FAA CENTER OF EXCELLENCE FOR ALTERNATIVE JET FUELS & ENVIRONMENT

Regional Supply Chain Analysis BANR/WSU/FTOT

Project 001

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Collaborators: Kristin Lewis, Matthew Pearlson, Volpe National Transportation Center

Project manager: Nathan Brown, FAA

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Atlanta, GA

BANR – USDA AFRI CAP Project

- Beetle Killed Stands
  - Material may or may not be suitable for traditional forest products
  - Harvest methods studied extensively
  - Focus on ecological impacts of local study sites
  - Did NOT develop a method for region wide estimates of materials

- LURA Model
  - Used by NARA and ASCENT for feedstock estimates
  - Based on FIA volumes and material flows to satisfy economic activity
  - Challenged with beetle killed material from location on public lands and no economic needs
  - Develop several scenarios to estimate

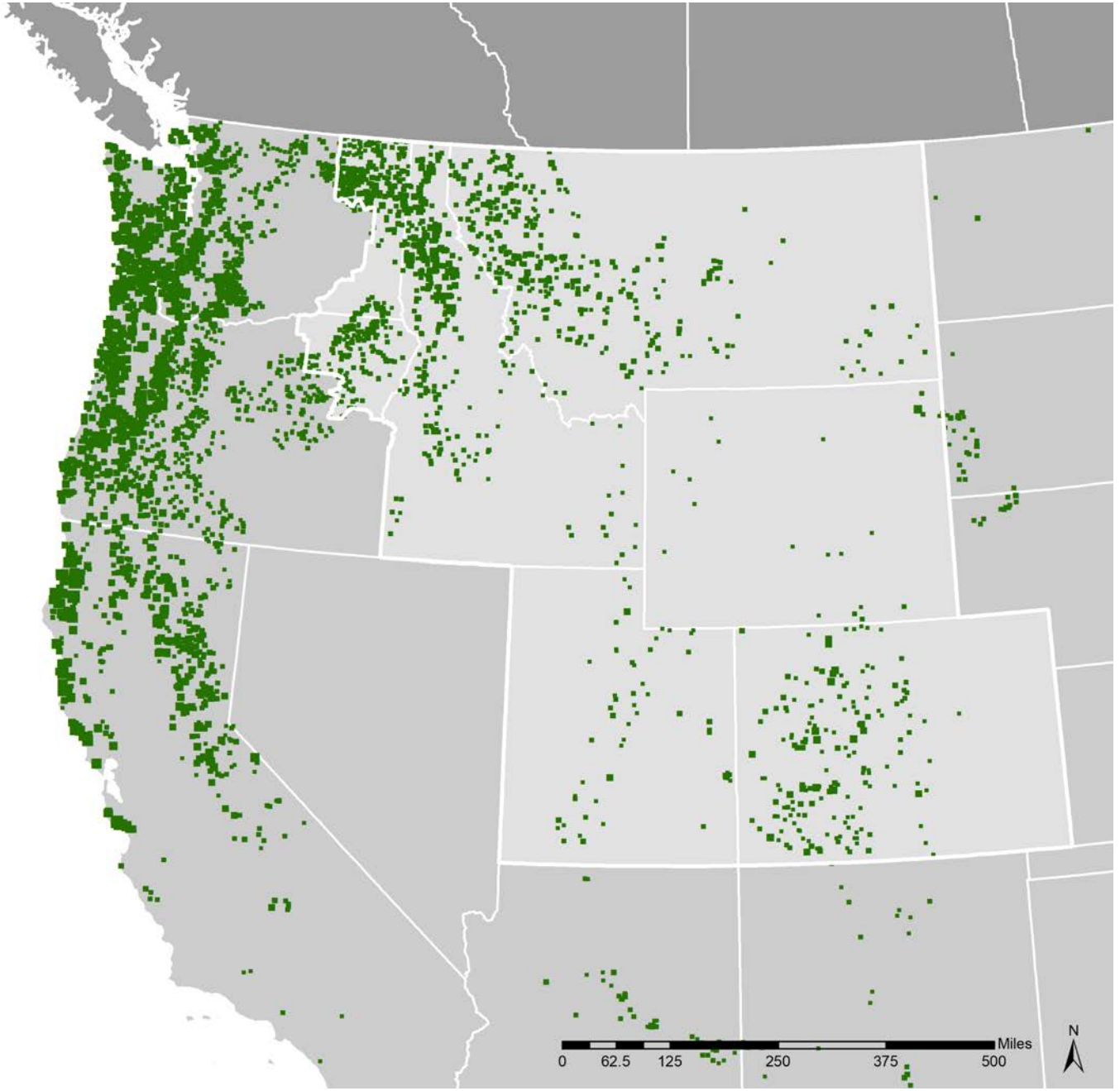
BANR SUPPLY CHAIN

CANDIDATE GENERATION

LURA Feedstock Modeling

Forest Inventory Analysis Points
Harvestable Residuals (BDMT/yr)

- > 5,000
- 5,000 – 3,000
- 3,000 – 2,000
- 2,000 – 1,000
- < 1,000



Grid Study

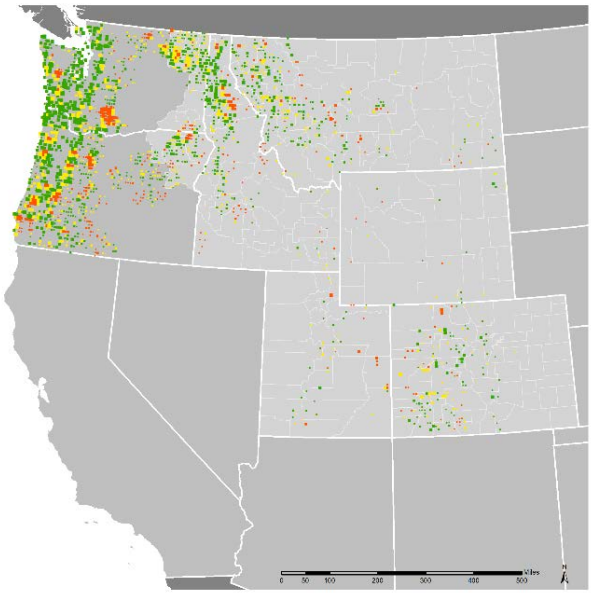
Aggregated Feedstock
(BDMT/yr)

- > 200,000
- 200,000 – 100,000
- 100,000 – 50,000
- 50,000 – 25,000
- 25,000 – 10,000
- 10,000 - 5000

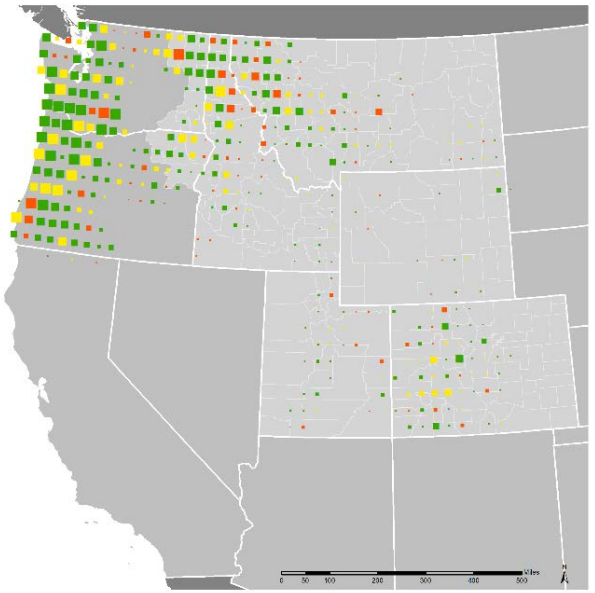
Distance to Freight Analysis Framework
(miles)

- < 5
- 5 – 10
- > 10

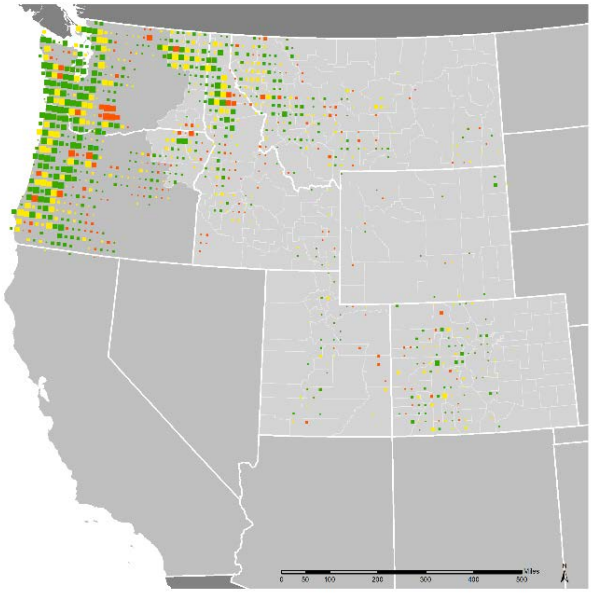
0.10˚ Grid



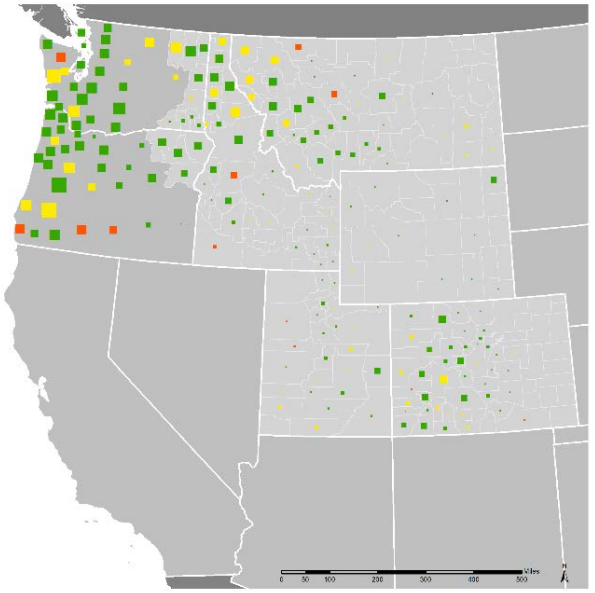
0.50˚ Grid



0.25˚ Grid



County Centroids



Grid Study

Nodes Types	Number of Points	Average Distance to Nearest Roads Point (m)	Average Distance from Approximated Point to LURA Point (m)
LURA points	2,831	8,300	0
0.10 degree grid	2,147	8,200	3,700
0.25 degree grid	962	8,300	9,300
0.50 degree grid	395	8,500	17,700
0.75 degree grid	221	9,100	27,600
County Centroids	213	6,300	31,500

