Forest Resource Economics Education

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Today's Talk

Mass Timber in Michigan

FEATURED SPEAKER:

Dr. Raju Pokharel
Assistant Professor
Department of Forestry,
Michigan State University

Learn more about the series- scan the QR code or click for.msu.edu/FREE

Jan 8 | Operational cost of harvesting timber- it's complicated- and other factors in the supply chain health
Speaker: Bill O'Brion
General Manager, Lyme Great Lakes Forest Management
Register: for.msu.edu/obrian

March 5 | Forest Products Industry and Timber Market
Speaker: Dr. Jagdish Poudel
Forest Economist, Michigan DNR
Assistant Adjunct Professor, MSU
Register: for.msu.edu/poudel

May 7 | Secondary Wood Product Manufacturing in Michigan
Speaker: Matthew Watkeys
Forest Marketing and Outreach Specialist, Michigan DNR
Register: for.msu.edu/watkeys

July 2 | Mass Timber In Michigan
Speaker: Dr. Raju Pokharel
Assistant Professor, Department of Forestry, MSU
Register: for.msu.edu/pokharel

September 3 | Forest Taxation
Speaker: Dr. Shivan Gc
Assistant Professor, Department of Forestry, MSU
Register: for.msu.edu/gc

November 5 | Hardwood Management, Economics, & Sustainability
Speaker: Dr. Gaurav Dhungel
ORISE Research Fellow, USDA Forest Service- SRS
Register: for.msu.edu/dhungel

Prospects for mass timber in Michigan:
Feedstock Supply And Demand Drivers

Raju Pokharel, **Ichchha Thapa**, Emily Silver, Sandra Lupien, George Berghorn, Jagdish Poudel

Department of Forestry, Michigan State University
Forest Economics and Resource Management (FERM) Lab:
https://www.canr.msu.edu/FERM/

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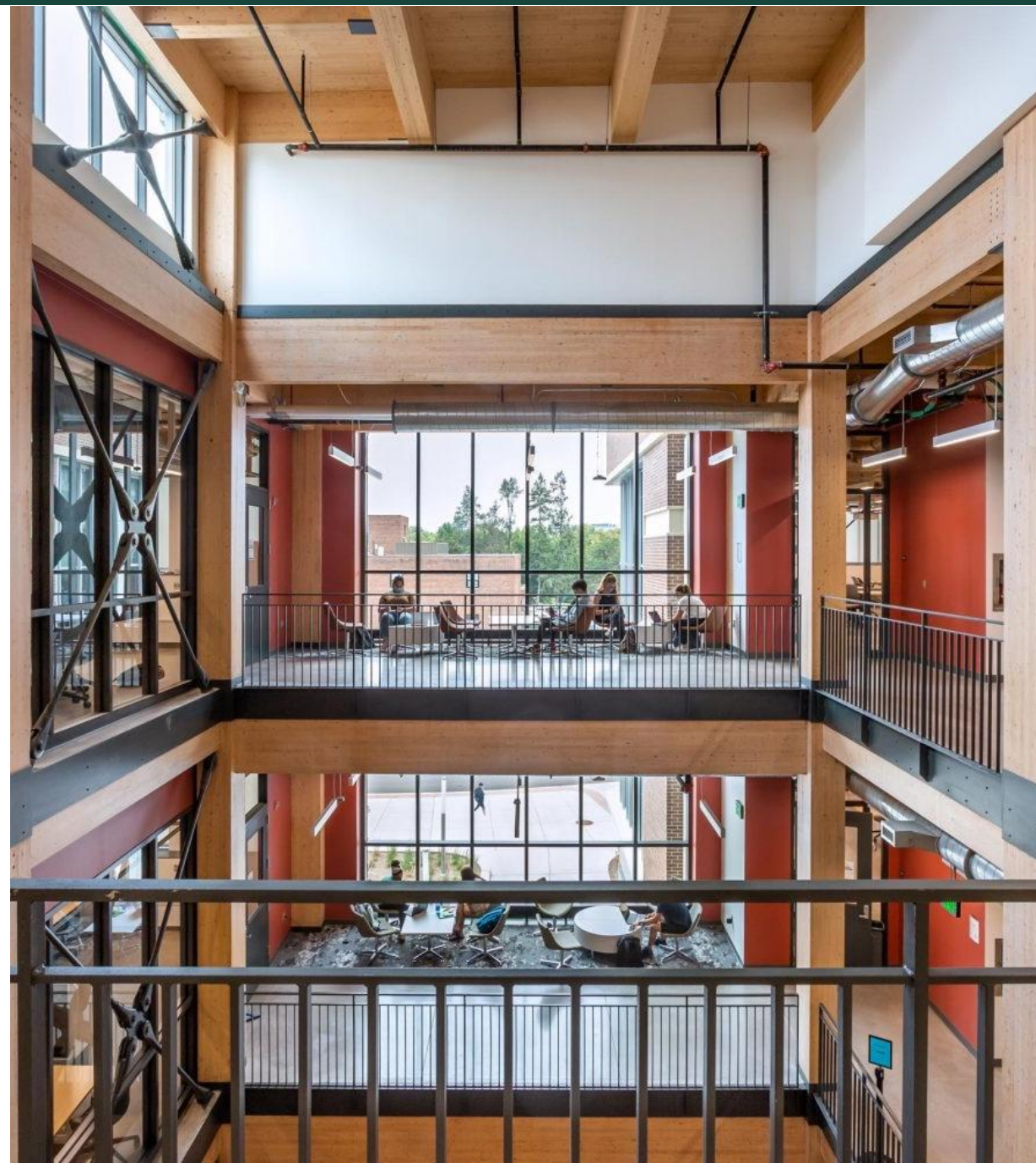
MASS TIMBER IS:

"… a category of framing styles typically characterized by the use of large solid wood panels for wall, floor, and roof construction. It also includes innovative forms of non-building structures, formed from solid wood panel or framing systems of six feet or more in width and depth"

—*American Wood Council*



TYPES OF MASS TIMBER

Glue-laminated Timber (Glulam)

Cross-Laminated Timber (CLT)

Nail-Laminated Timber

Laminated Veneer Lumber

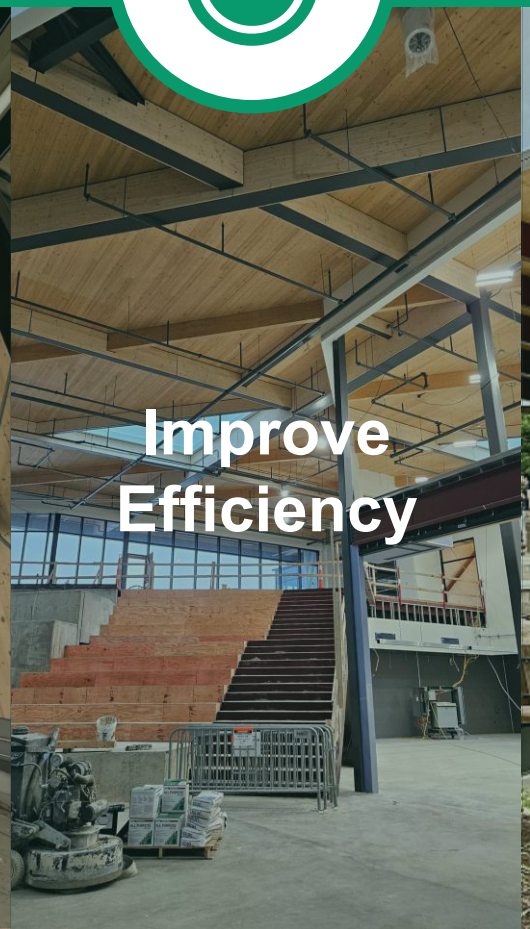
Mass Plywood Panels

Dowel Laminated Timber

TYPES OF MASS TIMBER

"Glulam is a stress-rated engineered wood beam composed of wood laminations, or "lams", that are bonded together with durable, moisture-resistant adhesives. The grain of the laminations runs parallel with the length of the member." *APA*	"Cross-laminated Timber (CLT) is a large-scale, prefabricated, solid engineered wood panel. Lightweight yet very strong, with superior acoustic, fire, seismic and thermal performance" *APA*	"Nail-laminated timber (NLT) is mechanically laminated to create a solid timber panel. NLT is created by placing dimension lumber on edge and fastening the individual laminations together with nails." *WoodWorks*
Glue-laminated Timber (Glulam)	**Cross-Laminated Timber (CLT)**	**Nail-Laminated Timber**
"Laminated veneer lumber (LVL) is a composite product manufactured from multiple thin layers of veneer that are aligned with the length of the finished lumber." *Oklahoma State University Extension*	"Mass plywood panels (MPP), a veneer-based engineered wood product, are a recent addition to the mass timber line-up of product options." *WoodWorks, Freres Lumber*	"Dowel-laminated timber (DLT) is similar to NLT. Instead of nails or screws, DLT uses wood dowels to join laminations. Softwood lumber panels are stacked like NLT and friction-fit together with hardwood dowels." *ThinkWood*
Laminated Veneer Lumber	**Mass Plywood Panels**	**Dowel Laminated Timber**

MASS TIMBER CAN:



U.S.A. MASS TIMBER MILESTONES

Pre-1980s

Image: StructureCraft

Glulam, nail-laminated timber in code and in use for many decades

1980s

Image: Structurlam

CLT emerged ~40 years ago in Austria and Germany

Early 2010s

Image: SmartLam NA

Early 2010s – CLT interest sparks in U.S.A.

2015

Image: WoodWorking Network

First certified CLT panels manufactured in U.S. – D.R. Johnson

2016

Image: International Mass Timber Conference

First International Mass Timber Conference (~500 attendees; in 2024 3500+ attendees)

2016

Image: Hines

First "tall" mass timber high-rise completed in the U.S.

2016

Image: Jeremy Bitterman

First building completed using U.S.-made CLT

2018

Image: Kaiser + Path

First multi-family mass-timber skyrise completed

2022

Image: Wisconsin Public Radio

Tallest mass timber building in the world completed

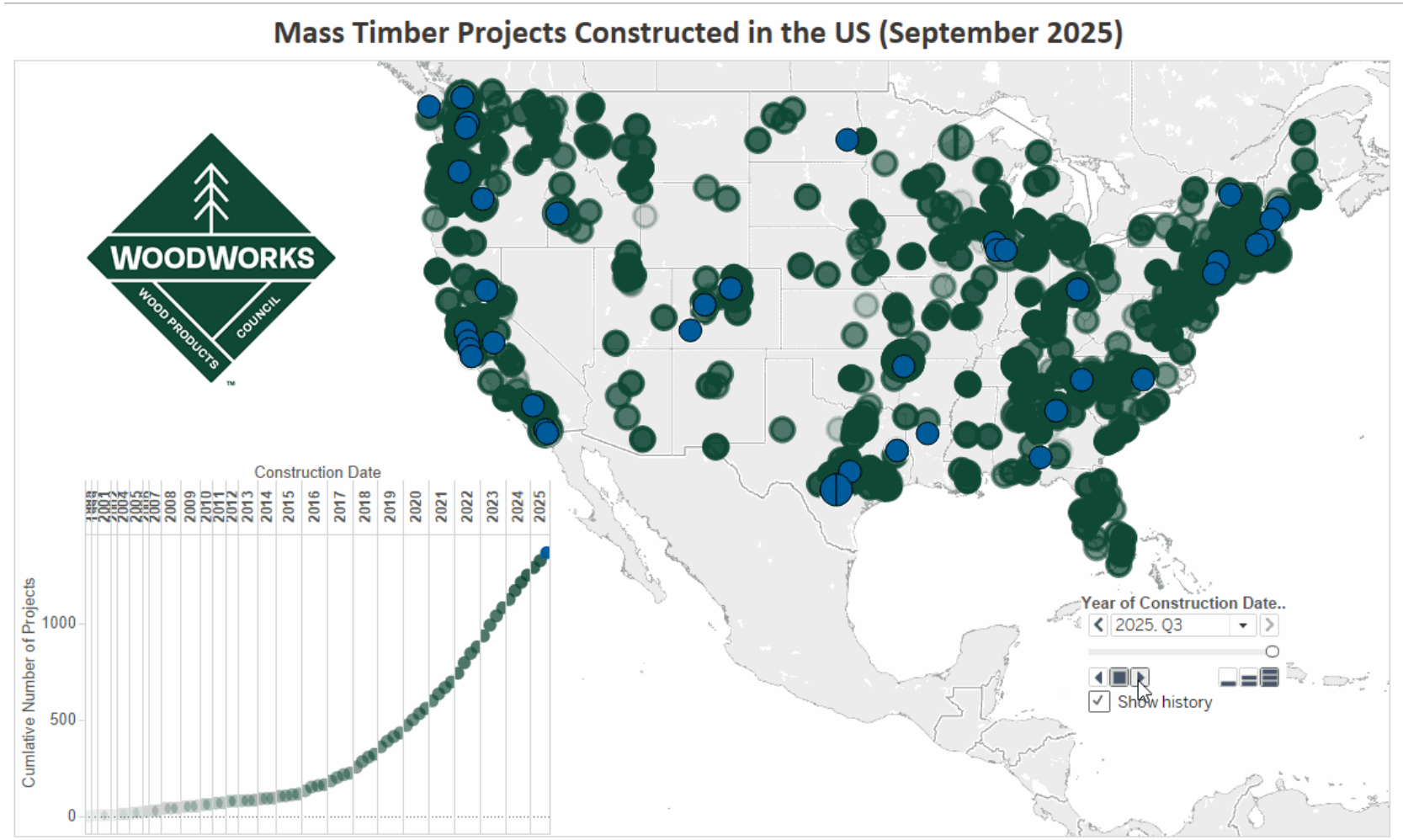
US MASS TIMBER DEMAND

September 2025

Total projects: **2595**
(Complete or in Development/Construction)

Projects in 2018: **439**

Increase ~ 6x



WHY MASS TIMBER FOR MICHIGAN?

