Tree Planting in Alaska

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Abstract

Tree planting for reforestation in Alaska has been modest compared with other timber-producing States and has never exceeded 1 million trees a year. Most timber harvest occurs in southeast Alaska, where natural regeneration is usually prolific and logistical costs are very high. Tree planting has been more suited to the boreal forest, where white spruce (*Picea glauca* (Moench) Voss) regeneration is sought and natural regeneration can be problematic. In the 1990s, a large spruce bark beetle (*Dendroctonus rufipennis* Kirby) epidemic on the Kenai Peninsula stimulated tree planting. Planting for poplars (*Populus* spp.) may develop near rural communities as biomass energy develops. Tree planting by homeowners and communities has been growing, which has resulted in the development of several community tree inventory programs and management plans. In 2010, approximately 1,600 trees were planted on municipal property or in public rights-of-way in Anchorage, and a much higher number is estimated to have been planted on private and other public land.

Introduction

History

Eskimos, Aleuts, and Indians are Alaska's first peoples, and anthropologists believe that Native Americans have lived in parts of Alaska for at least 10,000 years (Department of Natural Resources 2000). In the mid-1700s, Russian fur traders established posts and purportedly claimed Alaska. In 1805, Russian settlers transplanted Sitka spruce to the western Aleutian Islands, far beyond the range of forests, a grove of which survives today (Rakestraw 2002). This effort may be the first toward afforestation in the Americas. In 1867, Russia sold its interest in Alaska to the U.S. Government for $7.2 million, or about $0.02 an acre. Initially, Alaska was under U.S. military administration as the Department of Alaska. In 1912, the Alaska Territory was designated.

Outlined in the Statehood Act of 1959, the Federal Government granted the new State entitlement to 105 million acres (42.5 million hectares), or 28 percent of Alaska's total area. Much of the land near major communities was granted to the State and then transferred to local governments or private individuals. Although actual homesteading is no longer offered, State land sales are ongoing, mostly in remote locations without road access.

After establishing statehood, recognition arose that Russian and United States, claims were subject to unresolved aboriginal land claims by Alaska's first peoples. In 1971, the Alaska Native Claims Settlement Act (ANCSA) was intended to settle aboriginal land claims in exchange for 44 million acres (18 million hectares) of Federal land. ANCSA established more than 220 privately owned Alaska Native corporations, which differed from the reservation system common elsewhere. In 1980, President James Carter signed the Alaska National Interest Lands Conservation Act, which designated 106 million acres (43 million hectares) of Federal lands for conservation system units, thereby greatly enlarging the amount of Federal acreage dedicated to conservation.

Economy

The petroleum industry is Alaska's most important natural resource sector, contributing roughly one-third of the State's total economy (Goldsmith 2008). Alaska's other major resource industries are seafood, mining, and timber. Government employment, including the military, is also significant to Alaska's economy. Large-scale timber harvesting in southeast Alaska began in the 1950s, but the timber industry has declined since the 1990s. Alaska is among the world's top seafood producers, and only eight countries produce more wild seafood than the State of Alaska. The value of Alaska's minerals has climbed in recent years as metal prices have risen, and feasibility studies are under way for several new, large mining prospects.

Forest Regions

Alaska has 126 million acres (51 million hectares) of forest land, which is 35 percent of the State's total area and 17 percent of all forest area of the United States (Smith and others 2009). Alaska encompasses a diverse set of geological, climatic, and vegetative conditions. The State's 365 million acres (148 million hectares), which is one-fifth of the entire United States, have been divided into six ecological units: Southeast, South-central,

