

SENT TO LSU AGCENTER/LOUISIANA FOREST PRODUCTS DEVELOPMENT CENTER - FOREST SECTOR / FORESTY PRODUCTS INTEREST GROUP



Led by Washington State University and funded by the USDA National Institute of Food and Agriculture, the Northwest Advanced Renewables Alliance (NARA) is helping to develop a sustainable industry in the Pacific Northwest that uses wood residuals to make bio-jet fuel and valuable co-products. The alliance includes public universities, government agencies, private industry and interested stakeholders and is tasked with delivering the following:



**Sustainable aviation biofuel from woody biomass**



**Value-added polymer and carbon products from lignin**



**Regional supply chain coalitions**



**Rural economic development**



**Bioenergy literacy**

In this final year of the project, NARA will be producing 1,000 gallons of cellulosic-based bio-jet (IPK) from Northwest forest residuals, the tree limbs and branches that remain after a forest harvest. [Alaska Airlines will be flying a demonstration flight](#) next year using NARA produced cellulosic-biofuel.

To disseminate findings of our research, NARA will be hosting a Wood-To-Biofuel Webinar series summarizing the research and results of converting slash to biofuel while recognizing and conducting sustainable analysis (triple bottom line).

We are commencing this webinar series in October that celebrates the National Bioenergy Day on October 21.

**Who is it for?** These webinars would benefit industry (primary and secondary manufacturers, chemical, and biofuel), researchers, contractors, land managers, policymakers, state and local agency personnel, NGOs, educators, and students – all who are interested and involved in operations converting forest-based biomass to biofuels and co-products. Following are five webinars hosted in the month of October. Additional webinars will be posted to this webpage for future months as they are scheduled.

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Incorporating Timber Product Output (TPO) harvest residue information and forest market models to evaluate biorefinery siting potential

**November 19, 2015 | 9am PST**



Todd Morgan, Director, Forest Industry Research, Bureau of Business and Economic Research, University of Montana

Greg Latta, Assistant Professor, Senior Research, Forest Engineering, Resources & Management, College of Forestry, Oregon State University

NARA scientists have focused on building supply chain solutions demonstrating forest harvest residues as a viable source of woody feedstock for production of biojet. A key aspect in supply chain logistics is biorefinery siting, a fundamental component of which is knowledge of the current spatial allocation of the resource and how that allocation may change over time. U.S.D. A. Forest Service Forest Inventory and Analysis (FIA) TPO data is a consistent and comparable source of county-level harvest residue information. The Forest Industry Research Program at the University of Montana's Bureau of Business and Economic Research (BBER) collects and compiles logging utilization and TPO data for the 4-state project area. Since the NARA study began in 2011, BBER researchers have measured more than 2,500 felled trees within 108 logging sites. The NARA project uses this data to characterize how current forest harvest residues vary by region, county, ownership source, pulp removal, logging systems employed, and tree attributes such as species. To evaluate how that supply might change over time NARA utilizes spatially explicit economic models of forest products markets which balance harvests on FIA plots with demand for logs at regional mills. The resulting spatial allocation of logging operations for products such as lumber, plywood, and paper products is then further refined with the TPO data to assess future potential harvest residue availability. The combined information regarding current and potential future forest harvest residue supply coupled with collection and transportation cost data are used to generate supply cost estimates specific to any desired biorefinery site across OR, WA, ID, or MT.

Bios:

Todd Morgan is the director of the Forest Industry Research Program at the University of Montana's Bureau of Business and Economic Research. His research experience is related to wood supply and utilization in the western United States. His program collects and reports timber products output data for 13 western states to the U.S. Forest Service's Forest Inventory and Analysis Program. In addition, Morgan's program performs timber harvesting and hauling cost analyses for the Forest Service Northern Region, provides economic impact information related to timber harvest and utilization levels

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throughout the West, monitors timber processing capacity and mill operations in the West, and collects and reports quarterly delivered log prices and forest industry employment and production in Montana. Todd earned his M.S. in Forestry from the University of Montana in 1999, and his B.S. in Forest Science from Penn State in 1997.

Greg is an assistant professor, senior research within the Department of Forest Engineering, Resources and Management at Oregon State University. His research area of interest is the development and application of regional and national models of timber forest product markets. For NARA, he works within the biomass modeling and assessment group. Greg provides oversight of, and guidance for, the development of the market model and its extension to include biomass removals and transport within the NARA regions. As the project generates usable output, Greg participates in the authorship of reports and publications based on modeling results and analysis. Greg received a B.A. in economics at the University of California Santa Barbara, M.S. in forest resources at Oregon State University, and Ph.D. in forest and resource economics at the Norwegian University of Life Sciences.

