LAKE STATES
FOREST MANAGEMENT ACTIVITY COST GUIDE

WOODLOT ECONOMIC PROJECT

It's OK to print this resources. Paper is a biodegradable, renewable, sustainable forest product. Strong fiber (pulp) markets provide an optimal economic outlet for non-grade materials which encourages a viable working forest, and the best way to sustain our forestland resources is by sustaining our forest landowners. Growing and harvesting trees provides long-term ecological, social, and economic benefits to the working mosaic of forestland owners, forests themselves, and society such as clean air, clean water, wildlife habitat, and carbon storage, as well as millions of jobs. Thanks to our dedicated forest and resource professionals, we now have more trees growing in America than we had 100 years ago!

APPLIED RESEARCH

applied landowner research

College of Natural Resources
University of Wisconsin-Stevens Point

ABSTRACT

Investing in the forest as a resource today provides long-term ecological, social, and economic benefits to the working mosaic of forestland owners, forests themselves, and society. However, small-scale (10 to 49 acres) family forest owners in the Lake States (Mich., Minn., and Wis.) lack readily available passive resources to approximate the cost of managing their forestland; such information is accessible in other regions of the United States. Therefore, to close the knowledge gap, an online survey was developed and distributed to forest practitioners in 2022 to capture the cost of 21 forest management practices following an accounting approach. The survey results were analyzed through a break-even analysis and used to develop the Lake States Forest Management Activity Cost Guide. This effort resulted in the publicly available online dashboard described herein is available at the Wisconsin Forestry Center's Research and Development webpage and serves to provide landowners with information to encourage transparent dialog between forest practitioners and small-scale family forest owners. Monitoring and reporting changes in management costs, remain essential for forest managers to plan for costs, provide data for future meta-analyses, and guide economic policy. Such efforts may support ecosystems sustainability and foster the leading forest product economic sector within the Lake States region.

Keywords: Applied Economics, Cost Analysis, Small-Scale Forestry, Landowner Models

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam, *Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines, *Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

Acknowledgments: This study is funded by the USDA National Institute of Food and Agriculture, McIntire Stennis, the State of Wisconsin Board of Commissioners of Public Lands, and the Forestry Discipline in the College of Natural Resources at the University of Wisconsin-Stevens Point.

Data Availability Statement: Aggregated data can be found at the Wisconsin Forestry Center, Research and Development at the University of Wisconsin-Stevens Point webpage at uwsp.edu/cnr-ap/WFC/Pages/WFC/Research-and-Development/cost_guide.aspx

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FORESTLAND OWNERS

Nearly 35% of the Lake States' area or 53.6 million acres across Michigan, Minnesota, and Wisconsin, is covered in forest. The working mosaic of forestland owners consist of private ownership, including family forest owners and businesses, public owners including federal, state, and local governments, tribal communities, and other land stewards.

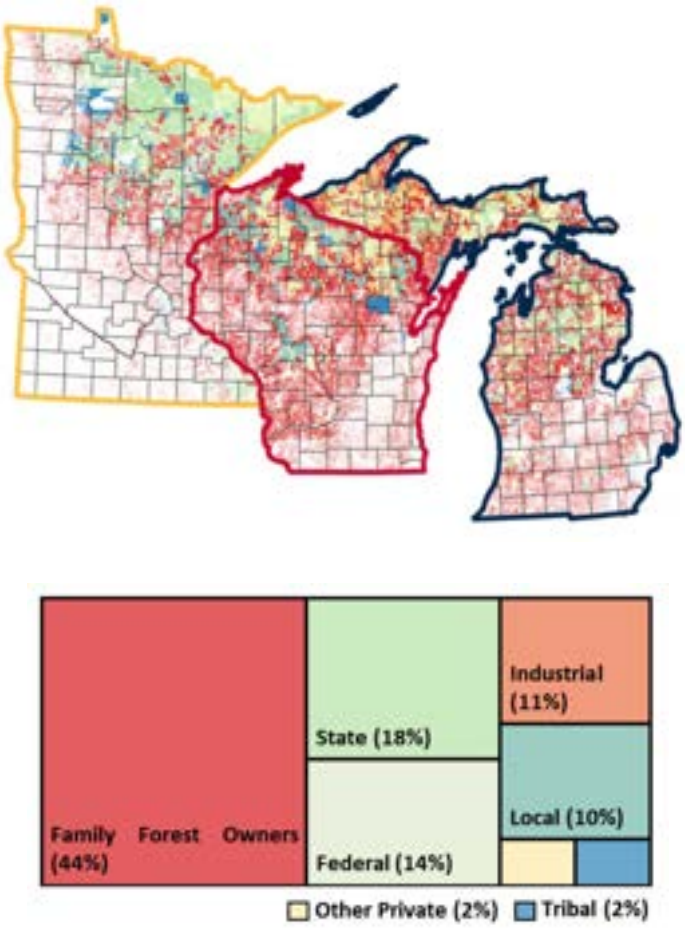


Figure 1. Forestland ownership pattern and percent within the Lake States region estimated by the 2018 USDA Forest Service National Woodland Owner Survey (Butler et al. 2021).

The largest forest-owning group is family forest owners, spanning nearly 24.4 million acres. This group of 902,000 ownerships strongly values beauty and scenery, wildlife habitat, and nature protection. They practice cutting trees for personal use, improving wildlife habitat, and harvesting timber resources. Often, families and individuals pass this land down to succeeding children in will and gift, which may lead toward a further fragmented forest ownership pattern, a common concern. Other concerns of families and individuals who own forestland include property taxes, trespassing, and poaching (Butler et al. 2021).

On average, individual and family forest owners maintain parcels between 30 and 50 acres in size, when excluding parcels less than 10 acres as they are unlikely to be managed with traditional forestry methods (Butler et al. 2021).

Across the region, there is a diversity of forest cover. According to the latest United States Forest Services, Forest Inventory Analysis report, major forest type groups in the Lake States region include aspen and birch (22.4%); maple and beech (20.2%); oak and hickory (18. 3%); spruce and fir (15.1%); elm, ash, and cottonwood (9.7%); and pines (9.1%).

Managing these diverse forests provides long-term ecological, social, and economic benefits to the working mosaic of forestland owners, forests themselves, and society. However, finically planning for management is difficult within the Lake States as there are few available resources to approximate the cost; such information is accessible in other regions.

Butler, B. J., Butler, S. M., Caputo, J., Jacqueline, D., Robillard, A., & Sass, E. M. (2021). Family forest ownerships of the United States, 2018: results from the USDA Forest Service, National Woodland Owner Survey. 1-57. doi.org/10.2737/NRS-GTR-199

USDA Forest Service, Forest Inventory and Analysis National Program, Tools and Data Spatial Data Services.

COST ASSISTANCE RESOURCES

Costs related to many forest management practices are often deducted from a stumpage value if completed in conjunction with a timber sale. Stumpage, refers to the commercial value of designated standing timber to be cut and sold during a timber sale, denoted in a timber sale prospectus, and agreed to in a timber sale contract.

Voluntary tax reduction programs can be great resource to save money on property taxes in exchange for practicing active sustainable forest management. When enrolled in these programs, landowners meet with a professional forester to determine a sustainable forest management plan tailored to meet the goals of forest ownership and site capabilities. Generally, goals are accomplished through active forest management, including a timber sale. Many other forest management activities can be completed during a timber harvest, while profiting from a timber sale. Noteworthy programs in the Lake States include the Forest Stewardship Plan and Qualified Forest Program in Mich., the Woodland Stewardship Plan in Minn., and the Managed Forest Law in Wis.

Each year the US Forest Services publishes a "Tax Tips for Forest Landowners," depending on the goals and motives of managing forestland and ownership designation, some continuous, regular, and necessary costs may be tax deductible. Be sure to keep careful record of any costs associated with forest management planning, regeneration establishment, timber stand improvement, fire and prescribed burning, forest health and protection, wildlife habitat enhancements, administration specialists and forester fees, and property taxes. Some to all of which may be tax deductible. Consider planning such management options with a forestry professional and discussing financial implications with your tax advisor.

