>1</sup>

- 1
- 2–3
- 4–5
- 6–10

### Community subsistence volume<sup>2</sup>

- Birds/Eggs
- Fish
- Land Mammals
- Marine Invertebrates
- Marine Mammals
- Vegetation

1. Flanders et al. 1998.  
 2. Alaska Department of Fish and Game 2015c.



Map 7.3: Community Subsistence Use



## TIMBER

*Benjamin Sullender and Melanie Smith*

The complex geography of Southeast Alaska creates a fragmented mosaic of forests, constrained by a low timberline (approximately 2,500–3,000 feet, depending on aspect and latitude) and interrupted by steep slopes, glaciers, and wet muskeg bogs (Sisk 2007a). Forests are composed primarily of Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*) (Hutchison and LaBau 1975). Within the Tongass, broad-scale disturbances such as fire are rare. Canopy gap generation instead stems primarily from windthrow (Kramer et al. 2001), and to a smaller extent from disease, insect damage, avalanches, and occasional flooding (Alaback et al. 2013; Ott and Juday 2002). As a result of these spatially limited processes, old-growth in the Tongass is heterogeneous, and multi-storied. Old-growth stands may include snags (standing dead or dying trees), saplings, pole timber, centuries-old trees, and layers of understory vegetation, exhibiting substantial diversity in vertical canopy structure (Alaback et al. 2013).

Historically, indigenous usage of Southeast Alaska's forests was typically limited to single-tree harvest for immediate needs (Crone and Mehrkens 2013). In the late 1800s and early 1900s, Southeast Alaska's forests were not officially managed. Instead, logging was primarily composed of localized harvest to support the immediate timber needs of the fishing and mining industries (Sisk 2007c). After the Tongass was officially designated as a national forest in the early 1900s, the United States Forest Service (USFS) began auctioning tracts of timber for harvest. However, the contemporary regulatory and economic environment forestalled significant investment by the timber industry. Operating costs were high due to difficult terrain, lack of transportation infrastructure, and remoteness, which presented an obstacle to supporting a workforce and accessing markets for forest products (Crone and Mehrkens 2013). Timber companies were hesitant to commit financing to build the requisite infrastructure and harvest in an unknown landscape, given the examples of failed sales, cancelled contracts, and small sawmills that rapidly went out of business (Rakestraw 1981).

As the 20th century progressed, calls strengthened to leverage Alaska's natural resources as a pathway toward widespread economic development. The prevailing political belief at the time, fostered by proponents of aggressive logging such as Regional Forester, and later Territorial Governor, Frank Heintzleman, was that the Tongass' wealth of timber could be the centerpiece of a regional development plan (Nie 2006). Partially due to a post-World War II boom in demand for forest products, efforts to establish a timber industry came to fruition with the Tongass Timber Act of 1947 (Beier et al. 2009). (Note that this controversial act was later legally challenged, albeit unsuccessfully, and was considered by many an unfair confiscation of indigenous lands.)

Rather than exporting unprocessed round logs, the early days of the Tongass timber industry focused on providing wood pulp and fiber (Crone and Mehrkens 2013). The Tongass Timber Act catalyzed wood pulp production by providing credits for logging road construction, a guaranteed supply of timber, and extending logging contracts to an unprecedented 50 years (Sisk 2007c). Two timber operations constructed major sawmills in Ketchikan (which began operations in 1954) and Sitka (in 1959); these sawmills would dominate the industry for the next several decades (Nie 2006). This domination was the product of decades of collusive business practices which led to antitrust convictions for the mills. The convictions resulted in Congress unilaterally modifying the long-term contracts in the 1990 Tongass Timber Reform Act (TTRA) to protect and wisely manage Tongass resources and promote fair competition within the Tongass industry.

In 1971, Congress passed a landmark bill known as the Alaska Native Claims Settlement Act (ANCSA). In Southeast Alaska, the law created a regional corporation (Sealaska) and 12 village and urban corporations and authorized these Alaska Native corporations to select 550,000 acres of land (Sisk 2007c). The corporations preferentially selected high-value timber lands from geographically restricted selection boxes offered through the Congressional action. Native Corporation practices on these selected lands have focused primarily on aggressive logging (Nie 2006).

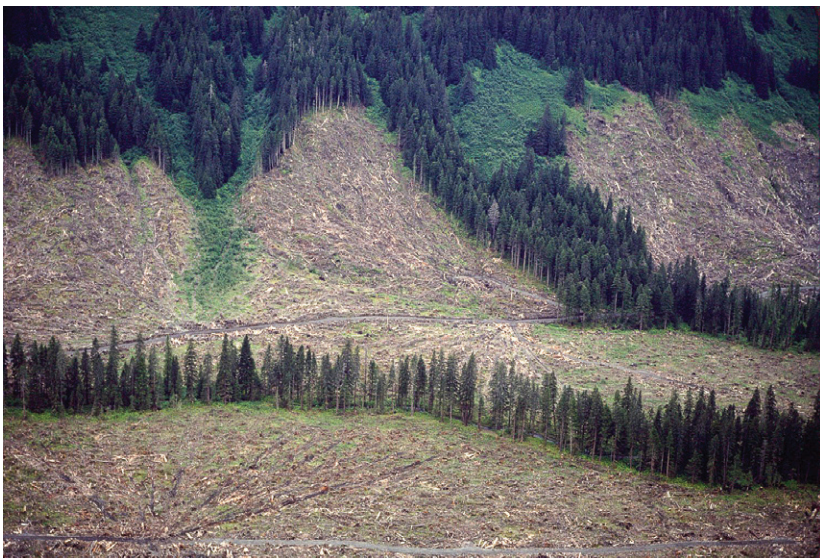
The Tongass timber industry received a somewhat unexpected boost with the 1980 passage of the Alaska National Interest Lands Conservation Act (ANILCA), which set aside a huge tract of the Tongass as wilderness. However, during legislative negotiations, ANILCA's Section 705 concurrently established an automatic \$40 million annual timber appropriation subsidies and a mandate to provide 4.5 billion board feet of timber per decade (Beier et al. 2009). With the subsidies in place and Native corporation logging operations ramping up, logging activity in Southeast Alaska peaked, providing about 4,000 jobs in 1990 (Crone and Mehrkens 2013).

Throughout the 20th century, the USFS worked closely with the timber industry to encourage economic growth. At one point, 95% of the forest was slated for logging (Sisk 2007c). The USFS' remarkable embrace of industrial forestry was rooted in contemporary support for clearcut logging practices, in which every standing tree is cut from a selected area. Although the denuded landscape results in increased light penetration that, in turn, encourages rapid regrowth, clearcutting fundamentally shifts regional ecology by creating thick stand impenetrable to sunlight thereby reducing structural diversity (Alaback 1984), with cascading implications for wildlife (Sisk 2007a) and especially old-growth-obligate flora and fauna (e.g. Shanley et al. 2013).



The Ketchikan Pulp Company mill in Ketchikan's Ward Cove in the early 1980s. Both the Ketchikan and Sitka pulp mills had 50-year timber contracts on the Tongass which dominated the timber industry in Southeast from the mid 1950s through early 1990s.





John Schoen

Clearcut on northeast Chichagof Island.



John Schoen

Forest regrowth 60 years after clearcut.

Whereas a naturally functioning temperate rainforest provides a variety of habitats in the same patch due to heterogeneity, post-clearcut regrowth follows three main stages: early productivity, stem exclusion, and maturity. Within 20 years of logging, forage biomass for herbivores such as Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) reaches peak abundance, albeit at a lower quality than in mature stands (Person and Brinkman 2013). After about 25 years, regrowth reaches a stage known as stem exclusion. In this stage, even-aged trees create a dense canopy that shades out the understory, essentially eliminating available forage (Alaback 1980). Depending on environmental factors such as soil quality and exposure to disturbances, the stem exclusion stage can last over 150 years, with some tree stands requiring 250 or more years to achieve the vertical canopy structure typical of productive old-growth forests (Alaback and Tappeiner 1984).

In addition to promoting clearcutting, Tongass logging has typically followed the practice of “high-grading,” or preferentially targeting large-tree stands (Sisk 2007c). Large old-growth trees represent high timber value, and loggers target these patches of forest disproportionately to their abundance (Albert and Schoen 2013).

Gradually, the scientific community and the public acknowledged these ecological realities and the USFS refocused its overall mission. Such incremental progress culminated in regulatory reform in the 1970s and 1980s (Beier et al. 2009), capped by the passage of the TTRA in 1990. The TTRA halted the Forest Service’s “timber-first” approach to Tongass management regardless of market demand, impact on other multiple uses, or cost to taxpayers. Later in the 1990s, global demand for timber products collapsed and higher operating costs put the Alaskan timber industry at a competitive disadvantage for a receding market share (Crone and Mehrkens 2013). In the face of declining pulp market, rising costs, and insurmountable competition, the pulp mills in Sitka (in 1994) and Ketchikan (in 1997) terminated their contracts and closed (Beier et al. 2009).

The 1997 Tongass Land Management Plan (TLMP) further shifted the agency away from its “timber first” approach and helped formalize the USFS multiple use mandate (Nie 2006). The 1997 TLMP called for the establishment of old-growth reserves, riparian and beach-fringe buffers, wildlife conservation measures, and ecosystem-based management (Beier et al. 2008). The TLMP Old-growth Conservation Strategy was a big improvement for habitat conservation across the Tongass; yet the Strategy was considered inadequate by many, including the Peer Review Committee of scientists established in 1993 by the Pacific Northwest Research Station of the Forest Service. The committee issued a joint statement in 1997, stating that the new plan relies on “an inadequate reserve system” and “ignores the adverse consequences of fragmenting habitat”. The conservation measures have since been the subject of multiple conservation and viability studies concerned with gaps in the TLMP strategy (Cook et al. 2006; Lindenmayer et al. 2006; Person and Brinkman 2013; Person and Logan 2012; Schoen and Dovichin 2007; Smith 2013; Smith and Person 2007).

The Audubon-TNC Conservation Assessment (Albert and Schoen 2007) addressed the gaps in the Tongass reserve network with identification of watershed-scale reserves (Lertzman and MacKinnon 2013) for conservation and restoration. Together with the TLMP old-growth conservation measures, the Audubon-TNC approach would ensure ecological integrity by protecting the core areas of the Forest in perpetuity. To date, those core watersheds have not been permanently protected. However, the 2008 TLMP postponed logging in many higher value watersheds under the Tongass Timber Sale Program Adaptive Management Strategy. Subsequently a smaller, closely related proposal identified the Tongass 77 (T77), a set of watersheds that best protect salmon and other values, as identified by local fishermen and Trout Unlimited with support from Audubon Alaska, based on the assessment work by Audubon and TNC.

In 2010, a major ideological shift occurred within the Forest Service when the Regional Forester announced that the Tongass National Forest would transition away from old-growth logging toward a sustainable, second-growth industry. Yet in years following, old-growth logging continued, and the highly controversial Big Thorne Timber Sale—the largest old-growth sale in a decade—was an indication to many that the Forest Service was dragging its feet. This led to a call for an amendment to the TLMP to codify the transition out of old-growth logging.

The proposed 2015 TLMP Plan Amendment set aside old-growth timber in the Audubon-TNC and T77 conservation priority watersheds from large-scale clearcut logging. Yet the proposed plan allows entry for second-growth logging into all timber-suitable lands previously logged. Those areas slated for clearcutting include second-growth in the same Audubon-TNC and T77 priority watersheds, as well as the beach fringe and riparian buffers, and old-growth habitat reserves that make up the TLMP Old-growth Conservation Strategy. Importantly, the plan also ramps up the level of old-growth logging at levels higher than the last decade. These concerns will be central to evaluating the success of this ongoing TLMP amendment process.

Economic realities, including persistent high operating costs for industry, may preclude the promised shift from old-growth to second-growth logging (Crone and Mehrkens 2013), or cause the industry to close their remaining operations, although others believe that the time is right for an industry shift to second-growth in as few as five years (Mater 2014). Some are calling for an end to old-growth clearcutting altogether, citing ecological impacts, high timber subsidy at cost to taxpayers (about \$200,000 per timber job on the Tongass), and maintaining a globally significant carbon stock in light of recent US commitments at the global climate talks in Paris. It remains to be seen whether the USFS will truly transition to a timber industry based on logging of second-growth as has been achieved in the Lower 48 States, or whether the transition to end old-growth clearcut logging entails an end to the timber-based economy altogether.



## CONSERVATION ISSUES

The heavy exploitation of rare large-tree stands on the Tongass has long been a concern of wildlife biologists. Those concerns were affirmed by a congressionally appointed blue-ribbon panel of scientific peer reviewers (Powell 1997) and reflected in a national position statement on management of old-growth forests on the Pacific coast of North America (The Wildlife Society 2007). In the 1990 Tongass Timber Reform Act, Congress acted to ban the highgrading of large-tree stands of old growth. Still, highgrading continues to be an ongoing concern on the Forest today (Albert and Schoen 2013). For example, yellow cedar (*Cupressus nootkatensis*), a species in serious decline across the region (Hennon et al. 2012), is targeted by industry as it is especially valuable in today's markets, with a stumpage value in 2005 that was five times higher than the next most valuable species (Beier 2011).

Currently the State of Alaska maintains a timber base of 42,000 acres in northern Southeast Alaska near Haines and 44,000 acres in southern Southeast Alaska on several major islands (Alaska Department of Natural Resources Division of Forestry 2015, 2016). Sealaska Corporation owns 290,000 acres of land that is subject to clearcut logging. State and Native Corporation timber programs contribute to environmental degradation, often with greater impact to the resource due to fewer ecological standards and guidelines for operating than required on federal lands. The cumulative impact of these timber sales must be considered by the USFS in their own planning and project implementation.

Log transfer facilities have localized impacts of concern for the marine environment. The timber industry stores masses of logs in protected, often productive, waters before towing them in rafts to a mill. The resulting bark loss damages the benthic habitat in those areas. The Alaska Department of Environmental Conservation has listed several areas as impaired waters due to log storage effects, including Ward Cove in Ketchikan, Thorne Bay on Prince of Wales Island, Silver Bay near Sitka, and East Port Frederick on northeast Chichagof Island (Alaska Department of Environmental Conservation 2010).

Until clearcutting is discontinued in the Tongass, succession debt (in which early post-harvest productivity disguises the negative impacts of subsequent stem-exclusion) will continue to accumulate (Person and Brinkman 2013). As more logged stands reach stem exclusion stages, wildlife habitat capability will decline, even if future logging is halted.

Beyond impacts to individual stands, more pervasive forces also affect Tongass timber lands. Subsidized development of infrastructure has left a network of logging roads that fragments remaining habitat and increases mortality risk for wildlife (Person and Brinkman 2013; Sisk 2007c; US Fish and Wildlife Service 2016). The recent sharp decline in Alexander Archipelago wolves (*Canis lupus ligoni*) on the heavily logged Prince of Wales Island is an example of how intense logging and high road densities can lead toward extirpation of populations if not properly managed (Audubon Alaska 2015d; US Fish and Wildlife Service 2016).

Audubon strongly recommends an end to old-growth clearcut logging in the Tongass National Forest. Alternative forest management could include logging of second-growth stands outside of conservation lands (TLMP Old-growth Conservation areas, Audubon-TNC conservation priority watersheds, and T77 watersheds), and small old-growth sales totaling less than 5 million board feet annually.

## MAPPING METHODS

The uncut suitable timber dataset was developed by the Tongass National Forest for their 2008 Plan. This is based on a forest-wide planning layer which represents suitable timber before on-the-ground stand exams are conducted. The TNF refers to "tentatively suitable" timber which indicates lands that are biologically productive, have shallow slopes, operable soil types, etc., and "suitable" refers to lands where timber is also allowed based on land use designations. This layer depicts suitable old-growth timber that has not been previously harvested. The suitability of previously harvested lands is in flux during 2016 due to pending decisions about the TLMP amendment.

Previously logged timber comes from two datasets. The transboundary land cover classification was put together by Audubon Alaska et al. (2012) which involved collaboration between Alaskan and Canadian government agencies (e.g. US Forest Service, National Park Service, US Fish and Wildlife Service, and British Columbia Ministry of Forests), non-profit organizations (including The Nature Conservancy), and universities (Including Simon Fraser University and University of Alaska Southeast) to pave the way for future cross-border cooperation, research, and large-scale conservation initiatives. Audubon collected, merged, and "cross-walked" attributes for forest vegetation cover types spanning the Southeast Alaska-northern British Columbia region with input from regional forestry experts. This layer is current across all ownerships as of 2012. The second layer was provided by the US Forest Service depicting timber harvest activity on TNF lands which is current through early 2016.