BANR REGION

Petroleum Infrastructure and Major Jet Fuel Markets

Airports
2030 Fuel Demand (avg Mbpd)
- 20
- 15
- 10
- 5
- 2.5

Petroleum Refineries
Total Production (Mbpd)
- 250
- 100
- 50
- 25

Petroleum Transportation
Mode
- Pipeline
- Rail
- Barge

Capacity (Mbpd)
- 300
- 100
- 50

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BANR REGION

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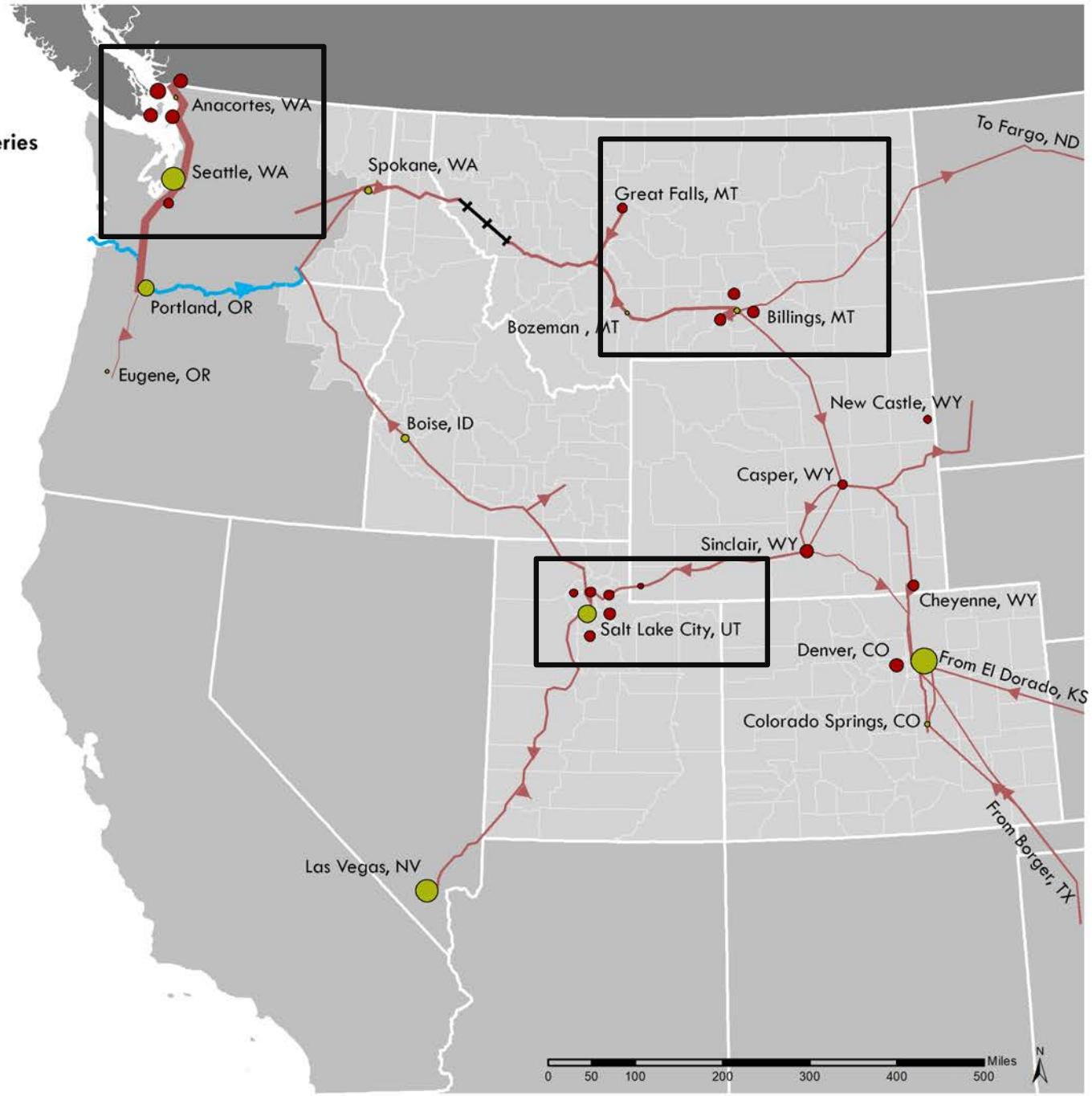

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Sub-Regional Modeling

Western Montana Corridor

Forest Inventory Analysis Points
Harvestable Residuals (BDMT/yr)

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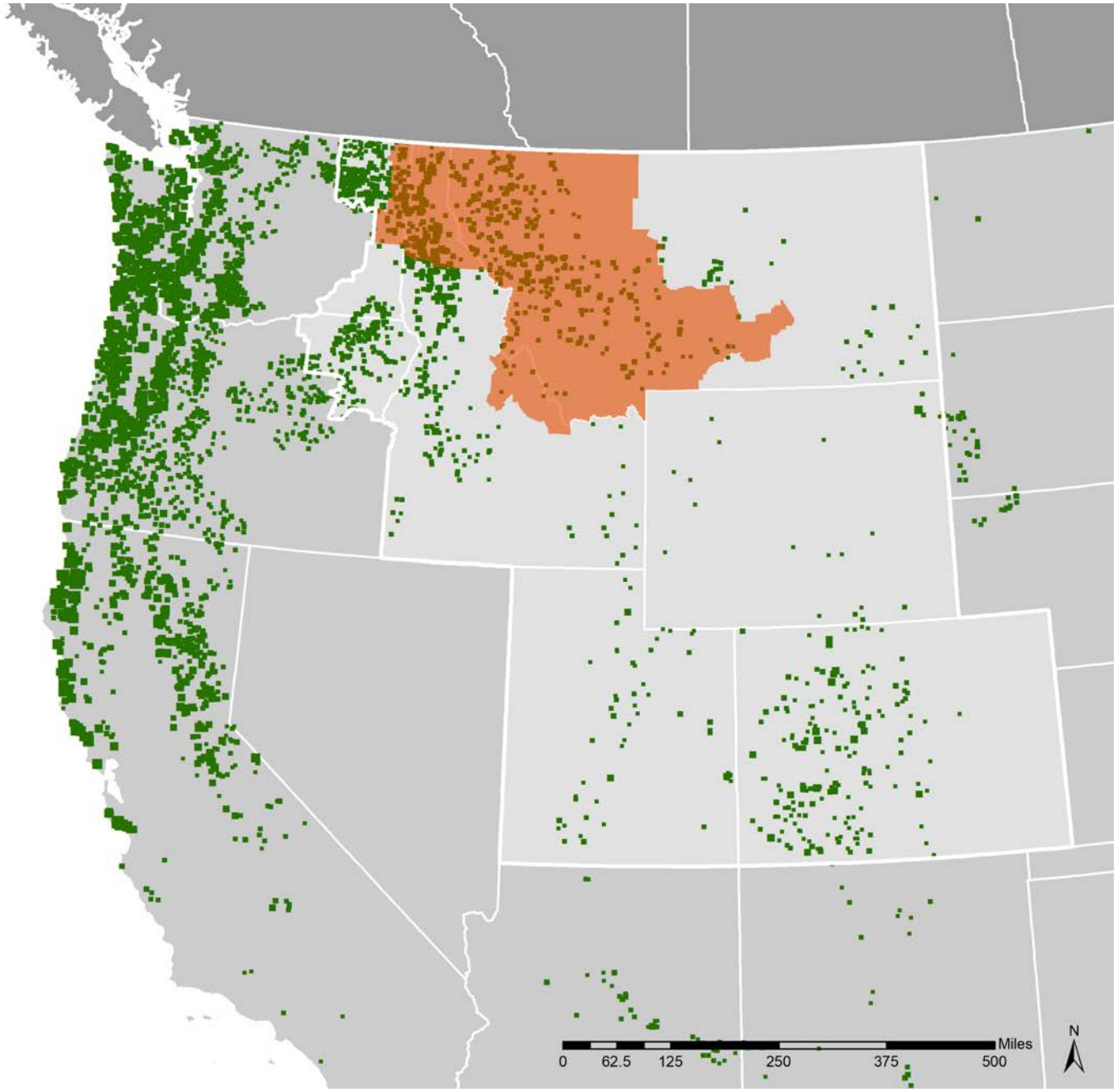
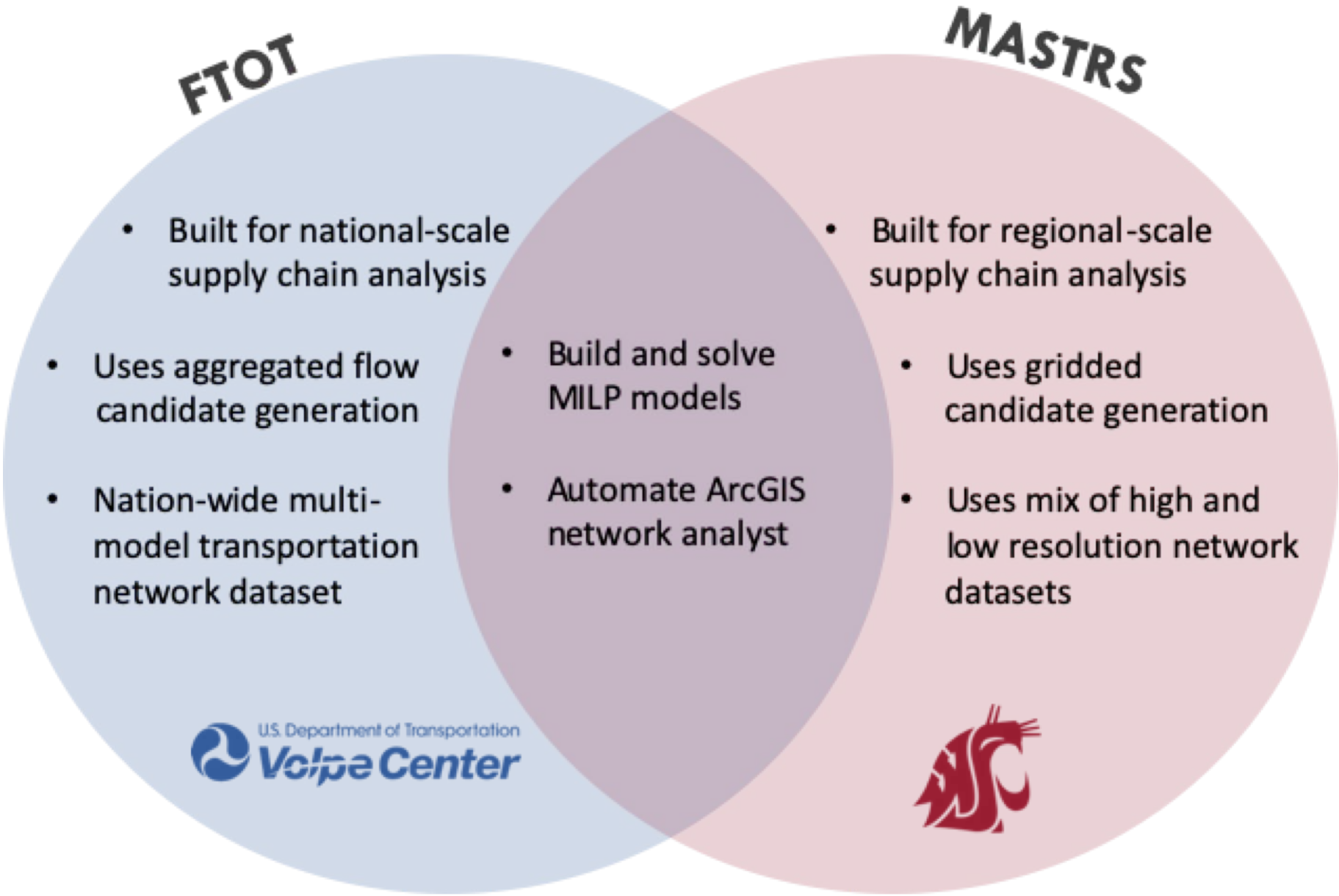