Cost-share can be another great resource to alleviate potential financial concerns associated with forest management activities. Some noteworthy national programs include the Forest Health Protection Program (FHPP), Conservation Reserve Program (CRP), and Environmental Quality Incentives Program (EQIP).

STUDY GOALS AND OBJECTIVES

This study aims to identify the costs associated with various forest management activities in the Lake States and continually update them through periodic online surveys.

This economic decision support tool is intended for small-scale Family Forest Owners in the Lake State and looks to foster a healthy dialog between Family Forest Owners and forestland professionals.

Benchmark costs were reported from forest practitioners and cost-share funds in the Lake States (Michigan, Minnesota, and Wisconsin) in the spring of 2022.

Estimates serve as a point of comparison for small-scale (30-50 acres) forest management activities done independently of a timber sale.

Results display an average cost per acre, most relevant when applied near the area needs, and were assessed through a break-even analysis based on response (n) weighting.

Data is not displayed for practices with less than five responses (*).

Benchmark costs may differ from open market conditions for given site characteristics.

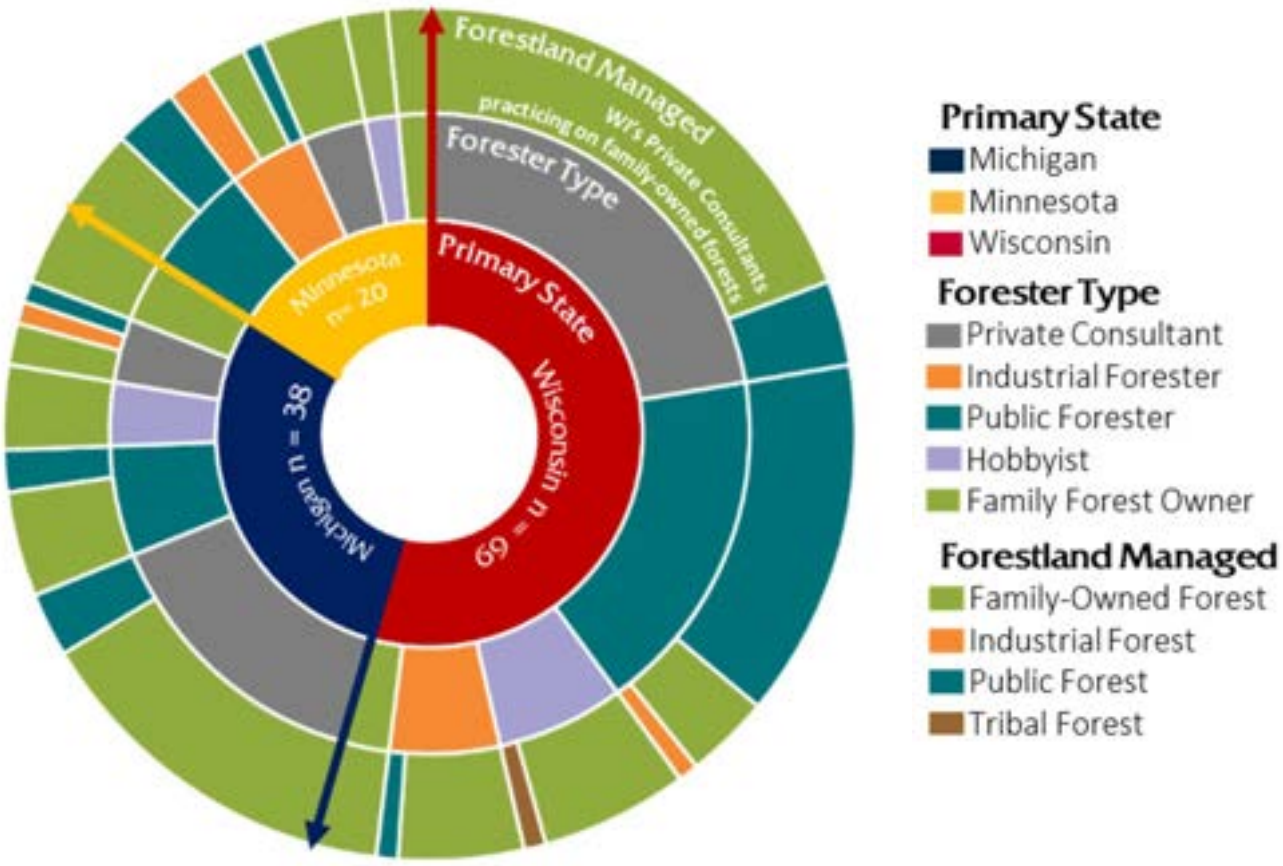
Landowners are encouraged to contact a forestland professional to understand viable forest management activities and how incurred expenses will be assessed.

SURVEYED FORESTRY FIRMS

Throughout the Lake States, various types of land ownership require various foresters to reach the desired goals of the land they manage. The Forest Management Activity Guide survey reached over 1,000 forestland professionals with a response rate of 11.7% and a 70% usable completion rate. Most responses (22%) came from Wisconsin's (69) private consulting foresters (50), practicing on family-owned forests (88).

The state of Wisconsin had 69 observations, 38 from Michigan, and 20 from Minnesota. Foresters were mostly private consulting forestry firms (50), followed by 36 governmental foresters, 17 industrial foresters, 13 part-time hobbyists, 8 family forestland owners and 1 tribal forest manager. Foresters generally worked primarily on family forest-owned land representing 70% of responses, 22% on public ownership, and industrial lands accounted for 8% of foresters.

Most foresters operated within a working radius of fewer than 100 miles, with 36% working 0-50 miles, 36% at a 51–100-mile radius, 14% managing lands at 101-150 miles, and 10% more than 150 miles from the office. The remaining 4% did not report on this statistic.



Read as parts of wedges starting in the middle, the most responses (22%) came from Wisconsin's (69) private consulting foresters (50), practicing on family-owned forests (88).

Forest Management Activity Cost Guide

IMPORTANT TERMS

Average Dollars per Acre: Forestry management practices generally assess the cost of services based on fixed and variable costing schema.

Average Cost: Sum of fixed costs divided by area needs, plus the sum of variable costs.

Error: Standard error of the mean, or the standard deviation divided by the square root of the number of observations read as plus or minus average cost per acre.

Fixed Costs: Remain constant regardless of landholding size.

Base Rate: Fixed cost to practice regardless of acres.

Distance: Average cost of travel to the woods, a product of distances and mileage reimbursement rate. Generally regarded as a variable cost, however assessed a fixed cost in this analysis.

Variable Costs: A product of a multifaceted relationship of fluctuations of inputs and outputs in open market conditions, site-specific variations, spatial and temporal environments, accompanying services provided, and other variables.

Area: Average cost of each additional acre of land.

Time: Average cost per hour, a product of compensation and productivity.

Material: Cost of materials in dollars per acre.

Relevant Area Needs: In general, the average cost per acre goes down with each additional acres completed. Estimates are most appropriate near the area needs.

Acres: Average minimum number of acres which practitioners were willing to practice on at the respective average costs.

NAVIGATING RESULTS

This cost guide is broken down forest management services into seven primary groups. Each primary group is further broken out further into multiple practices that has various nested activities and considerations that can be explored more in-depth on the respective page. Below is a brief description of each primary group, on the following page is a chart detailing respective practices.

Forest Management Planning
Tools and techniques used to guide forest activities and operations to meet current and long-term objectives.

Timber Sale Administration
Activities associated with commercial timber harvest operations.

Regeneration Establishment
Activities that encourage natural seed banks or utilize artificial sources to grow and meet desired objectives.

