Wisconsin
Statewide Wood
Energy Team

Wood Energy Cluster Development

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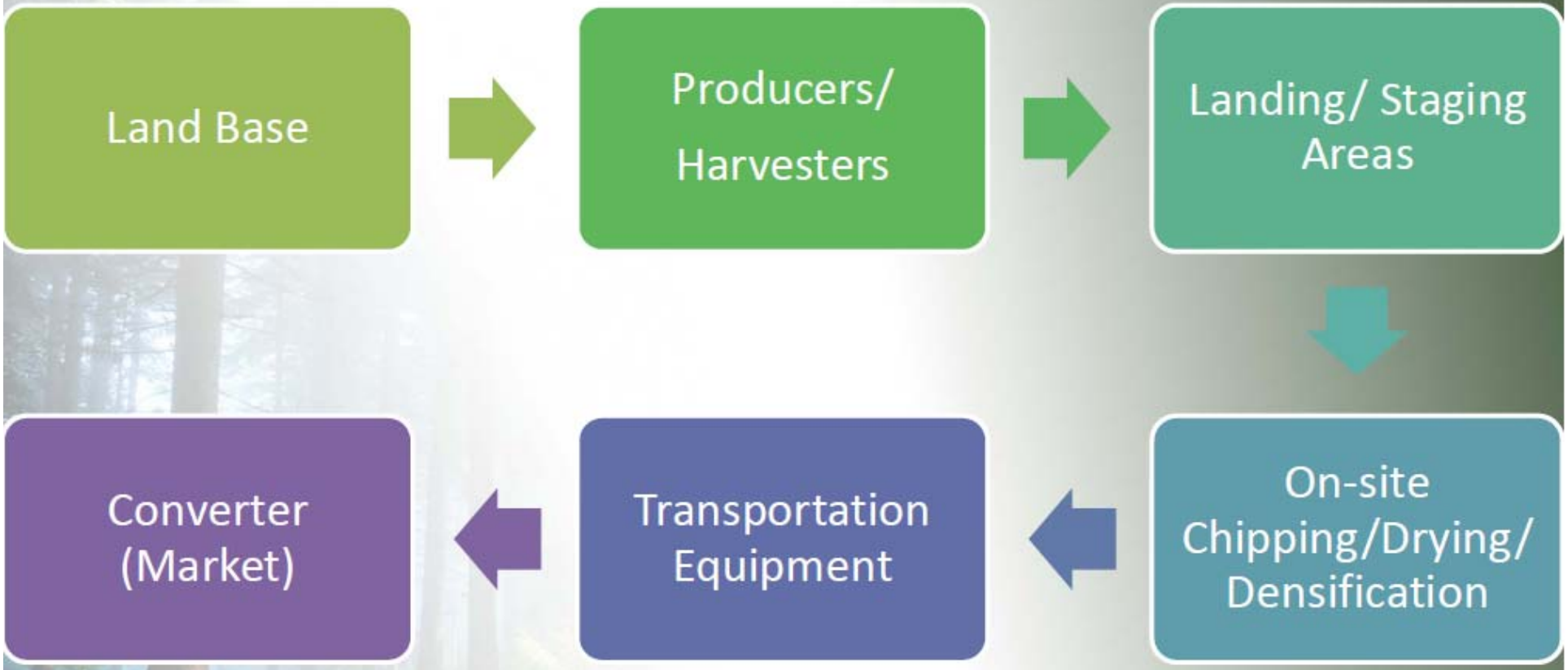
Wood Energy Cluster Development

- A group of wood energy producers, distributors, and/or users building economies-of-scale through cooperation (little or big C)

Opportunities Throughout the Value-Chain



From: Large Scale Biomass Heat and Power Projects, Baye

This Presentation

- From Forest to Furnace (opportunities for cluster development)
  - Forestland management, sourcing, harvesting
  - Purpose-grown wood energy crops
  - Processing, storage, delivery
  - Conversion of wood to heat and power

Forestland Management

(Wood Energy Beyond Mill Wastes)

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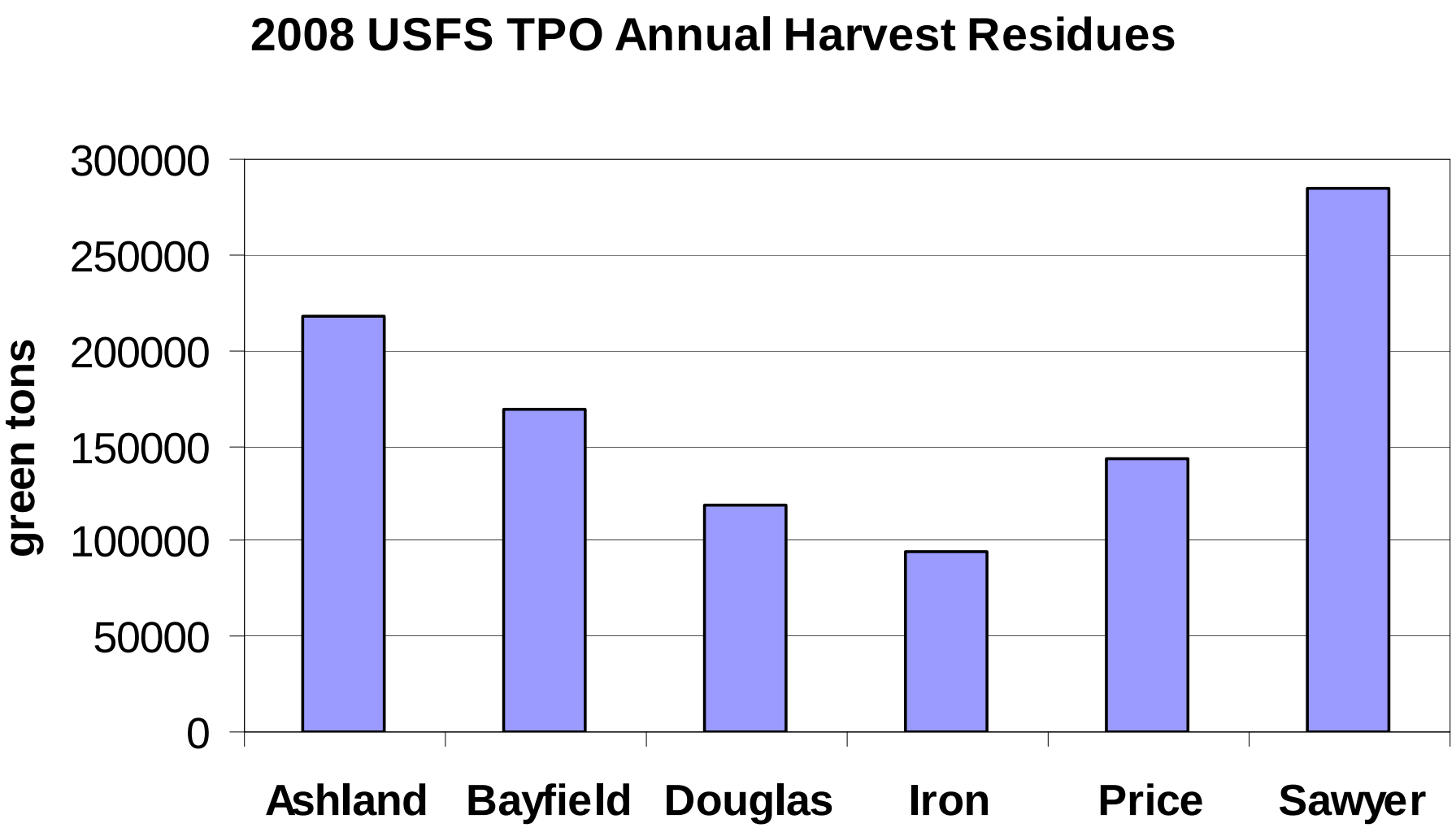
Forestland Management
(Why clustering is becoming more important)

- Patchwork of public land management
- Volatility of global paper (pulp) markets
- Increased parcelization of non-industrial private forest lands (NIPFs)
- Divestment of paper company lands (more NIPFs)
- Lack of active management by NIPFs

Harvest Residues (Slash)

