Diameter Growth Relationship by Density and Species Composition

Optimization of Diversity-Functioning Relationships in Stratified Conifer-Broadleaf Forest Mixtures

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Abstract

OBJECTIVE: This study will investigate the many benefits of multi species forest plantations. This poster covers the diameter growth relationship.

DESIGN: 27 different 25 meter squared plots with 36 to 121 trees of differing species mix.

SETTING: Grays Harbor College School Forest, Satsop, WA

RESULTS: Although this study will continue for many years, at this stage increased diameter of the Sitka spruce can already be seen in the high density plots of 1 to 1 species mixtures.

Recorded Data for Over 1,500 Trees.

Introduction

Conifer forests cover a large amount of our community including much of the Chehalis river basin, which is the second largest basin in Washington state. (chehalislandtrust.org) The management of these forests have a direct impact on wildlife habitats, recreation, air quality and the livelihood of locals who rely on the timber industry for income. (4) Modern timber management takes all these factors into consideration when planning and implementing harvesting techniques that have multiple benefits, while not impacting the revenue from timber harvests. (3)

Coastal western Washington and much of the western portion of the Chehalis Basin has historically had a mixed conifer composition of four dominant species which include Douglas-Fir *(Pseudotsuga menziesii),* western red cedar *(Thuja plicata),* western hemlock *(Tsuga heterophylla)* and Sitka Spruce *(Picea sitchensis)* (FIGURE 1). Sitka spruce, at the turn of the last century, was considered an extremely valuable timber species due to its very light, durable and strong wood properties. Lumberjacks of old cut and processed these trees with high regard for their profit.

Douglas-Fir | western red cedar | western hemlock | Sitka spruce

http://nwconifers.com

FIGURE 1

Over time much of the timberland was converted to plantation management through modern forestry techniques and the Sitka spruce slowly fell out of favor with landowners. A combination of early slow growth, apparent low yields and a mysterious but common top kill plagued the reintroduction of Sitka spruce into modern management. The other three major conifer species did not necessarily exhibit these attributes.

This research study evaluates the many challenges of re-introducing Sitka spruce into multi-layered canopy plantations. The research focuses on planting two completely different species of tree that ultimately might complement one another. (6) The Sitka spruce (FIGURE2) is a slow growing shade tolerant, long lived tree while the red alder *(Alnus rubra)* (FIGURE 3) is a fast growing broad leaf, short lived tree. One of the many benefits from planting red alder and Sitka spruce together, is that it creates a more natural habitat beneath the tree canopy. (1) Pure Sitka spruce stands, when planted in monocultures can grow very dense and block out sunlight, inhibiting other shrubs and herbaceous species from growing in the understory. This can impact the food supplies of wildlife. (FIGURE 4) (5) By allowing a more natural habitat to develop, water quality for fish in the Chehalis river will benefit by the herbaceous riparian buffer. (7) Reestablishing Sitka spruce in riparian wetlands adds long-term structure and stability that are important in flood disturbance events (versus short lived hardwood species).

Another benefit of planting the fast growing red alder with the slower growing Sitka spruce is that the red alder trees provide shade, cooling the understory microclimate in the plantation thus protecting the Sitka spruce from pest attacks. (4) Pest attack's can kill a years' worth of growth and lower the quality of the Sitka spruce wood. These attacks effect the following years growth volume (diameter and height). (8) Some pests prefer to lay their eggs on the warm terminal branches of Sitka spruce, this can be hindered by growing Sitka spruce in the cool shade of red alders. This study is being done to determine the best possible mix of the two species that will not only benefit Chehalis river basins watershed and wildlife but provide the best return for the forest industry. (2)

FIGURE 2 – Young Sitka Spruce

FIGURE 3 - Young red alder

FIGURE 4 – Sleeping baby birds

Methods

This research was conducted at the Satsop Business Park outside of Satsop, Washington (FIGURE 1). This facility contains approximately 2,000 acres owned by the Port of Grays Harbor and managed by Grays Harbor College as their school forest. 27 plots, each with a different density and composition ratio of species. (FIGURE 2) Measurements are taken each year collecting the height, diameter and condition of every tree. (FIGURE 3) Height tools used included a relaskope, a clinometer and a 15-foot fiberglass measuring rods. Diameter tools used were calipers and diameter measuring tapes. Clearing tools used were chain saws, loppers, pruning shears, hornet spray. (FIGURE 4) Safety protocols were followed by working in teams and wearing long sleeve shirts, long pants, safety vests, hard hats, leather gloves, chain saw chaps, safety helmets and work boots.