Marine Access Log Transfer Facility (LTF) sites were digitized by the USFS from known coordinates or using digital ortho photographs as backdrops for location of features. Points are included for historical LTFs that are no longer in existence. The LTF cover is updated as needed when new LTFs are built or proposed for timber sale support or non-operational LTFs are disposed of. This dataset is current as of 2004.

Ownership is depicted for USFS, Native Corporation, and State of Alaska lands. Together, these three entities permit the vast majority of timber operations in Southeast Alaska. Ownership is based on USFS and Alaska Department of Natural Resources datasets.

## MAP DATA SOURCES

- Logged forestland: Audubon Alaska et al. (2012), US Forest Service (2016c)
- Suitable timber: US Forest Service (2008a)
- Log transfer facilities: US Forest Service Tongass National Forest (2002)
- Ownership: US Forest Service (2016b), Alaska Department of Natural Resources: Information Resource Management (2015).

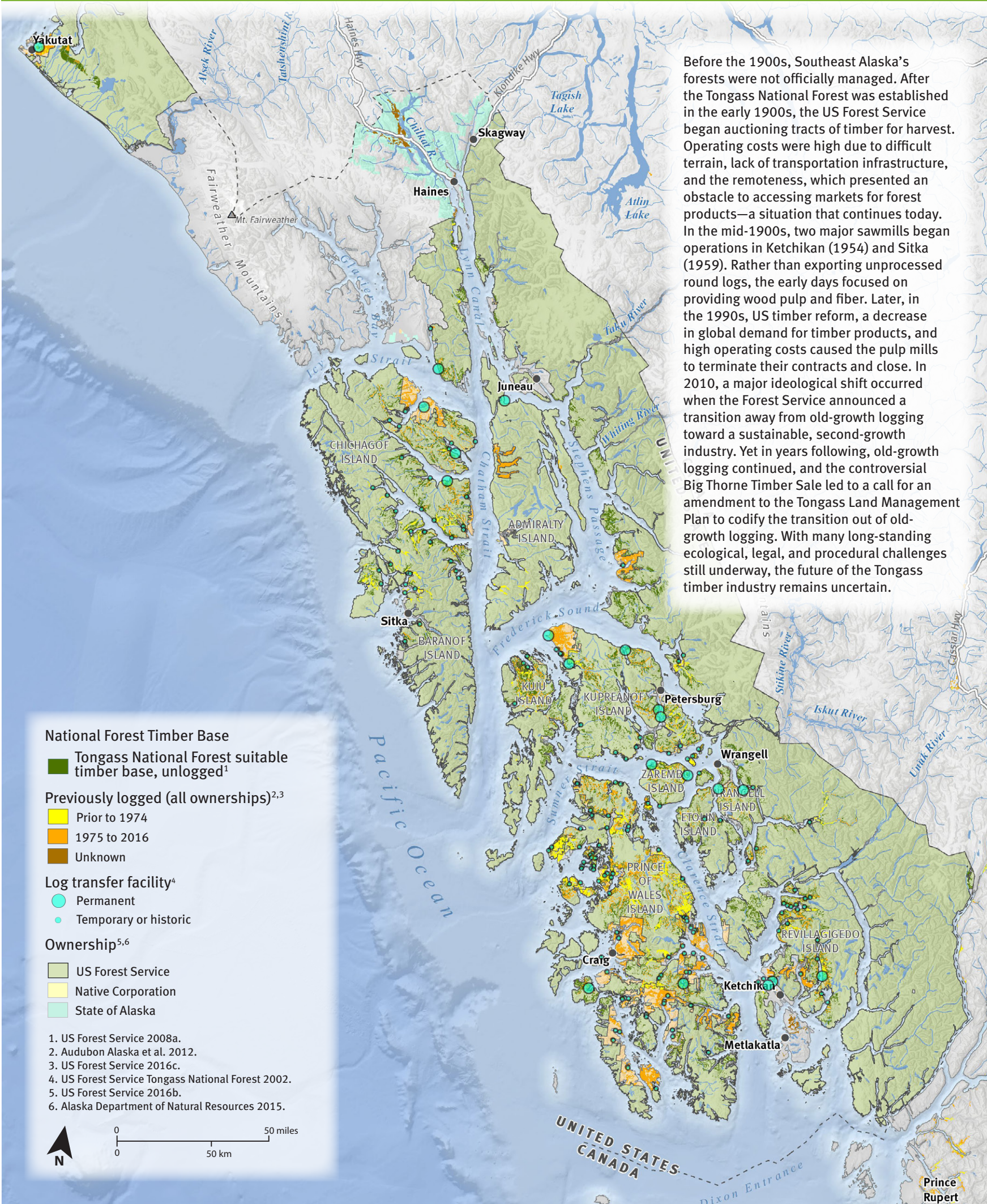


US Forest Service

Hand loggers using spring boards to stand on and axes and hand saws to cut a large old-growth Sitka spruce in the southern Tongass circa 1900. The biggest, best quality, and most accessible trees were cut first throughout the forest.



# Timber



Before the 1900s, Southeast Alaska's forests were not officially managed. After the Tongass National Forest was established in the early 1900s, the US Forest Service began auctioning tracts of timber for harvest. Operating costs were high due to difficult terrain, lack of transportation infrastructure, and the remoteness, which presented an obstacle to accessing markets for forest products—a situation that continues today. In the mid-1900s, two major sawmills began operations in Ketchikan (1954) and Sitka (1959). Rather than exporting unprocessed round logs, the early days focused on providing wood pulp and fiber. Later, in the 1990s, US timber reform, a decrease in global demand for timber products, and high operating costs caused the pulp mills to terminate their contracts and close. In 2010, a major ideological shift occurred when the Forest Service announced a transition away from old-growth logging toward a sustainable, second-growth industry. Yet in years following, old-growth logging continued, and the controversial Big Thorne Timber Sale led to a call for an amendment to the Tongass Land Management Plan to codify the transition out of old-growth logging. With many long-standing ecological, legal, and procedural challenges still underway, the future of the Tongass timber industry remains uncertain.

**National Forest Timber Base**

■ Tongass National Forest suitable timber base, unlogged<sup>1</sup>

**Previously logged (all ownerships)<sup>2,3</sup>**

- Prior to 1974
- 1975 to 2016
- Unknown

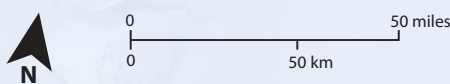
**Log transfer facility<sup>4</sup>**

- Permanent
- Temporary or historic

**Ownership<sup>5,6</sup>**

- US Forest Service
- Native Corporation
- State of Alaska

1. US Forest Service 2008a.
2. Audubon Alaska et al. 2012.
3. US Forest Service 2016c.
4. US Forest Service Tongass National Forest 2002.
5. US Forest Service 2016b.
6. Alaska Department of Natural Resources 2015.



Map 7.4: Timber



## METALS MINING

*Beth Peluso*

Mining, especially for gold, has played a large part in Southeast Alaska's history. The industry spurred settlements, some of which grew into today's communities and some of which faded away. Mining for metals continues to play a role in Alaska's economy today.

### MINING HISTORY

*(Passages in this section are excerpted from Sisk (2007b) and revised by Beth Peluso.)*

The first mineral location in Southeast was a copper claim in 1867 (Kaufman 1958; Roppel 1991), the same year that the United States purchased Alaska from Russia. Charles V. Baranovich staked the copper claim on Prince of Wales Island near the Haida Indian village of Kasaan. As a result, the Niblack area in Moira Sound saw significant copper mining and construction of ore trans-shipment facilities. Nearly all of these copper deposits were played out by 1908 (Roppel 1991).

Southeast Alaska also has a rich history of gold mining. In 1869, Max Silva discovered placer gold at Windham Bay, south of Juneau; that area produced gold for several years (Kaufman 1958). In 1872, silver and gold were found near Sitka at Silver Bay, and in 1879, a stamp mill briefly operated there (Kaufman 1958; US Department of the Interior 1999).

In 1880, Tlingit Chief Kowee led Joe Juneau and Richard Harris to Gold Creek and into the Silver Bow Basin, near present-day Juneau (Juneau Empire staff 2009). The miners returned with a large amount of gold ore, prompting Juneau's gold rush.

Throughout the Juneau gold mining years, staked claims and mining ventures ranged from Taku Inlet north to Lions Head Mountain on Berners Bay. Although many ventures produced gold and silver, none rose to the stature of the Alaska Juneau (AJ), Alaska Gastineau, and Treadwell complexes. Several Lions Head claims were consolidated into what became the Kensington claims, currently owned by Coeur d'Alene Mines (Stone and Stone 1980).

The Juneau and Harris discoveries led to the establishment of the Alaska Juneau Mining Company, which, over the lifespan of the mine, produced more than \$80 million (nominal value) in gold, silver, and lead ores. In 1881, John Treadwell began development of a complex of mines across Gastineau Channel from the Alaska Juneau (AJ) Mine. The Treadwell mine produced more than \$67 million in gold and silver during its lifetime. (Kaufman 1958; Stone and Stone 1980).

During the glory days of the boom, many steamships tied up at the numerous piers in Gastineau Channel, offloading supplies and loading gold ore from the AJ and Treadwell mines, the Alaska Gastineau mine at Thane, and the Silver Queen mine in Sheep Creek Basin (Roppel 1991; Stone and Stone 1980). The Silver Queen, Perseverance, and Silverbow Basin mines (all at Juneau) were consolidated into the Alaska Gastineau mine in 1911 (Stone and Stone 1980).

Juneau's major mining era wound down by the 1940s due to a combination of mine collapses and the demand for soldiers during World War II. Three of the four Treadwell underground mines collapsed and flooded in 1917, and the mine limped along for only five more years before closing (Juneau Empire staff 2009).



Gastineau Mining Company mill at Juneau, 1913.



**TABLE 7-3** Significant historically producing mines in Southeast Alaska.

Mine Name	Owner	Location	Materials Mined	Size	Activity
Alaska Gastineau Mine		Thane (near Juneau)	Gold		1912–1921 Silver Queen, Perseverance, and Silverbow Basin mines consolidated into this one in 1911; closed due to cave-ins.
Alaska Juneau (AJ)	Alaska Juneau Mining Company	Juneau	Gold, silver, lead	\$80 million over life of the mine.	1897–1944 closure of nonessential mines to free men up the war effort.
Bokan Mountain	Ucore (currently)	Prince of Wales Island	Uranium	95,000 tons of uranium oxide ore extracted	1955–1971 mine closed when it played out; now in exploration phase by Ucore for rare earth elements.
Iyoukeen Cove area (small mines)	Kaiser Gypsum Company, formerly owned by Pacific Coast Gypsum	Chichagof Island	Gypsum	500,000 tons during life of the mines	1902–1926; 1950s.
Klag Bay and Kimshan Cove areas (small mines)		Chichagof Island	Gold		1905, 1942.
marble quarries (small mines)		West coast of Prince of Wales Island	Marble		1895–1932.
Niblack	Heatherdale	Prince of Wales Island	Copper, gold, silver, zinc		Copper played out in 1908; in 2009 Heatherdale started underground exploration.
Silver Bay		Sitka	Gold, silver		1872.
Treadwell Mine	John Treadwell (founder)	Douglas Island across from Juneau	Gold, silver	\$67 million over life of the mine	3 of the 4 mines collapsed in 1917; mine closed in 1922.
Windham Bay	Max Silva	South of Juneau	Placer gold		1869 gold discovered; produced gold for several years.
Yakobi Island area (small mines)		Near Chichagof Island	Gold		1924–1939.

**TABLE 7-4** Significant currently producing mines in Southeast Alaska.

Mine Name	Owner	Location	Materials Mined	Size	Activity
Greens Creek	Noranda started mine; now owned by Hecla Mining Company	Admiralty Island	Gold, lead, zinc silver	Largest silver mine in US; in 2014 produced 7.8 million ounces of silver	1989 to present.
Kensington	Coeur d'Alene Mines (Coeur Alaska)	Berners Bay, north of Juneau	Gold	In 2013 produced nearly 115,000 ounces of gold	Current mining began in 2010; in 2015 the company announced mine expansion.

**TABLE 7-5** Exploration phase mines in Southeast Alaska.

Mine Name	Owner	Location	Potential Materials	Exploration Activity
Bokan Mountain	Ucore	Southern Prince of Wales Island	Rare earth minerals (Dysprosium, Terbium, and Yttrium)	Exploration restarted 2011 to present.
Herbert Glacier Mine	Houston Oil and Mineral initially; currently Quaterra Resources Inc. (Vancouver, BC)	18 miles north of Juneau	Gold, silver, copper, zinc, tungsten	Conducted some exploratory drilling beginning in 2010, but the mine remains in the early stages of exploration.
Niblack	Heatherdale	Prince of Wales Island	Copper, gold, silver, zinc	Copper played out in 1908; in 2009 Heatherdale started more exploration; operation currently suspended.
Palmer Mine	Constantine Metals and Dow Metal and Mining (Japan)	North of Haines	Copper, zinc, gold, silver	2010 to present; mid-stage exploration.
Port Snettisham Iron Ore Project	Arrowstar (Vancouver, BC)	Port Snettisham (south of Juneau)	Iron, initially gold	Ore first reported in 1897; in 2014 Arrowstar relinquished older claims, keeping only newer ones.



The Alaska Gastineau mine closed in 1921 because cave-ins and the intrusion of water into the mine made the ore unprofitable to mill. Gradually, the Alaska Juneau Mining Company acquired the shuttered mines around it; by 1934, the firm owned most of the immediate Juneau gold properties (Stone and Stone 1980).

Production at the AJ Mine peaked in the late 1930s, and 1941 was the mine's last profitable year. In 1942, the federal War Production Board closed all nonessential mines to free men up for the war effort. The AJ Mine closed permanently in 1944 (Stone and Stone 1980).

In addition to the larger mines, a variety of smaller mines historically operated throughout Southeast. Marble quarries operated on islands on the west coast of Prince of Wales Island from 1895 through 1932. Alaska marble was used in buildings from California and Nevada across the United States (Roppel 1991). Some 500,000 tons of gypsum were mined from the Iyoukeen Cove area on Chichagof Island between 1902 and 1926 (Kaufman 1958; Roppel 1991; US Department of the Interior 1999). Several small gold mines operated on west Chichagof Island at Klag Bay and Kimshan Cove from 1905 and 1942, and on adjacent Yakobi Island from 1924–39 (US Department of the Interior 1999). None of these mines are in operation today.

In the 1950s, a boom in uranium mining led to significant exploration throughout Southeast. Aerial detection of geologic radioactivity identified a deposit on Bokan Mountain on southern Prince of Wales Island in 1955. Between 1955 and 1971 the mine yielded nearly 95,000 tons of uranium oxide ore before the mine was played out and closed (Roppel 1991; US Geological Survey 1996).

In 1973, the Noranda Mining Company discovered a significant silver deposit on Admiralty Island in the Greens Creek watershed. Ironically, the Greens Creek deposit was also within an area that had been proposed to Congress for Wilderness designation (Kootznoowoo Wilderness). To address this, Congress set forth specific requirements and procedures in the 1980 ANILCA whereby the mine might be developed in a nonwilderness portion of an area otherwise considered Wilderness and having a national monument land designation. The Greens Creek silver was extremely high grade and valuable, and after extensive planning and review, development commenced. The Noranda Mining Company brought the mine on-line in 1989 and it continues to operate today (Bradner 2015; US Forest Service 1997a). See Table 7-3 for a summary of historic mines in Southeast.

### MINING TODAY

The only two major mines currently operating in Southeast Alaska are Greens Creek Mine on Admiralty Island and Kensington Mine along the east side of Lynn Canal near Berners Bay north of Juneau, summarized in Table 7-4.

Greens Creek is owned and operated by the Hecla Mining Company (Bradner 2015). It is the largest silver mine in the United States; in 2014 it produced 7.8 million ounces (243,000 kg) of silver. Greens Creek also produces gold, lead, and zinc (Hecla Mining Company 2015).

Since the 1980s, Coeur d'Alene Mines, operating as Coeur Alaska, endeavored to reopen the Kensington gold mine at Lions Head Mountain in Berners Bay, just north of Juneau (Sisk 2007b). From 2005 through 2009, local conservation organizations and Coeur were involved in court battles about the corporation's mine waste disposal plans (see the Conservation Issues below). The Kensington Mine moved into production in 2010. In 2013, the mine produced nearly 115,000 ounces (3,600 kg) of gold, reportedly up 40% from 2012. At the end of 2014, Coeur Alaska identified proven and probable gold reserves in excess of 600,000 ounces (19,000 kg) at Kensington (Coeur Mining Inc. 2015). In 2015, Coeur Alaska announced the mine will expand into the neighboring Jualin deposit, increasing the mine's gold output (Bradner 2015).

