# High-grading on the Tongass National Forest: Implications of Pending Land Selections on Forest Diversity

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## Abstract

*High-grading refers to the practice of preferentially logging stands with the largest trees. On the Tongass National Forest, the largest-tree stands, identified as classes 6 and 7, have been extensively logged. Half or more of the very large-tree stands (class 7) that existed in 1950 are gone. Today, class 7 stands are exceedingly rare, covering just ½ of one percent of the land area, and comprising 1.6% (81,770 acres) of the productive old growth on the Tongass. Class 6/7 stands cover 3.4% of the land area and comprise 11% (565,792 acres) of the productive old growth on the Tongass. Congress recognized the problems posed by high-grading, and banned the practice in the 1990 Tongass Timber Reform Act. Today, a legislative proposal by Sealaska Corporation would amend the Alaska Native Claims Settlement Act (ANCSA) to permit the corporation to obtain lands from the Tongass outside of areas designated for selection under*

*current law. The proposed selections include a substantial portion of the remaining largest-tree forest on public lands, including up to 16.6% of the remaining class 7 stands, and up to 5.7 % of the combined class 6 and 7 stands. The amount of very large-tree old growth (class 7) in the proposed new selection areas is greatly disproportionate to the Tongass as a whole and exceeds amounts in the existing selections by 11–12 times. This paper traces the history of high-grading on the Tongass and shows how the Sealaska legislation, if passed, would allow the corporation to high-grade a substantial portion of the remaining very large-tree old growth on the Tongass, permanently reducing forest diversity and harming dependant wildlife.*

## Introduction

Temperate boreal rainforests of the world are rare. They occur in 10 areas in the world and represent less than 3% of all forest cover on earth (DellaSala et al. 2011a). The northwest coast of North America is the largest of these temperate rainforests, containing 35% of the world's total (DellaSala et al. 2011a). Defined by a cool, very wet maritime climate, this forest spans 23 degrees of latitude from Kodiak Island in southcentral Alaska to the fog-belt redwood forest of northern California. Much of this region, especially the southern half, has been logged or converted to non-forest use (Kellogg 1995). The northern half, including the forests of northern British Columbia and southeast Alaska, contain the largest intact tracts of this rainforest type remaining in the world (Strittholt et al. 2005, DellaSala et al. 2011b).

The region, however, is not pristine, with a history of commercial logging dating back to the early 1900s (Makovjak 2010). As with most frontier forests, early logging followed a familiar pattern: the biggest, most accessible, and economically valuable trees were logged first (Shoaf 2000, Sisk 2007, Albert and Schoen, in review). In forestry, the term "high-grading" commonly

refers to the practice of targeting the largest, highest-quality trees in a stand for logging, and leaving behind smaller, or lower quality trees. It can also occur at a larger spatial scale, in which the most productive stands of trees are clearcut, and nearby stands of low productivity are retained, or conserved. While high-grading maximizes profit, the selective removal of certain forest types threatens ecological functioning over large areas (Albert and Schoen 2007, Albert and Schoen *in review*, Lertzman and McKinnon *in press,* DellaSala et al. 2011b). The effects of high-grading are especially severe for wildlife species with specialized habitat requirements associated with these preferred stand types, or those that rely on the mix of different forest types, including highly productive stands, to meet their annual life history requirements (e.g., Schoen et al. 1988, Schoen and Kirchhoff 1990).

In this paper, we review the history of high-grading on the Tongass National Forest and describe its relationship to forest diversity and associated wildlife resources. We document how pending land selections under legislation requested by Sealaska Corporation will affect the remaining large-tree old-growth stands in the Tongass National Forest and associated wildlife.

**Forest Types**

Southeast Alaska lies near the northern end of the North American temperate rainforest, where cool temperatures, high rainfall, thin soils, and rugged topography result in lower forest productivity (Farr and Harris 1979, DellaSala et al. 2011b). In southeast Alaska, less than one third of the land is covered with "productive forest," or forest that has been designated as suitable for commercial logging (USFS 1979, 2008). The productive forestland itself is far from uniform. Forest types range from sparse, small trees on poorly drained sites to well-stocked

stands of very large trees on the best, well drained growing sites (Carstetnsen 2007). These patterns of tree growth are visible on aerial photographs of the forest, and stands with similar structural and compositional attributes have been classified and mapped (Caouette and Degayner 2005, 2008). The largest trees on the Forest are grouped in a type designated size-density class 6–7 (Caouette and Degayner 2005). The numerals refer to the original volume class designation for these stands, which for class 6 stands is 30–50 thousand board feet per acre, and for class 7 is > 50,000 board feet per acre (USDA Forest Service 1979). Some stands in the highest volume class exceed 100,000 board feet per acre (USDA Forest Service1974).