Modeling Tools

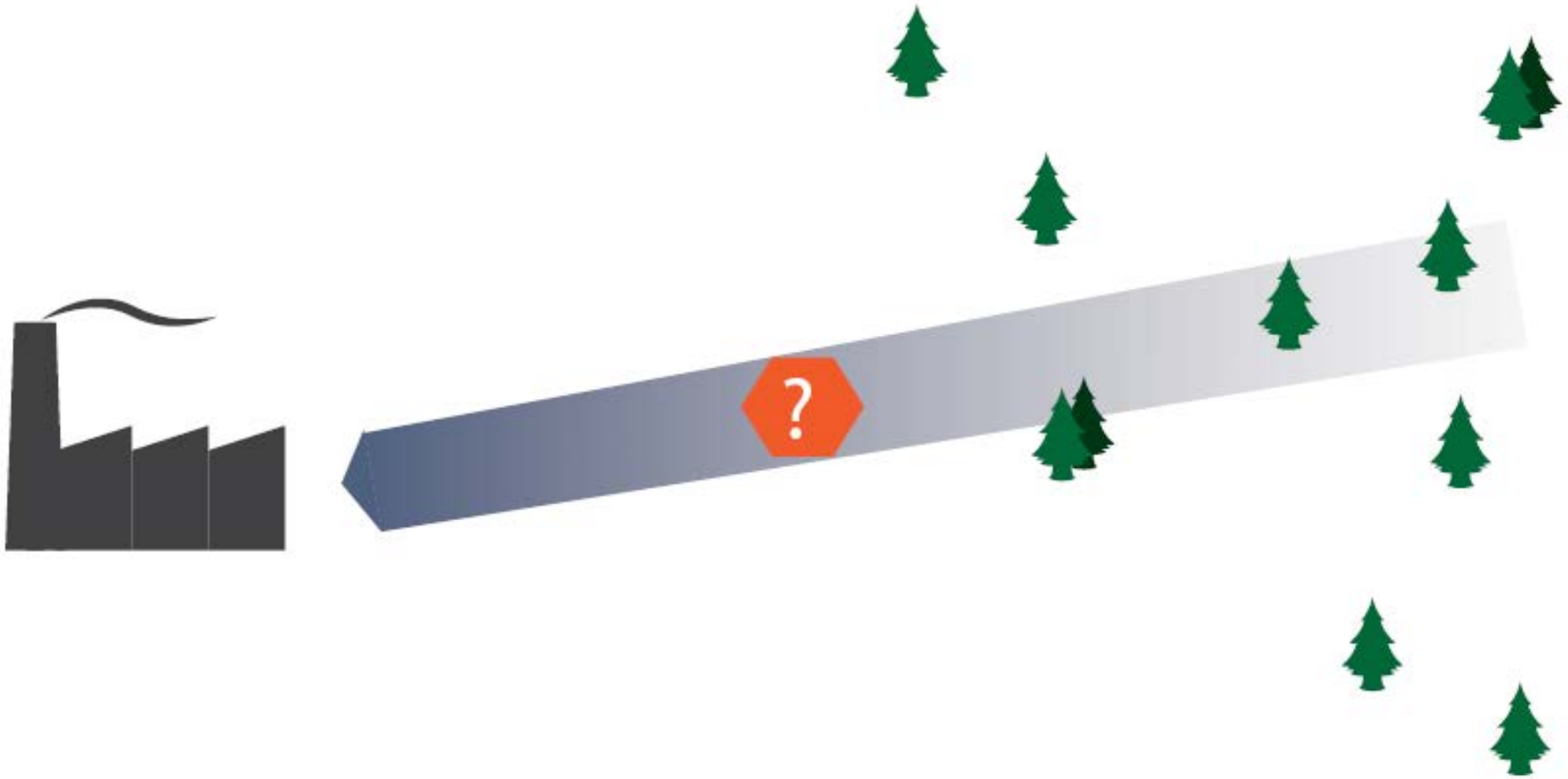


Site Candidate Generation

- FTOT
- Places candidates using link flow aggregation over multimodal network
- Candidate generation and optimization are done sequentially

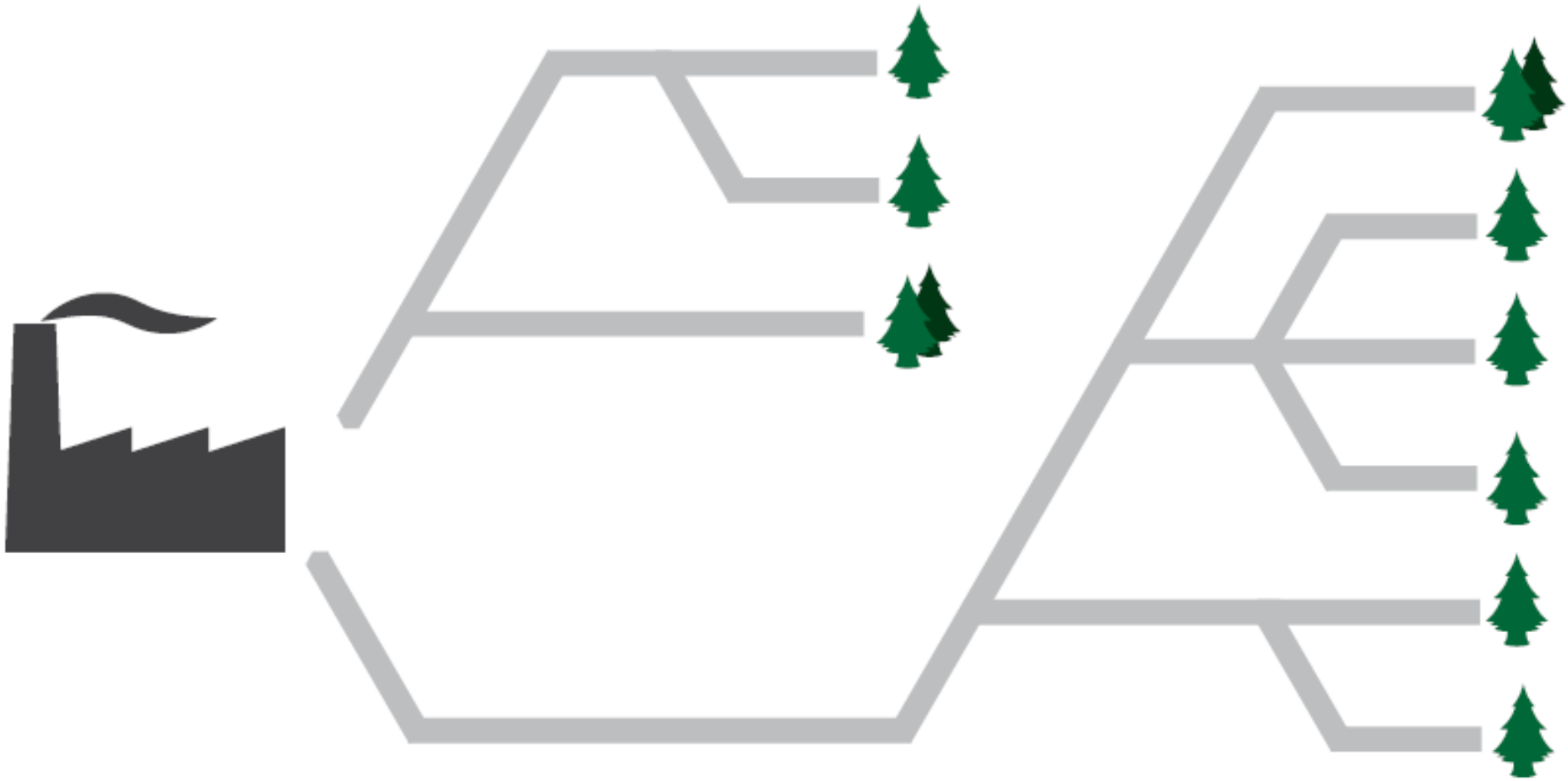
- MASTRS
- Places candidates using projected operating costs for single candidate
- Force geographic spread with grid
- Candidate generation and optimization are separate processes