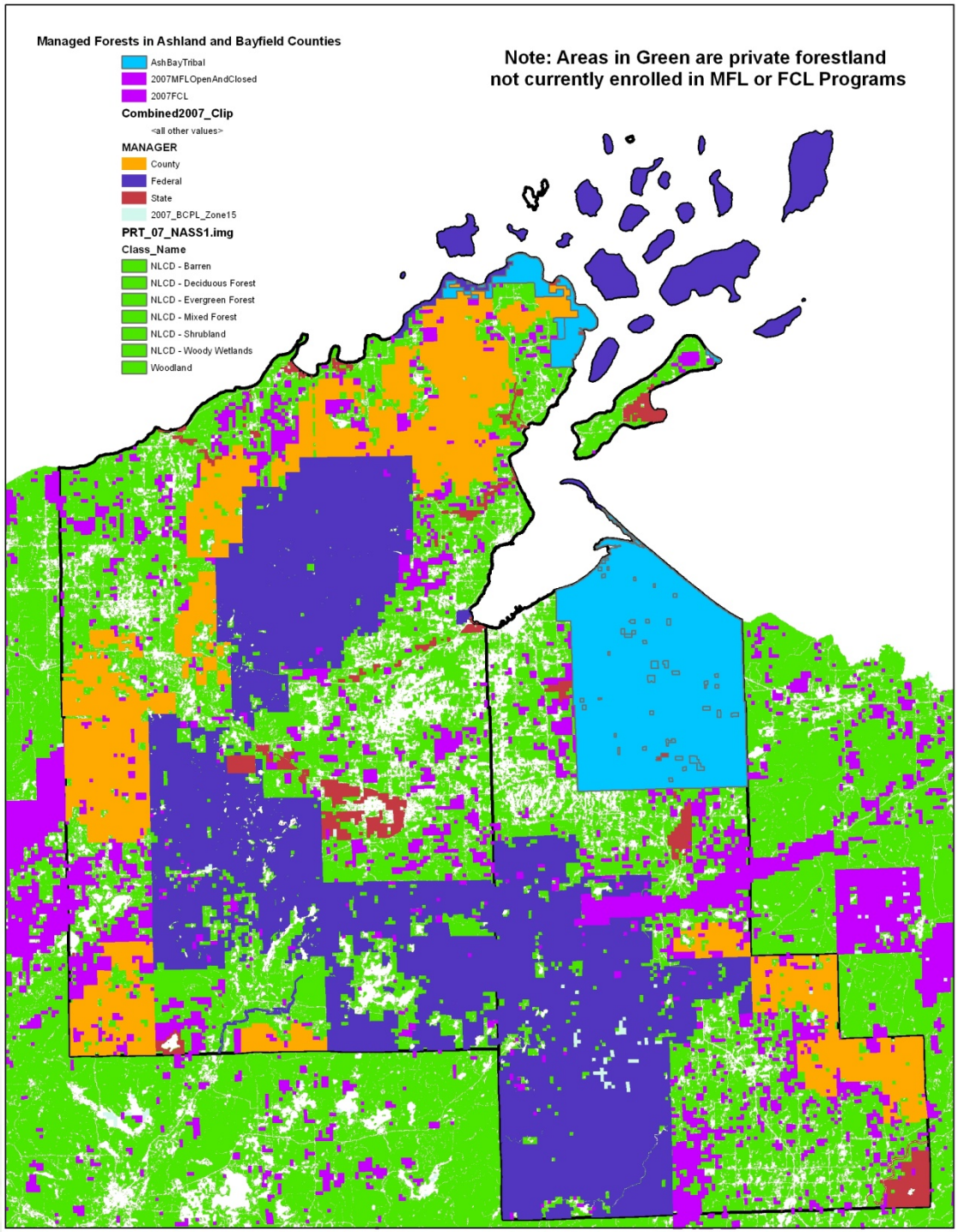
6-County Total: 1.03 million green tons



Total Harvest Residues Is Only One Piece of the Puzzle

- Who owns the harvest residues?
- How much residue can be removed?
- How much residue should be removed?

Supply of wood is largely contingent on private, state, county, tribal, and industrial timber management policies



Quantifying Harvest Residues

- Cord-Based (USFS TPO, 2007; BRDI, 2008)
  - Model-Based (Becker et al, 2009)
    - Acres-Based (Sorenson, 2006)

Minnesota Logged Area Residue Analysis
Minnesota DNR, 2006

Measured:

Coarse woody debris (>2 in)
Fine woody debris (1-2 in)
Slash piles
Standing residuals

Reported:

Green tons per acre
by cover type

Determining Harvest Residues by Ownership (Tribal, County, Federal)

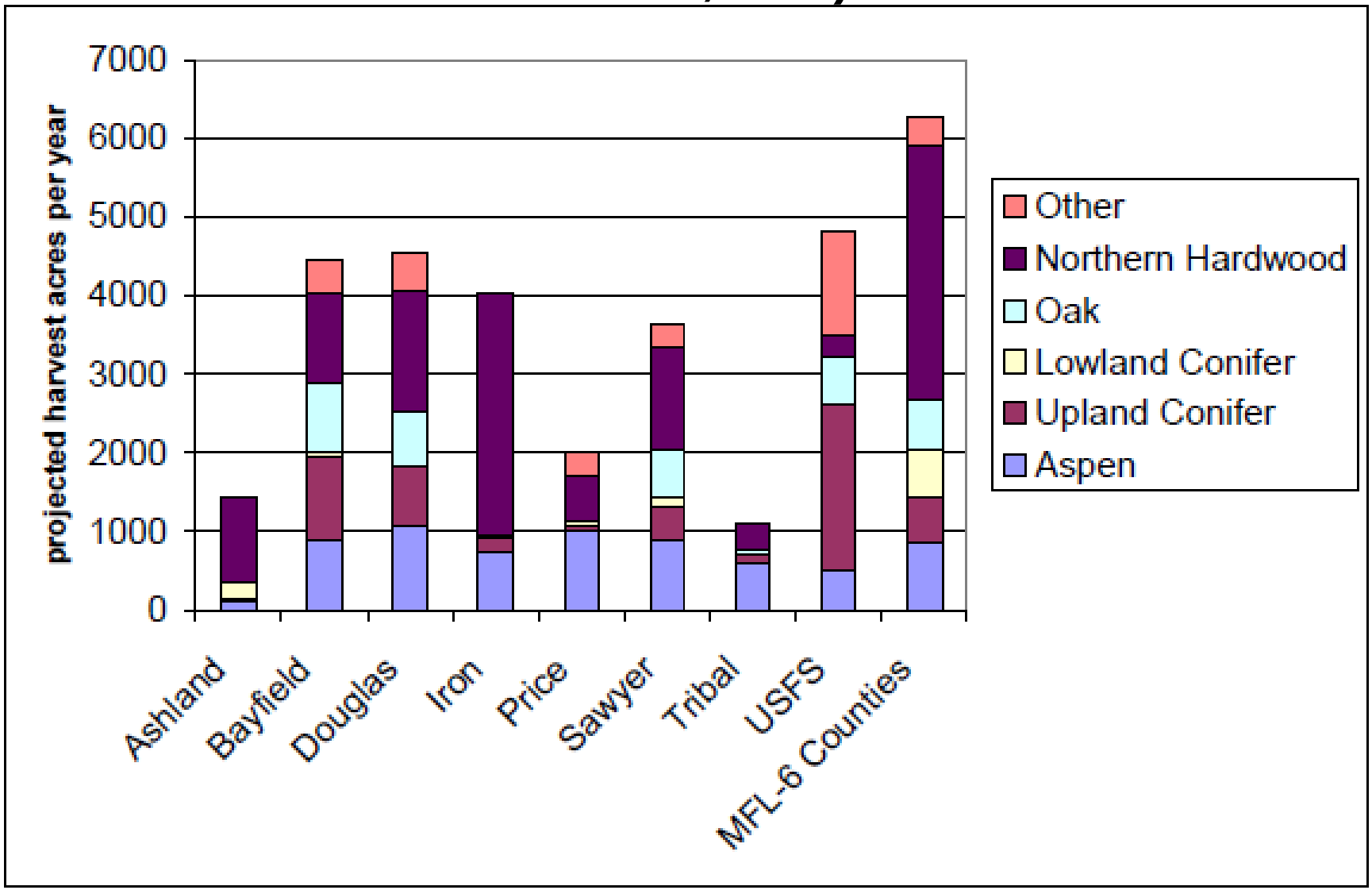
Calculated Estimates of Actual Harvest Residue Availability						
	Aspen	Upland Pine	Lowland Conifer	Oak	Northern Hardwood	Other
Average Annual Harvest Acres						
Available Residue (green tons/per acre))	14.15	12.37	14.32	19.2	19.86	15
Total Available Residue (total green tons)	0	0	0	0	0	0
% of acres harvested by whole tree operations						
Allowable removal percentage by BMPs						
Actual available Harvest Residue (green tons)	**0**	**0**	**0**	**0**	**0**	**0**

Self-reported expected annual harvest acres by cover type

Harvest Residues by Ownership (MFL)

1. PlanTrac database with MFL stand info
   - Timber type, acres, mandatory harvests
2. Tallied harvest acres by timber type and County (annual average of 2009-2013)
3. Calculated projected harvest residuals using MN Logged Area Residue Analysis

Total Estimated Annual Harvest Acres (2009-2013) by Cover Type and Ownership Class (County, Tribal, Federal, MFL)



Harvest Residue Production by Ownership

Entity	Annual Harvested Acres	Total Available Harvest Residue (green tons)
Tribal Trust Lands	1,100	17620 (2%)
Ashland County	1,440	26620 (3%)
Bayfield County	4,450	72570 (7%)
Douglas County	4,557	75950 (7%)
Iron County	4,044	74750 (7%)
Price County	2,000	31870 (3%)
Sawyer County	3,635	61420 (6%)
CNNF	4,831	70330 (7%)
NIPF MFL- 6 Counties	6,250	109400 (11%)
Total	**32,307**	**540,610 (52%)**