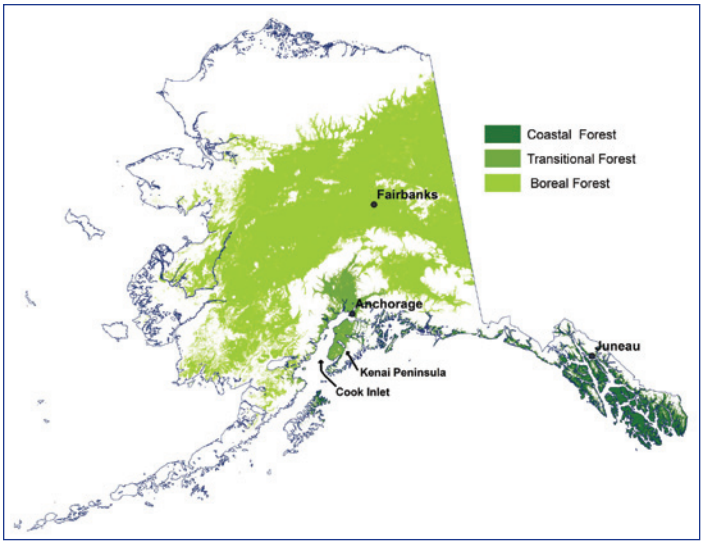

Figure 1. Alaska forest regions (Map source: Hans Buchholdt, Alaska Division of Forestry).

Southwest, Interior, Northwest, and Arctic (Viereck and others 1992). Alaska has three major forest regions (figure 1). More than two-thirds of Alaska's communities and more than three-fourths of the State's population live on or adjacent to forest lands. Of the 220 Alaska Native corporations, 90 percent own some forest land.

Coastal Forest

The coastal forest has a distinctly maritime climate with cool summers, moderate winters, and abundant rain year round. The coastal forest is part of one of the most productive forest ecosystems in the world. Western hemlock (*Tusga heterophylla* (Raf.) Sarg.)/Sitka spruce (*Picea sitchensis* (Bong.) Carr.) is the predominant forest type, and both western redcedar (*Thuja plicata* Donn) and Alaska yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach) are present. Large trees that exceed 6 ft (1.8 m) in diameter and reach nearly 200 ft (61 m) in height can be found in the southern part of this forest ecosystem. Tree size decreases with increasing latitude and longitude. Only pure Sitka spruce stands occur in the Kodiak archipelago, where western hemlock is not present. A wide diversity of wildlife species are found in this forest, including deer, bear, moose, mountain goat, and five species of salmon. Approximately 31 Alaska Native village corporations and three Alaska Native regional corporations are located in the coastal region. Historically, the coastal forest has supported significant timber harvest (Rakestraw 2002). Native Americans and Russian settlers used timber for buildings and vessels. In 1889, the Governor reported that 11 sawmills were operating in Alaska. Timber harvest was high during the operation of two large pulp mills, but these mills are now closed and the amount of timber harvest has greatly declined in recent years.

Boreal Forest

The interior forest is part of the circumpolar boreal forest type and comprises 115 million acres (47 million hectares) in Alaska (figure 1). Summers can be warm and dry, and long winters are among the coldest in North America. Vast areas of black spruce (*Picea mariana* (Mill.) B.S.P.) form the taiga, or "land of little sticks," and are characteristic of the boreal forest. Black spruce often grows on sites where permafrost is present. In contrast, significant stands of mature white spruce (*Picea glauca* (Moench) Voss) and mixed stands of spruce and paper birch (*Betula papyrifera* Marsh.) are found along river flood plains. In some flood plain stands, white spruce measure more than 2 ft (61 cm) in diameter and reach 100 ft (30 m) in height. Paper birch, aspen (*Populus tremuloides* Michx,), and balsam poplar (*Populus balsamifera* L.) stands are usually located on previously disturbed sites (generally fire sites). Moose, bear, caribou, beaver, and wolf are common wildlife species found in this forest type. Significant numbers of spawning salmon are found in many of the streams during the summer. The Federal Government is the principal landowner in this region, although large tracts of lands have been transferred to ANCSA corporations, to the State, and to various boroughs. Individually owned tracts are primarily along the limited road system, although native land allotments are scattered throughout the region.