Although these two highest classes are often combined based on mean volume, combining them sacrifices meaningful information on stand size structure (Caouette et al. 2000). The largest trees, and the highest timber volumes, are found in class 7 stands. These stands grow on well drained alluvial soils or karst, and individual trees can reach impressive size (Carstensen 2007). For this paper, we quantify the effects of proposed land selections on forest diversity in terms of volume classes 6 and 7 combined (class 6/7), and for volume class 7 alone (class 7). For description, we refer to class 6/7 as "large-tree forest" and class 7 as "very large-tree forest." In both cases, the stands are at least 150 years old, making them "old growth."

**Past Logging**

The large-tree stands in southeast Alaska have been sought by loggers since the early days of commercial logging (Mackovjak 2010). In the late 1880s there were nearly a dozen sawmills operating in the region supported by hand loggers that targeted the best and easiest-to-access trees. As reported in a history of the US Forest Service (USFS) in Alaska, during the early days

of logging in southeast Alaska, the "standard procedure was for the logger to go where he pleased and cut whatever he wanted, without getting permission from anyone" (Rakestraw 1981).

Lacking a mapped inventory of volume class prior to the 1970s, the original extent of the large-tree and very large-tree stands cannot be known with certainty. It is possible, however, to coarsely reconstruct the loss by analyzing data on volume harvested annually in comparison to acres harvested annually. Even as recently as the 1980s, the stands being logged were averaging 54,000 board feet (unpublished USFS data, *cited by Anderson 1989*). While some acres logged had much more volume than the average and other acres no doubt had less, this analysis provided documentation that the highest-volume stands had been, and were still being, targeted for logging (The Wildlife Society 1992). This pattern of harvest emphasis on the largest, most accessible trees has been acknowledged by the Forest Service (Anderson 1989, USFS 2008). By conservative estimates over half of the very large-tree stands on the forest have been logged (Anderson 1989, The Wildlife Society 1992, Albert and Schoen 2007).

Much of the high-volume stand harvest occurred following the establishment of two large pulp mills in southeast Alaska during the late 1940s and early 1950s. With long-term, 50-year harvest contracts issued by the Forest Service involving many billions of board feet and large public subsidies[1], the pulp and saw mills converted rare large-tree temperate rainforest on the Tongass into pulp and timber for Pacific Rim markets. The prevailing forest management paradigm was well summarized in the observation of A. W. Greely, Regional Forester, who wrote: "Forests are

[1] The Tongass Timber Supply Fund was established in the Alaska National Interest Lands Conservation Act (ANILCA) to provide a supplement of $40 million per year to the Tongass National Forest to maintain a steady supply of timber to the industry.

managed not by being left to themselves, but by the direction and control of some action which man brings on." B. Frank Heintzleman, Governor of the Territory, described the dedication of the Ketchikan Pulp Mill in 1954 as "an important milestone on Alaska's road to full industrial development" (Alaska Forest Association, undated).

**Wildlife Habitat Concerns**

While the focus on stands of large trees was not surprising given economic drivers, it did raise questions about the impacts this loss might have on wildlife. During the mid-1970s, there was a national shift in how old-growth forests were being viewed, and an emergent recognition of the myriad wildlife values and ecosystem services old growth provided (Schoen et al. 1981, Schoen et al. 1988). In Alaska, where there was still a relative abundance of old growth, but a rapidly dwindling supply of the large trees (Albert and Schoen 2007), increasing attention was focused on understanding the ecological role of large-tree stands. Scientists learned, for example, that large trees were an excellent predictor of a stand's ability to intercept and hold snow (Kirchhoff and Schoen 1987). They discovered that the majority of the Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) population moved into these rare large-tree stands during severe winters to escape deep snow, and that heavy mortality could be expected if those stands were not available (Schoen and Kirchhoff 1990). The crevices in the bark of especially large (>100 cm diameter) old trees provided important habitat for arthropods, making large-tree old growth important habitat for birds like Brown Creeper (*Certhia americana*) (Kissling 2008, USFWS 2010).

**Management Response**

Faced with these and other emerging wildlife concerns, the USFS convened an interagency Viable Population Committee to evaluate habitat needs of old-growth-associated species on the Tongass, and make recommendations for the Forest Plan that was then under revision (Suring et al. 1993). The goal was to ensure the Forest Plan complied with requirements linked to the National Forest Management Act (1976) that National Forests maintain viable, well distributed populations of vertebrates throughout the planning area. Following the lead of scientists who were designing a conservation strategy for the Spotted Owl in the Pacific Northwest (Thomas et al. 1990), Alaska scientists recommended a network of old-growth reserves (OGRs) of sufficient size, spacing, and quality to meet those goals (Kiester and Eckhardt 1994, USFS 2006). This original conservation strategy has been continued through multiple Forest Plan revisions, has shielded the Forest Service from adverse listing decisions under the Endangered Species Act (e.g., Iverson and DeGayner 1997), and remains a fundamental conservation element in the Forest Plan today (Haufler 2007, USFS 2008).[2]

Congress also turned its attention to the Tongass when it enacted federal legislation to reduce federal subsidies to the pulp mills and reform logging practices on the Tongass. A number of changes were enacted as part of the Tongass Timber Reform Act of 1990 (TTRA), including an explicit prohibition of high-grading, or the disproportionate logging of the rare higher-volume-class stands.[3] The bill was passed with overwhelming bipartisan support in both the House and Senate, including Alaska Senators (Stevens–R, Murkowski–R) and Alaska's representative in the

[2] OGRs can include a variety of habitat types including muskeg, low-volume forest, and second growth; the OGR network is not designed to conserve very large-tree old-growth stands.