As mining technology advances, companies sometimes revisit mining claims previously "played out" for renewed exploration. The Niblack area on Prince of Wales Island has recently experienced renewed interest in additional



John Schoen

The Greens Creek Mine on northern Admiralty Island is located within the Admiralty Island National Monument but lies outside the Kootznoowoo Wilderness. This mine is the largest silver mine in North America and also produces gold, lead, and zinc.

minerals. Since 2009, a Canadian company, Heatherdale, has been involved in exploration of the Niblack Mine for copper, gold, silver, and zinc.

On southern Prince of Wales Island, Ucore corporation returned to the Bokan Mountain area previously mined for uranium, now in search of rare earth elements (Ucore 2016). Although prices for rare earth elements have dropped since 2011, as of 2015 Ucore seems to be slowly moving forward toward permitting.

Constantine Metals and its partner, Dowa Metals and Mining Co. of Japan, started exploration of the Palmer Mine north of Haines in 2010 (Constantine Metal Resources Ltd. 2016). The Volcanogenic Massive Sulphide (VMS) project is targeting copper, zinc, gold, and silver. This project has major expansion potential, in part due to its location near a major Alaska highway with year-round deep-sea port access for shipping to Asian markets (Constantine Metal Resources Ltd. 2016).

The Vancouver, B.C. corporation Arrowstar is the current project operator for the Port Snettisham Iron Ore project. Marine navigators were the first people to detect iron deposits near Port Snettisham because compasses "went crazy." Gold and iron ore were first reported in 1897. In 2013, the corporation added additional claims to expand the project. In September 2014, Arrowstar announced it was relinquishing the older claims and keeping only the newer claims (Arrowstar Resources Ltd 2015). Although the corporation did not state a reason, the change was likely due to low market prices (Archibald 2015).

The Herbert Glacier Mine is in early stages of exploration. The retreat of the Herbert Glacier, 18 miles north of Juneau, relatively recently exposed this deposit of gold, silver, copper, zinc, and tungsten. (Miller 2012); (Ground Truth Trekking 2015). Houston Oil and Mineral discovered the newly revealed mineral veins in 1986. Quaterra Resources Inc. picked up the project in 2007, forming a partnership with another Vancouver corporation, Grande Portage Resources Ltd. in 2010 (Lasley 2012). They conducted some exploratory drilling beginning in 2010, but the mine remains in the early stages of exploration (Ground Truth Trekking 2015); (Archibald 2015).

Exploration phase mines in Southeast Alaska are summarized in Table 7-5.



### Transboundary Mines

Several large Southeast Alaska rivers spring from headwaters across the border in British Columbia. About ten active mines in the Stikine, Taku, and Unuk River watersheds are in various stages of permitting and development in Canada and could pose a threat to Alaska. In July 2014, BC Hydro completed the Northwest Transmission Line, which extended the British Columbia power grid 213 miles (344 km) north. The available power has added incentive for the boom of proposed mines in northwestern British Columbia. The Red Chris mine, at the confluence of the Iskut and Stikine Rivers, was one of the first mines to take advantage of the new power source (BC Hydro 2014). According to the B.C. Ministry of Energy and Mines, as of July 2015, there are about 10 “advanced project” mines in the region (Lavoie 2015). Eight mines of most concern to Alaska are listed in Table 7-6.

## CONSERVATION ISSUES

### Alaska Mines

Some types of mining use chemicals to separate ore, and some types of rock itself generate acid mine drainage, both of which often create concerns about effects on water quality, fish, and wildlife. The type of mining and the method of waste disposal have generated conflicts with communities throughout Alaska’s history. Acid mine drainage occurs mainly when water oxidizes with sulfide minerals, usually pyrite (or “fool’s gold”), commonly found alongside desirable minerals. The result is sulfuric acid, which in addition to being harmful to aquatic life, dissolves heavy metals such as arsenic, copper, and lead. Acid mine drainage can occur naturally, but ores are usually inert when intact underground. The mining process of crushing ore and storing it above ground vastly increases the amount of acid generated, damaging water quality and harming aquatic life (Ground Truth Trekking 2015).

The ruins of the AJ Mine are still visible as several stories of dilapidated wooden buildings near downtown Juneau. Periodically there is a push to reopen the mine. Echo Bay Mining Company submitted a proposal to the Environmental Protection Agency in the late 1990s, but abandoned the plan in 1997, citing economic reasons (Environmental Protection Agency 1997). The City and Borough of Juneau owns rights to most of the AJ mine. In 2011, the City revisited the idea of reopening a smaller mine than the 1997 proposal. At a community hearing, there was no clear majority either in support or opposition to reopening the mine (Ground Truth Trekking 2015). So far, concerns about the AJ mine’s potential to contaminate city drinking water, combined with concerns about increased traffic, noise, and the lack of sufficient electricity for the mine to operate are the major stumbling blocks that have prevented the mine from reopening. Of the comments submitted to the City and Borough of Juneau, over 80% were in opposition of reopening the AJ Mine (Guy Archibald, Southeast Alaska Conservation Council, personal communication).

Although the Greens Creek Gold Mine itself is outside the adjacent Wilderness area, the General Mining Act of 1872 allows the company to lease public lands for the purposes of milling operations including tailings storage. Half of the current tailings pile is in designated Wilderness. In 2013, Hecla Mining Company sought expansion further into Wilderness that would have resulted in the destruction of a salmon stream. Hecla’s lease runs until 2096.

Section 505(a) of ANILCA requires the USFS to “maintain the habitats, to the maximum extent feasible, of anadromous fish and other foodfish, and to maintain the present and continued productivity of such habitat when such habitats are affected by mining activities on national forest lands in Alaska.” There is significant local concern about the environmental effects of pollutant discharges from Greens Creek Mine into Hawk Inlet from pollutants that bioaccumulate, such as cadmium, copper, mercury, and lead. Along these lines, the USFS should increase the strength of their monitoring program to detect effects of mining on national forest lands, to support fish habitat as required under ANILCA, and avoid inducing impaired waterbodies.

In 1997, the US Forest Service approved a development plan for the Kensington Mine that required several provisions to minimize environmental impacts, including no cyanide processing, and requiring mine tailings be backfilled or impounded in a dry tailings facility. Coeur

Alaska obtained the necessary permits, and development appeared to be imminent (Sisk 2007b; US Forest Service 1997b). In 2001, Coeur Alaska proposed an amended plan, in part due to falling gold prices. The company proposed moving facilities to the Berner’s Bay side of Lions Head Mountain and depositing tailings into a lake. Marine terminals at Berners Bay would transport workers and equipment to the mine (Sisk 2007b; US Forest Service 2004).

The Kensington Mine plan to dump 4.5 million tons of tailings in the alpine Lower Slate Lake, killing all the fish in the lake, faced court challenges from local conservation organizations, such as the Southeast Alaska Conservation Council and Lynn Canal Conservation, that carried all the way to the federal Supreme Court. The point of contention was that the permits for dumping tailings in Lower Slate Lake came from the Army Corps of Engineers, classifying the tailings as “fill” instead of mine waste. The Environmental Protection Agency (EPA) said it was not the best alternative but did not oppose the permits. The groups contesting the permits said the EPA’s permission violated the Clean Water Act, which prohibits discharge into a waterbody. In 2009, the Supreme Court decision sided with Coeur, allowing the Kensington Mine to move forward (Golden 2009).

Concerns at the Palamer VMS mine north of Haines include acid mine drainage leaking into the headwaters of the Chilkat River and threatening salmon spawning habitat. The Chilkat Indian Village, located at the confluence of the Klehini and Chilkat rivers, is opposed to the development. Furthermore, the river runs through the Alaska Chilkat Bald Eagle Preserve, a state preserve and Audubon Alaska Important Bird Area. Thousands of Bald Eagles (*Haliaeetus leucocephalus*) gather along the river for a late salmon run in early November; a threat to the salmon run would also put the eagles that flock to the reserve at risk.

### Transboundary Mines

About ten active mines, in various stages of permitting and development, in the Stikine, Taku, and Unuk River watersheds in Canada could pose a threat to Alaska fisheries downstream from acid mine drainage, hazardous materials in tailings that enter the river systems, or breaches in tailings impoundments (Archibald 2015). A summary of environmental concerns at eight major transboundary mines are summarized below (also see Table 7-6):

**Brucejack:** The mine’s plan involves storing tailings underground or in Brucejack Lake. The Unuk River supports all five species of Pacific salmon and has the largest run of Chinook, or king, salmon (*Oncorhynchus tshawytscha*) in Southeast Alaska. Any leaching of toxic minerals into the watershed could have harmful effects on salmon runs (Wild Border Watersheds 2015).

**Galore Creek:** Environmental concerns for Southeast Alaska from this proposed open pit mine include contamination of the Stikine watershed and potential threat to salmon (Wild Border Watersheds 2015).

**Kerr-Sulphurets-Mitchell (KSM):** The mine plan includes underground mining and several massive open pit mines. The geology of the area has a high probability for generating acid mine drainage, so there are major concerns about water treatment and tailings of such a huge mine and the potential threat it poses to water quality and salmon in Southeast Alaska (Wild Border Watersheds 2015).

**New Polaris:** This mine is near the headwaters of the Taku River, which flows into the sea about ten miles south of Juneau. The Taku is one of the largest salmon spawning watersheds in the region, and with runs of nine anadromous fish species, is often considered the most important fish watershed in Southeast Alaska (Albert and Schoen 2007) (Griffiths 2014).

**Red Chris:** This open-pit mine is operated by the same corporation that operates the Mount Polley Mine that had a disastrous tailings dam failure in 2014, releasing 600 million cubic feet (17 million cubic meters) of wastewater and nearly 300 million cubic feet (8 million cubic meters) of tailings (Wild Border Watersheds 2015) (Government of British Columbia 2014). Alaska commercial fishermen, such as the Alaska Trollers Association, have voiced concern about the risk of toxic tailings from the Red Chris and other B.C. mines (Martin 2015).



**TABLE 7-6** Summary of transboundary mines of concern, located in British Columbia in watersheds upstream of Southeast Alaska (Canarc Resource Corp 2015; Galore Creek Mining Corporation 2015; Seabridge Gold 2015; Wild Border Watersheds 2015).

Mine Name	Owner	Location	Potential Materials	Status
Brucejack	Pretium Resources, Inc.	Lake-fill: the lake is at the headwaters of Sulphurets Creek, which flows into the Unuk River that lies within the Misty Fjords National Monument in Alaska	Gold, silver	The mine received its final permitting in 2015 and expects to begin production in 2017.
Galore Creek	The mine is owned equally by NovaGold Resources Inc. and Tech Resources Ltd., although as of 2015 NovaGold was seeking to sell its portion. The Galore Creek Mining Corporation manages the project	Between the Stikine and Iskut Rivers	Copper, gold, silver	The corporation published a prefeasibility study in 2011 and continues to do environmental baseline studies.
Kerr-Sulphurets-Mitchell (KSM)	Seabridge Gold Corporation	The mine lies along a tributary of the Unuk River, about 18 miles (30 km) from the US border and upstream from Misty Fjords National Monument	Gold, silver, copper, molybdenum	Touted as one of the largest undeveloped gold mining projects in the world, as of 2015, the mine is waiting for final permits before beginning construction.
New Polaris	Canarc acquired the mine in 1992	Tulsequah River upstream from the Taku River	Gold	Originally operated from 1937–1957, with a suspension in operation from 1942–1946 during World War II. Exploration restarted in 1988. In 2015, partner corporation Australian-based PanTerra Gold announced it could not commit to further exploration until the Dominican Republic government grants approval for processing the ore at its project facility in that country.
Red Chris	Imperial Metals	Stikine River Watershed	Copper, silver, gold	The mine has been given a temporary discharge permit to begin releasing into its tailings impoundment; if fully built, the mine would have a life of 28 years.
Red Mountain	IDM Mining Ltd.	Near Stewart BC within the Nass Wildlife Area and Nissa'a Territory within a transboundary watershed. Mine discharge will be in a river that enters Portland Canal just inside Canadian waters.	Gold, silver	The project is currently in both the federal and provincial environmental review process. The Canadians are currently coordinating with the State of Alaska, and plan to consult with Alaska Native representatives that have current, traditional, or cultural ties to Portland Canal.
Schaft Creek	Copper Fox Resources and Teck Resources	Headwaters of the Stikine River	Copper, gold, silver, and molybdenum	Proposed open-pit mine in pre-assessment stage in 2015; Teck announced the mine will pull out of the permitting process in 2016.
Tulsequah Chief (including Big Bull Mine)	Chieftain Metals Corporation	Located where the Tulsequah River flows into the Taku River.	Copper, gold, lead, silver, zinc	Previously in operation in the 1950s; currently permits have been issued to build the mine but operational hurdles make the project uncertain. Continues to leak acid mine drainage into the river in violation of its permits and non-compliance orders.

**Red Mountain:** An underground mine proposal in a transboundary watershed; however, all potential discharge from the project area would enter Portland Canal in Canadian marine waters.

**Schaft Creek:** Concerns include the millions of tons of tailings that would be stored in a lake and the possibility of acid mine drainage that would contaminate the Stikine watershed (Wild Border Watersheds 2015). On May 4, 2016, Teck Resources requested that the environmental study be terminated and the project withdrawn from further review.

**Tulsequah Chief (including Big Bull Mine):** The mine has been leaking sulfuric acid into the Tulsequah River since 1990. The Alaska section of the Taku River is about ten miles south of Juneau and is considered the biggest salmon watershed in Southeast Alaska (Griffiths 2014). The corporation briefly operated a water treatment plant to deal with the historical acid drainage, but stopped due to expense. The mine plan would store tailings in an impoundment next to the Tulsequah River (Wild Border Watersheds 2015). The Taku River Tlingit First Nation in Canada opposed reopening the mine because it lies in their traditional territory. The First Nation challenged the mine's operating status in 2102, but a 2015 decision denied the challenge, allowing the mine to proceed (Lazenby 2015).

**MAPPING METHODS**

We utilized the US Geological Survey (USGS) Alaska Resource Data File (2008) to identify mines and prospects in Southeast Alaska. Based on the available data attributes, we reclassified the mines and prospects into status categories of active, inactive, or undetermined; production categories of yes, none, or undetermined; and size categories of small, medium, or large. On the map we grouped these categories into active mines (all sizes), active prospects, and inactive mines (all sizes). Next, we updated the USGS layer based on data presented online by Ground Truth Trekking (2015) to identify major activities in Southeast Alaska. Transboundary mines were from the ACE Conservation GIS Center (2015), and represented major activities and affected rivers in BC. State mining claims and leases were from the Alaska Department of Natural Resources (2006) via the Alaska State Geospatial Data Clearinghouse. Areas withdrawn from federal mineral entry were from the US Forest Service (2016a).

**MAP DATA SOURCES**

- Major activity: ACE Conservation GIS Center (2015), Ground Truth Trekking (2015)
- Other activity: US Geological Survey Mineral Resources Program: Western Region – Alaska Section (2008)
- Mineral rights: US Forest Service (2016a), Alaska Department of Natural Resources: Information Resource Management (2006)
- Ownership: US Forest Service (2016b), USDI National Park Service (2015), Alaska Department of Natural Resources: Information Resource Management (2015).



# Metals Mining



Mining, especially for gold, has played a large part in Southeast Alaska's history. The industry spurred settlements, some of which grew into today's communities and some of which faded away. The first mineral location in Southeast was a copper claim in 1867, the same year that the United States purchased Alaska from Russia. In 1880, Tlingit Chief Kowee led Joe Juneau and Richard Harris to Gold Creek and into the Silver Bow Basin, near present-day Juneau. The miners returned with a large amount of gold ore, prompting Juneau's gold rush. Many hardrock mining operations have come and gone since. The only two major mines currently operating in Southeast Alaska are Greens Creek Silver Mine on Admiralty Island and Kensington Gold Mine near Berner's Bay. Greens Creek is the largest silver mine in the US. Several prospects in British Columbia, near the headwaters of major transboundary rivers in Southeast, are of concern for potential impacts to fish and wildlife.



