

Title: Seeing the Forest for the Trees

(For 8th/9th grade—Arizona SOL Thread 3, Science as a Social Concept)

- I. Subheader: Human Impacts on Forests and the Carbon Cycle
- II. Pic: probably the iconic image of the mother tree surrounded by natives from James Cameron's AVATAR (since the trope of the film is "seeing" the value of the ecosystem of the planet, especially trees)

Introductions: On PINEMAP and Me (~ 5 minutes, tops)

- I. PINEMAP!
 - i. Collective of institutions and stakeholders wishing to research the complex relationship between humans, climate, and our natural resources (especially TREES) so that we can maximize the efficiency of human inputs to the ecological system with minimal environmental damage but maximum productivity. (pic of eddy flux system @ Alligator River)
 - ii. PINEMAP fellows spend one summer at a host institution conducting such research.
 - iii. I spent my summer under Asko Noormets at NCSU. (pic, soil respiration assay)
- II. But, who am I?
 - i. Brief summary of me & my home institution (pic: John Green on Middle Path @ Kenyon)

What does any of that even mean? (25-30 minutes) Humans have an intense and long term impact on our ecosystems, and we have a very effective tool (science) that helps us qualify and quantify that.

- I. The Carbon Cycle (pic: schematic of carbon cycle).
 - i. Overview of the carbon cycle (photosynthesis, respiration, carbon sources and sinks)
 - ii. The importance of trees, forests, in the carbon cycle.
 1. The importance of each part of the carbon cycle in how we manage natural resources like forests. (Aboveground vs underground carbon stores, fluxes)
 - iii. Human impacts on the carbon cycle (ie, fossil fuel dependence)
 1. Deforestation, forestry, and best management practices.
 2. Effects of deforestation and positive feedback loops (ie, more CO₂ means greater warming, which melts permafrost in the Arctic → trees there fall over and die, returning their stored carbon to the atmosphere → MORE warming.

How can we study forests to make sure they are still healthy and beneficial to humans?

- II. There's a lot of ways to manage forests, but science can help us identify the policies that are most effective by our PINEMAP standards.
 - i. Asko's underground carbon cycling studies focusing on root decay and harvest residuals. (pic: soil respiration assay w/deep root collars) (maybe a scientific figure or two from the Effects of Residuals on Forest Productivity paper)
 - ii. Wen Lin's study on water use efficiency in trees (pic: tree core reader and oscilloscope array).

- iii. Caveat: even though Wen's study focuses on water and trees, it's still an important piece of the global carbon cycle puzzle. Trees use water to add wood to themselves and also to sustain their leaves, so we need to know what functions trees prioritize under water stress and how that affects their inputs to the carbon cycle.

Why do any of this?

- III. Because healthy forests = healthy people
 - i. Forests produce the air we breathe (pic, girl using plant as a respirator w/ industrial wastescape in the background)
 - ii. Also clean water
 - iii. Cool the climate & add to biodiversity, which overall makes us healthier (pic, figure from Keesing *et al* 2010)
 - iv. Lumber & other economic goals.

Activity (15-20 minutes): Using tree cores to calculate the total biomass of a tree and how much C is in the tree using allometric equations (borrowed from Kerkhoff survey of Kenyon's Forests). Alt. activity: going outside and doing DBH's of trees outside, if possible.

Conclusion: Science is a very powerful tool that human society can use not only in the short term to benefit ourselves through things like medicine and industry; but also as a tool to develop long term strategies and goals to keep the forest ecosystems which sustain our civilization alive and beneficial to us.