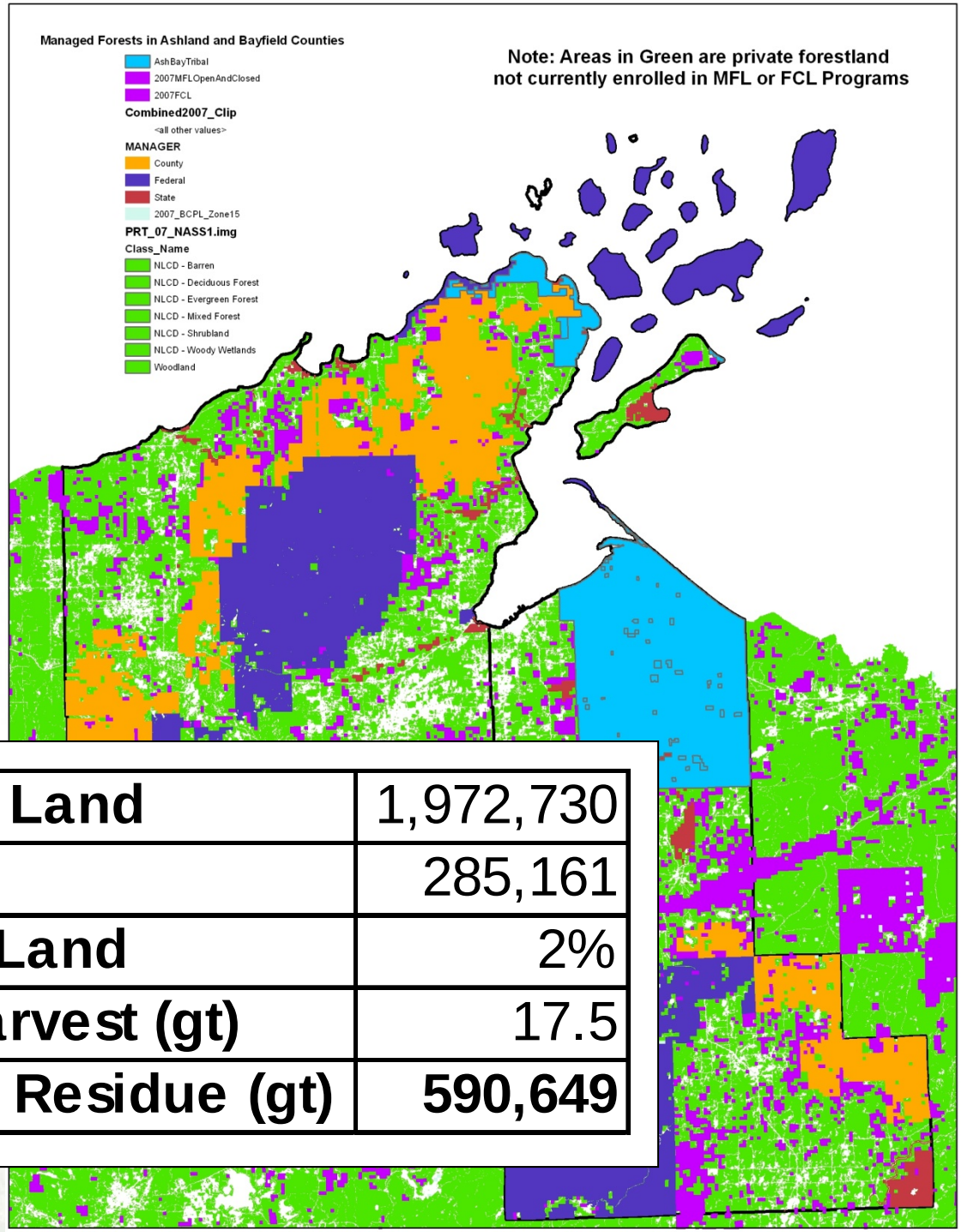
Timber Product Output (TPO) Data for Residues: 1.03 million green tons

Forest Administrator Interpretations of Residue Removal BMPs

% allowable by BMPs						
		Upland	Lowland		Northern	
	Aspen	Conifer	Conifer	Oak	Hardwood	Other
Ashland	90	90	90		90	
Bayfield	85	5	90	77	90	87
Douglas	70	50	0	65	40	50
Iron	90	45	33	40	33	0
Price	90	90	90	90	90	90
Sawyer	90	90	90	90	90	90
Tribal	50	66	0	66	0	
USFS	85	41	0	78	90	80
MFL	90	75	25	75	90	90

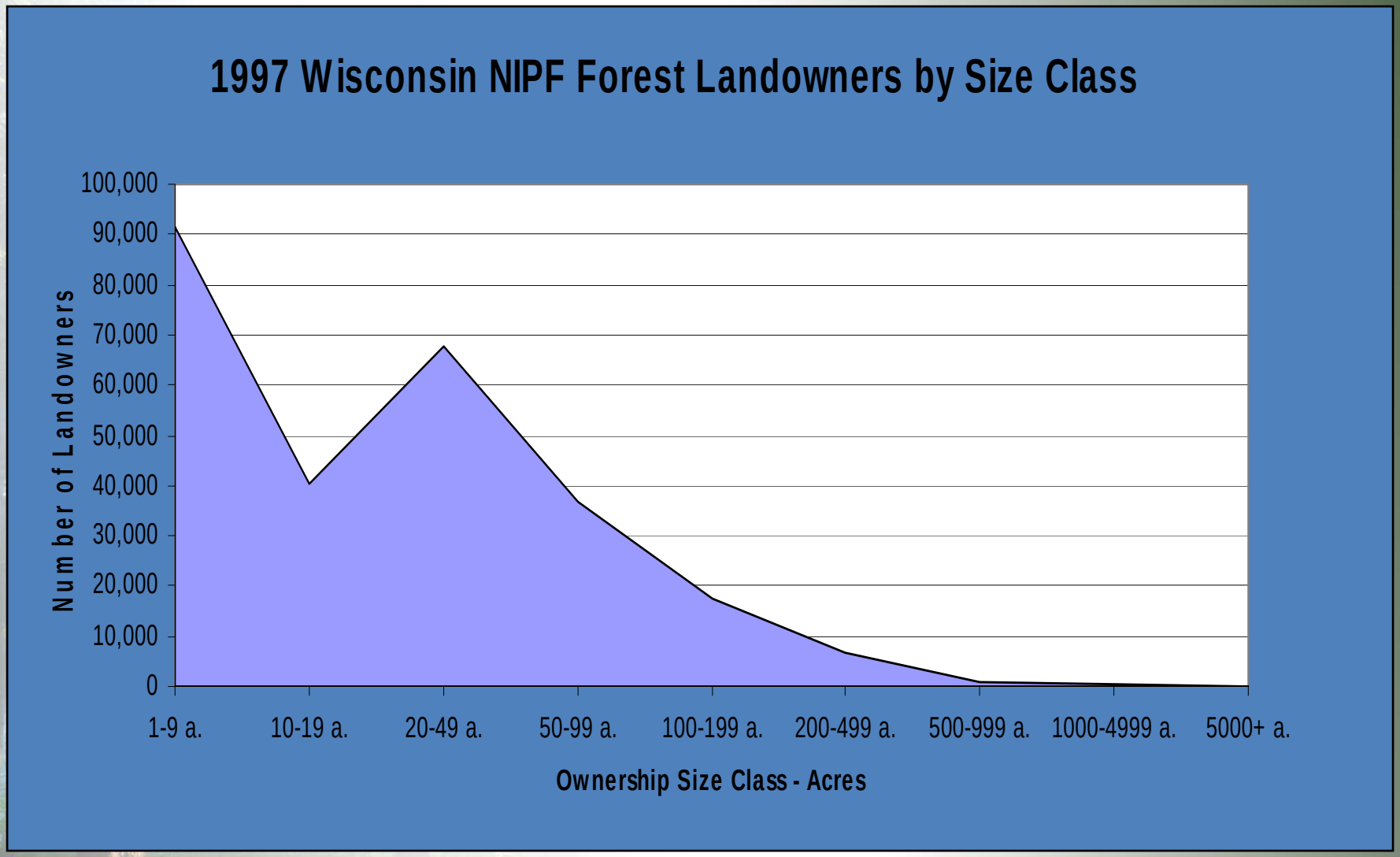
Where's the other 48%?

- State
- Industrial
- Private non-MFL
- TPO vs MN LARA



6-County Private Forest Land	1,972,730
6-County MFL Land	285,161
Annual Harvest of MFL Land	2%
Residue/acre of MFL Harvest (gt)	17.5
6-County non-MFL NIPF Residue (gt)	**590,649**

Most Private Forestland Owners Have Parcels < 50 acres.

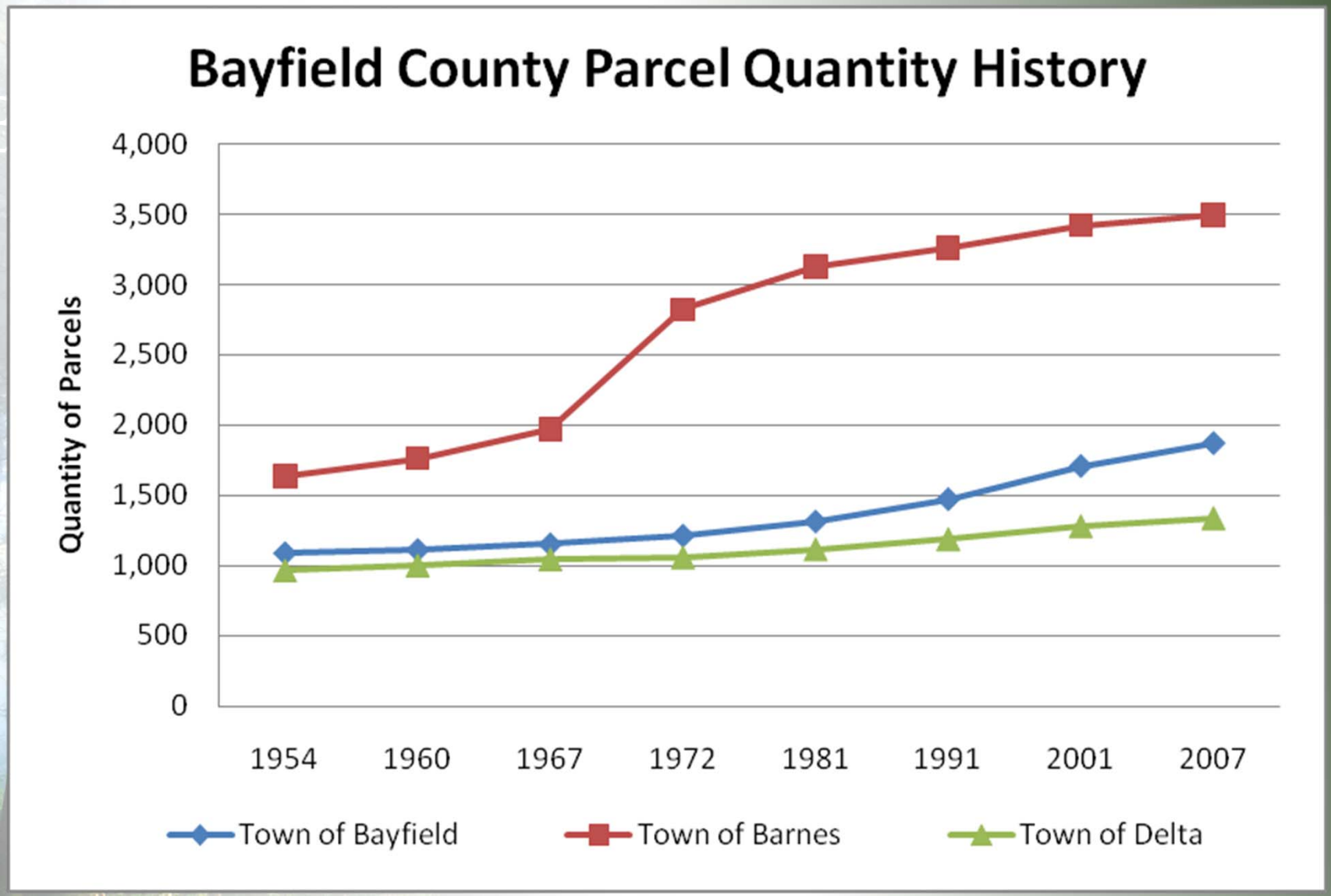


~262,000 NIPF Owners Total. (About 4% of WI woodland is sold annually, resulting in a turnover of ~10,500 new landowners each year.)