Transitional Forest

In the Cook Inlet Basin of south-central Alaska, the climate forms a transitional zone between coastal and boreal (figure 1). Summers are cool but dry enough for wildfires to occur, and winters are moderate compared with the interior portions of Alaska. Outside the Cook Inlet basin, high mountain ranges separate boreal and coastal forests. On the western Kenai Peninsula and around Anchorage, the forest type is outwardly similar to the boreal forest and is mostly paper birch, quaking aspen, and white and black spruce. The highest population density and largest number of individual private forest owners are in the transitional forest zone.

Challenges to Trees

Climate Change

The University of Alaska Fairbanks research provides likely scenarios of future climate conditions in Alaska (Scenarios Network for Alaska Planning 2008). The projected Alaska statewide trends indicate that temperatures and precipitation are expected to increase across all regions. Temperature increases

are predicted for every month, and increases are expected to continue throughout the century (Scenarios Network for Alaska Planning 2010). Although the growing season precipitation is likely to increase statewide, precipitation alone does not predict ecosystem moisture limitations. Increased plant growth and increased evaporation because of higher temperatures may more than offset the additional precipitation, resulting in drier soils. Climate change is expected to affect many aspects of Alaska. Forest effects are expected to include wildfire, insect epidemics, invasive species, forest regeneration and growth, and wildlife habitat. For example, the 2004 wildfire season, the largest documented since the early 1950s, was a direct result of record temperatures and little precipitation. Also, the first recorded large spruce budworm outbreak (*Choristoneura fumiferana* Clemens) occurred in the early 1990s and may have resulted from elevated summer temperatures that produced drought stress in the host white spruce trees.

Wildfire

The amount of annual acreage burned in the boreal forest ranges from an average low of about 100,000 acres to a high of more than 6 million acres (40,000 to 2.4 million hectares). Lightning causes most wildfires, but the large majority of fires that start near communities are human caused. Essentially no trees, however, are planted following wildfire in Alaska because natural regeneration is usually enhanced by fire, particularly for broadleaf browse species.

Bark Beetle

During the 1990s, a historic spruce beetle (*Dendroctonus rufipennis* Kirby) epidemic occurred in south-central Alaska, and more than 4 million acres (1.6 million hectares) of both pure white spruce and mixed spruce-hardwood forest were affected. The spruce beetle epidemic on the Kenai Peninsula that began in the late 1980s and continued into the 1990s was most likely triggered by the significant climatic shift to longer and drier spring-summer periods (Berg and others 2006, Werner and others 2006). During the epidemic, the western Kenai Peninsula sustained more than 80 percent beetle-caused mortality on approximately 1 million acres (0.4 million hectares) of mature white spruce forest. Many landowners, both public and private, conducted salvage harvesting and tree planting in response to the epidemic.

Land Ownership

Federal Land

The Federal Government is the largest landowner in Alaska and is responsible for 222 million acres (90 million hectares), or 60 percent of the State. More than a dozen Federal agencies manage lands in Alaska. Most Federal lands are reserved for conservation of natural areas, such as national parks and wildlife refuges. The Bureau of Land Management, the largest Federal land owner in Alaska, manages 82 million acres (33 million hectares). The U.S. Fish and Wildlife Service manages 79 million acres (32 million hectares) in 16 national wildlife refuges. The National Park Service manages 52 million acres (21 million hectares) in 13 national parks or preserves, including the 5 largest parks in the United States. The Forest Service manages 22 million acres (8.9 million hectares), including the two largest national forests in the United States, the Chugach and Tongass National Forests, as well as two national monuments.

Alaska Native Lands

ANCSA mandated the formation of Alaska Native corporations to accept the title for approximately 44 million acres (18 million hectares) of selected Federal lands. Most land selections are complete, but the process of transfer of title from the Federal Government to the corporations is still in progress. Great variation exists in the size of corporate holdings and management objectives. Lands granted under ANCSA are private and, thus, are not Federal trust lands, such as reservations managed by the Bureau of Indian Affairs. ANCSA corporations own an estimated 95 percent of the private forest acreage in Alaska. Less than 1 percent (about 700,000 acres or 283,000 hectares) is in individual Native allotments.

