

Title: Top-down effects of wildlife and bottom-up drivers of soils and productivity in intensively managed forest plantations

Investigators:

PI (point of contact): Jeff Hatten (Forest Engineering, Resources & Management)

Co-PIs: Matt Betts and Thomas Stokely (Forest Ecosystems and Society)

Project duration:

July 1, 2015 – June 30, 2017

Objectives:

1. Determine the quantity and quality of O-horizon available to arthropod detritivore communities and detrital arthropod prey to songbirds.
2. Characterize the interacting effects of IFM and bird abundance on detrital arthropod communities and relative decomposition rates.
3. Characterize the impact of IFM on cervid use and the subsequent effects on relative decomposition rates.
4. Characterize role of top-down and bottom-up processes on soil fertility and conifer growth.

Summary of accomplishments toward objectives over past 12 months:

Personnel:

- Graduate student (Dave Frey (FERM)) has been hired and funded for his first year of graduate school from a FERM department AOC fellowship. His second year of funding will be paid from this project.

Data Collection:

- All foliar samples were collected from 4 Douglas-fir trees in every treatment and enclosure December, 2015. These samples have been dried, ground, and analyzed for C&N. These samples are currently in the queue at the CEOAS Stable Isotope Lab for stable isotope analysis in order to examine treatment effects on water relations ($\delta^{13}\text{C}$) and nitrogen cycling ($\delta^{15}\text{N}$).
- All forest floor and mineral soil samples have been collected from each block, treatment, and enclosure. We expanded the soil sampling effort to include two mineral soil horizons (0-15cm and 15-30cm).
- All mineral soil samples have been dried, sieved, and ground and analyzed for C&N. These samples are in the queue at the CEOAS Stable Isotope Lab for stable isotope analysis in order to examine treatment effects on relative rates of cycling of carbon and nitrogen.
- Currently, due to variable quantities of decomposing wood in O-horizon samples among sites and blocks, O-horizons are in the waning stages of being sorted to remove decomposition class four and five materials. We are nearly complete with this process and most samples have been analyzed for C&N and sent to CEOAS Stable Isotope Lab.
- All soil samples' bulk density, moisture content, and pH have been determined.

- To better examine the effects of the treatments on decomposition we have established at litter-bag decomposition study. Five litter bags filled with a homogenous set of Douglas-fir needles picked from trees (to better represent the litter entering a site after harvest) has been installed in each treatment and enclosure. We have collected the first set of samples at 3 months and plan to collect the remainder (4) at 6, 12, and 24 months. This first set of litter bags (90 days) has been analyzed for C&N.

Problems, barriers, proposed changes to objectives:

- Bursle funnel analysis was unproductive, most likely due to disturbance of the O-horizon collection area when removing biomass. The process was aborted after completing a full block without successfully collecting arthropods. We will use arthropod data collected from sweep nets and pit traps to examine the impact of the treatments on the decomposer community. Dave Frey will begin the work of analyzing that data over the coming months.

Planned work:

- Determine total carbon and nitrogen contents for Oi, Oe/Oa, and separated decomposed wood
- Stable isotope analyses on all O-horizon components
- Loss-on-ignition on all O-horizon components
- Complete remaining stable isotope analyses on mineral soil samples
- Stable isotope analysis on foliar samples
- Collect remaining sets of litterbags
- Calculate mass loss for remaining litterbags
- Determine total carbon and nitrogen contents for remaining litterbags
- Sort O-horizons (sorting into decayed wood from previous stand and forest floor material from regrowing stand)
- Our goals:
 - Have all data (except litterbags) collected by January, 2017
 - Have all data analysis, reduction, and presentation (figures and tables) complete by March, 2017
 - Dave Frey's thesis defense in late Spring.

List of names and brief overview of graduate and/or undergraduate engagement in project:

Dave Frey has taken the lead on all soil sample collection, processing, and laboratory analysis. Dave will be taking the lead on all data analysis and manuscript/thesis preparation. He will also work with Thomas Stokely and other members of the research team to integrate these results into the efforts of the entire project.

Thomas Stokely is working with Dave to collect soil and vegetation samples and the assist the integration of soils and vegetation data into the overarching goals of the project.

Mandy Allen-Kahl (NR), Hayden England, and Ethan Donoghue are undergrads working on the project to assist in sample preparation and analysis.

List of presentations, posters, etc.:

- Frey, D., J. Hatten, T. Stokely, M. Betts. 2016. Top-down Effects of Wildlife and Bottom-up Drivers of Soils and Productivity in Intensively Managed Forest Plantations. 2016 Western Forestry Graduate Research Symposium, Corvallis, OR. April 22, 2016. (poster)
- Frey, D., J. Hatten, T. Stokely, M. Betts. 2016. Effects of the interplay between wildlife, plant communities, decomposition and soils on productivity in intensively managed forest plantations. 2016 Ecological Society of America Annual Meeting, Fort Lauderdale, FL. August 7-12, 2016. (poster)
- Frey, D., J. Hatten, T. Stokely, M. Betts. 2016. Effects of the interplay between wildlife, plant communities, decomposition and soils on productivity in intensively managed forest plantations. 2016 Soil Science Society of America Annual Meeting, Phoenix, AZ, November 7-9, 2016. (poster)

List of publications, thesis citations:

None to report