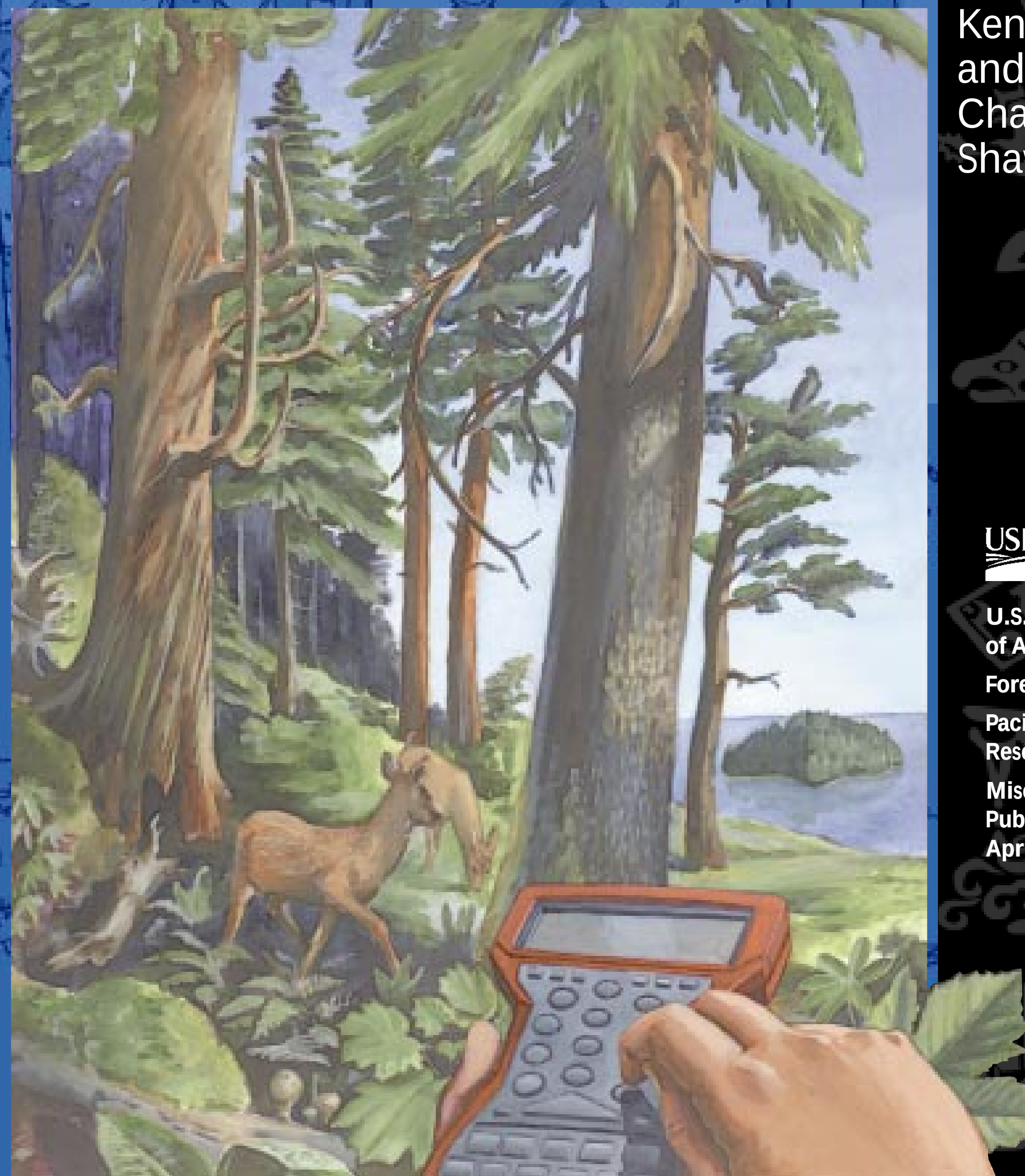
Science Matters:

Information for Managing the Tongass National Forest



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and
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Science Matters:

Information for Managing the Tongass National Forest

An overview of the scientific information used in preparing the Tongass Land and Resource Management Plan

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Abstract

Julin, Kent R.; Shaw, Charles G., III. 1999. Science matters: Information for managing the Tongass National Forest. Misc. Publ. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 28 p.

A team of research scientists was assembled to help Federal land use planners prepare a plan to guide management of the Tongass National Forest for the next 10 to 15 years. These scientists produced a series of resource and conservation assessments on northern goshawk, marbled murrelet, Alexander Archipelago wolf, endemic mammals, brown bear, fish, wind disturbance, old-growth timber volume, debris avalanches, karst topography, timber demand, and the socioeconomics of southeast Alaska. The research scientists led expert judgment panels to assess the risks that different management options posed for various resources and provided advice on approaches to mitigate potentially adverse management effects on specific resources. Without making any management recommendations or decisions, the scientists also evaluated how the available scientific information was applied; risks to resources were acknowledged in the final plan.

This paper highlights the engagement of these research scientists in the planning process and their contributions to maintaining healthy wildlife and fish populations, understanding landscape dynamics, and defining socioeconomic conditions related to management of the Tongass National Forest.

Keywords: National Forest planning, Alaska, Tongass National Forest, expert panels, risk assessment, old growth, natural disturbance, wildlife, fish, socioeconomics.

Contents

The Tongass National Forest is 16.9 million acres of land distributed across more than 22,000 islands and a narrow strip of mainland in the southeast panhandle of Alaska. Although the Tongass is called a forest, it is more like a quilt—a rich patchwork of forested land bordered by muskeg, alpine meadow, rock, water, and ice.

Engaging Science

After more than a decade of dedicated effort by planners and scientists, a land and resource management plan to guide future use of the Tongass National Forest was approved in 1997. It is not surprising that the plan took so long to complete, given the size of the Forest, the inherent diversity and complexity of the landscape, and the numerous competing demands for its resources and management. Over the years, the planning process was stalled, restarted, and shaped by many events. These included changing Federal administrations, new laws such as the Tongass Timber Reform Act of 1990, proposals to list the Alexander Archipelago wolf and Queen Charlotte goshawk as federally threatened species, shifts in public views on resource management of public lands, and enhanced appreciation for the Forest's world-class karst (weathered limestone) resource.

The deliberate engagement of research scientists in the planning process proved to be an effective catalyst for completing a Forest plan that was considered to be scientifically credible, resource sustainable, and legally sufficient. During the planning process, the research scientists focused their efforts to provide sound information on three components of the Tongass ecosystem:

- Factors that affect maintenance of healthy wildlife and fish populations
- Disturbances that affect resource sustainability
- Socioeconomic conditions as they exist and will change through management activities

The publication in your hands is a guide for a journey through the Tongass—the biological, physical, and social elements that define this temperate rain forest. The information described here was used in development of the land management plan for the Tongass National Forest, but it has usefulness beyond this application. By adding to our basic understanding of this temperate rain forest and the economies with which it interacts, our overall knowledge has been enriched. Other agencies also benefited from the effort; for example, the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game have used the information in several of their activities.

The role of Pacific Northwest Research Station scientists in the Tongass National Forest plan revision was to assure that credible, value-neutral, scientific information was developed independently without reference to management decisions. Scientists provided managers with baseline information and helped predict consequences.

Thomas J. Mills

Station Director
Pacific Northwest
Research Station

Conservation and Resource Assessments—Developing New Information

Pacific Northwest Research Station scientists, with the support of more than 50 scientists and technical specialists from other Federal and state agencies, examined existing data and synthesized it with new information on the following topics:

- Conceptual approaches for maintaining well-distributed, viable wildlife populations
- Life histories and management effects on the northern goshawk, marbled murrelet, and Alexander Archipelago wolf
- Patterns of natural wind disturbance relative to timber harvest practices
- A system for mapping timber volume levels within the old-growth forest
- Physical factors that control slope stability
- The values and vulnerabilities of karst lands
- Anticipated future demand for wood from the Tongass
- Regional, subregional, and local social and economic conditions

Published assessments cover these topics and can be ordered free of charge by their GTR number, which will be given, from:

> Pacific Northwest Research Station, Publications
> P.O. Box 3890, Portland, OR 97208-3890
> (503) 326-5648 or http://www.fs.fed.us/pnw/

These assessments provided the foundation of information necessary to build a scientifically credible plan. This information alone, however, was not sufficient to provide managers with a comprehensive background on issues of vital importance to management of the Tongass. So the research scientists designed a structured process to obtain professional opinions about management risks, as described in the following section.

Expert Panels—Evaluating Management Risks to Resources

During development of the Tongass land management plan, forest managers and planners crafted a wide range of possible management approaches for the resources within the Tongass. In planning vernacular, these approaches are called alternatives. To provide decisionmakers and the general public with further information on the relative risks of each alternative for Tongass resources, the research scientists were asked to evaluate the effects of each alternative considered.

To accomplish this task, a structured format was used. Panels of scientific experts were convened to assist decisionmakers in interpreting and understanding the available technical information and to predict levels of risk for wildlife and fish, old-growth ecosystems, and local socioeconomic conditions resulting from the different management approaches.

