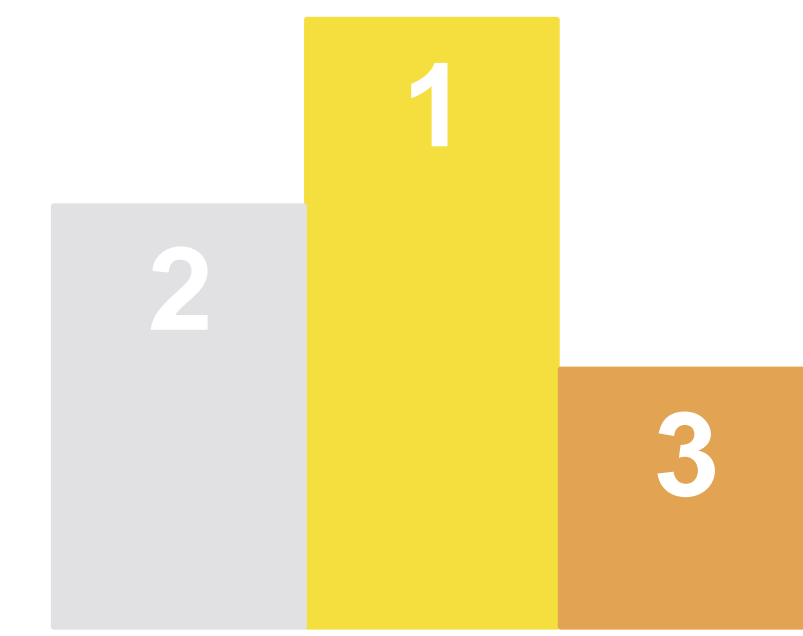
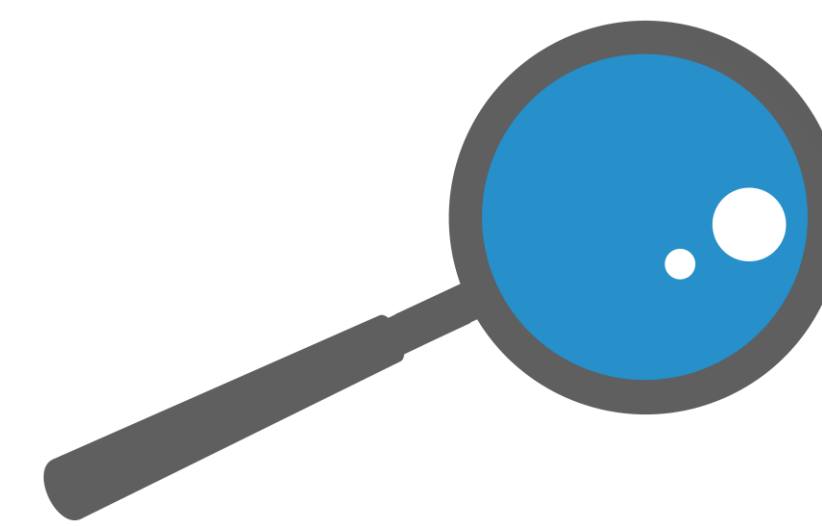