2003 WI NIPF Forest Management Planning	
% Owners With Plan 18.67%	% Owners Without Plan 81.33%
% Acres With Plan 31.18%	% Acres Without Plan 68.82%

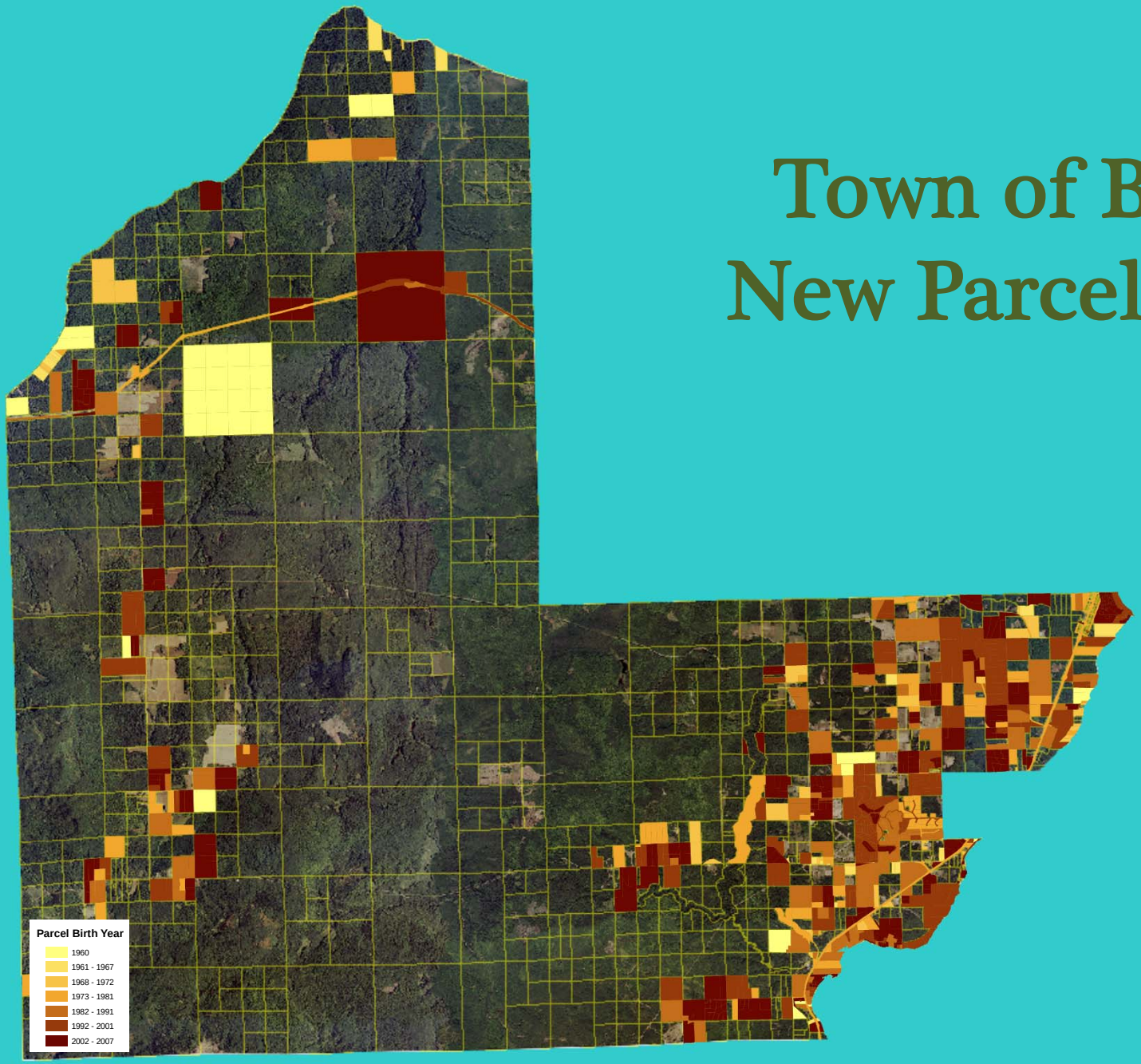
On average 9,600 new NIPF parcels are created each year.