These expert panels provided information about:

- The relative risk from each alternative on the continued persistence of a species or resource
- Potential socioeconomic effects on communities
- Possible management approaches that could be used to reduce risk to resources and communities

Panelists assessed how each management alternative might impact the viability or sustainability of a given resource after 100 years of full implementation. The various wildlife panels, for example, used an array of possible outcomes ranging from the maintenance of habitat sufficient to support well-distributed and healthy breeding populations to complete loss of a species' habitat from the Tongass.

As anticipated, results from these scientist panels often showed marked differences in likely effects among alternatives. As such, this information became an integral part of

the “effects analysis” section of the environmental impact statement for the Forest plan. Some examples of information from these panels appear in the following sections.

These panel reports can be ordered by contacting:

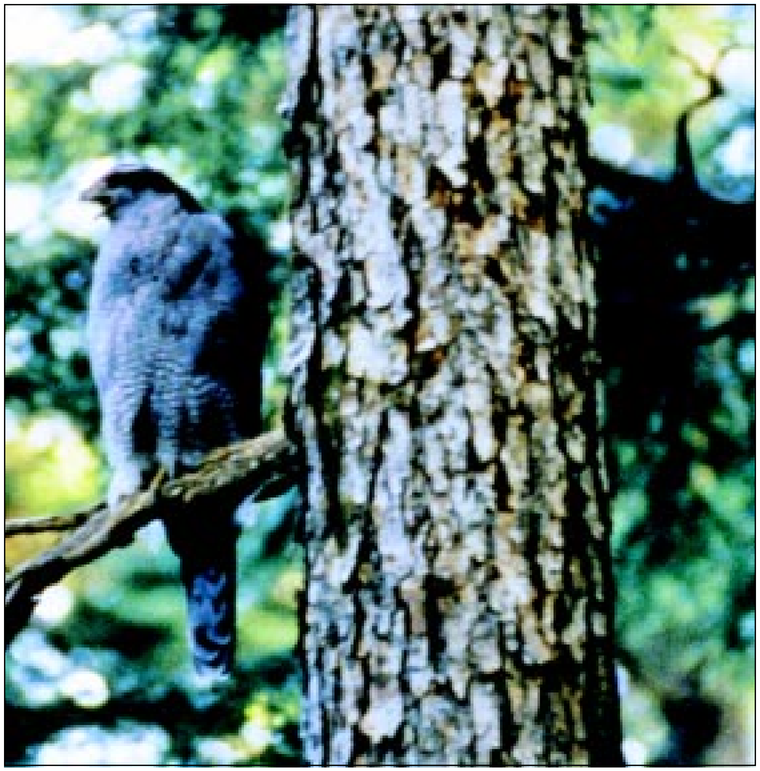
Documents Coordinator, USDA Forest Service
P.O. Box 21628, Juneau, AK 99802-1628
(907) 586-8701

For an overview of the panel process, read *Use of risk assessment panels during revision of the Tongass Land and Resource Management Plan*, by Shaw. (To be published in mid-1999, currently referred to as case file 98-369.)

Panels of experts addressed the following species or resource areas:

- *Northern goshawk*
- *Alexander Archipelago wolf*
- *Brown bear*
- *Sitka black-tailed deer*
- *Marbled murrelet*
- *American marten*
- *Other locally native mammals*
- *Old-growth ecosystems*
- *Fisheries resources*
- *Socioeconomics*
- *Subsistence*

Sustaining Wildlife and Fish



Biologists are concerned about the long-term health of the goshawk population in southeast Alaska because of the strong association of the goshawk with higher volume old-growth forests and the timber harvesting that has occurred on both public and private lands in its preferred habitat. A panel of goshawk experts suggested that harvesting individual or small groups of trees from dispersed areas, extending the clearcutting cycles to beyond 200 years, and providing old-growth reserves could reduce the risk to goshawk populations.

Native animals respond to changes in their environment in often complex and sometimes unpredictable ways. How has logging nearly 1 million acres of timber from private and public lands in southeast Alaska affected the wildlife that is adapted primarily to natural forest conditions? The Forest Service has explored this question because it is mandated to maintain habitat sufficient to support healthy wildlife populations within the Tongass. To meet this requirement while allowing other uses of the Forest, an understanding of basic biological needs, population trends, and effects—positive and negative—that management actions can have on the quantity and quality of wildlife habitat is needed. This understanding is derived from field observations, research, and in the absence of complete knowledge, the professional opinions of knowledgeable experts. Following are some highlights of the body of knowledge that we have distilled for several old-growth-associated wildlife species.

Healthy Bird Populations—Tracking the Pulse of the Forest

Northern goshawk—The northern goshawk is a nonmigratory bird of prey that inhabits northern and mountain forests throughout much of the Northern Hemisphere. Locally, it feeds on Steller's jay, grouse, varied thrush, woodpecker, and red squirrel. Goshawks nest in the mid-section of trees where their young are protected from the elements and from becoming prey for hungry great horned owls. About 35 active nests have been found in the Tongass.

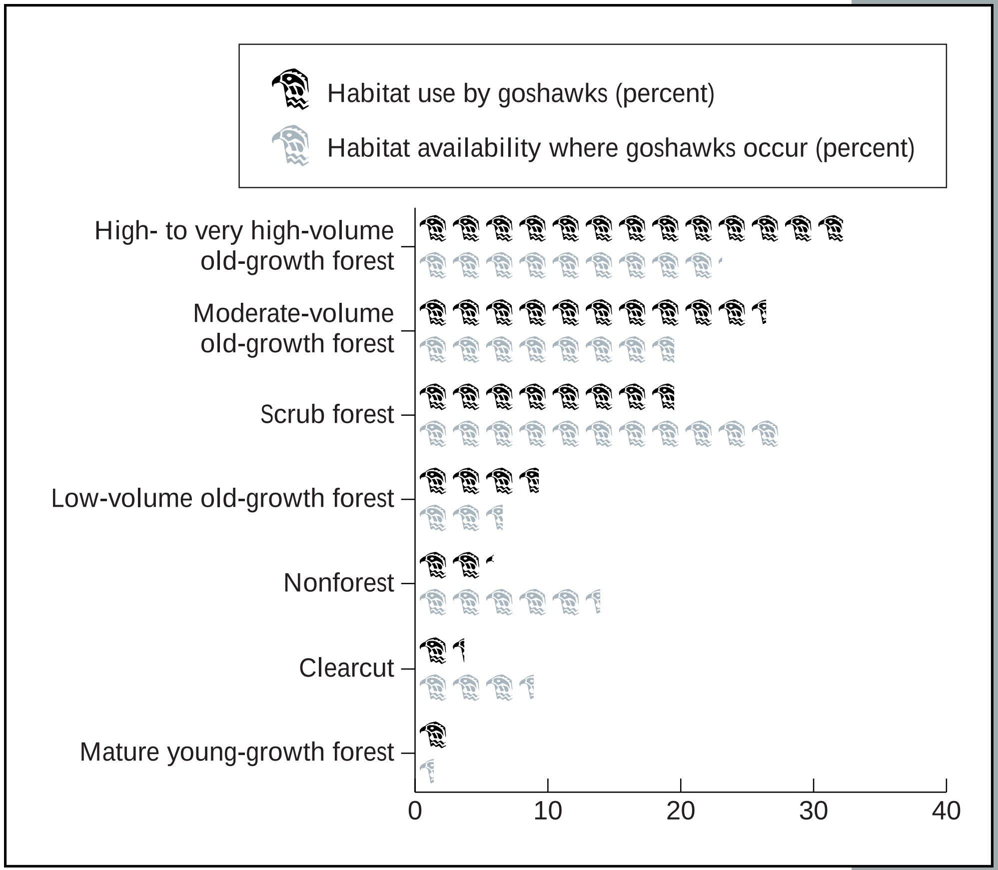
Since 1991, goshawks fitted with radio transmitters have been tracked through the Tongass to improve our understanding of their habitat preferences and territorial movements. This research has demonstrated that goshawks spend nearly 70 percent of their time in moderate- to high-volume old-growth forests. Goshawks avoid sparsely treed forests, alpine areas, and clearcuts where their prey is apparently less abundant. During the breeding season, adult goshawks use about 10,000 acres to gather food for their young.

The Queen Charlotte goshawk is a recognized subspecies of the northern goshawk that inhabits parts of coastal British Columbia and southeast Alaska. The U.S. Fish and Wildlife Service's recent decision to not list the Queen Charlotte goshawk as endangered was based mainly on information presented in the goshawk assessment noted below and on management direction prescribed in the Forest plan. This direction applied information found in the assessment by markedly reducing commercial timber cutting within 1,000 feet of beaches and estuaries, along streams, and in an established system of old-growth reserves. The Forest plan further restricts timber harvesting on portions of Prince of Wales Island where extensive areas already have been harvested.

Two reports from the Pacific Northwest Research Station will help in understanding issues about the northern goshawk:

Conservation assessment for the northern goshawk in southeast Alaska, by Iverson and others, PNW-GTR-387.

Assessments of wildlife viability, old-growth timber volume estimates, forested wetlands, and slope stability, by Julin, PNW-GTR-392.



Goshawks primarily occupy old-growth forested habitats where their prey and suitable nesting sites are more abundant.