State Land and State Forests

As of 2010, the State has received patent to approximately 99 million acres (40 million hectares), 96 percent, of its total land entitlement. The State was permitted to select lands from any Federal land not already reserved for other uses. The State chose land to meet three specific needs: settlement, resource stewardship and development, and recreation. About 2 percent of Alaska's State-owned land is in three designated State forests. In 1982, the legislature established the Haines State Forest. The next year, it created the Tanana Valley State Forest. In 2010, the Southeast State Forest was established. In addition to designated State forests, much of the State's public domain land is available for multiple uses, including forest management.

The 270,410-acre (109,477-hectare) Haines State Forest is located in the northern tip of the southeast Alaska panhandle. The panhandle generally has a maritime climate, but high surrounding mountains create warmer and drier summer conditions than the rest of southeast Alaska. Hence, the forest provides suitable conditions for a diversity of vegetation. The rugged topography ranges from sea level up to a more-than-7,000-ft (2,100 m) elevation. The forest is composed mostly of two forest types, western hemlock/Sitka spruce, and black cottonwood (*Populus trichocarpa* Torr. & Gray)/willow (*Salix* spp.). Lodgepole pine (*Pinus contorta* Dougl.) and paper birch are minor species throughout the forest.

The 1.8 million acre (0.73 million hectares) Tanana Valley State Forest lies almost entirely within the Tanana River Basin and is located in the east-central part of Alaska (figure 2). The basin area elevation varies from 275 ft (84 m) along the Tanana River to a more-than-5,000-ft (1,500 m) elevation, and stretches 265 mi (127 km) from near the Canadian border to west of Fairbanks. Almost 90 percent of the Tanana Valley State Forest is forested, mostly with paper birch, quaking aspen, balsam poplar, black spruce, white spruce, and tamarack (*Larix laricina* (Du Roi) K. Koch). Timber harvest from the Tanana Valley State Forest averages around 6 million board ft annually.

The 25,291 acre (10,239 hectares) Southeast State Forest is comprised of 20 separate parcels, mostly on Prince of Wales Island with some parcels on adjacent islands and the mainland. Although this land was approved for forestry activities before its designation as a State forest, the new designation will give local processors access to a long-term supply of timber. In addition, management investments, such as precommercial thinning, will be feasible.

Figure 2. Tanana Valley near Fairbanks (Photo source: Jeff Graham, Alaska Division of Forestry).

Municipal Lands

Alaska's local government structure has only two types of municipal government: cities and organized boroughs (Bockhorst 2001). Organized boroughs are intermediate-sized governments, analogous to counties. Alaska has 16 organized boroughs that average about 17,400 mi^2 (4.6 million ha^2) and encompass about 43 percent of the geographic area of Alaska. Three boroughs own significant acreage of forested land: Matanuska-Susitna Borough, Kenai Peninsula Borough, and Fairbanks North Star Borough.

Alaska is home to 686,000 people, of which more than 60 percent live in towns with populations greater than 5,000. More than one-half of the population lives in the Municipality of Anchorage or the Matanuska-Susitna Borough. Hence, the importance of Alaska urban and community forests is increasingly recognized. The number of arborists in Alaska has grown from 1 in 1991 to 32 in 2011. Community forestry programs in six communities employ arborists, foresters, or natural resource managers. The Municipality of Anchorage hired the State's first urban forester in 2008 to manage trees and forests on 10,000 acres (4,000 hectares) of parkland, 250 mi (402 km) of trails and greenways, and more than 80 mi (129 km) of rights-of-way.

Individually Owned Private Land

Excluding Alaska Native land, individually owned private land comprises less than 1 percent of the total land in Alaska. Birch (1997) reported that Alaska has an estimated 16,600 private landowners with one or more acres of forest land. Most individual private forest lands are in the more settled areas of the State, particularly the Kenai Peninsula, the Matanuska and Susitna valleys, and the Fairbanks and Delta Junction areas. Forest management objectives of individual forest landowners are diverse. In the boreal forest region, most landowners have concerns about wildfire, damaging insects and diseases, and wildlife habitat.