Fragmentation Makes Timber Sales Less Feasible



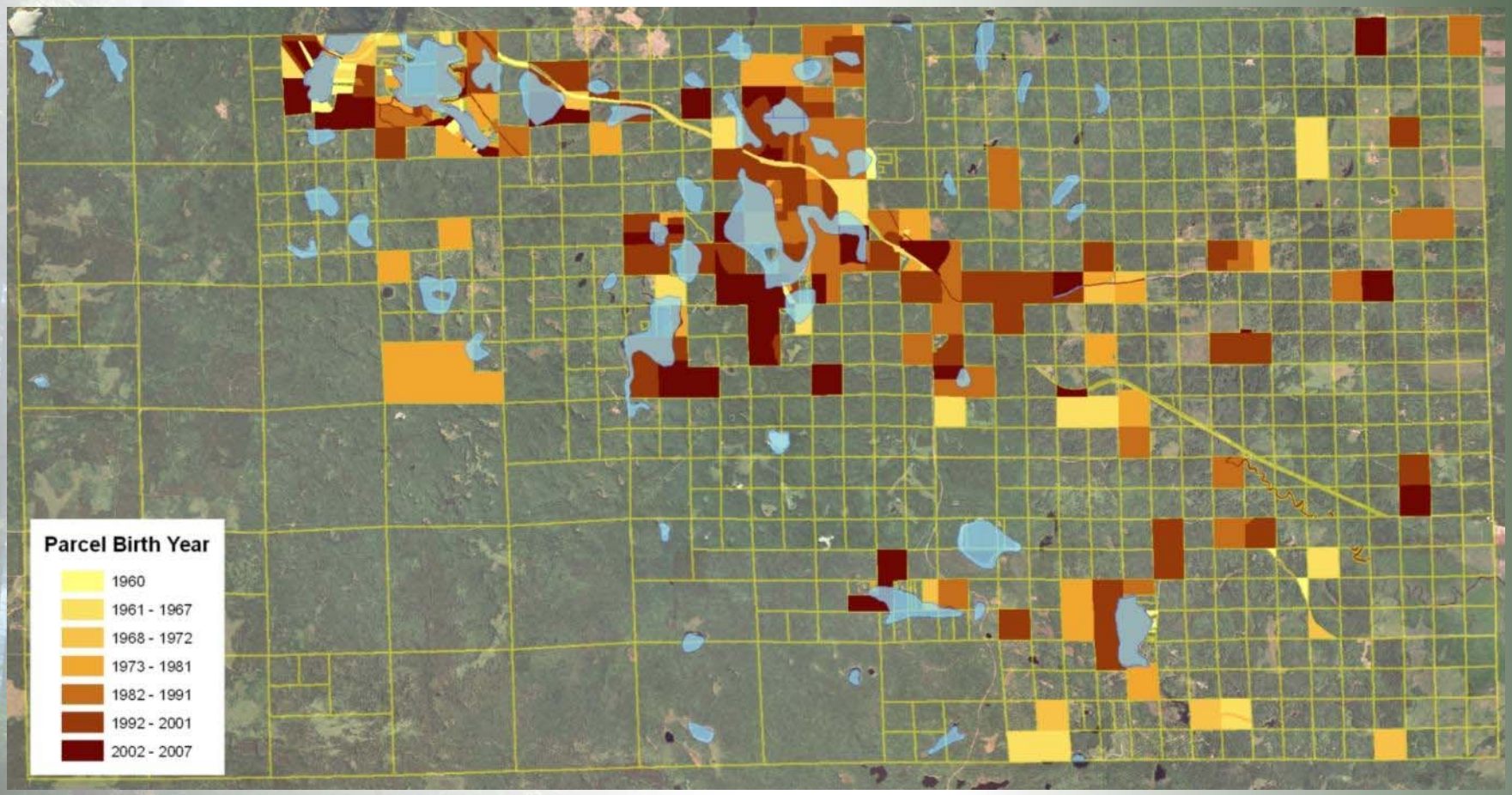
From: Dr. Anna Haines

Town of Bayfield
New Parcel History



From: Dr. Anna Haines

Town of Delta New Parcel History



From: Dr. Anna Haines

Cooperative Forest Management

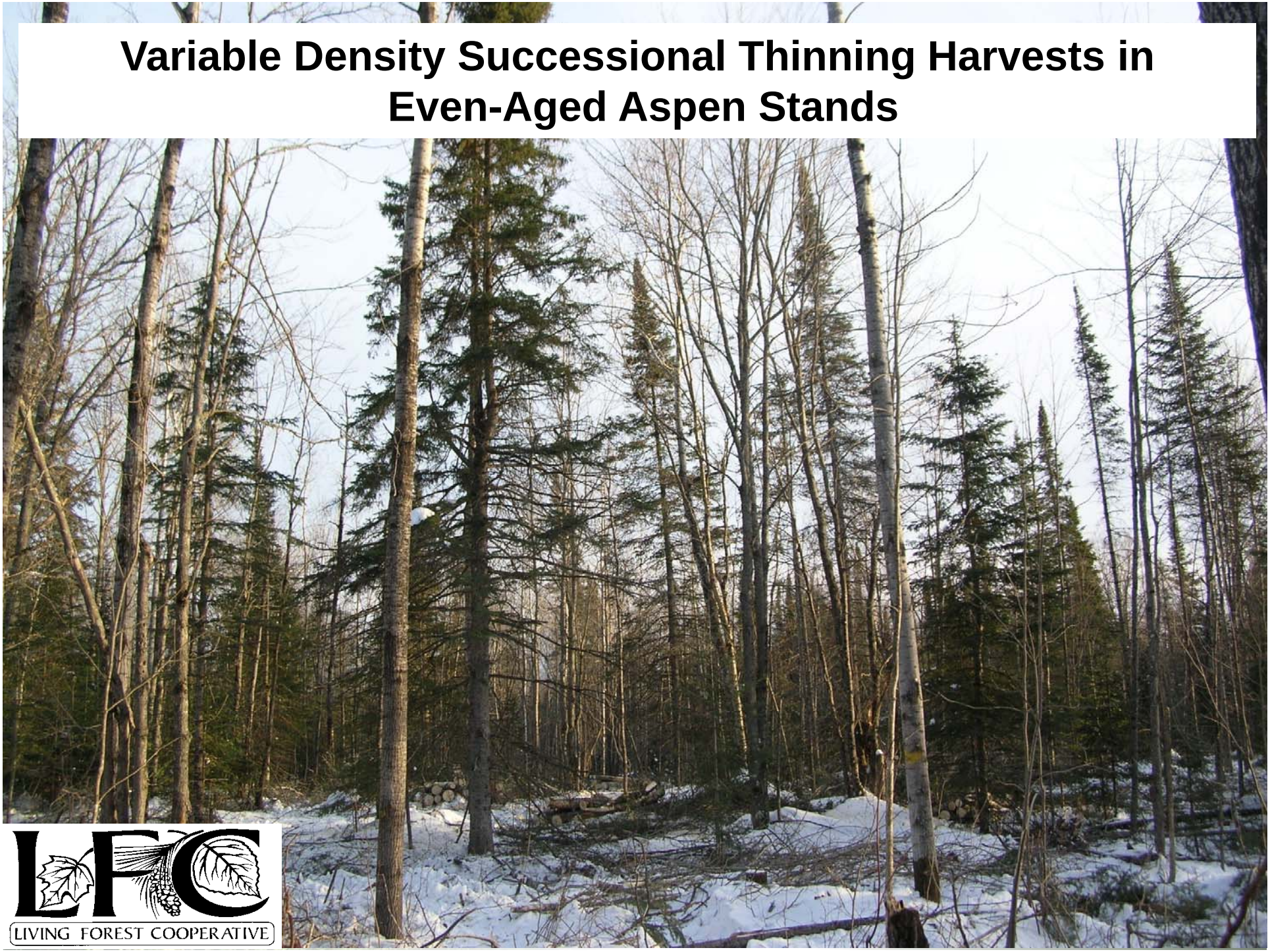
- Pool timber sales to improve operability and economics
- Landowner responsive timber management
  - Ecosystem restoration, big bucks, maple-syruping, etc.
- Can be done through a landowner cooperative (Living Forest Cooperative) or well-networked private forester

LIVING FOREST COOPERATIVE

Landowners Looking For Alternatives to This

LIVING FOREST COOPERATIVE

Variable Density Successional Thinning Harvests in Even-Aged Aspen Stands



LIVING FOREST COOPERATIVE

Cooperative Forest Management

- Forestry fee-for-service business model for landowner cooperatives is feasible, but member services (education, field days, etc.) require significant time and resources
- Cash flow and credit are the major barriers to cooperative business model involving purchase of stumpage, contract logging, and marketing

Purpose-Grown Wood Energy Crops

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Poplar Plantations

Poplar Coppice Trials – Ashland, WI

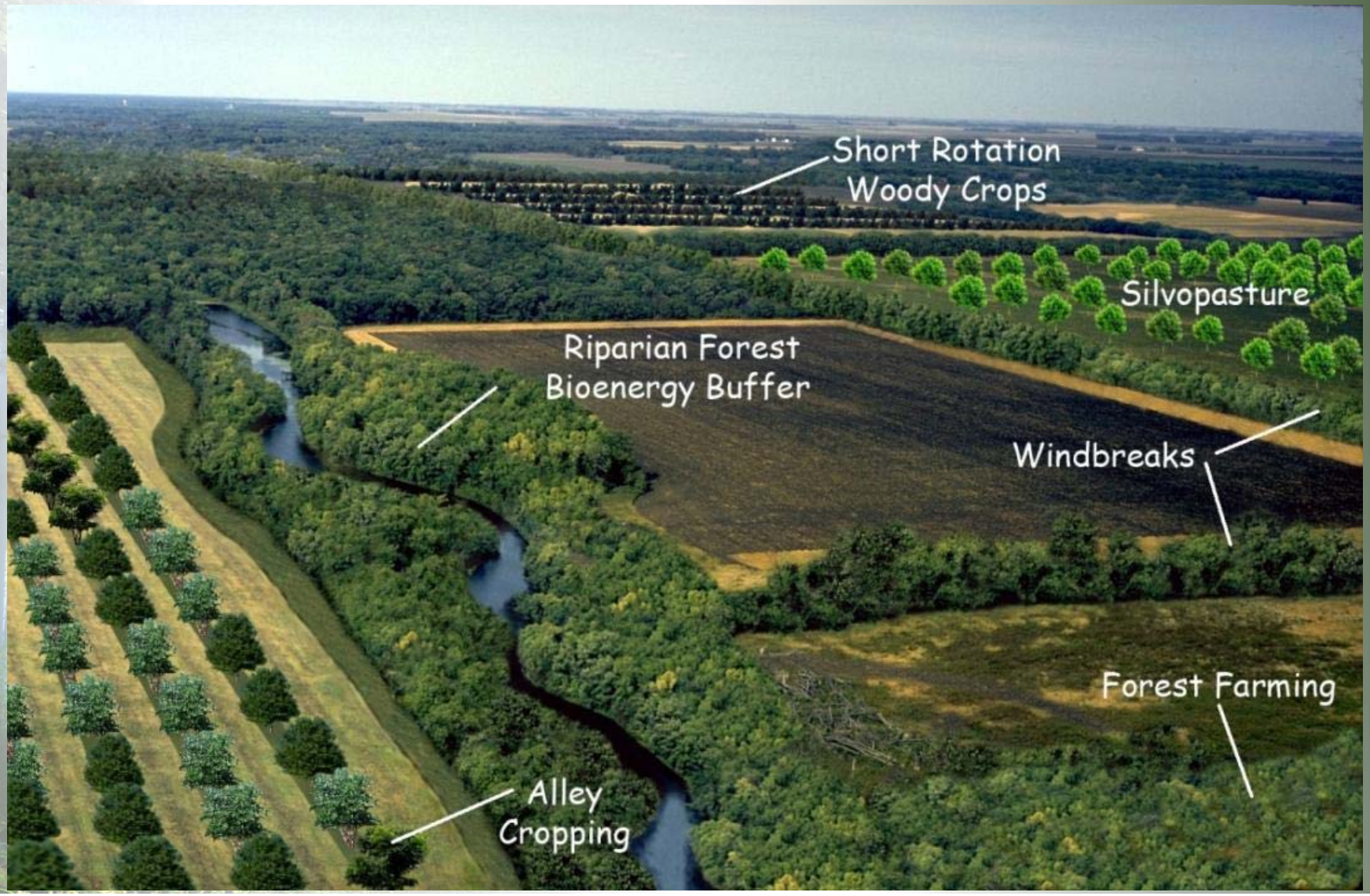
Coppice Willow

Willow Clone Trials – Ashland, WI

Purpose-Grown Woodies

- Requires specialized equipment
- Long-history of agricultural cooperation around inputs, harvest, storage