Marbled murrelet—Southeast Alaska is the geographic center of the estimated 600,000 marbled murrelets in North America. The marbled murrelet ranges from central California, where it nests in coastal redwoods, to the Aleutian Islands where it nests on the ground. Throughout most of its range, however, marbled murrelets lay their eggs primarily on large, moss-covered branches in older forests within 20 miles of the coast.

Natural predators of adult murrelets include the northern goshawk and peregrine falcon; crows are thought to be important predators of young still in the nest. Oil spills, fishing nets, and timber cutting also cause the loss of marbled murrelets.

Some ornithologists believe that marbled murrelet population numbers are diminishing in areas where widespread logging has created extensive stands of young forest. The concern over long-term survival of segments of the population is so great that the marbled murrelet is listed by the U.S. Fish and Wildlife Service as threatened in California, Oregon, and Washington, and the Canadians have expressed concerns in British Columbia. The marbled murrelet is not listed as threatened in Alaska. Although marbled murrelet has no special status in Alaska, some concerned individuals have pondered the possible effects that timber harvesting from public and private lands in southeast Alaska have had on the local murrelet population. Nobody knows.

Currently there are insufficient census data to either properly evaluate how many marbled murrelets reside in southeast Alaska or define changes in population numbers over time.

Marbled murrelets feed on small fish and crustaceans in salt water and nest in old-growth forests of southeast Alaska.

For example, only a handful of nest sites are known in southeast Alaska, although 250,000 or more murrelets are thought to be in the area during the year. Ongoing murrelet research aimed at tracking the birds from the sea to the forest and back will help to answer this question. Meanwhile, the Forest plan, using information from the goshawk scientist panel and the assessment noted below, provided habitat for old-growth-associated species, such as the marbled murrelet, in wilderness areas, beach and estuary buffers, and in a system of old-growth reserves and other areas where commercial timber harvest is not allowed.

The following papers[1] will help in understanding issues about the marbled murrelet:

A conservation assessment for the marbled murrelet in southeast Alaska, by DeGange, PNW-GTR-388.

Long-term trend in marbled murrelets in southeast Alaska based on Christmas bird counts, by Hayward and Iverson, Northwest Science 72: 170-179.

The challenge of evaluating population trend for conservation management: marbled murrelets in Alaska, by Hayward and Iverson, Northwest Science 72: 315-319.

Marbled murrelets have declined in Alaska, by Piat, Northwest Science 72: 310-314.

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[1] Order the three journal articles from: Pacific Northwest Research Station; Forestry Sciences Laboratory; 2770 Sherwood Lane, Suite 2A; Juneau, AK 99775-6780.

Wolves in southeast Alaska are recognized as a separate subspecies isolated from wolves in interior Canada and Alaska by the Coast Mountains. The Alexander Archipelago wolf tends to be smaller, shorter haired, and darker than other wolves.

Mammals of the Temperate Rain Forest—Balancing Competing Uses

Alexander Archipelago wolf—At least 8,000 years ago, wolves strayed northward into what is now southeast Alaska in pursuit of a favored prey—the Sitka black-tailed deer. Since then, wolf packs have established territories encompassing 25,000 to 100,000 acres along the mainland and larger southern islands of the Tongass. Interestingly, wolves have been unsuccessful in colonizing Admiralty, Baranof, and Chichagof Islands, perhaps owing to the high brown bear densities and the water barriers. Concerns about the long-term health of wolves in the Tongass center around four principal issues:

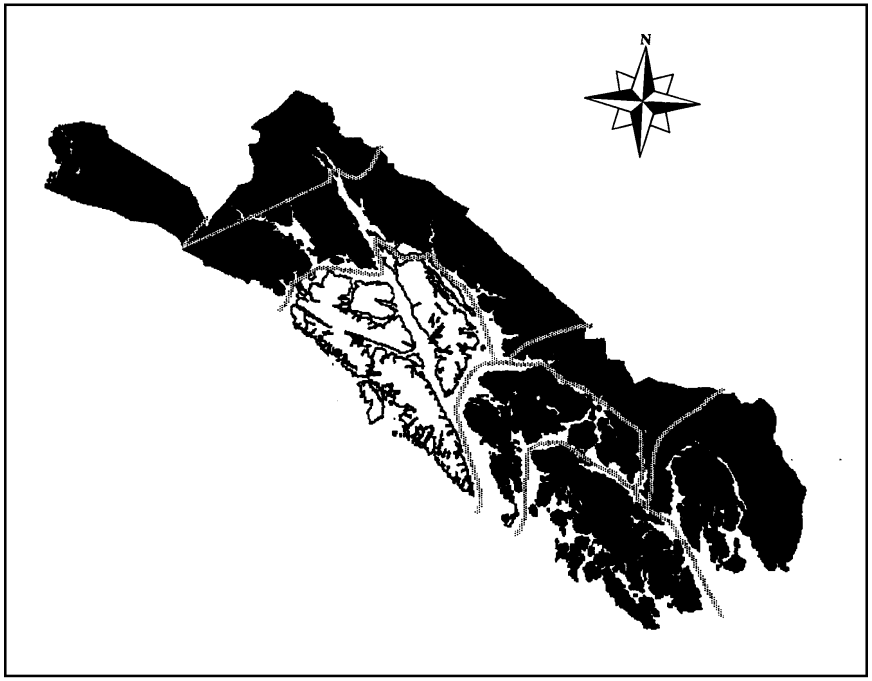
1. Deer habitat quality and clearcutting. Considerable scientific evidence indicates that clearcutting of timber in southeast Alaska substantially reduces the quality of deer habitat. And as the deer goes, so goes the wolf. Dietary research on deer has shown that the reduced nutritional quality of forage in clearcuts may contribute to lower reproductive success of deer that feed primarily in clearcuts. Forage in clearcuts becomes unreachable during periods of deep snow, and it also is shaded out by the dense forest canopy that forms within 30 years after clearcutting. This sparse understory condition can persist for 150 to 200 years. Clearcutting also fragments the forest and can lead to more hunting of deer by wolves when deer congregate in uncut patches of timber during heavy snow. The Forest plan protects 86 percent of the highest quality deer winter range within the Tongass in the 1,000-foot beach buffers, stream buffers, and old-growth reserves.
2. Deer populations. In southeast Alaska, each wolf eats an average of 26 deer each year. To meet this need, and given hunting by humans and other factors affecting deer survival, wildlife biologists estimate that 170 to 180 deer per wolf (more than 157,000 total) are needed to maintain the current estimated balance between wolves and deer.

Wolves depend primarily on Sitka black-tailed deer for food. Long-term negative effects on the quality of deer habitat, particularly those associated with clearcut timber harvesting, concern wildlife biologists.

3. Roads and wolf mortality. State of Alaska harvest statistics show that more roads in an area lead to significantly greater mortality for wolves from hunting and trapping. Research from other areas of the United States shows that wolves do not survive in areas where road densities exceed about 1 mile of road for each 640 acres. In roaded areas, wolf packs are generally found in the least densely roaded portions of their home range. The Forest plan established numerous large, relatively unroaded reserves as a result of information from the wolf scientist panel and the wolf assessment: *The Alexander Archipelago wolf: a conservation assessment*, by Person and others, PNW-GTR-384.

4. Exploitation of wolves by people. People are responsible for a high percentage of wolf mortality. From 1990 to 1995, 1,163 wolves were reported as taken by hunters and trappers in southeast Alaska. Hunters currently are allowed to bag five wolves per year; there is no limit for trappers. Unreported or illegal killing of wolves can be substantial. Researchers on Prince of Wales Island put radio collars on 17 wolves that subsequently died: 9 (53 percent) were legally taken by humans, 5 (29 percent) were illegally killed, and 3 (18 percent) died naturally. Although the Alaska Department of Fish and Game regulates the legal human harvest of wolves, the Forest Service can indirectly affect wolf mortality by limiting new road construction and regulating allowed uses of existing roads.

The decision by the U.S. Fish and Wildlife Service to not list the Alexander Archipelago wolf as threatened or endangered was based mainly on information presented in the wolf assessment and on management direction outlined in the Forest plan.



In southeast Alaska, an estimated 900 wolves live in a shifting balance with available food as affected by natural and human-induced influences. Wolves occupy the areas shown in black.

The American marten is used as an indicator species for understanding how management activities, primarily clearcutting to harvest timber, affect wildlife species living in low-elevation, old-growth forests. Concern over the type and extent of past timber harvest on both public and private lands in portions of southeast Alaska and the effects on old-growth habitat, as indicated by the marten scientist panel, prompted the Forest Service to discontinue or limit timber harvest in certain areas of the Tongass. In these areas, individual-tree or group selection harvest will be used instead of clearcutting to retain important habitat features for old-growth-associated species such as the marten.