[3] H.R. 987: Tongass Timber Reform Act, Section 301(c)(2)

House (Young–R). The Tongass Timber Reform Act was signed into law by President George H. W. Bush on 28 November 1990.

Following passage of the TTRA, the 50-year contracts that supplied wood to the pulp mills were eventually cancelled and, by 1997, both pulp mills had closed. Because the ban on high-grading provision had been placed in the long-term contract section of the Tongass Timber Reform Act, the cancellation of those contracts freed the Forest Service from a formal legal requirement to implement the provision. The Forest Service could have implemented such protection voluntarily, but they were facing strong pressure to provide economic timber sales (Shoaf 2000). More often than not, this meant making the harvest unit pool more profitable by including some large-tree stands, or valuable tree species (e.g., yellow cedar, *Chamaecyparis nootkatensis*). While the Forest Service has endeavored to strike a balance, they have left neither industry nor conservation interests fully satisfied (Nie 2006). From a conservation perspective, the harvest of remaining large-tree stands is effectively additive and permanent. Because the largest trees are 300–800 years of age, these giant, ancient trees will never be replaced in a plantation forest managed on a 100-year rotation.

**Proposed Sealaska Land Selections**

The Tongass National Forest is not the only entity in the southeast Alaska region involved with the management of large-tree old-growth forest. Under provisions of the 1971 Alaska Native Claims Settlement Act (ANCSA), 571,000 acres from the Tongass National Forest were to be conveyed to private Village, Urban, and Regional Native Corporations (USFS 2009). Under the terms of the Act, these selections are to be made from within selection areas designated by

Congress that reflect a balancing of public and private interests under the settlement. Today, under existing law, the Sealaska Corporation still has a remaining entitlement of 68,000–79,000 acres (USFS 2009) to be made within previously designated areas. Those selection areas were established with the support of the Sealaska Corporation in 1976.[4]

Although Sealaska has identified lands within these selection areas (often referred to as selection "boxes") to fulfill its remaining entitlement, the Corporation requested that the Bureau of Land Management (BLM) *not* convey those lands. Sealaska wishes to delay finalization while it pursues new legislation (S 730/HR 1408) in Congress to amend existing settlement law (BLM, 2010).[5] The legislation proposed by Sealaska (S 730/HR 1408) would change existing ANCSA law in two important ways:

(1) allow Sealaska's remaining 68,000–79,000 acres to be selected *outside* the designated ANCSA selection areas, and

(2) allow numerous, small (<20 acres), and disjunct areas throughout the National Forest.

The proposed legislation creates an unprecedented ability, under ANCSA, for the Sealaska Corporation to "pick and choose" tracts of public lands throughout the Tongass National Forest and would open the door to additional high-grading. New selections proposed in the legislation include some of the very best large-tree old growth along with valuable infrastructure (roads, bridges, log transfer sites), and strategically located small parcel sites suited for recreation, tourism and hydropower development.

[4] As reported by Alaska Congressman Don Young, the selection areas Congress established in 1976 "embodies a compromise negotiated and supported by Sealaska, the State of Alaska, Native villages in the region and various environmental groups." (Congressional Record, Dec. 16, 1975)

[5] Sealaska filed its final land selections with BLM on June 10, 2008 under the Alaska Land Conveyance Acceleration Act of 2004. At the same time, Sealaska requested that BLM halt conveyance of these lands pending the outcome of its efforts to secure new legislation that would give the Corporation the ability to make new selections in other parts of the Tongass National Forest.

**Effect on Forest Diversity**

Lands previously selected by Sealaska Corporation to fulfill its land entitlement, on file with BLM, reflect a proportional distribution of forest types/classes that is generally representative of the Tongass as a whole (Figure 1). Sealaska Corporation's selections under current law include slightly higher proportions of class 7 and class 6/7 stands than found forest-wide (Table 1).

By contrast, pending legislation would allow transfer of vastly greater amounts of class 7 and class 6/7 lands to Sealaska (Table 1).[6] The lands that would be conveyed to the corporation under pending legislation differ slightly between the Senate (S 730) and House (HR 1408) versions of the legislation but both bills reflect significant high-grading. Under S 730, a total of 80,825 acres would be available to Sealaska in 8 areas, including 26,342 acres of size class 6/7, and 12,141 acres of size class 7 (Table 1). Under HR 1408, a total of 100,957 acres would be available to Sealaska in 8 areas, including 32,387 acres of size class 6/7, and 13,550 acres of size class 7 (Table 1). The distribution of acres by volume class shows a distinctly disproportionate selection of stands with bigger trees, and higher volumes, than occur naturally on the forest (Figure 2).