FTOT



FTOT

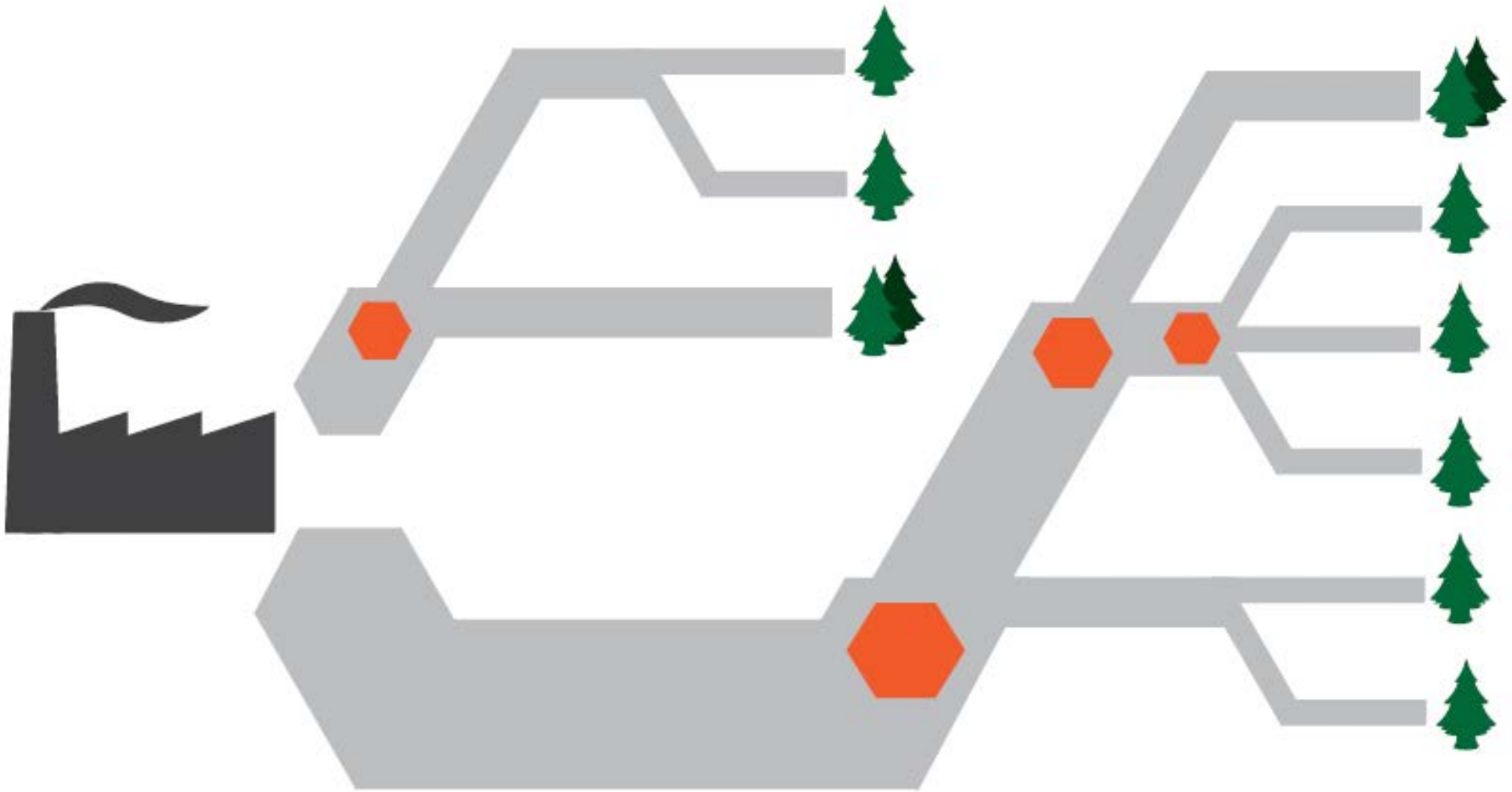
1. Route feedstock to destinations



2. Aggregate route flow

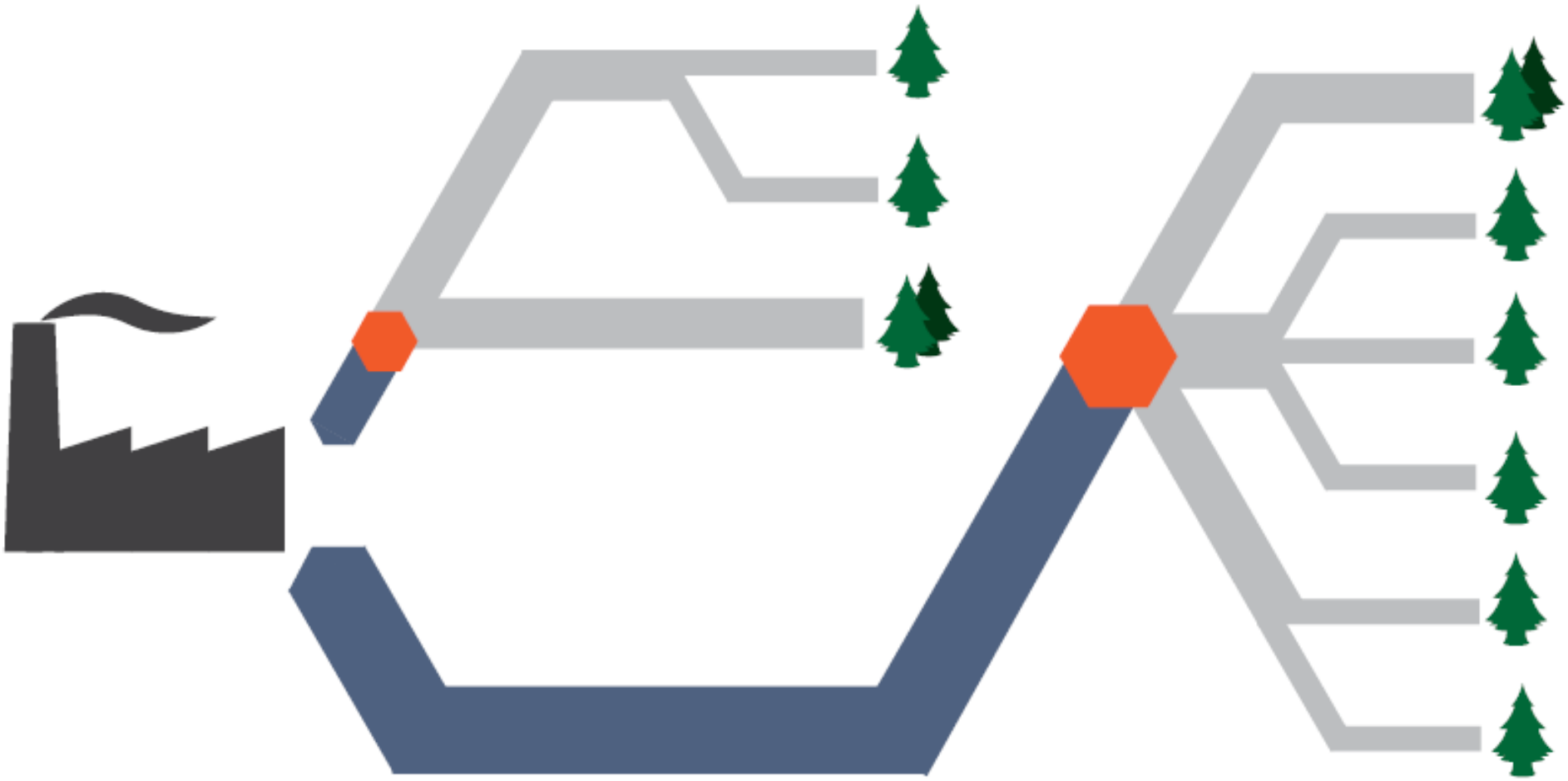
FTOT

3. Place processor candidates where flow meets a threshold

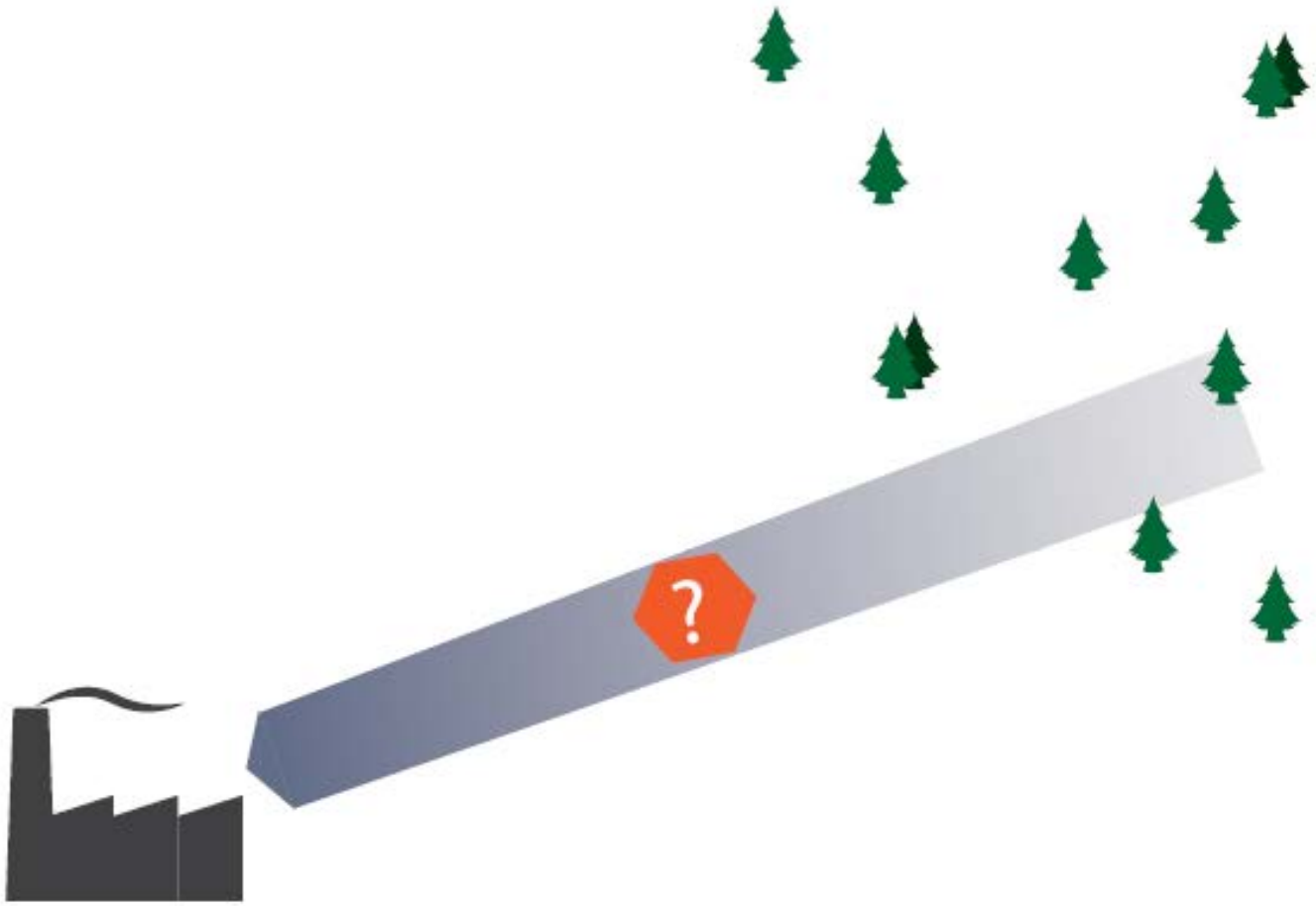


FTOT

4. Find optimized route solution

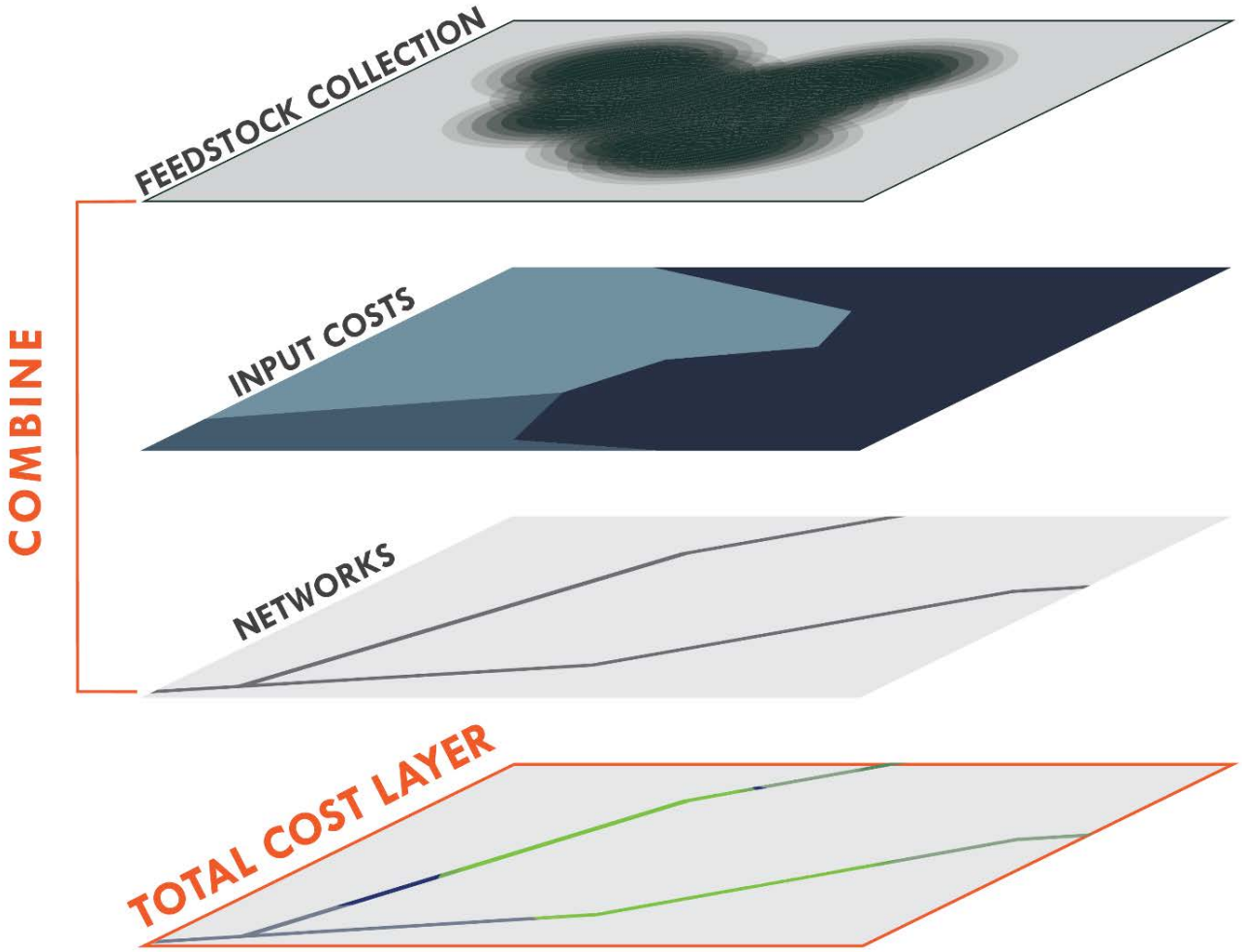


MASTRS



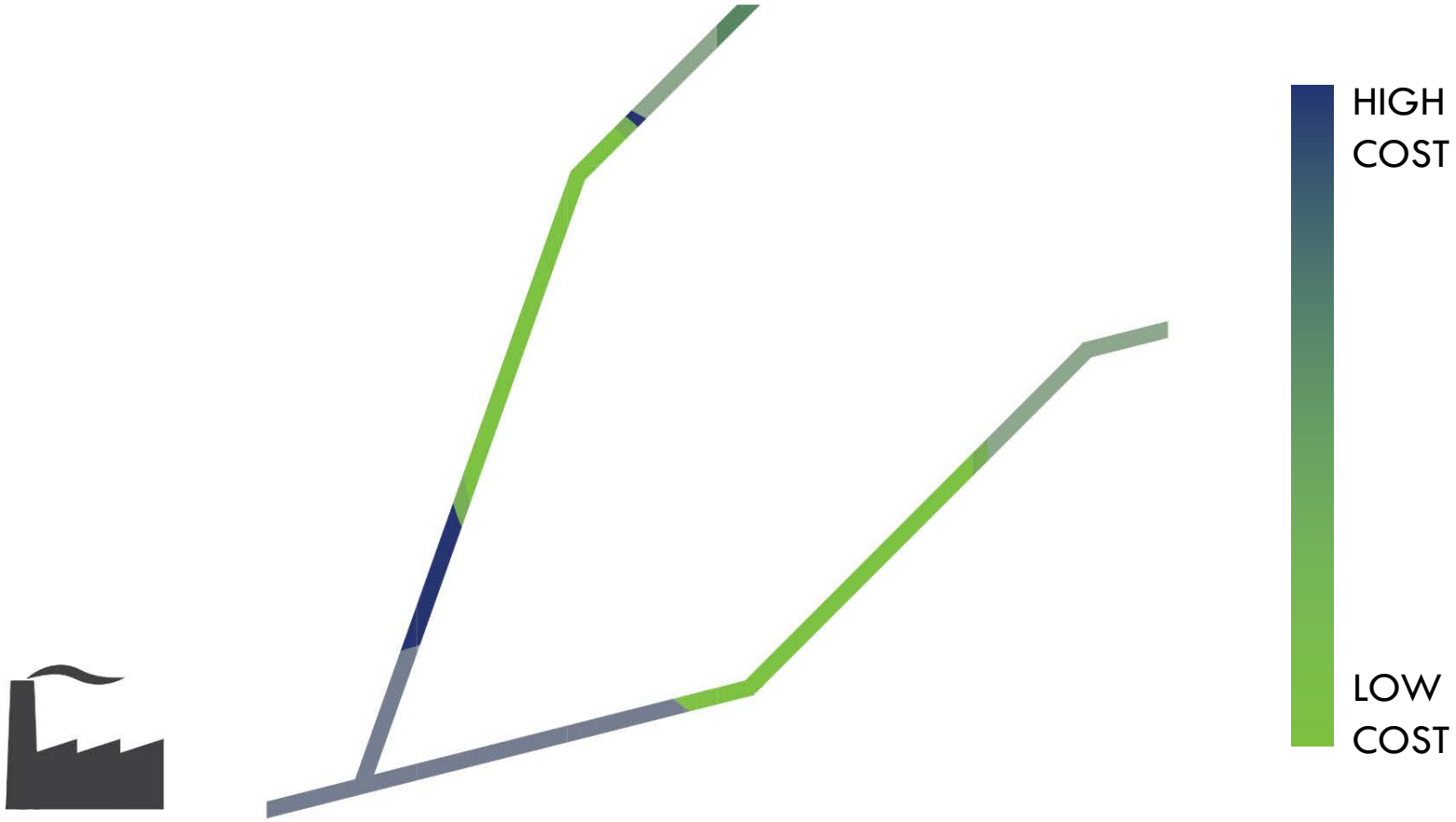
MASTRS

1. Combine input layers to produce total costs layer