Heavily Forested

53% of the state;
19.3 million acres

Manufacturing and Engineering Culture

- Employs almost 42,000 people;
- $26.5 billion annually

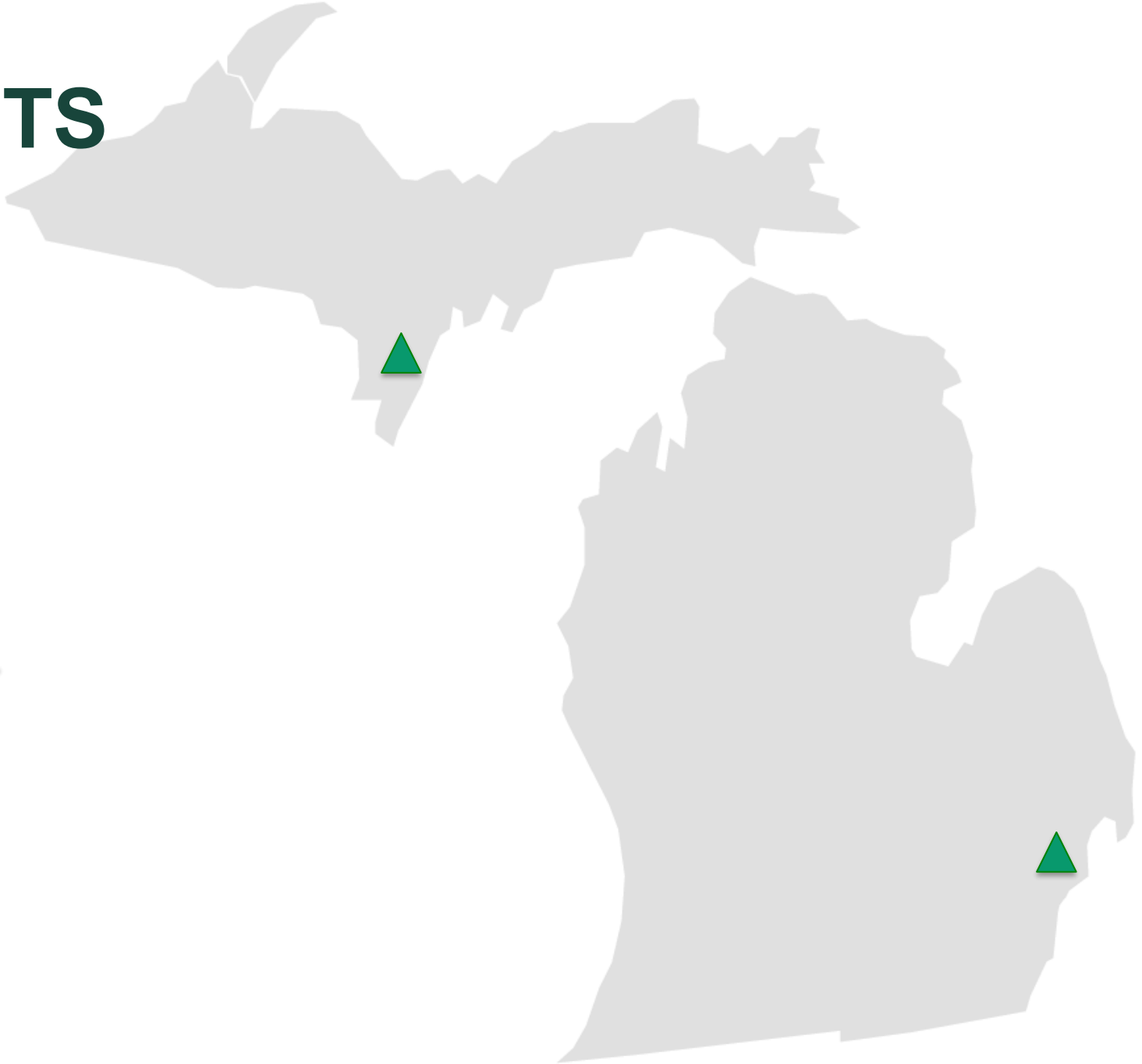
Need to Build

190k housing units

Net-Zero Carbon by 2050

ECONOMIC IMPACTS

(2025 $ Values)



For 50,000 m^3

- $134.01 MM GDP (Direct $75.97 MM)
- 290 jobs (Direct 69 jobs at the facility)
- $8.12 MM Total Taxes (Direct $2.12 MM)
- $1.71 MM Total State Taxes (Direct $0.38 MM)

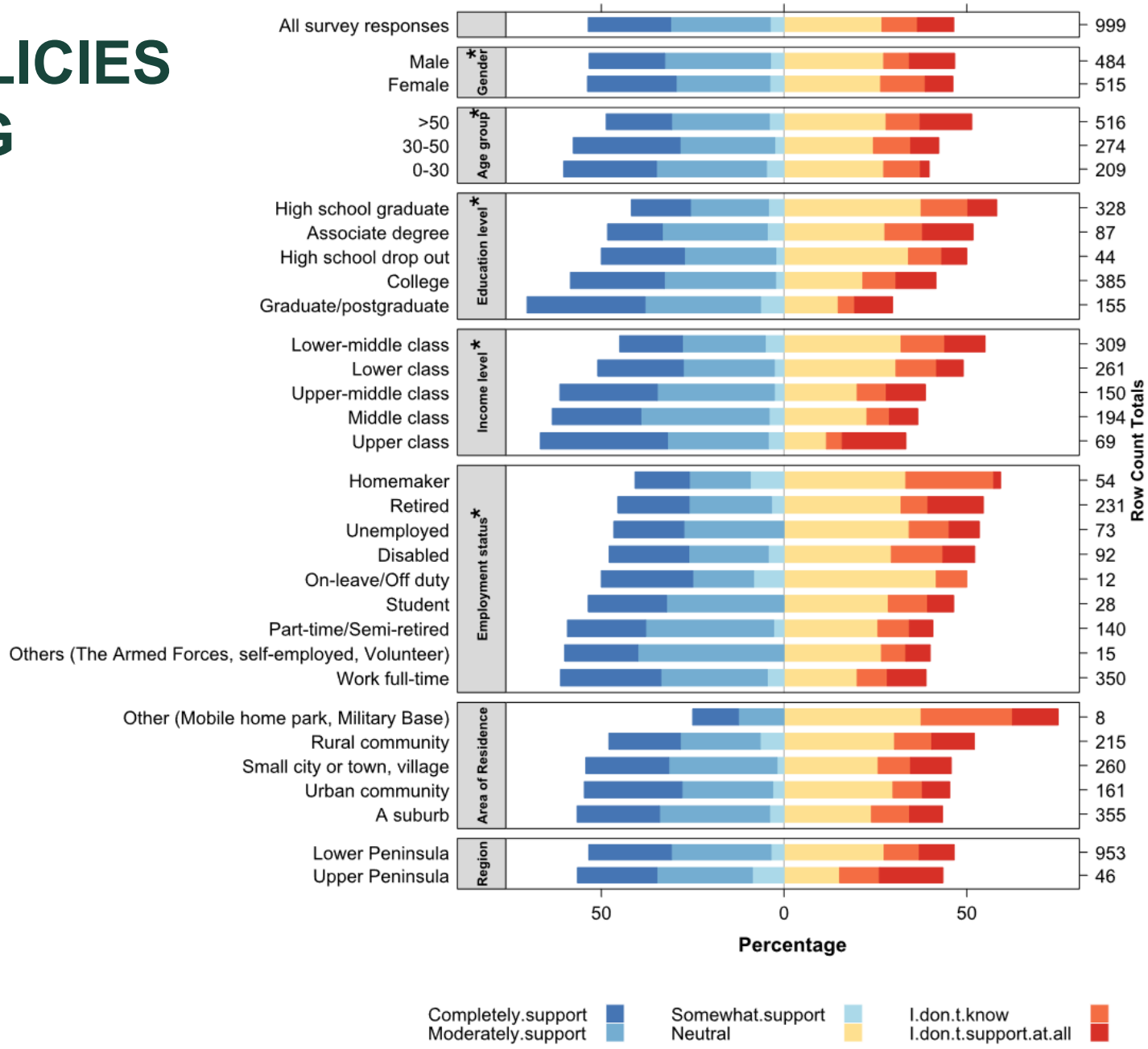
For 100,000 m^3

- $267.57 MM GDP (Direct $151.94 MM GDP)
- 533 jobs (Direct 100 jobs at the facility)
- $15.32 MM Total Taxes (Direct $3.48 MM)
- $3.31 MM Total State Taxes (Direct $0.70 MM)

PUBLIC SUPPORT FOR POLICIES AIMED AT MAINSTREAMING MASS TIMBER

- Majority of Michigan residents (54%) completely or moderately **favor mainstreaming mass timber** in Michigan

- Women, younger individuals with higher levels of education, above-median household incomes, and employed were more supportive



DEMAND DRIVERS

Awareness & Confidence in Mass Timber

- Most professionals are aware yet, local and regional decision makers less familiar with engineered wood and the term "mass timber"
- Confidence with and agreement on market demand varies by different groups

More support and knowledge building would benefit local and regional decision makers and the forestry community

Knowledge and perception	Chi-squared statistic (χ^2)	Degrees of freedom	P-value (<0.05)
Knowledge of wood's potential as engineered construction material	24.61	4	0.000
Familiarity with "mass timber"	21.38	4	0.000
Knowledge of forest certification	21.50	4	0.000
Likelihood to support mass timber with certified raw materials	16.41	12	0.167
Support mass timber due to its low carbon footprint	21.30	16	0.112
Agreement on market demand to shift to mass timber as building material	27.77	16	0.048
Confidence with mass timber as a construction material	44.42	16	0.000
Likelihood to support mass timber based on geographical sourcing of wood (local, region, national)	7.98	4	0.092

More inclined to support mass timber construction when **timber is sourced domestically**

Barriers in Adopting Mass Timber

Cost Concerns
Higher costs compared to traditional materials

Code Limitations
Building codes and height restrictions

Lack of Familiarity
Limited knowledge and experience

Supply Chain Limitations
Restricted availability and production

SUPPLY ANALYSIS
(LAND USE AND RESOURCE ALLOCATION MODEL)

Main Variables

- Softwood & Hardwood Feedstock Availability and Cost
- Demand Locations
- Transportation Cost

What We Modeled (2025 – 2040)

50,000m³ in 2025

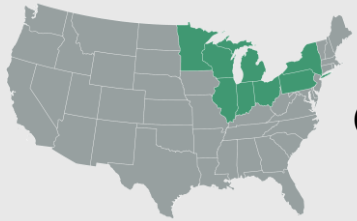
50,000m³ in 2030

Two supply models:

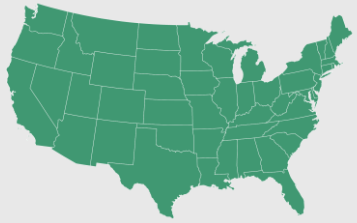
- Secondary manufacturing
- Integrated manufacturing

Feedstock Spatial Models

Michigan Only



Great Lakes Region



Across the US

SECONDARY VS INTEGRATED MANUFACTURING MODEL

Secondary Manufacturing

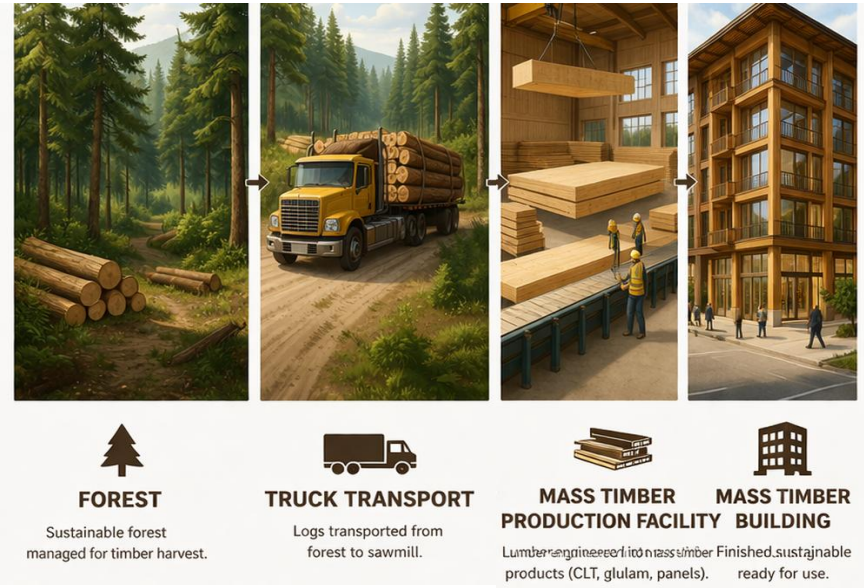
Pros

- Integrated into the existing lumber supply chain
- Lower capital investment (no sawmill or kiln-drying facility required)

Cons

- Competition for lumber may constrain supply
- Large climate-controlled lumber storage may be required

Integrated Manufacturing



Pros

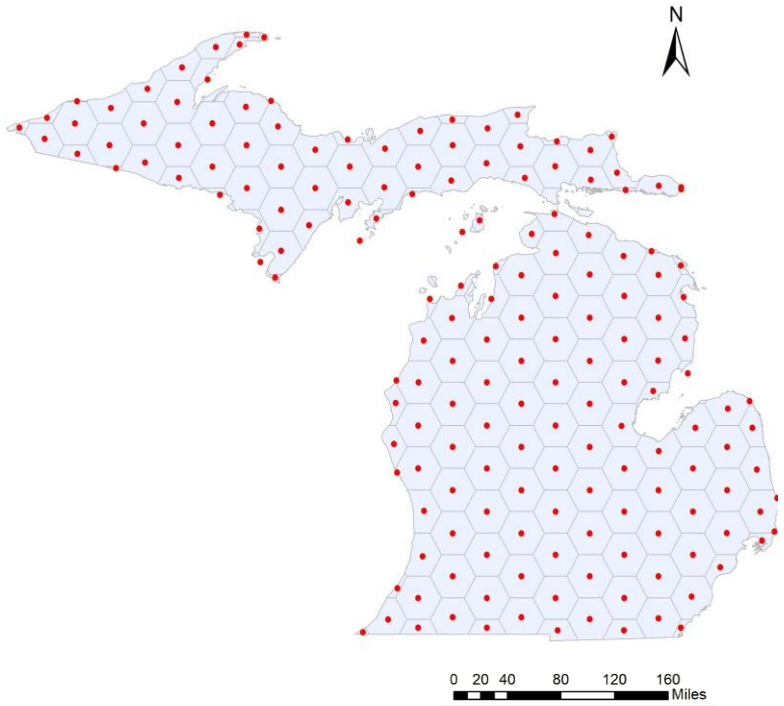
- Flexible site selection to maximize resource availability and reduce competition
- Can use small-diameter logs, custom dimensions, and underutilized species

Cons

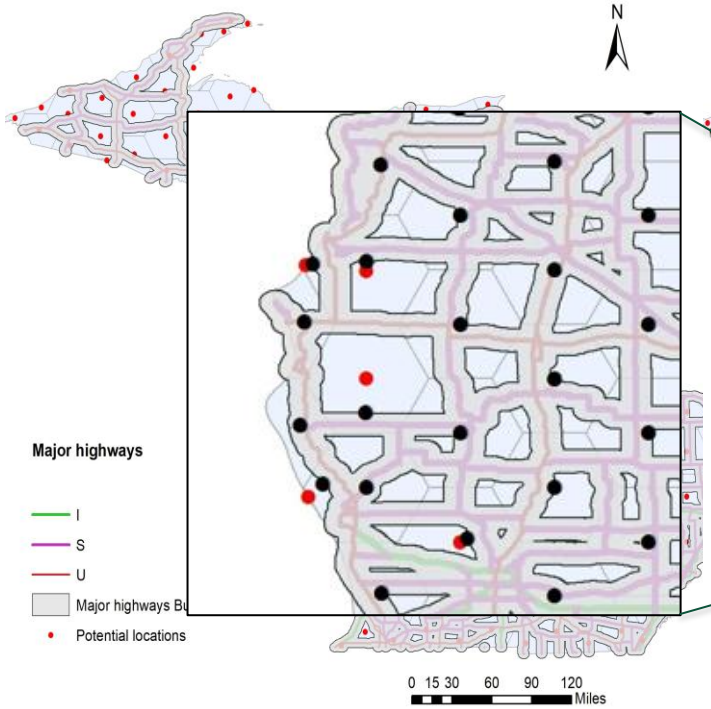
- Higher capital investment (requires sawmill and kiln-drying facilities in addition to the mass timber plant)

LOCATION IDENTIFICATION

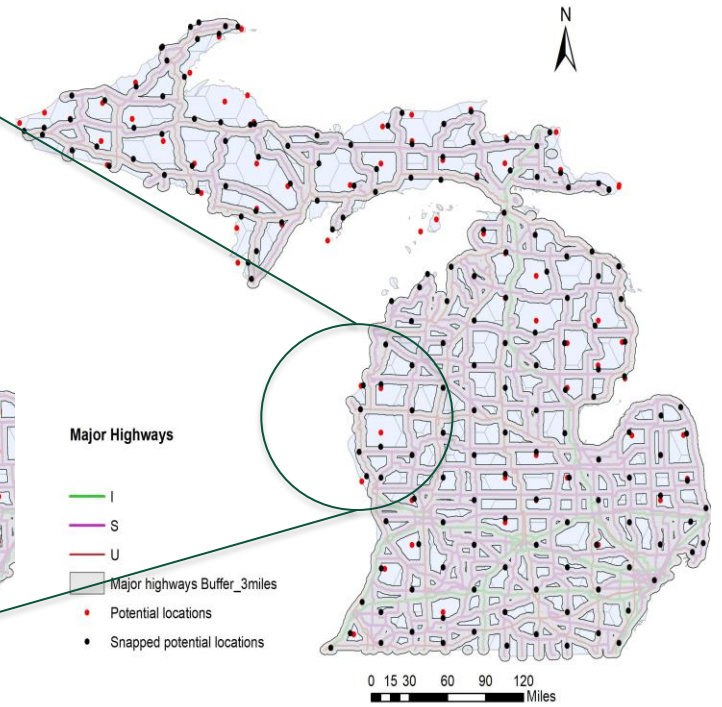
FOR MASS TIMBER PRODUCTION



Tessellated grid of hexagonal polygon
Established a mid-point in each hexagon as potential locations



Overlaid the potential location grids with major highways and created a buffer of 3 miles



Snapped the potential locations to the closest highways

SUPPLY FOR MASS TIMBER

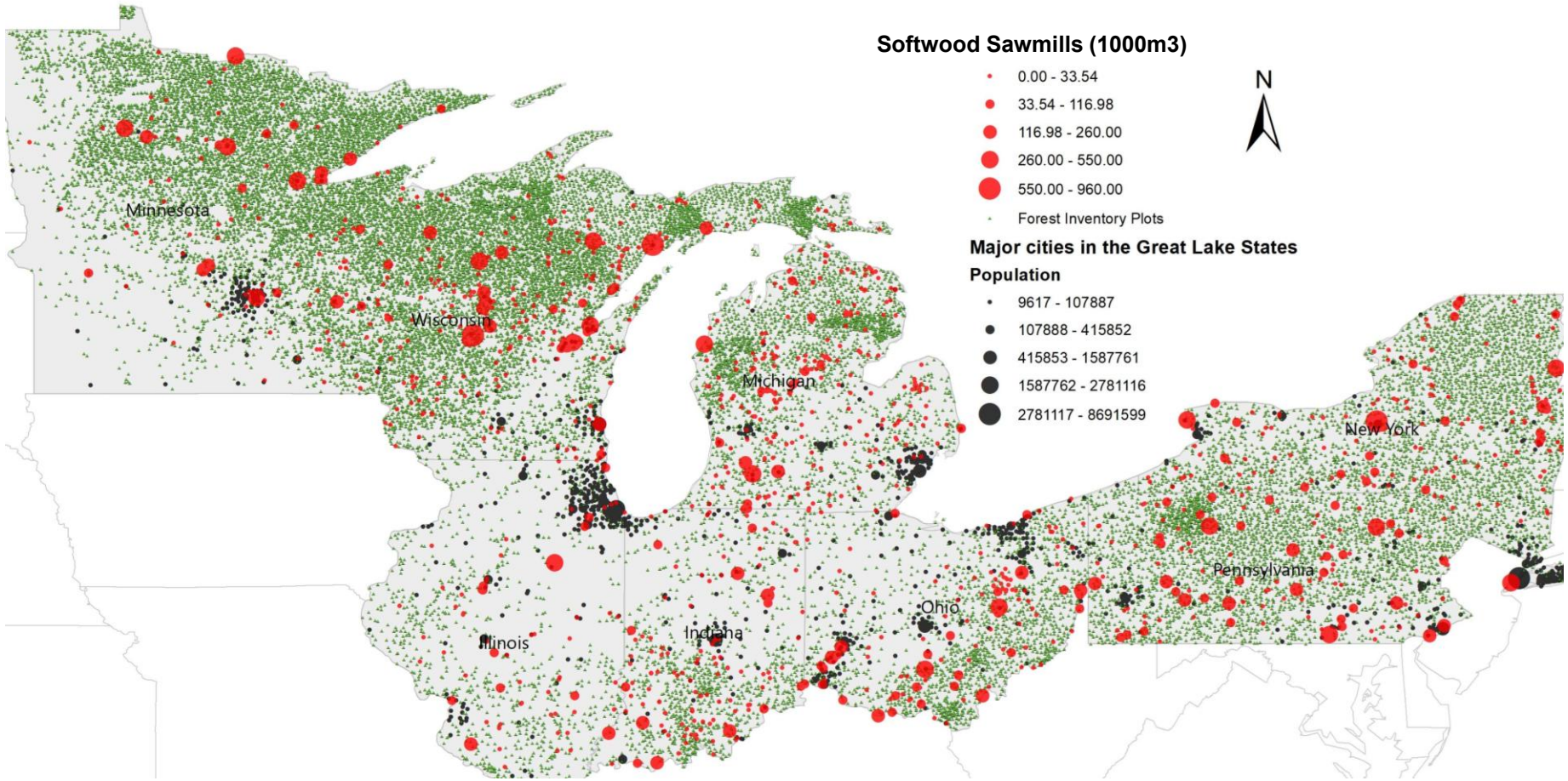
GREAT LAKES REGION

Supply points

- Softwood sawmills (N=1298)
- FIA plots (N=32,683)

Demand points

- Cities (N=924)