Expressed as a percentage of productive old growth (Table 1):

- 24–27 % of Sealaska's proposed selection acreage is composed of very-large-tree old-growth (class 7) stands in contrast to class 7 in the Tongass as a whole at 1.6%, and
- 57–59 % of Sealaska's proposed selection acreage is composed of large-tree (class 6/7) stands in contrast to class 6/7 in the Tongass as a whole at 11.0%.

[6] To evaluate the implications of Sealaska's proposed timber selections on forest stand diversity, we used mapping software to overlay the proposed selection areas in each of the two bills on forest type data layers to determine the composition of their selections. The boundaries of parcels proposed for selection were based on data layers provided by the Sealaska Corporation. The forest type layers used in the analysis were based on Forest Service data layers.

Sealaska's proposed new selections under S 730/HR 1408 contain 10.9–12.1 times more acres of very large-tree old growth, (class 7) and 2.9–3.5 times more acres of large-tree old growth (class 6/7) compared with the existing selections filed with BLM (Table 1).

The high-grading is particularly pronounced with regard to the very large-tree stands (class 7). This is accomplished by locating the selection areas in the most productive parts the Tongass National Forest, and within those selection areas, drawing convoluted boundaries to include the very large-tree stands and to exclude non-forested lands (e.g., Figure 3). In absolute terms, the proposed land selections would allow Sealaska to remove up to 5.7 % of the large-tree stands (class 6/7) and up to 16.6 % of the last remaining very large-tree stands (class 7) from the Tongass National Forest (Table 2).

This would constitute a substantial, permanent loss of a rare resource that is currently held in public trust and managed by the US Forest Service. The proposed legislation clearly contravenes the earlier intent of Congress to end high-grading and afford higher protection to these rare and valuable large-tree stands on the Tongass. If enacted, the Sealaska legislation would erode more than 30 years of effort by foresters, conservationists, biologists and other scientists to conserve these remaining rare stands, not only for their value to wildlife and human users in Alaska, but as a resource valued by citizens nationwide.

**Conclusions**

1. Large-tree old growth in the coastal temperate rainforest is a rare forest type, with only ~82,000 acres of class 7, and ~566,000 acres of class 6/7 remaining on the 16.8 million acres of the Tongass National Forest.
2. Because large-tree stands are more profitable to log, the highest harvest pressure has historically focused on these stands. Conservative estimates are that half or more of the original class 7 stands are gone.
3. The Sealaska Corporation has a remaining land entitlement of 68,000–79,000 acres. Sealaska has provided its final land selections to BLM but has asked the agency to halt conveyance as it seeks proposed changes to current law to permit the corporation to make land selections in new areas of the Tongass.
4. The new lands proposed for selection by Sealaska contain 11–12 times more acres of very large-tree old-growth (class 7), and 2.9–3.5 times more acres of large-tree old-growth (class 6/7), than occur within existing selections submitted by Sealaska to the BLM under existing law.
5. The high-grading proposed by Sealaska would reduce very large-tree forest on the Tongass up to 16.6 %, and large-tree forest up to 5.7 %. These losses would be substantial, permanent, and additive to any other large-tree old growth harvest resulting from US Forest Service timber sales, having long-term implications for forest diversity and associated wildlife.

[October 31, 2011 - final]

**Table 1.** Acreage of very large-tree and large-tree old growth (Class 7 and Class 6/7) within 10 timber selection areas under proposed legislation (S 730 and HR 1408).

| Proposed Selection Area | Total Acres | Productive Old Growth (acres) | Class 7 (acres) | Class 7 (% POG) | Class 6/7 (acres) | Class 6/7 (% POG) |
|---|---|---|---|---|---|---|
| Calder (S 730) | 3,744 | 2,740 | 115 | 4.2% | 1,487 | 54.3% |
| Calder (HR 1408) | 20,810 | 13,152 | 1,496 | 11.4% | 7,049 | 53.6% |
| Keete (S 730) | 9,391 | 7,978 | 1,845 | 23.1% | 3,923 | 49.2% |
| Keete (HR 1408) | 12,456 | 10,293 | 1,873 | 18.2% | 4,406 | 42.8% |
| Kosciusko Island | 19,445 | 7,437 | 2,281 | 30.7% | 4,920 | 66.2% |
| North Election Creek | 1,999 | 1,614 | 344 | 21.3% | 731 | 45.3% |
| North Kuiu | 15,006 | 9,388 | 2,406 | 25.6% | 6,090 | 64.9% |
| Polk / McKenzie | 10,328 | 7,320 | 2,756 | 37.7% | 4,417 | 60.3% |
| Tuxekan Island | 13,579 | 6,278 | 2,303 | 36.7% | 4,336 | 69.1% |
| Twelve Mile | 7,334 | 1,770 | 91 | 5.1% | 438 | 24.7% |
| S 730 Total | 80,825 | 44,525 | 12,141 | 27.3% | 26,342 | 59.2% |
| HR 1408 Total | 100,957 | 57,251 | 13,550 | 23.7% | 32,387 | 56.6% |
| Sealaska Timber Priorities Total (Submitted to BLM) | 138,831 | 60,430 | 1,117 | 1.8% | 9,200 | 15.2% |
| Tongass National Forest (Non-Private) | 16,800,553 | 5,135,753 | 81,770 | 1.6% | 565,792 | 11.0% |

