

Feedstock Options for the Northwest

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Feedstock and Conversion

Previous Activities in the Northwest

- WA Dept of Ecology Biomass Inventory
- NARA – Forest Residuals
- AHB – Poplar
- SAFN Focus Feedstocks

Snapshot of Northwest Feedstocks and Potential Fuels

Supply Chain Considerations

- ASCENT – Oilseeds and Waste FOGS
- NARA – Forest Residuals

TODAY'S TALK

Approved	Gasification & FT (FT-SPK)	50% max blend
	Hydroprocessing (HEFA-SPK)	50% max blend
	Biochem sugars (HFS-SIP)	10% max blend
	Aromatic tweak of FT (FT-SPK/A)	50% max blend
	Conversion of alcohols (ATJ-SPK)	30% max blend
Feedstocks	FT-SPK	Lignocellulosics, MSW Fats, Oils, Grease Sugar, Starch, Cellulose Lignocellulosics, MSW Sugar, Starch, Cellulose
	HEFA-SPK	
	HFS-SIP	
	FT-SPK/A	
	ATJ-SPK	

Modified from: S. Csonka (2017) The development and commercialization of Sustainable Alternative Jet Fuel (SAJF).
ATIP Regional Forum. Richland, WA.

PATHWAY	PRODUCT YIELD (gals/BDMT feedstock)
ATJ	57
Pyrolysis	60-65
GFT	46-53
HEFA	285-290

- Extensive inventory of 45 sources in WA
- Agricultural and Industrial Biomass Waste
- Available Mass Estimates
- County Level
- Low Resolution

DEPT OF ECOLOGY

BIOMASS INVENTORY



Biomass Inventory and Bioenergy Assessment

An Evaluation of Organic Material Resources for Bioenergy Production in Washington State

December, 2005



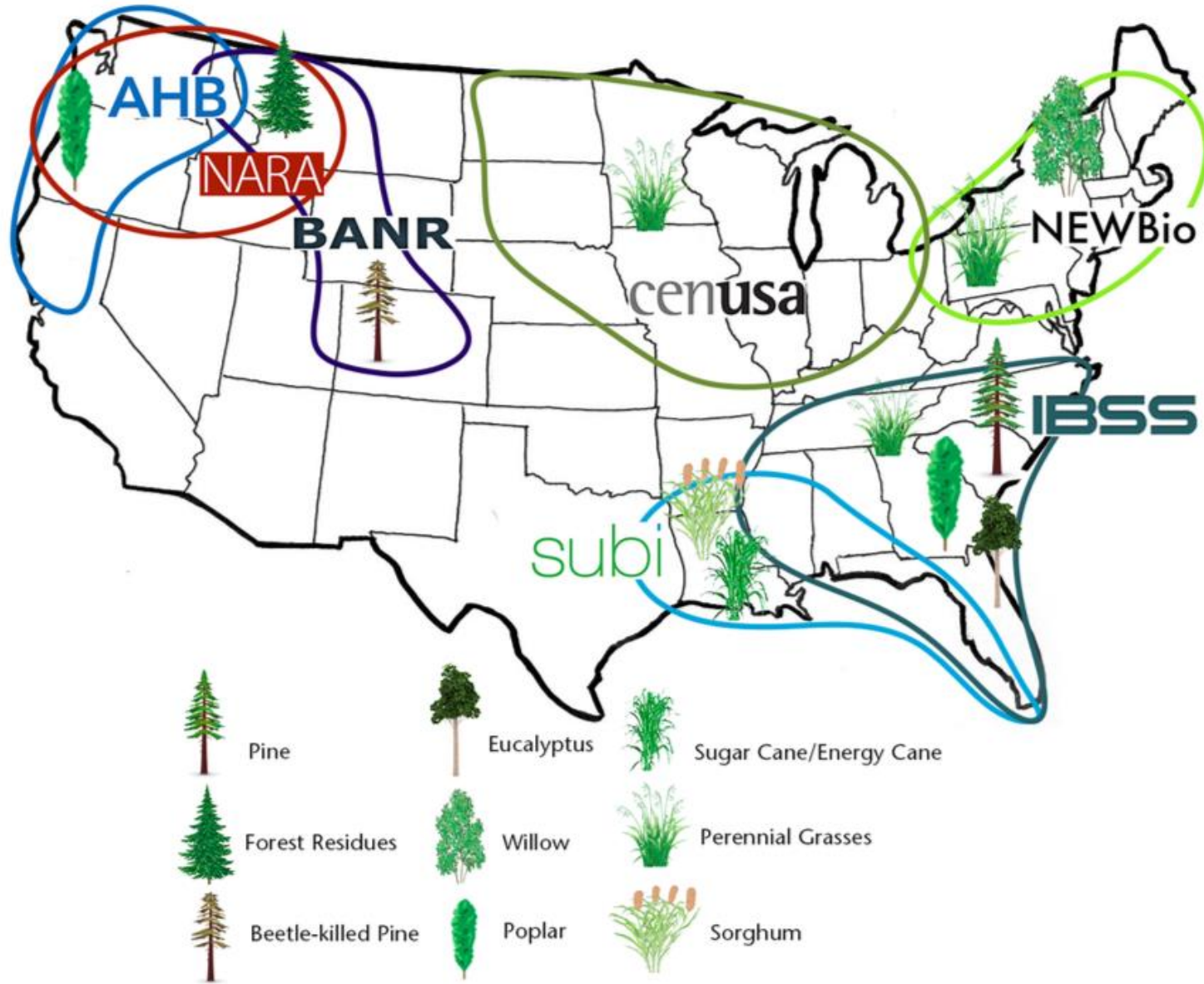
Publication No. 05-07-047
printed on recycled paper



Frear, C., Zhao, B., Fu, G., Richardson, M., Chen, S. and Fuchs, M., 2005. Biomass inventory and bioenergy assessment: an evaluation of organic material resources for bioenergy production in Washington State. Department of Biological Systems Engineering, Washington State University and the Solid Waste and Financial Assistance Program, Department of Ecology, publication, (05-07), p.047.

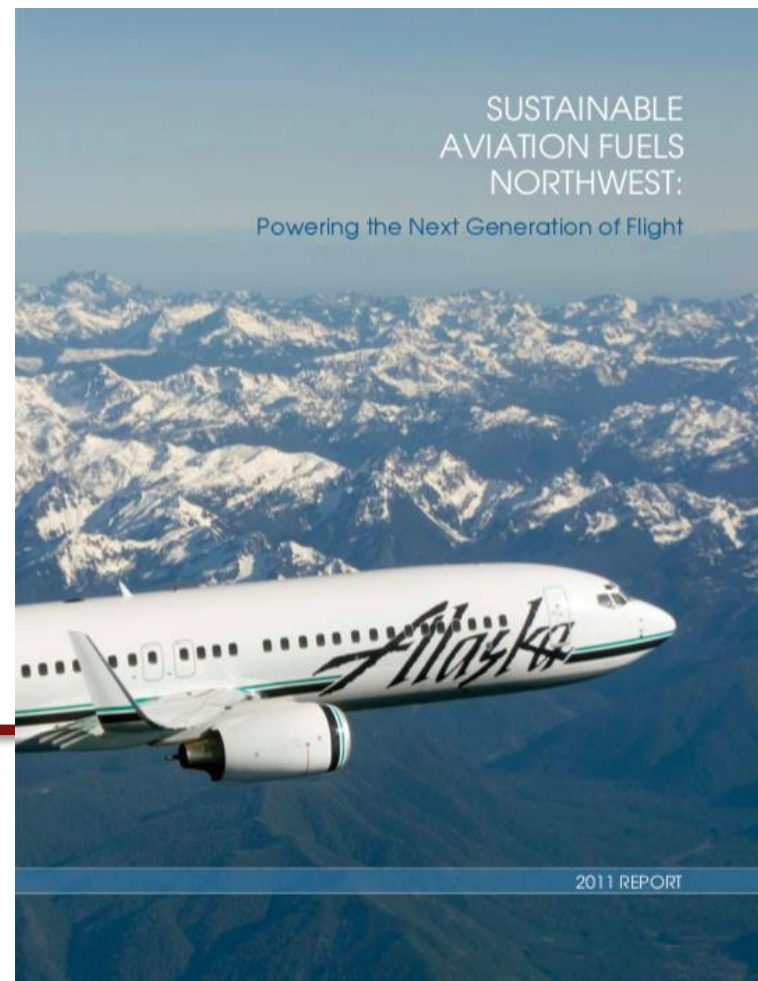
USDA Feedstock Supply Chain Programs

2019 – Washington SAF
Seattle, WA



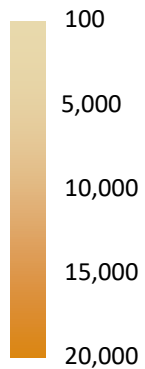
No single feedstock or technology pathway is likely to provide sustainable aviation fuel at the scale or speed needed to achieve our goals. Therefore, this report focuses on a portfolio of options. They include different conversion technologies and sources of potentially sustainable biomass, including oilseeds, forest residues, solid waste, and algae.