Map 7.5: Metals Mining



## SPORT AND COMMERCIAL FISHING

*Jim Adams and Susan Culliney*

Whether commercial, recreational, or subsistence, fishing is culturally important to Southeast Alaska and forms a significant economic driver to the region. In 2013 and 2014, the Southeast Alaska seafood industry accounted for 20% of regional average monthly employment, which included 12,078 direct jobs and 6,600 full-time equivalent jobs (McDowell Group 2015b). Along with the visitor industry, it is one of the two largest private sectors in Southeast (Southeast Conference Report 2014). The Southeast Alaska salmon fishing industry contributed over \$986 million to the economy in 2007, with the direct output generated by commercial fishing and processing of salmon estimated at \$599.3 million (TCW Economics 2010).

The fisheries of Southeast Alaska are some of the finest and most intact in the world. Harvest enhancement procedures complement rather than replace Alaska's world-renowned natural fisheries. The state-run hatchery program aims to "increase salmon abundance and enhance fisheries, while protecting wild stocks" (Vercessi 2013b). Mariculture (a type of aquaculture that uses the natural nearshore environment to raise organisms like oysters, clams, and mussels) is also common in Southeast waters. Nearshore aquaculture of salmon and other finfish, however, is prohibited by the State of Alaska.

Southeast Alaska features numerous small natural fisheries for groundfish (e.g. rockfish, lingcod (*Ophiodon elongatus*), and Pacific cod (*Gadus macrocephalus*); shellfish (e.g. Dungeness crab (*Metacarcinus magister*), shrimp, scallop); and miscellaneous dive fisheries (for sea cucumber, sea urchins, and geoduck clams (*Panopea generosa*). Herring (*Clupea pallasii*) are also harvested in the winter as baitfish, and during the spring for their roe. But the salmon fisheries of Southeast are by far the most visible and economically important in the region.

Commercial salmon fishing in Southeast Alaska focuses primarily on the five species of salmon: king/Chinook (*Oncorhynchus tshawytscha*), red/sockeye (*O. nerka*), silver/coho (*O. kisutch*), pink/humpy (*O. gorbuscha*), and chum/dog (*O. keta*). Commercial salmon harvests began in the late 1870s; red salmon was the species most harvested until the early 1900s, when pink salmon began to dominate (Conrad and Davidson 2013). In the past 10 years pink salmon has made up three-quarters of Southeast's total salmon harvest (Conrad and Davidson 2013). According to a 2007 study, "Between 2003 and 2007, the commercial fishing harvest in Southeast Alaska annually ranged between 30 million and 70 million fish. Pink salmon accounted for about 74% of all salmon commercially caught in Southeast Alaska, followed by chum (18% of all salmon), sockeye (4% of all salmon), coho (2% of all salmon), and Chinook (0.7% of all salmon)" (TCW Economics 2010).

Commercial salmon fisheries in Alaska are limited entry, which limits the number of total vessel permits for different gear types. When averaged over the last ten years in Southeast Alaska, the percentages of harvest by gear type (including Yakutat) are: 75% by purse seine, 9% by drift gillnet, 9% by hatchery organizations, 4% by troll, 3% by Annette Island (a federally permitted hatchery on Native Alaskan reservation land), and 1% by set net (Conrad and Davidson 2013).

Each gear type results in different total harvest numbers and targets different types of salmon. In 2012, 235 purse seine permit holders caught 24.5 million of the 37 million salmon commercially harvested in the Southeast Alaska and Yakutat regions (Conrad and Davidson 2013). Purse seiners caught the vast majority of pinks and 39% of the chum harvested in the region; 445 drift gillnet permit holders harvested 5.2 million salmon, including over 3 million chum (28% of the harvest) and 498,000 sockeye—over half the sockeye harvested; 1,096 troll permit holders caught 209,000 of the 281,000 Chinook harvested in Southeast Alaska, as well as 1.2 million of the 2.1 million coho (Conrad and Davidson 2013). Another 3.5 million salmon were also harvested by non-profit, private hatcheries for cost-recovery purposes and are not included in the above gear numbers (Conrad and Davidson 2013).

The State of Alaska defines "ex-vessel value" as "the average price for an individual species, harvested by a specific gear, in a specific area" (Alaska Department of Fish and Game 2015d). For salmon species in 2015, when ex-vessel values are broken down by gear, the purse seine fishery gross earnings were \$52.1 million, followed by the troll fishery earnings of \$23.5 million, and the drift gillnet fishery earnings of \$18.9 million (Alaska Department of Fish and Game 2016). When broken down by species, in 2012 chum brought in the highest earnings, followed by pink, silver, Chinook, and red (Conrad and Davidson 2013).

Salmon hatcheries play an important role in Southeast's salmon fisheries. In 2012, there were 17 active hatcheries in Southeast Alaska that provided a significant supplement to wild runs of salmon (Vercessi 2013a). Southeast hatcheries released over 615 million juvenile salmon made up of roughly 7.5 million Chinook, 15 million sockeye, 20 million coho, 101 million pink and 471 million chum in 2012 (Vercessi 2013a); however, returns are much smaller at around 1.5–3% for chum and pink salmon, and 8–12% for Chinook and coho salmon. Returning hatchery-produced salmon accounted for 27% of the salmon in the 2012 commercial common property fishery: 84% of the chum, 27% of the coho, 21% of the Chinook, 12% of the sockeye, and 1% of the pink salmon (Vercessi 2013a).



Power troller, Prince of Wales Island.



Southeast Alaska draws sport fishermen from around the globe to its world-class salmon runs. Recreational fishing includes the five species of salmon; halibut, rockfish, steelhead (*O. mykiss*), and Dolly Varden (*Salvelinus malma*); and rainbow, brook (*S. fontinalis*), and cutthroat trout (*S. clarkii*). In 2013, an estimated 109,571 people fished an estimated 546,050 sport angler-days in Southeast Alaska (including Yakutat). The ten-year average is 108,769 anglers and 509,858 angler-days fished (Alaska Department of Fish and Game 2015b). The anglers primarily spent their time on saltwater, with an estimated 462,179 saltwater days and an estimated 83,871 freshwater days.

Silver (coho) salmon were the fish most frequently caught and harvested by sport anglers (with an estimated 485,851 fish caught and 339,585 harvested). Pacific halibut were the second most caught fish (an estimated 245,936 fish), with rockfish a close third (an estimated 213,604 fish caught). Among salmon, pink salmon were the second most caught (with an estimated 324,543 fish), with Chinook salmon coming in third (with an estimated 166,824 fish caught).

From 2004 to 2013, Dolly Varden led the trout and char fishery, with an estimated 56,778 caught and 10,859 harvested. An estimated 17,430 cutthroat trout, 9,005 rainbow trout, and 6,163 steelhead were also caught (Alaska Department of Fish and Game 2015b).

#### King (Chinook) Salmon

King salmon (also called Chinook) spawn in the streams and rivers that empty into the marine waters of Southeast. But compared to other salmon species, king salmon are more limited in their spawning habitat. Fewer than 40 watersheds in Southeast support spawning populations of king salmon, and most of the kings found in these rivers actually spawn in the Canadian portion of the watershed (Heard et al. 1995).

Hatcheries produce 21% of the king salmon harvested commercially in Southeast Alaska (Vercessi 2013a). Most wild, commercially caught king salmon in Southeast come from rivers in British Columbia, Washington, and Oregon (Orsi and Jaenicke 1996). The king salmon all-gear harvest quota is established according to guidelines contained in the US/Canada Pacific Salmon Treaty, which covers the years of 2009–2018 (Jones and Chadwick 2011). The Alaska Board of Fisheries subsequently allocates Alaska's share of the quota to the drift gillnet, set gillnet, seine, troll, and sport fisheries. The Board of Fisheries allocates approximately 7% of the quota to the net fisheries, and the remainder is split 80/20 between the troll and sport fisheries, respectively (Jones and Chadwick 2011). In 2012, trollers took 209,000 of the 281,000 king salmon harvested commercially in Southeast (Conrad and Davidson 2013). The 2014 ex-vessel value of the Chinook fishery in Southeast Alaska was \$21.7 million (Alaska Department of Fish and Game 2015a) topping the 10-year average from 2002–2011 of \$15.6 million (Conrad and Davidson 2013).

In 2013, sport fishers caught an estimated 166,824 king salmon and harvested 34% of them (56,392 fish), which was a drop from the estimated ten-year annual average of 68,258. Almost all king salmon caught recreationally were taken in saltwater (Alaska Department of Fish and Game 2015b). A 126 lb (57 kg) king salmon taken in a fish trap near Petersburg, Alaska in 1949 is the largest on record. The largest sport-caught king salmon was a 97 lb (44 kg) fish taken in the Kenai River in 1986.

#### Red (Sockeye) Salmon

In the Pacific Region, red salmon, also known as sockeye, were the first salmon to be commercially harvested. Because of their color, rich oil content, flavor, and superior flesh quality they remain the most sought after of all the Pacific salmon. Sockeyes are the most economically important species in Alaska. While the economic dominance does not hold true in Southeast, they are still the salmon most harvested by personal use and subsistence fishers in Southeast (Schindler et al. 2010).

In Southeast Alaska in 2012, the total sockeye harvest in commercial, personal use, and subsistence salmon fisheries was 0.9 million sockeye, which is 0.4 million lower than the long-term average of 1.3 million sockeye (Conrad and Davidson 2013, p. 4). From 2002 to 2011, driftnets took 45% of the commercial harvest of sockeye, purse seiners took 35%, setnets took 11%, and trollers took less than 1% of the commercial sockeye harvest. Hatcheries took 8% and produced 12% of the commercial common property fishery (which constitutes approximately 108,000 fish) (Conrad and Davidson 2013). The ten-year average ex-vessel value of the Southeast sockeye fishery from 2002–2011 was \$9 million (Conrad and Davidson 2013).

The estimated average annual sport catch of red salmon in Southeast Alaska from 2004–2013 was 33,732 fish. The estimated catch in 2013 alone was 35,923. Anglers keep almost 60% of the sockeyes that they reel in, a retention number topped only by coho. The harvest numbers are therefore lower than the catch numbers. The estimated average annual sport harvest of red salmon in Southeast Alaska from 2004–2013 was 17,376 fish, while the estimated sport harvest of red salmon in Southeast in 2013 alone was 21,146 fish. A little over half the red salmon caught came from freshwater (Alaska Department of Fish and Game 2015b).

#### Silver (Coho) Salmon

In 2012, the total commercial, personal use and subsistence harvest of coho salmon (also called silver salmon) was 2.1 million fish. This was well below the recent 10-year average harvest of 2.6 million. The record harvest for silver salmon of 5.7 million occurred in 1994 (Conrad and Davidson 2013). From 2002 to 2011, trollers took 58% of coho harvest, driftnets took 12%, purse seiners took 11%, and setnets took 5% (Conrad and Davidson 2013). Hatcheries took 12% and produced 27% of the common property commercial coho take (Vercessi 2013a). The ex-vessel value of the coho fishery in Southeast was \$18.1 million, just below the ten-year average of \$19 million (Conrad and Davidson 2013).

Sport anglers catch more coho than any other Alaska fish. In 2013, sport anglers caught an estimated 485,581 coho, compared to 245,936 Pacific halibut, the second-most-caught recreational fish in Alaska, and compared to 324,543 pink, the second-most-caught anadromous fish species in Alaska. The harvest of cohos by recreational anglers was 70% of those caught, estimated at 339,586, with 91% harvested in saltwater (Alaska Department of Fish and Game 2015b). The state angling record for coho salmon is a 26 lb (12 kg) fish caught in 1976 in Icy Strait.

#### Pink (Humpy) Salmon

Pink salmon have dominated the commercial fish harvest in Southeast Alaska since the early 1900s. In the past 10 years pink salmon has comprised 74% of Southeast's total salmon harvest. In 2012, the pink harvest was below the ten-year average and came in at 21.3 million pinks, compared to the record harvest at 77.8 million pink salmon in 1999. Lower harvests in some years are generally attributed to the pink salmon's unique life cycle rather than declining populations. But a drought in 2004 likely also contributed to the wider fluctuations now seen in pink salmon numbers (Piston and Heintl 2014). The commercial pink salmon harvest in 2012 was valued at more than \$101.1 million (Conrad and Davidson 2013).

Between 2002 and 2011, purse seiners harvested 92% of the commercial pink salmon. Driftnetters took 3%, while setnets, trollers, and hatcheries all harvested minimal amounts (Conrad and Davidson 2013).

As with the pink salmon commercial fishery, catch numbers for pink salmon in the recreational fishery vary widely by year. In 2005, sport anglers caught an estimated 428,382 pinks. In contrast, sport anglers caught only an estimated 178,336 pinks in 2008. This wide disparity is due in part to the pink salmon's life cycle in which pinks spawn at two years of age, with different populations returning on odd and even years. A drought in 2004 is another likely cause of the large swings between even and odd year stocks now regularly seen in pink salmon numbers. Prior to 2004 the odd-even-year regime was not as drastic, with even years being the bigger producers. The dismal harvest and the subsequent early closure of the fishery in 2006 was the smallest catch in almost two decades (Piston and Heintl 2014).





Melanie Smith / Nick Jans

Steelhead fishing, Prince of Wales Island.

More recently, 2013 was a strong year for the recreational pink fishery. The estimated 324,543 pinks caught by sport anglers in 2013 was second only to silver salmon in anadromous fish numbers. Often considered a lower quality salmon by locals, about 70% of the pinks caught recreationally were returned to the water, leaving the estimated sport harvest at 95,783 pinks. Although anglers caught a substantial number of pinks in freshwater—an estimated 95,783—only 12,275 of those pinks were kept (Alaska Department of Fish and Game 2015b). The state angling record for pink salmon is a 13 lb (6 kg) fish caught on the Moose River on the Kenai Peninsula in 1974.

#### Chum (Dog) Salmon

Southeast Alaska once saw wild chum salmon harvest at over 9 million, in 1917 (Piston and Heintz 2011). Numbers plummeted during 1962–1984. Today, most chum production comes from hatcheries (Conrad and Gray 2014). With the establishment of the state hatchery program in 1971, the population of chum salmon has more than doubled since the 1980s. According to Conrad and Davidson (2013), “the recent 10-year average chum harvest is six times pre-hatchery production [excluding the early 1900s] and the 2012 fishery was nearly eight times that amount.” In 2012, the total harvest of chum salmon in commercial, personal use, and subsistence was 12.4 million, the sixth highest total since statehood (Conrad and Davidson 2013).

Purse seiners took 38% of the chum salmon harvested commercially. Driftnets took 23%, trollers took 3%, and setnetters took less than 1%. Hatcheries took 35% of the commercial chum salmon harvest (an arrangement set up to pay for operations), by far the highest percentage of any of the commercial salmon fisheries.

The sport catch numbers for chum vary widely by year. Between 2003 and 2013 the catch went from an estimated high of 84,306 in 2004 to a low of 33,698 in 2010. In 2013, sport anglers caught an estimated

57,942 chum. The anglers kept, or harvested, an estimated 22,737 chum, or 39% of the catch. About 87% of the chum taken in the recreational fishery were caught in saltwater (Alaska Department of Fish and Game 2015b). The chum salmon state angling record is a 32 lb (14.5 kg) fish in 1985 at Caamano Point near Ketchikan.

#### Steelhead

Steelhead are not fished commercially, but are prized by sport anglers for the thrill of catching this strong oceanic version of the rainbow trout. Due to population concerns, the State places significant limits on steelhead fishing in Alaska. In 1994, state regulations went into effect to dictate that anglers could only keep steelhead that are over 36 in (91 cm) in length, thus protecting most first-time spawners and effectively excluding about 95% of all steelhead (Harding and Coyle 2011). Regulations further limit anglers to one fish per day, with a total limit of two fish per season. Steelhead are almost exclusively caught in freshwater and are overwhelmingly a catch and release species. In 2013, for instance, anglers landed an estimated 6,163 steelhead, but only kept 46 (Alaska Department of Fish and Game 2015b).

#### Dolly Varden

Dolly Varden, also known as Arctic char, were once wrongly accused of preying on the young of other salmonids, and had a bounty on their heads from 1921–1939 (Harding and Coyle 2011). Today Dollys are prized as a sport fish and for their excellent taste, but primarily constitute a catch and release fishery. Like steelhead, Dolly Varden are not fished commercially. But historically, Dolly Varden constituted a large amount of the bycatch from commercial salmon harvest.

Dolly Varden are the most frequently caught of the trout and char species in Southeast Alaska. Just over 75% of the Dolly Varden captured are caught in freshwater (Alaska Department of Fish and Game 2015b). In 2013, for instance, sport anglers in Southeast Alaska



kept a little under 20% of the Dolly Varden they caught, with an estimated catch of 56,778 Dolly Varden and a harvest of about 10,859 fish (Alaska Department of Fish and Game 2015b). The state Dolly Varden/Arctic char angling record is a 27 lb fish caught in 2002 on the Wulik River at Kivalina, Alaska.