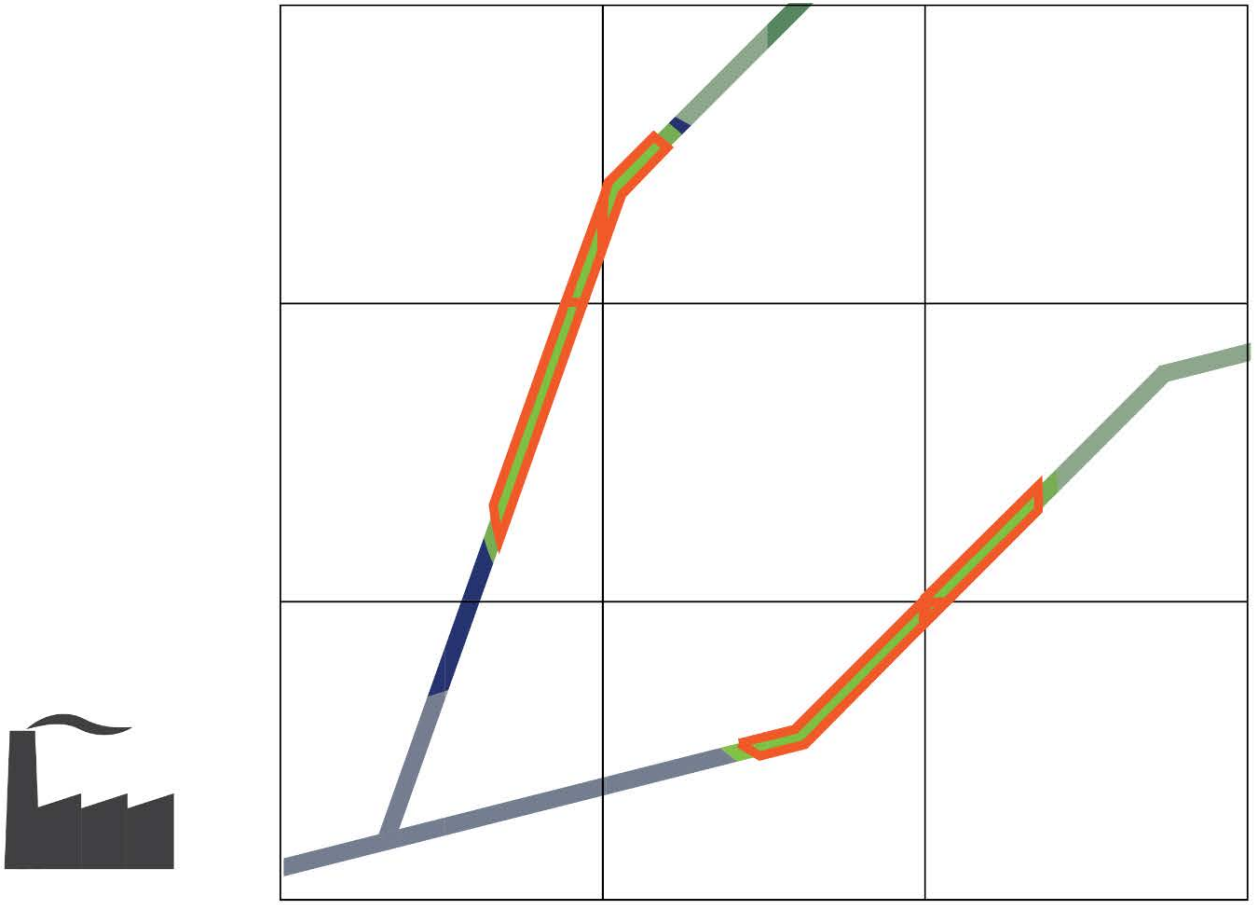
MASTRS

2. Lay road grid over total cost layer



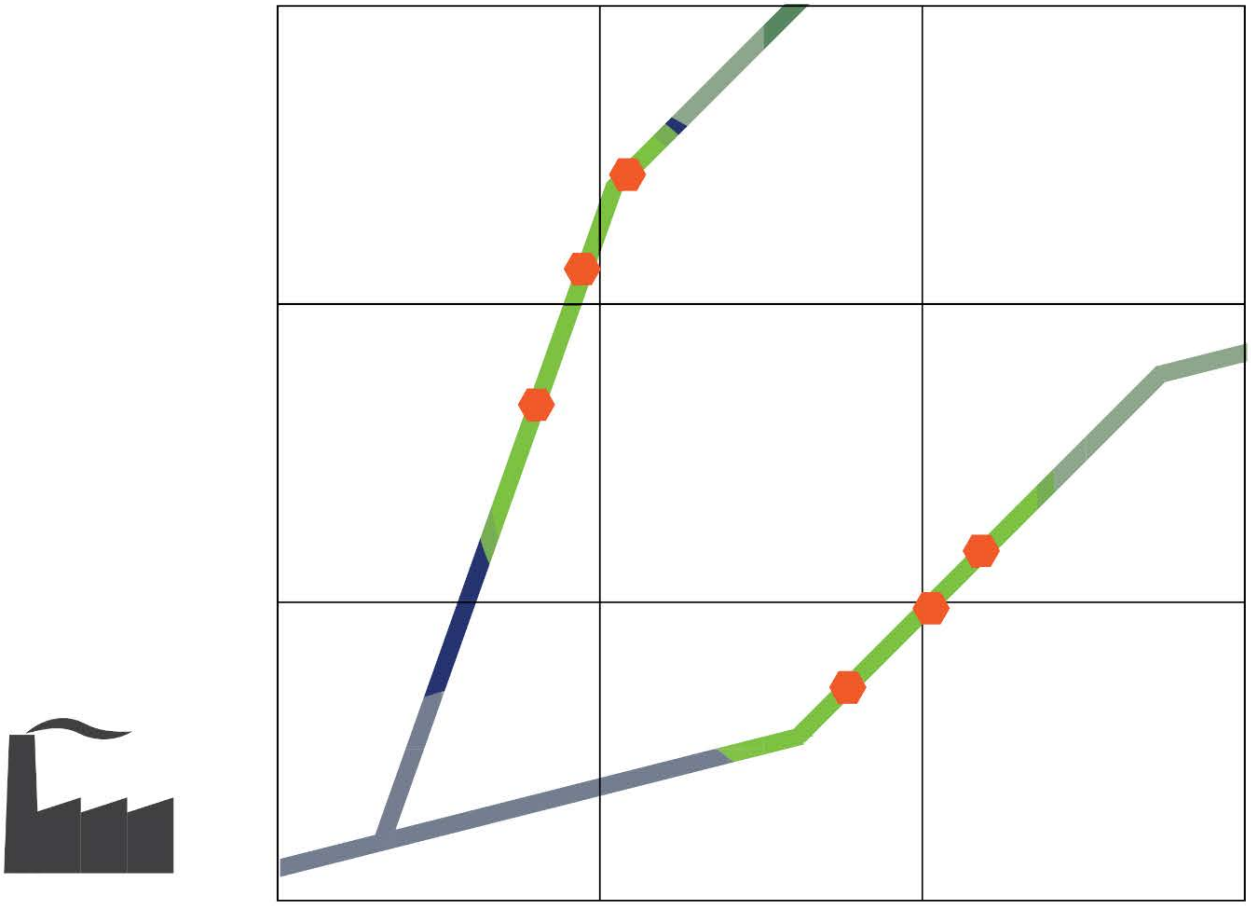
MASTRS

3. Select lowest scoring polygon in each grid



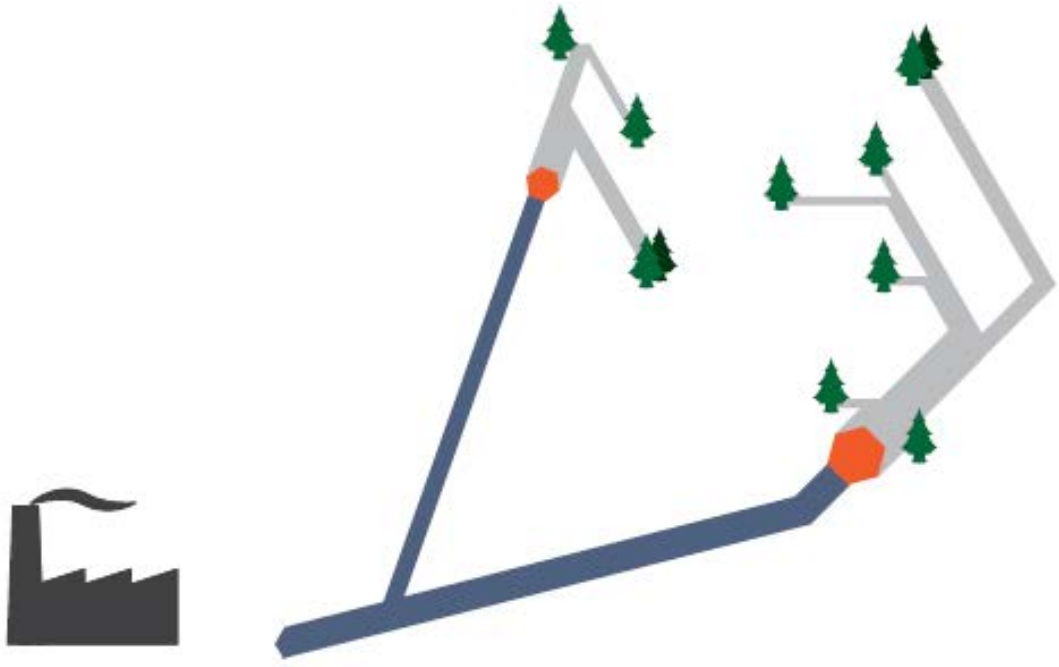
MASTRS

4. Locate candidate site in center of each polygon



MASTRS

5. Find optimized route

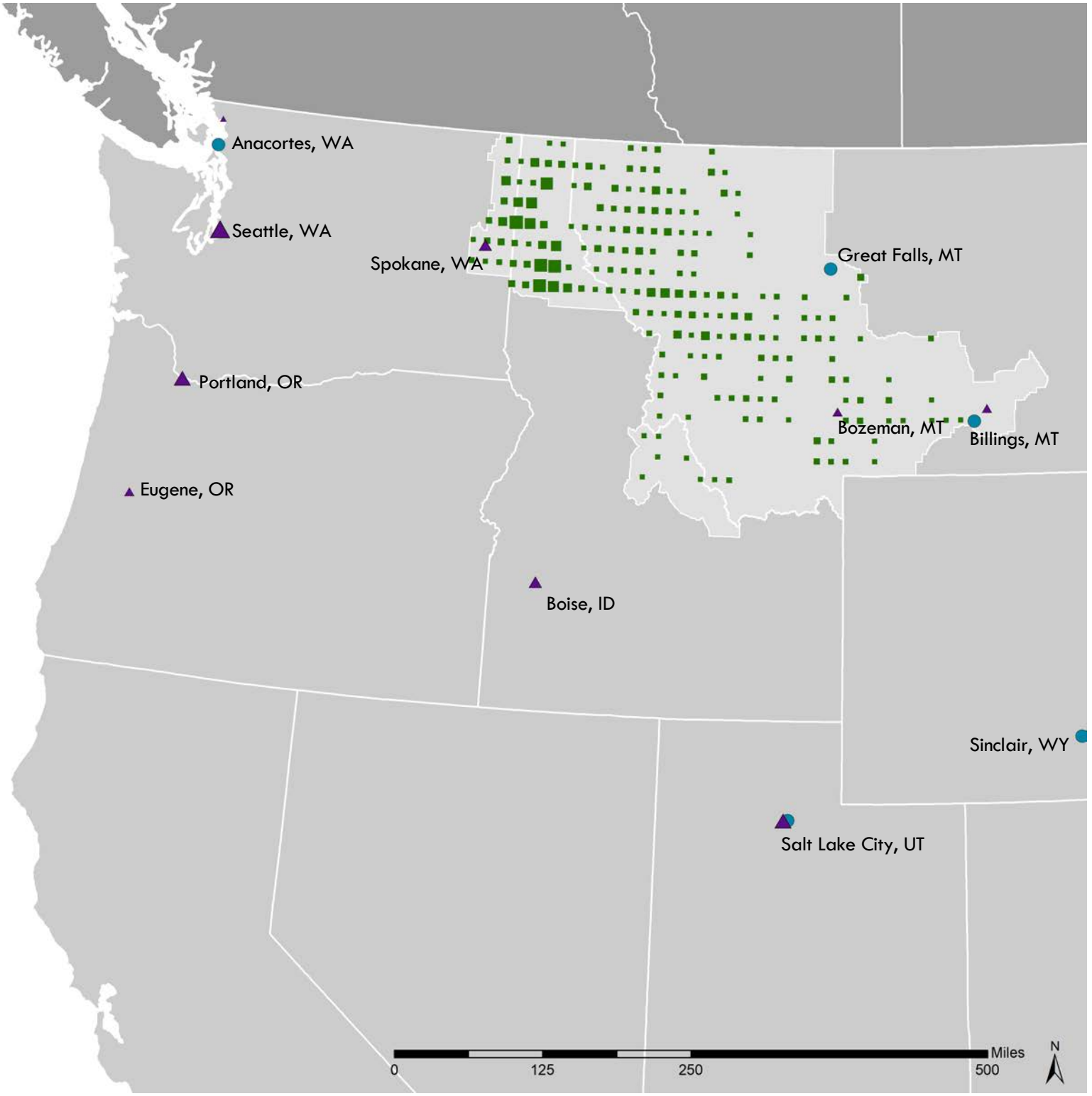


CANDIDATE GENERATION COMPARISON

Western Montana Corridor

Existing Points

- Forest Residuals
- Petroleum Refineries
