A Comparative Study of Carbon Sequestration Models at Zena Forest

ENVS 380W: Forest Management & Policy

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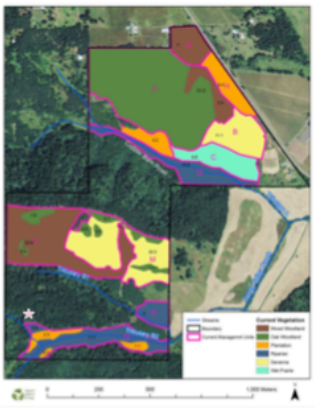
OVERVIEW/OBJECTIVES

Overview:
Climate change is a defining issue of our time, in which forests play a crucial role. Forests cover about 30% of the Earth's land surface and absorb 33% of anthropogenic carbon emissions (Bonan, 2008). Pacific Northwest (PNW) forests are especially important, as they store more carbon per unit area than any other region in North America (Krishnan, 2009). Because of this, forests can provide an essential tool in curbing atmospheric greenhouse gasses. Understanding the capacity of Pacific Northwest forests to capture and sequester carbon can allow for breakthroughs in mitigating climate change. Carbon sequestration is the process by which atmospheric carbon dioxide is captured and stored in plant biomass. Carbon sequestration models provide tangible measurements of the carbon stored in forests, allowing forest managers to identify the storage capacity of any given stand and plan for the future.

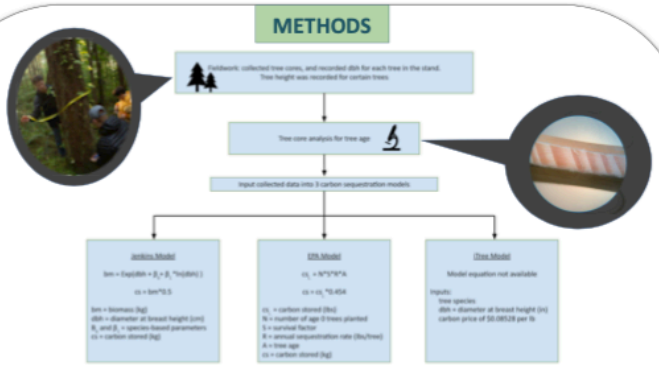
Objective:
The aim of this study is to approximate the carbon being sequestered at a plot in Zena forest, as well as compare results from different carbon sequestration models.

FIELD SETTING

- We are taking samples from MF3, a plot that is 1/20 of an acre
- 21 trees present in the plot, with primarily Douglas firs and some Cherry.
- Terrain:
  - Sloped
  - Fallen/felled trees
  - Presence of invasive understory



METHODS



RESULTS FIGURES

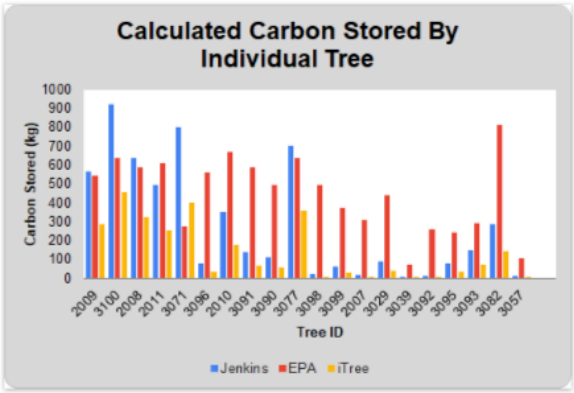


Figure. 1. This graph depicts three different model's calculated carbon storage for each tree in the stand.

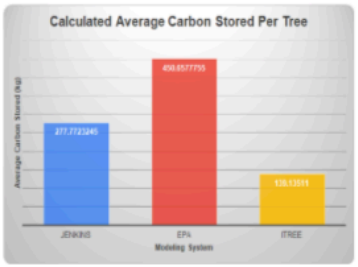


Figure. 2. This shows three different model's calculated average carbon storage in kilograms for each tree in stand MF3.

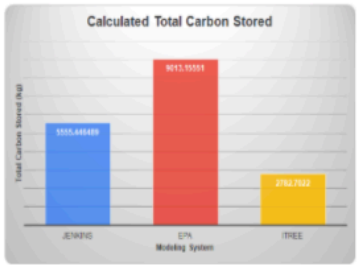


Figure. 3. This depicts three different model's calculated total carbon storage in kilograms for stand MF3.

RESULTS FIGURES CONT.

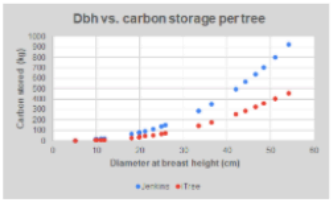


Figure. 4. Two models show a potential relationship between dbh and carbon storage. The EPA model is not shown because it did not include an input for dbh.

Conclusion and Discussion

Discussion of findings

- Averaging results from our models, this stand sequesters 115,675 kg or 115 metric tons of carbon per acre. This is comparable to similar Douglas Fir stands in the region (Fain et al., 2018). This carbon stored is worth $10,480, based on i-Tree calculations.
- This amount of carbon per acre is equivalent to 428,425.93 kg of carbon dioxide
- Using i-Tree's results, this stand would sequester carbon at a rate of 1,115 kg per acre per year, which would equate to an additional $200 worth of carbon being stored each year.

Model selection and error

- Model-selection error can present up to 20-40% uncertainty in carbon storage estimates (Melson et al., 2011), in part due to differing inputs.
- The EPA model covered trees through the age of 59. Five trees in the plot we studies were outside this scope, which could compromise the results.
- All models used assumed tree heights based on other inputs, which possibly skewed results.

Future implications of climate change

- Douglas fir forests in Oregon will be threatened by climate change through drought, disease and fire, reducing its range by up to 87% by the late 21st century (Spies et al., 2010)

Management recommendations

- Partial harvest of Douglas-fir forests in the Pacific Northwest has been shown to lead to higher carbon stores than complete harvest (Harmon et. Al., 2009)
- Diversifying forest stands with higher drought tolerant species, such as Ponderosa Pine, could enhance stand health and carbon storage under future climate change scenarios
- Sustainable forest management practices such as longer harvest rotations can be implemented to increase carbon sequestration

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