### CONSERVATION ISSUES

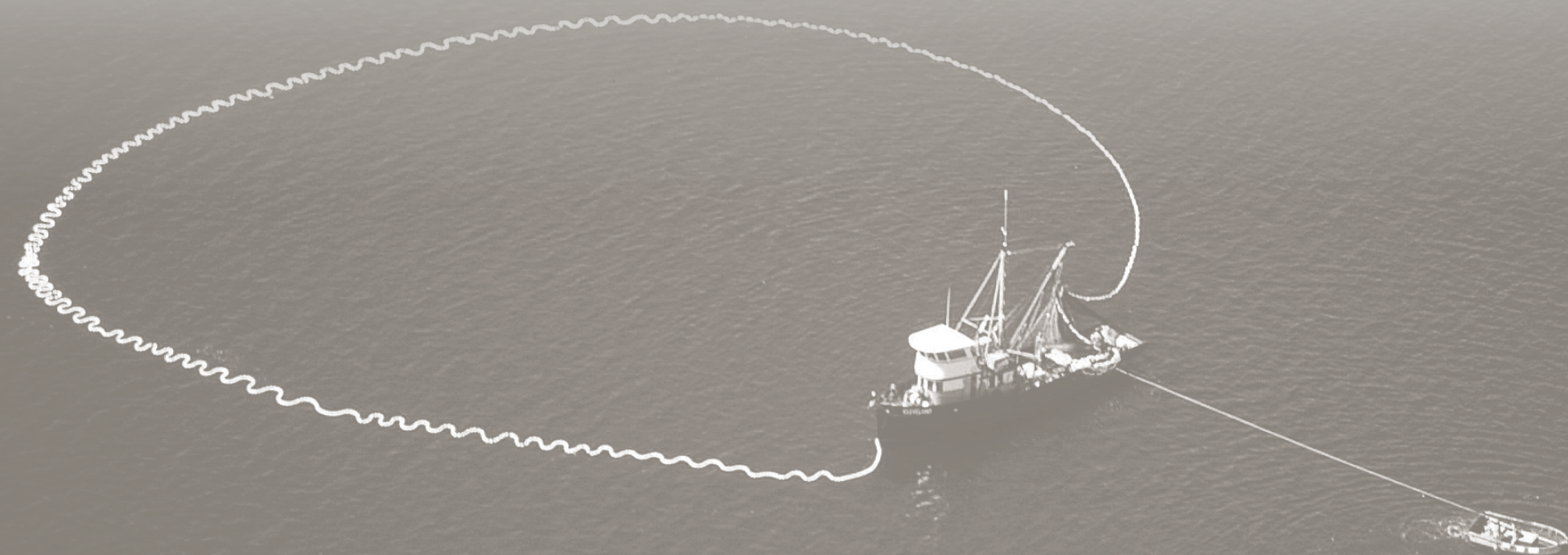
The fisheries in Southeast provide a solid foundation to the region's economy. Fisheries in turn are dependent on prudent stock management and sound habitat conservation practices, in both marine and terrestrial environments. Clearcut logging in watersheds can harm salmon runs by introducing sedimentation to streams, lowering recruitment of large woody debris, and warming water temperatures. Wild stocks also face threats from overharvest, climate change, and escaped pathogens from farm-raised organisms. By implementing sustainable and careful management of Southeast Alaska's incredible aquatic resources, fisheries managers can have a profound positive effect on the region's economic and cultural way of life, as well as on the interconnected natural ecosystem.

### MAPPING METHODS

This map includes data from several different sources: the ADFG Hatchery locations and salmon harvest data were provided by ADFG's Division of Commercial Fisheries to the Alaska chapter of The Nature Conservancy, who processed the data for publication (Alaska Department of Fish and Game: Division of Commercial Fisheries and The Nature Conservancy 2011, 2013). The mariculture data represent currently permitted aquatic farm locations, and were provided by the ADFG Mariculture program (Alaska Department of Fish and Game: Commercial Fisheries Division: Mariculture Program 2013). Aquaculture sites are from the Environmental Sensitivity Index dataset (NOAA: Office of Response and Restoration 2005).

### MAP DATA SOURCES

- Hatcheries: Alaska Department of Fish and Game: Division of Commercial Fisheries and The Nature Conservancy (2013)
- Mariculture sites: Alaska Department of Fish and Game: Commercial Fisheries Division: Mariculture Program (2013)
- Aquaculture: NOAA: Office of Response and Restoration (2005)
- Salmon harvest: Alaska Department of Fish and Game: Division of Commercial Fisheries and The Nature Conservancy (2011).

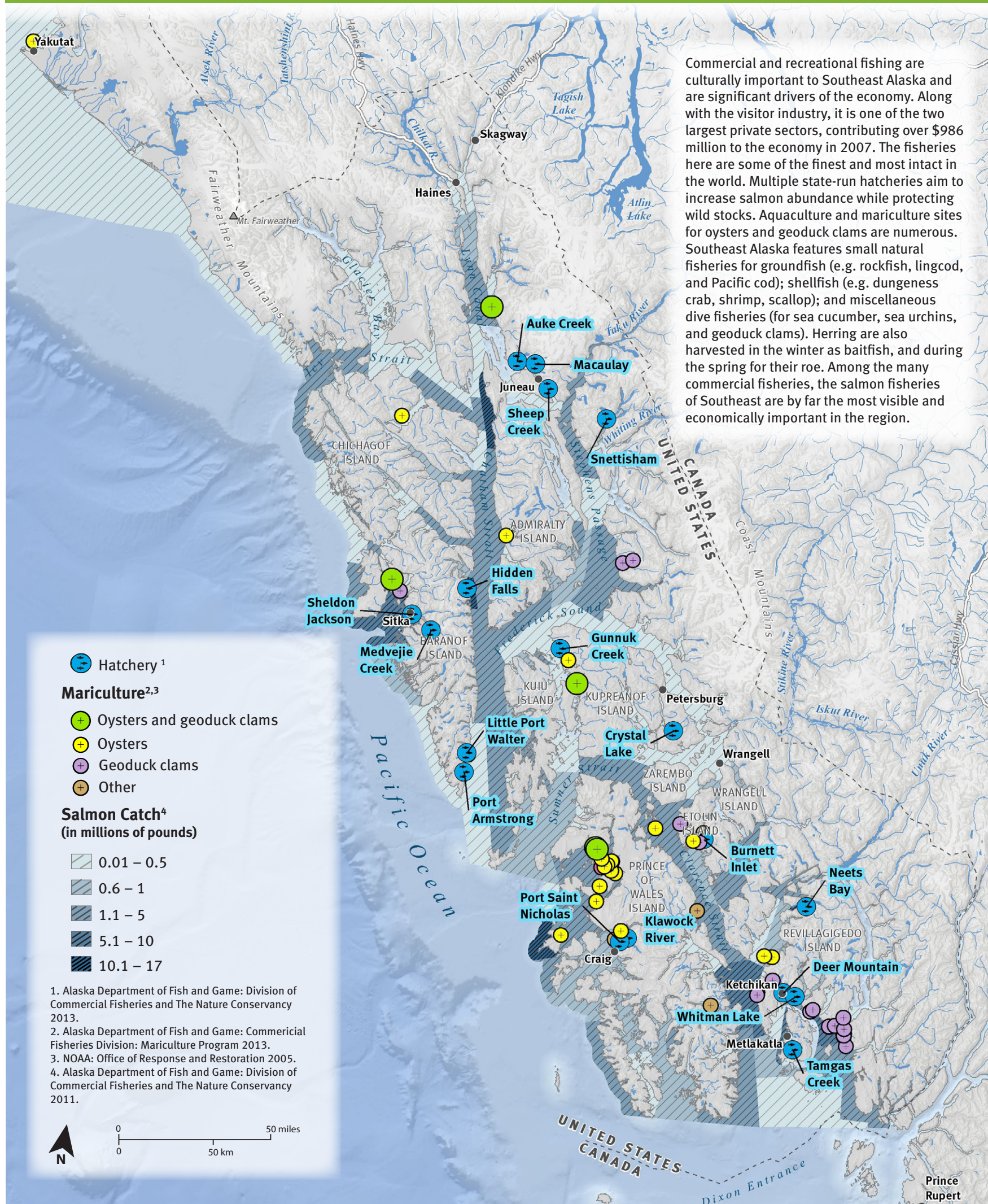






# Commercial Fishing

Commercial and recreational fishing are culturally important to Southeast Alaska and are significant drivers of the economy. Along with the visitor industry, it is one of the two largest private sectors, contributing over \$986 million to the economy in 2007. The fisheries here are some of the finest and most intact in the world. Multiple state-run hatcheries aim to increase salmon abundance while protecting wild stocks. Aquaculture and mariculture sites for oysters and geoduck clams are numerous. Southeast Alaska features small natural fisheries for groundfish (e.g. rockfish, lingcod, and Pacific cod); shellfish (e.g. dungeness crab, shrimp, scallop); and miscellaneous dive fisheries (for sea cucumber, sea urchins, and geoduck clams). Herring are also harvested in the winter as baitfish, and during the spring for their roe. Among the many commercial fisheries, the salmon fisheries of Southeast are by far the most visible and economically important in the region.



Hatchery<sup>1</sup>

**Mariculture<sup>2,3</sup>**

Oysters and geoduck clams

Oysters

Geoduck clams

Other

**Salmon Catch<sup>4</sup>**  
(in millions of pounds)

0.01 – 0.5

0.6 – 1

1.1 – 5

5.1 – 10

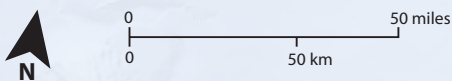
10.1 – 17

1. Alaska Department of Fish and Game: Division of Commercial Fisheries and The Nature Conservancy 2013.

2. Alaska Department of Fish and Game: Commercial Fisheries Division: Mariculture Program 2013.

3. NOAA: Office of Response and Restoration 2005.

4. Alaska Department of Fish and Game: Division of Commercial Fisheries and The Nature Conservancy 2011.



Map 7.6: Commercial Fisheries



## LAND USE DESIGNATIONS

*John Cannon and Melanie Smith*

Southeast Alaska is managed in broad land use categories that range from congressionally designated Wilderness to private development lands. As the largest landowner in the region, the Tongass National Forest's land management plan drives much of the region's land use allocation. Most broadly, the lands and waters of the Tongass are managed in three Land Use Designation (LUD) groups: Wilderness, Natural Setting, and Development. Within each of these three groups, there is a further division into several specific LUDs for a total of 17 designations on the Tongass. Additionally, there is one Minerals LUD that overlays areas within the Natural Setting group. LUDs identify the most important natural areas to be protected, set forth lands targeted for intensive uses such as logging, and also provide guidelines for the management of these areas to ensure that ecological value is maintained into the future.

The following information is referenced from the Tongass Land Management Plan (TLMP) and Plan Amendment (US Forest Service 2008d; USFS Tongass National Forest 2015), and is summarized in Table 7-7.

There are four Development LUDs, including Experimental Forest, Modified Landscape, Timber Production, and Scenic Viewshed. These designations represent more intensive uses such as forestry.

The 13 non-development LUDs (Wilderness and Natural Setting groups) aim to preserve the important biological value or wilderness characteristics that define these areas. The three designations within the Wilderness group afford some of the highest levels of protection from human impact. These designations include Wilderness, Wilderness National Monument, and Nonwilderness National Monument. There are 19 Wilderness areas identified in the Tongass National Forest.

The Natural Setting group includes ten LUDs. After Wilderness, the next most protective designation is LUD II. These places are roadless areas which make up a large part of the official Inventoried Roadless Areas (IRAs) on the Tongass. These areas emphasize wilderness values, prohibit timber cutting, and allow roads only in rare situations. There are 12 LUD II roadless areas identified within the Tongass National Forest.

Both Wilderness and LUD II roadless areas allow hunting and fishing, temporary camps and facilities for the harvest of fish and game, and traditional access, including established use of motorboats and fixed-wing airplanes. The other designations within the Wilderness group and the Natural Settings group are less protective but still aim to conserve drinking water, old growth habitat, wild and scenic wild rivers, and to specifically provide for remote recreation opportunities.

### WILDERNESS LUD GROUP

**Wilderness** areas are managed with the goal of maintaining natural ecological processes largely free from the impact of civilization. These areas exhibit qualities described by the Wilderness Act of 1964 as being important to recreation, science, ecosystem integrity, spiritual values, opportunities for solitude, and wildlife needs. Managers thus limit motorized use in these areas to the minimum needed for the administration of Wilderness.

Most National Monument areas also fall under the Wilderness designation, and appear as **National Monument/Wilderness** in the accompanying map. National Monuments embody a combination of outstanding scientific and historical features. These designations provide specifically for the protection and study of particular resources that may include cultural resources, geology, plant and animal succession, or brown bear (*Ursus arctos*) and Bald Eagle (*Haliaeetus leucocephalus*) populations.



John Schoen

Old-growth habitat and Wild, Scenic, and Recreational rivers are some of the conservation land uses on the Tongass National Forest.



**TABLE 7-7** Tongass National Forest Land Use Designations (adapted from USFS Tongass National Forest 2015).

Land Use Designation (LUD)	Acres
Wilderness LUD Group	Total: 5,908,240
Wilderness	2,630,037
Wilderness National Monument	3,110,924
Nonwilderness National Monument	167,279
Natural Setting LUD Group	Total: 7,734,138
Land Use Designation II	875,454
Remote Recreation	2,004,323
Semi-Remote Recreation	3,007,591
Old-Growth Habitat	1,188,034
Municipal Watershed	43,975
Research Natural Area	56,057
Special Interest Area	329,454
Wild River	187,425
Scenic River	15,501
Recreational River	26,324
Development LUD Group	Total: 3,448,987
Experimental Forest	31,420
Scenic Viewshed	307,402
Modified Landscape	728,679
Timber Production	2,381,486

The **National Monument (non-wilderness)** management efforts aim to protect natural resources, and provide for public access to the Monument, while also permitting valid mining activities, but limiting mining’s impact to the extent possible.

These protected areas have their origin in the passage of ANILCA in 1980, which established 5.4 million acres (2.2 million hectares) of designated Wilderness in the Tongass, including the establishment of Admiralty Island National Monument, the Kootznoowoo Wilderness, and the Misty Fiords National Monument Wilderness. Twelve other wilderness areas were also established with the passage of this Act, from the southern, storm-swept area of Prince of Wales Island, to the outer coasts of Chichagof and Yakobi islands, to Russell Fjord in Yakutat Bay. Wilderness areas were expanded (to a total of 19) with the passage of the Tongass Timber Reform Act (TTRA) in 1990. This legislation designated an additional 280,483 ac (113,508 ha) of Wilderness.

**NATURAL SETTING LUD GROUP**

The areas officially known as **LUD II** were first established with the passage of the TTRA in 1990, which designated 727,762 ac (294,516 ha) for this use. No timber harvest or road construction may occur in these areas, in order to retain the wilderness character. These areas are managed for low-impact recreation and tourism opportunities, with some primitive recreational facilities permitted. Personal use of harvest cabin logs and firewood is allowed, as are water and power developments that are designed to be compatible with primitive characteristics. Roads are allowed only to provide vital linkages for infrastructure. Mineral development is allowable.

There are two Recreation Area LUDs shown on the accompanying map: Remote and Semi-Remote Recreation. **Remote Recreation** provides primitive recreation opportunities in areas largely free of any signs of human impact. Trails and primitive facilities may appear, and boat, aircraft, and snowmachine access may occur. **Semi-Remote Recreation** provides opportunities for semi-primitive recreation, as well as occasional areas of concentrated recreation facilities in a natural or

natural-appearing setting. Motorized recreation activities are permitted in these areas unless specified otherwise.

**Old-Growth Habitat LUDs** maintain ecosystem processes and support the species associated with these intact natural habitats. These areas are managed to maintain currently present old-growth characteristics, as well as to encourage younger stands to develop successionaly into mature forest stands. Managers typically limit roads and facilities within this LUD. The 2016 plan revision may allow clearcutting of second-growth forest in these areas.

Tongass National Forest also serves to maintain safe drinking water for the cities located within its boundaries. The designation of **Municipal Watersheds**, which have been established for nine cities and boroughs, illustrates this vital ecosystem service. Managers generally maintain these areas in a natural condition to ensure the consistent supply of high quality water.

The system of **Research Natural Areas** allows for the research and study of unmanipulated natural areas. This network of study areas represents the predominant vegetation types, wildlife habitats, and aquatic communities present in the Tongass National Forest. Researchers can use the system as a scientific control site to compare against specific management actions undertaken in other areas. Managers maintain these areas in as natural a state as possible, with the only facilities or roads permitted being those necessary for conducting research.