- Large Airports



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FTOT CANDIDATES

Existing Points

- Forest Residuals
- Petroleum Refineries

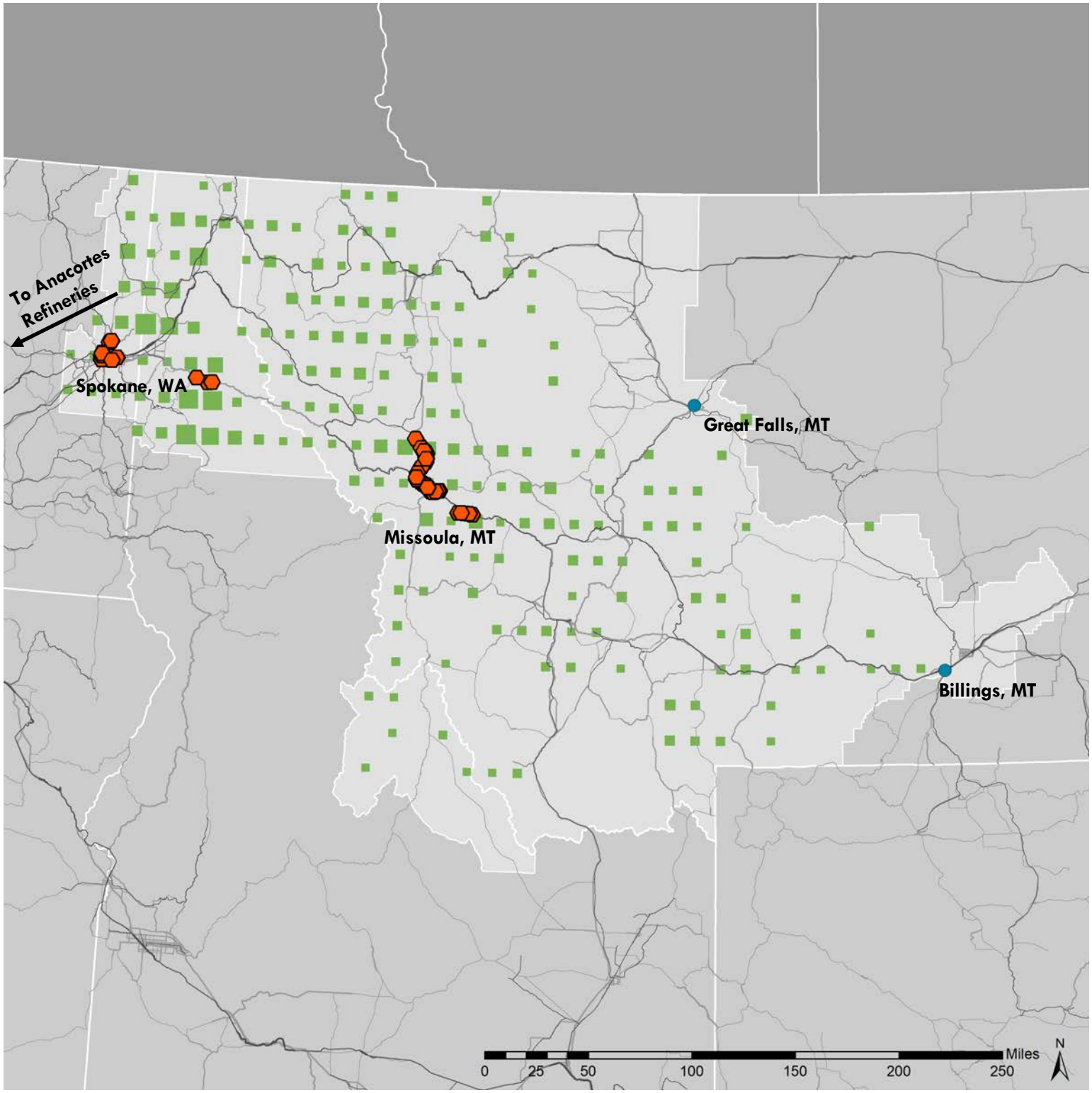
Freight Network

- Road
- Rail

- FTOT Candidates (63)

Criteria:

- Candidates required > 50k tons of flow
- Minimum depot size set to 250k tons for optimization



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MASTRS CANDIDATES

MASTRS Candidates (22)

Total Cost ($/BDMT)

