

Rapid Assessment of Woody Biomass Supply and Demand from Wisconsin's Wild Rivers Legacy Forest

Jessica Price¹, Janet Silbernagel¹, Nicholas Miller², Randy Swaty²

¹University of Wisconsin-Madison, ²The Nature Conservancy

Introduction

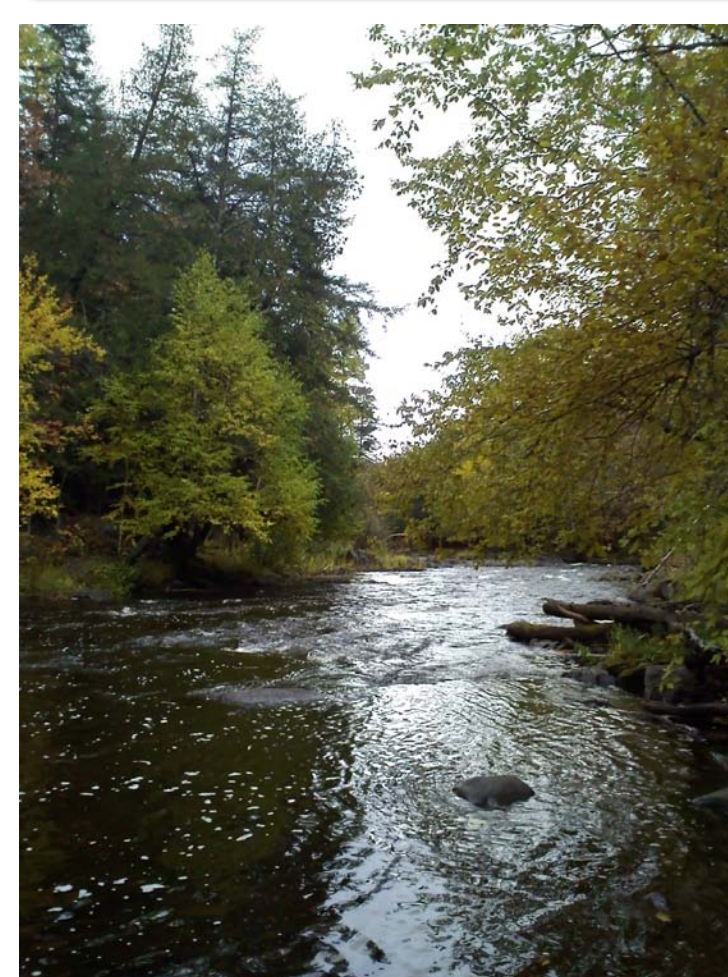


Figure 1. Looking down the Popple River in the Wild Rivers Legacy Forest near Florence, Wisconsin.

Production of renewable energy from woody biomass is increasingly recognized as a crucial component of climate change mitigation strategies and has gained both political and social support as a result. For example, several Great Lakes states, including Minnesota and Wisconsin, have included the production of renewable energy from biomass in climate change legislation. Wisconsin Governor Jim Doyle's 2008 'Clean Energy Wisconsin' plan calls for Wisconsin to generate 25% of its electricity and 25% of its transportation fuels from renewable resources by 2025 (Office of Governor Jim Doyle 2008). In response, states including Minnesota and Wisconsin have developed guidelines for woody biomass harvest from natural forests (MFRC 2008; Herrick, et al. 2009).

Natural resource managers and conservation partners are now faced with the possibility of integrating harvest of woody biomass into land management strategies, from utilizing the biomass generated by restoration or invasive control activities to including biomass as a component of their timber harvest regime in working forest conservation easements. To best design these strategies, decision-makers need a clearer picture of the availability and demand for woody biomass in specific locations. Here, we demonstrate a rapid assessment of woody biomass supply and demand from the Wild Rivers Legacy Forest (WRLF), a protected area in Florence, Forest, and Marinette counties in northeastern Wisconsin.