SUSTAINABLE AVIATION FUELS NW



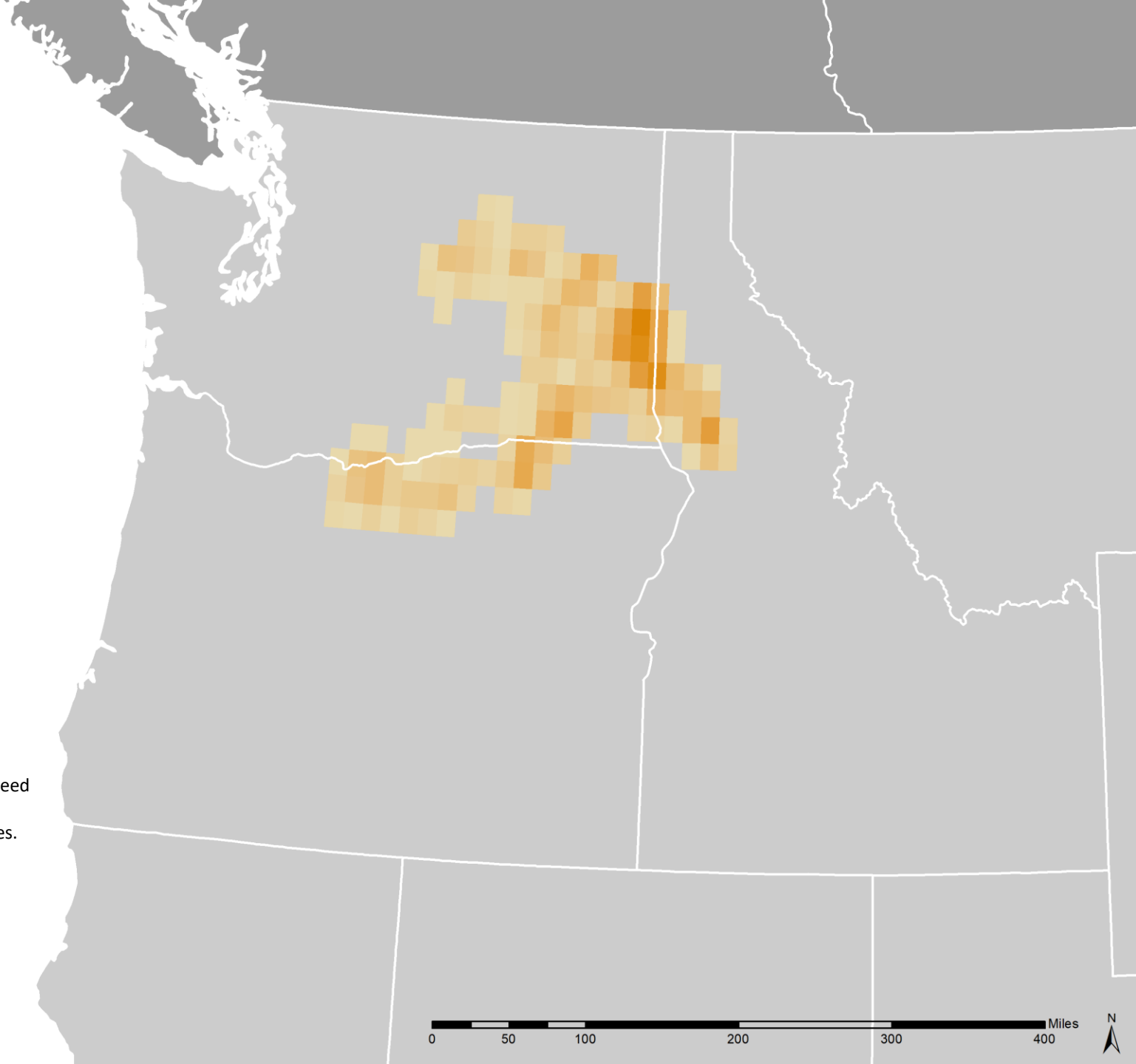
Oil from Oilseeds

(MT/yr)



¼ degree grid cells

Map shows Maximum Oilseed
Production Scenario:
Would require ~1.8 M acres.
2017: 86,000
2018: 118,000
US Canola Association

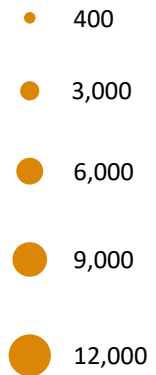


0 50 100 200 300 400 Miles

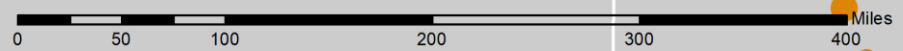
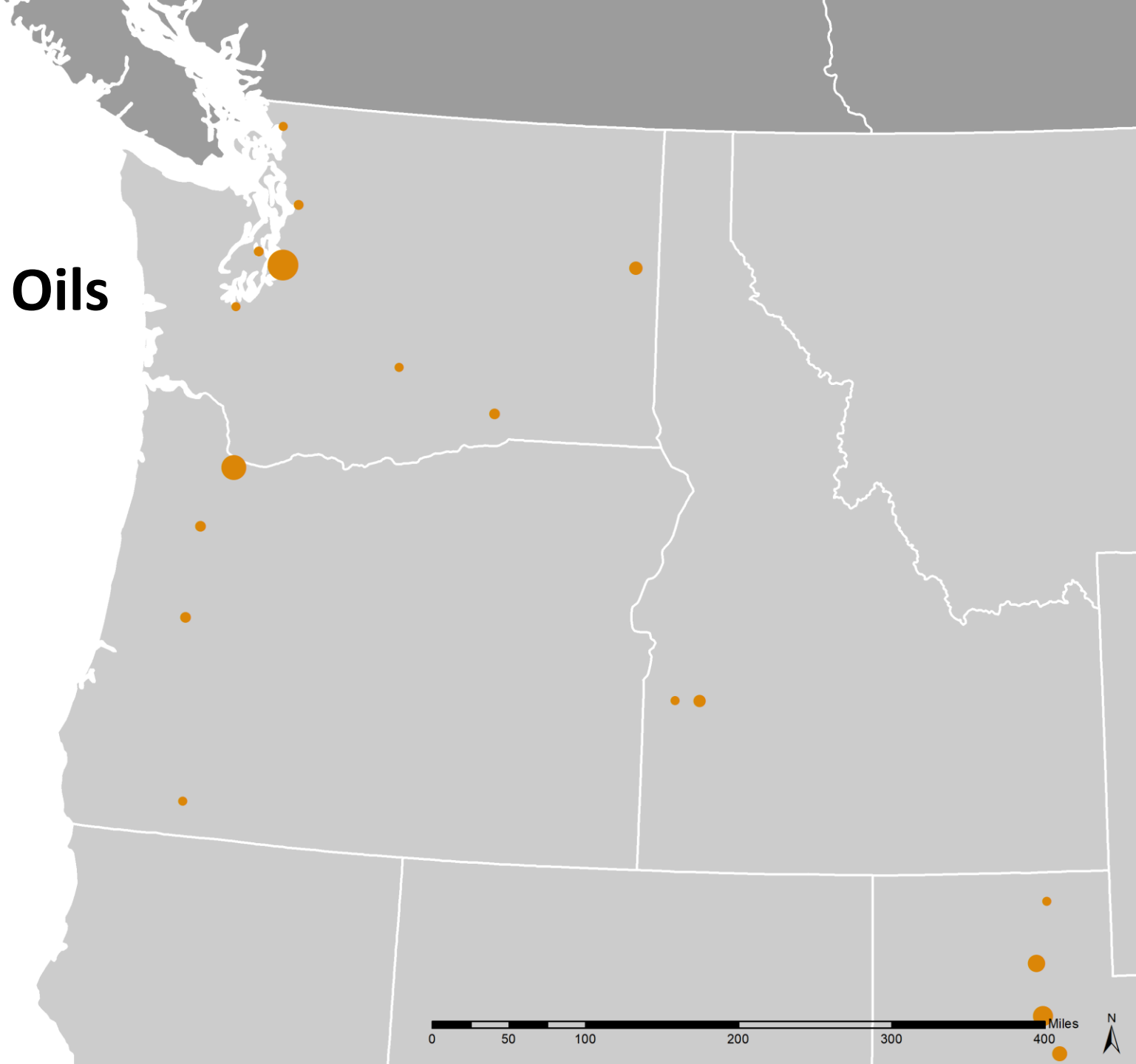