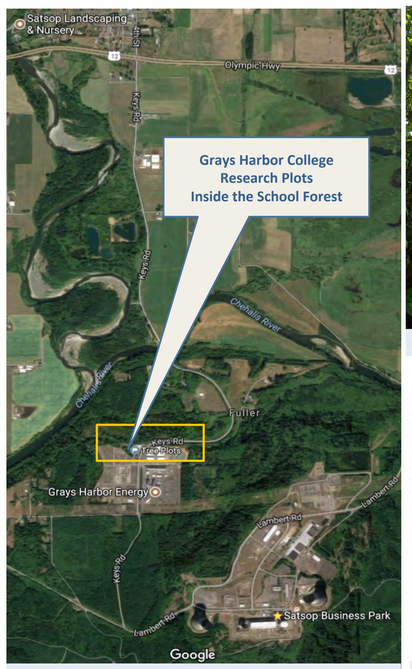


FIGURE 1

FIGURE 3 - Measuring Tree FIGURE 4 -Clearing

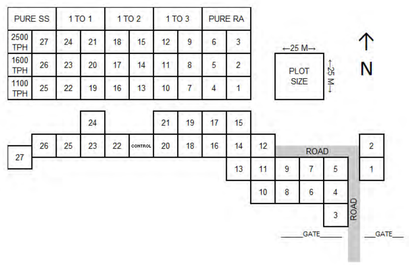


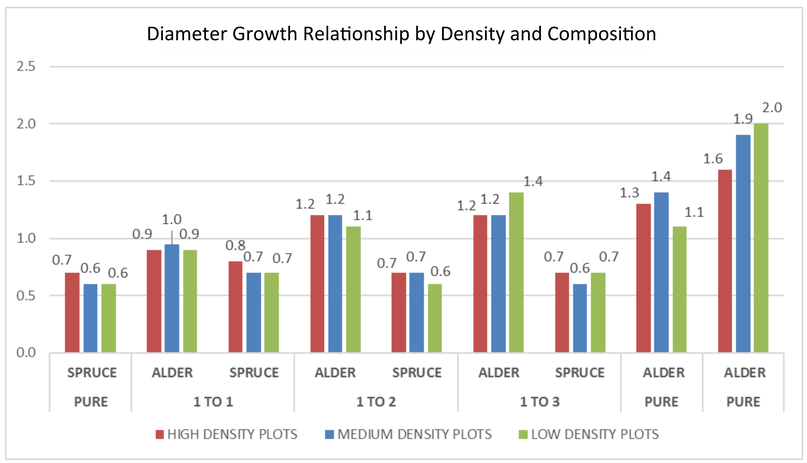
FIGURE 2 – Plot Diagram and approximate layout

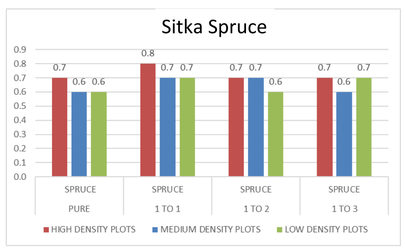
Results

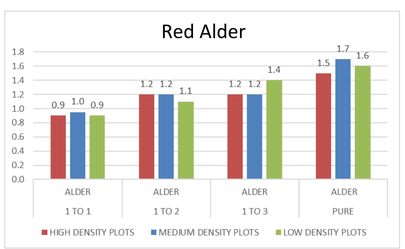
This year's results on diameter growth relationship:

Diameter Growth Relationship by Density and Species Composition

	PURE SPRUCE	1 TO 1 ALDER	1 TO 1 SPRUCE	1 TO 1 ALDER	1 TO 2 SPRUCE	1 TO 2 ALDER	1 TO 2 SPRUCE	1 TO 3 ALDER	1 TO 3 SPRUCE	1 TO 3 ALDER	PURE SPRUCE	PURE ALDER	PURE ALDER
HIGH DENSITY PLOTS	0.7	0.9	0.8	0.9	0.8	1.0	0.8	1.3	0.6	1.2	0.7	1.2	0.7	1.3	1.6
MEDIUM DENSITY PLOTS	0.6	0.9	0.6	1.0	0.7	1.0	0.7	1.3	0.7	1.3	0.6	1.1	0.6	1.4	1.9
LOW DENSITY PLOTS	0.6	0.7	0.8	1.0	0.6	0.9	0.5	1.2	0.7	1.5	0.7	1.3	0.7	1.1	2.0







These are year 5 results. Trees are about 7 years old as they were planted at age 2. This is early in the study so results will become clearer as trees reach a mature age. But even at this stage in the study the Sitka spruce in high density plots with a 1 to 1 composition of red alder to Sitka spruce show a higher diameter at breast height.

Discussion

The plantation trees had intense competition with understory brush species. These included salmonberry *(Rubus spectabilis),* elderberry *(Sambucus),* scotch broom *(Cytisus scoparius)* and Himalayan blackberry *(Rubus armeniacus)* (FIGURE 1); in most cases the next research tree was not visible through the brambles. (FIGURE 2) The trees have identification tags showing their plot and tree number. The research crew gathered equipment and made trails through the plantation to access each tree. Gaining access was labor intensive and many scratches and bruises were attained, even a few stitches. (FIGURE 3)

salmonberry | elderberry | scotch broom | Himalayan blackberry

FIGURE 1

Visibility as entering plot. Visibility after working plot.

FIGURE 2

FIGURE 3

The preliminary results show minor difference at this time and may not be statistically significant. Further time and data gathering may show increase differences.

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