Introduction

Climate change is not a recent issue. Global atmospheric CO₂ has risen from the historical average of 280 ppm to the current 400 ppm². Its effects can be observed worldwide with ocean acidification, rising sea levels, melting polar caps, etc. British Columbia's mean annual temperature has also been on the rise and could be shifting the boundaries of the Biogeoclimatic Ecosystem Classification (BEC) zones as the warmer climate could potentially favor relatively warmer climate BEC zones over colder climate BEC zones, like the Coastal Douglas-fir (CDFfm) subzone and the Coastal Western Hemlock (CWHmL) subzone variant, respectively³. For simplicity's sake, the CDFfm subzone will be referred to as the CDF zone and CWHmL subzone variant as the CWH zone.

The aim of this research was to conduct various surveys and collect data at multiple locations on South Eastern Vancouver Island. The study tested the gathered data against several statistical methods and explored if there is any evidence of climate change causing the potential expansion of the CDF zone into the adjacent CWH zone, using selected CDF zonal site indicator plant species. Assuming the mapped boundary was accurate, if climate change is not having an effect on the BEC zone boundaries, then we expect common indicator species characteristic of their respective zone to show differences in percent cover. However, if there is a correlation between climate change and the expansion of CDF into the CWH zone, then we expect to see no difference in the presence or abundance of indicator plants between the CDF and CWH plots.

Vancouver Island BEC Zones

Vancouver Island has a diverse landscape that is rich in a wide range of animal and plant life. It is home to the Vancouver Island Mountain Range, which runs down the spine of Vancouver Island. The variation in topography, soil types, and proximity to water plays a crucial role in the distribution of biota. All their ecosystems across Vancouver Island².

The British Columbia Ministry of Forests formerly recognizes the existence of 16 ecosystems found in B.C., with primarily 4 of them established on Vancouver Island². The Ministry constructed Biogeoclimatic Ecosystem Classification (BEC; Figure 1) zone maps to illustrate the distribution of ecosystems across the landscape. The 4 main ecosystems found on Vancouver Island include:

- Coastal Western Hemlock (CWH)
- Coastal Douglas-fir (CDF)
- Alpine Tundra (AT)
- Mountain Hemlock (Mh)

Field Work

A BEC zone map of the study area was incorporated to provide a better understanding of the distribution of the 3 study blocks within the BEC zones (Figure 2). The study blocks looked exclusively at the CDF and CWH zonal sites long the coast of South Eastern Vancouver Island. In anticipation, a transect strategy was devised to discourage any bias during data collection. This was achieved by overlaying a dot grid over the BEC zone map and using a random number generator to select our plots sites.

There were 9 study sites, each located in either a CDF, CWH, or Boundary zone.

Statistical Analysis

An Analysis of Variance (ANOVA) Test was applied to compared the mean for the percent covers of each indicator species between the data from each of the selected BEC zone locations (CDF, CWH, and CDF/CWH Boundary). A Two-Sample T-Test was included to supplement the ANOVA Test. A Jaccard Coefficient of Community Test (JCC) Test was also applied to compare species composition between the data samples based only on the presence of the species within each data set.

Discussion

The ANOVA and T-Test in a sense doesn't seek to directly prove a hypothesis but rather aims to disprove the opposite (null hypothesis or Ho) of a formulated hypothesis (alternative hypothesis or Ha). If successful, the tests would disprove the null hypothesis, suggesting the alternate hypothesis may be true based on the data's reliability.

The results of the ANOVA Test suggest the means of the 3 blocks were not significantly different. However, the tests do not differentiate between which blocks the means don't correlate. To resolve this issue, a Two-Sample T-Test was applied to confirm the results.

The results of the Two-Sample T-Test suggest each combination of comparisons between the CDF, CWH, and Boundary plots had zero correlation.

The third test compared the differences and similarities of the 8 indicator plants which are suggestive to the expansion of the CDF into the CWH zone.

The Jaccard Coefficient of Community Test suggest there is a similarity of vegetation present between the CDF and Boundary study sites.

Conclusion

The purpose of this research was to explore how the changing climatic processes could potentially alter the current boundaries between the CDF and CWH zones and to understand how these trends could have an impact on the local forestry industry.

Both the ANOVA and T-Test failed to disprove the null hypothesis, suggesting climate change had no effect on the expansion of the CDF into the adjacent CWH zone.

The ICC Test had mixed results; suggesting the CDF and the boundary zones had the greatest correlation of data sets across all sites.

This is currently a topic of uncertainty among the scientific community. Several studies completed by Dr. Hamann and Dr. Wang and other UBC researchers believe this is a growing concern and will continue to be for the foreseeable future.

Recommendations:

- Expand and increase the number of survey plots in each BEC zone study site for greater representation of vegetation cover.

Acknowledgements

- Bill Beese for his guidance in completing this research.
- CREATE organizers for providing a student platform to present scientific research.
- The VSF Forestry Department for providing the essential field equipment.
- The CREATE organizers for providing a student platform to present scientific research.

References