ADVANCES IN PLANT MATERIAL AND REVEGETATION TECHNOLOGY IN ALASKA[1,2]

by
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Abstract. This paper is intended to be informative and descriptive, rather than purely conclusive. The paper will cover the gamut of revegetative and reclamation efforts being attempted by the Alaska Plant Materials Center throughout Alaska. These efforts include coastal and wetland restoration, cost-effective methods for willow reestablishment, and extention of seeding periods through the use of dormant or Fall seedings. New cultivars and adapted species of vegetation will also be addressed.

Additional Key Words: arctic, boreal and northern coastal reclamation.

Introduction

The Alaska Plant Materials Center (PMC) is a section of the Division of Agriculture within the Department of Natural Resources. In contrast to other PMCs, the Alaska center is fully state funded. Early attempts in establishing a federal Plant Materials Center in Alaska failed.

The PMC not only conducts revegetation oriented work, but also horticultural development, foundation seed production, and the Potato Disease Control project.

This paper is a composite of individual reports available from the Alaska Plant Materials Center. The intent of the paper is to present the state of the Alaska Plant Materials Center's reclamation and revegetation research. The paper will also present general revegetation recommendations and techniques in willow planting, wetland restoration, and coastal revegetation.

Methods

Since the establishment of the Alaska Plant Materials Center in 1972, in excess of 2,000 accessions of native and introduced plants have been screened and evaluated for conservation uses.

The PMC follows seven basic steps to establish a resource of conserva-

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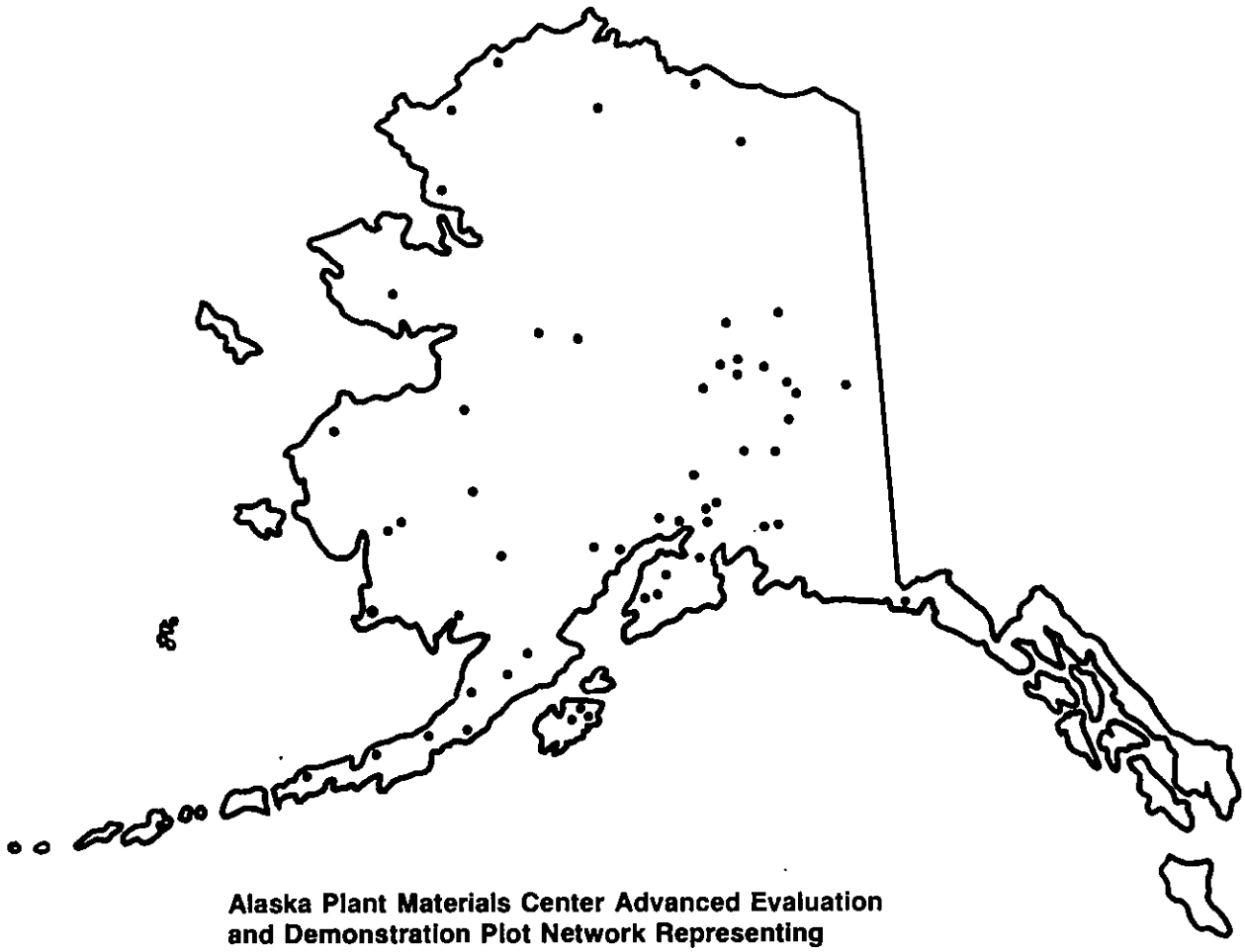