95

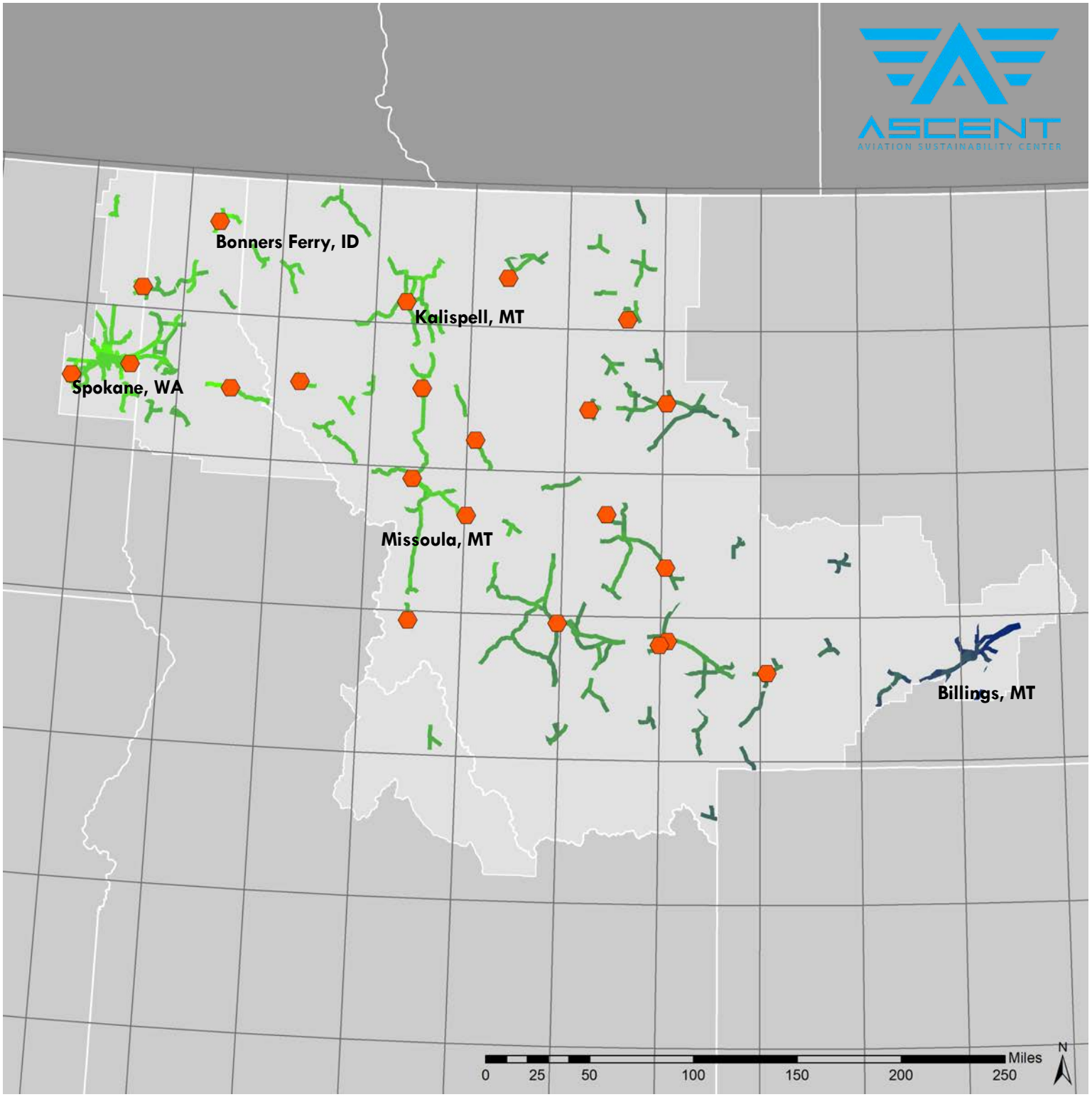
125

160

190

Criteria:

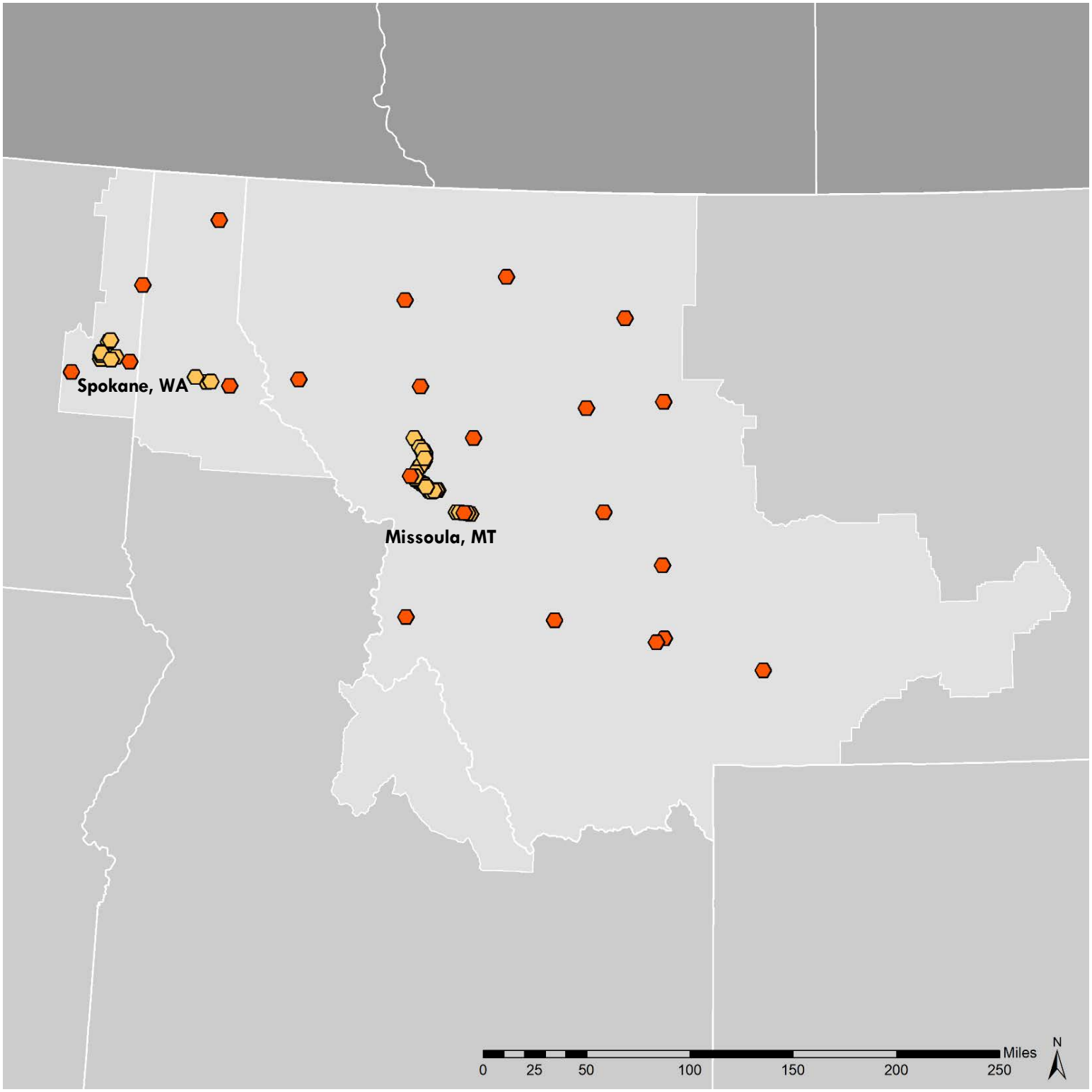
- Feedstock collection cost estimate
- Electricity cost estimate
- Natural gas/propane cost estimate
- Falls within highway network
- Falls within 5 miles of town with population > 300



CANDIDATES COMPARISON

Candidates

- MASTRS Candidates (22)
- FTOT Candidates (63)



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CANDIDATE COMPARISON

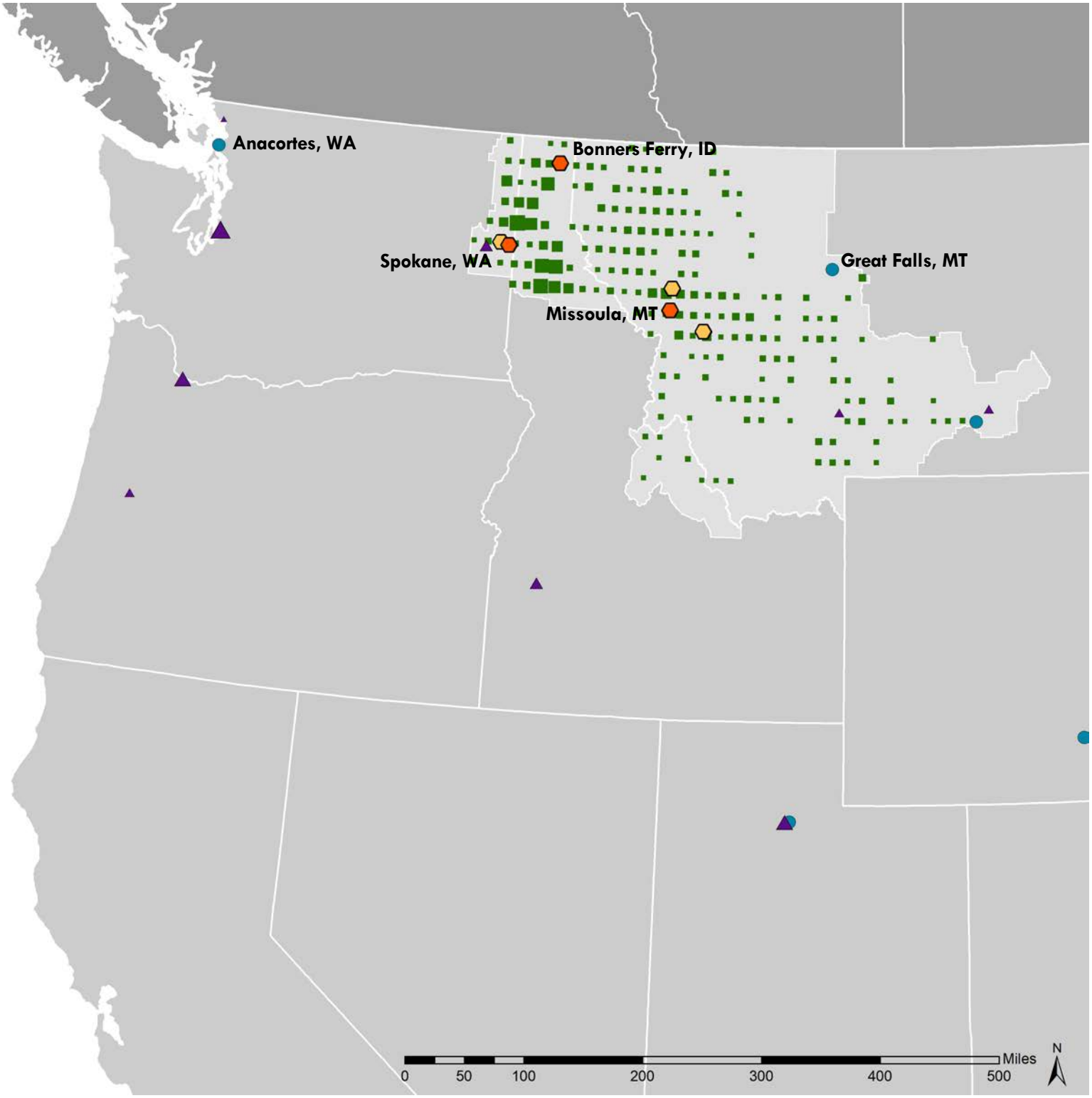
Western Montana Corridor

Existing Points

- Forest Residuals
- Petroleum Refineries
- Large Airports

Pyrolysis Depot Selections

- MASTRS Selections (3)
- FTOT Selections (3)