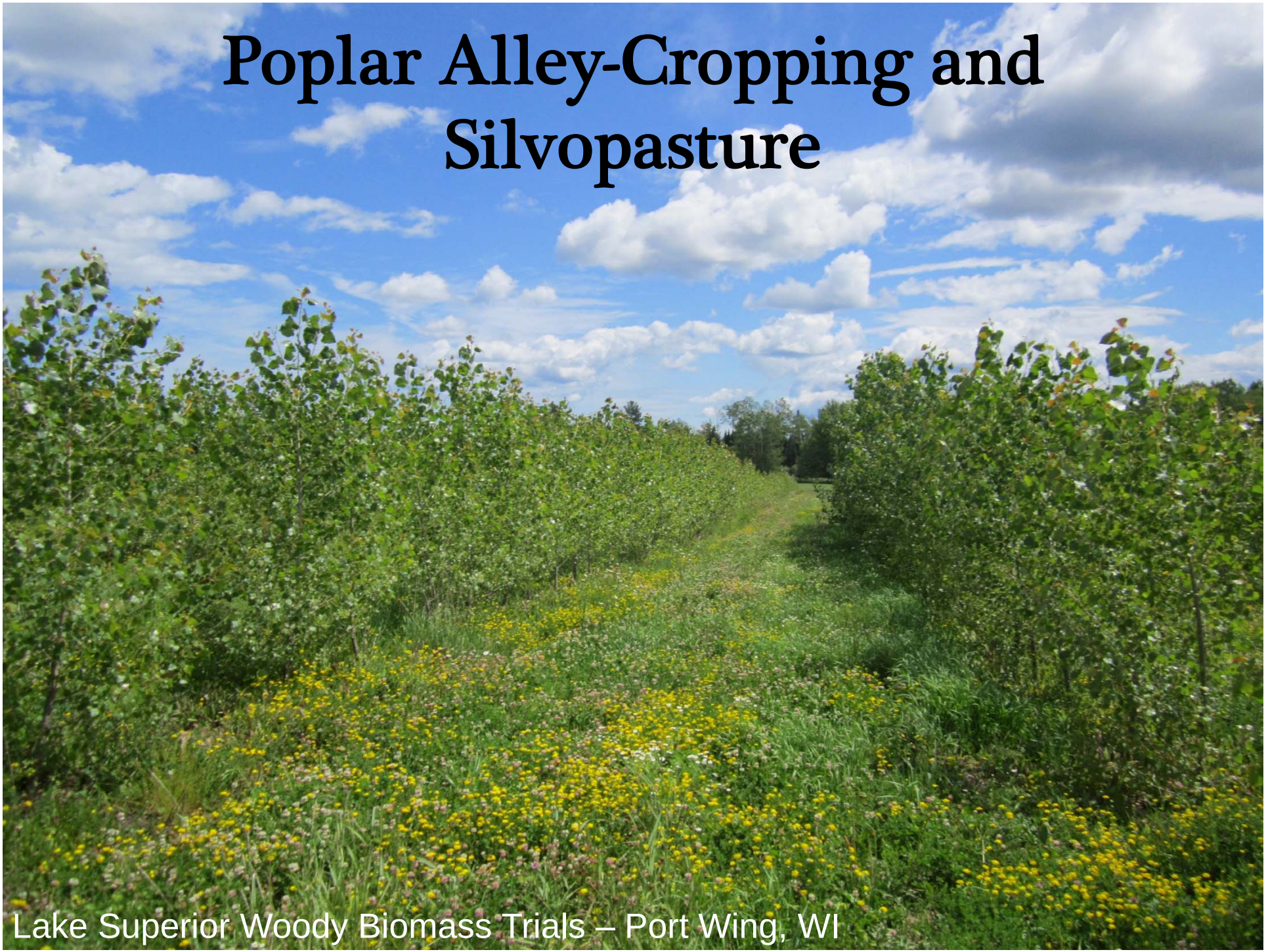
With Current Economics, Purpose-Grown Woodies for Energy May Require Multi-Use Deployment



Willow Windbreak/Snowfence

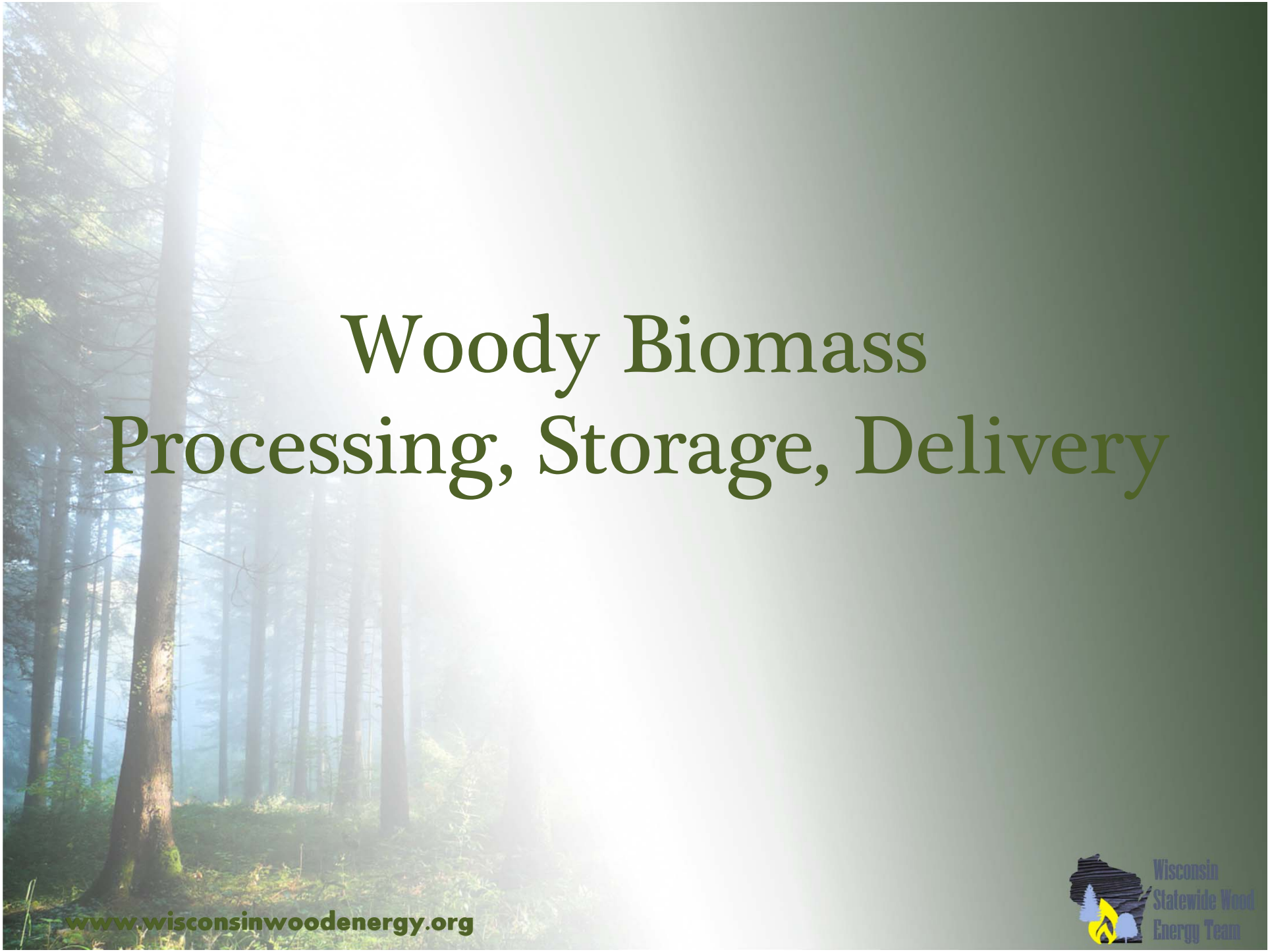
Willow Demonstration Plots– Ashland, WI

Poplar Alley-Cropping and Silvopasture



Lake Superior Woody Biomass Trials – Port Wing, WI

Woody Biomass
Processing, Storage, Delivery



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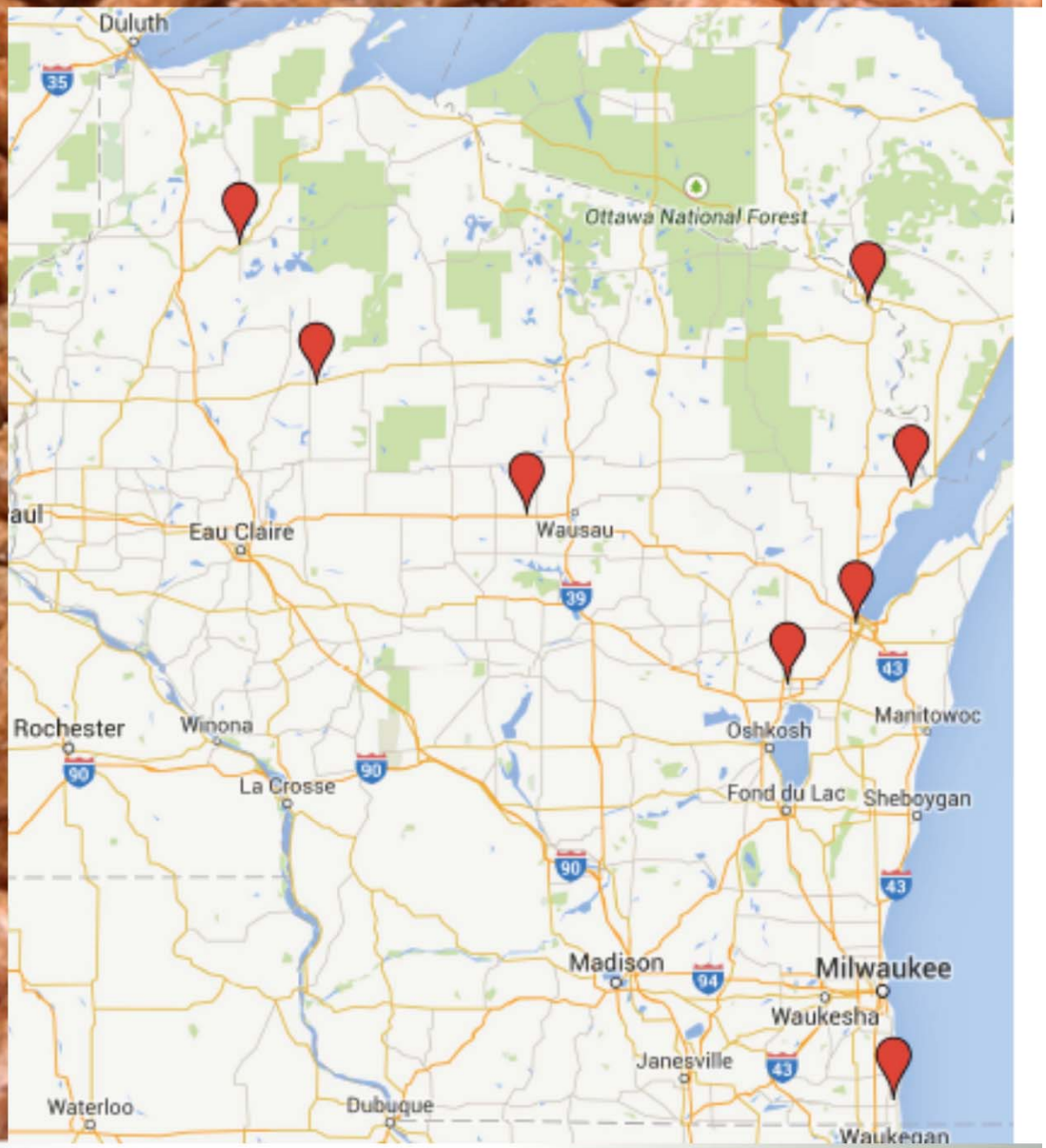
Processing (Market Tensions)