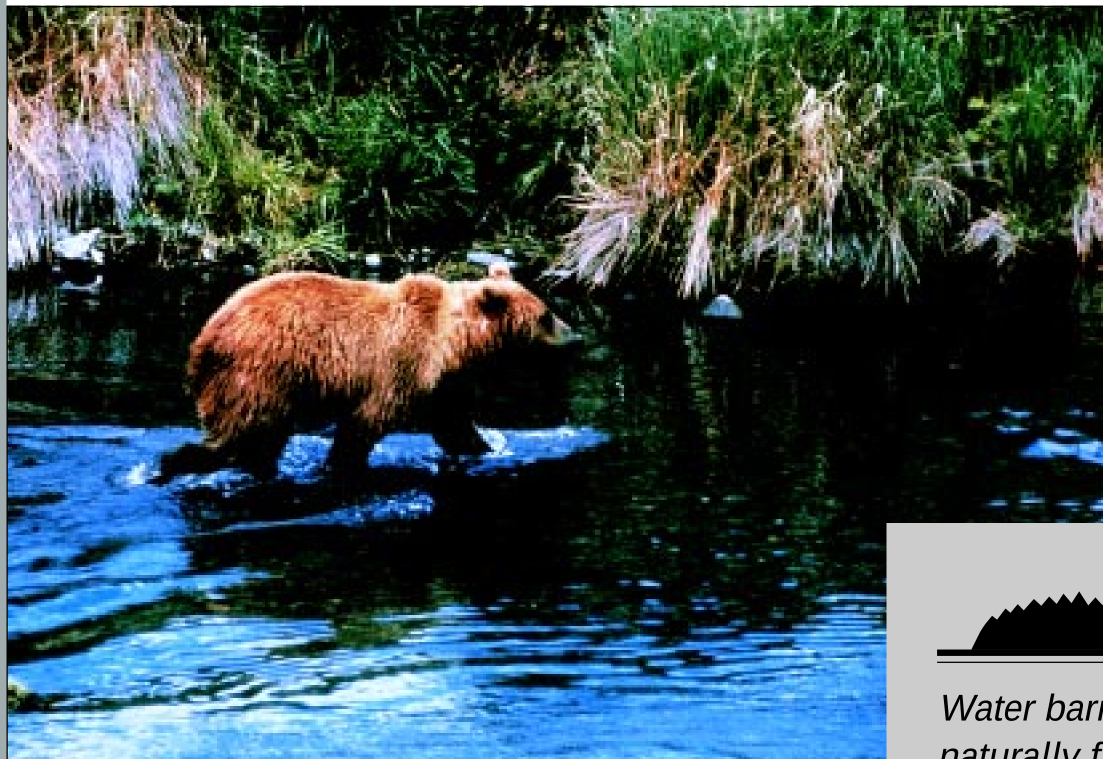
Other locally native mammals—Natural features that fragment and isolate, such as the island biogeography of the Tongass, create conditions where animal populations have become genetically distinct over the millennia. Currently, 27 genetically distinct subspecies of native mammals are known within the Forest, some occupying various island clusters and others restricted to single islands. The scientist panel of mammal experts suggested that measures such as the following, all adopted in the Forest plan, could be used to reduce the risk to the long-term persistence of locally native mammals in the Tongass:

- Cease timber harvesting on islands of less than 1,000 acres
- Expand wildlife studies in proposed project areas
- Commit to further research on distributions, population numbers, and genetics

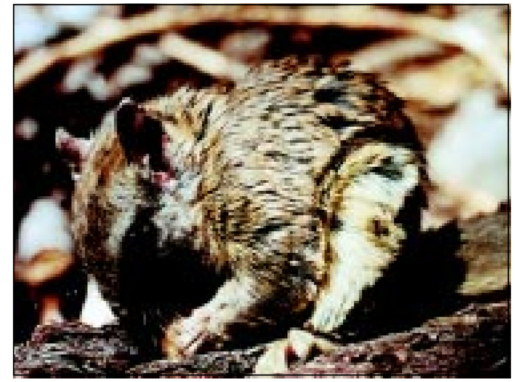
The following papers will help in understanding issues about mammals in the archipelago (see footnote 1 for ordering information):

The land mammal fauna of southeast Alaska, by MacDonald and Cook, Canadian Field Naturalist 110(4): 571-598.

The mammals of southeast Alaska: a distribution and taxonomic update, by MacDonald and Cook, University of Alaska Museum, Fairbanks.



Both radio-telemetry research on brown bears and a panel of bear experts indicate that key bear-feeding habitat along salmon-spawning streams extends 500 feet on either side of the streams. Bears need space from other feeding and resting bears and hiding cover from humans.



The Prince of Wales flying squirrel occurs only in southeast Alaska.

Water barriers and mountain ranges naturally fragment animal habitats. Roads and timber-harvest areas further fragment the forest. Providing reserves of suitable habitat and maintaining wildlife travel routes among habitats is one strategy (developed from the available information) that is applied in the Forest plan to promote the continued health of wildlife populations.

World-Class Fisheries—Managing Spawning and Rearing Habitat

Commercial fishers catch an average of 160 million pounds of fish annually in southeast Alaska at a value of about $250 million. The industry provides more than 5,000 direct jobs. Sport fishers spend about 250,000 days at their sport every year and create the equivalent of 1,200 direct full-time jobs with annual earnings of $28 million. In addition, some 1.2 million pounds of salmon and trout are harvested by southeast Alaskan families for subsistence use.

Protection of stream and lake habitats for fish was identified as a key issue in the Forest plan revision. At the direction of Congress, guidance for making timber harvest more compatible with managing aquatic habitats was developed by more than 50 scientists and managers in the Alaska anadromous fisheries habitat assessment.[2] Among the recommendations in this assessment were:

- Increase protection for headwater streams
- Enlarge streamside buffers
- Establish measurable objectives for evaluating the quality of fish habitat
- Apply a systematic procedure for describing ecological processes in watersheds
- Improve and monitor land management practices that help control sediments

The interagency team of fish experts that reviewed Forest Service practices for managing fish habitat and the scientist panel for fisheries stressed the importance of protecting streams in the upper portions of watersheds. Although these headwater streams often are without fish, they contribute sediment and woody debris to habitat downstream.

[2] Anadromous Fisheries Habitat Assessment Team. 1995. Report to Congress: Alaska anadromous fisheries habitat assessment, R10-MB-279.

Southeast Alaska has one of the most productive and highly valued fisheries in the world.

Southeast Alaska supports rich populations of chinook, coho, sockeye (pictured above), pink, and chum salmon.

The importance of salmon to native cultures is evident in the legends, artwork, and family crests. Development of a rich and complex culture has been tied to the abundance of salmon; the ease of finding food allowed natives to pursue their arts. Tlingit, Haida, and Tsimshian continue their traditional use of salmon—it is cooked, baked, smoked, and dried.

Based on information in the Alaska anadromous fisheries habitat assessment and the fisheries scientific panel, the Forest plan protects fish habitat in several ways. These include a multitude of lands being withdrawn from commercial timber harvest, establishment of streamside buffers and watershed analysis procedures, and reductions in timber harvesting on steep slopes (slopes greater than 72 feet vertically for every 100 feet horizontally).

Landscape Dynamics

Natural disturbance is a key ecosystem process that drives change in forested landscapes. Wind topples trees weakened by decay, thereby creating growing space for new stands. Landslides transport soil and woody debris from hillsides into streams and infuse the water with nutrients and structural features (logs and boulders) that are part of good fish habitat. Acidic groundwater carves fissures and underground caverns in limestone, producing nutrient-rich karst waters and habitat for cave-dwelling animals. Understanding how these disturbances operate can guide planners in managing forest resources sustainably.

Wind and Decay—
Defining Patterns of Blowdown

Unlike most of North America, where fires can quickly transform forested slopes into charred wood, wildfires are rarely kindled in the cool rain forest of southeast Alaska. Here, wind—working in combination with wood-eating fungi and gravity—replaces fire as the principal natural disturbance agent. Storm gales and glacier winds snap weakened trunks and uproot shallow-rooted trees in predictable patterns.

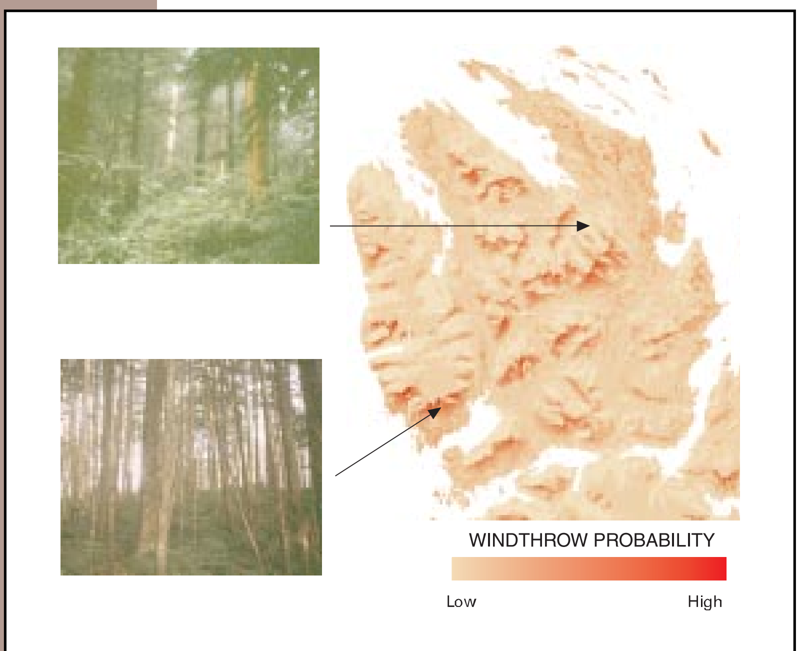
Wind in the Tongass often topples trees in small patches averaging less than one-tenth of an acre and involving generally fewer than 10 trees per patch (small-scale windthrow). These patches, which help to create the natural habitat for the native plants and animals, are dispersed over the landscape and typically include less than 25 percent of a given stand of trees. In contrast, the widespread clearcutting done in the past did not closely mimic natural blowdown patterns. Clearcut units were considerably larger and occupied a much greater proportion of the landscape. Only infrequently are extensive tracts of timber laid down by the wind. During the

Thanksgiving Day 1968 blowdown.