A system of **Special Interest Areas** provides for the protection, study, and enjoyment of certain areas with unique cultural, geological, botanical, zoological, recreational, scenic, or other special features. Managers may permit facilities if they provide for compatible public uses and are not visually disruptive, but otherwise these areas are maintained in a natural state.

**Wild and Scenic Rivers** are designated to maintain, enhance, and protect the free-flowing, unmodified condition of the river as well as provide opportunity for recreation and tourism. **Recreational Rivers** are designated to maintain, improve, and protect the essentially free-flowing condition through a modified setting that allows timber, roads, and other developments.

**DEVELOPMENT LUD GROUP**

**Experimental Forest** areas provide opportunities for the study of forest management activities. These areas allow timber harvest for research and demonstration purposes, as well as the roads necessary to carry out this experimental harvest.

The main objective of **Scenic Viewsheds** is to maintain the visual quality of these areas as seen from roads, trails, water travel routes, and recreation sites. The harvest from Scenic Viewsheds also supplies timber to meet market demand. All identified suitable timber in these areas is harvestable, subject to any other applicable regulations, with a priority placed on maintaining scenic integrity.

Areas identified as **Modified Landscape** also seek to provide a sustained yield of timber, while placing less emphasis than Scenic Viewsheds on minimizing the visibility of timber activity. Guidelines encourage avoiding clearcutting when other methods meet land management objectives. Recreation opportunities that are compatible with roaded areas are available in these areas.

**Timber Production** areas are managed to provide sustained long-term timber yields. Managers place little emphasis on maintaining the visual quality of these areas. However, this LUD encourages the reduction of clearcutting when other methods may be available for meeting land management objectives. Recreation opportunities associated with roaded areas are available in these areas.

In all, the LUDs prescribed for the Tongass National Forest provide zoning for how the forest should be managed, and what uses should be permitted. This vision seeks to protect the Forest’s important natural features, while continuing to make timber resources available for harvest.



### LANDS OUTSIDE OF THE NATIONAL FOREST

Other nationally significant protected lands that are in the region, but not a part of the Tongass National Forest, include Glacier Bay National Park and Klondike Gold Rush National Historical Park, managed by the National Park Service.

The Haines State Forest is managed by the State of Alaska for a sustained yield of resources that include timber, recreation and tourism, minerals, and fish and wildlife habitat.

Much of the rest of Southeast Alaska is privately owned by Native Corporations, municipalities, or individuals. Those lands are largely developed areas within communities, or lands used for timber or transportation.

### CONSERVATION ISSUES

The Tongass National Forest is the major land owner in Southeast Alaska. Accordingly, the TLMP largely determines the ecologic and economic setting of the region. The land uses of the forest provide an array of values such as solitude and aesthetic beauty, clean water, wildlife habitat, and job opportunities. The use of these lands fuels the region's fishing, tourism, and timber industries. Conservation of much of the landscape is important for maintaining healthy ecosystems and, in turn, economic opportunities, into the future.

Adequate protection of the Forest requires conservation of lands at multiple scales, including large-scale or watershed-scale reserves as well as designations such as buffers of important natural features. In addition to the protection afforded by Wilderness and Natural Setting LUDs, there are other conservation measures specified in the TLMP that help to protect important natural resources within the matrix of lands not otherwise protected. These include beach fringe and riparian buffers, and old-growth reserves.

Beach fringe buffers cover all marine coastline and estuaries, specifying that a 1,000-foot-wide buffer of beach fringe forest will be left in its natural state. These protections help to ensure that the ecological integrity of these biologically important and sensitive habitat areas is maintained. Riparian buffer regulations vary depending on the classification of the stream type, but generally do not permit any logging operations within 100 feet of a stream. These protected buffers help to ensure that salmon, an important food resource for wildlife and humans alike, is not adversely affected by logging.

Old-growth reserves were identified to ensure sufficient quality, quantity, and spatial arrangement of mature forest habitat to support ecosystem processes and the species dependent upon mature forest

stands. A system of reserves was envisioned to achieve this goal that is comprised of small, medium, and large old-growth reserves (OGRs). Medium and large reserves serve to protect some of the best and largest core habitat areas remaining, while the small reserves serve to maintain a functioning distribution of high-quality habitat that conserves landscape connectivity.

Together, these protected areas form a network to help ensure the continued health of this ecosystem. Currently, the future status of this network is uncertain—the current plan amendment proposes to enter beach fringe and riparian buffers and OGRs for clearcutting of second-growth. Because these areas can be vital habitat for fish, mammals, and birds, conservationists are concerned that the new plan may degrade the integrity of these places through clearcut logging, in lieu of letting the buffers and reserves continue to mature.

Audubon and partners such as The Nature Conservancy (TNC), Trout Unlimited (TU), and the Southeast Alaska Conservation Council (SEACC) have worked diligently for decades to identify and propose improvements to the Tongass conservation lands network. SEACC and others have proposed additional Wilderness areas as well as Wild and Scenic Rivers that should be given further consideration. The Audubon-TNC Conservation Area Design and TU-Audubon T77 watershed proposals aim to permanently protect watersheds essential to the functioning of the whole forest ecosystem, in combination with the finer-scale beach fringe, riparian, and OGR protections in TLMP. Those plans are described in the next sections.

### MAPPING METHODS

Land Use Designations were developed by the Forest Service using Tongass-wide forest maps, with an accuracy of 3500 feet. These are then updated as needed for specific projects, to resolve gaps or conflicts between LUDs and existing harvest units, roads, or other boundaries. The Forest Service has resolved these inconsistencies as needed, by following physical features, endeavoring to maintain the natural setting, and using best professional judgment (US Forest Service 2008d).

### MAP DATA SOURCES

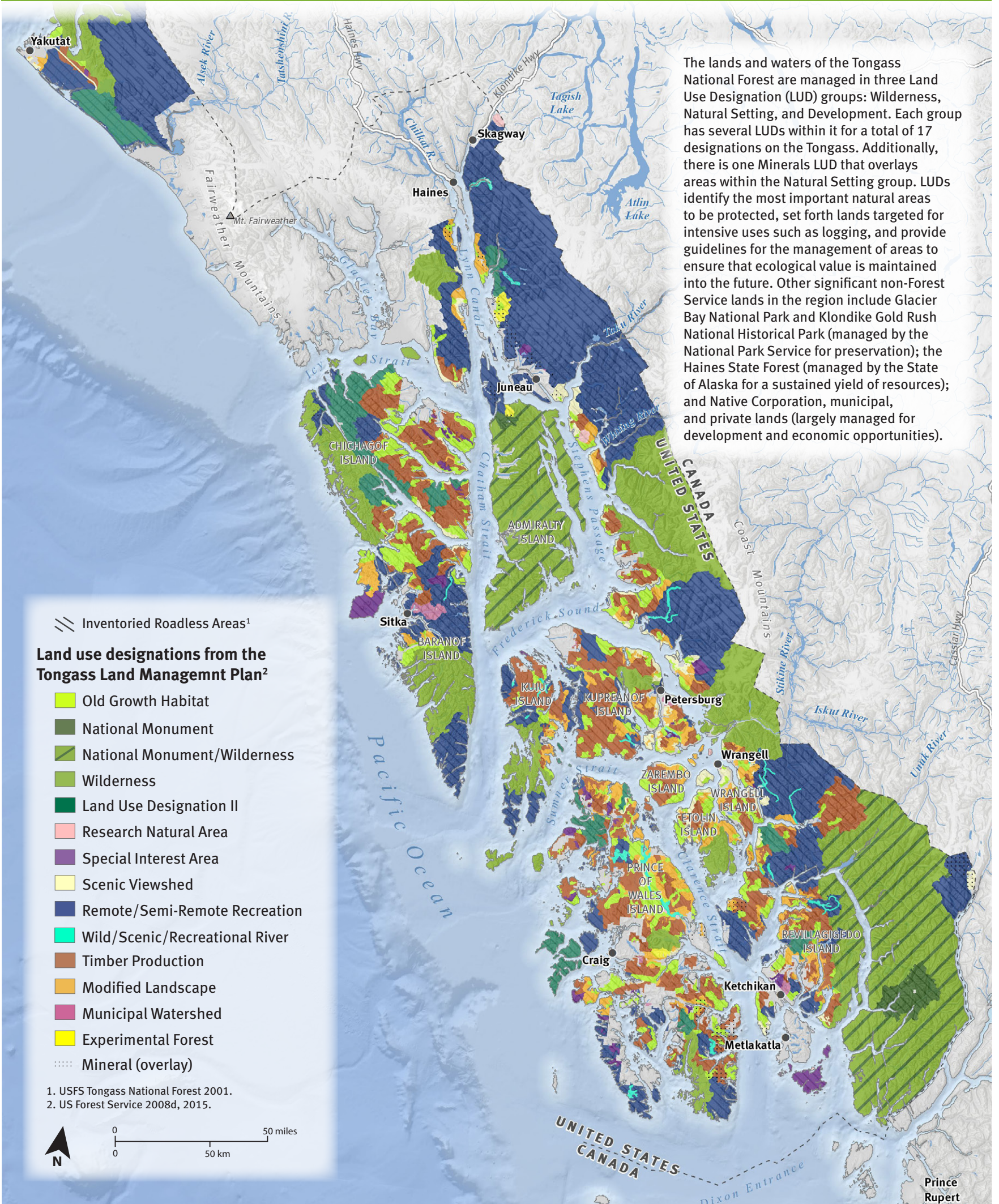
- Land Use Designations: US Forest Service (2008d); US Forest Service (2015)
- Legislatively protected areas: US Forest Service (2008d)
- Inventoried Roadless Areas USFS Tongass National Forest (2001).





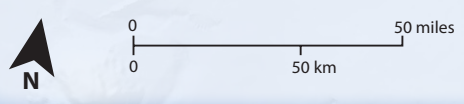
# Land Use Designations

The lands and waters of the Tongass National Forest are managed in three Land Use Designation (LUD) groups: Wilderness, Natural Setting, and Development. Each group has several LUDs within it for a total of 17 designations on the Tongass. Additionally, there is one Minerals LUD that overlays areas within the Natural Setting group. LUDs identify the most important natural areas to be protected, set forth lands targeted for intensive uses such as logging, and provide guidelines for the management of areas to ensure that ecological value is maintained into the future. Other significant non-Forest Service lands in the region include Glacier Bay National Park and Klondike Gold Rush National Historical Park (managed by the National Park Service for preservation); the Haines State Forest (managed by the State of Alaska for a sustained yield of resources); and Native Corporation, municipal, and private lands (largely managed for development and economic opportunities).



- /// Inventoried Roadless Areas<sup>1</sup>
- Land use designations from the Tongass Land Management Plan<sup>2</sup>**
- Old Growth Habitat
- National Monument
- National Monument/Wilderness
- Wilderness
- Land Use Designation II
- Research Natural Area
- Special Interest Area
- Scenic Viewshed
- Remote/Semi-Remote Recreation
- Wild/Scenic/Recreational River
- Timber Production
- Modified Landscape
- Municipal Watershed
- Experimental Forest
- Mineral (overlay)

1. USFS Tongass National Forest 2001.  
 2. US Forest Service 2008d, 2015.



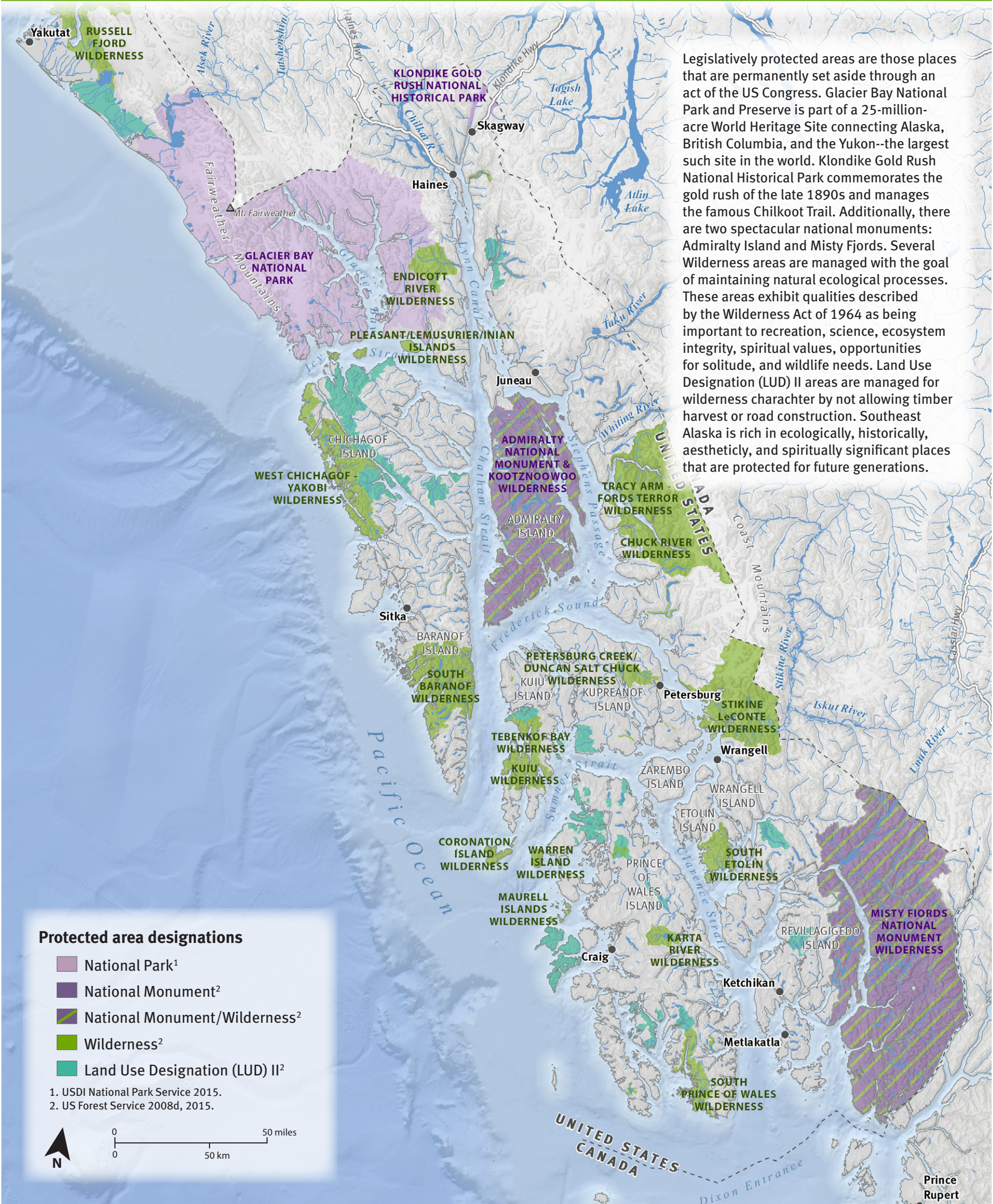
Map 7.7: Land Use Designations





# Legislatively Protected Areas

Legislatively protected areas are those places that are permanently set aside through an act of the US Congress. Glacier Bay National Park and Preserve is part of a 25-million-acre World Heritage Site connecting Alaska, British Columbia, and the Yukon--the largest such site in the world. Klondike Gold Rush National Historical Park commemorates the gold rush of the late 1890s and manages the famous Chilkoot Trail. Additionally, there are two spectacular national monuments: Admiralty Island and Misty Fjords. Several Wilderness areas are managed with the goal of maintaining natural ecological processes. These areas exhibit qualities described by the Wilderness Act of 1964 as being important to recreation, science, ecosystem integrity, spiritual values, opportunities for solitude, and wildlife needs. Land Use Designation (LUD) II areas are managed for wilderness character by not allowing timber harvest or road construction. Southeast Alaska is rich in ecologically, historically, aesthetically, and spiritually significant places that are protected for future generations.



**Protected area designations**

- National Park<sup>1</sup>
- National Monument<sup>2</sup>
- National Monument/Wilderness<sup>2</sup>
- Wilderness<sup>2</sup>
- Land Use Designation (LUD) II<sup>2</sup>

1. USDI National Park Service 2015.  
2. US Forest Service 2008d, 2015.

**Scale:** 0 to 50 miles / 0 to 50 km

**North Arrow:** N

Map 7.8: Legislatively Protected Areas



# A CONSERVATION AREA DESIGN FOR SOUTHEAST ALASKA

*David Albert and John Schoen, Revised by Melanie Smith*

In Southeast Alaska today, resource managers, scientists, and conservationists have an unprecedented opportunity for protecting the ecological integrity and unique natural qualities of this coastal rainforest, while also sustaining local economies and maintaining the quality of life valued by the people who live and work in the region. The opportunities for conserving intact landscapes have largely disappeared throughout much of the world.

