A Development Plan For a Forest Nursery

By

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INTRODUCTION

The people interested in the forest industry have come to realize that if the industry is to survive, steps must be taken to assure adequate growing stock for the future. Of this growing stock, a large percentage will originate in nurseries. To meet this demand, present nurseries will be expanded and new ones developed.

The main purpose of this thesis is to show how a nursery might be developed in Oregon by outlining the steps involved from selection of a site to the completed nursery.

An area owned by the State of Oregon, located near the present Oregon Forest Nursery was used for study and assimilated development.

Mr. Vern McDaniel, Superintendent of the Oregon Forest Nursery, was exceedingly helpful in giving valuable information and advice.
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NURSERY SPECIFICATIONS

An ideal permanent nursery site, like any ideal, is rarely found. The usual policy is to choose the location which possesses the most desired qualities under the imposed limitations.

The selection of the nursery site is largely determined by the following factors.

Location

The nursery should be located close to the areas to be planted to reduce transportation time and cost, increase efficiency of operation, be near to sources of labor and materials, and decrease the need for storing the seedlings. Thus only housing facilities for the nurseryman and one or two assistants would be necessary.

Climate

It is practically impossible to have one location meet the requirements of all the planting areas; therefore the nursery seasonal climate should be similar to that of the greatest planting area. For planting in the coastal area, the nursery should be open all winter.¹

Soil

The soil should be free of rocks and stones, fairly light, of sandy loam or loamy sand foundation, deep and fresh, and well drained. The physical characteristics of

The soil are more important than chemical composition as fertility can be improved by adding fertilizers easily and more cheaply than the physical characteristics can be improved. Virgin soil, composed of 60 to 85 percent sand and 15 to 40 percent silt and clay is usually best. It should be acid with a pH value between 5.0 and 6.5 as conifer stock prefers acid soil.

Water Supply

No matter where the nursery is located, a good supply of water for irrigation is necessary. Nature cannot be depended upon to supply water at the right times in the right amount. During the period of germination and establishment of the seedlings, water is of the utmost importance. The greatest amount will be used during July and August which is usually the dry season in the Pacific Northwest. The supply of water available must be sufficient to meet the heaviest daily needs during the dry season with a large margin of safety for extreme conditions and future nursery expansion. Before the irrigation water is used, it should be tested for injurious impurities.

Topography

The nursery should be nearly level, with a uniform slope of not less than 0.25% nor more than 2.0% to get surface drainage without erosion. Greater extremes of slope may be used with special textured soils and if special steps are taken to control erosion, such as terracing.
Latitude and altitude of the site are the determining factors where the aspect is concerned. Where the area is to be irrigated, southern aspects in northern latitudes and at high elevations are good because of their greater warmth. In this locality a northern aspect is better because there is less injury from frost and slower evaporation of the water from the surface soil.

Usually it is best not to have a nursery in deep canyons or narrow valleys because the sun cannot hit the area directly long enough each day for best growth. The frost damage is also much greater at these lower altitudes. Where possible, the nursery should be protected by a high forest or well-developed windbreak, especially on the side of the prevailing winds.

**EXPERIMENTAL AREA**

**History**

On October 3, 1941, the Oregon State Board of Forestry purchased 44.66 acres of land, for $30 per acre, from the John Carnegie Estate. This area in the NW 1/4 of S31, T10 S, R 4 W, joins the present Oregon State Forest Nursery on the north side. It was purchased to provide an area for possible future expansion of the present nursery. Originally about one-third of the area was covered with large stumps, brush and a few scattered trees of a neglected orchard. The remainder was grazing land with scattered 10 to
20 year-old seedlings.

Development

In 1947 twelve acres on the west side were cleared of stumps and brush with a Cletrak 80. A larger tractor, such as a D-8 Caterpillar, could have been used to greater advantage for this work. The smaller size costs less per hour to hire and operate but is less efficient. This 12 acre tract was used as the development project for this thesis.