1968 Thanksgiving Day storm, for example, a deep low-pressure area created winds up to 100 miles per hour, and more than 1 billion board feet of timber on over 18,500 acres was toppled as a result of that event.

Research has demonstrated that trees most susceptible to wind damage grow on south-facing slopes directly exposed to prevailing winds, on hilltops and ridge noses, and along east- and west-facing slopes where winds accelerate around mountain flanks. Forest stands in these wind-vulnerable positions are blown over more frequently than

Although tracts of large-scale windthrow can encompass 1,000 acres, they average less than 40 acres each.



This map was made with a computer model that uses topography, vegetation, and wind exposure to predict the locations of large- and small-scale windthrow events on Kuiu Island, Alaska.

those in other areas; the trees that replace them thus are relatively young compared to much of the surrounding natural forest. Stands of trees in wind-sheltered areas tend to be larger and older and develop characteristics often associated with old-growth forests.

Recent ecological detective work and advances in computer-modeling technology have broadened our understanding of how wind shapes the Tongass. This new knowledge enables forest planners to design harvest units so that their size and locations can more closely mimic natural openings in the forest.

From our deeper understanding of how wind disturbance patterns operate at small scales (stands) and large scales (islands), managers can mimic natural blowdown patterns—the same disturbance patterns to which plants and animals of the forest have adapted. Although planners can emulate the size and distribution of natural blowdowns in forest planning, they realize that the overall level of disturbance is nevertheless greater than what is natural and the nutrient recycling associated with blowdown cannot be duplicated, even in small patch cuttings.

Natural patterns of wind disturbance can be emulated by:

- Harvesting smaller groups of trees in wind-protected landscapes
- Locating clearcut units in wind-exposed landscapes where natural wind-generated openings are more common
- Reducing the average size of clearcut units

For more information on wind disturbance, see the report from the Pacific Northwest Research Station:

The effects of wind disturbance on temperate rain forest structure and dynamics of southeast Alaska, by Nowacki and Kramer, PNW-GTR-421.

Estimating Timber Volume—Drafting a New Map of the Old Forest

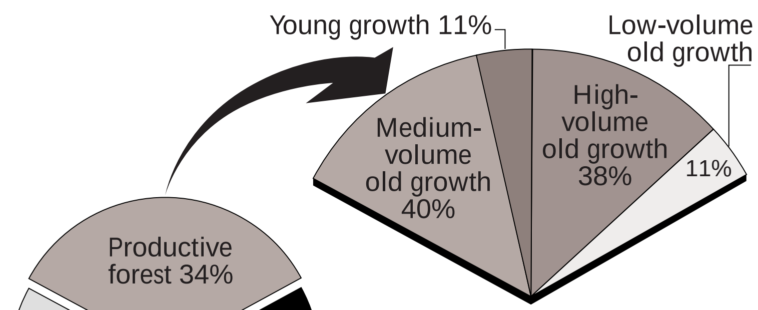
Only about 10 million acres of the 16.9-million-acre Tongass is forested, and these forests are dominated mostly by western hemlock and Sitka spruce. There are about 400,000 acres of dense young stands of trees, most of which began growing after the 1950s when industrial-scale logging started in earnest. There also are expansive mixed stands of younger and older trees that have developed from natural disturbance processes, such as windthrow and landslides. These various stand types are scattered across the archipelago in a mosaic with other nonforested terrain.

Use of old-growth timber was the pivotal issue in the Forest plan revision. Land managers sought to balance the demand for wood products with the protection of scenery, fish and wildlife habitat, and other values. To help define this balance, managers needed to know how much old-growth timber exists, where it is, and how it is distributed across the landscape.

To meet this need, a new timber map was developed for the Forest plan. It was based on aerial photographs, soil type and topographic maps, and a series of tree plots distributed across the forest. This map shows the location and abundance of previously unharvested stands of timber in three categories of average, estimated usable wood per acre: low (16,000 board feet), medium (25,000 board feet), and high volume (35,000 board feet). This map has proven to be a helpful tool for managers to use in establishing annual timber harvest levels as called for in the Forest plan.

For more information about how the old-growth forest was defined, read *Old-growth timber volume estimates*, by Julin and Caouette, PNW-GTR-392.

Big trees, fallen logs, and open stands with trees of different heights characterize old-growth forests in wind-sheltered areas.

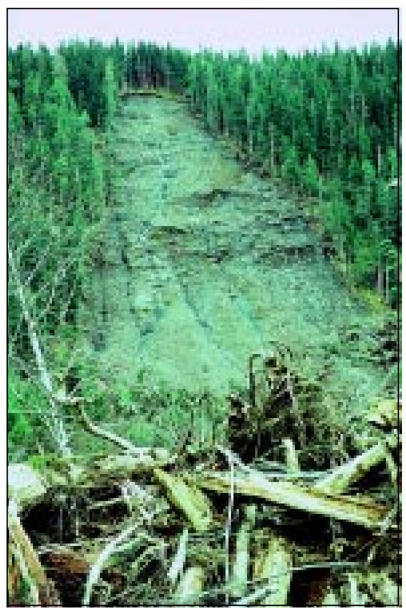


The Tongass National Forest is 16.9 million acres; the productive[3] forest component is 5.6 million acres.

[3] For purposes of the Forest plan, the term "productive" refers to the ability of a forested area to provide wood products.

Debris Avalanches—Sliding Soil and Plants

Debris avalanche in Marten Arm, northern shore of Bradfield Canal, southeast Alaska (above), and Neets Bay (right).



Debris avalanche is the most common type of landslide in mountainous terrain of the Tongass. When soil becomes waterlogged on steep slopes, it breaks loose from the underlying bedrock, and debris avalanches move the thin soil mantle and plants in it downslope. Although landslides are an important natural disturbance for delivering nutrients, gravel, and woody material into streams, excessive erosion is troublesome because it can clog spawning gravels and impede upstream salmon migration.

When roads are built and timber is harvested, the frequency and sizes of debris avalanches are altered. A threefold increase can occur in the frequency of debris avalanches in clearcuts compared to uncut areas. Debris avalanches in clearcuts tend, however, to be smaller and travel shorter distances than avalanches in uncut areas, in part because of where clearcuts are located on the landscape (e.g., generally lower on the slope).

Debris avalanches have been studied in southeast Alaska for over 30 years. Research has documented the physical processes that control debris avalanches and their patterns of occurrence across the landscape. The single most important factor regulating soil stability is slope steepness. Harvesting timber on slopes greater than 72 percent creates a high potential for landslides. Other factors affecting soil stability include soil depth, soil drainage, density of streams, slope shape and length, and underlying bedrock characteristics. On very steep slopes, roots affect stability by anchoring the soil into joints and fractures of the underlying bedrock and by interlocking with roots of adjacent vegetation.

For more information on landslides, see *Controlling stability characteristics...*, by Swanston, PNW-GTR-392: 44-58. To reduce potential landslides, the Forest plan adopted information from this assessment in not allowing commercial timber harvest on slopes over 72 percent.

Weathered Limestone—Protecting Fissures, Sinkholes, and Caverns

Karst is a geologic feature that forms over centuries as acidic groundwater dissolves limestone and marble. At the surface, karst is characterized by fissures, caves, and sinkholes that have developed in the fractured limestone. Fissures in the rock can be relatively fine, like those pictured, or they can be large enough to engulf an unwary hiker. These fissures lead to vertical shafts or sinkholes and lateral tunnels connecting to massive, underground river systems.

People have long known about these unusual surface features; however, their connection to subsurface tunnels and underground water systems has only recently been appreciated. Since 1989, scientists have been exploring karst terrain in the Tongass, and their studies have revealed some surprises. Underground water flow patterns are noticeably different from surface water runoff patterns. In several tests, environmentally friendly dye was poured into the underground system. Almost invariably, the dye reappeared in highly unlikely places—sometimes in surface streams 20 miles away!

The nutrient-rich karst waters support some of the most productive fisheries in Alaska. Fish feed on aquatic insects that thrive in karst waters. Bats and river otters are among the many other species that live in the limestone caves found in the Tongass.

Some of Alaska's most highly valued timberland is along valley bottoms, particularly those developed atop karst. These well-drained, nutrient-rich sites create optimal conditions for tree growth. Trees sink their roots into karst fissures, which makes them less likely to blow over in the wind. Rain trickles through the forest canopy onto the ground and through the fissures, bringing with it nutrients and some sediment. These nutrients support creatures that live in the underground river system.