OPTIMAL LOCATION IDENTIFICATION

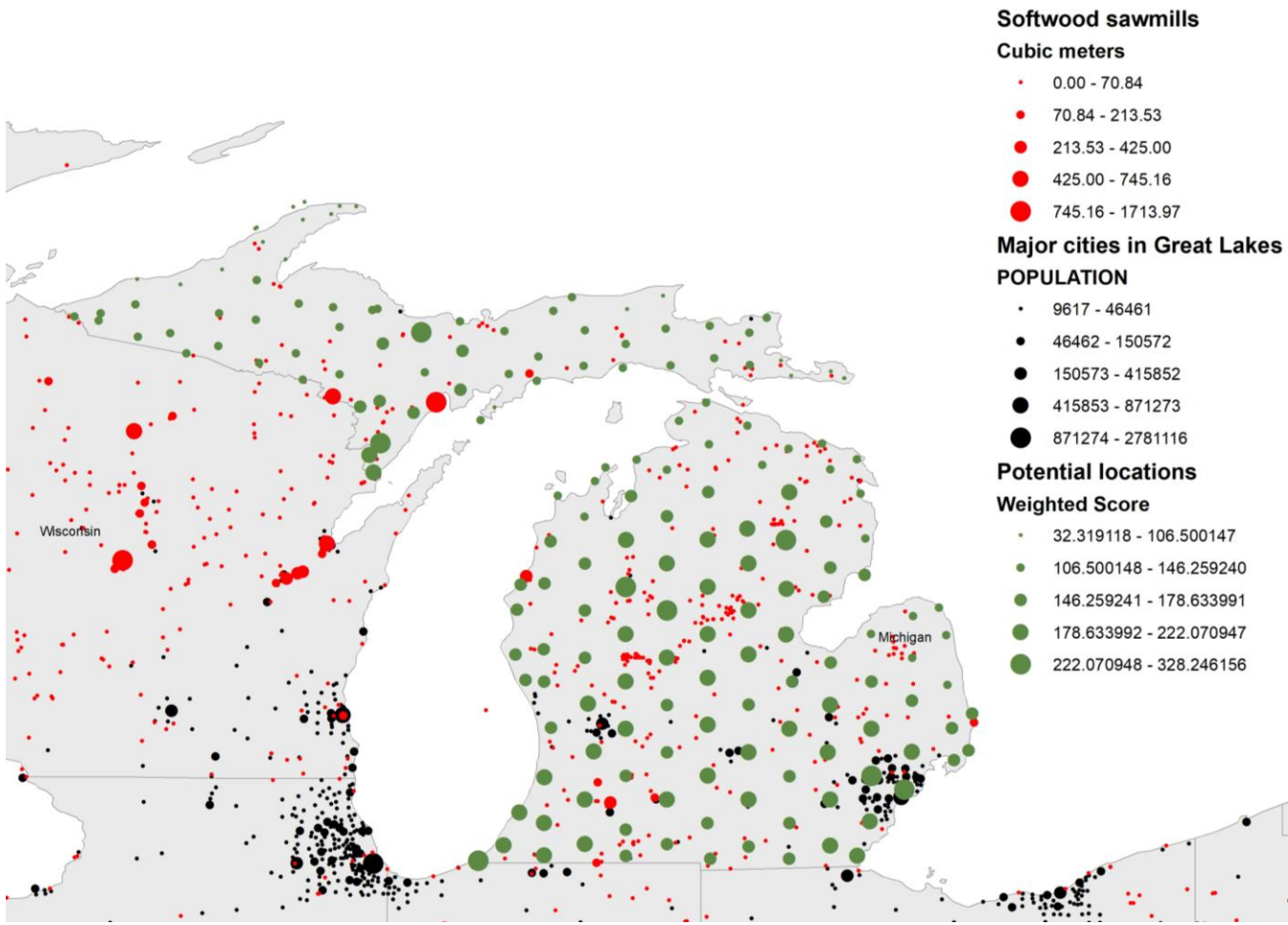
FOR MASS TIMBER PRODUCTION

- 1st Step:
- Equal Weight to supply of softwood lumber and demand for mass timber

$$Score_{Location} =$$

$$0.5\left(\frac{\sum city^1 \sum Lumber\_mill^1}{\sum City^1}\right) * \sum_{city} \frac{\left(\frac{Population_{city}}{Population}\right)}{Drive\_Time_{facility,city}}$$

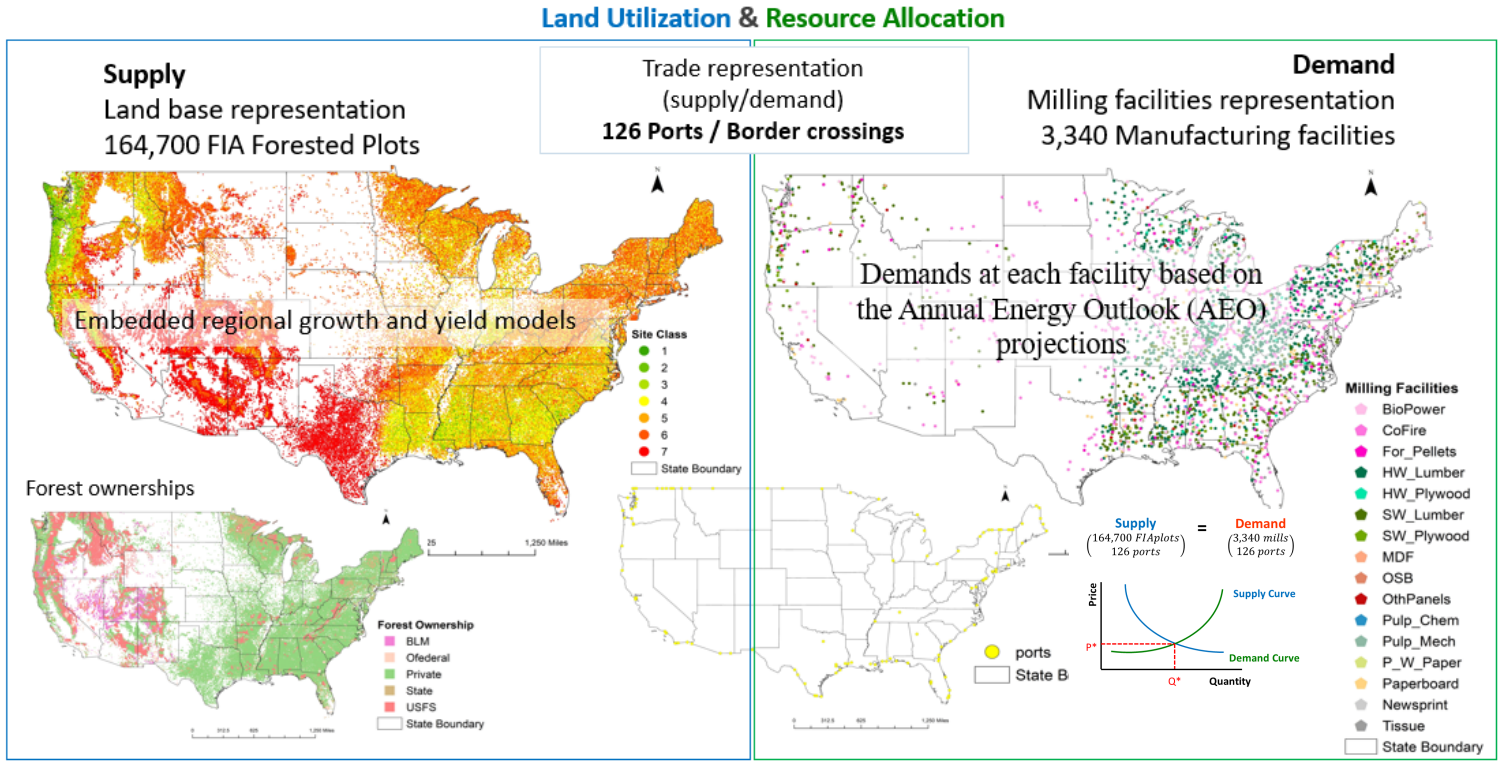
$$+ 0.5\left(\frac{\sum city^1 \sum Lumber\_mill^1}{\sum Lumber\_mill^1}\right) \sum_{Lumber\_mill} \frac{\left(\frac{Capacity_{Lumber\_mill}}{Capacity}\right)}{Drive\_Time_{Lumber_{mill},facility}}$$

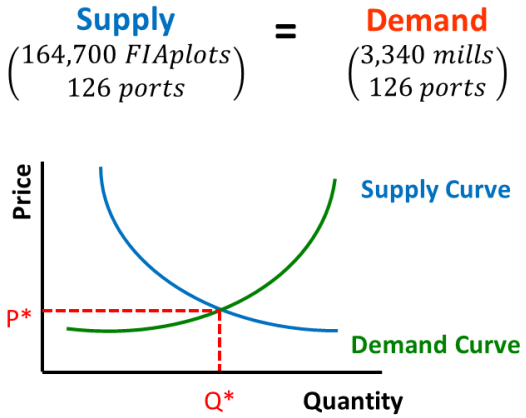


LAND UTILIZATION AND RESOURCE ALLOCATION (LURA)

MODEL

Partial Equilibrium model , Price endogenous , One-to-many regions, One-to-many products





Harvest Changes in response to policy, industry, supply and demand changes in the forest sector.

(6) Latta, G.S., Baker, J.S., Ohrel, S., 2018. A Land Use and Resource Allocation (LURA) modeling system for projecting localized forest CO_2 effects of alternative macroeconomic futures. For. Policy Econ. 87, 35–48

LAND UTILIZATION AND RESOURCE ALLOCATION (LURA)

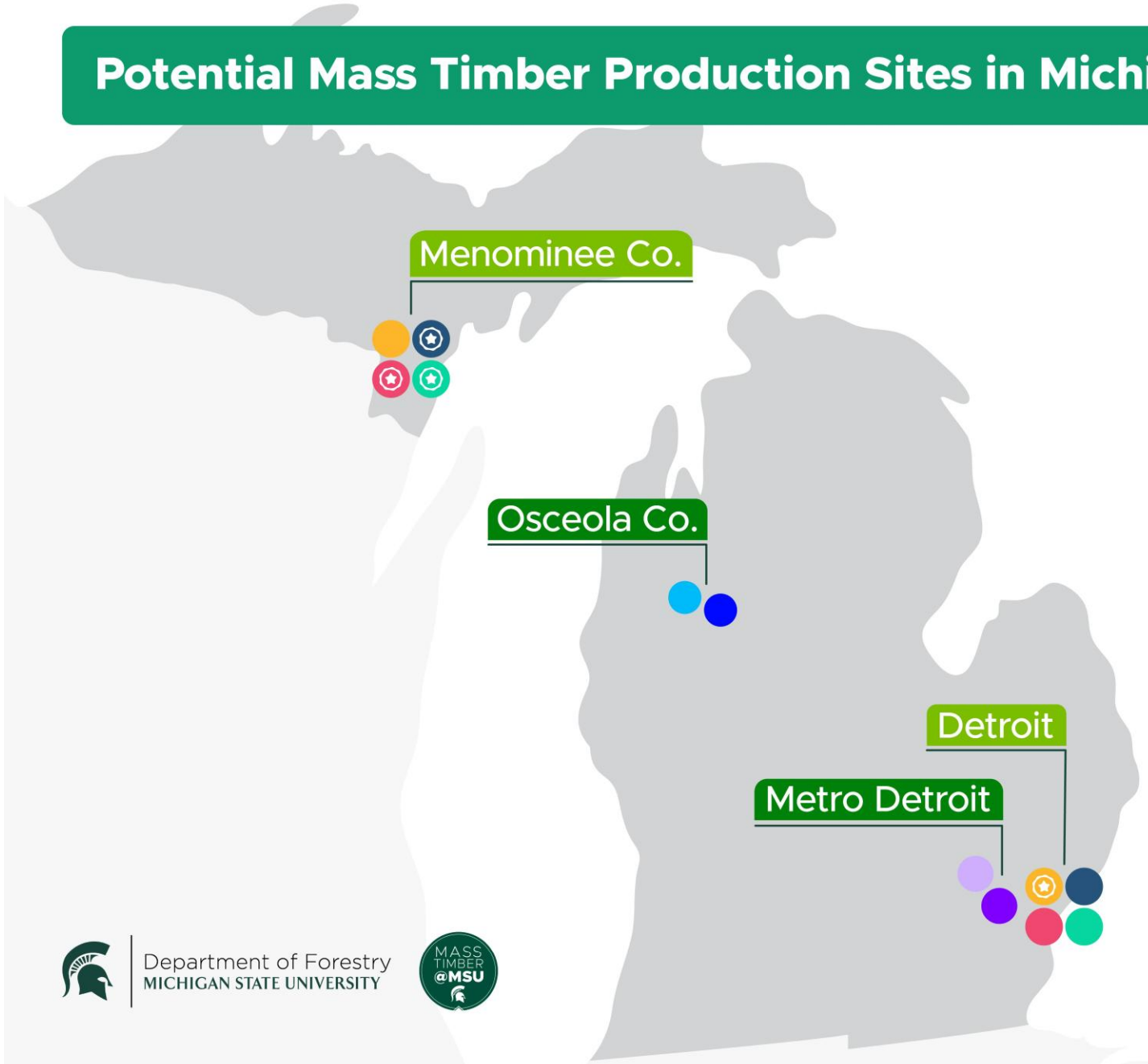
MODEL

Constrained Welfare (W) maximization approach

$$\text{Max } W = \left(\sum_{l_k} \int_0^{Q_{l_k}} P_{l_k}(Q_{l_k}) dQ_{l_k}\right) - \left(\sum_{l} C_l + \sum_{l} \sum_{l'} T_{ll'} t_{ll'} + \sum_{l} \sum_{l'} B_{ll'} b_{ll'}\right)$$