Used Cooking Oils

(MT/yr)



Census Bureau
Urban Areas with
Population greater
than 100,000



Animal Fats

(MT/yr)

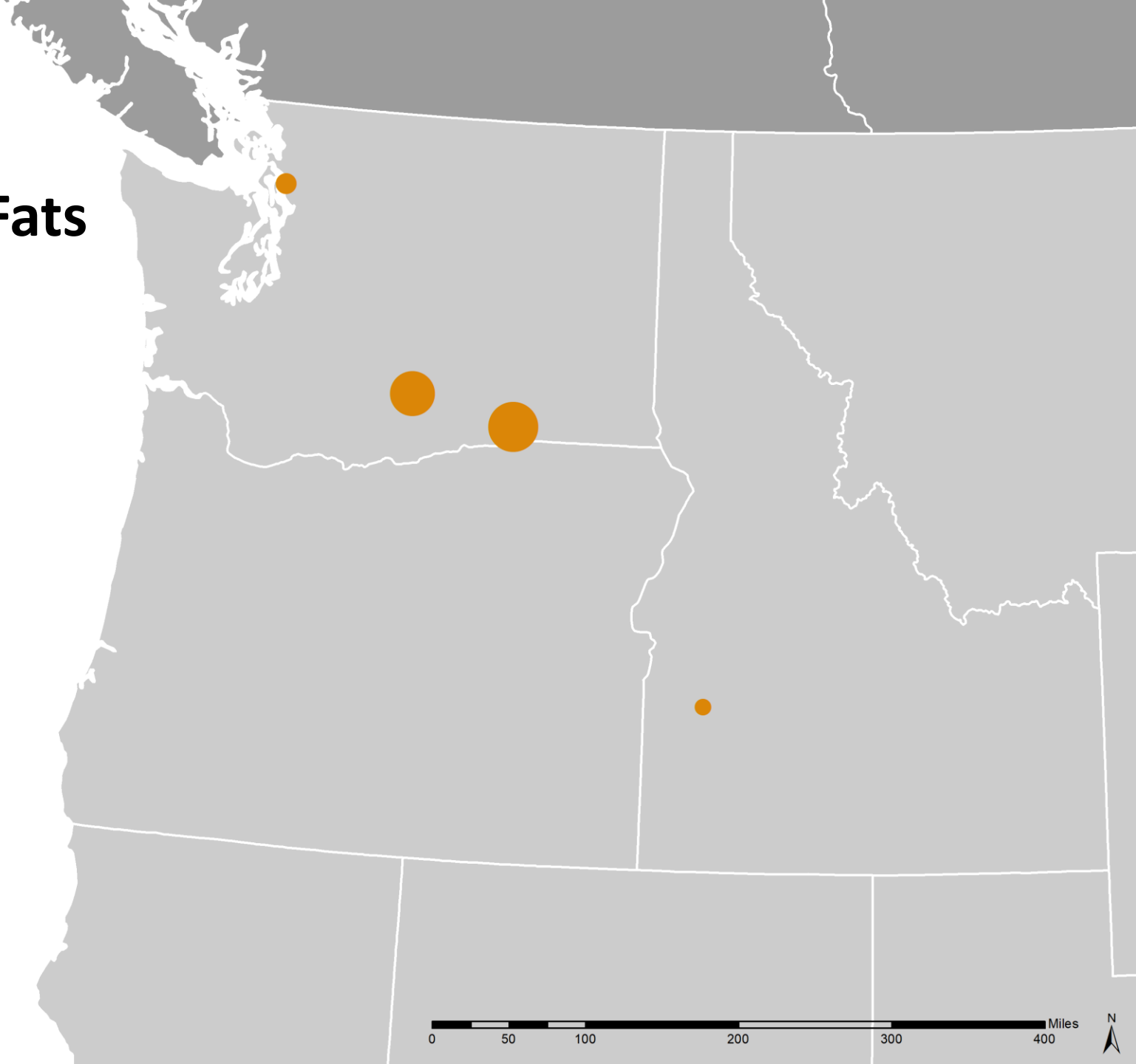
● 3,000

● 15,000

● 30,000

● 45,000

Production at
Major Packing
Plants

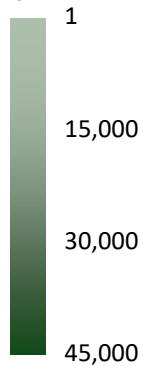


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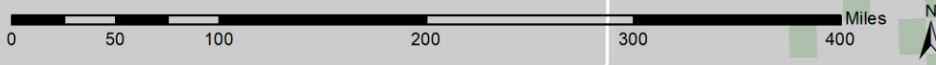
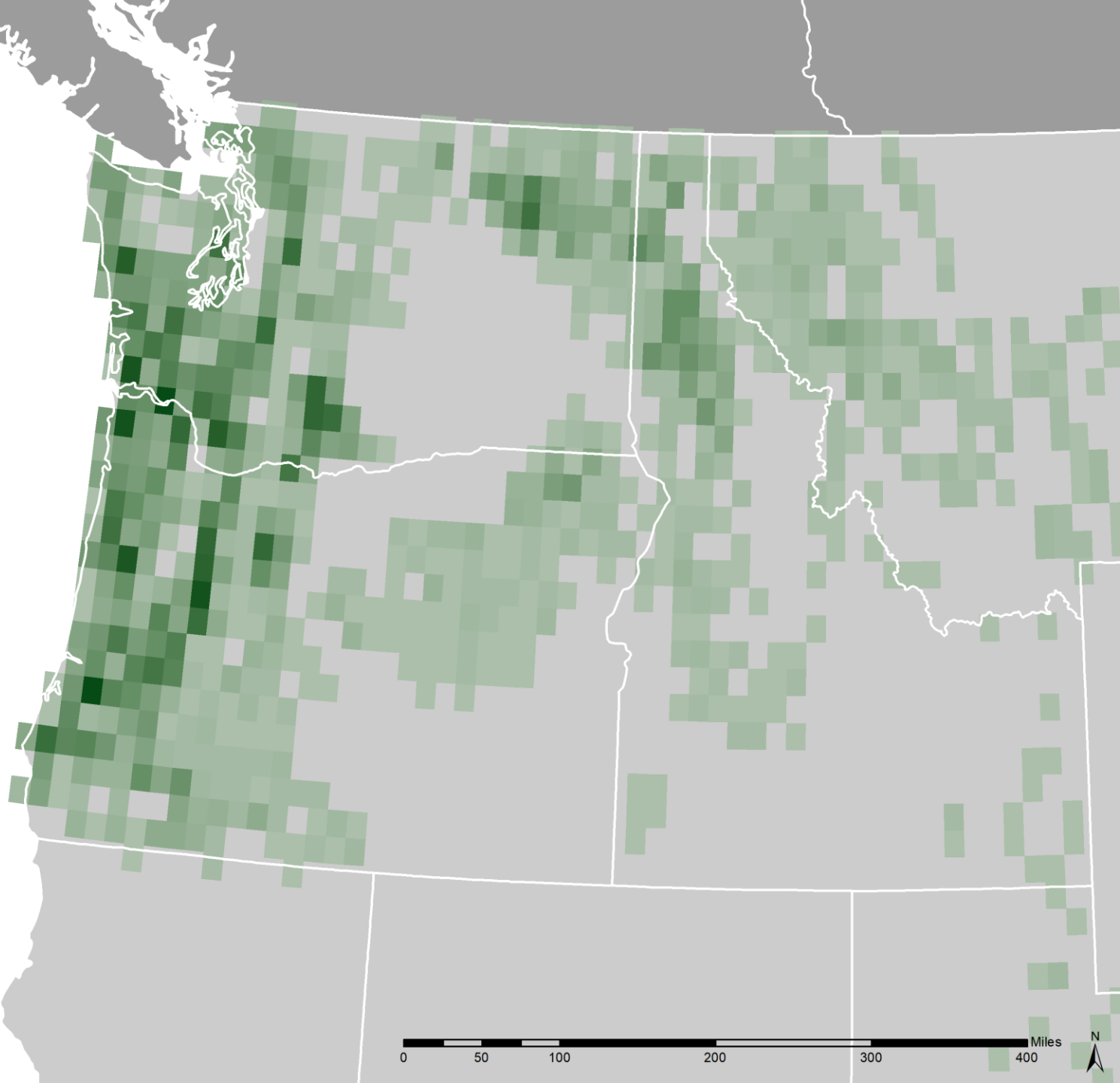


