ALASKA'S CHANGING BOREAL FOREST

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Timber Harvest in Interior Alaska

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Introduction

The most active period of timber harvesting in the history of Alaska's interior occurred nearly a century ago (Roessler 1997). The beginning of this era was the year 1869, when steam-powered, stern-wheeled riverboats first operated on the Yukon River (Robe 1943). Gold was discovered in Alaska in the 40-Mile River area in 1886, a find that was overshadowed 10 years later by the discovery of gold in the Klondike, Yukon Territory. By 1898, Dawson City, Yukon Territory, was reported to have 12 sawmills producing a total of 12 million board feet of lumber annually (Naske and Slotnick 1987).

Over the next 50 years, more than 250 different sternwheeled riverboats operated in the Yukon drainage, covering a large part of Alaska and Canada's Yukon Territory (Cohen 1982). This transportation system required large amounts of fuel. Woodcutters contracted with riverboat owners to provide stacked cordwood at the river's edge, at a cost of $7.14 in 1901 (Fig. 18.1; Cohen 1982). Between 100 and 150 cords of wood were required to make the 1400-km round trip from the upper Yukon to Dawson City (Trimmer 1898). Over time, woodcutters moved inland from the rivers' edges, significantly impacting the forest along many rivers of the Yukon drainage (Roessler 1997).

The growth of the town of Fairbanks required wood for buildings and flumes as well as for fuel. In Fairbanks's early days, all electrical generation was by wood fuel at the N.C. Company's power plant. From the founding of the town in 1903 through the 1970s, white spruce harvested in the Fairbanks area was used exclusively by local sawmills, which produced small amounts of green and air-dried lumber. In 1984, however, the Alaska Primary Manufacturing Law was struck down

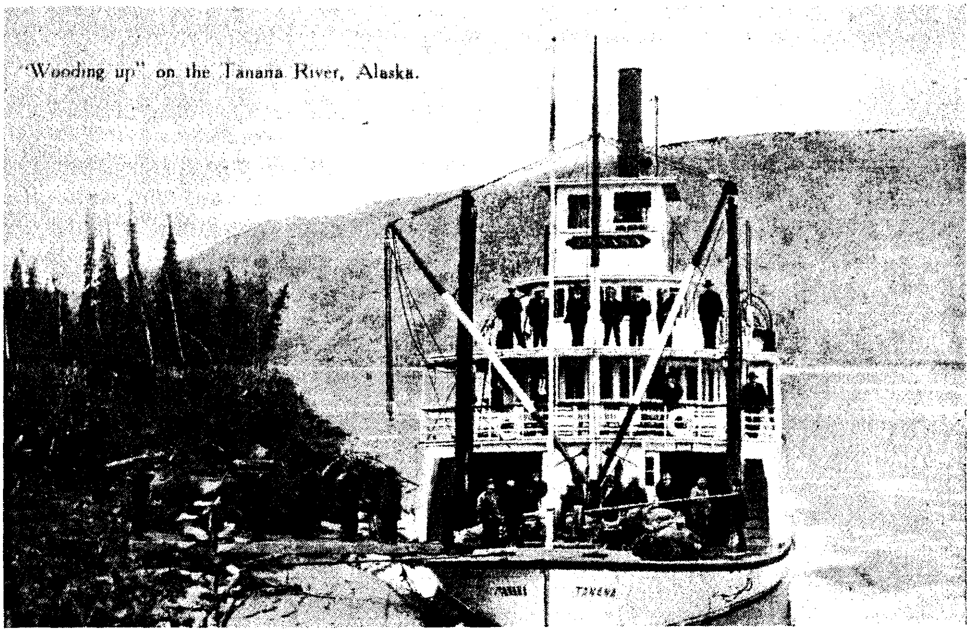

Figure 18.1. "Wooding up" on the Tanana River, ca. 1910. Photo printed with permission of The Olive Joslyn Bell Collection, Accession number 79-41-165, Archives and Manuscripts, Alaska and Polar Regions Department, University of Alaska Fairbanks.

by the U.S. Supreme Court, removing the legal barrier to round-log export of timber harvested from State lands. During the late 1980s and 1990s, many high-quality logs from State and private land timber sales were exported, primarily to Pacific Rim countries. Declining markets ended this trend in the late 1990s, and there have been no significant exports since the market collapse. The past few years have seen significant shifts in the nations that supply logs to the world market, as well as a much higher level of competition in log supply, conditions that will likely preclude a return of any significant round-log export from interior Alaska to Asia.

