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Effects of Residual Biomass Harvesting on Soil Productivity

BACKGROUND

By using residual biomass from logging operations as feedstock, the Northwest Advanced Renewables Alliance (NARA) project aims to create a sustainable industry to produce aviation biofuels and value-added co-products.

Standard timber harvests leave behind tree tops and branches. When left on site to decompose, this residual biomass breaks down into organic matter that amends the soil while delivering key elements such as nitrogen, which aids growth of the next generation of trees. Four long-term study sites in western Washington and Oregon are yielding information about how soil productivity is affected by the removal of most woody biomass. These studies are part of NARA's effort to carefully assess the environmental impacts associated with production of wood-based biofuel to ensure the sustainability of a biobased aviation fuel industry.

KEY FINDINGS AFTER 10 TO 15 YEARS

Soil type matters

- Productivity of forest plantations at sites with rich, highly productive soil was minimally affected by removal of residual biomass.
- Plantation productivity was negatively affected at sites with coarse, lower productive soil.

Competing vegetation fills void, resulting in reduced tree growth

- Residual biomass can act as mulch, conserving soil water and cooling the soil, which inhibits germination of invasive species such as Scotch broom that competes with Douglas-fir for nutrients and light. It also provides habitat for native vines, which increases their growth and thereby excludes nonnative forbs, grasses, and shrubs.
- Removing residual biomass does increase soil temperatures and water infiltration, which likely increases soil mineralization rates and potential for nitrogen loss via soil leaching.

Soil compaction isn't an issue

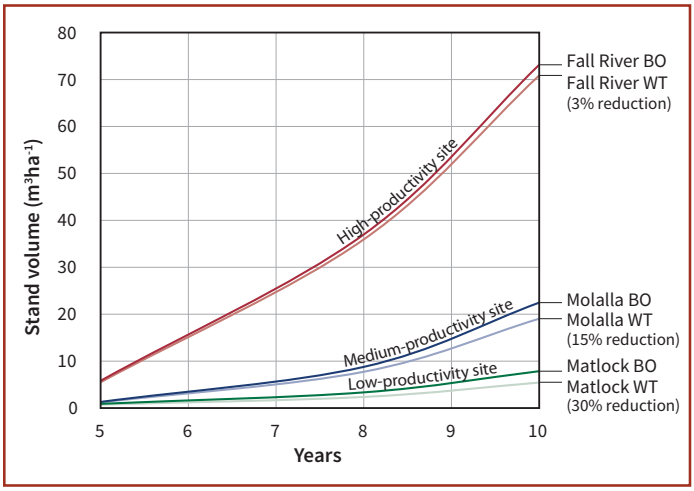
- Standard harvesting practices did not negatively affect plantation productivity. A positive response was seen at sites with coarser soil, likely because compaction increases water-holding capacity of soil.

Concentration of soil nutrients varies by soil depth

- Investigating the effects of removing residual biomass requires deep soil sampling. Upper soil horizons have the highest soil nutrient concentrations, whereas a large percentage of total soil nutrients is found below the standard sampling depth of 8 inches.

CONSIDERATIONS

Forest plantation development at the older study sites is approaching, or has recently reached, canopy closure when nutrient limitations may be strongest. The newest study site, established in 2013, is in a warmer, drier area of the Douglas-fir range compared to the other three. Effects of residual biomass harvesting on tree regrowth at this site are still to be determined.



The effect of residual biomass removal (BO =bole only, WT = whole-tree removal) on three stands in the Long-term Soil Productivity study. Stands with lower soil productivity showed a greater reduction in stand volume 10 years after residual biomass removal compared to sites with high to medium productivity.

ABOUT NARA

NARA was funded from 2011 through 2016 by Agriculture and Food Research Initiative competitive grant no. 2011-68005-3016 from the USDA National Institute of Food and Agriculture.

https://nararenewables.org/

NARA

Northwest Advanced Renewables Alliance

Led by Washington State University, the NARA project includes a broad alliance of private industry, government laboratories, and educational institutions throughout the United States. The project includes study sites affiliated with the North American Long-Term Soil Productivity Network (Fall River, Matlock, and Molalla) which were established with support from the forest industry and U.S. Forest Service Research and Development through the Agenda 2020 Program.

Washington State University