where: *l* is the set of locations including all forest plots, mills, and ports, l_k is a subset of the locations including mills that produce the price endogenous commodities *k*, $P_{l_k}(Q_{l_k})$ that is the derived demand for commodity *k* at mill location l_k, C_l are all non-transportation costs (harvest, chipping, grinding, and capacity) incurred at location *l*, $T_{ll'}$ is the quantity *of* woody biomass transported from location *l* to location *l'*, $t_{ll'}$ is the transportation cost from location *l* to *l'*, $B_{ll'}$ is the woody biomass transported by barge from location l to location l', and $b_{ll'}$ is the transportation cost from location *l* to *l'*.

Potential Mass Timber Production Sites in Michigan Based on Procurement Cost



- **Softwood** – Secondary Manufacturing Model *(Open Sourcing)*
- **Softwood** – Secondary Manufacturing Model *(Michigan Sourcing)*
- **Softwood** – Integrated Manufacturing Model *(Open Sourcing)*
- **Softwood** – Integrated Manufacturing Model *(Michigan Sourcing)*
- **Softwood** – Lower Total Procurement Cost (Menominee Co. v. Detroit)

- **Hardwood** – Secondary Manufacturing Model (30% HW 70% SW)
- **Hardwood** – Secondary Manufacturing Model (50% HW 50% SW)
- **Hardwood** – Secondary Manufacturing Model (100% HW)
- **Hardwood** – Integrated Manufacturing Model (100% HW)

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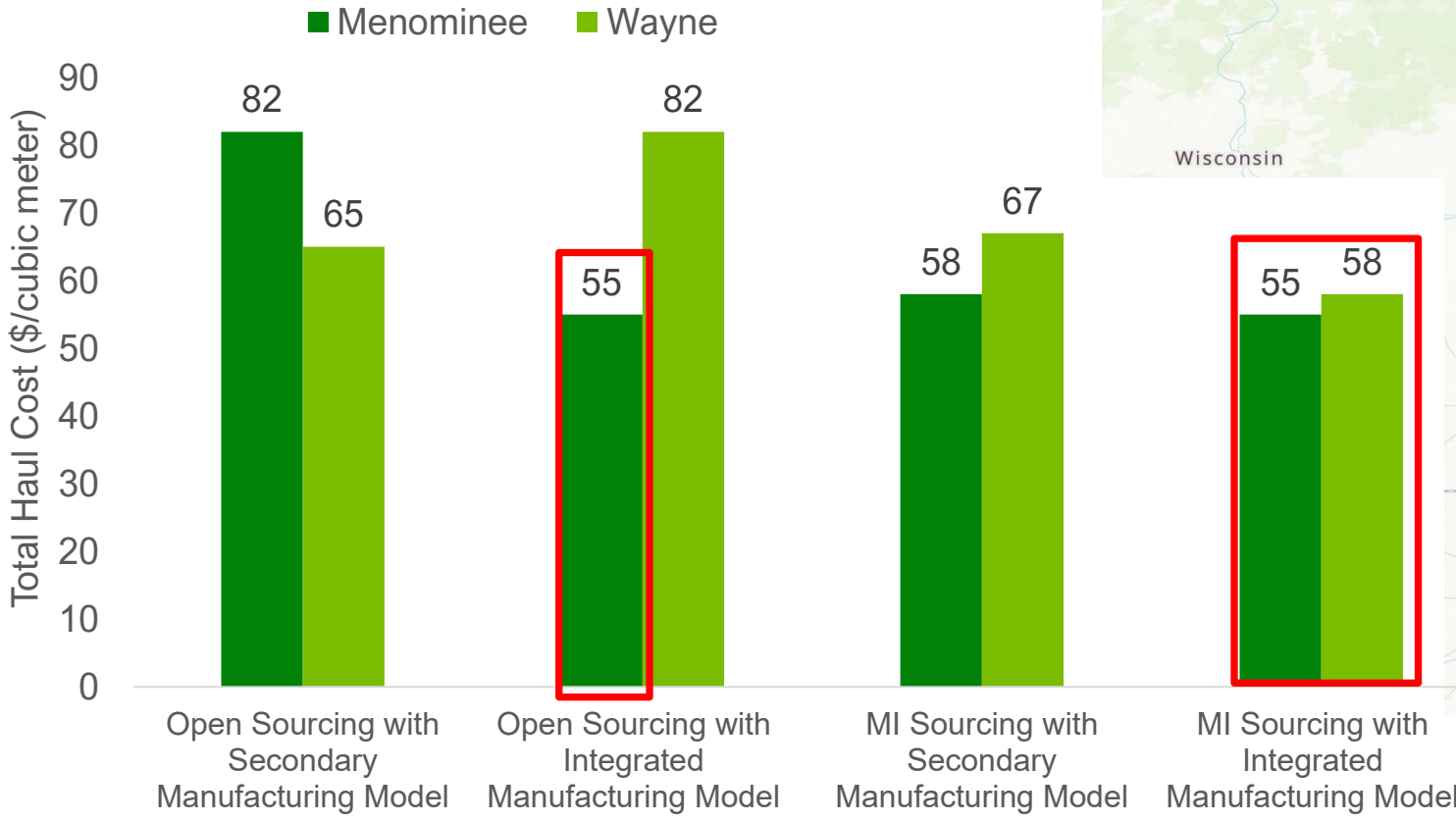
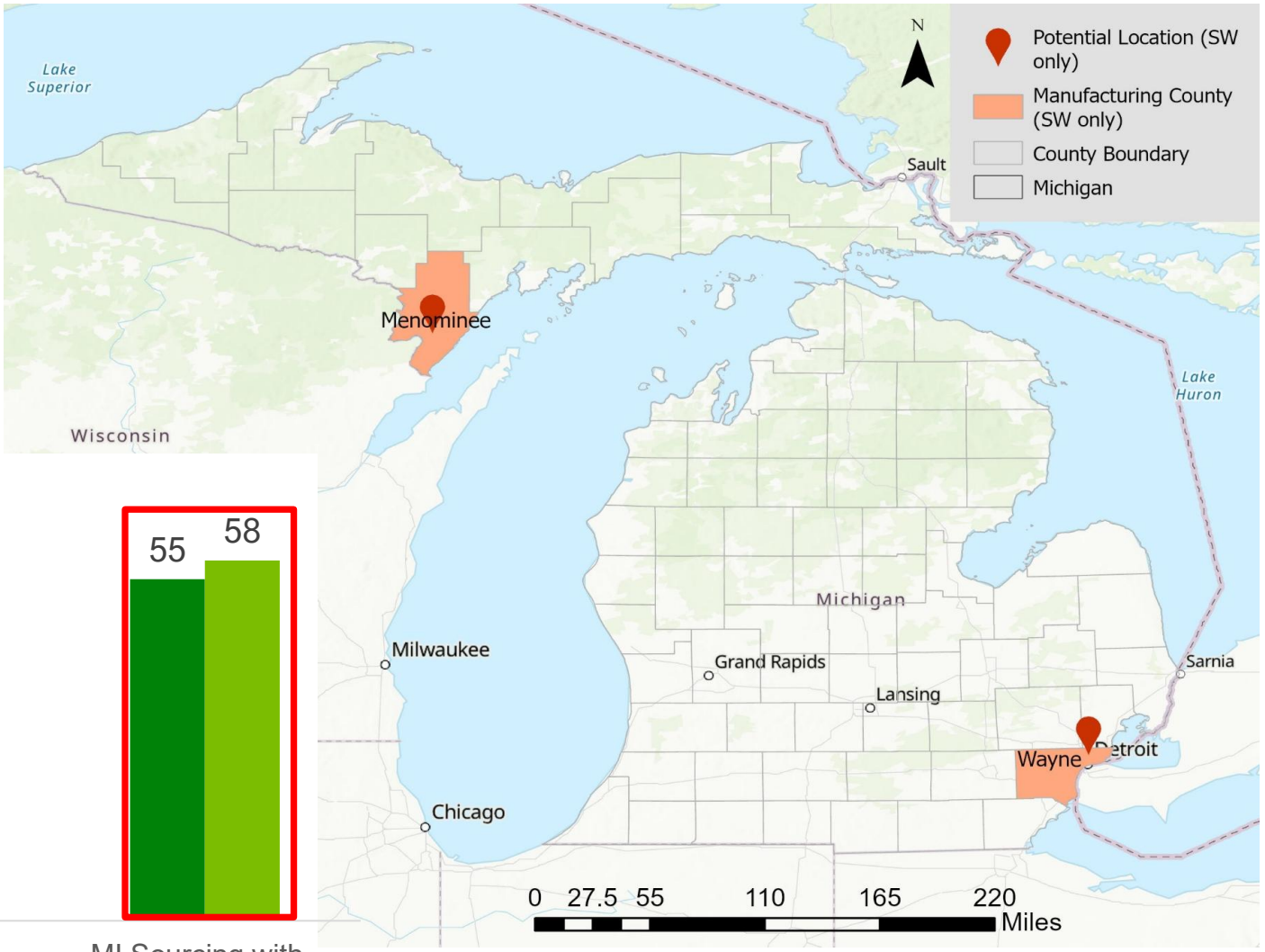
MASS TIMBER @MSU