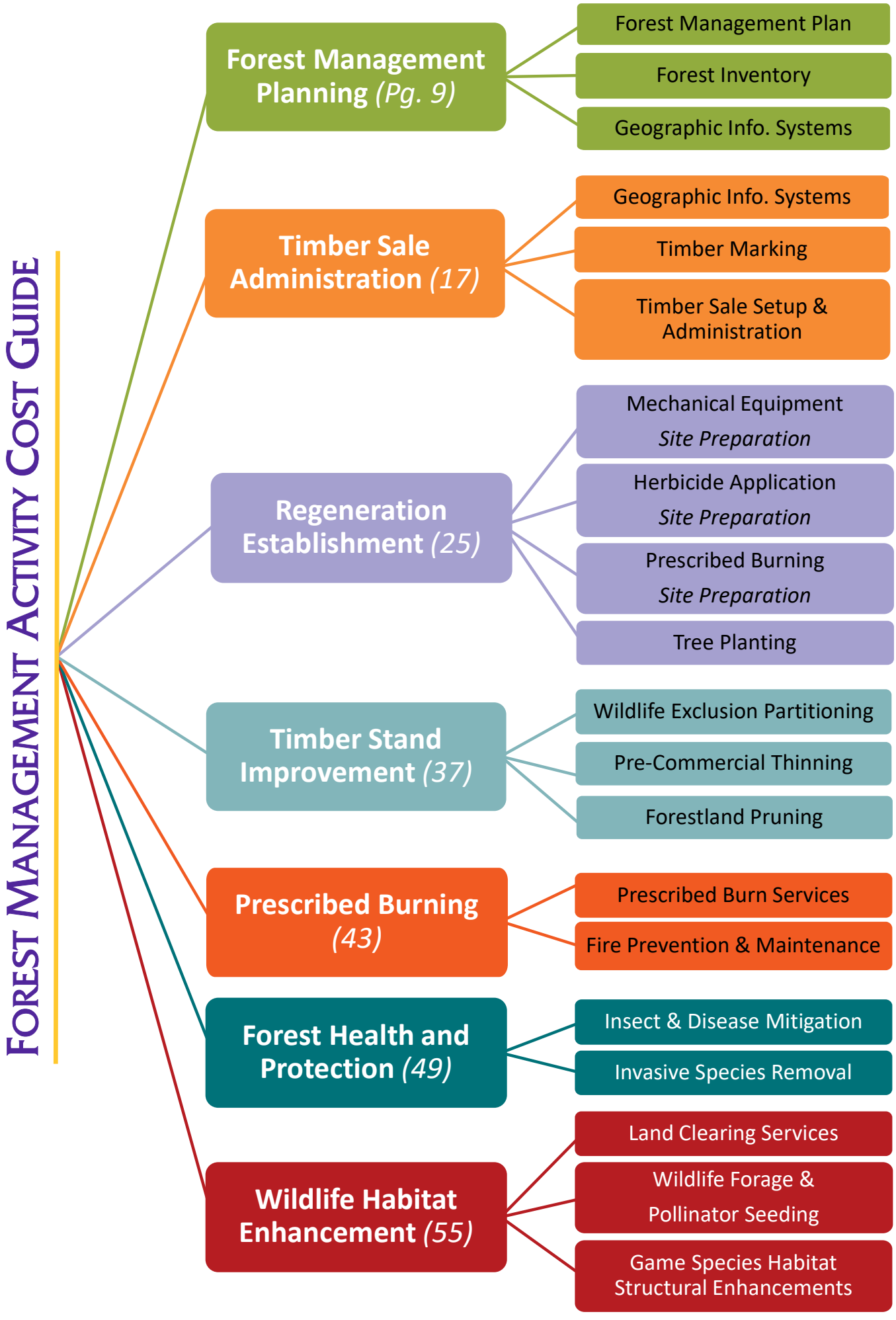
Timber Stand Improvement
Commercial and intermediate forest activities to guide and improve individual trees to reach specific forestland goals.

Fire & Prescribed Burning
Controlled burning and wildfire management activities.

Forest Health & Protection
Preventive and reactive measures of non-native and exotic plants, pathogens, and animals that harm the native ecosystem.

Wildlife Habitat Enhancements
Activities that improve or alter ecosystem, habitat, or structure, and encourage desired species diversity.

Forest Management Activity Cost Guide



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Forest Management Activity Cost Guide Lake States

Woodlot Economic Project

Keywords: Planning, Inventory, GIS, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Forest Management Planning							
Forest Management Plan							
Average Cost	149	113	89	49	20	43	14
Standard Error	*243*	*64*	*8*	*10*	*8*	*8*	*5*
Forest Inventory							
Average Cost	29	18	34	20		26	5
Standard Error	*8*	*9*	*5*	*4*		*6*	*0*
Geographic Information Systems and Cartography							
Average Cost			25	12		4	1
Standard Error			*0*	*4*		*2*	*0*

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	Acres	($/Ac)		n
Forest Management Planning	**36.54**	**60.2**	**196**	**27**	***70***
Forest Management Plan					
Average Cost	57.23	140.7	389	44	*61*
Standard Error	*8.60*	*45.2*	*28*	*9*	
Forest Inventory					
Average Cost	25.12	20.4	110	19	*44*
Standard Error	*0.90*	*0.9*	*12*	*1*	
Geographic Information Systems and Cartography					
Average Cost	10.53	29.0	121	4	*10*
Standard Error	*0.90*	*1.8*	*7*	*0*	

FOREST MANAGEMENT PLAN

Forest management plans vary in intensity, duration, and purpose. Plans are designed to help individual landowners reach desired goals and objectives by providing small steps to accomplish overall desired outcomes through a long-term plan.

The cost of writing a forest management plan was reported by 59 individuals across the Lake States and averaged $57 per acre.

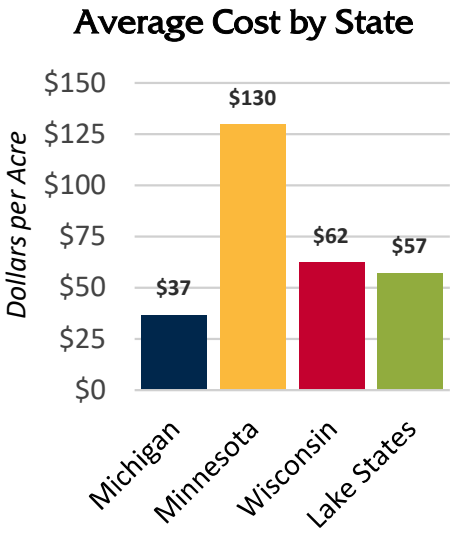
At $130, Minnesota had the highest average cost per acre to write a forest management plan and was 252% higher than Michigan, which had the lowest average cost per acre at $37. Wisconsin's average reported cost was $62 per acre.

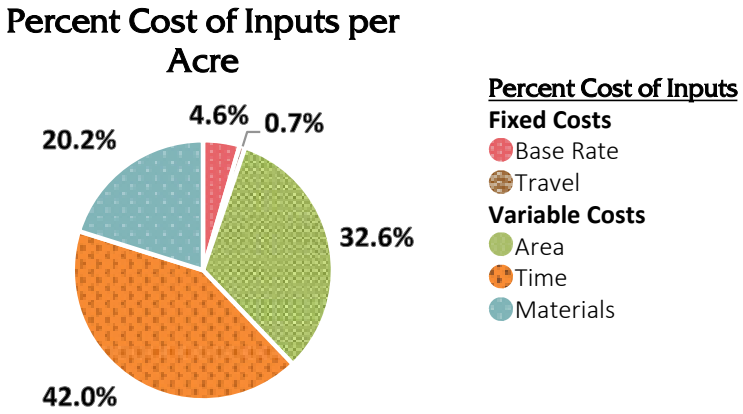
The most common plan written was a Managed Forest Law (MFL) plan, which was observed to cost $51 per acre and ranged $6 if practiced on 21 acres.

Average cost and area needed for Forest Management Plans assessed in the Lake States during 2022.