**Table 2.** Percentage of remaining class 7 and class 6/7 stands in Tongass National Forest (non-private) potentially harvested under alternative proposals

| | Percent of class 6/7 | Percent of class 7 |
|---|---|---|
| S730 Total | 4.7% | 14.8% |
| HR1408 Total | 5.7% | 16.6% |
| Sealaska Timber Selections Under Current Law Total (Submitted to BLM) | 1.6% | 1.4% |

**Figure 1.** Proportional distribution of forest types/classes in areas currently selected by Sealaska under current law on file with BLM (orange bars) versus Tongass NF overall (green bars).

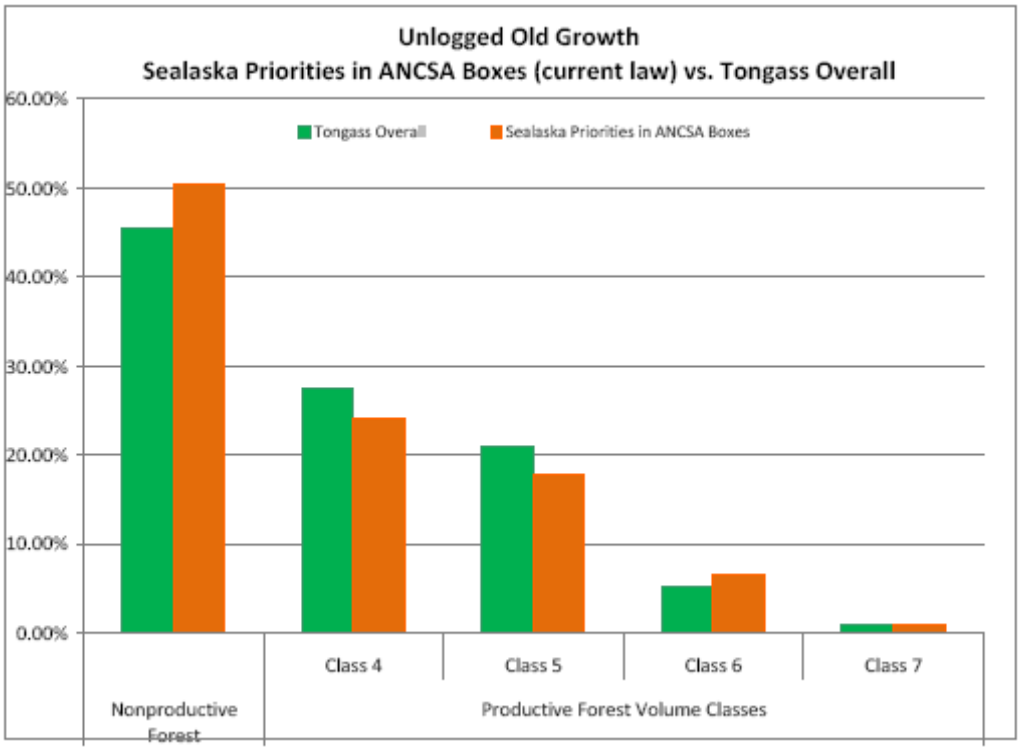


**Figure 2.** Proportional distribution of forest types/classes in selected areas (red bars) versus Tongass NF overall (green bars) under S 730 (results for HR 1408 are qualitatively the same).