Field observations have revealed that timber harvest can increase the amount of soil and debris washed into the underground river system. These sediments disrupt nutrient cycling, dam underground waterways, and make the underground ecosystem less inhabitable. To aid with management of these sensitive areas, known karst terrain has been mapped and placed into the Forest's geographic information system.

For more information on karst, see *Karst landscapes and associated resources: a resource assessment*, by Baichtal and Swanston, PNW-GTR-383.

Highly fractured and jointed lime-stone from the Heceta formation near Twin Island Lake, northern Prince of Wales Island.

Well-developed surface or epikarst from the alpine zone on Dall Island. Note the cravasslike solution fissures developed along joints and fractures that lead directly to deep shafts and ultimately to subsurface drainage systems.

How Much Wood is Needed—Anticipating Future Demand

Forecasts of the amount of wood that will be needed by the timber industry are used by planners to guide their thoughts when crafting a Forest plan. Updated forecasts of wood demand developed by Forest Service scientists are based on four factors affecting the forest product industry's desire for Tongass timber:

1. Closure of southeast Alaska's two pulp mills substantially reduced the manufacturing capability of the region's forest products industry.
2. Competition from other suppliers has increased. Export of sawn lumber from Europe to Japan has increased from 0.3 percent in 1990 to more than 10 percent now.
3. Demand for less expensive engineered wood products, such as laminated beams, has increased, while demand for sawn western hemlock and Sitka spruce structural timbers has decreased.
4. Timber harvest levels in the Pacific Northwest are lower and the cost of buying timber on the stump is higher as a result of concern over the survival of northern spotted owl and other old-growth-associated wildlife.

A range of projected demands was developed for Tongass timber though 2010. The lower end projection assumed that:

- Alaska will recover some of the Japanese market lost to competitors
- Higher costs and competition will continue to limit Alaska's opportunities

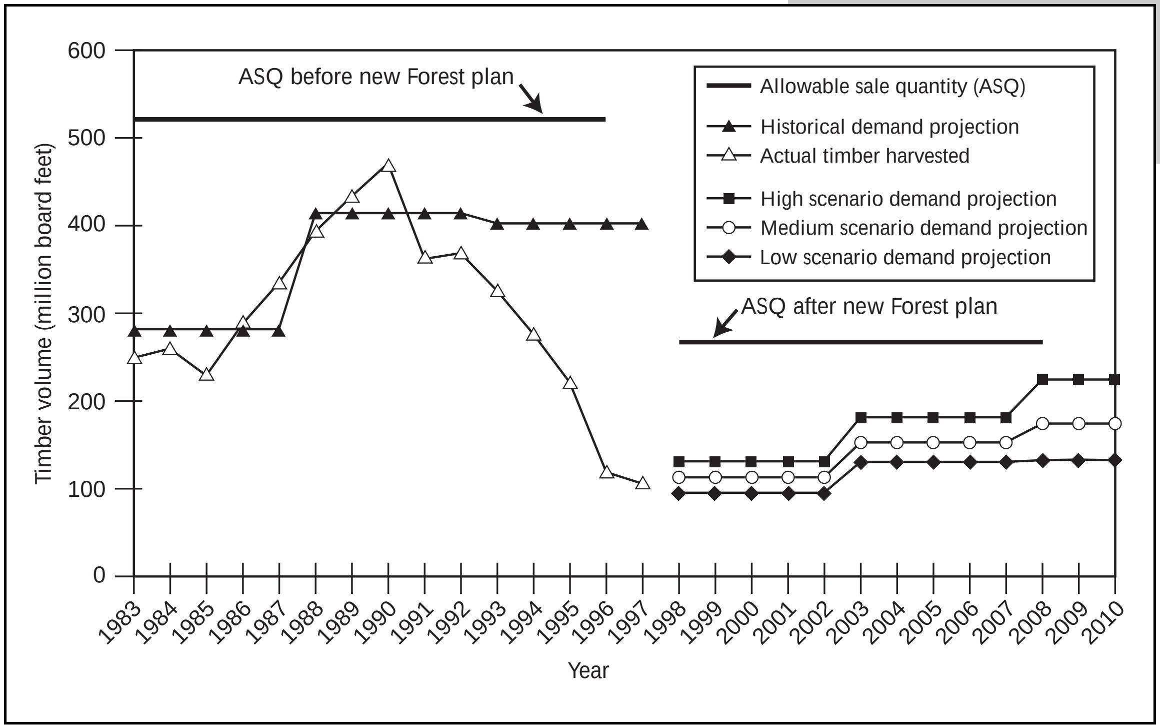
- Only the higher grade saw logs accounting for less than 50 percent of the available timber will be used.

The higher end projection assumed that:

- Alaska will recover a greater share of the Japanese market.
- Timber buyers will pay a premium for old-growth logs.
- Nearly the entire range of saw-log quality grades will be used.

For more information about projected timber demand, read *Timber products output and timber harvests in Alaska: projections for 1997-2010*, by Brooks and Haynes, PNW-GTR-409.

Allowable sale quantity (ASQ) is the maximum amount of timber that may be sold from the Tongass. The current ASQ is 267 million board feet per year. One board foot measures 1 foot square by 1 inch thick. About 15,800 board feet of wood are needed to build a conventional 2,000-square-foot home, including the framing, sheathing, flooring, molding, and cabinets.



This graph shows past and future timber demand projections in relation to the actual timber harvest. Also shown is the allowable sale quantity: the maximum amount of timber that can be sold annually from the Tongass. This level represents a sustainable amount of timber that can be harvested from the forest and is not determined by demand. The upper limit established by the Forest plan (1997 and beyond) is a calculation for the amount of timber that can be removed from the Forest, on a sustainable basis, in the context of multiple-use management.

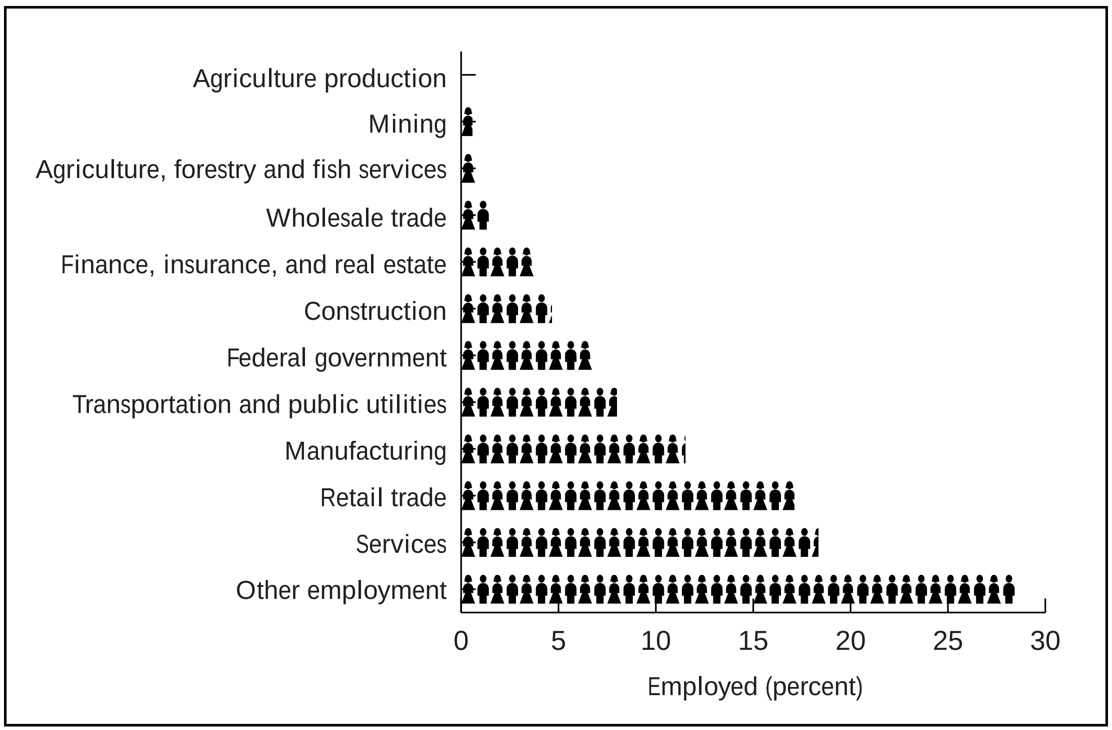
People of the Panhandle—Finding an Economic Focal Point

Southeast Alaska consists of a narrow strip of mainland and a chain of hundreds of islands known as the Alexander Archipelago. The region's abundant resources from the forest and the water have provided for the physical and cultural livelihood of its inhabitants for thousands of years. Today, about 74,000 people live in its towns, communities, and villages, with Juneau, the state capital, accounting for almost 40 percent of the population (1995 data). The Forest Service has responsibility for managing more than 80 percent of the land area (16.9 of 21 million acres) and thus has a pervasive influence on the quality of life for the region's inhabitants.