Alaska Plant Materials Center Advanced Evaluation and Demonstration Plot Network Representing 149 Plot Years as of 1987

FIGURE 1.

tion plants for use in land reclamation, wildlife habitat improvement and erosion control. They are: 1) define and anticipate conservation problems and establish priorities; 2) research and assemble candidate plant materials; 3) conduct initial evaluations; 4) establish small scale seed or vegetative increases; 5) conduct advanced and final testing and field evaluation plantings; 6) establish large scale seed or vegetative increases; and, 7) release of a variety or cultivar.

Of these steps, the most critical are the field evaluation plantings. This aspect of the program allows plant material to be evaluated in a wide range of edaphic and climatic conditions (Figure 1). Basically, this phase revolves around two classes of plantings, advanced evaluation and demonstration plots, and mining and industrial evaluation plots.

Advanced Evaluation and Demonstration Plots are established throughout Alaska for three purposes: 1) advanced or final evaluation of plant materials that have performed well at the Palmer PMC for a period of at least three years; 2) demonstration plantings of plant material already recommended for the area; and, 3) provide a centralized area for local plantings by the cooperative Extension agents and other cooperators.

Mining and Industrial Evaluation Plots are usually designed for reclamation and/or erosion control. The plots are developed in a manner consistent with the clients intended final management practice, i.e., "fertilize it once and forget about it." The plantings are made on the substrate that is expected to be available when reclamation occurs.

These plots also serve as an advanced evaluation of plant materials that have been selected at the PMC for their outstanding performance.

This class of evaluation plot probably provides the most important and useful information to the North Latitude Revegetation and Seed Project.

When an accession has proven to be superior through the evaluation process, and specific cultural and management techniques have been developed, the accession is released for commercial production.

Results: Releases, Recommendations and Technology Advances

New Releases

The evaluation network established by the PMC and the data collected from these plots has resulted in the release of two new grass cultivars and five willow cultivars. Within three years, an additional four grasses and one willow may be released.

The following cultivars have been released:

'Egan' american sloughgrass, Beckmannia syzigachne. 'Egan' was released for commercial seed production in 1986. This cultivar has performed well at most test sites. Its expected uses are wetland restoration and waterfowl habitat enhancement.

'Gruening' alpine bluegrass, Poa alpina. This selection of alpine bluegrass was released for production in 1987. A native species, alpine bluegrass has shown extreme hardiness throughout Alaska and is well adapted to harsh sites such as mine spoil (Wright 1985).

'Roland' pacific willow, Salix lasiandra. 'Roland' was released in 1985 and is probably the most attractive willow selected by the PMC to date. This cultivar will be used for landscaping, stream protection and revegetation throughout most of Alaska (Wright 1985).

'Wilson' bebb willow, Salix bebbiana. This willow has a dense growth form and has many potential uses for screening, windbreaks and living fences. Because of the the species' wide range of adaptability, it is also expected to be utilized for reclamation activities. 'Wilson' is a 1985 release (Wright 1985).