To maintain ecological integrity in Southeast, scientists and resource managers must refine the regional conservation strategy through a collaborative process that uses the best available science. Audubon Alaska and The Nature Conservancy (TNC) provided such a strategy in the *Conservation Assessment and Resource Synthesis for the Coastal Forests and Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest* (Schoen and Dovichin 2007). The overarching goal of the conservation assessment was to conserve the biological diversity and ecosystem function of the temperate rainforest of Southeast Alaska.

The Conservation Area Design is the focus of the 2007 Audubon-TNC Conservation Assessment. That report explains the foundation of this work in great detail. Data, methods, results, and discussion of that work are very briefly summarized here. For more information on the ideas behind watershed-scale conservation, the process, and results of this work, read Chapters 2 and 10 of that report.

## PROCESS

To achieve that goal, Audubon and TNC first reviewed existing resource information for Southeast and the Tongass and developed a spatial database that integrated data across administrative boundaries from Yakutat to Ketchikan. That was followed by developing a process for ranking individual ecological values by watershed within 22 biogeographic provinces distributed across the region. Finally, combined ecological values were modeled using the Marxan tool to provide a conservation blueprint for the region.

In this collaborative project, a scientific advisory committee of agency and university scientists was established for guidance. Public documents reviewed included scientific literature, resource inventories, agency reports, and planning documents (such as the US Forest Service 1997 Tongass Forest Land and Resource Management Plan and environmental impact statement). In addition, knowledgeable field experts were identified and interviewed. The mapping component of this project was spearheaded by TNC in cooperation with Audubon by using data layers from state and federal resource agencies.

## ECOLOGICAL FOUNDATION

An effective conservation strategy requires a measure of geographic distribution and representation of the natural range of variability within which populations and ecosystems occur (Poiani et al. 2000). A well-balanced geographic distribution is particularly important in Southeast Alaska where ecosystems are naturally fragmented by islands and steep glacial terrain, and isolated from the continent of North America by mountains and icefields along the coastal mountain range (Cook and MacDonald 2001; MacDonald and Cook 1996).

This assessment used a regional geographic stratification based on Southeast biogeographic provinces to ensure that conservation areas are sufficiently distributed among the islands and mainland. This assessment focuses on conservation of whole watersheds, and restoration of developed watersheds. Importantly, these areas are supplemented by the finer-scale reserves set forth in the TLMP for a multi-scaled conservation approach that would preserve the forest over the long-term, for species functioning from small to large scales.

The assessment focused on conservation at the watershed scale to preserve ecological processes in holistic, functional landscape units. According to Lertzman and MacKinnon (2013), “The most compelling argument for watersheds as reserves is that, more than any other delineations of equivalent size (or investment), they represent areas of landscape with strong internal connections among ecosystem processes and weaker external connections. Thus, watershed-based reserves have a greater likelihood of maintaining the ecological integrity of the area over the long-term without significant human subsidies.”

A central element of the Tongass National Forest’s TLMP conservation strategy is a system of small and medium-sized old-growth reserves that are intended to serve as linkages between larger conservation areas. Site-specific protection standards apply within development LUDs and other lands, including buffers on riparian forests and beach and estuary fringe forests. These measures are critical to maintain ecological function within developed landscapes.

The Ecological Society of America has developed a set of principles for managing national forests in the US (Aber et al. 2000). Principles that are relevant to land management and conservation in Southeast and the Tongass include:

- Conservation of forest biodiversity requires reducing forest fragmentation by clearcuts and roads, avoiding harvest in vulnerable areas such as old-growth stands and riparian zones, and restoring natural structural complexity to cutover sites
- Planning at the landscape level is needed to address ecological concerns such as biodiversity, water flows, and forest fragmentation
- Despite natural disturbance and successional change, forest reserves are much more likely to sustain the full biological diversity of forests than lands managed primarily for timber production
- Protection of water quality and yield and prevention of flooding and landslides require greater attention to the impacts of logging roads and recognition of the value of undisturbed buffer zones along streams and rivers
- Traditional beliefs that timber harvesting can duplicate and fully substitute for the ecological effects of natural disturbance are incorrect, although newer techniques such as retaining trees and large woody debris on harvest sites can more closely mimic natural processes
- There is no scientific basis for asserting that silvicultural practices can create forests that are ecologically equivalent to natural old-growth forests, although our understanding of forest ecology can help restore managed forests to more natural conditions.

While the ultimate benchmark for successful conservation is to maintain the diversity, natural distribution, and functional roles of species and ecological systems (Noss et al. 1997; Poiani et al. 2000), it was not practical to assess every species or habitat association. Instead, a representative set of focal targets were selected for this conservation assessment:

- Brown and black bear (*Ursus arctos* and *U. americanus*) habitat
- Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) winter habitat
- Marbled Murrelet (*Brachyramphus marmoratus*) old-growth nesting habitat
- Anadromous fish habitat (for five species of Pacific salmon (*Oncorhynchus spp.*) and steelhead (*O. mykiss*))
- Estuaries
- Riparian and upland large-tree old-growth forest.



## RESULTS

This conservation assessment analyzed the distribution, abundance, and management of biologically important communities as a foundation to maintain the biological diversity of the region, conserve a wide range of species, and maintain ecosystem integrity.

The “Conservation Priority” watersheds identified are those with highest concentrations of ecological values, which represent a globally rare opportunity for conservation of coastal rainforest ecosystems and associated species. These watersheds contain approximately 34% of existing habitat values for all focal species and ecological systems combined.

An important set of watersheds with high concentrations of ecological values but which have also sustained substantial roading and logging activity represent areas appropriate for a balanced prescription with emphasis on second-growth timber production and restoration of habitat values for fish and wildlife. These areas are described as zones of “Restoration Priority” to emphasize the necessity to maintain critical ecosystem functions throughout the forest matrix and in the context of overall forest management objectives. Core areas of biological value within the Restoration Priority areas represent the highest concentration of intact ecological values and, in this context, represent important opportunities for conservation of remaining old-growth characteristics within the matrix and for enhancing connectivity among watersheds. Restoration Priority watersheds represent approximately 15% of existing habitat values for the combined focal species and ecological systems studied.

“Lower Value” watersheds are typical of extensive areas of bedrock and glacier-dominated landscapes along the mainland coast and southern and eastern Baranof Island. These areas contain lower ecological values, and represent approximately 10% of existing habitat for combined focal species and ecological systems.

## CONSERVATION ISSUES

The ecological integrity (i.e., long-term productivity and resilience of fish, wildlife, and their habitats) of Southeast’s rainforest ecosystem will depend, in large part, on balancing industrial development with sound conservation measures, including an expanded watershed-scale reserve system for this region.

An expanded system of intact watershed reserves would complement the current TLMP conservation strategy and minimize risks to ecosystem integrity, including sensitive populations of fish and wildlife and rare habitat types. As an example, floodplain and karst forest communities represent small but important components of the forest ecosystems of Southeast. This study estimated that a significant portion of the rare, large-tree floodplain and karst old growth forests (>50% in some provinces) have been harvested in Southeast during the last century.

Audubon Alaska recommends the following conservation measures throughout Southeast and the Tongass:

- Maintain and expand the existing conservation reserve network to include additional intact watersheds (Conservation Priority Watersheds) throughout Southeast and the Tongass
- Each of Southeast’s 22 biogeographic provinces should include a representative set of intact watershed reserves of high ecological value
- Apply best management practices (e.g., TLMP conservation strategy including, old-growth reserves, habitat buffers, standards and guidelines, and State Forest Practices Act guidelines) to resource development projects conducted in matrix lands throughout Southeast. Particular emphasis should be placed on maintaining riparian buffers and productive salmon spawning and rearing habitat throughout Southeast including outside of the Tongass
- Consider establishing additional critical habitat areas surrounding state lands and waters that include high-value and/or sensitive fish and wildlife habitats and where multiple land or water jurisdictions overlap, consider developing co-management agreements to safeguard fish and wildlife habitat values.

## MAPPING METHODS

This conservation assessment synthesized geographic information for a wide range of resource values integrated across public and private lands. Primary input data included biogeographic provinces, vegetation and land cover, landform and soils, shoreline, watersheds, elevation, streams and lakes, spawning and rearing salmonid distribution, and wetlands. Where possible, attributes and merged data from the Tongass National Forest were cross-referenced with other data sources into seamless layers for all of Southeast. For this purpose, Landsat imagery (current in 1999–2002) was acquired to fill gaps related to forest condition on private lands and to map estuaries in areas for which the National Wetlands Inventory was not yet complete.

This data was used to assess total habitat value within each watershed (also termed Value Comparison Unit [VCU]), by biogeographic province, and then rank the VCUs from most to least habitat for each focal target assessed (bears, deer, estuaries, etc.). The resulting “watershed matrix” spreadsheets consisted of a quantitative ecological ranking (within each biogeographic province) for each individual focal target within VCUs across Southeast.

Next, all focal targets were assessed together to identify optimal areas for conservation of multiple species. That analysis was conducted by using the Marxan spatial optimization tool (Possingham et al. 2000) for developing and evaluating reserve networks based on explicit conservation goals. Marxan was used at a range of spatial scales, including (1) entire watershed units (VCUs), (2) core areas within biogeographic provinces, and (3) core areas within VCUs. The watershed context provided the primary, landscape-scale characterization, while “core areas” represented the highest concentrations of intact ecological values at the sub-watershed scale.

Although this “spatial optimization” tool relies on an iterative simulated annealing, scenario-based algorithm, in short the Marxan analysis simply identifies the most concentrated distribution of habitat values across the landscape. The utility of Marxan is to identify a set of areas that most efficiently meet specified goals for representation of conservation targets. Ecological rankings were based on the areas of highest concentration of habitat values for the suite of focal species and ecological systems selected with the minimum total area and maximum connectivity. Many conservation efforts have been based on manual mapping, simple overlay, and expert opinion to identify priority areas. The optimization tool described allows conservation planners to base evaluation of alternatives on explicit and quantitative criteria for a more objective prioritization process.

Because habitat for the six fish species was highly spatially correlated, we used all salmon species habitat combined as a single target in the final model. Other focal targets included old-growth forest (big-tree riparian and upland stands), estuaries, brown and black bear summer habitat, Sitka black-tailed deer winter habitat, and Marbled Murrelet nesting habitat. Marxan was utilized to optimize a conservation area design for the combination of these values.

The combined ranking of ecological values at the watershed- and sub-watershed scales provided an analytical framework for conservation and management prescriptions across a range of ecological conditions. This information will allow managers and conservationists to focus conservation efforts on the most important core areas of ecological value.

## MAP DATA SOURCES

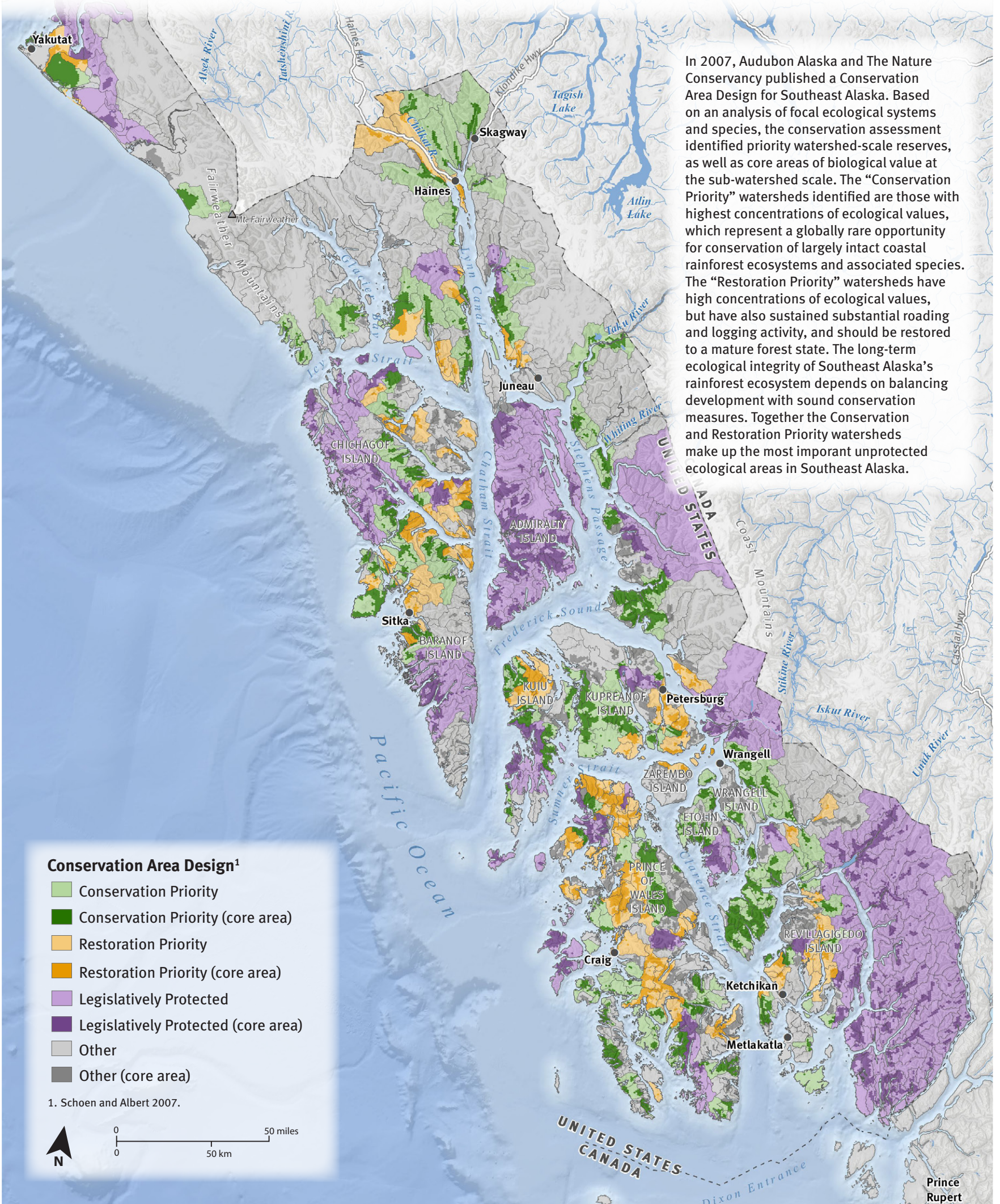
- Conservation area design: Albert and Schoen (2007).





# A Conservation Area Design for Southeast Alaska

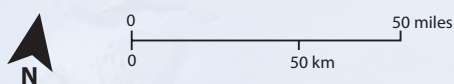
In 2007, Audubon Alaska and The Nature Conservancy published a Conservation Area Design for Southeast Alaska. Based on an analysis of focal ecological systems and species, the conservation assessment identified priority watershed-scale reserves, as well as core areas of biological value at the sub-watershed scale. The “Conservation Priority” watersheds identified are those with highest concentrations of ecological values, which represent a globally rare opportunity for conservation of largely intact coastal rainforest ecosystems and associated species. The “Restoration Priority” watersheds have high concentrations of ecological values, but have also sustained substantial roading and logging activity, and should be restored to a mature forest state. The long-term ecological integrity of Southeast Alaska’s rainforest ecosystem depends on balancing development with sound conservation measures. Together the Conservation and Restoration Priority watersheds make up the most important unprotected ecological areas in Southeast Alaska.



**Conservation Area Design<sup>1</sup>**

- Conservation Priority
- Conservation Priority (core area)
- Restoration Priority
- Restoration Priority (core area)
- Legislatively Protected
- Legislatively Protected (core area)
- Other
- Other (core area)

1. Schoen and Albert 2007.



Map 7.9: A Conservation Area Design for Southeast Alaska



## TONGASS 77 WATERSHEDS

Melanie Smith

The Tongass 77 (T77), also known as the “Salmon Forest” Proposal, designates key watersheds in Southeast Alaska for permanent protection to safeguard the most important salmonid habitat across the region that is currently open to development status. The proposal is based on a scientific assessment of Southeast Alaska’s Coastal Forests and Mountains Ecoregion (Schoen and Dovichin 2007). The assessment resulted in a habitat ranking system for six salmonid species as well as other values. Top watersheds were identified in each of the 14 biogeographic provinces in Southeast Alaska that are not in legislatively protected status, based on combined values for the six anadromous fish species, plus related habitat quality indicators such as old-growth forest, bear and deer habitat, and estuaries.