Forest Residuals

(BDMT/yr)

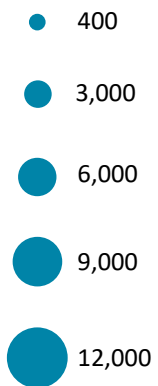


¼ degree grid cells

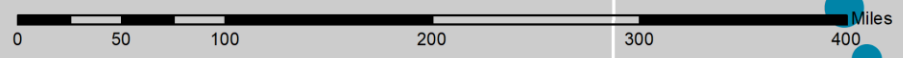
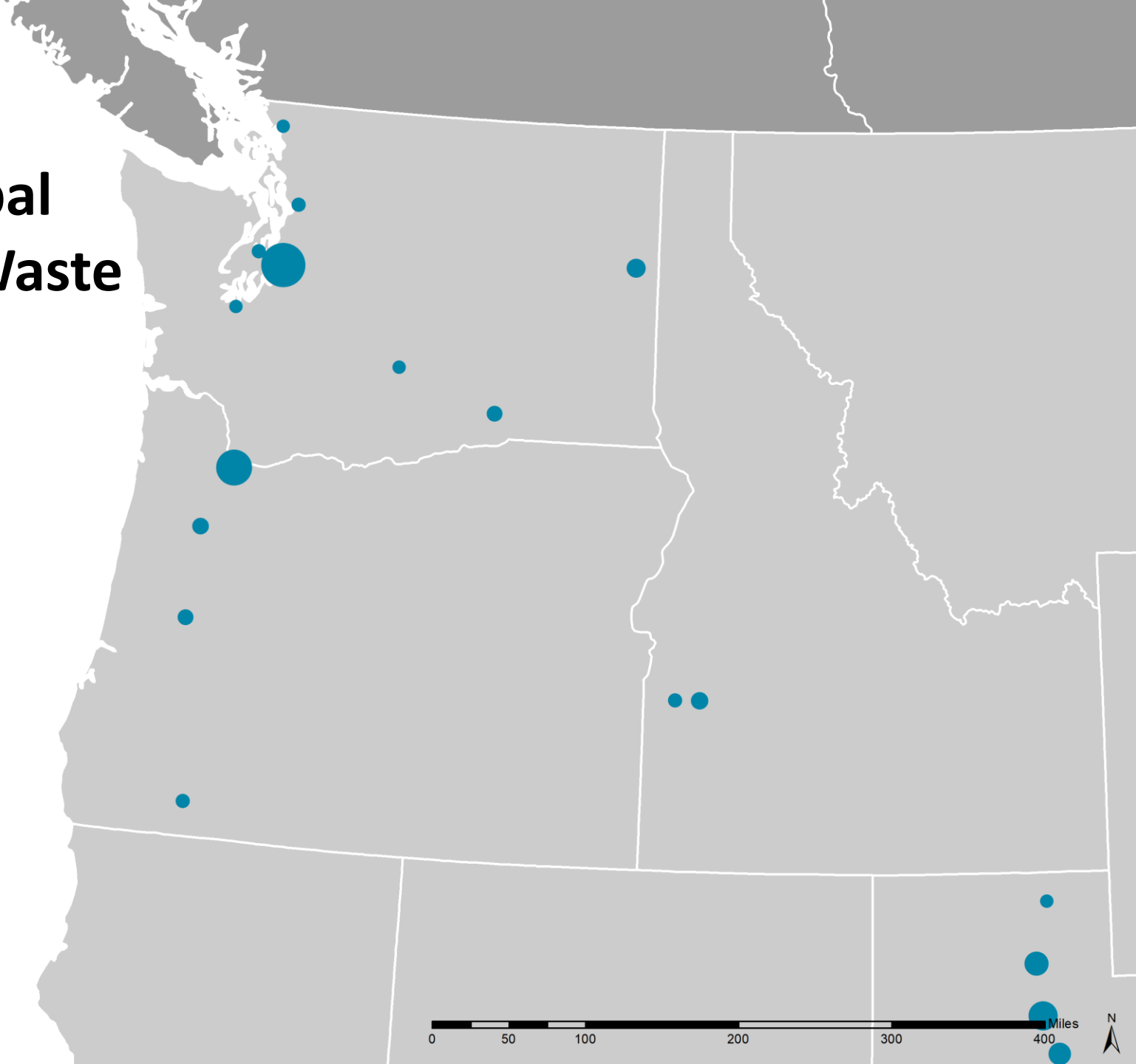


Municipal Solids Waste

(MT/yr)



Census Bureau
Urban Areas with
Population greater
than 100,000



State	Forest Residuals	Combined Lipid Feedstocks	Oilseeds	Used Cooking Oil	Animal Fats	Municipal Solids Waste
Washington	1,940,000	463,000	370,000	17,900	75,700	1,370,000
Oregon	1,930,000	214,000	116,000	9,790	0	747,000
Idaho	435,000	148,000	143,000	1,880	2,720	144,000
Western Montana	318,000	0	0	0	0	0
Total (tonnes)	4,620,000	825,000	629,000	29,600	78,400	2,260,000
Total Possible Distillates (MMgals)	262	240				113
Possible SAF (MMgal)	262	132				37

**TOTAL Possible SAF
(MMgal) 432**

**SEA - 2017 Fuel Uplift
(MMgal) 613**

**PDX - 2017 Fuel Uplift
(MMgal) 177**

A large pile of forest residuals, including logs and branches, is the central focus of the image. In the foreground, four workers wearing orange hard hats and high-visibility vests are standing and looking towards the pile. The background shows a dense forest of evergreen trees.

FOREST RESIDUALS

2019 – Washington SAF
Seattle, WA

A large industrial facility, likely a sawmill or wood processing plant, featuring massive piles of brown feedstock (wood chips or sawdust) and a conveyor system. The scene is dominated by the texture and color of the wood waste, with a grey conveyor belt cutting through the piles. Two yellow heavy machinery vehicles are visible on the conveyor system.