'Long' barclay willow, Salix barclayi. This attractive, fast-growing native willow was released for commercial production in 1985. This cultivar will be used for reclamation, landscaping and shelter belts (Wright 1985).

'Oliver' barren ground willow, Salix brachycarpa. 'Oliver' was released for commercial production in 1985. This cultivar's interesting growth form will lend itself well for incorporation into hedges. Additional uses range from reclamation to windbreaks (Wright 1985).

'Rhode' feltleaf willow, Salix alaxensis. 'Rhode' was also released for commercial production in 1985. This species occurs throughout Alaska and is listed as a preferred wildlife species. This cultivar will find uses in habitat restoration, reclamation, streambank protection and shelter belts (Wright 1985).

Revegetation Regions of Alaska

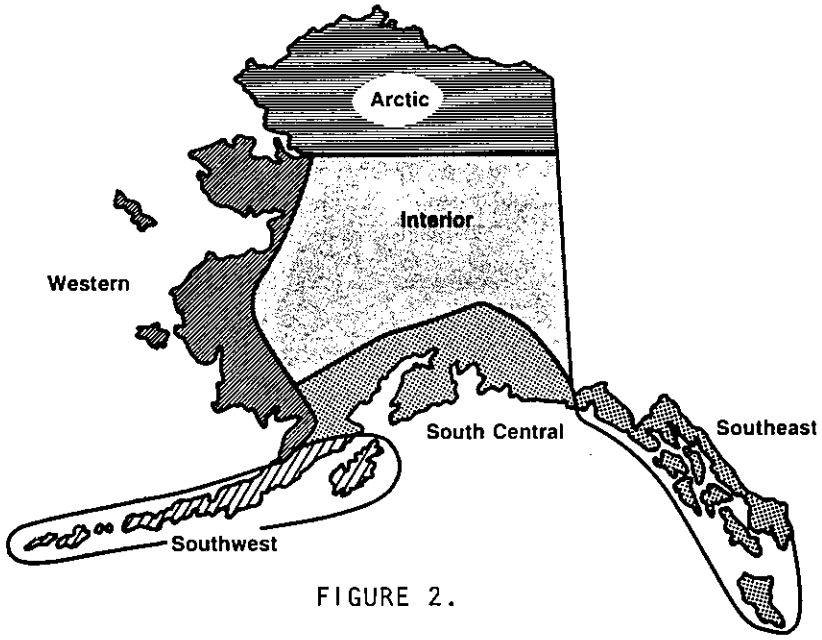

FIGURE 2.

Regional Recommendations

In addition to the new plant materials released for producton, the plot network has allowed a base of knowledge to be developed for revegetative recommendations. This systematic evaluation network has allowed for ground truthing and refining past standard recommendations and developing new recommendations based on regions. Figure 2 designates revegetation regions.

Findings of the PMC statewide evaluations are presented in Table 1 (Moore 1986a, b; Wright 1986a, 1987a, b, c, d, e, 1988a, b, c, d, 1989a, b).

As with all general regional revegetation recommendations, the Alaska Plant Materials Center does not suggest that these be followed without site specific refinement.

Specific site recommendations can be developed with specific information on soil conditions (texture, pH, and moisture), exposure and other microclimatic factors, i.e., elevation.

These factors will allow specific seed mixtures to be recommended using adapted varieties and secondary cultivars in specific proportions.

Commercial availability of native cultivars will always be a factor in developing recommendations.

The seed industry in Alaska is still in its infancy, and a degree of reluctance to grow new cultivars still exists in the commercial sector.

Willow Planting Techniques

Of all the methods used in Alaskan reclamation, willow planting is, by far, the most maligned. The

Table 1. Adaptability of Species/Cultivars Tested.