The economic picture of southeast Alaska differs according to regional and local perspectives. Although reports on regional conditions provide a broad understanding of economic health and trends, they mask local conditions in specific boroughs or communities. Both perspectives are necessary to bring the interrelated communities and the relations with management of the Tongass into sharper focus.

For the region—The social and economic systems of southeast Alaska are subject to many of the same forces affecting rural areas nationwide. The region has a high unemployment rate; however, this is a structural feature that characterizes small rural communities elsewhere in the Nation and does not necessarily indicate a trend in any particular industry. Population, employment, and wages have increased in recent years but at a slower rate than in the past. Between 1985 and 1994, population grew more than 1 percent annually to 72,700 people. During this same period, employment increased by 2 percent annually to 47,400 workers, but future job growth is projected to be less than 1 percent annually. Traditionally, wage rates in the state as a whole have been higher than those in the rest of the Nation, but the gap is narrowing: Alaska wages were 38 percent higher than the national average in 1985 but only 18 percent higher in 1994. Federal, state, and local governments are a primary source of jobs in the region, with Forest Service employment accounting for at least 45 percent of Federal government employment, although the level of employment has been declining.

Natural resource-based employment—In recent years, the region's share of natural resource-related employment in wood products, commercial fishing and seafood processing, recreation and tourism, and mining and mineral development has remained fairly steady; however, the mix of jobs is changing, with far fewer jobs in the wood products industry and substantially more in tourism. The recent closure of southeast Alaska's two pulp mills added to this trend, and timber harvest levels continue to decrease on both Forest Service and private lands. One effect of this shift is a lowering of average annual income; jobs in the pulp mills not only paid higher-than-average wages, but they also were year-round jobs that employed many southeast Alaska residents. The timber industry in southeast Alaska is in a state of transition that may take several years to reach a new equilibrium. The tourism industry is expanding as cruise ship and ecotourism visits continue to increase. The number of jobs in fishing and seafood processing remains steady despite changes in industry structure and management.



Southeast Alaska employment by sector for 1995.

Subsistence includes 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 resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade.

Subsistence is vital to rural economies—Subsistence is an important part of the Alaska economy, although it is not revealed by measures of economic growth, employment, or income. A subsistence lifestyle reinforces self-reliance and is one of the reasons why some people move to or remain in southeast Alaska. Following are four key facts about subsistence use in southeast Alaska:

- Eighty-five percent of rural households harvest subsistence food
- Forty percent of all households obtain at least a quarter of their food from subsistence harvest
- Thirty percent of rural households obtain 50 percent or more of their meat from subsistence activity
- One in 10 households harvested more than 10 different types of subsistence resources

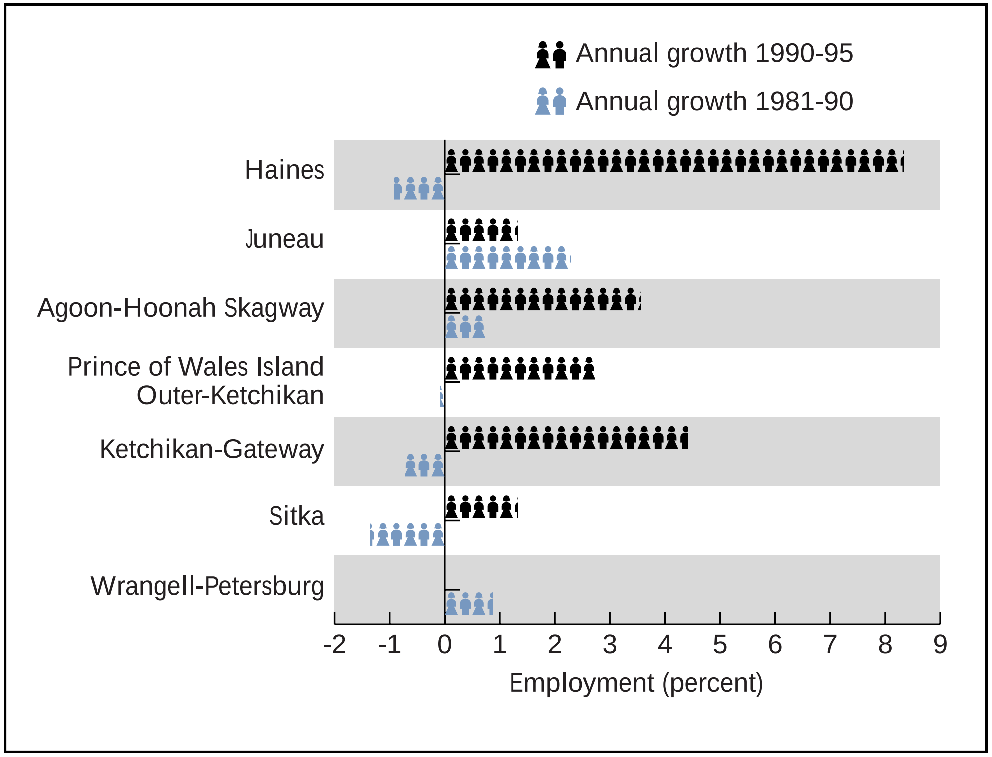
Subregional trends—At the subregional level, southeast Alaska is composed of five boroughs and three census areas (the functional equivalent of counties elsewhere in the United States). Three of the five boroughs are city-boroughs: Juneau, Sitka, and Yakutat.

Economic diversity—Economic diversity refers to the balance of employment among various industries and is one measure of economic health. Although southeast Alaska's regional economy is becoming more diversified, the economies of its boroughs and census areas (land areas for which boroughs have not been established) are among the least diversified in the Nation. Even though low economic diversity is a common characteristic of small, semi-isolated communities, it is still of concern to local residents.

Local conditions dictate employment and income levels—Employment growth rate has slowed in most borough-census areas since the 1980s, but the size of the decrease has differed widely. Growth has been negative in some borough-census areas as a direct result of decreases in employment in the wood products sector.

Corresponding changes in personal income occurred during the period. The greatest personal income losses were in Prince of Wales-Outer Ketchikan borough-census area in the southern portion of the region, where growth in the job sector did not keep pace with a sharp population increase. On the other hand, increased tourism has provided a boost to job creation and personal income, particularly in northern borough-census areas.

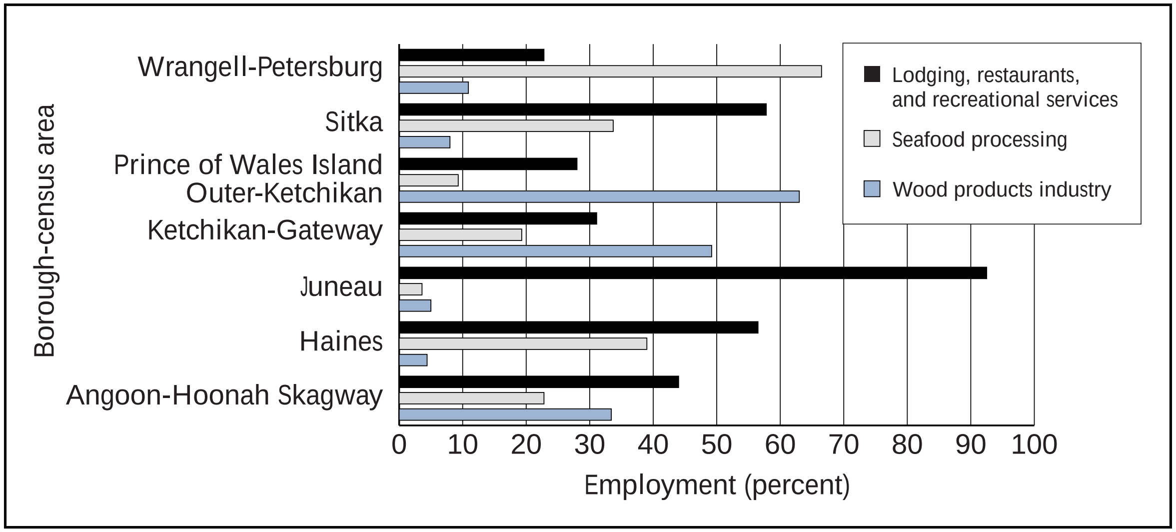
Borough-census areas differ in their dependence on natural resource-related jobs—Areas of southeast Alaska differ greatly in employment related to natural resources. Northern borough-census areas, for example, are less reliant on the wood products industry for their employment base and contain higher proportions of employment in recreation and tourism. Differences become more pronounced at the community level.



Annual employment growth by borough-census area for 1981 to 1995.