Current Situation

Though the contemporary forest products industry in interior Alaska is small and in some cases economically marginal, it is locally important for employment and for providing wood products for local needs. Most of the forest management activity occurring today involves converting unmanaged forest stands to managed stands and addressing forest health issues such as the salvage of trees damaged by insects or fire. Timber harvest occurs primarily in mature white spruce stands with a high component of sawlog material (defined as having a DBH, or diameter at breast height, > 23 cm). A small volume of sawlog-size paper birch and aspen is also harvested for use in both primary (lumber) and secondary (molding, flooring, furniture) manufactured products. All species are used for fuel wood; in many rural areas, wood is often the primary or secondary heating source for individual homes.

Until recently, timber harvested in interior Alaska was typically clearcut because this is efficient and inexpensive and because some of its effects are similar to those of fire. Harvest unit sizes range from 0.4 ha to about 60 ha but are generally 12–16 ha in size. Over the past 10 years, however, aesthetic and environmental concerns have increased the emphasis on partial-harvest methods. Partial-harvest methods used in interior Alaska today include diameter-limit cuts, species-selection cuts, and seedtree cuts, where scattered mature trees are left standing as seed sources. Today, most timber sales involve harvesting the white spruce sawlogs and retaining any white spruce trees smaller than a minimum sawlog diameter. Species such as balsam poplar, paper birch, and aspen are also commonly left standing, as well as large-diameter spruce with either external or internal defects (e.g., broken tops or heart rot) and individual standing dead trees.

An outcome of the thin economic margins of the current forest products industry is that only management costs necessary for timber extraction (timber sale layout, road building, harvest) and, to a lesser extent, reforestation are generally incurred. Intensive silvicultural measures used elsewhere, such as fertilization and precommercial and commercial thinning, have been shown experimentally to improve tree growth in interior Alaska (Van Cleve and Zasada 1976) but when applied operationally can cost more per ha than the value of the harvested timber. Marginal economic returns discourage even those silvicultural treatments that are considered minimal elsewhere, such as scarification of seedbeds, broadcast burning of slash, and application of herbicides to control competing vegetation.

Harvested sites are reforested both by natural and artificial means. Deciduous species—paper birch, quaking aspen, balsam poplar—naturally regenerate by vegetative propagation and seeding. White spruce is regenerated through natural seeding and by the hand planting of containerized nursery stock.

Because white spruce is the primary commercial species in interior Alaska, it has been the focus of most of the silvicultural research conducted there. Early research concentrated on natural regeneration following timber harvest. This work documented that white spruce seed germinates better on mineral soil than on other substrates (Zasada and Gregory 1969, Ganns 1977), and a variety of types of scarification equipment have been tested with a goal of creating mineral soil seedbeds (Zasada 1972, Youngblood and Zasada 1991, Densmore et al. 1999). However, when scarification is immediately followed by a good cone crop, it can result in severe spruce overstocking (Zasada and Wurtz 1990, Wurtz and Zasada 2001). Concerns about the unpredictability of spruce cone production prompted the creation of a State Forest Nursery in Eagle River, Alaska, in the 1980s, to produce containerized seedlings for local reforestation applications. Recent re-examinations of experiments begun in the 1970s and 1980s indicate, however, that spruce seed germinates and becomes established on undisturbed forest floor better than had previously been recognized. It is not necessary for good cone crops to follow logging immediately for them to play a significant role in regenerating the stand. When evaluated 15 or 20 years after harvest, spruce stocking from natural seed rain was as good on unscarified surfaces as on scarified surfaces.

In one case, growth of the young spruce saplings was significantly better on unscarified surfaces, a reversal of the pattern observed on that site shortly after treatment (Wurtz and Zasada 2001). This work documented trends that had already been observed by forest managers. Today, some managers question the need for any artificial regeneration methods at all, and scarification is viewed primarily as a means to promote the regeneration of wildlife browse.

Timber Harvest and Wildlife

The harvest of timber in interior Alaska can affect wildlife habitat and biological diversity in many ways. The impacts associated with the timber harvest can be positive or negative, depending on the wildlife species in question. Some silvicultural practices can mitigate the negative impacts of timber harvest on species that use mature white spruce forests. Examples of practices that can benefit wildlife include the retention of some of the structural features of mature forests, including patches of spruce trees and shrubs, snags, defective trees, and trees of other species. Such features provide cavity trees, resting, nesting and feeding areas for wildlife, and function as a long-term bank of coarse woody debris. For wildlife species that use early-successional vegetation types, timber harvest can have a net positive effect. The conversion of mature spruce to young birch or aspen can increase habitat quality by providing both cover and browse for a variety of animal species (Haggstrom and Kelleyhouse 1996).

Timber management can result in significant habitat enhancement for moose, an economically and culturally important game species in interior Alaska. The fall 2003 population estimate of moose in the state-designated game management unit south of Fairbanks was from 1 to 1.3 moose per km^2 of vegetated habitat (nearly 13,000 km^2; Alaska Department of Fish and Game 2004). The density of moose in this area is managed primarily by regulated hunting, where, since the mid-1990s, between 800 and 1,300 moose have been harvested annually. Silviculture is increasingly recognized as a tool with great potential to help land managers maintain habitat quality and quantity.