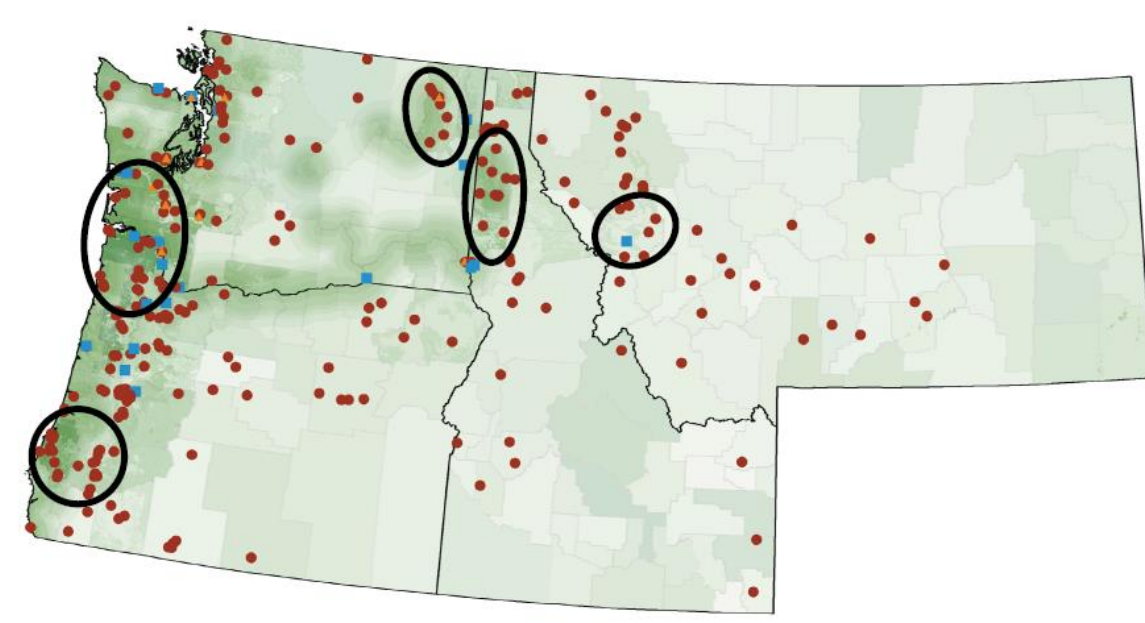
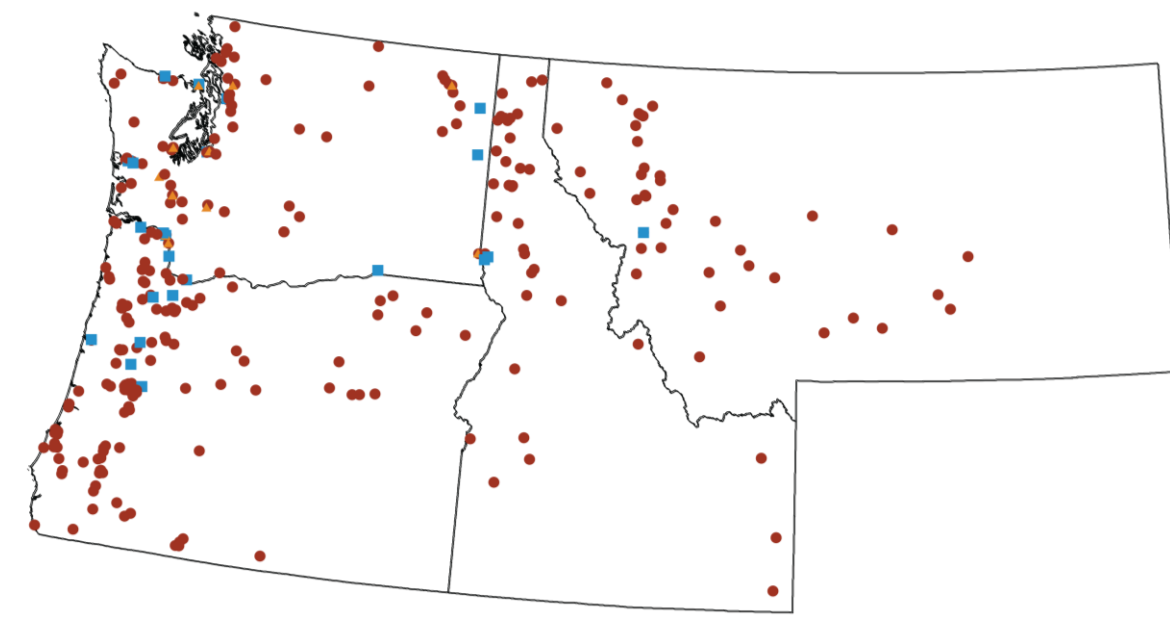