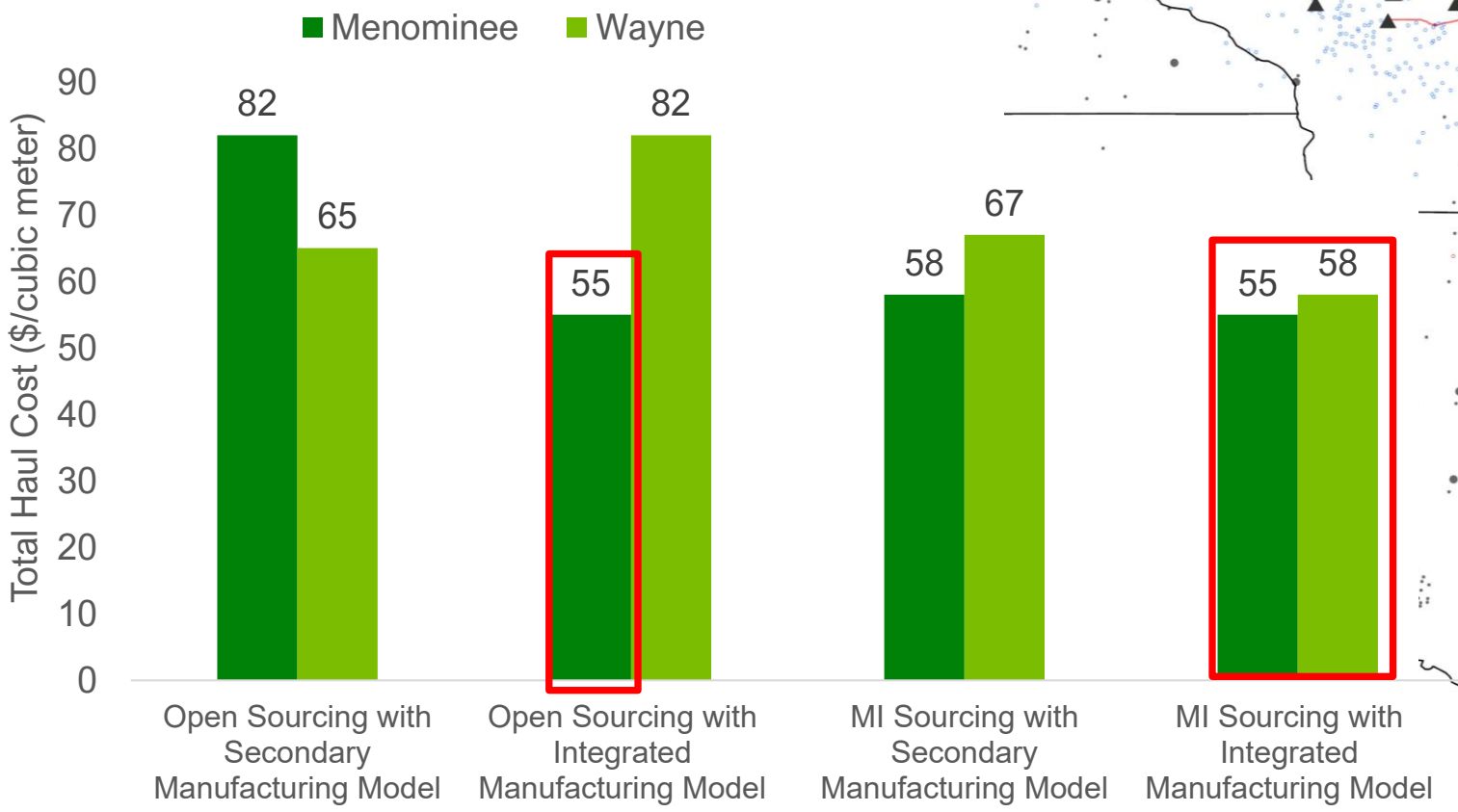
Thapa, I., Pokharel, R., Silver, E., Latta, G., Berghorn, G., Poudel, J., Lupien, S. (2026). Supply Chain Optimization for Mass Timber Manufacturing in Michigan: Feedstock Availability, Procurement Cost, & Optimal Locations [Unpublished doctoral dissertation]. Department of Forestry, Michigan State University.

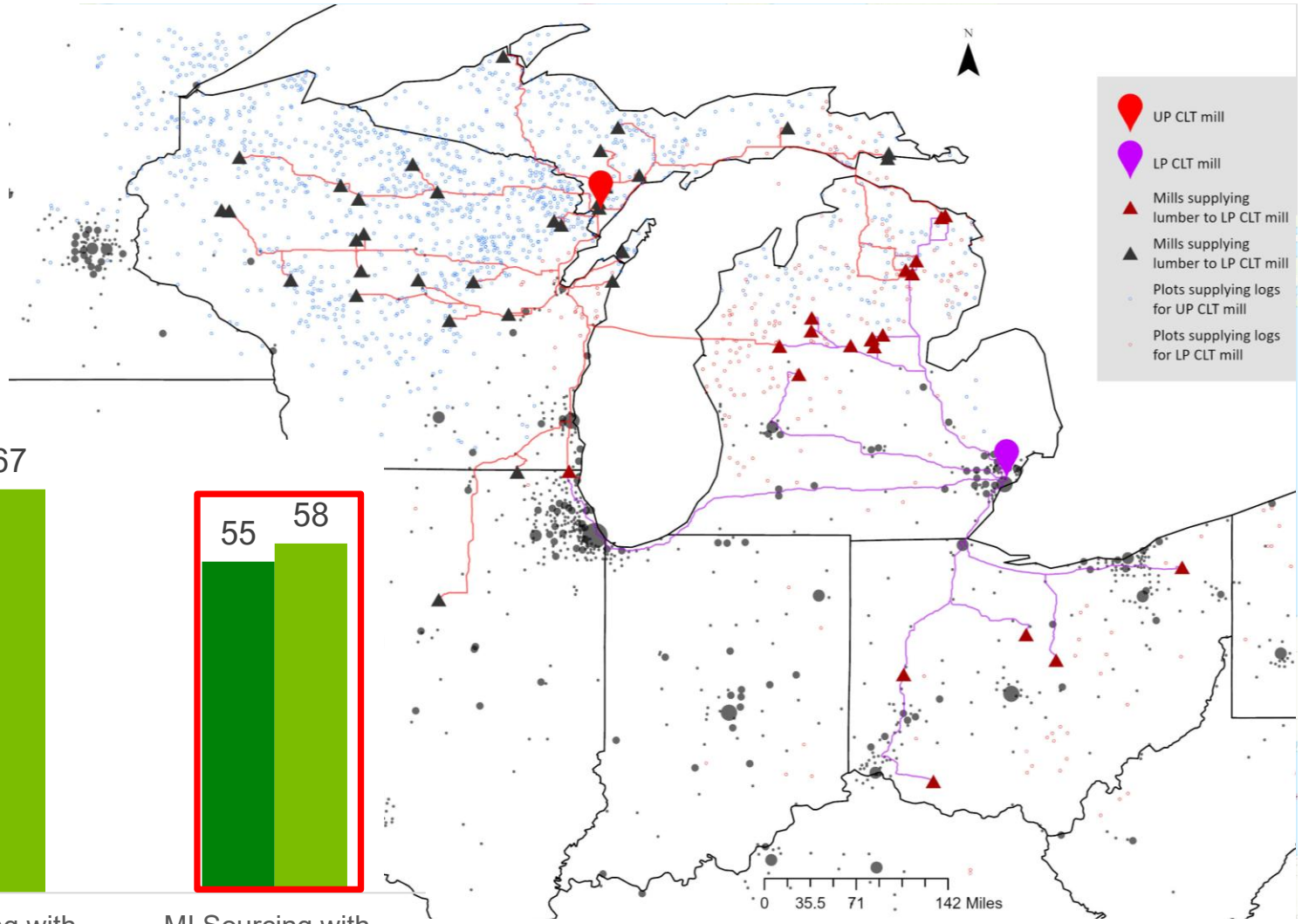
TOTAL PROCUREMENT COSTS
(SOFTWOODS ONLY)



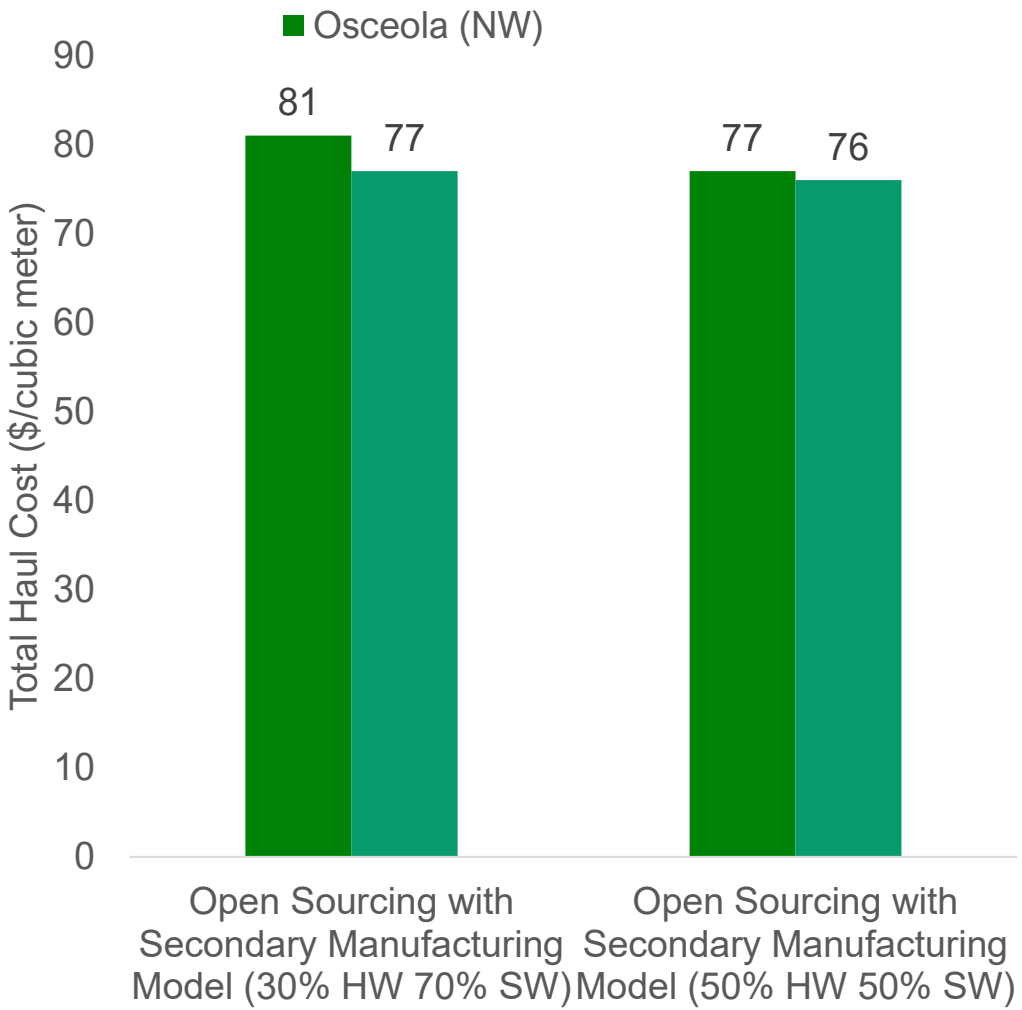


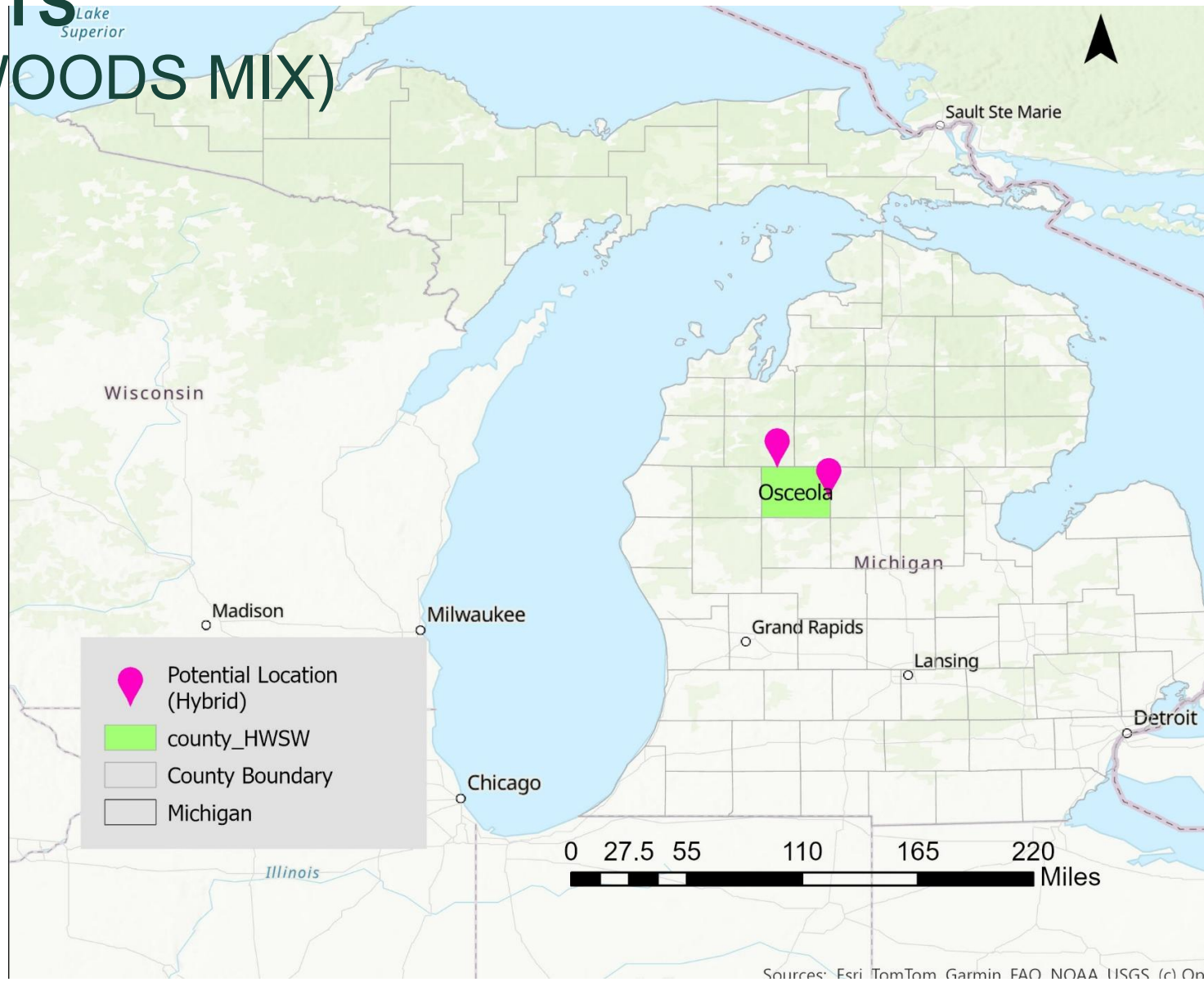
TOTAL PROCUREMENT COSTS
(SOFTWOODS ONLY)