Trust Lands

The University of Alaska and Alaska Mental Health Trust are significant landowners and enjoy quasi-private landowner status. These land trusts predate statehood. Currently, the Mental Health Land Trust holds 999,860 acres (40,429 hectares) and the University Land Trust holds approximately 150,000 acres (60,729 hectares). Both trusts have harvested timber in southeast Alaska and largely rely on natural regeneration for reforestation.

Tree Planting in Alaska

Tree Planting in the Recent Past

During the past 20 years, tree planting in Alaska has varied considerably (figures 3 and 4), which reflects the amounts of both legislative appropriations and Alaska Native Corporation funding for reforestation. Following major wildfires, essentially no tree planting has occurred because of the remoteness of the sites and logistical high costs associated with planting there. Spruce beetle mortality has resulted in restoration efforts, but only following harvest. Under the Alaska Forest Resource and Practices Act, reforestation is required within 7 years following commercial timber harvest. Methods of reforestation are not specified, and natural regeneration can be used.

The State operated a forest nursery from 1974 to 1996. Seedlings were produced for reforestation of harvested lands, public events such as Arbor Day and fairs, and research projects. White spruce was the major species grown using Ray Leach Cone-tainers™. To meet public interest, a variety of nonnative species were also grown, such as Siberian larch (*Larix sibirica* Ledeb.), lodgepole pine, and Scots pine (*Pinus sylvestris* L). Average annual production was around 400,000 seedlings.

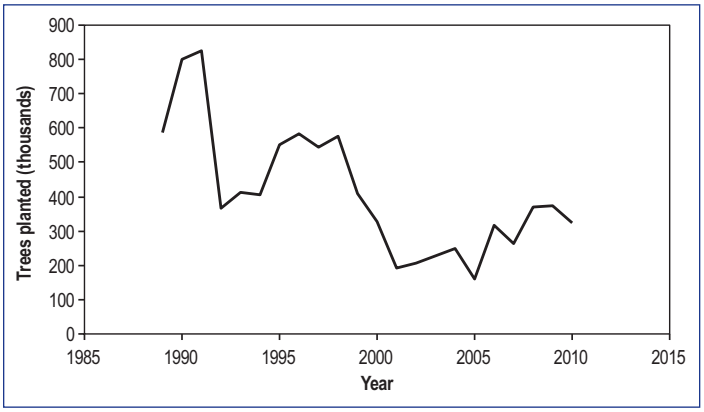

Figure 3. Trees planted for reforestation in Alaska since 1990 (Graph source: Jeff Graham, Alaska Division of Forestry).

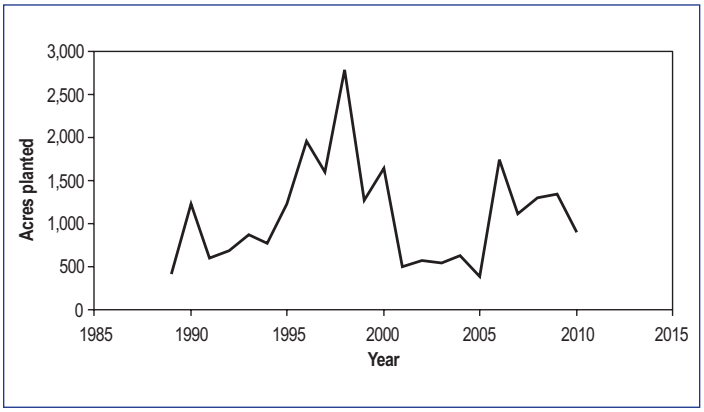

Figure 4. Acres planted for reforestation in Alaska since 1990 (Graph source: Jeff Graham, Alaska Division of Forestry).

The nursery closed because of high operating costs and availability of high-quality, less expensive, container-grown seedlings from out-of-State nurseries.