Wood to Wing: Site Selection Methods for a Biofuel Supply Chain

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Washington State University



Site Identification

Viability Mapping

Site Specific Inventory

Matrix Compilation

Introduction

The Integrated Design Experience (IDX) team at Washington State University is currently researching how to efficiently improve a supply chain that takes woody biomass from forest residuals, and through the Northwest Advanced Renewables Alliance (NARA) procedure, create a sustainable aviation biofuel. For this process, slash piles are utilized as the primary biomass because it would add jobs and stability to the local communities; currently the slash piles are being burned on site for no capital benefit and act as a carbon source.

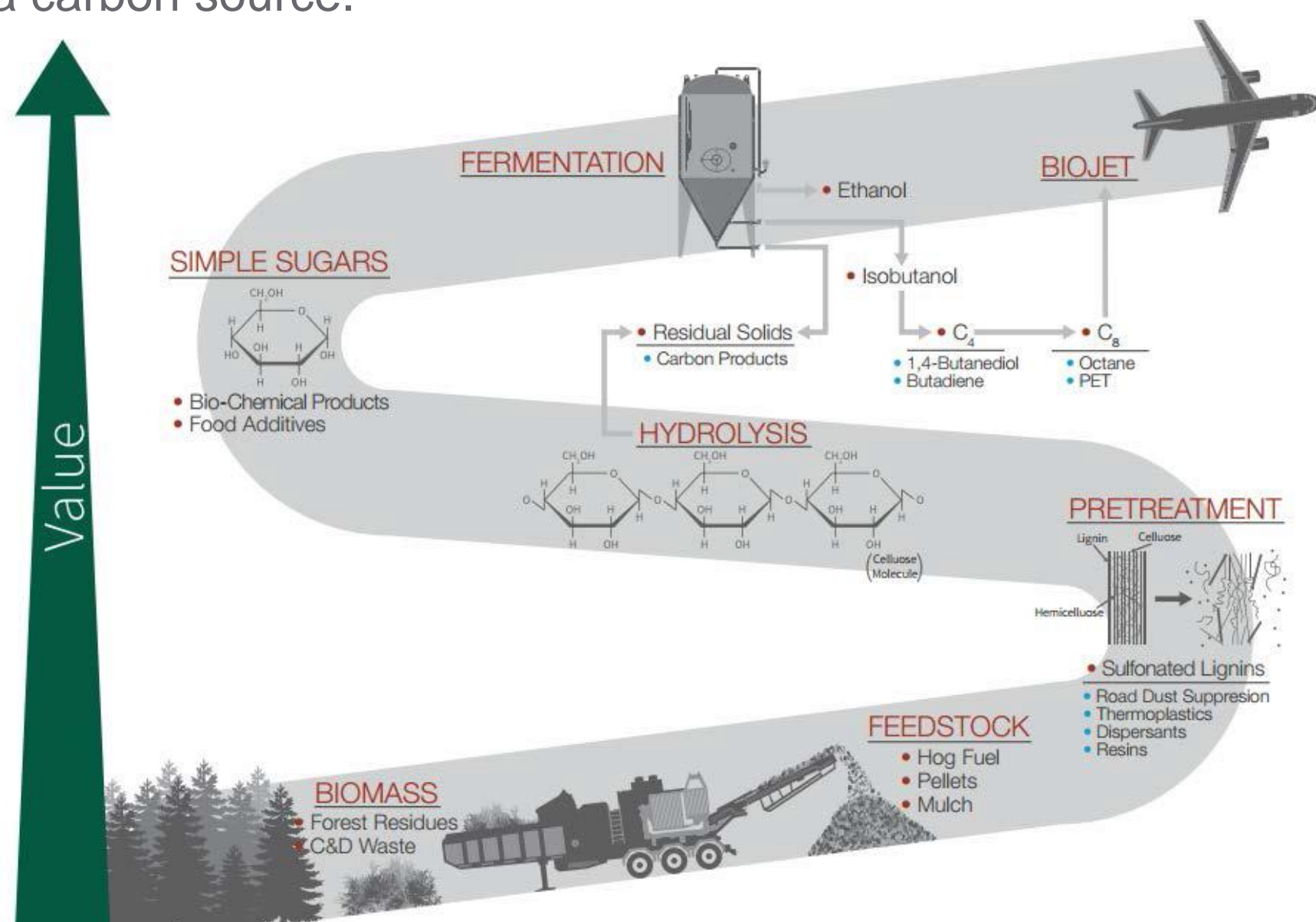


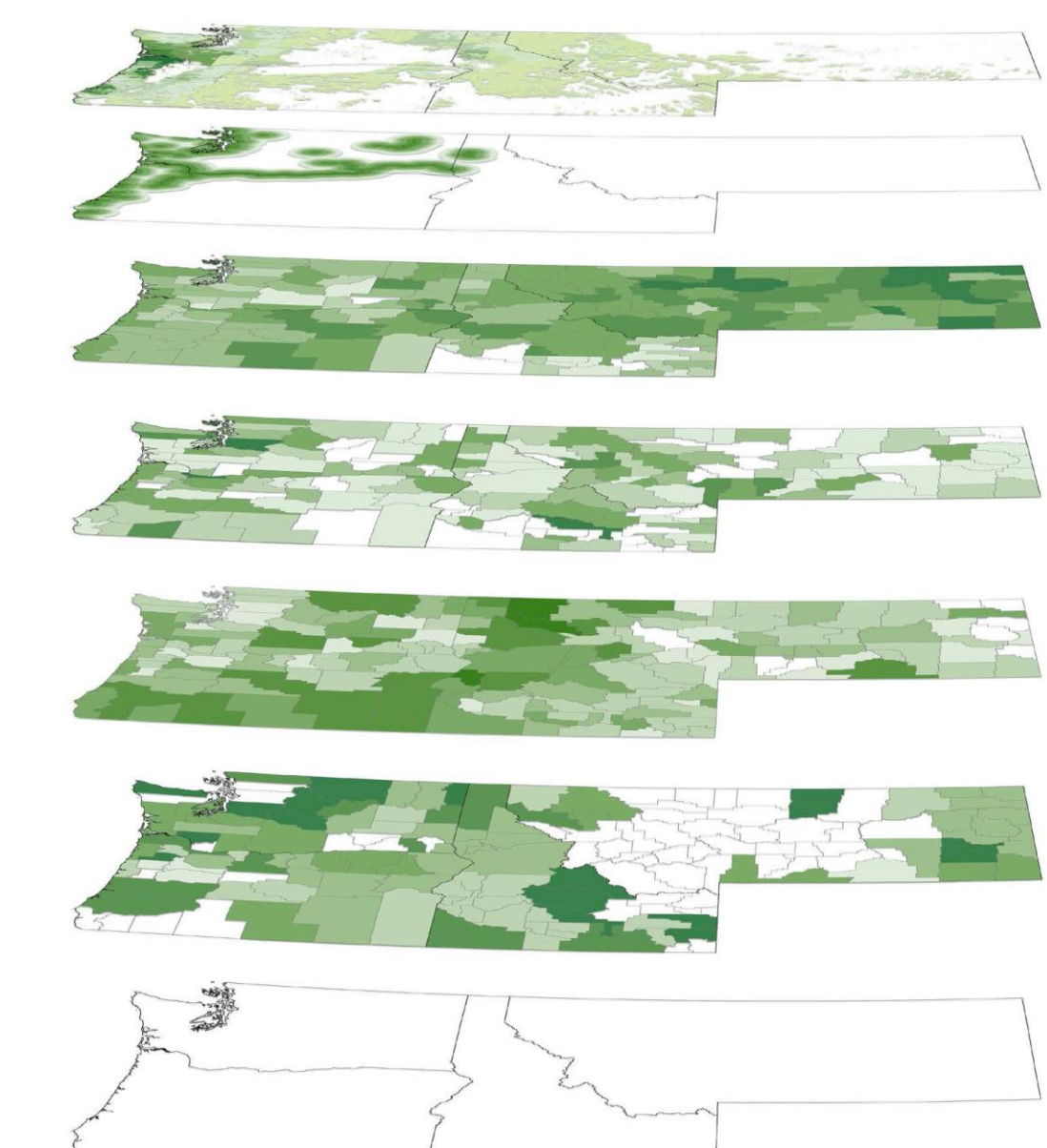
Figure 1: The NARA supply chain model for biofuel production in the Northwest.