- High capital costs require centralization
- High transportation costs drive de-centralization (distributed energy)
- Combined, we have opportunities for rural economic development at many different scales and levels of cooperation

Firewood Processors
(companies or cooperatives)

Wood Pellet Mills



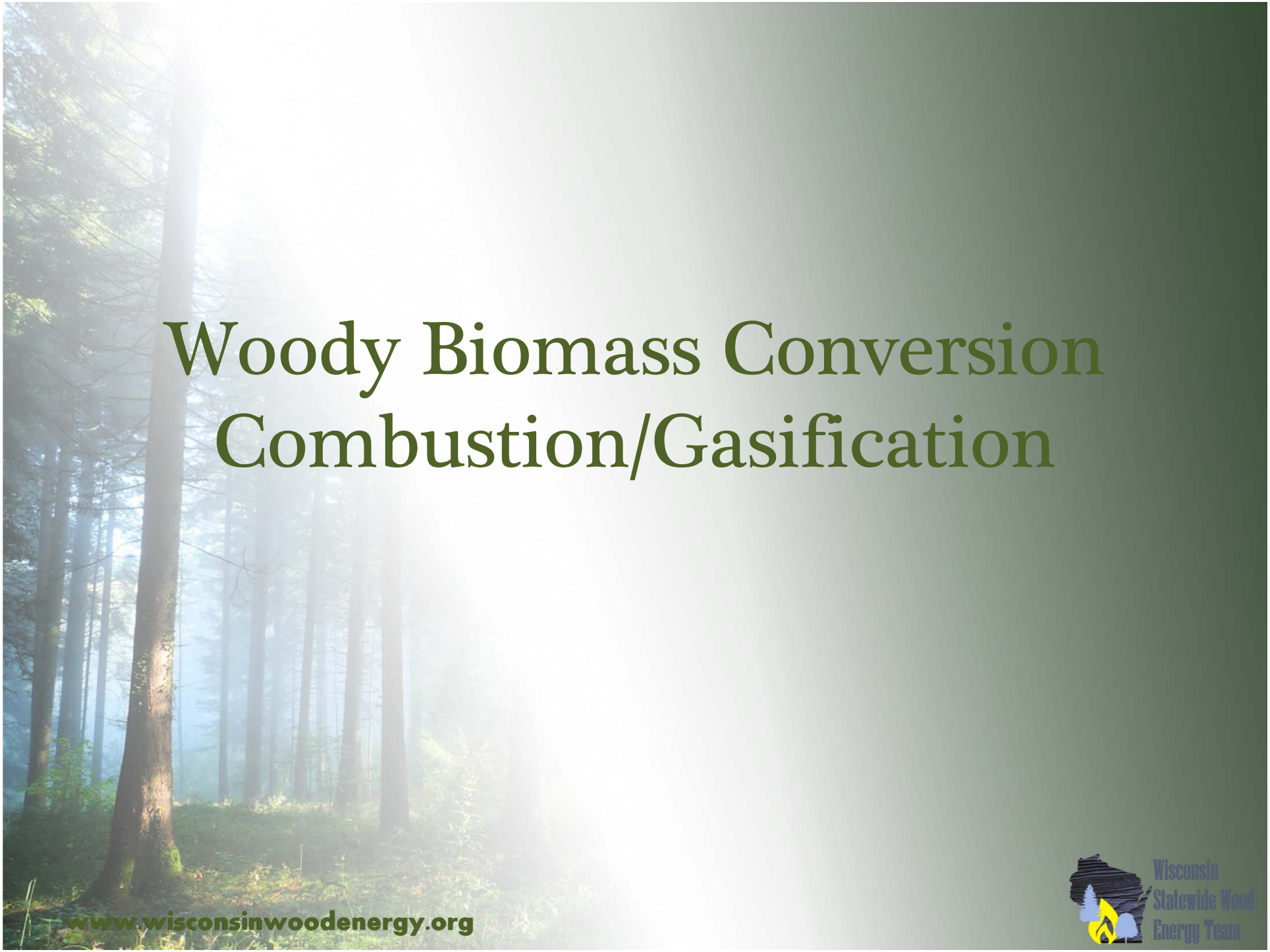
Bay Front Power Plant (Chips)

(Burning wet wood since 1979)

Chip Dewatering, Densification

- In-field processing and storage
- Waste heat for pre-combustion drying
- Buyers still primarily take chips “as is”
- See Tim Baye’s March 25 webinar

Woody Biomass Conversion Combustion/Gasification



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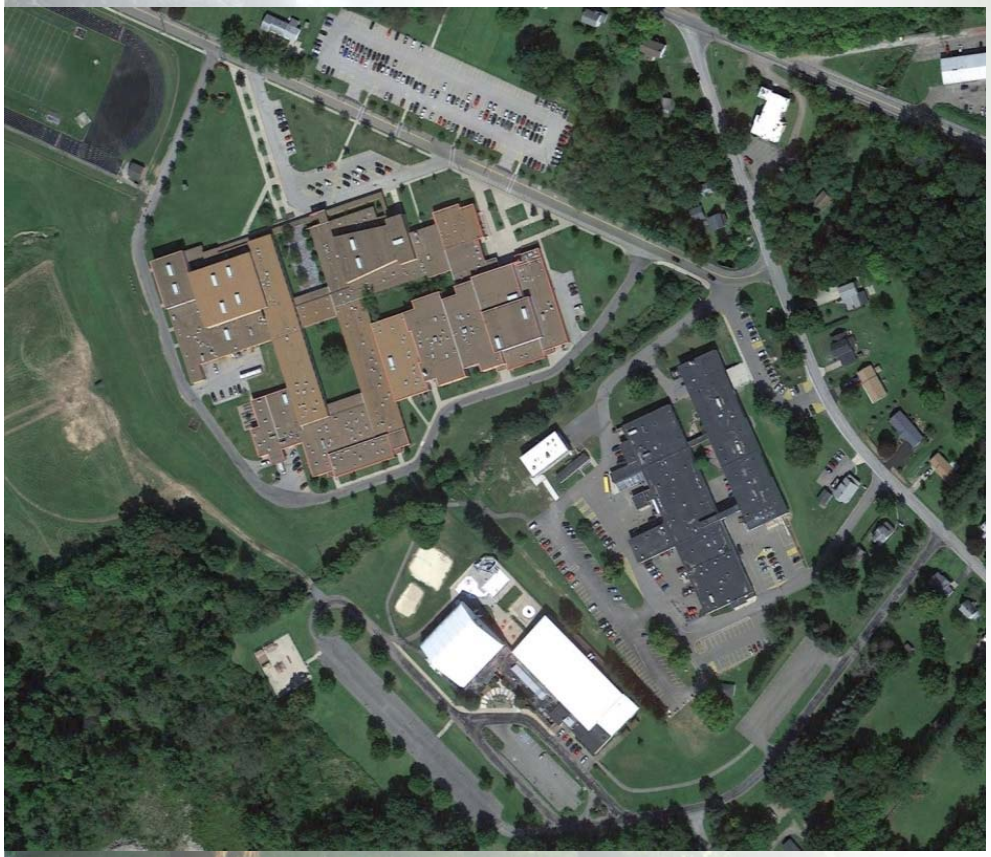
Combustion/Gasification
(Opportunities for Clustering)

- Group-buying for home appliances, efficiency improvements
- District-heating opportunities
- Combined heat and power
  - Off-take agreements for heat and/or power

Is There Potential To Add Loads?

- Can adjacent buildings be cost effectively connected



- Increased fuel savings
- Varied load profile for extended seasonal coverage
- Potential to operate closer to rated boiler capacity
- incremental increase in heating capacity generally lowers investment per unit of capacity
- Shared (lower) operating costs per unit of heat delivered

From: Wood Energy Systems in Commercial and Industrial Settings, Wilson and McCreery

How is the Heat Used? – Generation, Distribution, and Quality

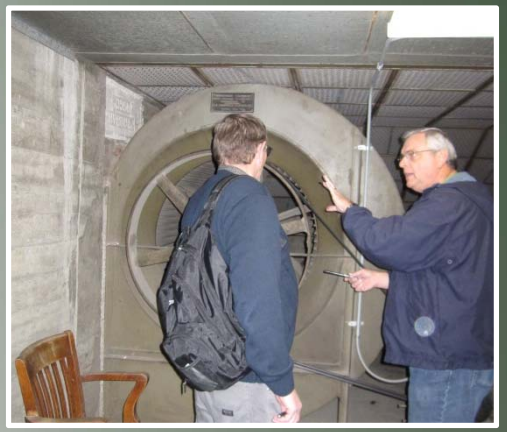
Steam

- Temperature
- Pressure
- Uses (heating, humidification, etc.)
- Building or process operating schedule
- Allowable variance

Hot Water

- Required temperature
- Uses (pool, DHW, heating, laundry, drying, etc.)
- Building or process operating schedule
- Allowable variance

Forced Air



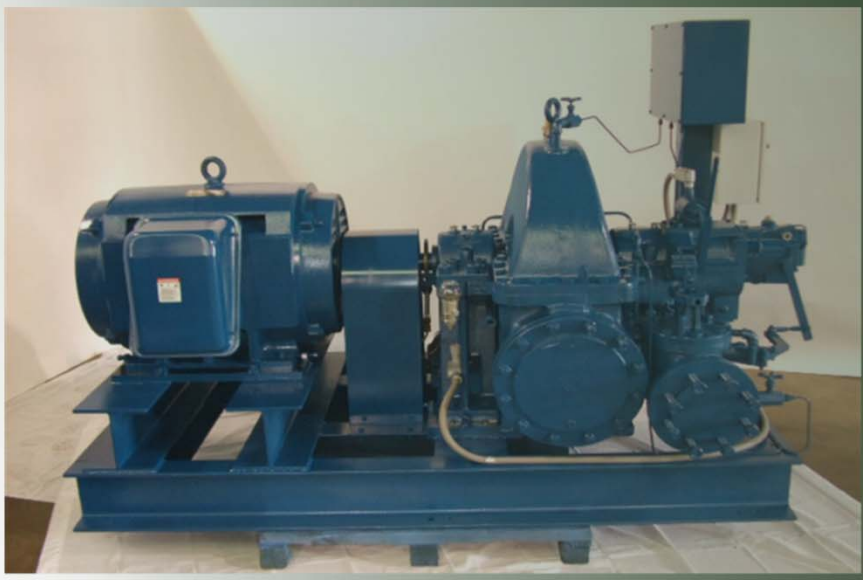
- Required temperature
- Required air flow
- Uses (heating, drying, etc.)
- Building or process operating schedule
- Allowable variance

From: Wood Energy Systems in Commercial and Industrial Settings, Wilson and McCreery

Is There Potential To Add Loads?