INDUSTRIAL FEEDSTOCK

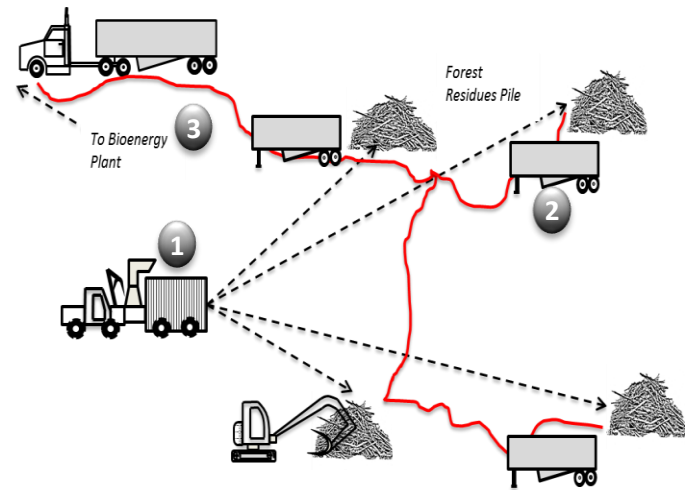
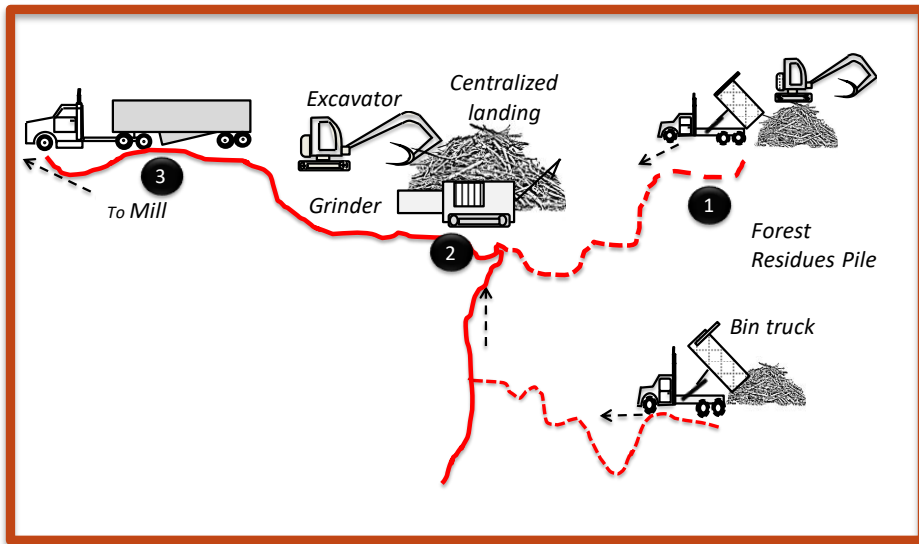
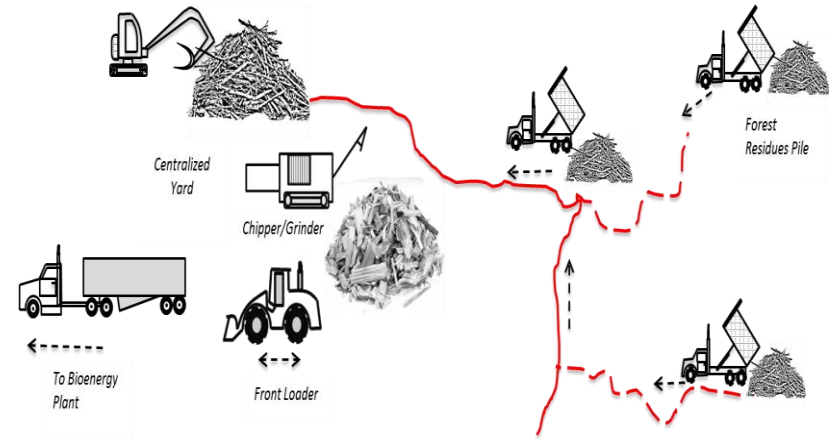
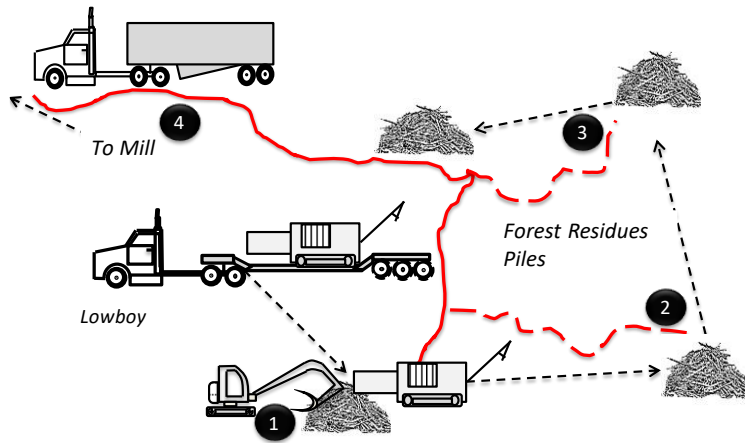
2019 – Washington SAF
Seattle, WA