The north and south sides have a good wind break of second growth Douglas fir, the west, a 20 year-old pine plantation and on the east also second growth Douglas fir, part of which is about 600 feet away.

Description

For description purposes, the north half of the nursery site will be designated area "A" and the south half area "B". Area A has an average grade of less than 4% with a north to northwest slope. The nursery space is 625 feet east and west, and 375 feet north and south, making 225,000 square feet or 5.33 acres. Part of this space will be used for roads and drainage ditches which will be discussed later. The soil is from two to four feet in depth and of Aiken and Olympic clay loam. Being new soil, it should be rich in nutrients. Due to the unsettled and changing weather conditions of this part of Oregon, it is difficult to
do the necessary tilling without damaging the texture and construction.

Area B has an average grade of 8% which is higher than should normally be used. Special drainage procedure must be employed to prevent excessive erosion. The aspect is mostly southern. This area is the same width (east and west) as area A, and runs 425 feet north and south, making 6.09 acres. Between area A and B will be a strip 16 feet wide and 625 feet long—.23 acres making a total area of 11.69 acres. There is a small gully and intermittent stream which cuts across the lower end of area B. Some drainage system must be installed to reduce erosion along the intermittent stream and control the excess runoff of water. A four or six inch tile buried two feet in the ground and extending from the shallow drainage ditch along the sod road, to the southern boundary of the nursery is one system that could be used. It would take about 300 feet of four inch and 250 feet of six inch tile. Because of past erosion, the soil here isn't as deep or as rich as in area A but of a similar type and texture.

Leveing

A certain amount of leveling will be necessary, such as filling in the holes left by the large stumps, and natural low areas. Care must be taken in this process to prevent removing all of the top soil from the high places.
A large tractor with dozer blade, such as a D-7 or TD-16, should be used for this job. The ground can be stirred up and large roots removed with a ripper blade attachment. All roots and other debris should be removed prior to leveling. After the leveling is completed, the bulldozer may be used to construct the drainage ditches and roads.

**Roads**

A strip 25 feet wide around the entire area will be used for a roadway, drainage and sanitation. The roadbed to be 14 feet wide with a shallow two-foot wide ditch along the east side. This road will have a sod surface as it will not have heavy use during the winter and the original cost will be low. If the sod road does not prove satisfactory, it may be gravelled later. The strip of land between area A and B will also be used for a road, but this road will be gravelled as it will have much greater use.

**Fencing**

This nursery site is near a game refuge, and a strong, high fence will be necessary to keep out deer and livestock. It could be constructed of six-foot fish-trap wire with two strands of barbed wire above, spaced six inches apart, and one below. The anchor posts to be of cedar, at least 14 inches in diameter, 12 feet long with four feet buried in the ground. The remaining posts will also be of cedar but only 10 feet long. Only the west and north sides will need all new fence. The boundary fence along the north
side of the Oregon State Forest Nursery will also serve as the southern boundary of the new area. On the east side the new fence will extend south only as far as the gravel road separating the two areas, then it will run east to the property line. In all, there will be 2675 feet of new fence to be built. The Department of Agriculture has developed several types of gates that may be opened and closed without getting off a tractor or out of a truck. A gate of this type or a wide cattle crossing will be used where the gravel road enters the nursery.

NURSERY PLAN

Irrigation System

An ample water supply is a prerequisite for any nursery. In 1937 the Cronemiller Lake, an artificial reservoir formed in a natural hollow with an earth fill dam, was constructed by the Civil Conservation Corps. The lake covers an area of two and three-quarter acres and contains nearly eight million gallons when full. A small diversion dam on Calloway Creek feeds the reservoir.¹

A six-inch wooden pipeline extends from the lake to the nursery entrance gate, where there is a shut-off valve which controls the flow of water for both area A and B. This pipeline continues for 600 feet along the north side of the gravel road and ends in a shut-off valve and a

Cronemiller Lake

Lake Area

Fig. 3.
three-way reducer outlet. The irrigation system will be of aluminum alloy sprinkler pipes mounted on four foot posts with Skinner overhead motors. The Skinner system of overhead sprinklers consists of pipes with spray nozzles, running the length of the beds, and turned by automatic water motors. These motors have turning radius of 180 degrees but are usually set for about 140 degrees.