The Timber Resource

Interior Alaska has 42 million ha of forested land. About one-tenth of this land produces more than 1.4 m^3 per ha per year of wood and is thus classified by the U.S. Department of Agriculture's Forest Service as capable of sustained commercial wood production (Anonymous 1995). In the 5.8 million ha Tanana Basin, there are approximately 600,000 ha of productive mixed white spruce/hardwood and pure white spruce forest on state lands classified for forestry purposes (Crimp et al. 1997). But, despite the fact that this large land base is available for timber management, the timber industry in interior Alaska is very small. Over the past 30 years, the total harvest from these lands has averaged fewer than 500 ha per year, or less than 5% of the harvest level that is believed to be sustainable (Parsons unpublished).

Why is so little timber harvested in interior Alaska? The answer has many facets, from aspects of the environment to economies of scale. One such component is access. Because of topographic conditions, soil characteristics and permafrost distribution, stands of commercial timber in interior Alaska are typically small and scattered. Productive stands are commonly separated by sizable areas underlain by permafrost, with vegetation ranging from lowland black spruce forest to muskeg. The state's road system, and industrial development in general, is extremely limited. Alaska has only 0.01 km of road per km^2 of land area, compared to California's 0.67 km (Alaska Department of Transportation 2002). Building all-season roads across lowland black spruce forest or muskeg requires expensive measures to insulate the underlying permafrost. Though ice bridges and temporary winter roads are sometimes used to traverse areas where all-season roads would be problematic (Zasada et al. 1987), their use is limited to three to four months per year.

A second obstacle is the distance from interior Alaska to sizable markets. Once harvested logs reach the road or rail system in the Tanana Valley, the closest major market and the closest seaport are more than 550 km away. Such a long haul-distance is a significant economic barrier.

A third reason for the small amount of timber harvested is the small diameter of the logs that make up the timber resource. On even the most productive sites, white spruce trees from interior Alaska rarely exceed 50 cm DBH (Juday and Zasada 1984, Wurtz 1995). Small-diameter timber is more work to harvest and transport and therefore has higher costs (Barbour 1999). The hardwood resources, mainly birch and aspen, are predominantly small in size, with the majority of stems in pure stands falling in the 15–20 cm range at DBH (Crimp et al. 1997). Mixed stands of spruce and hardwood have a higher percentage of hardwood stems in the 20 cm and 25 cm class but often exhibit higher levels of defect because of their older stand ages. This combination of small diameter and high defect limits the competitiveness of the resource on the world log market.

Another reason for the small amount of timber harvested in the interior may be public participation in the forest planning process for state lands. Even a modest proposal for timber harvest is the subject of intense attention by the local public. Because of the limited road system, recreational users and forest harvesters can be concentrated in the same areas, increasing the likelihood of conflict. The state has occasionally deferred timber sales in response to public opposition, leading to concerns among sawmill owners about the predictability of wood supply.

Small-diameter logs, high defect rates in hardwoods, access, infrastructure deficiencies, and long distances to significant markets all suggest that any future wood-processing facilities would need to be large in order to be feasible. Large facilities carry high capital costs and in turn require large volumes of raw material to operate. These large facilities can keep costs down by distributing the cost of production over a high volume of finished product, which translates into low unit costs. Low unit costs can compensate for other factors, such as distance to market and high transportation costs. However, large facilities carry a higher level of risk with regard to long-term viability of the log supply. Issues such as whether the land base can be maintained, whether social, political, and economic conditions are stable, and whether the inventory is accurate are crucial in this regard. These factors collectively contribute to a high level of both risk and uncertainty for commercial timber operations.

Most companies use a rate-of-return calculation to determine the merits of a particular investment against other similar opportunities. Feasibility studies conducted to date for large wood-processing facilities in interior Alaska have not resulted in competitive rate-of-return figures. This situation may change as new markets arise for hardwood resources, as new wood processing technologies are developed, or as road networks expand in Alaska.

Conclusions

Though timber harvest has had only a small impact on the landscape of interior Alaska, it is of interest in the Bonanza Creek LTER program for several reasons. Timber harvest has impacted the forests of interior Alaska over the past hundred years. Today, it is the basis of a small local economy, providing wood products for local needs. Changes in market or political factors may increase the economic return from timber harvesting in interior Alaska, leading to a greater rate of cutting than has occurred to date. Timber harvest proposals and activities are the subject of intense attention by the local public. Logging may be used increasingly in the future as a substitute for fire near human habitation, to improve habitat for certain species of wildlife, and to reduce hazard fuel loads. Finally, the commercial harvest of timber directly adjacent to the Bonanza Creek LTER site provides an opportunity to integrate the scientific understanding of these boreal forest ecosystems with real-world management actions.

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