Tree Planting by Alaska Regions

Throughout most of southeast Alaska, natural regeneration of forests following timber harvest is usually abundant. Southeast second-growth forests often have densities far greater than optimum for individual tree and value growth. Thinning and pruning are silvicultural techniques that are commonly used for both timber value and wildlife habitat. Genetic gain through tree improvement has been considered for many years in Alaska. However, abundant natural regeneration in southeast Alaska and high logistical costs have hindered tree improvement development.

The Haines State Forest is located in a transitional climate in northern southeast Alaska (figure 5). In this climate some natural regeneration occurs readily. All large commercial sales have been replanted since the 1970s, however, to ensure prompt regeneration. Sitka spruce is exclusively planted and the stocktype is usually plug + 1 from an out-of-State private nursery. About 10,000 seedlings are planted annually on the Haines State Forest. Thinning and basal pruning are sometimes used on second-growth stands.

Afognak Island and the northern part of Kodiak Island have the western most commercial forest in Alaska. Afognak Island was formerly under Chugach National Forest, but a large amount was transferred to Alaska Native Corporations after ANCSA. These islands have had timber production for many decades under both Forest Service and Alaska Native corporation management. Natural regeneration has worked in some areas, but attempts in other areas have been problematic. Grass competition and browsing by hares (*Lepus* sp.) have affected

Figure 5. Timber harvest site on the Haines State Forest (Photo source: Greg Palmieri, Alaska Division of Forestry).

regeneration in some areas. Sitka spruce is exclusively planted in this region, and a southeast Alaska seed source has resulted in superior growth capabilities compared with local seed sources.

The Kenai Peninsula was heavily affected by a spruce beetle epidemic in the 1990s, and both public and private landowners have conducted salvage harvests and tree plantings. If any regeneration delay occurs, sites can become dominated by bluejoint reed grass (*Calamagrostis Canadensis* [Michx.] Beauv.) for many years. Mechanical site preparation has been commonly used. Trees planted are mostly container-grown white spruce, particularly on public and Alaska Native corporation lands. Many individual private landowners are interested in fast-growing, nonnative species such as lodgepole pine from northern Canada and Siberian larch.

Boreal forest sites are harvested for both timber and firewood. Both summer and winter logging occur, with ice roads and bridges providing the best access during winter. Mechanical scarification or fire can be effective for site preparation and natural regeneration, but winter logging alone has little site preparation effect. Without site preparation, bluejoint reed grass can be a major seedling competitor on some boreal sites. Tree planting has been effective on boreal sites (figure 6). Planting nursery grown seedlings is often too costly, however, for remote locations off the road system. White spruce seed has been collected and stored to provide out-of-State nurseries with Alaskan seed sources. Although spruce seed can retain viability for 20 years, new seed collections are made when good cone crops occur, roughly every 5 to 8 years. On the Tanana Valley State Forest, tree planting is used on a portion of harvested sites and planting averages around 400 acres (162 hectares) and 200,000 seedlings annually (figure 7). White spruce is exclusively planted on the Tanana Valley State Forest, mostly grown in Stryoblock® 313B containers.

In rural areas of interior Alaska, energy has become a major expense and is jeopardizing continued existence of many small communities. Wood energy is hoped to provide a viable alternative to fossil fuel. Studies are under way with willows (*Salix spp.*) and poplars (*Populus spp*.) to find low-cost methods of forest regeneration following biomass harvest.

Urban and Community Tree Planting

In more urban areas, Alaskans are recognizing the need for professional management of valuable forest resources, especially because they witness how pests, invasive species, wildfire, climate change, and expanding development limit the benefits that community trees and forests could be providing. Inventories and management plans are helping them select appropriate species and planting and maintenance techniques. Cities are also beginning to adopt ordinances that require developers to meet standards for the number and quality of plants installed as part of any construction project.

The palette of plant species used has expanded greatly in the past 20 years. Although only 33 native species of trees grow in Alaska, approximately 130 species are being grown successfully in the State. A description of trees and shrubs planted in Alaska has recently been developed (Alaska Cooperative Extension Service, Alaska Division of Forestry; American Society of Landscape Architects Alaska Chapter 2010).