Site Selection Process

To begin the process of identifying potential sites the IDX team performed a regional analysis of the Pacific Northwest region of Washington, Idaho, Montana and Oregon by using various physical and social factors. This gave the team regional hot spots that could be analyzed for the most suitable site for the NARA process. These locations included sites such as current pulp and paper mills, chip mills, saw mills and ethanol plants.

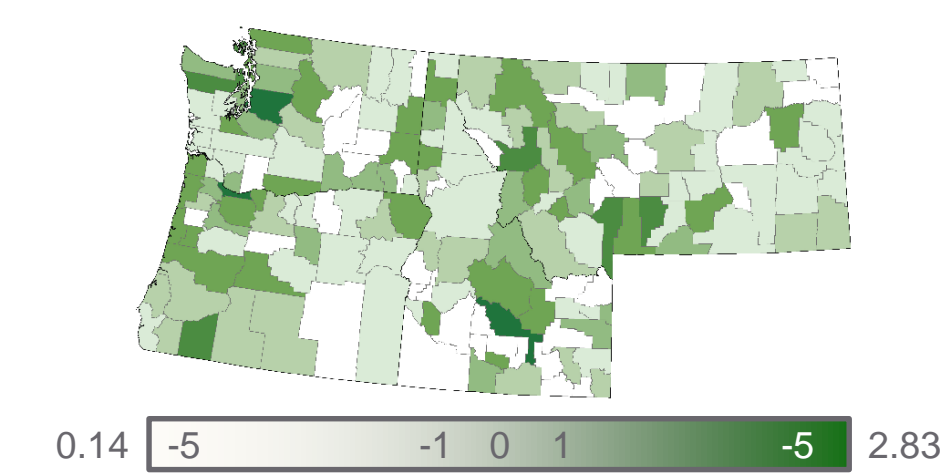
Once the regional analysis was complete, the site process continued by choosing the top fifty sites from the regional analysis. The team then examined these top fifth sites on a site-by-site basis, and created a site inventory that utilized more detailed factors to further rank these top sites.

Factors include biomass availability, labor costs, electricity rates, building and operations taxes, creative vitality index, poverty rates, natural gas rates, acreage, transportation on site, environmental permitting, wastewater treatment availability, boiler availability, and the type of the facility being examined. These factors gave the team the ability to rank the top five potential site locations for each facility type that could be utilized for the NARA supply chain processes.

