# RED ALDER AND SITKA SPRUCE HEIGHTS VIA OPTIMIZATION OF DIVERSITY-FUNCTIONING RELATIONSHIPS IN STRATIFIED CONIFER-BROADLEAF FOREST MIXTURES

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## Abstract


- Site of collection was plantation in Satsop Business Park.
- Plots were cleared for easier access to each tree.
- Data was collected for each plot.
- Tree heights, diameter, and overall health were measured and recorded for each tree on plot.
- Charts of data were created for visual comparison of data.
- This years data was then compared to previous years.


**Robin's nest on Sitka**

**area of plot locations compared to Chehalis river**


**Sitka spruce**

**red alder**

**weevil damage**

## Introduction

Commercial forests cover a large amount of our community including much of the Chehalis river basin, which is the second largest river basin in Washington State. The management of these forests have a direct impact on wildlife habitats, recreation, air and water quality. Efficient timber management takes all these factors into consideration to find planting, managing and harvesting techniques that have multiple benefits, while not impacting the revenue of timber harvests or the quality of life in these areas. 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 *Pseudotsuga menziesii* (Douglas-Fir), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock) and *Picea sitchensis* (Sitka Spruce). 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. This species can thrive in poor soil, can regenerate itself in the right conditions, and because of its needles unique ability to take in minerals from the fog it makes an ideal species to be planted in northwest plantations.(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.

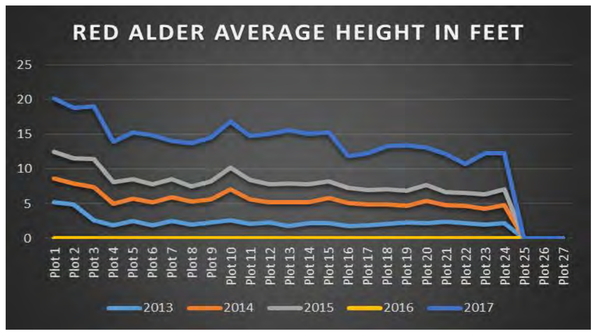
This study evaluates the many benefits of layered canopy plantations. This is done by planting two of the highest revenue making lumbers that complement one another. Sitka Spruce is a slow growing shade tolerant evergreen while *Alnus rubra* (red alder) is a fast-growing deciduous broadleaf. One of the benefits in planting red alder and Sitka spruce together is that it creates a more natural habitat beneath the tree canopy. Pure Sitka spruce stands when planted in monocultures grow very dense and block out sunlight inhibiting the growth of other shrubs and herbaceous species reducing the quality and variety of food available for wildlife. Another benefit of planting the alder with the Sitka is that the alder trees provide shade and reduce the temperatures in the understory helping to protect the Sitka spruce from weevil attacks. Weevils can kill a years' worth of growth in one attack and lower the quality of the Sitka by causing more knots in the wood. Weevils lay their eggs on the warm terminal branch of the Sitka but by growing Sitka's in the cool shade of the alders it hinders the weevil's reproduction. The presence of associated plants in the intercrop can lead to attack escape in three ways, all involving lower population growth rate of the attacking organism. In one, the associates cause the plants of the attacked component to be less good hosts; in the second, they interfere directly with activities of the attacker; and in third, they change the environment in the intercrop so that natural enemies of the attacker are favored.(3) This study is being done to determine the best possible mix of the two species that will not only benefit wildlife around the Chehalis river basin but provide the best return for the forest industry while reintegrating the Sitka spruce into our northwest forest plantations.

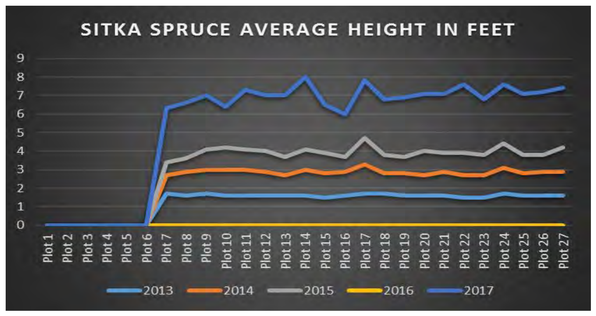
With the data from this study it hopes to find positive evidence that by growing layered canopy plantations the Sitka are both healthier and thriving. A major finding in the past two decades has been the critical role that species composition plays in dynamics and functioning of ecosystems. Composition matters because organisms drive ecological processes and differ in their traits. Large differences in traits, such as the presence or absence of nitrogen fixation, or of deep roots, or of flammable tissues, can have large impacts on ecosystem processes. Species composition is likely to be one of the major determinates of stability, primary productivity, nutrient dynamics, invasibility and other ecosystem traits.(2) By making the Sitka once again a major competitor in the in the timber market. The healthier forests of a mixed stand will lead to cleaner air and cleaner runoff into the Chehalis river basin which in turn will mean cleaner water for fish habitats making a layered canopy forest a win for all sides.