Background and Methods

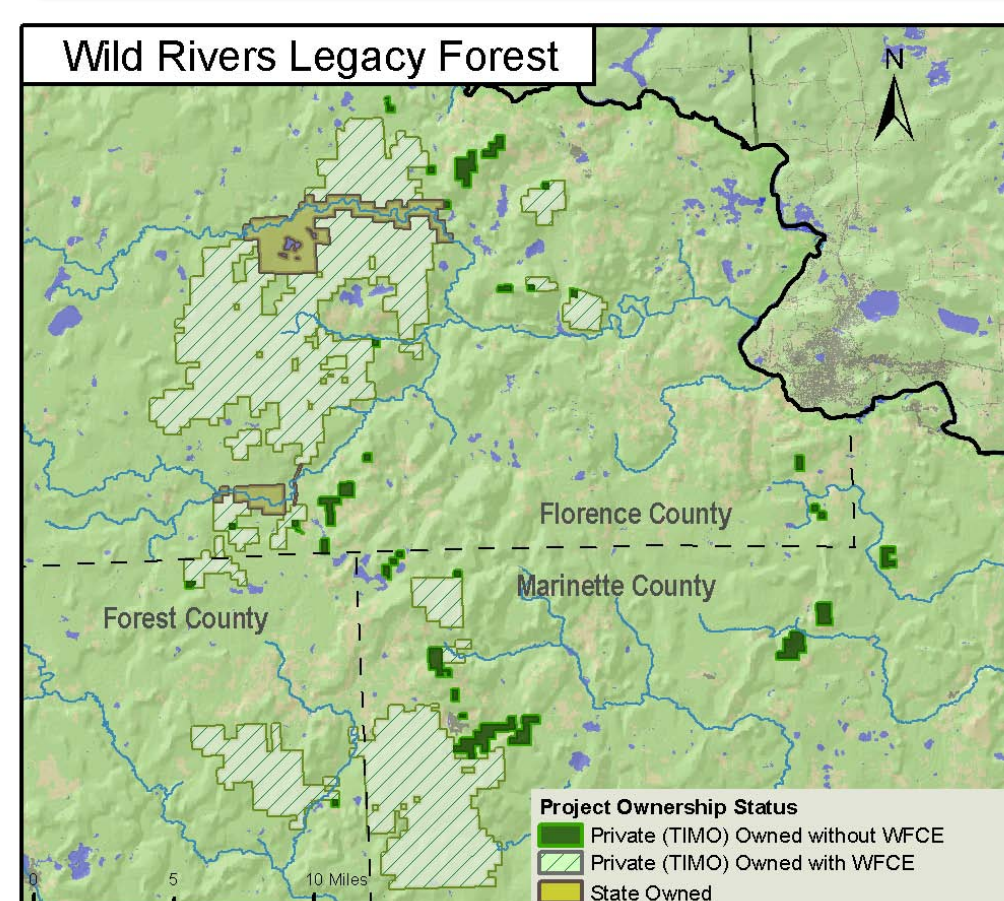


Figure 2. A map of the Wild Rivers Legacy Forest showing the ownership status of specific areas. Map courtesy of John Wagner, Wisconsin TNC.

Study Area. The WRLF area encompasses 26,300 ha of northern hardwood forest and a complex of wild lakes along the Pine and Popple Rivers in northeastern Wisconsin. The current ownership and conservation of this area is the result of a collaboration between The Nature Conservancy, International Paper, the Wisconsin Department of Natural Resources (DNR), and two timber management investment organizations (TMOs). As a result, the area contains both state-owned forests managed by the DNR as well as lands owned by TMOs, most with state and TNC held working forest conservation easements (Figure 2) (TNC 2010).

Woody biomass and energy production. Woody biomass for energy production can be obtained from two main sources—plantations of quickly growing woody plants, such as aspen, and natural forests. While it is expected that plantations will provide the majority of woody biomass in the future, natural forests will likely serve as a stop-gap source of woody biomass in the early stages of technology and market development. As the study area has productive timber and pulp industries, it is expected that only woody biomass residues from timber harvest, other removals (thinning operations, fuel removal, and land clearing, for example), and mill processes are currently available.

Assessing woody biomass availability and demand. We used county-level data from the 2007 U.S. Forest Service Forest Inventory and Analysis (USFS 2009) to estimate the amount of currently accessible woody biomass residues in Florence, Forest, and Marinette counties. The demand for pellet production and co-firing with coal to produce electricity from counties within 50 and 100mi of the study area represent low and high demand, respectively (Figure 3).