Activity Name Forest Management Plan	Average Cost ($/acre)		Area (acres)	*Count (n)*
Cost Share Program Plan	$69	± 11	22	*23*
Forest Carbon Management Plan	$32	± 3	20	*5*
Forest Health Management Plan	$50	± 4	29	*10*
Forest Management Plan for Wildlife	$55	± 8	26	*6*
Forest Stewardship Plan	$48	± 4	21	*24*
Managed Forest Law Plan	$51	± 6	21	*26*
Other Plan	$150	± 121	1,686	*8*
Qualified Forest Program	*	*	*	*
Woodland Stewardship Plan	$53	±11	19	*12*
Plan Average	**$57**	**±9**	**145**	***59***

The most responses (43%) came from private consulting firms (26) practicing in family-owned forests (52). Wisconsin had 27 observations, 16 from Michigan, and 9 from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of writing a forest management plan using area, base rate, time, material, and distance traveled. Fixed costs are estimated at $389 per tract plus $44 per acre, for at least 25 contiguous acres *(excluding one outlier of 500 acres)*.

Type of Plan	Generalized Definition
Woodland Stewardship Plan	The Woodland Stewardship Plan (WSP) serves as an information handbook tailored to an individual tract of forest lands in Minnesota while providing a timeline and advice on how to actively manage a forest to provide for the 'landowners' expressed goals and desires.
Managed Forest Law Plan	The Managed Forest Law (MFL) program is a voluntary tax reduction program for Wisconsin's forests where landowners engage in forestry management to meet their individual goals and objectives by following silvicultural appropriate timelines and practices.
Forest Stewardship Plan	Forest Stewardship Plans (FSP) provide Michigan's forested landowners with a personalized guide to help them achieve their forest management goals and discuss the benefits of forestry-related conservation programs available to landowners.
Cost Share Program Plan	Cost-share programs are funds available to assist entities in accomplishing a task for the common good. Numerous entities provide various cost-share programs for forestry work on NIPFs' land bases. Key organizations involved are the United States Department of Agriculture (USDA) Farm Service Agency (FSA) and Natural Resources Conservation Services (NRCS), as well as some Department of Natural Resources (DNR) agencies. Noteworthy examples from the USDA NRCS include the Conservation Reserve Program (CRP), Conservation Stewardship Program, and the Environmental Quality Incentive Program (EQIP).
Forest Management Plan for Wildlife	Forest management plans center around considerations dedicated to increasing and improving wildlife species' habitats. These plans are often part of a larger landscape initiative. They are done with many landowners, silviculturists, and ecologists, such as the Deer Management Assistance Program (DMAP), run by the WI DNR.
Forest Health Management Plan	Often referred to as Integrated Pest Management plans (IPM), they are designed to reach desired landowner goals by following pest life cycles and environmental interactions. These plans are often united within different plans at an individual landowner or landscape level.
Forest Carbon Management Plan	Some plans allow landowners to preserve forested land and exchange growing carbon pools to offset carbon emissions elsewhere for short-term economic gain and environmental good.
Other Plan	Various other forest management plans exist and serve a variety of roles. Examples of plans included within others include fire management plans and tree planting plans.
Qualified Forest Program	The Qualified Forest Program (QFP) provides Michigan's private forestland owners with some tax exemptions while encouraging property managers to harvest timber sustainably according to a landowner's forestland goals and objectives.

FOREST INVENTORY

Many reasons exist for conducting a forest inventory or timber cruise, including writing a forest management plan, preparing for a timber sale, and more. Depending on the purpose, a forester may change the sampling method or target variable of the timber cruise.

The cost of conducting a forest inventory was reported by 44 individuals across the Lake States and averaged $25 per acre.

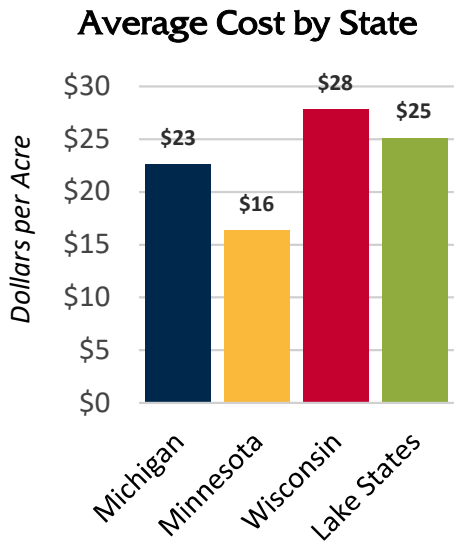
At $28 per acre, Wisconsin had the highest average cost of conducting forest inventory and was 24% higher than Minnesota, which had the lowest average at $23 per acre. Michigan's average was $26 per acre.

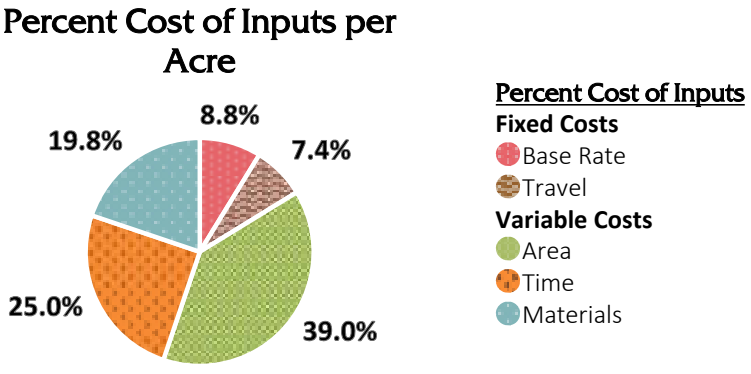
The most common purpose of a timber cruise was to estimate basal area using a variable radius method to write a management plan, which was observed to cost $25 per acre and ranged $5 if practiced on 21 acres.

Average cost and area needed of Forest Inventory assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Forest Inventory	($/acre)		(acres)	*(n)*
Purpose of Inventory				
Evaluate a stand	$25	± 3	20	*39*
Maintain continuous forest inventory	$26	± 8	14	*11*
Other Reason	$21	± 4	16	*5*
Prepare a timber sale	$25	± 3	21	*38*
Quantify forest carbon	*	*	*	*3*
Timber appraisal	$26	± 3	22	*29*
Write a forest management plan	$28	± 3	20	*40*
Inventory Target Variable				
Basal Area (BA)	$23	± 2	20	*39*
Mass (e.g., Tons)	$14	± 2	17	*9*
Trees Per Acre (TPA)	$26	± 3	24	*20*
Volume (e.g., MBF, Cords)	$26	± 3	18	*38*
Plot Type				
Fixed Area Plot	$22	± 4	18	*5*
Variable Radius (BAF)	$26	± 3	21	*39*
Inventory Average	**$25**	**± 1**	**20**	***44***

The most responses (50%) came from private consulting firms (25) practicing in family-owned forests (37). Wisconsin had 27 observations, 12 from Michigan, and 7 from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of timber cruising using area, time, material, base rate, and distance traveled. Fixed costs are estimated at $110 per tract plus $19 per acre, for at least 20 contiguous acres.

Purpose	Generalized Definition
Write a forest management plan	Documenting volume, stocking, species, infrastructure, and other ecosystems to guide conversations regarding stand goals and objectives and prepare maps.
Evaluate a stand	Evaluating field conditions.
Maintain continuous forest inventory	Maintaining and documenting volume, stocking, or other conditions continuously.
Prepare a timber sale	Estimating the volume harvested in an upcoming timber sale is often used in scaled sales and lump sum sale estimations. May also include assessing ground conditions for harvest operations.
Timber appraisal	121.5 Assessing the economic value of a stand is often done before a harvest or for tax and accounting purposes.
Quantify forest carbon	Estimating the total dry biomass or carbon stored in the woody material within the forest.

Target Variable	Generalized Definition
Trees Per Acre (TPA)	The estimated number of trees on an acre
Basal Area (BA)	The cross-sectional surface area of tree stems at 4.5 feet above ground expressed as square feet per acre
Volume (e.g., MBF, Cords)	Estimated volume of standing or laying woody material. Pulp and bolts are often measured in cords, and sawtimber is measured in thousand board feet (MBF).
Mass (e.g., Tons)	Estimated weight of standing or laying woody material. Pulp and bolts are often measured in tons.

