Comparison of Richness and Diversity of Plants in an Old Growth Forest and a Young Replanted Forest

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Abstract
In 2008 at the HJ Andrews LTER Forest using two different methods, a line intersect, and meter squared plots, we collected data to determine whether an old growth forest or 47 year old re-growth of a clearcut area has a higher richness and/or diversity of plant species. The two methods were used to gather data to determine the frequency or abundance of plant species in the two areas. As another component of the study we wished to compare the different protocols of data collection used to analyze whether they are comparable for acquiring information that give similar results when analyzed. We found that by the line intersect method of collection that the young forest had a higher diversity of plant species, but not richness. While the meter squared plot collections showed there to be no difference in richness or plant diversity between the two. I attribute the difference in outcomes of the different protocols to the amount of vegetation that each takes into consideration while data is collected, thus giving a broader scope of the abundance of vegetation, and thus what I feel to be a better representation. The absence of a clear significance of difference in the two stands may be attributed to the fact that the immature forest stand has had no management and may therefore represent a natural form of succession, post logging and planting.

Introduction

Forest ecosystems supply habitat for millions of plant and animal species. One often hears of the importance of forests for the services that they provide. Clean water, clean air, carbon sequestering, and soil stabilization (preventing erosion) are just a few services deemed important to us all. Industry also utilizes forests as a natural resource for building and other needs, which inevitably leads to man made disturbances. Whether these man made disturbances come in the form of clear cutting or selective cutting, they create changes within the forest ecosystems. Old growth forests definitions tend to include the types and sizes of trees, and general structural characteristics, like understory trees, snags, and rotting or downed logs (Franklin and Spies, 1991), but tend to not include such characteristics as biodiversity, thus giving us a vague picture as to their value in terms of this quality. Studies focusing on silvicultural management have shown that managed sites have higher richness of understory plants than in reserves of 80 year old non-managed areas (Battles et al. 2001). Others have shown just the opposite, and suggest that factors such as moisture, and plant- available soil nitrogen were indicators of diversity in their findings (Qian et al. 1997). While others show that vascular plant diversity tends to increase with time, and peaks in the old growth (Halpern and Spies, 1995). These apparently conflicting findings are what lead me to my primary objective, to determine whether there is a significant difference in understory plant diversity, between an old growth forest stand and a young, previously logged (but not managed) forest stand. I felt that the old growth forest would have a higher diversity since the old growth stands are just that, old, and I felt that the communities in them would be well established and therefore more diverse.

Methods

The study was conducted at the HJ Andrews LTER Forest, in an area known as B133. The site had been clear cut in 1960 and replanted with Douglas Fir in 1961. The old

growth site runs parallel to the young site and consists primarily of Western Hemlock, with 450-500 year old Douglas Fir dispersed throughout the Hemlock.

Two methods of data collection were used to determine the abundance of plant species in the two different stands of forest. Method 1) Point intercept - Transects were laid out in 20m lengths, placed at 4m intervals from each other running parallel to the road near the site. At 20cm intervals along the tape, the tip of a dowel was touched to the ground and the type of plant(s) that the stick was touching was recorded, giving us 100 data entries per transect line. Method 2) Along the same transect we placed on the ground, a 1m X 1m square PVC pipe frame, centered over each 4m interval (4, 8, 12,16,and 20m) and determined the percentage of coverage of each type of plant in the defined area, by looking over the square, perpendicular to the ground. If there was overlap in the foliage of the different species present, one could end up with greater than 100% coverage.

Results

Species abundance was calculated by determining the average that each species was present, for each of the two methods. The line intercept gives an indication of frequency of appearance and once the total of each appearance is determined, is then divided by the total to give an average percentage of occurrence, since it is based on one hundred samples per line. The meter square plot data gives a percentage of coverage of each plant when it is recorded, so when averaged gives an average of the percent coverage. These values were then used as the starting point for the statistical analysis that followed. Results were mixed, depending on which of the two collection method's data sets were analyzed. I used the *Community Analysis* tool on the Ecoplexity web site (http://www.ecoplexity.org/community_analysis) to determine the **richness, and diversity** of the data sets (table1). I then ran an ANOVA of the Simpson indices factors (which give a value for diversity based on Richness times Evenness) generated by this program. Data for the line intercept showed a significant difference in the diversity of the two sites, p= .03, with the young forest having more diversity (Table 2). When the same analysis was done using the dataset from the meter square plots, there was no significant difference, p= .55, between the two forest types (Table 3). ANOVAs comparing richness were found to be insignificant for both sets of data collected.

(O or OG stands for old growth, M or Man is the "managed" stand, or young forest, despite there being no record of management since its planting.)

Table 1. Result of Line Intercept Dataset

Site	Richness	Shannon	Simpson
TO1	12	1.5	0.65
TO2	14	1.4	0.58
TO3	14	1.8	0.75
TO4	10	1.6	0.72
TO5	13	1.8	0.77
TM1	15	1.8	0.76
TM2	16	2.1	0.8
TM3	16	2.2	0.83
TM4	11	1.8	0.79
TM5	15	1.9	0.8

Table 2. Result of Line Intercept Dataset
Anova: Single
Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
OG	4	2.7	0.68	0.01
Man	4	3.18	0.8	0

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.03	1	0.03	8.73	0.03	5.99
Within Groups	0.02	6	0			
Total	0.05	7				

Table 3. Result of M2 Dataset
Anova: Single
Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
OG	25	15.48	0.62	0.02
Man	25	14.8	0.59	0.03

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.01	1	0.01	0.37	0.55	4.04
Within Groups	1.2	48	0.03			
Total	1.21	49				

Discussion

I don't entirely discount the one value that shows the younger stand to have more biodiversity, but since all other values from the analysis of the richness and biodiversity of the two datasets agree that there is no significant difference in biodiversity between an old growth forest and this 47 year old replanted forest, then I must lean in the direction of those findings. This is not to say that there is no difference in the two forests. And since one value is not higher than another, we can assume that biodiversity, whether high or low, has a similar intrinsic value in each of the two stands

Of the two methods of data collection to determine frequency or abundance of plants being surveyed, I feel that the line intercept (the one that showed a difference in diversity,

which was also the same method used by Battles et al 2001, and showed a significantly higher biodiversity in a managed forest than an 80 year old reserve) was not the best for our purposes. In fact Battles et al (2001) used this technique in order to have new data they were collecting able to coincide with data that had been collected prior to their study, implying that they may have chosen a different method if it had been possible. The square meter plots would appear to capture a larger representation of the area we were surveying and thus a more accurate picture of the quantity of each plant.

One must always take into consideration that this was a small test taken in a very particular, and not very big, study area, which could limit the outcome of the study. Therefore, I feel that to get a better picture this study could be done covering a larger area. But this would still only tell us more about this particular site. As the literature indicates, the outcomes of studies can vary. I believe that this is because every area can have a specific set of conditions that are particular to that area, and therefore outcomes are also potentially specific.

When one walks into the two sites there is an unmistakable recognition that you have left one forest and entered another. Since looks can be deceiving, the question that came to my mind concerning this was what kind of differences are there really, if any? My look into biodiversity suggests that there is no difference. They are both diverse, in their own ways. I am not surprised by this since forests go through many stages and cycles and without the workings at each stage the cycles would have seized long ago. Nature tends to take care of itself without our help.

Literature Cited

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