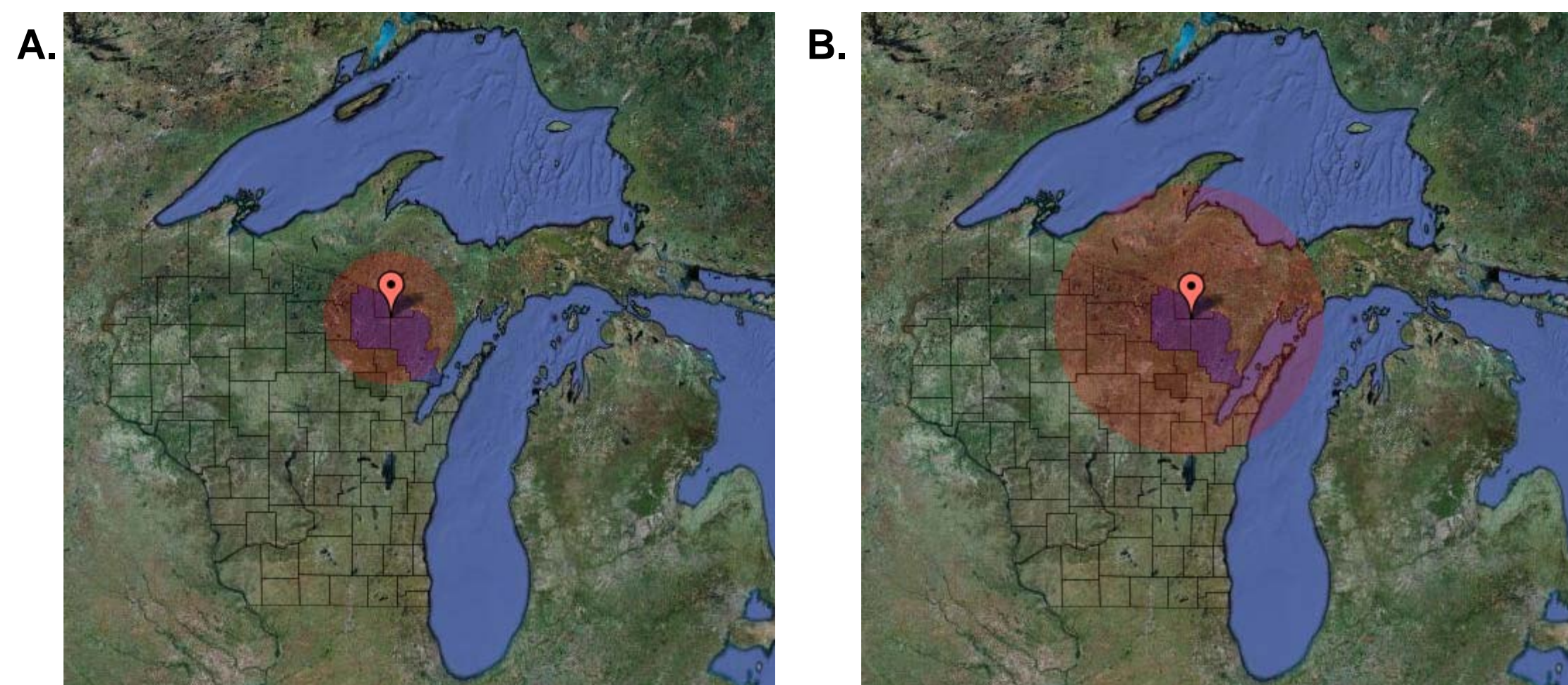


Figure 3. The Wild River's Legacy Forest lies in Florence, Forest, and Marinette counties, highlighted in blue. Woody biomass demand from counties within a 50mi radius (A) and a 100mi radius (B) was evaluated.