Plot Type	Generalized Definition
Fixed Area Plot	This sampling technique is primarily used to evaluate seedlings to pole-sized timber. In this sampling technique, a forester evaluates all the stems within a set area.
Variable Radius (BAF)	The sampling technique is used primarily to evaluate saw timber-sized timber. This sampling technique allows for a sample to be determined based on a ratio of stem diameter and proximity to a sample point.
Remotely Sensed	The sampling technique is used to evaluate a host of spatially referenced data. Emerging technology is commonly completed using aerial-based light detection and ranging (LIDAR) equipment.

GEOGRAPHIC INFO. SYSTEMS

Geographic Information Systems (GIS) combine various spatial and temporal information. Foresters use multiple tools to collect, interpret, and display this information and may or may not charge for these services, depending on the purpose of compiling data.

The cost to utilize Geographic Information Systems (GIS) was reported by 26 individuals across the Lake States and averaged $11 per acre.

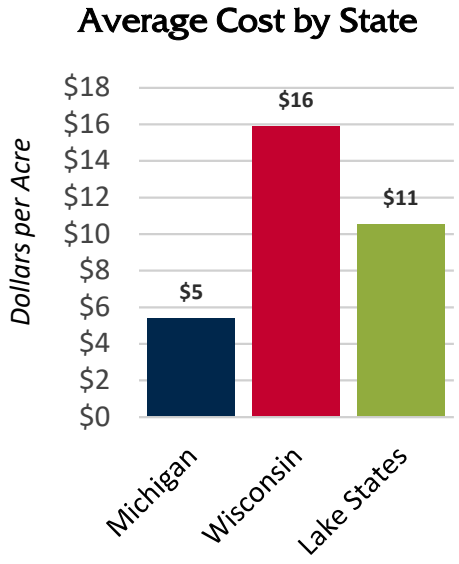
Wisconsin's average cost was reported at $15 per acre and Michigan's average was $5 per acre.

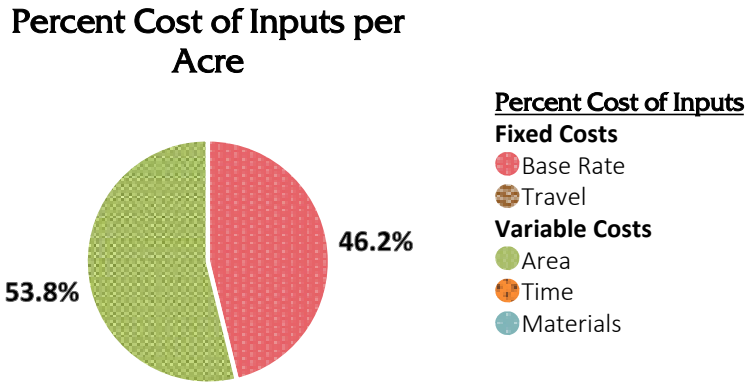
The most common purpose of GIS was to calculate area of land using Avenza Maps, which was observed to cost $10 per acre and ranged $2 if practiced on 31 acres.

Average Cost and area needed of Geographic Information Systems and Cartography assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
GIS	($/acre)		(acres)	*(n)*
Purpose of GIS				
Calculating Acreage	$10	± 2	31	*38*
Cartography for Landowner	$8	± 1	32	*34*
Finding Points	$12	± 2	24	*33*
Forest Management Planning	$10	± 2	31	*37*
Harvest Map for Loggers	$11	± 2	26	*34*
Other Reason	*	*	*	*3*
Spatial Referencing	$11	± 2	31	*34*
GIS Program				
ArcGIS	$10	± 2	31	*24*
Avenza Maps	$10	± 2	31	*29*
fGIS	$12		20	*6*
Garmin Products	$12	± 3	25	*17*
Google Maps	$12	± 2	32	*26*
Other Program	$6		20	*7*
QGIS	$10	± 1	30	*17*
SOLO Forest	$15	± 4	18	*8*
GIS Average	**$10**	**± 1**	**29**	***40***

Most responses (35%) came from private consulting firms (14) practicing in family-owned forests (26). Wisconsin had 14 observations, 7 from Michigan, and 5 from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of GIS using area and base rate. Fixed costs are estimated at $121 per tract plus $4 per acre, for at least 29 contiguous acres.

GIS Purpose	Generalized Definition
Forest Management Planning	Forest management plans often have a map of a tract of timber broken up into smaller management zones where they may be mapped differently—for example, forestland cover type, tree density, hydrologic areas, or other points of interest.
Harvest Map for Loggers	When preparing a timber sale, foresters often use a harvest map to display relevant information to landowners, loggers, and others, such as silvicultural considerations, riparian management zones, log decking areas, fueling zones, and others.
Cartography for Landowner	Some forestry firms collect a myriad of geospatial information and imagery that can be neat for landowners to display.
Calculating Acreage	There are many ways to calculate the area and utilizing various GIS software can make the process more efficient.
Spatial Referencing	Many GIS data sets are readily available and provide a plethora of information that can be useful to denote when preparing a map. Common examples may include riparian and utility rights-of-way and property boundaries.
Finding Points	Although many GIS data sets are available, often, these data sets are not entirely complete or may require collecting additional field data for validation. Examples may include site access locations, woods roads and trail networks, and finding inventory cruise points.

FOREST MANAGEMENT ACTIVITY COST GUIDE LAKE STATES

WOODLOT ECONOMIC PROJECT

Timber Sale Administration

Keywords: GIS, Timber Marking, Sale Administration, Cost Analysis, Small-Scale Forestry, Lake States

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Acknowledgments: This study is funded by the USDA National Institute of Food and Agriculture, McIntire Stennis, the State of Wisconsin Board of Commissioners of Public Lands, and the Forestry Discipline in the College of Natural Resources at the University of Wisconsin-Stevens Point.

Data Availability Statement: Aggregated data can be found at the Wisconsin Forestry Center, Research and Development at the University of Wisconsin-Stevens Point webpage at uwsp.edu/cnr-ap/WFC/Pages/WFC/Research-and-Development/cost_guide.aspx

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Timber Sale Administration							
Geographic Information Systems and Cartography							
Average Cost			17	23		5	
Standard Error			*5*	*4*		*3*	
Timber Marking							
Average Cost	204	92	80	70		60	
Standard Error	*76*	*25*	*12*	*21*		*23*	
Timber Sale Setup, and Administration							
Average Cost	153	73	83	53		83	
Standard Error	*104*	*14*	*24*	*12*		*21*	

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	*Acres*	*($/Ac)*		*n*
Timber Sale Administration	**68.06**	**18.9**	**165**	**57**	***53***
Geographic Information Systems and Cartography					
Average Cost	16.33	23.3	161	7	*10*
Standard Error	*1.08*	*1.2*	*11*	*1*	
Timber Marking					
Average Cost	79.49	16.3	93	75	*51*
Standard Error	*4.19*	*0.7*	*13*	*4*	
Timber Sale Setup, and Administration					
Average Cost	70.60	19.3	194	57	*41*
Standard Error	*2.60*	*0.6*	*15*	*2*	

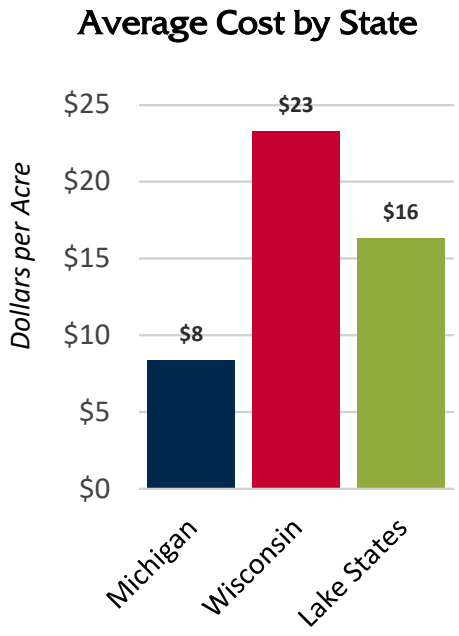
GEOGRAPHIC INFO. SYSTEMS

Geographic Information Systems (GIS) combine various spatial and temporal information. Foresters use multiple tools to collect, interpret, and display this information and may or may not charge for these services, depending on the purpose of compiling data.