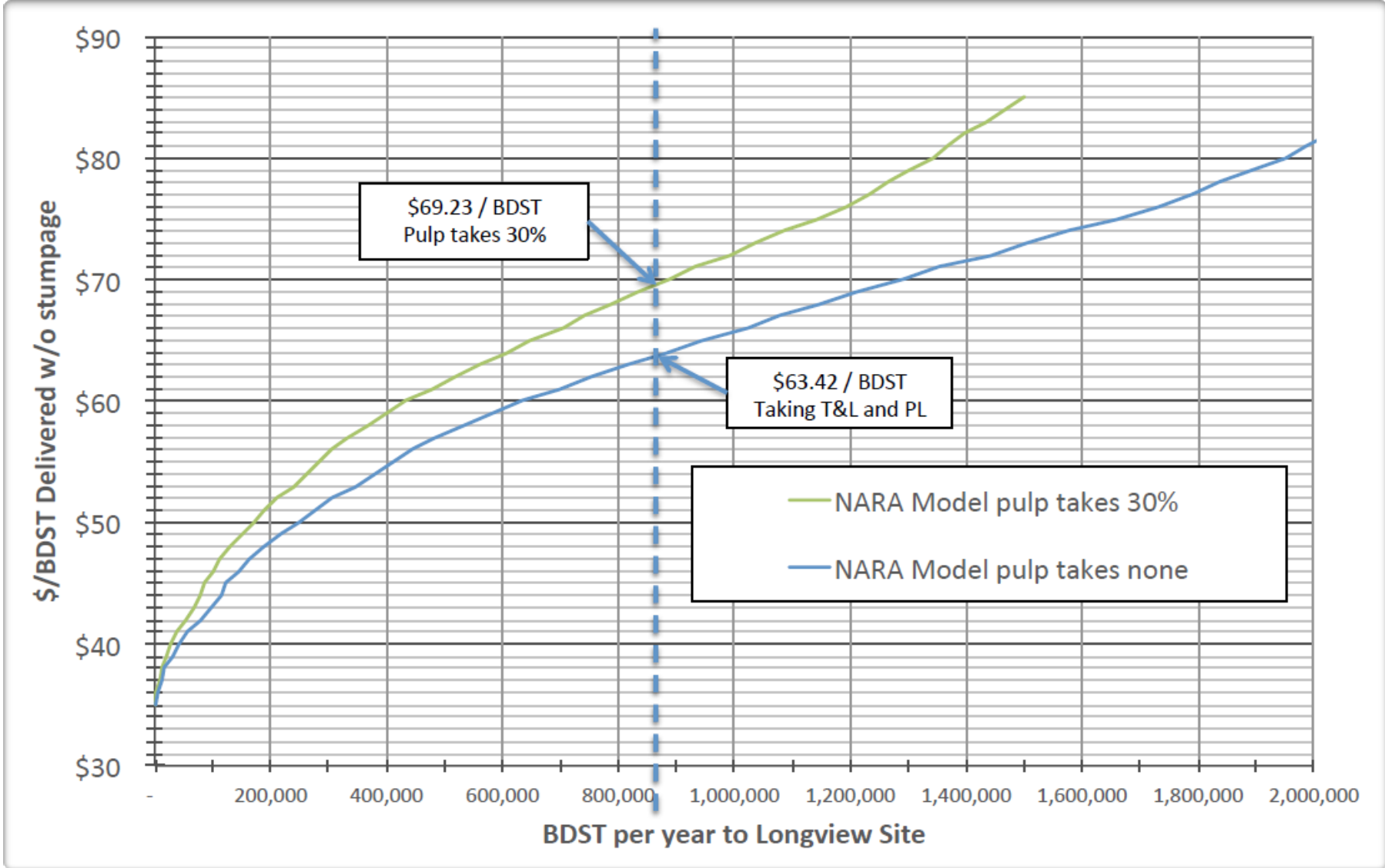
INTEGRATED BIOREFINERY

2019 – Washington SAF
Seattle, WA

Trucking / Grinding Options

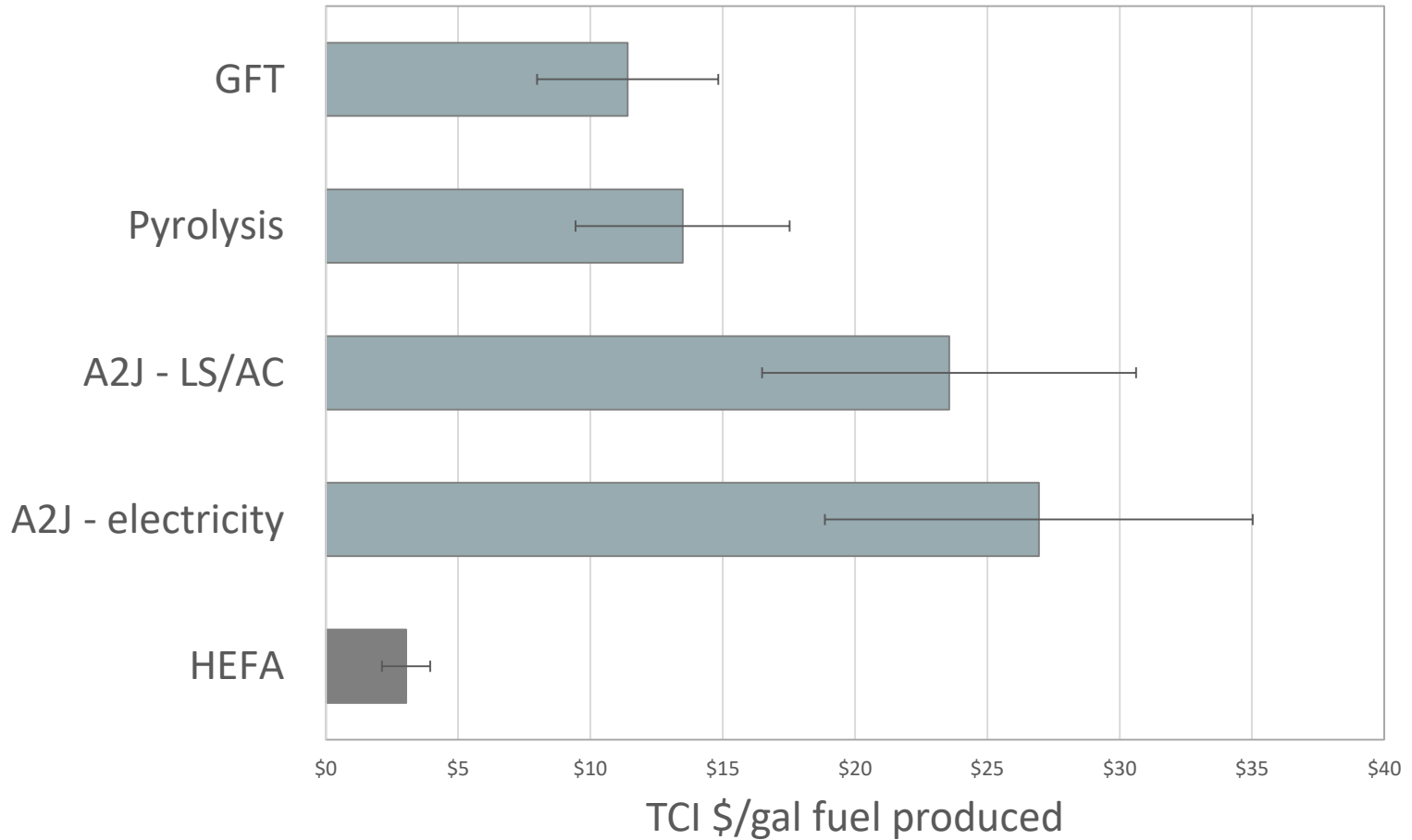


Delivered Costs – Residues – Longview, WA



Capital Costs of Production Plants

2019 – Washington SAF
Seattle, WA

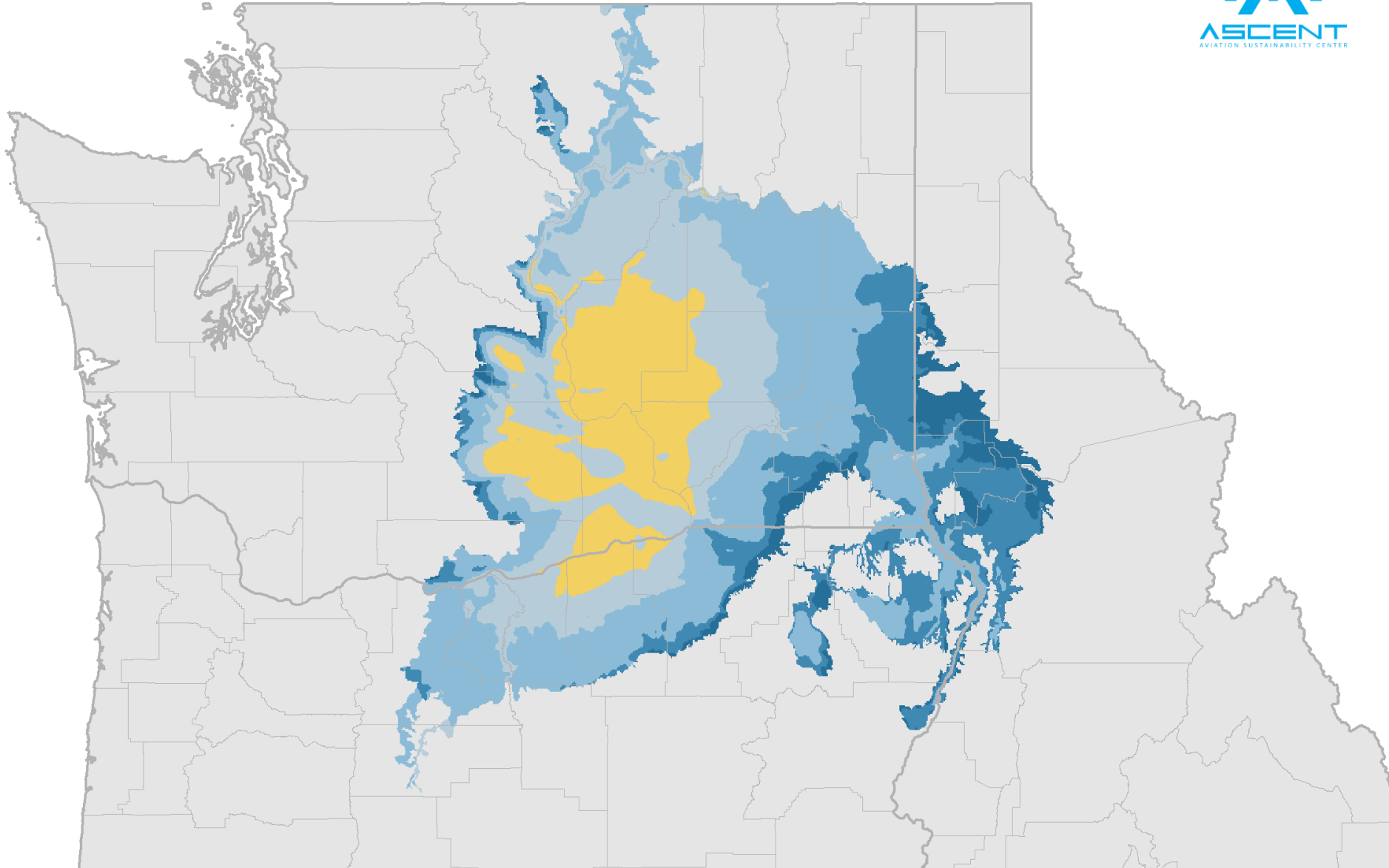


OILSEED SUPPLY CHAIN



Precipitation Driven Rotations

2019 – Washington SAF