❖ Thermally Led CHP

- May improve year round load profile
- May be helpful to overall project Economics



From: Wood Energy Systems in Commercial and Industrial Settings, Wilson and McCreery

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IS There Potential To Add Loads?

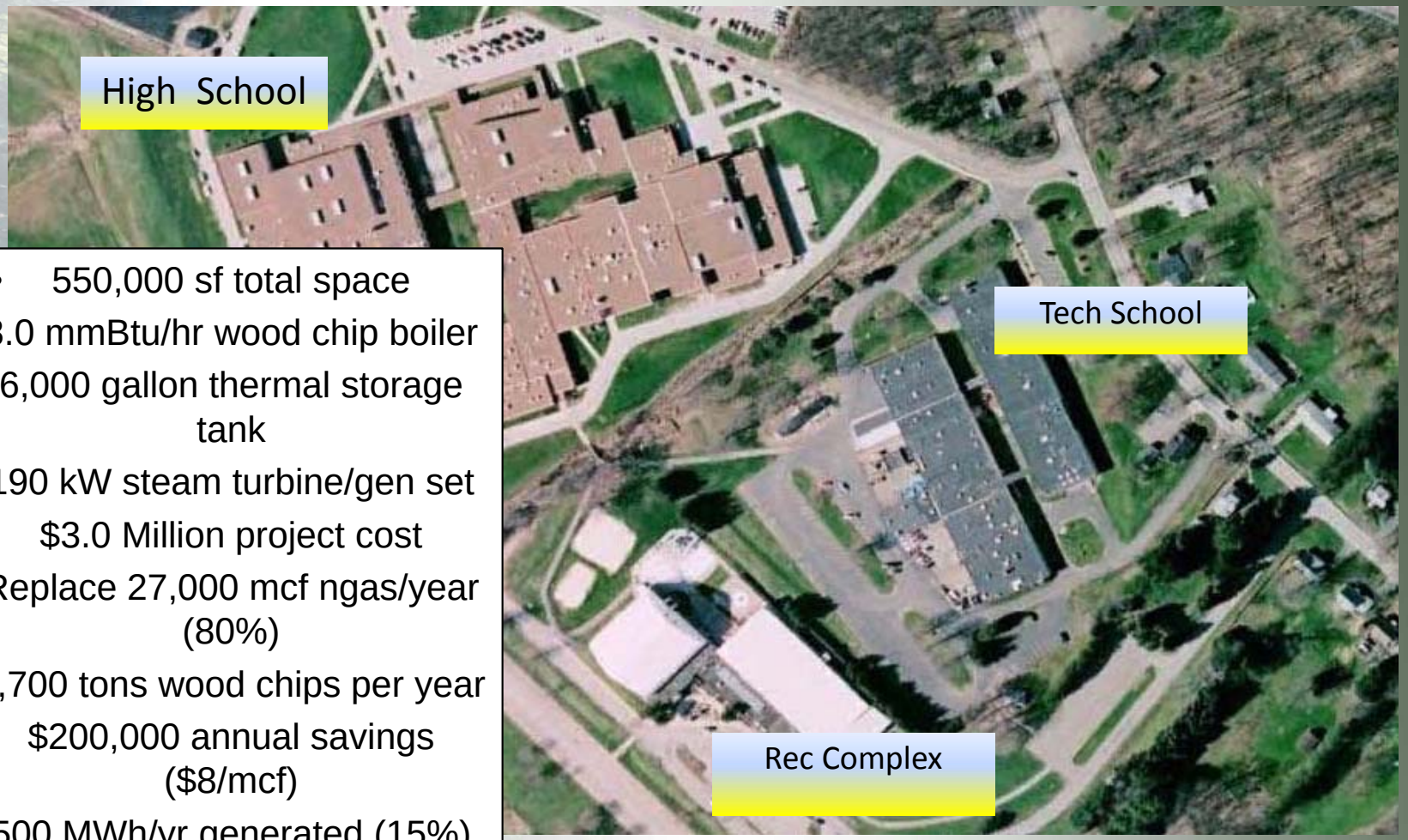
- Air Conditioning/Chilling

- May allow year round operation of boiler to offset summer heating loads?

- Substantial savings for reduced electric demand charges?

From: Wood Energy Systems in Commercial and Industrial Settings, Wilson and McCreery

Crawford County Biomass CHP & District Heating (Hot Water)



- 550,000 sf total space
- 8.0 mmBtu/hr wood chip boiler
- 6,000 gallon thermal storage tank
- 190 kW steam turbine/gen set
- $3.0 Million project cost
- Replace 27,000 mcf ngas/year (80%)
- 2,700 tons wood chips per year
- $200,000 annual savings ($8/mcf)
- 500 MWh/yr generated (15%)

From: Wood Energy Systems in Commercial and Industrial Settings, Wilson and McCreery

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Examples of Wood Energy Clustering

A Firewood Cooperative
Opportunities and Challenges

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A project of Vermont Family Forests

Hogback NeighborWood Heating Cooperative

Overview, Charette Findings, Action Plan, and Follow-up

Opportunities

- Access to pooled member lands for firewood
- Shared ownership of a firewood processor
- Shared “time” to allow for appropriate curing
- More buying-power for heating appliances, efficiencies, maintenance

Challenges

- Intentionally harvested firewood will always be more expensive than low-quality wood harvested during a timber sale
- Processing logs into dried and cut firewood has a cost that most homeowners incur themselves but aren't used to monetizing
- To be viable, will rely on sufficient volume of timber sales within membership and likely willingness to pay more for social or environmental values

Vertically-Integrated Wood Heat Company

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Maine Energy Systems

MESYS
MAINE ENERGY SYSTEMS

PRODUCTS PELLETS PLANNING PROFESSIONALS CONTACT

Professional Installation

500+ trained and MESys certified installation contractors.

Virtually Maintenance Free

Our systems clean themselves automatically and only require emptying of the ash container several times per year. This is a quick, clean and easy task and the ash is great for your lawn or garden.

Watch Video »

Storage Options

Indoor fuel storage for almost any application and outdoor silo storage.

Bulk Pellet Delivery

Delivered to you, bagless in bulk, the same way as oil or propane.

Hands-Free Fuel Feed Options

You'll never see or touch a pellet with our fully-automatic fuel feed systems.

Farmer-Owned District Heating Systems (The Austrian Model)

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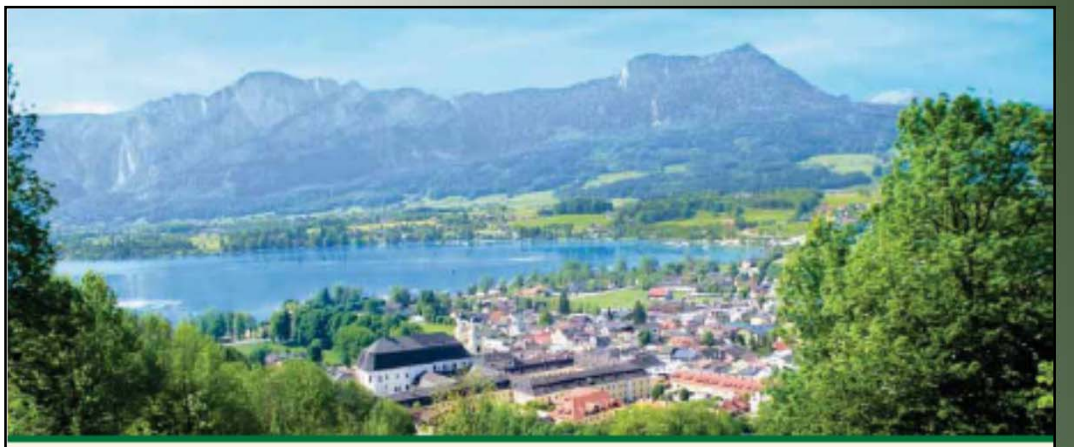

Biomass heating in Upper Austria
Green energy, green jobs

LAND OBERÖSTERREICH

ÖKOENERGIE OEC CLUSTER

Cluster Development 101

- Find like-minded landowners and manage your woods together
- Find waste wood and add value (chips, pellets)
- Before installing a heating system look for additional loads among your neighbors
- We must continue to educate about efficiency, which may create opportunities for pre-processing

How to Work Together

- It just happens as individuals work toward their best interests and identify ways to collaborate for mutual self-interest
- It is planned and intentional as a means to meet a specific mutual need or opportunity (carrot and tambourine approach)

Cooperative Business Development 5-keys

- Well-understood and quantifiable needs shared by ALL parties
- A viable business model that meets those needs
- Well-written and understood operational/governance policies to streamline decision-making
- Minimal personality conflicts in the early days
- A good cat-herder is crucial during the launch phase