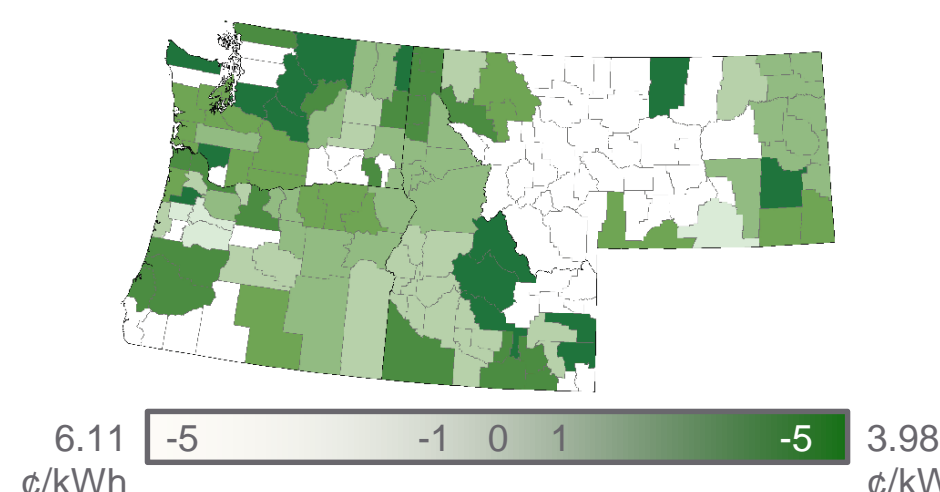


“Hot Spot” Map Layering

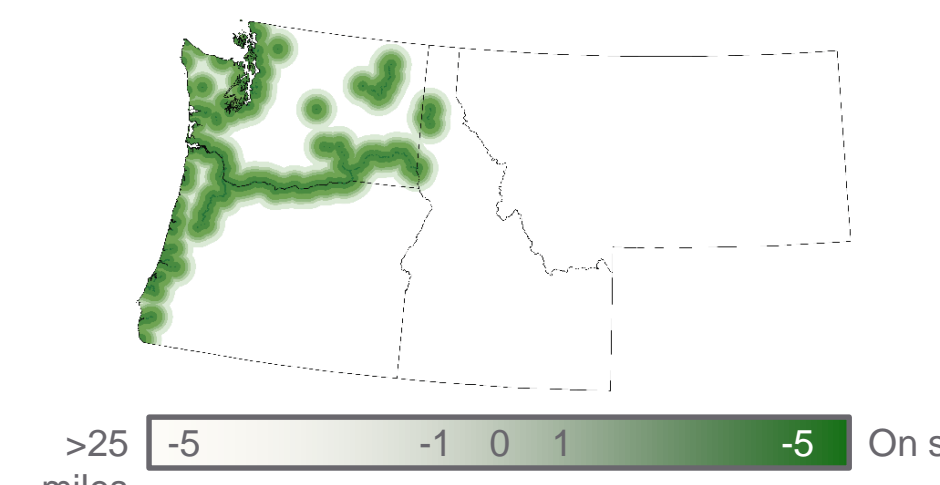
Creative Vitality Index



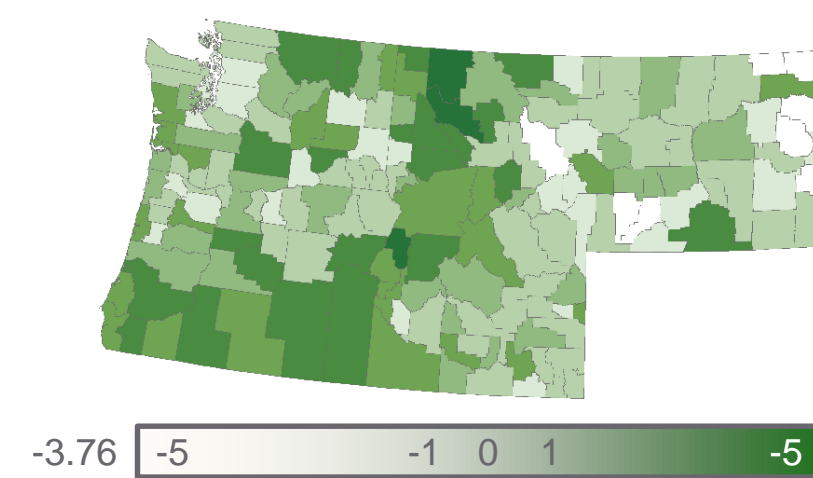
Electrical Rates



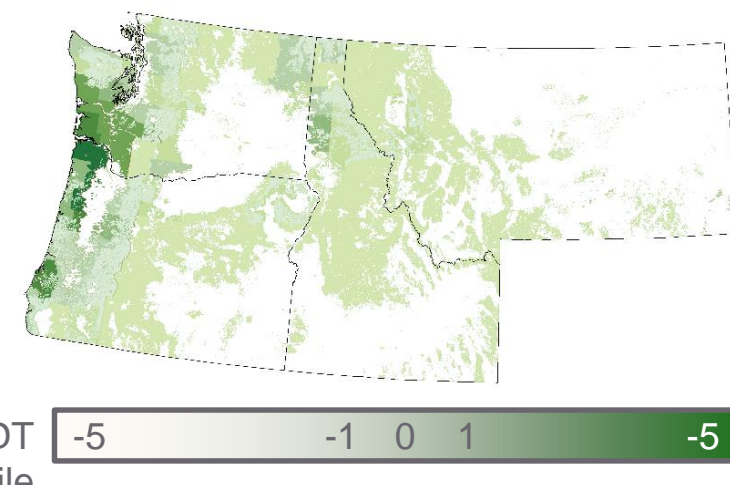
Port Access



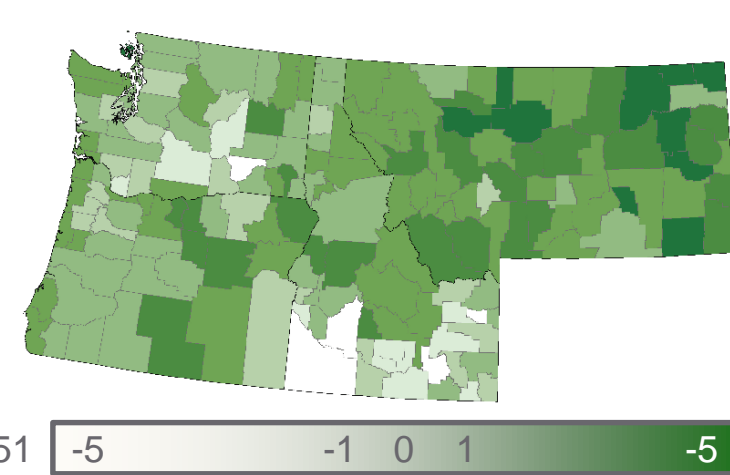
Poverty Rate



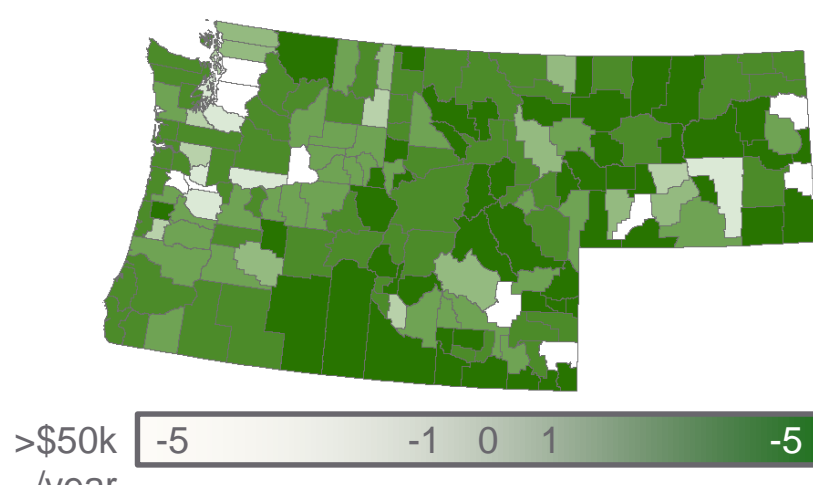
Biomass Availability



Social Capital



Relative Labor Cost



Conversion Depot Matrix

		Regional								Site Specific							Score		Rank	
		Opex					Capex			Opex		Capex								
		Dist from Preconversion	Dist to Market	Labor Cost	Electricity Rate	B & O tax	CVI	Social Index	Poverty	Natural Gas Rate	Transportation	Acreage	Permitting	Wastewater	Boiler	Other Infrastructure				
Site	Location	5.99	0.68	2.55	1.52	0.43	0.17	0.17	0.17	0.31	1.20	0.05	0.05	0.47	0.97	5.24				
Georgia-Pacific Corporation	Camas, WA	3	4	-2	-5	5	0	-2	-1	-4	5	-2	5	5	3	2	30.3	1		
Georgia Pacific Corporation – Wauna Mill	Clatskanie, OR	3	-5	2	4	-5	-3	1	-1	-4	0	5	2	5	1	0	25.5	2		
North Pacific Paper Corporation (NORPAC)	Longview, WA	0	-4	-1	5	5	-3	0	1	-3	0	-5	-5	0	1	3	19.4	3		
KapStone Kraft Paper Corporation	Longview, WA	0	-3	-1	5	5	-3	0	1	-3	5	1	5	5	1	0	13.5	4		