Seattle, WA





SMALL GRAINS

- Winter Wheat
- Spring Wheat
- Barley



PULSES

- Peas
- Lentils
- Garbanzo Beans




BRASSICA OILSEEDS

- Canola/Rapeseed
- Mustard
- Camelina
- Carinata


ESTIMATED SPRING CANOLA YIELDS

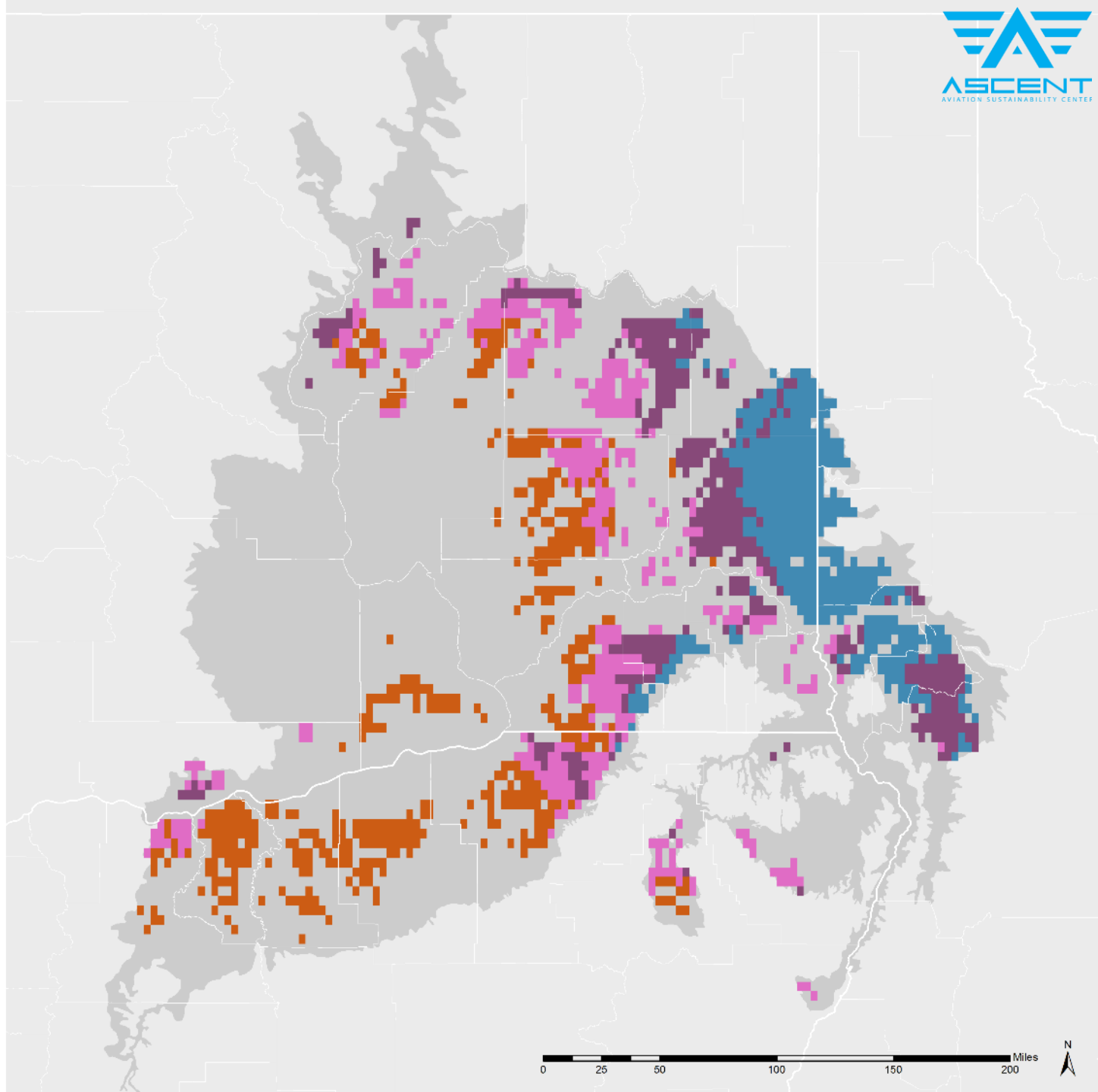
Yield (bushels/acre)

 <20

 20 - 40

 40 - 60

 > 60



0 25 50 100 150 200 Miles



Simple Oilseed to Fuel Supply Chain



OILSEEDS
(HARVEST)