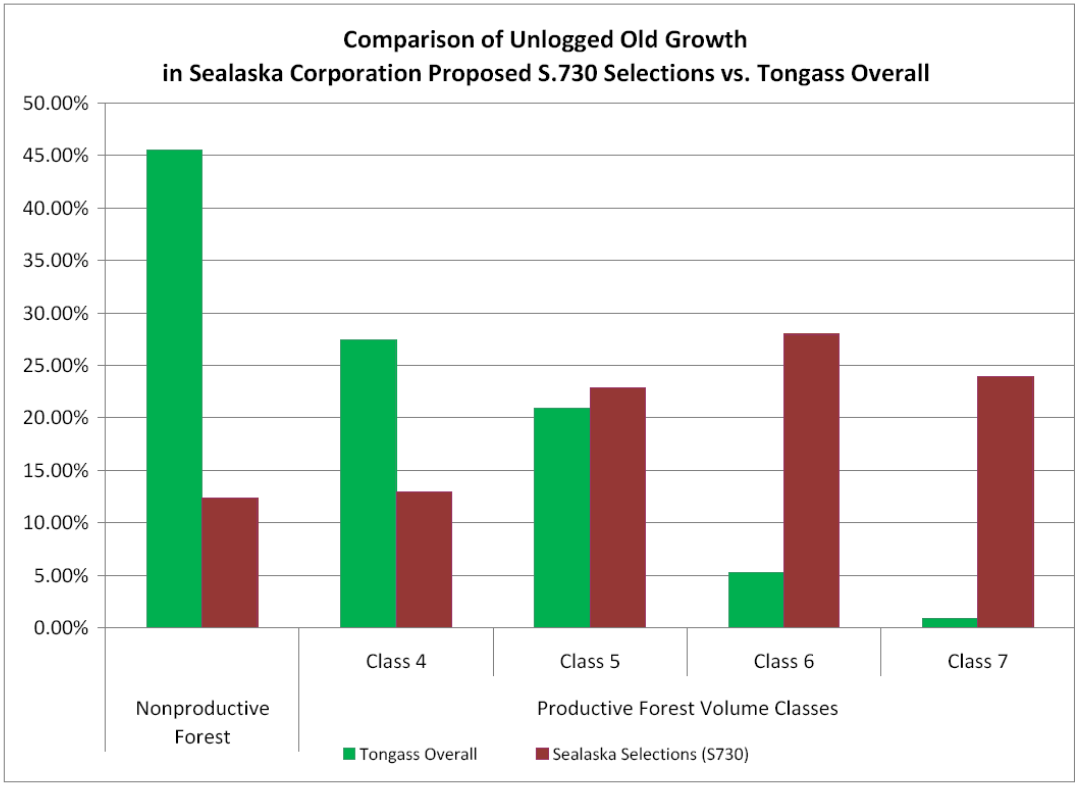
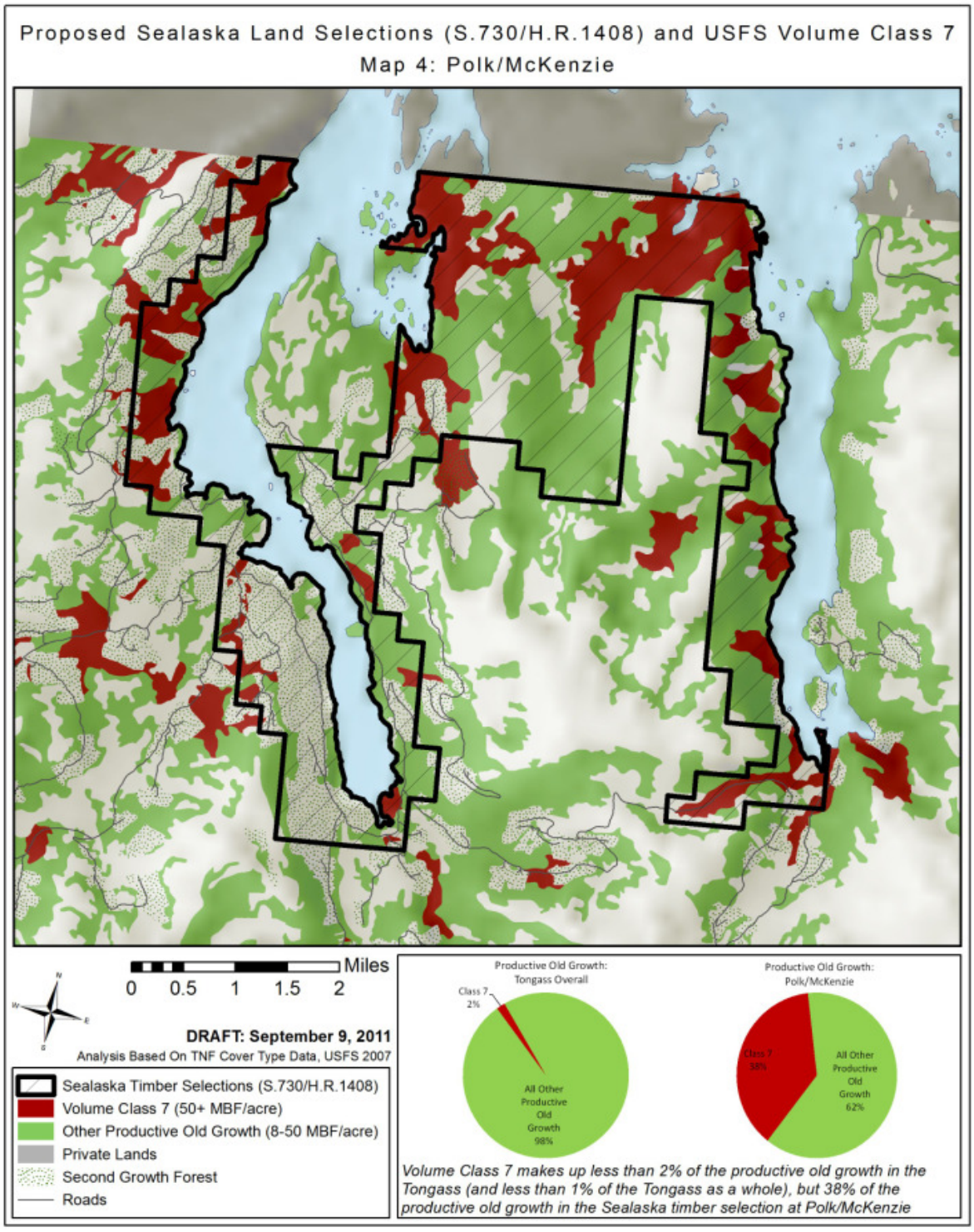