Results

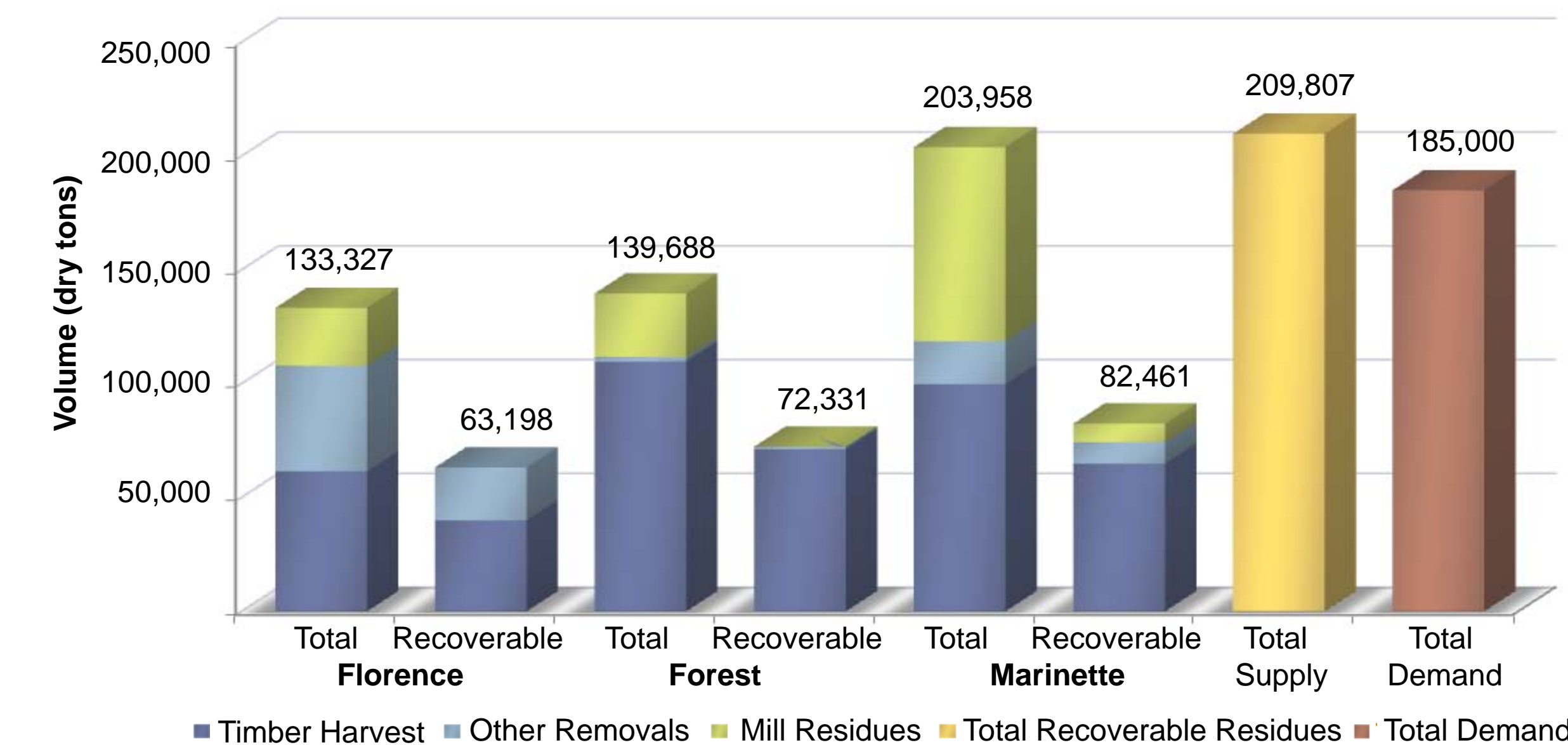
Supply of woody biomass for energy production. Florence, Forest, and Marinette counties contain a total of 1,536,416 acres of timberland. A total of 476,973 dry tons of woody biomass residues are produced from timber harvest, other removals, and mill processes in these counties (USFS 2009), and 209,807 dry tons are recoverable for energy production. Not all residues from timber harvests and other removals are recoverable due to limitations of harvest equipment and considerations of nutrient cycling. Table 1 shows a breakdown of timberland, total biomass, and recoverable biomass by county. Timber harvest residues are assumed to be 100% accessible and 65% recoverable, while residues from other removals are assumed to be 100% accessible and 50% recoverable (Perlack et al. 2009).