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FTOT OPTIMIZATION

Entry Nodes

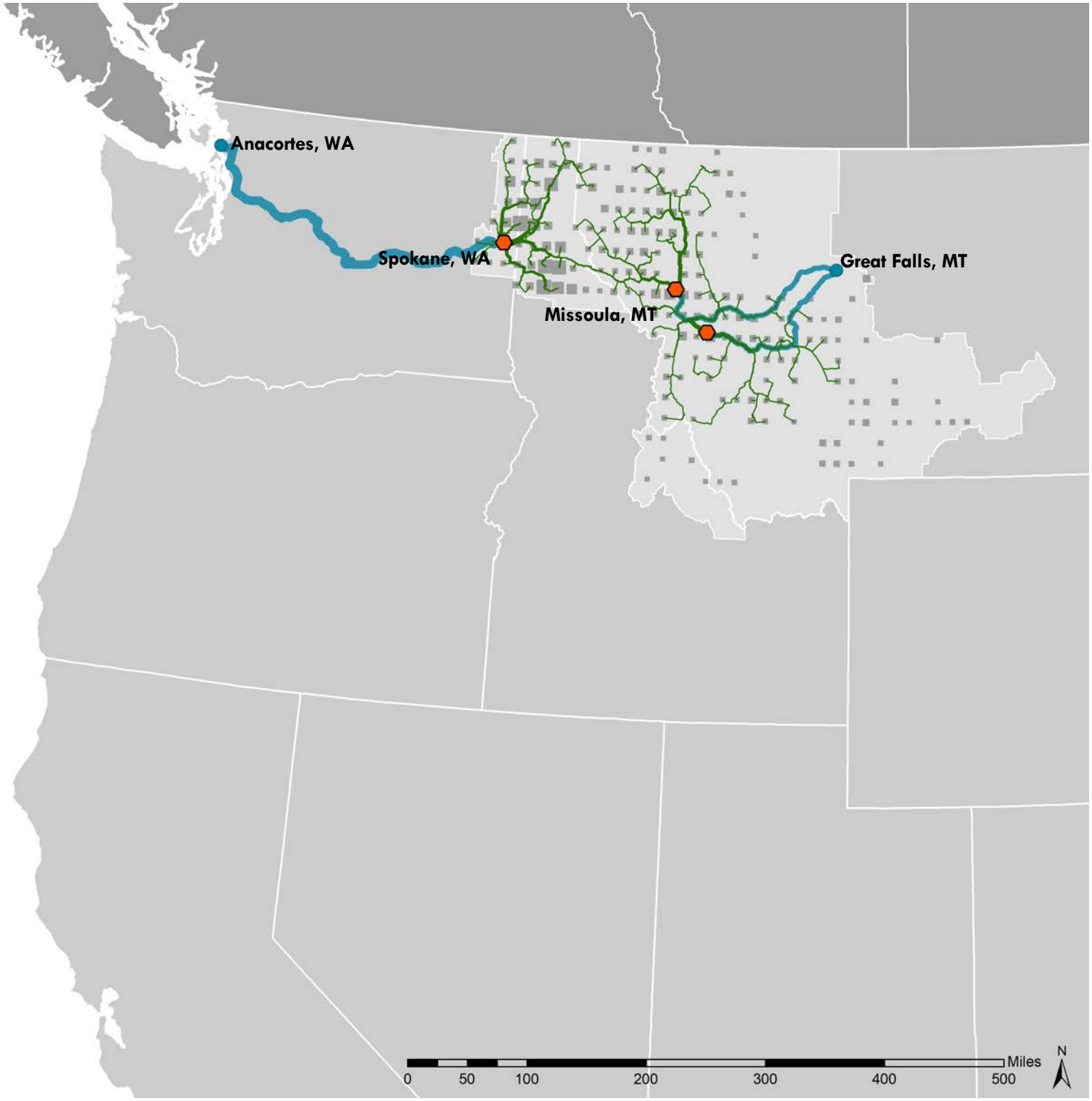
- Forest Residuals

Intermediate Nodes

- Pyrolysis Depots (3)
- Upgrade Refineries (2)

Transportation

- Forest to Depot
- Depot to Upgrade



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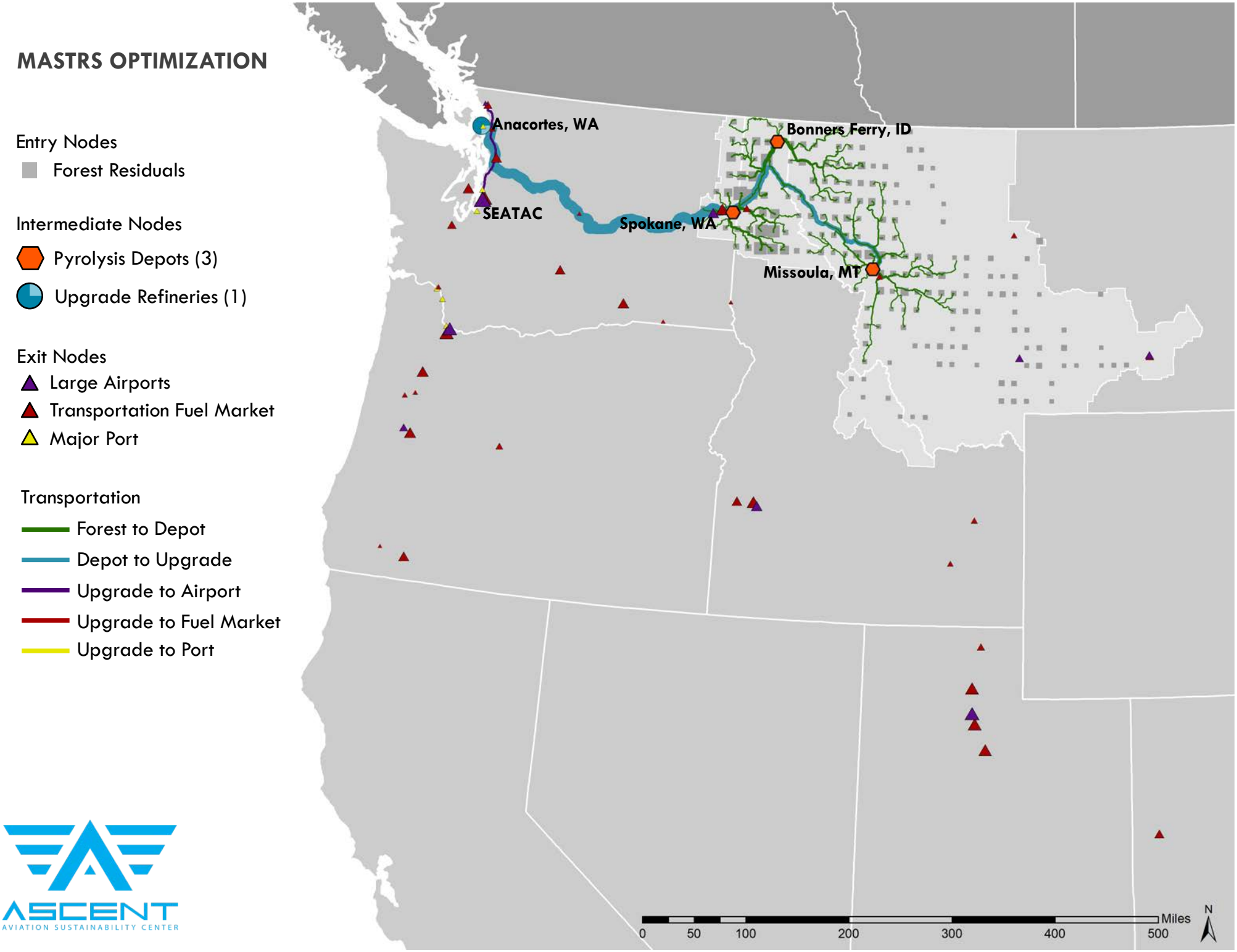
MASTRS OPTIMIZATION



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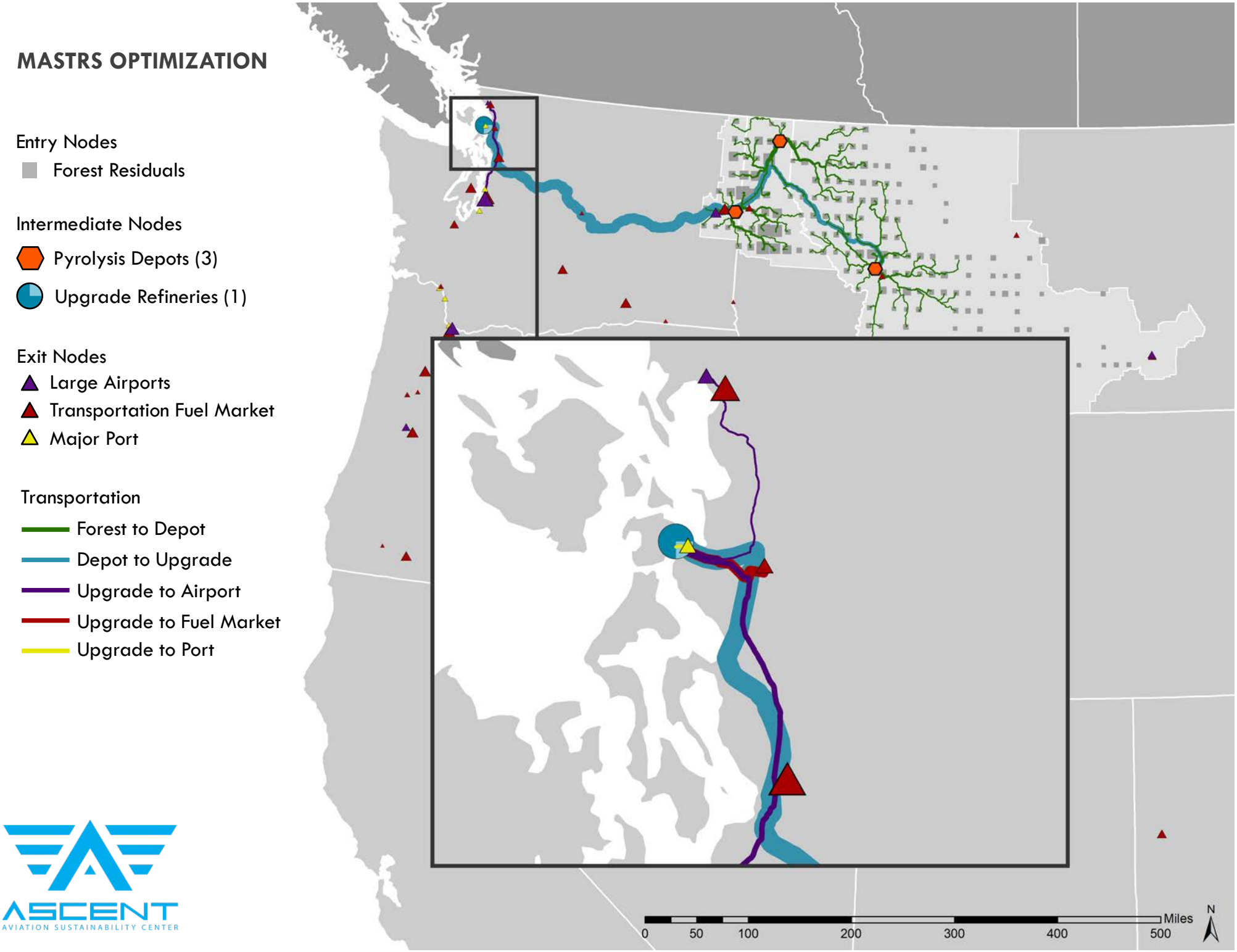
MASTRS OPTIMIZATION



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THANK YOU