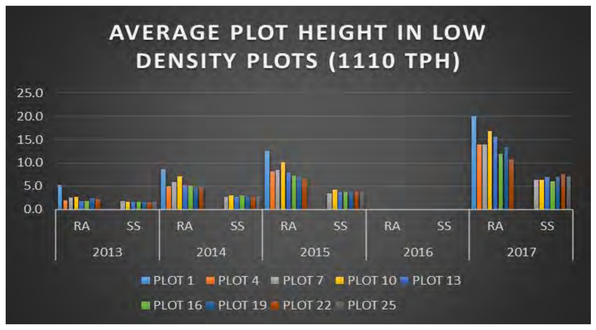
## Methods

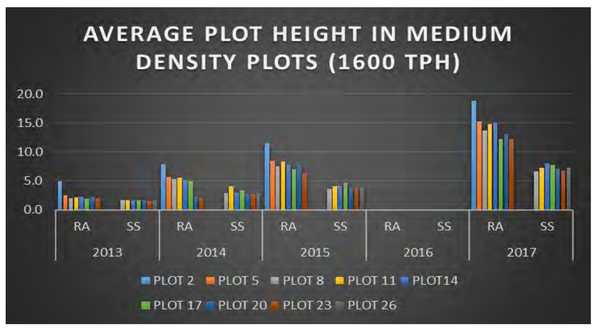
Data was collected on each tree in each plot. Height measurements were taken using a telescoping fiberglass measuring rod, clinometer, or Spiegel relaskop if over 20 feet tall. Diameter measurements were made with a diameter tape or calipers to the tenths of an inch. Each tree was accurately measured and recorded on write in the rain data sheets. A multitude of tools were used to just get into each plot which commonly were overgrown with *Rubus armeniacus* (Himalayan blackberry), *Cytisus scoparius* (Scotch broom), *Sambucus racemose* (red elderberry), and *Rhamnus purshiana* (cascara) just to name a few. Loppers and a Swedish clearing axe took care of many of these obstacles and when push came to shove chainsaws cut thru the thickets. Gloves, long shirts, pants, boots, and hardhats were also necessary in getting thru the brush uninjured. This research was conducted at the Satsop business park outside of Satsop, Washington. This facility contains approximately 2,000 acres owned by the Port of Grays Harbor and managed by Grays Harbor College as their school forest. There are 27 plots each containing a different quantity and ratio of alder and Sitka. Plots 1-6 contained only red alder, plots 7-12 contained a 1:3 ratio of Sitka and alder, plots 13-18 contained a 1:2 mixture, plots 19-24 contained a 1:1 mixture and plots 25-27 contained only Sitka spruce. Each year height and diameter measurements are taken of each tree as well as overall health and documented in a log. This is an ongoing study with no definite end date currently. Data was then entered into an excel spreadsheet to create charts to compare this year's data with previous years.

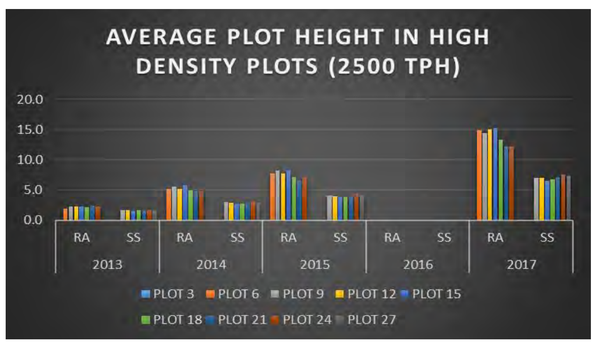
## Results




## Discussion

Once the data was all compiled into charts a definite trend in the height portion of this study can easily be seen. The red alder is a much faster growing tree than the Sitka spruce which is apparent in the charts. This is only the fifth year in this study and the growth of the red alder ranges from foot to several feet each year with the most height growth in the low and medium density plots but the most consecutive growth across the board lies in the higher density plots. Whereas the Sitka spruce only sees a gain of inches to barely a foot each year that is much the same in all density plots but like the alder the most consecutive growth is in the high density mixed plots. What this is showing is that in a higher density plot the competition from the two species allows for a slower growth of both that is more leveled out. In the two lowest density plots a trend of a quick upshot can be noticed. Now whether this trend continues or tapers off is yet to be seen.

Many factors are involved in the growth of trees not just the type and how many were planted. Soil, other competition, moisture, animals, when planted, etc. all have a role in a tree's life. The major components looked at in this study were the trees and the interaction between the two species and how the growth in height, diameter, and instances of weevil damage were observed. Being so young in the study it is still to early to see an definitive answer to the question asked, "does planting a multilayer plantation have a positive impact on the Sitka spruce and a negative impact on the weevil?" not only that, " but is it a option for the future of northwest plantations?" As this study continues on it is the goal of all involved that the Pacific northwest will see an increase in the Sitka spruce in our managed forests leading to a healthier and more diverse forest.

With the reintroduction of the Sitka the study hopes to bring our northwest forests back to a more historical crop of species and increase the health of our forests and the Chehalis river basin. Runoff from the forests drain directly into streams, with the increase in diversity and a more productive understory it will help to filter the runoff leading to a cleaner water which will mean a cleaner streams, rivers, and tributaries all leading back to the ocean with the positive impact of increasing salmon returns upriver like the times of old. The alder will also add a second harvestable species before the Sitka would be ready to harvest. This will increase revenue of the plantation and create jobs for the Chehalis basin and other northwest areas. With a multilayered forest it also provides habitat for multiple species such as the black tail deer, black bear, elk, birds and many other small creatures that reside under the canopy.

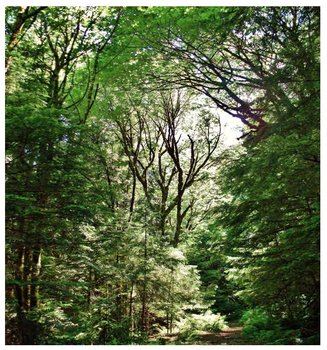
As this study continues on in the years to come and with each Gray's Harbor student and teacher involved taking the measurements thru till harvest time it is the hope that the Sitka will once again be a valuable and profitable species to reintroduce to northwest plantations. Bringing the forests back to the magnificent glory of days gone by.

**pure Sitka spruce plot**

**JoAnna and Colleen**

**Mary Valentine**

**typical multi-layered forest**



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