After researching each site and completing the site inventory, the IDX Team developed a ranking system based on the relative importance of each asset to the type of facility being considered and the quality/quantity of the asset. This ranking system featured a matrix focused on economic, social and environmental aspects of each individual site. Each site was entered into this ranking matrix and the top sites were found for each type of facility in the NARA Supply Chain: Solids Depot, Liquids Depot, Conversion Facility, and Integrated Biorefinery.

Though the top sites were found for all these facilities, the focus of the IDeX team moved to the design of a Liquids Depot.

Top Sites

Site	Location	Score	Rank
RSG Forest Products - Olympic Forest Products	Mist, OR	56.0	1
Georgia Pacific Corporation – Wauna Mill	Clatskanie, OR	45.8	2
Stimson Lumber Company	Clatskanie, OR	37.0	3
Hampton Lumber Mills Warrenton	Warrenton, OR	16.6	4
Weyerhaeuser Longview Mill	Longview, WA	16.3	5



Solid Depot



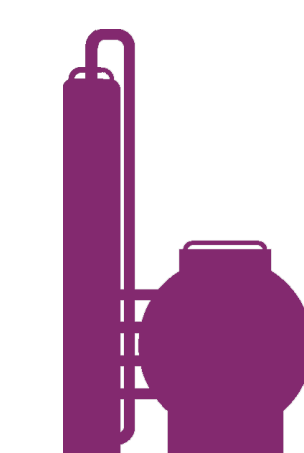
Liquid Depot

Site	Location	Score	Rank
Georgia Pacific Corporation – Wauna Mill	Clatskanie, OR	44.5	1
RSG Forest Products - Olympic Forest Products	Mist, OR	31.7	2
Georgia-Pacific Corporation	Camas, WA	26.9	3
Cosmo Specialty Fibers, Inc. (CSF)	Cosmopolis, WA	24.6	4
North Pacific Paper Corporation (NORPAC)	Longview, WA	22.4	5