In-State nurseries are not currently meeting the growing demand for landscape trees. This demand creates a potential market for local growers, however (figure 8). Most retail and wholesale nurseries import trees from out-of-State nurseries. Stock types include bare root, container-grown, and balled and burlapped trees, but rarely seedlings. Traditionally, large numbers of trees were dug from the wild to meet the need for

Figure 6. White spruce regeneration from planted seedlings on Toghotthele Corporation land with Jake Sprankle of Tanana Chiefs Conference (Photo source: Jeff Graham, Alaska Division of Forestry).

Figure 7. Tree planters on the Tanana Valley State Forest (Photo source: Patricia Joyner, Alaska Division of Forestry).

native plants; however, easily accessible sources are becoming more difficult to find, which is leading to an increase in locally grown plants.

In 2010, approximately 1,600 trees were planted on municipal property or in public rights-of-way in Anchorage. A much higher number was likely planted on residential, commercial, school district, university, and State and Federal Government properties. Military bases plant a large number of trees each year as part of residential development and restoration projects. In 2010, Eielson Air Force Base planted 500 trees, and Joint Base Elmendorf-Richardson planted 200 trees. Other communities around the State plant between 15 and 150 trees annually on city-maintained property.

Programs for Tree Planting

Most tree planting in Alaska occurs on State forests after administratively approved management plans and legislative appropriations have been established. Tree planting on private lands, including Alaska Native corporation lands, has been aided by Federal cost share from the Forest Land Enhancement Program and the Environmental Quality Incentives Program. The Forest Stewardship Program has contributed management plans for eligibility to cost share programs. Tree planting on borough lands has been aided by Federal funding from the American Recovery and Reinvestment Act of 2009. The Cook Inlet Chapter of Society of American Foresters (CISAF) has conducted an annual Arbor Day tree sale in Anchorage for many years. The CISAF tree sale has annually provided urban and suburban residents with around 10,000 seedlings, including a variety of native and nonnative species. Small-scale growers and city parks departments also take advantage of this opportunity to buy quantities of seedlings at a low cost. The Fairbanks Soil and Water Conservation District also holds an annual sale of native and nonnative tree and shrub species.

The Alaska Community Forestry Program helps communities build forestry and tree care programs that include tree planting. Since 1991, the number of Tree Cities USA in Alaska has grown from zero to eight. Anchorage, Wasilla, Homer, Sitka, Juneau, the Ketchikan Gateway Borough, and the Fairbanks North Star Borough have inventoried, or are in the process of inventorying, their public trees. Anchorage, Wasilla, and the Ketchikan Gateway Borough completed comprehensive management plans in the past 2 years, and Soldotna will complete an inventory and management plan in 2011. The plans describe conditions, threats, and opportunities, and make recommendations for creating and sustaining vibrant, healthy, and safe community forests. The plans also identify appropriate species that could be planted to diversify the urban forests. Several

Figure 8. Commercial nursery for landscape trees near Anchorage (Photo source: Patricia Joyner, Alaska Division of Forestry).

Figure 9. Community tree planting in Hoonah, AK (Photo source: Tina Denzl-Pederson, City of Hoonah).

communities have organizations that promote tree planting and maintenance as a means of enriching communities (figure 9); the most active groups are TREErific Anchorage, the Fairbanks Arbor Day Committee, Juneau Urban Forestry Partnership, and the Sitka Tree and Landscape Committee.

Conclusion

Tree planting for reforestation in Alaska has been modest in numbers compared with other States. However, planting for both reforestation and community enhancement will continue. Although southeast Alaska forests will rely on natural regeneration, timber sales farther north should continue to have seedlings planted as part of regeneration operations. White spruce planting following the spruce beetle epidemic continues on the Kenai Peninsula. A surge in interest in biomass heating may foster poplar and willow establishment near rural communities. Communities increasingly understand the value of urban forests and trees. This understanding should lead to more tree planting and comprehensive forest management by local governments in Alaska communities.

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