In area A the first riser will be 25 feet east of the edge of the first nursery bed, and will extend north 350 feet. There will be 12 water lines to supply the area, with 50 feet between lines, leaving 25 feet of space east of the last line similar to the space west of the first pipe line. Two feet east of the last riser will be a shut-off valve, with a three-way reducer outlet. The outlets for north and south lines are reduced to four inches and the one toward the east reduced to five inches. Area B is similar except the lines are 400 feet long instead of 350 feet. The irrigation system is shown in figure 1.

Improvements

For an operation of this size, several buildings will need to be constructed. A packing and utility shed with a cold storage department, a large machine shed and tool house, and a home for the man in charge of the nursery. As the new nursery would serve as an addition to the Oregon Forest Nursery, the only additional improvements necessary would be living quarters for the permanent workers. About
75 feet east of the nursery proper is a rise of ground overlooking the nursery which would make an ideal location for buildings.

Machinery

In the line of machinery, several special implements are required along with a few general ones. First, a small all-purpose tractor. Mr. McDaniels has found the small Ford to be very good for everyday service. For the heavy farming work a TD6 or one similar in size. Next a disk, plow, grain drill, and harrow for maintaining the cover crops. Special tools should include a mechanical eight-row seed drill, a tiller, and a lifter blade.

Seed Beds

The distance between risers will be fifty feet and in this fifty feet will be eight beds, each bed consisting of 8 rows, six inches apart running the full length of the bed. The beds will thus be 42 inches wide and 350 feet long in area A and 400 feet long in area B. With clay loam soil it is best to use tractors with rubber tires though they need more space between beds than when a Cletrac tractor is used. The space between the riser and the first bed will be 30 inches with 29 inches between the next seven beds, leaving about 31 inches from the last bed to the next riser. If the land had less grade and was of a sandy loam type, less space would be needed between beds for the tractor wheels and there would be room to have nine beds.
instead of eight in each unit.

With rows six inches apart, for each square foot of space there will be two feet of lineal row distance. This nursery should produce 25 Douglas fir seedlings per lineal foot and 18 ponderosa pine. By figuring on the basis of lineal feet, the quantity of seed, spacing within the row, and total seedlings in a unit are easily computed. For example, one bed of Douglas fir seedlings would contain about 70,000 plants—eight rows, 350 feet long, 25 seedlings per foot of row. At this rate area A could produce more than $6\frac{3}{4}$ million seedlings per year. The species to produce would be largely Douglas fir with smaller quantities of ponderosa pine, western red cedar, Sitka spruce, and Port Orford white-cedar.

The nursery should be operated on a crop rotation of three or four years with one-quarter to a half in a cover crop or fallow each year and the rest in nursery production.
This area is not a good nursery site for several reasons. The soil is very shallow, with a preponderance of clay; the aspect could be much better, and the slope is much too steep; erosion has removed valuable top soil on a large part of area B, a large amount of work and expense will be necessary to control the surface water, and there is need of much leveling and filling. On the other hand, it is near a public highway and city, labor supply and materials, and markets. The soil is relatively free of rocks and has a favorable pH value. The water supply is sufficient and easily available. All sides of the area are protected from the full force of the wind by good wind breaks. The climate is similar to that found west of the Cascade Mountains. Each summer the State Board of Forestry maintains a fire suppression crew, consisting of 20 to 25 young men, within a few minutes walk of the area. These boys would be available for clearing work, cleaning fence rows and sanitation strips around the nursery, weeding, brush disposal and road repair.

The design, organization, and management of a nursery varies with the size, location, climate, topography, soil, and financial budget. There is no one set of rules which will work in all cases. Only through years of study and experience is it possible to become thoroughly familiar with the nursery phase of forestry work.
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