OILSEED
STORAGE

OILSEED
CRUSHER

HEFA
REFINERY

GREEN JET
FUEL

KEY



Inputs



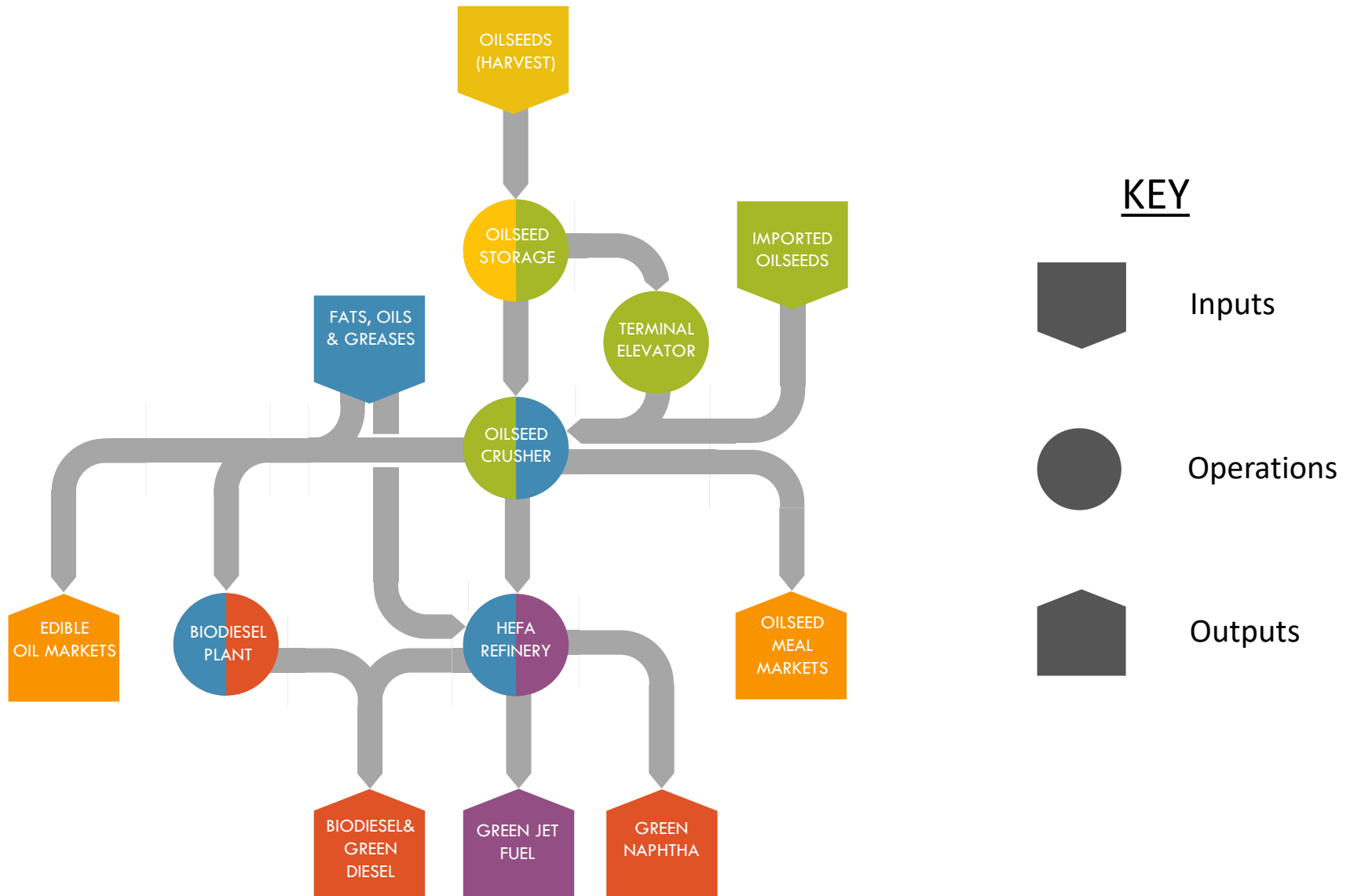
Operations



Outputs

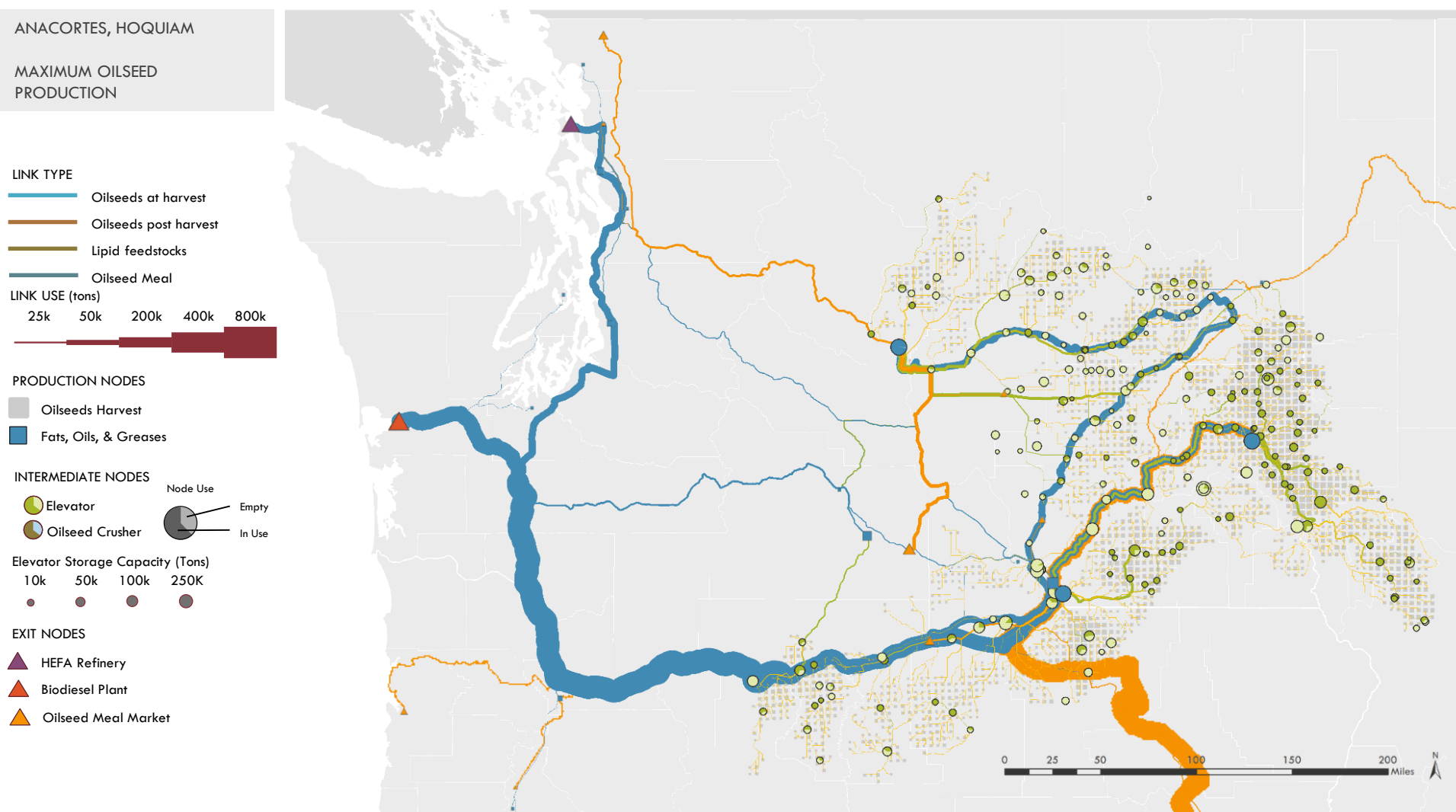
Actual Oilseed to Fuels Supply Chain

2019 – Washington SAF
Seattle, WA



100% of Maximum Oilseed Production

2019 – Washington SAF
Seattle, WA



50% of Maximum Oilseed Production

2019 – Washington SAF
Seattle, WA

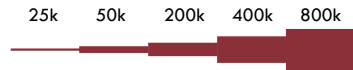
ANACORTES, HOQUIAM

50% OF MAXIMUM OILSEED PRODUCTION

LINK TYPE

- Oilseeds at harvest
- Oilseeds post harvest
- Lipid feedstocks
- Oilseed Meal

LINK USE (tons)



PRODUCTION NODES

- Oilseeds Harvest
- Fats, Oils, & Greases

INTERMEDIATE NODES

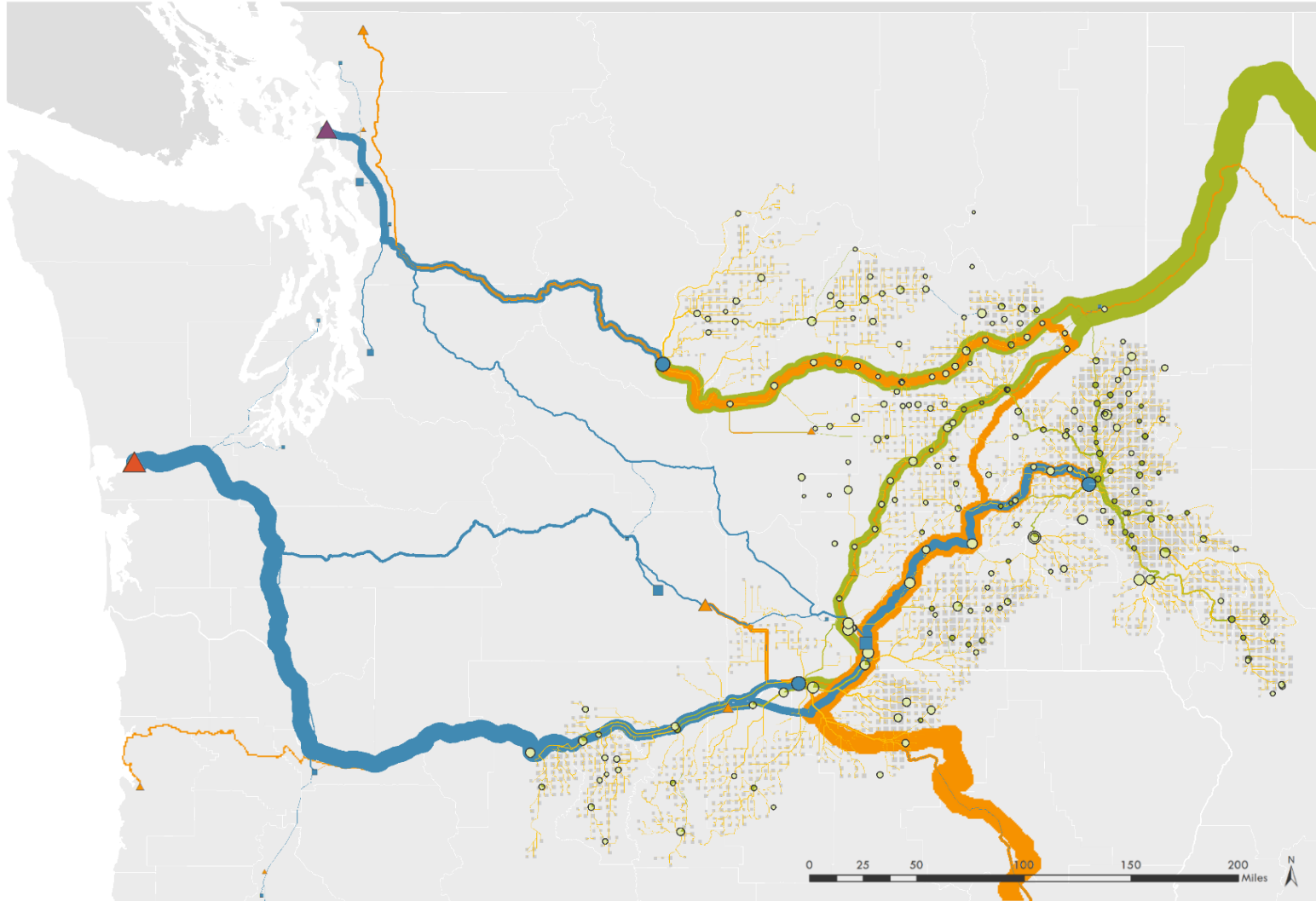
- Elevator
 - Oilseed Crusher
- Node Use: Empty, In Use

Elevator Storage Capacity (Tons)

- 10k
- 50k
- 100k
- 250K

EXIT NODES

- HEFA Refinery
- Biodiesel Plant
- Oilseed Meal Market



QUESTIONS