The cost of mapping other GIS was reported by 31 individuals across the Lake States and averaged $17 per acre.

Wisconsin's average cost was reported at $23 per acre and Michigan's average was $8 per acre.

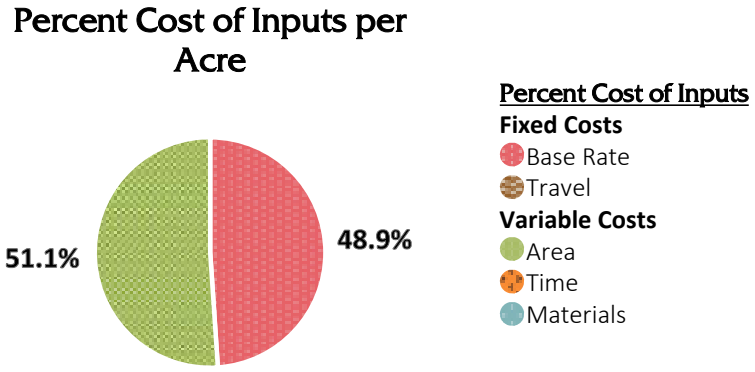
The most common purpose of GIS was to do cartography for landowner using ArcGIS, which was observed to cost $16 per acre and ranged $1 if practiced on 24 acres.



Average Cost and area needed of Geographic Information Systems and Cartography assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
GIS	($/acre)		(acres)	*(n)*
Purpose of GIS				
Calculating Acreage	$17	± 3	23	*19*
Cartography for Landowner	$16	± 2	24	*27*
Finding Points				*5*
Forest Management Planning	$17	± 3	22	*17*
Harvest Map for Loggers	$20	± 2	18	*20*
Other Reason	*	*	*	*4*
Spatial Referencing	$8		40	*13*
GIS Program				
ArcGIS	$16	± 1	24	*31*
Avenza Maps	$16	± 2	24	*30*
fGIS	$12	± 2	26	*24*
Garmin Products	$16	± 2	23	*28*
Google Maps	$16	± 2	24	*30*
Other Program	$18	± 2	26	*31*
QGIS	*	*	*	*1*
SOLO Forest	$18	± 2	23	*29*
GIS Average	**$17**	**± 1**	**22**	***31***

The most responses (35%) came from private consulting firms (11) practicing in family-owned forests (18). Wisconsin had 12 observations, 3 from Michigan, and 3 from Minnesota. (indicates not enough responses)*



Forest practitioners generally assessed the cost of GIS using area and base rate. Fixed costs are estimated at $161 per tract plus $7 per acre, for at least 23 contiguous acres.

GIS Purpose	Generalized Definition
Forest Management Planning	Forest management plans often have a map of a tract of timber broken up into smaller management zones where they may be mapped differently—for example, forestland cover type, tree density, hydrologic areas, or other points of interest.
Harvest Map for Loggers	When preparing a timber sale, foresters often use a harvest map to display relevant information to landowners, loggers, and others, such as silvicultural considerations, riparian management zones, log decking areas, fueling zones, and others.
Cartography for Landowner	Some forestry firms collect a myriad of geospatial information and imagery that can be neat for landowners to display.
Calculating Acreage	There are many ways to calculate the area and utilizing various GIS software can make the process more efficient.
Spatial Referencing	Many GIS data sets are readily available and provide a plethora of information that can be useful to denote when preparing a map. Common examples may include riparian and utility rights-of-way and property boundaries.
Finding Points	Although many GIS data sets are available, often, these data sets are not entirely complete or may require collecting additional field data for validation. Examples may include site access locations, woods roads and trail networks, and finding inventory cruise points.

TIMBER MARKING

The process of denoting or marking which trees are to be harvested and which are to be left standing during a harvest. Marking regimes follow various silvicultural systems to reach a landowner's goals.

The cost of marking timber for harvest was reported by 31 individuals across the Lake States and averaged $79 per acre.

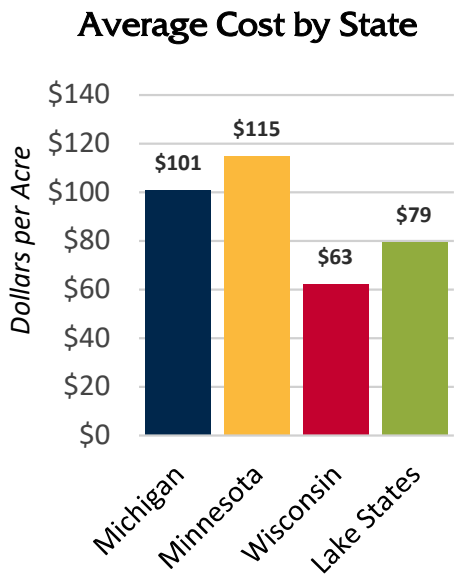
At $115 per acre, Minnesota had the highest average cost of timber marking and was 84% higher than Wisconsin, which had the lowest average at $63 per acre. Michigan's average was $101 per acre.

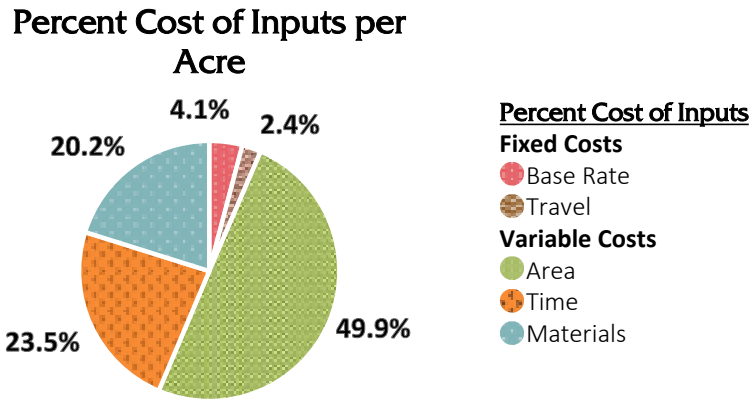
The most common method of timber marking was having company foresters mark trees for harvest, which was observed to cost $77 per acre and ranged $5 if practiced on 17 acres.

Average Cost and area needed of Timber Marking assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Timber Marking	($/acre)		(acres)	*(n)*
Marked by				
Company Forester (Internal)	$77	± 5	17	*41*
Contracted Forester (External)	*	*	*	*3*
Logger Select	*	*	*	*1*
Not Reported	$66	± 3	15	*6*
Marking Average	**$79**	**± 4**	**16**	***51***

The most responses (50%) came from private consulting firms (25) practicing in family-owned forests (41). Wisconsin had 24 observations, 12 from Michigan, and 5 from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of timber marking using area, time, material, base rate, and distance traveled. Fixed costs are estimated at $93 per tract plus $75 per acre, for at least 16 contiguous acres.

Marking Method	Generalized Definition
Company Forester (Internal)	Marking timber for harvest or retention trees within the company overseeing a timber sale.
Contracted Forester (External)	Marking timber for harvest or retention trees outside the company overseeing a timber sale.
Logger Select	Allows a logger to select which trees need to be harvested and left following silvicultural systems to meet the goals of a stand while actively felling.
Not Reported	Not enough information or unknown who was marking timber for harvest.

TIMBER SALE SETUP & ADMIN.

Foresters communicate with landowners, loggers, and others involved; matching loggers with appropriate sites to meet landowner goals; recording volumes of harvested and sold timber; and overseeing logging operations to meet landowner and forest management needs.

The cost of setting up a timber setting up and administering a timber sale was reported by 41 individuals across the Lake States and averaged $71 per acre.

At $89 per acre, Michigan had the highest average cost of timber sale setup and administration and was 46% higher than Wisconsin, which had the lowest average at $61 per acre. Minnesota's average was $73 per acre.