TOTAL PROCURMENT COSTS (HARDWOODS AND SOFTWOODS MIX)





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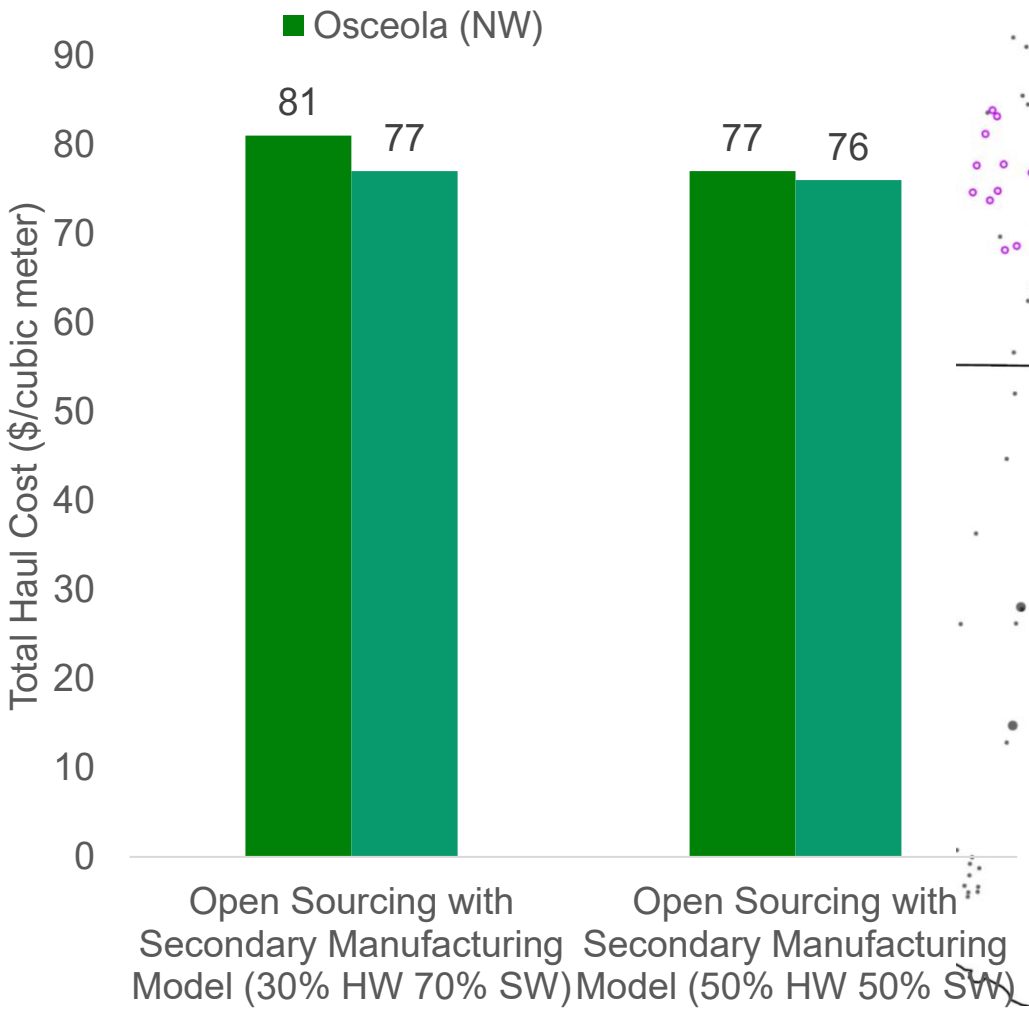
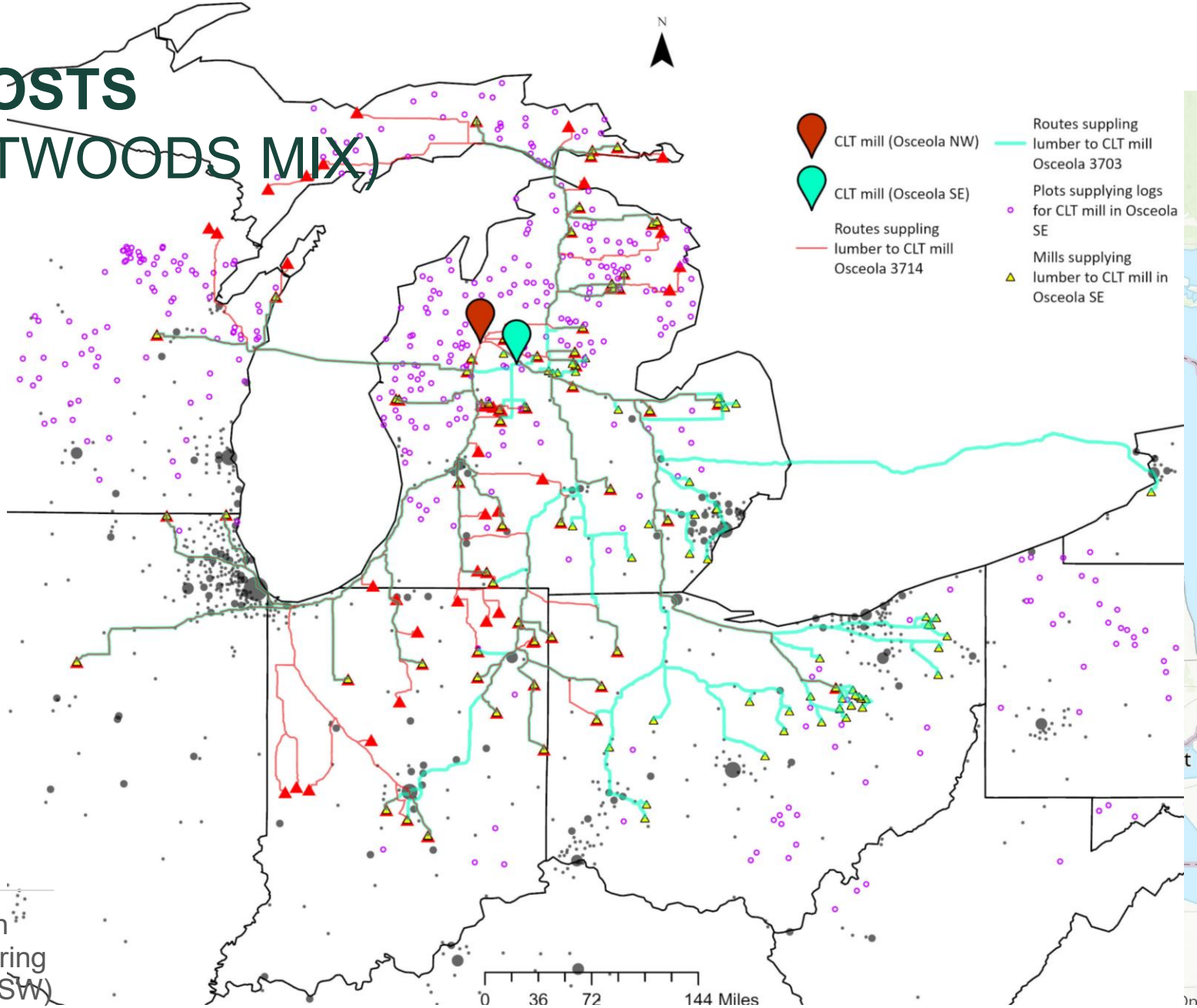
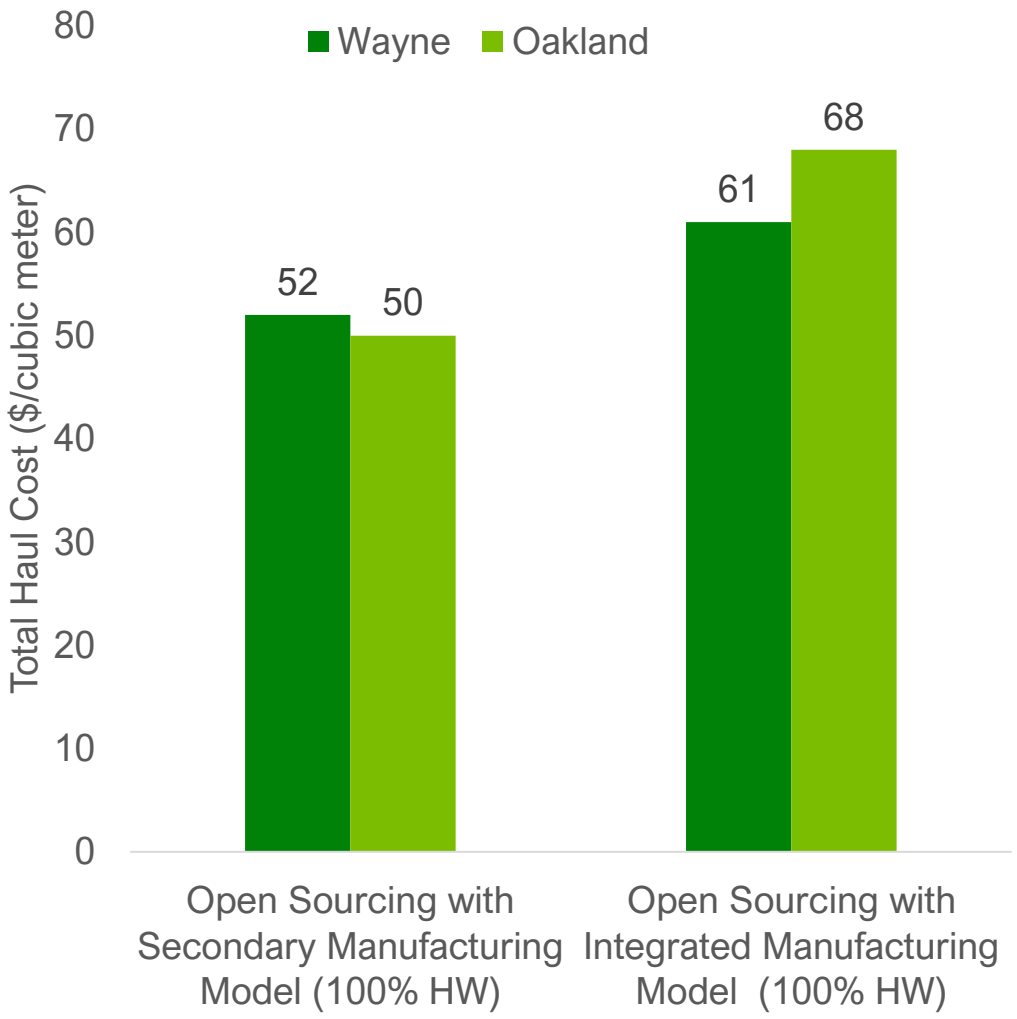
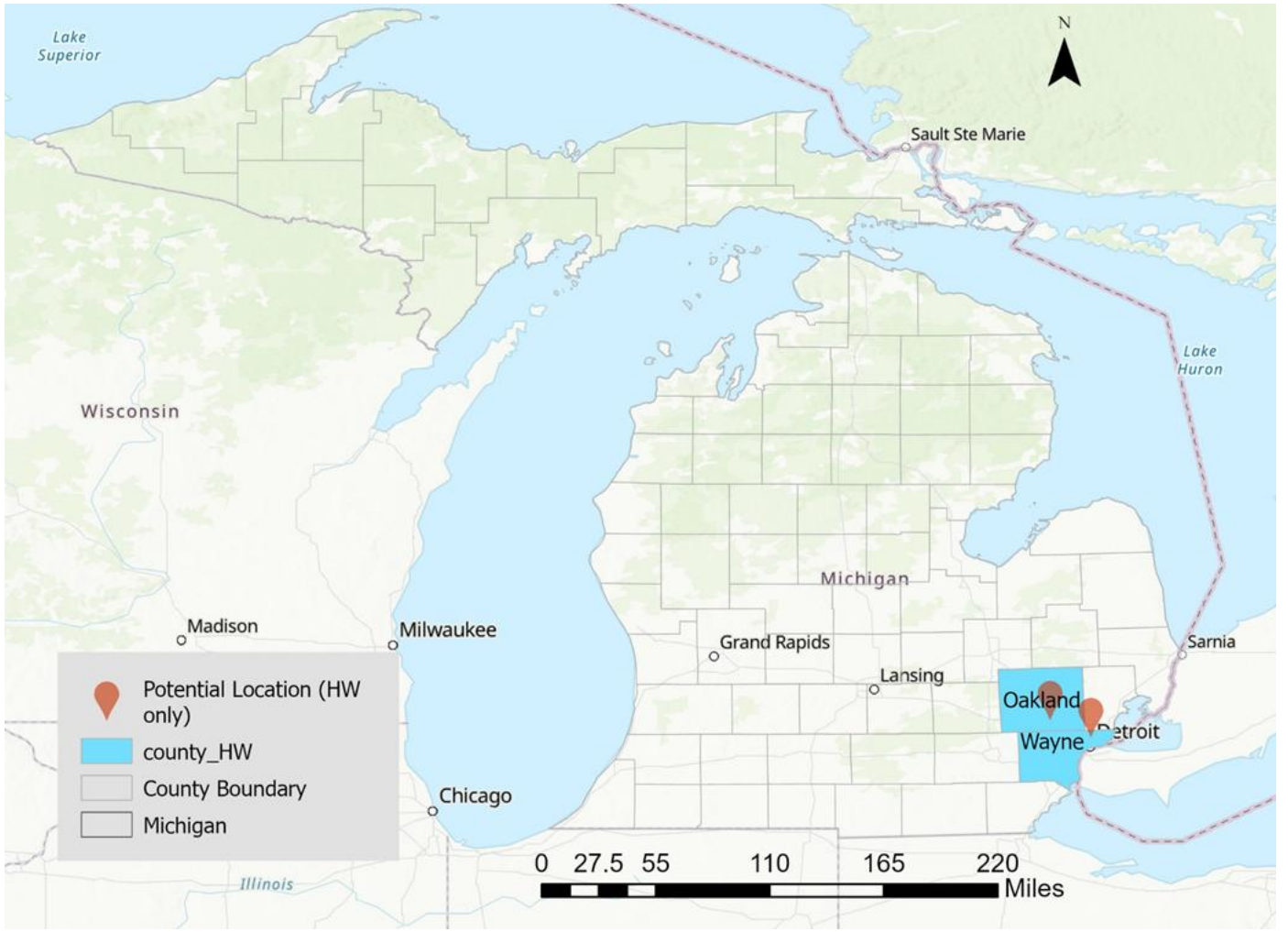