Table 1.	Florence	Forest	Marinette	Total
Total Timberland (acres)	277,133	572,413	686,870	1,536,416
Total Residues (dry tons)				
Timber Harvest Residues	61,492	109,687	99,822	271,001
Other Removals	46,456	2,070	18,788	67,314
Mill Residues	25,379	27,932	85,348	138,658
Total	133,327	139,688	203,958	476,973
Recoverable Residues (dry tons)				
Timber Harvest Residues	39,970	71,297	64,884	176,151
Other Removals	23,228	1,035	9,394	33,657
Unused Mill Residues	0	0	8,183	8,183
Total	63,198	72,331	82,461	209,807

Current demand for woody biomass for energy production. Current annual demand for woody biomass for wood pellet production totals 140,000 dry tons from counties within 50mi of the study area and 185,000 dry tons from counties within 100mi of the study area (WI DNR 2009, Table 2). While amount of woody biomass usage by mill power plants (starred in Table 2) is unknown, it is assumed that they optimize coal and woody biomass co-firing based on fossil fuel prices, as these mills report very little unused mill residues.

Table 2.	County and State	Biomass Use (tons/year)	Generation Capacity (MW)
50 mile radius			
Pellet Plants (WI DNR 2009)			
Marth Wood Shaving Supply	Marathon, WI	100,000	
Dejno's Inc.	Langlade, WI	20,000	
Bay Lakes Companies, LLC	Oconto, WI	20,000	
Coal Fired Power Plants (SourceWatch 2010)			
Niagara Mill Power Plant*	Marinette, WI	---	11.8
Rhineland Mill Power Plant*	Oneida, WI	---	23.3
Menominee Paper Power Plant*	Menominee, MI	---	4
Total		140,000	39.1
100 mile radius			
Pellet Plants (WI DNR 2009)			
Earth Sense Energy Systems	Outagamie, WI	40,000	
Performance Wood	Outagamie, WI	5,000	
Coal Fired Power Plants (SourceWatch 2010)			
Fraser Paper Power Plant*	Price, WI	---	5.7
Packaging Corporation of America Tomahawk Power Plant*	Lincoln, WI	---	15.7
Weston Power Plant	Marathon, WI	---	492
Whiting Mill Power Plant*	Portage, WI	---	4.1
Appleton Papers, Inc. Combined Locks Mill*	Outagamie, WI	---	Unknown
Kaukauna Cogeneration Plant*	Outagamie, WI	---	12
J.P. Pulliam Power Plant	Brown, WI	---	410
Manitowoc Power Plant	Manitowoc, WI	---	32
White Pine Power Plant	Ontonagon, MI	---	60
Stone Container Ontonagon Power Plant*	Ontonagon, MI	---	15.6
Shiras Station	Marquette, MI	---	77.5
Presque Isle Power Plant	Marquette, MI	---	625
Escanaba Power Generating Station	Delta, MI	---	23
Escanaba Paper Power Plant*	Delta, MI	---	54
Total		185,000	1865.7

Figure 4. Summary of Woody Biomass Supply and Demand



Discussion



Figure 5. Local foresters and ecologists discussing the dynamics of the WRLF.

Woody biomass residues from timber harvest in natural forests and mill operations can serve as a stop-gap feedstock for renewable energy production as markets and technologies continue to develop. The total recoverable woody biomass residues from the WRLF area can fulfill the current demand for woody biomass for pellet production within 100 miles (Figure 4). While mill power plants currently utilize their residues in co-firing (starred in Table 2), none of the area's utility coal fired power plants currently co-fire with biomass. If they were to produce just 5% of their electricity using woody biomass residues, annual demand would increase from 185,000 to 859,603 dry tons. These results indicated that demand for woody biomass from natural forests will likely increase with even minimal increases in renewable energy production, at least in the short term.

This approach could be applied to rapidly assess the supply and demand of woody biomass from other areas in the Western Great Lakes region as a first step for exploring the addition of woody biomass harvest to forest management strategies. This study informs an ongoing collaboration between TNC and the University of Wisconsin to develop and apply an integrated scenario-building and landscape modeling approach to evaluate the effectiveness of various conservation strategies in response to anthropogenic and climate change pressures in the WRLF area (Figure 5).

Acknowledgements

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