KapStone Kraft Paper Corporation	Longview, WA	20.4	6

Site	Location	Score	Rank
Georgia-Pacific Corporation	Camas, WA	30.3	1
Georgia Pacific Corporation – Wauna Mill	Clatskanie, OR	25.5	2
North Pacific Paper Corporation (NORPAC)	Longview, WA	19.4	3
KapStone Kraft Paper Corporation	Longview, WA	13.5	4



Conversion Facility



Integrated Biorefinery

Site	Location	Score	Rank
Georgia-Pacific Corporation	Camas, WA	41.2	1
North Pacific Paper Corporation (NORPAC)	Longview, WA	32.5	2
Cosmo Specialty Fibers, Inc. (CSF)	Cosmopolis, WA	26.3	3
Georgia Pacific Corporation – Wauna Mill	Clatskanie, OR	24.8	4
KapStone Kraft Paper Corporation	Longview, WA	11.7	5

Conclusion and Next Steps

From our analysis, it was determined that biomass availability for sites largely dictated sites rankings. The factors that were created in order to rank the sites gave the IDX team the ability to rank the top five potential site locations for each facility type that could be utilized for the the NARA supply chain processes. The next steps for the team are:

- Sensitivity Analysis
- Gather more site specific/company information
- Further examine native American tribal lands
- Perform specific site design

NARA

Northwest Advanced Renewables Alliance

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