TOTAL PROCUREMENT COSTS (HARDWOODS ONLY)





TOTAL PROCUREMENT COSTS
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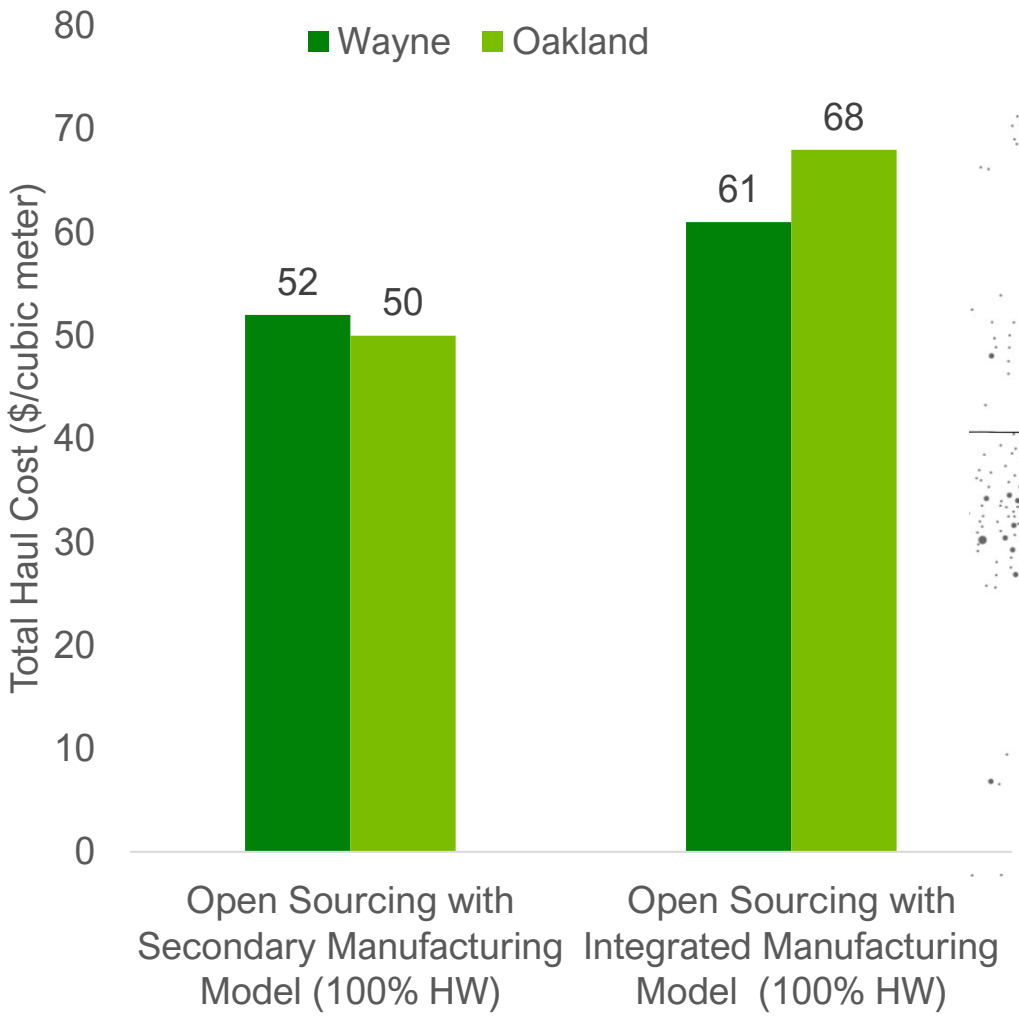

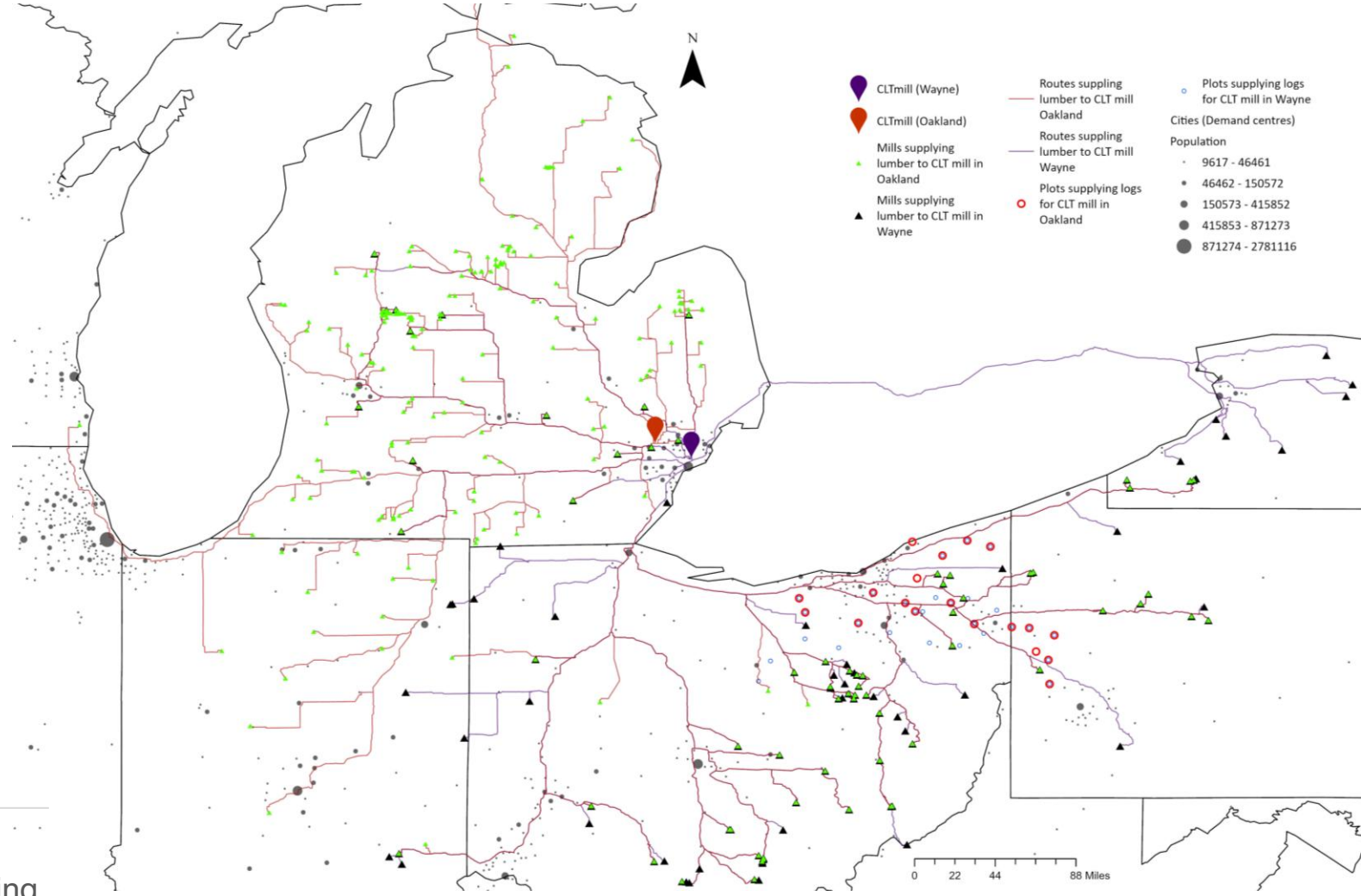

Feedstock Availability & Transportation Cost Findings

Enough feedstock available in the region

Michigan-sourced softwood feedstock favored the LP facility, while open-sourcing favored the UP facility

In the softwoods-only model, Michigan-sourced integrated manufacturing offers the lowest hauling costs

Hardwoods-only scenario favors facilities closer to demand centers

Secondary manufacturing offers the lowest hauling costs compared to the integrated manufacturing model

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Mobilizing research, education, outreach, communications, policy, and partnerships to advance sustainable mass timber construction and manufacture in Michigan, the Great Lakes region and beyond.

canr.msu.edu/masstimber/

@MassTimberatMSU

Thank you!

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NEXT SPEAKER IN THE SERIES

September 3, 2026 (3:00-4:00 PM ET)

Forest Taxation

Featured Speaker: **Dr. Shivan GC,** Assistant Professor, Department of Forestry, Michigan State University

Location: Online via Zoom
Click to register for this webinar
or copy and paste the link: **for.msu.edu/gc**

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