Species/Cultivar	Regions						
	Arctic	Western Alaska	Interior	South Western	South West Alpine	South Central	South East
Kentucky Bluegrass							
Nugget	2	1	1	1		1	
Merion		2	2	1		2	
Sydsport		2	2			2	
Fylking			2	2		2	
Park			1			2	
Red Fescue							
Arctared	1	1	1	2	1	1	
Boreal		1	1	1	1	1	
Pennlawn				1		1	
Alpine Bluegrass							
Gruening	1		1		1	1	
Glaucous Bluegrass							
Tundra	1	1	1				
Polargrass							
Alyeska	1	1				1	
Bering Hairgrass							
Norcoast	2	1	1	1	1	1	
Bluejoint							
Sourdough	2	1	1	1	1	1	
Sloughgrass							
Egan	1	1	1			1	
Brome							
Polar		1	1			1	
Manchar		2	1			1	
Sheep Fescue							
Highlight		2				2	
Reed Canarygrass							
Vantage		2		1			
Timothy							
Engmo			1			1	
Meadow Foxtail			2	2		2	
* Violet Wheatgrass	2		2				
* Rough Fescue		2	2	2		2	
* Tilesy Sage		2	2	2		2	
* Big Bluegrass		2	2				
* Beach Wildrye		2		2			
* Boreal Wheatgrass			2				

No evaluation by the Plant Materials Center has occurred in Southeast Alaska as of 1988.

* Those species so noted have not been released by the Plant Materials Center, and are therefore listed as secondary choices (2). After release, many of these will become preferred choices (1).

only large-scale use of willow by industry has been the plantings conducted on the Trans Alaska Pipeline. A decade has past since this attempt and methods have improved.

In 1979, the PMC started investigating improved methods to establish willow. These methods not only needed to produce a high degree of success, but also needed to be cost-effective.

The Plant Materials Center started with 8-10 inch dormant, unrooted cuttings. This method has proven successful, provided grass competition is not significant and adequate moisture is available. Dormant, unrooted cuttings provide the advantage of being easy to prepare and plant as well as being low in cost.

The disadvantages of this method are: 1) the cuttings must be kept in cold storage until planted, 2) they must not be permitted to dry out or become excessively wet during storage, 3) they have a lower survival rate than other methods, and 4) it requires planting sites with adequate soil moisture.

The next method that was adopted by the PMC, was bundling or wattling of dormant material. This technique involved tying four-foot long, dormant willow branches in bundles 4-6 inches in diameter. The bundles are then planted horizontally to a depth three fourths of the bundle's diameter. This method has proven to be more able to compete with grass. The prime advantage to this technique is the physical block that the bundle mass provides in erosion control. Bundles also provide quick linear cover.

The disadvantages are the same as for dormant cuttings except soil moisture is not as critical. This method does require more plant material than any other method.

The use of container grown cuttings is probably the most effective method to establish willow. It is more costly than using dormant material, and also requires more care in planting.

The advantages are obvious. The plants are established and growing when planted. The container material is also more suited to dry sites. The age of the planting stock can range from material rooted in the year of planting to 1-0 and older stock (Moore et. al. 1986, Wright and Moore 1986).

More efficient methods of planting need to be developed before large-scale plantings are likely in Alaska. This is presently being explored by the Plant Materials Center.

Dormant Seeding vs. Traditional Spring Seedings

The Center is actively attempting to determine if dormant seeding is a viable procedure in Alaska. Because of Alaska's long winters, heavy snowfall, and rapid melt, it has been the feeling of many in Alaska that dormant seedings are not practical. Therefore, most seedings are conducted between May and July.

By permitting dormant seedings, the period to seed would be greatly increased. This would, of course, allow greater flexibility in scheduling revegetation. Seedings in the Arctic can be restricted to a period as short as 20-30 days.

Recent findings by the Plant Materials Center at the Kuparuk Oil field, Red Dog Mine and the Beluga Coal fields, have suggested that dormant seedings are possible. The critical factors in dormant seedings are still slope and spring run-off. On level ground, as was used in the plots, no difference in overall success was noted between dormant and non dormant. However, in the Kuparuk plots, prolonged dormancy in some of

the spring seeded grasses occurred. In fact, some accessions did not break dormancy for one year. The dormant seedings produced measurable stands the spring following planting. A slight increase in vigor was noted for the dormant seedings (Wright 1986c, 1987e, 1989a, b).