Register for this webinar at <https://attendee.gotowebinar.com/register/3156963235974222850>

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#### Long-term soil productivity and sustainability of forest harvest residue harvesting October 30, 2015



By Jeff Hatten, Assistant Professor, Oregon State University; Scott Holub, Silviculture Research Scientist, Weyerhaeuser NR Company

Forest harvesting intrinsically removes organic matter and associated nutrients; these exports may impact soil productivity of managed forests. We will examine the effects of removing forest floor and harvest residues on soils and sustainable production in intensively managed Douglas-fir forests of the Pacific Northwest. We will discuss the amount and types of biomass being removed and how biomass harvesting impacts various nutrients (e.g. nitrogen, phosphorus, calcium). Nutrient removals may impact long-term production or growth in these forests, and we will use simple thresholds and nutrient budgets to examine this trend. Finally, we will discuss the limitations of this approach and opportunities for further research. Webinar attendees will come away with an understanding of the issues surrounding long-term sustainability in forest residue harvesting scenarios and the limitations of our knowledge on these issues.

View this webinar at <https://youtu.be/Bkho8fsrZGA>

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Woods-to-Wake' life cycle assessment of residual woody biomass based jet-fuel

October 21, 2015



By Indroneil Ganguly, Assistant Professor, Research, University of Washington

The residual woody biomass (a.k.a harvest slash) produced during forest harvest operations in the Pacific Northwest, is generally burned in the forest or left on the forest floor to decompose. Drop-in biofuel production from these residual cellulosic feedstock can provide an alternative to utilizing this unused resource and simultaneously displace fossil based fuels. Utilizing a 'woods-to-wake' (WTWa) Life Cycle Assessment (LCA) methodology, which is comparable to well-to-wake for its fossil based counterpart, this paper assesses the environmental implications of recovering these harvest residues to produce woody biomass based bio-jet fuel.

The woody biomass to bioconversion process presented in this paper uses a milder version of bisulfite pre-treatment of the feedstock liberating the C6 sugars which then go through enzymatic hydrolysis, saccharification and fermentation producing isobutanol (iBuOH). The isobutanol is then converted to bio-jet fuel (iso-paraffinic kerosene, IPK) using a proprietary biocatalytic fermentation and oligomerization processes. The woods-to-wake environmental impacts of woody biomass jet-fuel are then compared to WTWa impacts of fossil based jet-fuel. The results indicate that the woods-to-wake global warming impact of wood based bio-jet fuel represents a 60% or greater reduction as compared to WTWa of traditional jet fuel.

View this webinar at <https://youtu.be/YK-IcYqQjDY>

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## Characterization of forest residuals for bio-jet fuel production

**October 19, 2015**



By Gevan Marrs, Feedstock Sourcing, NARA

Softwood feedstock samples collected throughout the Pacific Northwest have been characterized for carbohydrate, lignin, and extractives content. Some of the samples have received exhausting testing through pretreatment, hydrolysis and fermentation into alcohols. In addition, the cost impacts associated with various feedstock processing options have been quantified in order to evaluate the economic impacts to deliver a “standard sized” feedstock product for conversion into bio-jet fuel and co-products.

View this webinar at <https://youtu.be/gcDjDaafxlg>

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## Decision support for forest harvest residue collection

**October 14, 2015**



By John Sessions, University Distinguished Professor and Rene Zamora-Cristales, Post Doctorate, Oregon State University

Forest harvest residues are often available at roadside landings as a byproduct of the log manufacturing process. This residue is usually available for renewable energy production if desired, however there is a significant amount of residues that do not reach the landing during the harvesting process that could potentially increase the supply of forest biomass from each harvest unit. The proportion of recoverable residues depends on their collection costs which are a function of the distance from roadside landing, terrain conditions, and collection method as well as subsequent truck transportation costs. Residues close to landings and nearest to the processing center will usually have the lowest delivered costs. Tradeoffs between increasing truck transportation costs and increasing collection costs affect which residues will be collected to reach a supply target or residue payment price. A forest residue collection



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model using forwarders and excavator loaders is presented to estimate the potential cost of biomass extraction from the forest to roadside landings. Tradeoffs between increasing collection costs and increasing road transportation are examined. The impact of tax credits and site preparation savings are discussed. On flatter terrain, one excavator is efficient at short distances. As distance from landing increases, one excavator loading one forwarder becomes more efficient, and at long distances, one excavator loading two forwarders becomes more efficient.

View this webinar at <https://youtu.be/i5xOUmmdtC4>

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