Density of Douglas Fir Tree: Elevation and the Human Impact

Sadie Hawkins
Salt Lake Community College

Abstract

- Does elevation have an effect on the density of *Pseudotsuga menziesii*, specifically when compared to human activity in the area? I.e. CO_2 densities, wildfires, deforestation.
- Data collection occurred using three ten by ten square meter quadrants.
- Elevation range between 6,000 and 8,000 feet.
- How do the Cottonwood Canyon plots compare to the FIA (Forest Inventory and Analysis) database plots of Salt Lake County?

Figure 1: Douglas Fir Forest, Big Cottonwood Canyon. Photographed by Sadie Hawkins

Introduction

- Growth of Douglas Fir Trees, *Pseudotsuga menziesii*, occurs between 6,000 and 9,000 feet of elevation along the Wasatch and Uintah mountain ranges.
- Mass reproduction relies on the presence of fire.
- Mature trees 12+ years can live through a fire.
- Hypothesis: Douglas Fir trees will grow denser at lower elevation due to increased CO_2 levels, and a lower human impact.
- The FIA documents tree density on a 10 year cycle.

Figure 3: Douglas Fir Along River, Little Cottonwood Canyon. Photographed by Sadie Hawkins

Figure 2: Douglas Fir Trees, Big Cottonwood Canyon. Photographed by Sadie Hawkins

Methodology

- Canyons used: Little Cottonwood, and Big Cottonwood
- Elevations: 6,000, 7,000, and 8,000 feet.
- CC plots were 10 sq meters.
- Circumference of individual trees was measured at chest height.
- Did not have the equipment available to test CO_2 levels.
- The FIA plots were 58.9 ft radius

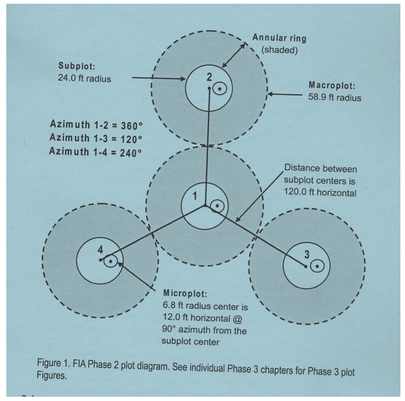

Figure 4: Plot set up by FIA. *Interior West Forest Inventory & Analysis: P2 Field Procedures*. Vol. 7.00, Forest Inventory & Analysis Program, Rocky Mountain Research Station, 2016, Page 9

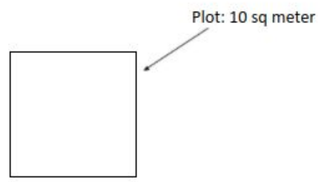

Figure 5: Plote set up by Sadie Hawkins.

Figure 6: Douglas Fir Trees 2, Little Cottonwood Canyon. Photographed by Sadie Hawkins

Figure 7: Douglas Fir Life and Death, Little Cottonwood Canyon. Photographed by Sadie Hawkins

Results

- Elevation did not have a significant impact
- P-value of 0.76 indicates the two canyons are part of the same population.
- P-value for the elevation difference was 0.19, because the density of the two canyons ran opposite of each other.

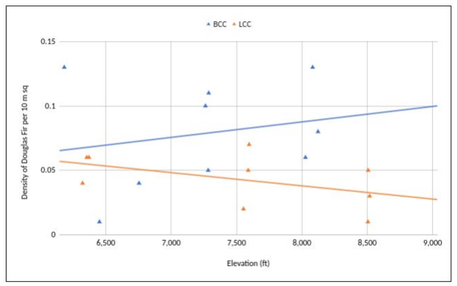

Figure 8: Tree density for the separate elevations did not vary significantly. However, there is a difference between Big Cottonwood Canyon and Little Cottonwood Canyon Douglas Fir density, as shown above.

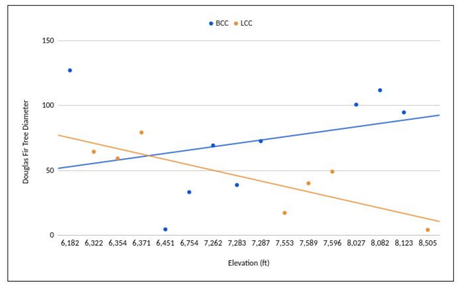

Figure 9: The trees in Big Cottonwood Canyon increased in size with higher elevations, as opposed to the individuals in Little Cottonwood Canyon which averaged a smaller diameter as elevation increased.

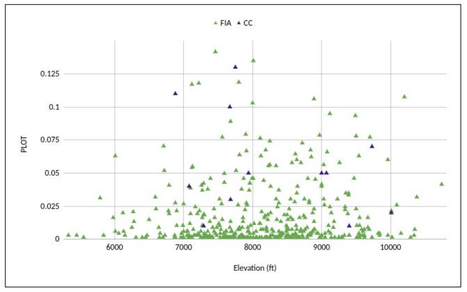

Figure 10: Tree density at the measured elevations, Cottonwood Canyon plots vs FIA plots.

Results Cont.

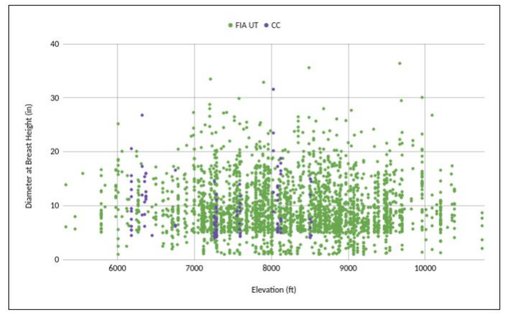

Figure 11: Tree diameter at the measured elevations, Cottonwood Canyon plots vs FIA plots.

Conclusion

- Results did not support my hypothesis of elevation affecting Douglas Fir Density
- Human activity does effect tree density, both canyons have ski resorts, and 100 years ago Douglas Fir had to be replanted due to deforestation.
- The Cottonwood Canyons do not reach 9,000 feet elevation.
- Having the ability to measure CO_2 density, and time to measure more canyons would allow for a more conclusive experiment and results.
- Comparing canyons with ski resorts vs those without would help illustrate the human impact on our mountain ecology.

Acknowledgements

Special thanks to Jessica Berryman of Salt Lake Community College, and James S. Menlove of US Forest Service Research & Development

McAvoy, Darren, et al. "Utah Forest Types: An Introduction to Utah Forests" *Forestry, USU Extension*, May 2012, forestry.usu.edu/

Cook, Morgan. "Life Cycle and Reproduction." *Coast Douglas Fir*, 2008, bioweb.uwlax.edu/bio203/s2009/cook_morg/Reproduction.htm.

Interior West Forest Inventory & Analysis: P2 Field Procedures. Vol. 7.00, Forest Inventory & Analysis Program, Rocky Mountain Research Station, 2016.