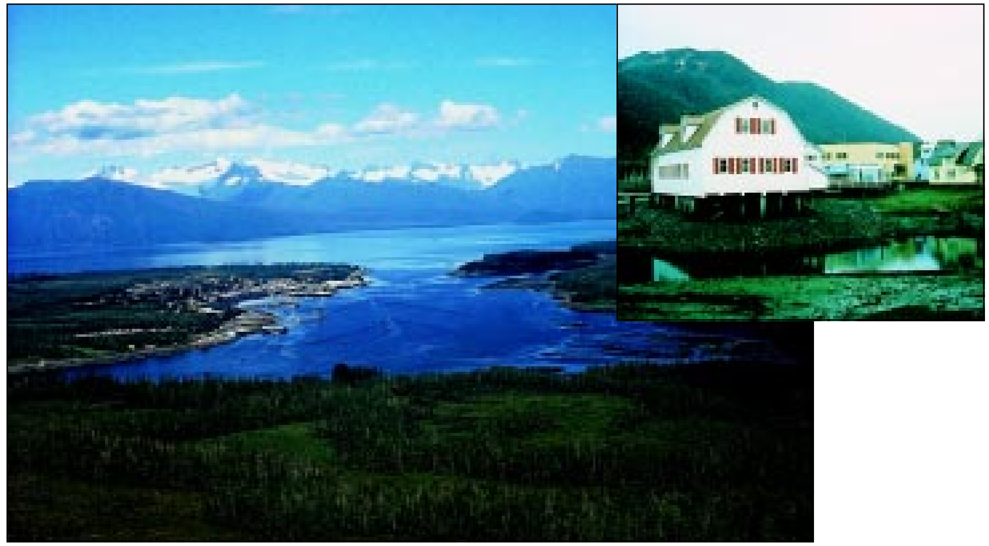
Community conditions—Community-level economic conditions were assessed from 32 communities or groupings of similar communities. A new tourist attraction or the loss of a major employer can have great localized impacts. Because of their relatively small number and diverse characteristics, southeast Alaska communities are unique and difficult to describe as a group. Communities differ in population, ethnic composition, income, subsistence use, and economic diversity.

For more information about the economy, read *Economies in transition: an assessment of trends relevant to management of the Tongass National Forest*, by Allen and others, PNW-GTR-417.



Yakutat's economy is dependent on fishing, fish processing, and government. One hundred and seventy-four residents hold commercial fishing permits. A cold storage plant is the major private employer. Recreational fishing opportunities, both saltwater and freshwater in the Situk River, are world-class. Most residents depend on subsistence hunting and fishing. Salmon, trout, shellfish, deer, moose, bear, and goats are harvested.

Seafood processing and other types of operations, government other than Federal, and retail trade dominate Petersburg's economy. Fishing and seafood processing dominate Tongass-related employment here.



Wood-related manufacturing, government other than Federal, retail trade, and services dominated Ketchikan's economy in 1995; since then, the manufacturing sector lost nearly 500 jobs when the pulp mill closed. Tongass-related employment in Ketchikan is divided among wood products, seafood, and tourism.

Applying Scientific Information

Consistency Check—Ensuring the Use of Science

Forest Service scientists conducted an independent review of the ways that managers applied available resource information to major decisions in the Forest plan. Management decisions were judged to be consistent with available scientific information when:

- All scientific information made available to managers was considered in the decision.
- Scientific information was understood and correctly interpreted by managers.
- Resource risks were acknowledged and documented by managers.

The review was conducted by applying these criteria to an array of important resource decisions made in the Forest plan. Results of this evaluation were given to the managers *while the Forest plan was still in draft form* so that managers could adjust the plan to make the best use of available information. Managers and scientists worked together to ensure that the best scientific information available was interpreted correctly, and that resource risks and tradeoffs were acknowledged. The final review of the Forest plan indicated a high degree of consistency with the available scientific information.

For more information on how science was used to formulate the Forest plan, see the following papers:

Evaluation of the use of scientific information in developing the 1997 Forest plan for the Tongass National Forest, by Everest and others, PNW-GTR-415.

Scientific information and the Tongass land management plan: key findings derived from the scientific literature, species assessments, resource analyses, workshops, and risk assessment panels, by Swanston and others, PNW-GTR-386.

> *Scientists should not advocate any particular outcome or decision; they should, however, determine whether the decision is consistent with the science information.*
>
> *Thomas J. Mills*
>
> *Station Director*
> *Pacific Northwest*
> *Research Station*

What the Future Holds—Addressing Information Needs

As a "living" document, the Forest plan needs to be fed new information as it becomes available. These new sources of information become the building blocks for change.

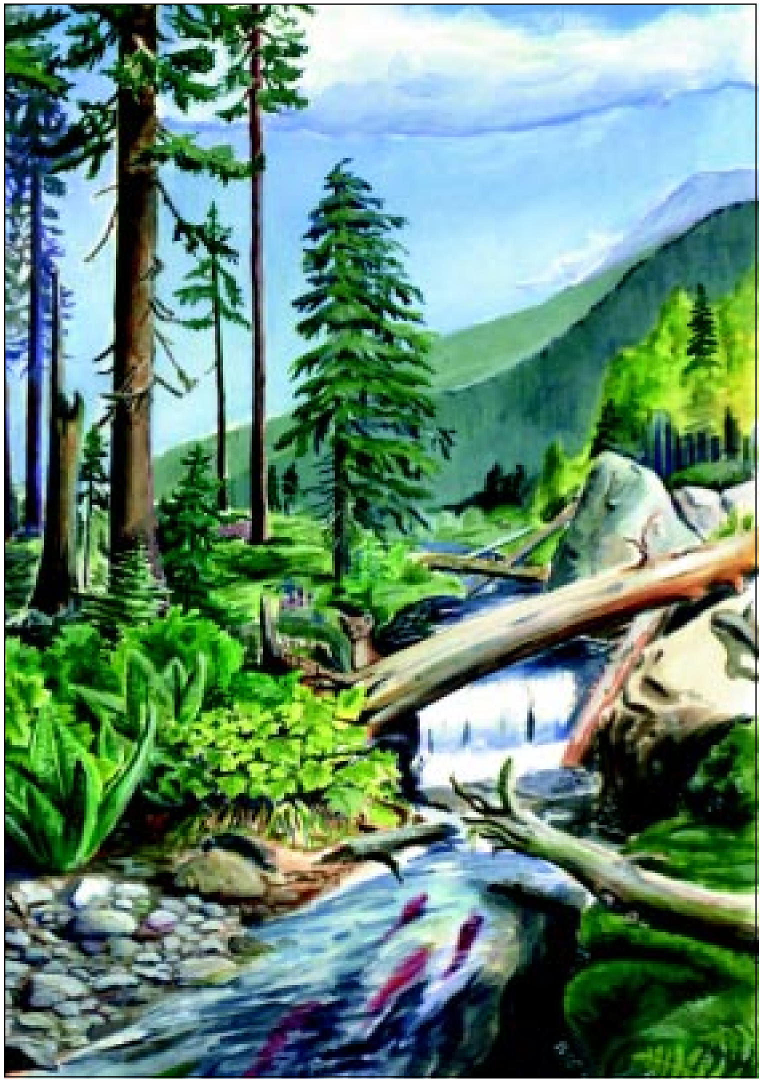
As part of the long-range effort to improve the information base available to support management decisions in the Tongass National Forest, Pacific Northwest Research Station scientists have been working with their colleagues in the Alaska Region of the Forest Service and other agencies to address the high-priority information needs identified in the Forest plan. Studies scheduled for completion in the next 3 to 5 years address the following issues:

- Growth rates of young trees on certain wetland soils following timber harvest
- Quality of wood in developing young-growth stands
- Genetic relations and habitat needs for certain locally distinct small mammals
- Nesting biology and food preferences of the northern goshawk
- Contributions of upstream, non-fish-bearing streams to the quality of downstream fish habitat
- Biological, social, and economic aspects of alternatives to clearcutting
- Interactions between forest management actions and the economic and social fabric of communities
- Economics of forest-related tourism

The primary goal of this collaborative effort is to have an enhanced information base available for managers to use by 2002, when they will conduct a 5-year review of the Forest plan. The new information will help managers evaluate the effectiveness of the plan in meeting its stated goals and objectives and in providing background to support any changes managers may decide are necessary to better meet the goals and objectives of the plan.

The additional information also will enhance our ability to integrate and synthesize knowledge across discipline areas (e.g., fish and wildlife, landscape dynamics, and socioeconomics). This process should allow us to more fully understand and appreciate the intricate interactions and balance among biological, physical, and socioeconomic components of the Tongass and its people. Thus, the scientific information should continue to provide highly relevant input into policy decisionmaking, on-the-ground management, and the needs of the people who use and appreciate the Tongass and its resources.

Conclusion



We wrote this paper around the premise that "science matters." This title was used to frame both the scientific information itself and its importance. On one side, science matters (the noun) include the physical, biological, and social elements of the forest ecosystem that become understood through scientific methods of discovery. On the other side, science matters (the verb) when land managers apply scientific information to balance competing resource needs.

We hope that your journey through some Tongass-specific information recently developed, assessed, and synthesized by research scientists has led you to an understanding of why science does matter in the Tongass. It matters not only because obtaining new knowledge is exciting and mentally stimulating, but also because the information derived can have direct practical applications to the often contentious management of these public lands.

The information not only should help managers make informed decisions about allocation of resources to meet often competing demands but also help the public better understand and thus more clearly articulate their desires for the direction of resource management on these, their public lands. The nature of that management, and the public understanding regarding it, can be enlightened by science, an objective of this paper and the other Tongass assessments noted herein. But the decisions regarding management direction are societal ones. An informed opinion expressed by the public regarding these complex management issues should benefit all components of society who use and appreciate this unique temperate rain forest.

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