**Figure 3.** Lands near Polk/McKenzie Inlet, in southeast Alaska, proposed for transfer from the Tongass National Forest to Sealaska Corporation under S730 and HR 1408.



**Literature Cited**

Alaska Forest Association. Undated. Alaska Timber Industry History, Southeast Alaska http://www.akforest.org/Alaska%20Timber%20Industry%20History.pdf

Albert, D. M. and J. W. Schoen. 2007. A conservation assessment for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. *In* Schoen and Dovichin (eds), A conservation assessment and resource synthesis for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. The Nature Conservancy and Audubon Alaska, Anchorage, AK. Available online at: www:conserveonline.org/workspaces/akcfm.

_____ and J. W. Schoen, *in review*, Using forest change as an indicator of ecological risk and sustainability in the temperate rainforest of southeast Alaska. *Conservation Biology* ____.

Anderson, D. 1989. Testimony before the Committee on Energy and Natural Resources, United States Senate, one hundred first Congress on S. 346: To Amend the Alaska National Interest Lands Conservation Act and for Other Purposes. February 28, 1989, Part 1. US Government Printing Office, Washington DC. 97-134.

Brickell, J. E. 1989. Review of Forest Inventory Methodology and Results, Tongass National Forest. USDA Forest Service, Alaska Region, unpublished report. 28 p.

Bureau of Land Management. 2010. Letter from Robert Abbey, Director to Heather Prichter, dated October 15, 2010.

Caouette, J. P., and E. J. DeGayner. 2005. Predictive mapping for tree sizes and densities in Southeast Alaska. *Journal of Landscape and Urban Planning* Vol. 72/1-3 pp 49–63.

_____ and E. J. DeGayner. 2008. Broad-scale classification and mapping of tree size and density attributes in productive old-growth forests in Southeast Alaska's Tongass National Forest. West. J. Appl. For. 23(2). 7 p.

_____, M. G. Kramer, and G. J. Nowacki. 2000. Deconstructing the timber volume paradigm in the management of the Tongass National Forest. Gen. Tech. Rep. PNW-GTR-482. USDA Forest Service, Pacific NW Res. Stn. Portland OR.

Carstensen, R. 2007. Terrestrial Habitats of Southeast Alaska. Chapter 5.2 (70 pp) *in* Albert, D. M. and J. W. Schoen (eds) A conservation assessment for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. In Schoen and Dovichin, editors, A conservation assessment and resource synthesis for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest.

DellaSala, D. A., P. Alaback, T. Spribille, H. von Wehrden, and R.S. Nauman. 2011a. Just what are temperate and boreal rainforests? Pages 1-41 *In*: DellaSala (ed*)* Temperate and boreal rainforests of the world: ecology and conservation. Island Press, Washington, D.C. 295 pp.

_____, F. Moola, P. Alaback, P. Paquet, J. Schoen, and R. Noss. 2011b. Temperate and boreal rainforests of the Pacific Coast of North American. Pages 42–81. *in* D. DellaSala (ed.). Temperate and boreal rainforests of the world: ecology and conservation. Island Press, Washington, D.C.

Farr, W. A., and A. S. Harris. 1979. Site index of Sitka spruce along the Pacific coast related to latitude and temperatures. Forest Science 25(l):145–153.

Haufler, J. 2007. Review of conservation science produced since 1997 and its relationship to the Tongass National Forest Land and Resource Management Plan. Report prepared for Tetra Tech and Tongass National Forest. Ecosystem Management Research Institute. 35 pp.

Iverson, C. and E. DeGayner. 1997. Reply To: RS-G-10-b; Subject: Old-growth Forest Habitat Conservation Strategy. Alexander Archipelago Wolf and Queen Charlotte Goshawk Analysis. Analysis to the Planning Files, Tongass Land Management Planning Team. USDA Forest Service, January, 1997. Juneau, AK. 77pp.

Kellogg, E. L. (ed). 1995. The rainforests of home: an atlas of people and place. Authored by E. C. Wolf, A. P. Mitchell, and P. K. Schoonmaker. Published by Ecotrust, Pacific GIS, and Conservation International. Portland, OR.