Salmon were selected as a focal species for forest management because spawning and rearing salmon are widely distributed in streams and rivers throughout Southeast Alaska and because these fish play a fundamental role in the ecology of coastal, freshwater, and terrestrial systems. Salmon are keystone species because they transfer marine-derived nutrients into the terrestrial and freshwater ecosystems, and many terrestrial and freshwater species and ecological processes are inextricably connected to salmon (Willson and Halupka 1995).

The project assessed top watersheds for each biogeographic province in order to account for the unique island biogeography of different areas of the Tongass. The Tongass 77 are therefore a dispersed network of sites identified at the whole watershed scale, employing both a “single large” and “several small” reserve design at the province or ecoregion scale, respectively. This land management strategy is analogous to preserving an ecological investment portfolio (Schindler et al. 2010). The proposal will permanently protect top watersheds in Southeast Alaska.

The Tongass 77 proposal includes all of the top-ranking (i.e. #1) watersheds within all 14 of the biogeographic provinces in Southeast Alaska not under permanent protection, based on values for all six fish species and related habitat conservation targets. Also included in the Tongass 77 are the #1 ranking watersheds for the six individual fish species assessed, as well as the highest ranking watersheds for all salmonids combined. Salmonid species included:

- King (Chinook) salmon (*Oncorhynchus tshawytscha*)
- Red (sockeye) salmon (*O. nerka*)
- Silver (coho) salmon (*O. kisutch*)
- Pink (humpy) salmon (*O. gorbuscha*)
- Chum (dog) salmon (*O. keta*)
- Steelhead trout (*O. mykiss*)

In addition to including valuable fish habitat, the proposal is supplemented with watersheds that capture other biological values in order to ensure the region will sustain a viable ecosystem. The Tongass 77 captures the #1 ranking watershed in each province for the following ecosystem components, which are highly correlated with healthy salmon habitat:

- Estuaries (highly important anadromous fish habitat)
- Riparian large-tree old growth (nutrient exchange, large woody debris, cold water refuge, erosion stability)
- Black and brown bear (*Ursus americanus* and *U. arctos*) summer habitat (correlated with salmon concentration areas)
- Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) wintering habitat (indicative of healthy upland forest at the watershed scale)
- Marbled Murrelet (*Brachyramphus marmoratus*) nesting habitat (an ecological link between old-growth forest and the marine ecosystem).



John Schoen

Waterfall Bay (Dall Island) is one of the Tongass 77 watersheds.



The proposal included all identified top-ranked watersheds in Southeast Alaska, except those: already protected, in non-federal ownership, actively managed for other values (such as urban recreation, experimental forest, or active timber sale), or lacking public support (for example, the strong landowner opposition to protecting the Taku, which is the top salmon watershed in all of Southeast Alaska). In addition to the #1 watersheds, the proposal included several carefully chosen individual watersheds deemed important through additional review by scientists and fishermen. Additional watersheds met one or more of the following criteria:

- Based on all salmonid values combined, fell within the top 10% of watersheds in Southeast Alaska (without the biogeographic province filter)
- Based on all (salmonid and other) habitat correlates combined, fell within the top 10% of watersheds in Southeast Alaska (without the biogeographic province filter)
- Fell within the top five watersheds for a biogeographic province
- Identified as a Tier 1 watershed based on ecological optimization modeling as described by Albert and Schoen (2007). Tier 1 watersheds fall within the top 25% of each biogeographic province, using an evaluation of the smallest footprint to achieve the highest value for the combination of all salmonid and other habitat correlates combined
- ADFG data indicated exceptional salmon production and/or diversity.

The Tongass 77 proposal was based on several years of rigorous data collection, scientific analysis, and modeling, combined with local knowledge of the highest productivity areas. The proposal therefore captures the most important places in Southeast Alaska's Tongass National Forest for ensuring the long-term existence and health of the Southeast Alaska ecosystem and salmon fishery.

### CONSERVATION ISSUES

The Tongass 77 Watersheds make up the most ecologically important but unprotected 1.89 million ac (764,855 ha) of the 17 million ac (6,879,656 ha) Tongass National Forest. Conservation of whole watersheds maintains ecological processes and local habitat diversity (Lertzman and MacKinnon 2013). Including key watersheds across

provinces ensures well-distributed, high-quality habitat that will sustain population viability and ecosystem integrity across Southeast Alaska. The Tongass 77 includes both intact and developed watersheds, in order to capture those watersheds most important to ensuring long-term viability of the region as a salmon forest.

Four of the T77 watersheds have changed status since the proposal was developed. In 2015, the National Defense Reauthorization Act included a provision for the transfer of lands to Sealaska Corporation. To the dismay of conservation groups, that land transfer included Nutkwa Inlet, one of the T77 watersheds proposed for LUD II designation. At the same time, however, three other watersheds were placed into LUD II status as part of the Sealaska deal. Those were Lovelace Creek, Lake Kushneahin, and Sarkar Lakes.

Currently Southeast Alaska has a \$1 billion fishing industry that supports 7,000 jobs, and a \$1 billion tourism and recreation industry which supports another 10,000 jobs. The same watersheds that support ecological values also contribute to Southeast Alaska's economic vitality. Trout Unlimited and Audubon Alaska recommend permanent protection for the remaining Tongass 77 watersheds to continue these opportunities for future generations.

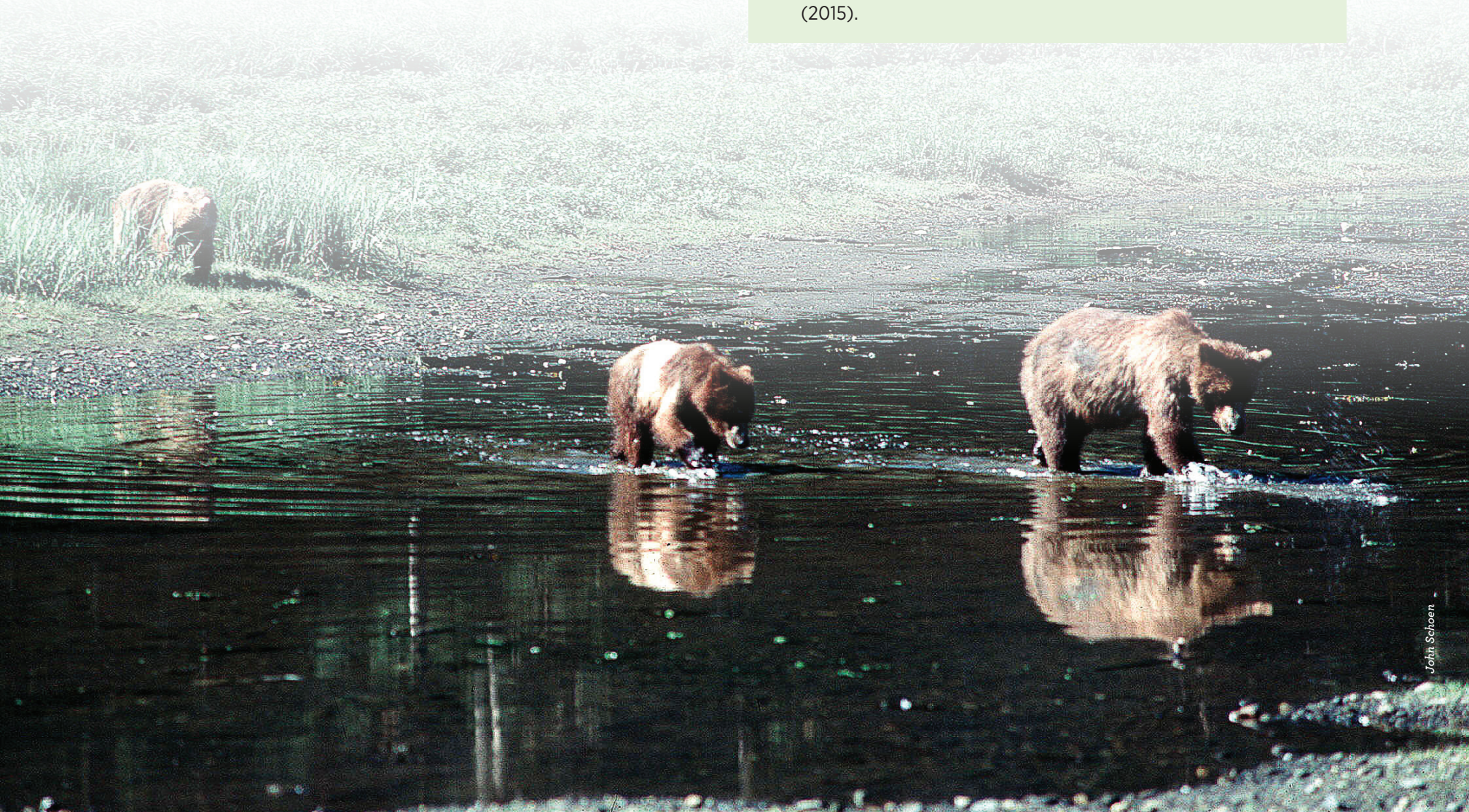
### MAPPING METHODS

The Tongass 77 watersheds are based on the collection of spatial data generated by Audubon Alaska and TNC for the Conservation Assessment and Resource Synthesis for the Coastal Forests and Mountains Ecoregion (Schoen and Dovichin 2007), as well as scientific research and local knowledge from fishermen collected by Trout Unlimited.

More specific information about mapping methods for each focal resource appears in the summaries for Estuaries, Productive Old Growth, Anadromous Fish Species Richness, King Salmon, Red Salmon, Silver Salmon, Pink Salmon, Chum Salmon, Marbled Murrelet, Sitka Black-tailed Deer, Black and Brown Bears, and Conservation Area Design.

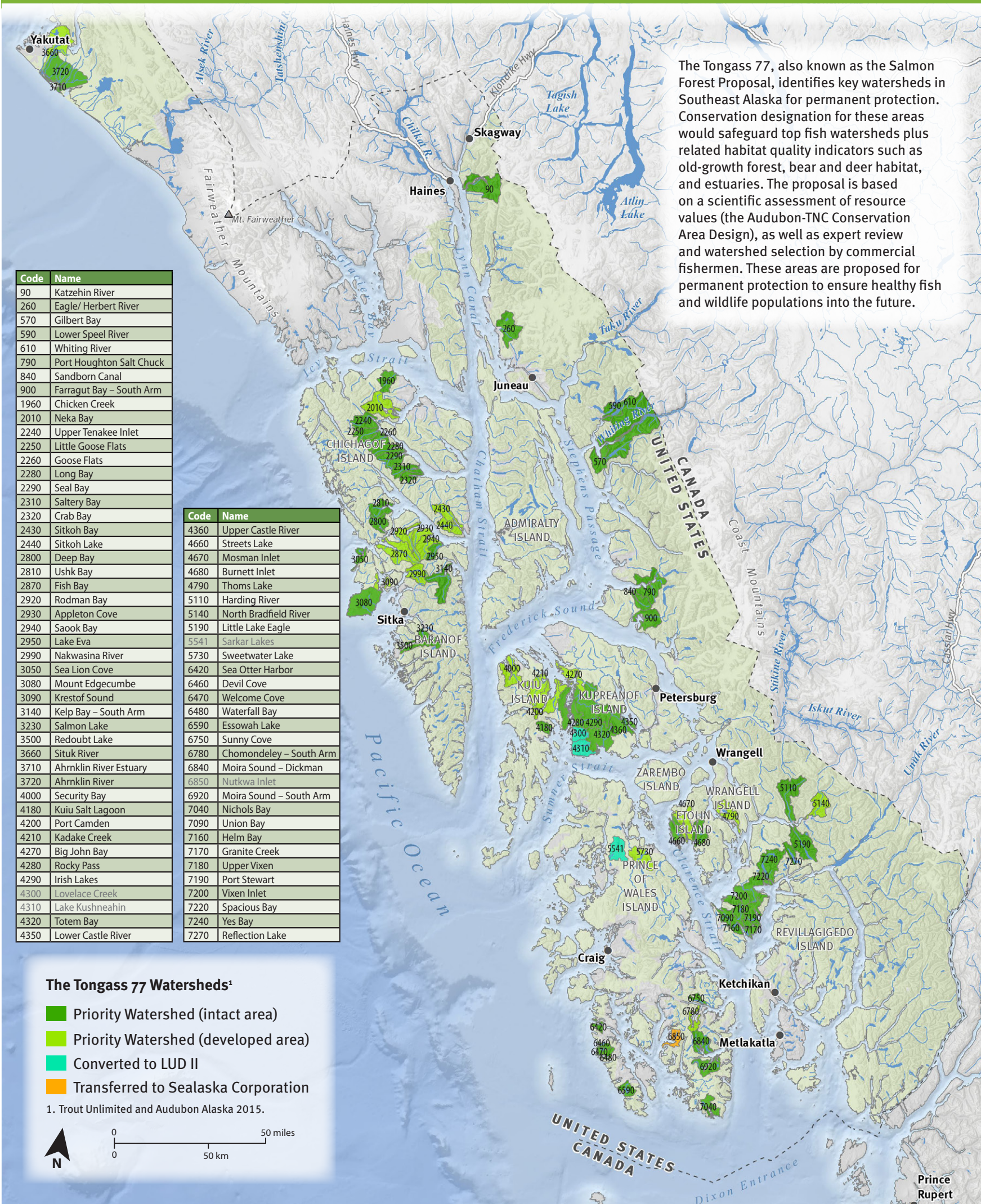
### MAP DATA SOURCES

- Tongass 77 watersheds: Trout Unlimited and Audubon Alaska (2015).





# Tongass 77 Watersheds



The Tongass 77, also known as the Salmon Forest Proposal, identifies key watersheds in Southeast Alaska for permanent protection. Conservation designation for these areas would safeguard top fish watersheds plus related habitat quality indicators such as old-growth forest, bear and deer habitat, and estuaries. The proposal is based on a scientific assessment of resource values (the Audubon-TNC Conservation Area Design), as well as expert review and watershed selection by commercial fishermen. These areas are proposed for permanent protection to ensure healthy fish and wildlife populations into the future.

Code	Name
90	Katzehin River
260	Eagle/ Herbert River
570	Gilbert Bay
590	Lower Speel River
610	Whiting River
790	Port Houghton Salt Chuck
840	Sandborn Canal
900	Farragut Bay – South Arm
1960	Chicken Creek
2010	Neka Bay
2240	Upper Tenakee Inlet
2250	Little Goose Flats
2260	Goose Flats
2280	Long Bay
2290	Seal Bay
2310	Saltery Bay
2320	Crab Bay
2430	Sitkoh Bay
2440	Sitkoh Lake
2800	Deep Bay
2810	Ushk Bay
2870	Fish Bay
2920	Rodman Bay
2930	Appleton Cove
2940	Saook Bay
2950	Lake Eva
2990	Nakwasina River
3050	Sea Lion Cove
3080	Mount Edgecumbe
3090	Krestof Sound
3140	Kelp Bay – South Arm
3230	Salmon Lake
3500	Redoubt Lake
3660	Situk River
3710	Ahrnklin River Estuary
3720	Ahrnklin River
4000	Security Bay
4180	Kuiu Salt Lagoon
4200	Port Camden
4210	Kadake Creek
4270	Big John Bay
4280	Rocky Pass
4290	Irish Lakes
4300	Lovelace Creek
4310	Lake Kushneahin
4320	Totem Bay
4350	Lower Castle River

Code	Name
4360	Upper Castle River
4660	Streets Lake
4670	Mosman Inlet
4680	Burnett Inlet
4790	Thoms Lake
5110	Harding River
5140	North Bradfield River
5190	Little Lake Eagle
5541	Sarkar Lakes
5730	Sweetwater Lake
6420	Sea Otter Harbor
6460	Devil Cove
6470	Welcome Cove
6480	Waterfall Bay
6590	Essowah Lake
6750	Sunny Cove
6780	Chomondeley – South Arm
6840	Moira Sound – Dickman
6850	Nutkwa Inlet
6920	Moira Sound – South Arm
7040	Nichols Bay
7090	Union Bay
7160	Helm Bay
7170	Granite Creek
7180	Upper Vixen
7190	Port Stewart
7200	Vixen Inlet
7220	Spacious Bay
7240	Yes Bay
7270	Reflection Lake

### The Tongass 77 Watersheds<sup>1</sup>

- Priority Watershed (intact area)
- Priority Watershed (developed area)
- Converted to LUD II
- Transferred to Sealaska Corporation

1. Trout Unlimited and Audubon Alaska 2015.



Map 7.10: Tongass 77 Watersheds



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