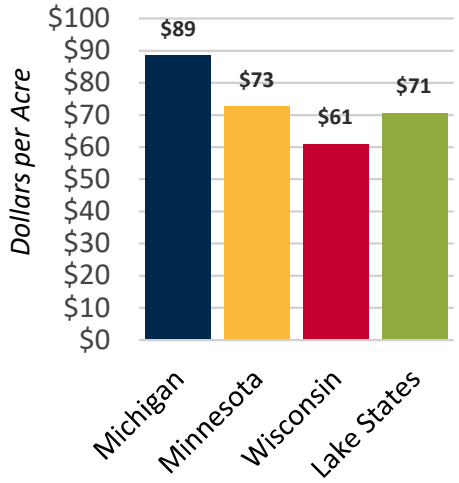
Company foresters generally marked timber and bid stumpage using a scaled sale, which was observed to cost $60 per acre and ranged $3 if practiced on 20 acres.

Average Cost and area needed of Timber Sale Setup and Administration assessed in the Lake States in 2022.

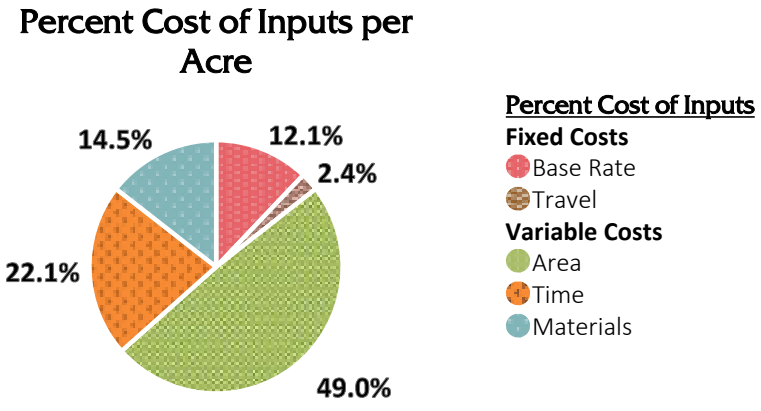
Activity Name	Average Cost		Area	*Count*
Timber Sale Setup and Admin.	($/acre)		(acres)	*(n)*
Harvest Bidding Method				
Lump Sum Sale	$108	± 15	19	*8*
Scaled Sale	$62	± 4	19	*33*
Harvest Marking Method				
Company Forester (Internal)	$70	± 4	20	*36*
Contracted Forester (External)	*	*	*	*3*
Logger Select	*	*	*	*2*
Marking and Bidding Method				
Company Forester (Internal)				*36*
Lump Sum Sale	$121	± 17	19	*7*
Scaled Sale	$60	± 3	20	*29*
Contracted Forester (External)				*3*
Lump Sum Sale	*	*	*	*2*
Scaled Sale	*	*	*	*1*
Logger Select				*2*
Scaled Sale	*	*	*	*2*
Sale Average	**$71**	**± 3**	**19**	***41***

The most responses (51%) came from private consulting firms (21) practicing in family-owned forests (30). Wisconsin had 17 observations, 9 from Michigan, and 4 from Minnesota. (indicates not enough responses)*

Average Cost by State



Percent Cost of Inputs per Acre



Forest practitioners generally assessed the cost of timber sale setup and administration using area, time, materials, base rate, distance traveled. Fixed costs are estimated at $194 per tract plus $57 per acre, for at least 19 contiguous acres.

Marking Method	Generalized Definition
Company Forester (Internal)	Marking timber for harvest or retention trees within the company overseeing a timber sale.
Contracted Forester (External)	Marking timber for harvest or retention trees outside the company overseeing a timber sale.
Logger Select	Allows a logger to select which trees need to be harvested and left following silvicultural systems to meet the goals of a stand while actively felling.
Not Reported	Not enough information or unknown who was marking timber for harvest.

Bidding Method	Generalized Definition
Lump Sum Sale	Timber sales sold using lump sum sales are pre-scaled appraisals that are bid at. The timber sale is then administered without scaling timber as it is harvested, although a per-unit stumpage rate is used to appraise the stand.
Scaled Sale	Timber sales bid as scaled sale or stumpage sale is when timber volume is estimated and sold at a unit price. The timber sale buyer must harvest all volume at a given price, usually sold by product and species. Examples include dollars per cord, ton, or thousand board feet (MBF).

Forest Management Activity Cost Guide Lake States

Woodlot Economic Project

Regeneration Establishment

Keywords: Site Preparation, Tree Planting, Regeneration Establishment, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Regeneration Establishment							
Site Prep: Mechanical Equipment							
Average Cost	501		45	89			
Standard Error	*164*		*26*	*41*			
Site Prep: Herbicide Application							
Average Cost	207	191	173	133		59	
Standard Error	*39*	*80*	*12*	*98*		*9*	
Site Prep: Prescribed Burning							
Average Cost			185				
Standard Error			*161*				
Tree Planting							
Average Cost	447	405	349	103		75	206
Standard Error	*144*	*138*	*170*	*39*		*4*	*78*

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	Acres	($/Ac)		n
Regeneration Establishment	**246.26**	**39.8**	**182**	**228**	***67***
Site Prep: Mechanical Equipment					
Average Cost	218.56	9.6	50	232	*11*
Standard Error	*15.22*	*0.5*	*19*	*17*	
Site Prep: Herbicide Application					
Average Cost	127.89	14.0	30	157	*23*
Standard Error	*4.13*	*0.9*	*6*	*9*	
Site Prep: Prescribed Burning					
Average Cost	169.22	10.0	1125	73	*5*
Standard Error	*20.93*	*0.0*	*140*	*9*	
Tree Planting					
Average Cost	346.66	118.5		244	*23*
Standard Error	*16.07*	*17.5*		*10*	

Frequency of Average Objectives and Site Conditions at Regeneration Establishment assessed in 2022 Lake States Forest Management Activity Cost Guide Survey.

	Michigan	Minnesota	Wisconsin	Lake States
	Responses *(n)*			
Primary long-term objective				
Aesthetics		2		*2*
Timber	8	3	13	24
Wildlife	6	3	3	12
Soil type and moisture regime				
Well Drained Uplands (Sandy to Loam Soils)	7	4	7	18
Drought Prone Uplands (Sandy Soils)	3	2		5
Moderately Drained Uplands (Silt to Clay Loam)	3	2	8	13
Poorly Drained Uplands (Clay or Impeded Drainage Solis)	1			1
Current vegetation status				
Brush (Dense)			1	1
Clear Cut 5 Years Ago (Brush, Saplings)	2	1		3
Clear Cut Recently (Lots of Tops, Difficult Walking)	5	5	9	19
Row and Cover Crops	1	1	1	3
Grass - Brush (Scattered Trees, Rough Ground, Old Pasture)	5	1	1	7
Herbaceous (Dense Ferns, Berries, Nettles, etc.)			3	3
Invasive (Aggressive Threshold of Invasive Species Present)	1			1

The average site described by the largest collection of responses (18%) had a goal of timber (24), well drained upland soils (18), was clear cut recently (19), and from Wisconsin (16). Wisconsin had 16 observations, 14 from Michigan, and 8 from Minnesota.

MECHANICAL EQUIPMENT SITE PREP.

Creation or promotion of growing conditions favorable for a preferred specie's survival through mechanical alterations on a given site. Mechanical site preparation is often used with more than one of the following or other means.

The cost of using mechanical equipment in site prep was reported by 11 individuals across the Lake States and averaged $219 per acre.

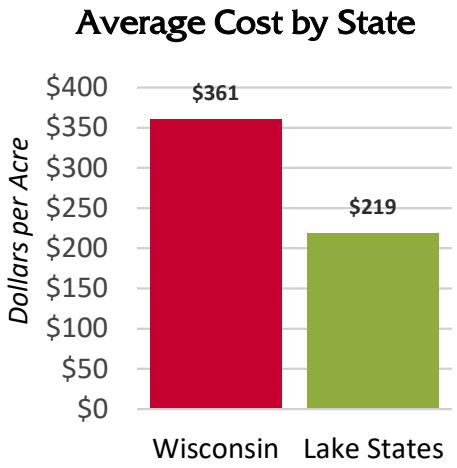
Wisconsin had the highest average cost per acre for site preparation at $316 per acre followed by Minnesota and Michigan.