Kiester, A. R. and E. Eckhardt. 1994. Review of wildlife management and conservation biology on the Tongass National Forest: a synthesis with recommendations. Pacific Northwest Research Station, USDA Forest Service, Corvallis, OR. 282 pp.

Kirchhoff, M. D. and J. W. Schoen. 1987. Forest cover and snow: implications for deer habitat in southeast Alaska. *Journal of Wildlife Management* 51:28–33.

Kissling, M., T. DeSanto, M. Kirchhoff, S. Matsuoka, D. Rabe, A. Russell, and M. Willson. 2008. New Information related to forest birds. *In:* Tongass Land Management Plan Interagency Conservation Strategy Review: An Assessment of New Information since 1997. Final Report of a workshop held 10–14 April 2006, Ketchikan, AK. 167 pp.

Lertzman, K. and A. MacKinnon. In press. Why watersheds: evaluating the protection of undeveloped watersheds as a conservation strategy in northwestern North America. *in* G. Orians and J. Schoen (eds), Ecology and conservation of North Pacific temperate rainforests. University of Washington Press.

Mackovjak, J. R. 2010. Tongass timber: a history of logging and timber utilization in Southeastern Alaska. Forest History Society. Durham, N.C. 386 pp.

Nie, M. 2006. Governing the Tongass: national conflict and decision-making. *Environmental Law* 36:385–480.

Rakestraw, L. 1981. As cited by Sisk, 2007. The Southeastern Alaska Timber Industry: Historical Overview and Current Status. *In* Schoen and Dovichin (eds), A conservation assessment and resource synthesis for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. The Nature Conservancy and Audubon Alaska, Anchorage, AK. Available online at: www:conserveonline.org/workspaces/akcfm.

Schoen, J. W, and M. D. Kirchhoff. 1990. Seasonal habitat use by Sitka black-tailed deer on Admiralty Island, Alaska. *Journal of Wildlife Management* 54:371–378.

_____, M. D. Kirchhoff, and J.H. Hughes. 1988. Wildlife and old-growth forests in southeastern Alaska. *Natural Areas Journal*. 8: 138–145.

_____, O. C. Wallmo, and M. D. Kirchhoff. 1981. Wildlife-forest relationships: Is a reevaluation necessary? *Transactions of the North American Wildlife and Natural Resources Conference*. 46: 531–544.

Shoaf, B. 2000. The taking of the Tongass: Alaska's rainforest. Running Wolf Press, Sequim, WA. 283 pp.

Sisk. 2007. The Southeastern Alaska Timber Industry: Historical Overview and Current Status. In Schoen and Dovichin (eds), A conservation assessment and resource synthesis for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. The Nature Conservancy and Audubon Alaska, Anchorage, AK. www:conserveonline.org/workspaces/akcfm.

Strittholt, J. R., D. A. DellaSala, and H. Jiang. 2005. Status of mature and old-growth forests in the Pacific Northwest. *Conservation Biology* 20: 363-374.

Suring, L. H., D. C. Crocker-Bedford, R.W. Flynn, C. S. Hale, G. C. Iverson, M. D. Kirchhoff, T. E. Schenck, L. C. Shea, and K. Titus. 1993. A proposed strategy for maintaining well distributed, viable populations of wildlife associated with old-growth forests in Southeast Alaska. Review Draft, May 1993, AK. 278 pp

The Wildlife Society 1992. Statement of reasons for appeal of Record of Decision Alaska Pulp Corporation, Long-tem Timber Sale Contract, Kelp Bay Environmental Impact Statement 3-6.7 April 1992.

Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the NS Owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. U.S. Department of Agriculture Forest Service, Portland, OR.

USDA Forest Service. 1974. Inventory, Southeast Region. Report by the Resource Planning Team, Joint Federal-state land use planning commission. May, 1974. 16 pp.

_____. 1979. Tongass Land Management Plan Revision. Record of Decision. Tongass National Forest, Alaska Region. R10-MG-338a.

_____ 2006. A Summary of the Tongass National Forest Conservation Strategy. http://tongass-fpadjust.net/Documents/cons_strat_summary_final4.pdf

_____ 2007. TNF Cover Type [file geodatabase]. Available: Southeast Alaska GIS Library. http://seakgis.alaska.edu/data/CoverType.zip.

_____. 2008. Tongass land and resource management plan amendment: final environmental impact statement and record of decision. R10-MB-603A. USDA Forest Service Alaska Region, Juneau, AK.

_____ 2009. Alaska Conveyances–Tongass National Forest. Juneau, AK http://www.fs.fed.us/r10/tongass/newsroom/Lands_Info/updated%20Conveyance%20info%20and%20pending%20legislation.pdf

_____, 2010. Wildlife Management Indicator Species (MIS) -- 2010 Monitoring Report. Wildlife Terrestrial Habitat. Tongass National Forest, Juneau AK. http://www.fs.fed.us/r10/tongass/projects/tlmp/2010_monitoring_report/1016WildlifeMIS.pdf