Wetland Revegetation and Restoration

The importance of wetlands in Alaska cannot be understated. In addition to the ecological importance of these areas the regulations developed to protect them can be overwhelming.

The Plant Materials Center is the only agency in State government attempting to solve problems associated with revegetation of wetlands.

The Center has worked with the Alaska Department of Fish and Game and Ducks Unlimited in the revegetation of two waterfowl habitat enhancement projects. These projects, at Palmer and Fairbanks, have demonstrated the effectiveness of new wetland cultivars developed in Alaska; primarily 'Egan' american sloughgrass and 'Norcoast' bering hairgrass.

Another demonstration project that was designed to revegetate a wetland area was the Bethel Small Boat Harbor. This project, initiated in 1984 in cooperation with the Corps of Engineers, proved the adaptability of 'Egan' american sloughgrass and 'Norcoast' bering hairgrass to the Bethel region of western Alaska and the adaptability of these species for wetland reclamation (Moore 1986).

Presently, the Plant Materials Center, in cooperation with ARCO Alaska, is attempting to determine the potential of successfully establishing arctic pendant grass, Arctophila fulva, in the Arctic. Arctic pendant grass is an emergent species usually associated with lakes and ponds in the Arctic.

Initial findings, after four years of investigations, have been inconclusive as to success and economic feasibility of transplanting arctic pendant grass (Moore and Wright, in press).

Coastal Restoration and Erosion Control

Alaska has more coastal shoreline than the remainder of the United States combined. Therefore, coastal revegetation merits study.

The first major project involving coastal revegetation and erosion control in Alaska occurred on Shemya Air Force Base. The base is located approximately 1,500 air miles south of Anchorage, on Shemya Island in the last group of islands at the western extreme of the Aleutian Island chain. Shemya Island is roughly four miles east to west and two miles north to south.

Climatically, the island is classified as maritime. Seasonal variations in temperature are small. Mean daily temperatures in January are approximately 31° F, and in July they are approximately 45° F. Average annual precipitation is slightly less than 28 inches. The most obvious and overriding climatic factor is wind and fog. Severe winds, at times in excess of 70 knots, can lash the island. The most significant winds occur during late fall, winter and early spring.

In 1987, construction adjacent to the runway at Shemya Air Force Base, removed existing dunes and vegetation and exposed 27 acres of erodable sand to the winds. Transported sand would cause aircraft maintenance and safety problems.

Previous attempts to revegetate the area adjacent to the runway failed. In 1987, the U. S. Army Corps of Engineers Alaska District and the PMC designed a revegetation and erosion control project to prevent

erosion on the area planned for construction in 1987.

Based on initial studies in 1986, it was determined that beach wildrye, Elymus arenarius L. (also referred to as E. mollis Trin.) could be established using transplanted sprigs (Wright 1986d).

The revegetation plan also called for seeding with the adapted perennial grass 'Norcoast' bering hairgrass. Adapted cultivars of red fescue and traces of annual ryegrass were also indicated.

The seed mix was applied at a rate of 60 pounds per acre.

Prior to sprigging, the area was fertilized at a rate of 500 pounds per acre of 14-30-14. A supplemental application of 75 pounds per acre of 34-0-0 occurred 60 days after seeding.

In May, 1987, the contractor, aided by the Center, started the revegetation project. Minor modifications to the available construction equipment allowed the methods for harvest and planting to be simplified to the point where the rate for planting one acre (20,000 sprigs) was 60 man hours.

In September, 1987, the area was evaluated. Twelve 50-meter transects indicated that 90% of the beach wildrye sprigs had become established.

Overall ground cover was 80-85%, 41% of which was beach wildrye, 43% seeded perennial grasses, 15% annual ryegrass, and <1% invading native broadleaf species. The vigor of the vegetation was good to excellent (Wright, et. al. 1987).

Stand diversity was higher than expected. Propagules from broadleaf native species had been introduced when a thin (2-4 inches) veneer of peat had been applied to the area as a temporary solution to reduce wind erosion.

The project was the first major attempt to establish beach wildrye in Alaska. The success of the project indicates that it is a viable reclamation and erosion control method.

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