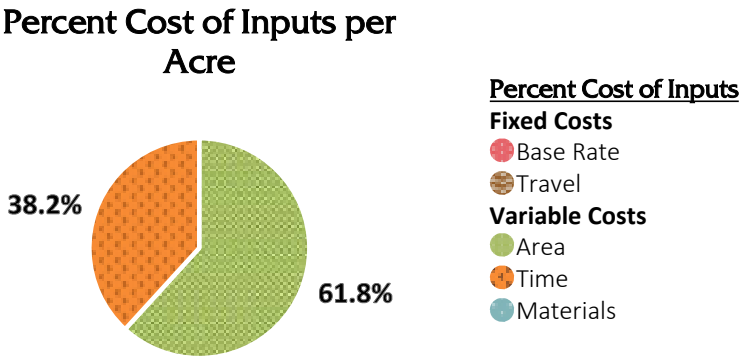
Cost-share funds across the region averaged $80 per acre, indicating rates may be near $161 per acre, and providers estimated rates were $234 (± 19) if practiced on 10 acres.

Average Cost and area needed of Mechanical Equipment Site Prep. assessed in the Lake States in 2022.

Activity Name Site Prep: Mechanical Equipment	Average Cost ($/acre)		Area (acres)	*Count* *(n)*
Passes for Mechanical Equipment				
Double Pass	*	*	*	*2*
Single Pass	*	*	*	*4*
Type of Mechanical Equipment				
Disking	*	*	*	*4*
Scalping and Trenching	*	*	*	*4*
Any Equipment	*	*	*	*4*
Piling or Root Raking	*	*	*	*3*
Mowing or Brush-Hogging	*	*	*	*3*
Mulching	*	*	*	*2*
Plowing	*	*	*	*2*
Subsoil Ripping	*	*	*	*2*
Drum Chopping	*	*	*	*1*
Other Equipment				
Straight and Salmon Blade	*	*	*	*1*
Site Prep Average	**$219**	**± 15**	**10**	***11***

The average site described by the largest collection of responses (30%) had a goal of timber (10), well drained upland soils (9), was clear cut recently (7). The most responses (45%) came from cost-share data (5) practicing on family-owned forests (9). Wisconsin had 6 observations, 3 from Minnesota, and 3 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of mechanical equipment site preparation using area and time. Fixed costs are estimated at $50 per tract plus $232 per acre, for at least 10 contiguous acres.

Mechanical Equipment	Generalized Definition
Disking	Disking, also known as trenching, generally provides mineral soil in parallel trenches to assist in hand planting the following year. This method is best completed on non-rocky sites with low amounts of downed woody debris.
Drum Chopping	Drum or roller chopping is a method in which a large drum with knives is rolled across vegetation and woody debris to expose mineral soil and destroy existing regeneration. This method is often used to set back existing regeneration before direct seeding for a disturbance-dependent species.
Mowing or Brush-Hogging	Reduces the height of species in competition with the desired species. It can be used for planting, direct seeding, or encouraging a non-shade tolerant species when high amounts of the fine woody or herbaceous plants are on site.
Mulching	Reduction of woody material through wood chipping, shredding, and mulching.
Piling or Root Raking	Also known as root raking, a method to remove coarse woody debris and rocks from a site or confine them to a select area.
Plowing	Like disking, plowing is used on old fields and sites with large amounts of sod to overturn and expose bare mineral soil.
Scalping and Trenching	Removal of the duff layer to the upper topsoil to provide a mineral soil layer. It can be hand-planted, machine planted, or left to regrow in the disturbed area. Best done on non-rocky sites with low amounts of downed woody debris and where regeneration requires a serve soil disturbance.
Subsoil Ripping	Breaking up compacted soil layers through deep infiltration and fracturing of ground elements promotes root and water penetration, nutrient cycling, air space, and soil strength. Given a site's harvesting or prior use history, it may be necessary.
Any Equipment	The type of equipment was unknown, not reported, or was not used to evaluate the rate.

Number of Passes	Generalized Definition
Single Pass	The equipment made a single pass across a tract or site.
Double Pass	The equipment made two passes across a tract or site.

HERBICIDE APPLICATION SITE PREP.

The creation or promotion of favorable growing conditions for a preferred specie's survival through chemical means to alter existing regeneration and herbaceous communities. Effectiveness depends on the application rate, timing, and pre- and post-weather conditions.

The cost of using herbicide application as a site prep method was reported by 23 individuals across the Lake States and averaged $128 per acre.

At $147, Wisconsin had the highest average cost per acre and was 49% higher than Michigan, which had the lowest average cost per acre at $99. Minnesota's average was $121 per acre.

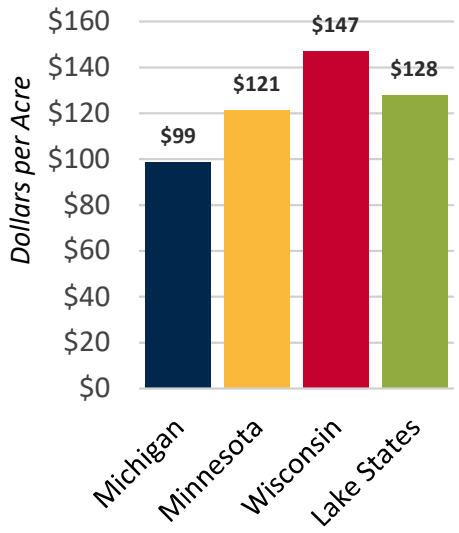
Manual herbicide application for herbaceous weed control was the most common site prep operations observed at $86 per acre and ranged $12 if practiced on 10 acres.

Average Cost and area needed of Herbicide Application Site Prep. assessed in the Lake States in 2022.

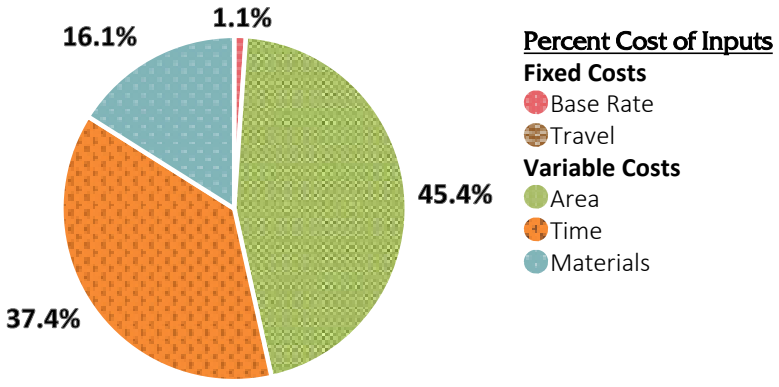
Activity Name Site Prep: Herbicide Application	Average Cost ($/acre)		Area (acres)	*Count* (n)
Method of Herbicide Application				
Aerial Application	*	*	*	*2*
Manual Application *(ex. Backpack Sprayer)*	$136	± 9	7	*13*
Mechanical Application *(ex. Tanker and Boom)*	$146	± 7	9	*12*
Purpose of Herbicide Application				
Expose Mineral Soil	*	*	*	*1*
Herbaceous Weed Control	$48	± 8	33	*10*
Invasive Species Control	*	*	*	*2*
Understory Species Control	$118	± 9	1	*9*
Site Prep Average	**$128**	**± 4**	**14**	***23***

The average site described by the largest collection of responses (30%) had a goal of timber (9), well drained upland soils (8), was clear cut (8). The most responses (30%) came from cost-share data (16) practicing on family-owned forests (20) in Wisconsin (9). Wisconsin had 9 observations, 7 from Minnesota, and 4 from Michigan. Note the requirements guiding the use of cost-share funding distorts described frequencies. (indicates not enough responses)*

Average Cost by State



Percent Cost of Inputs per Acre



Forest practitioners generally assessed the cost of herbicide application site preparation using area, time, material, and base rate. Fixed costs are estimated at $30 per tract plus $157 per acre, for at least 14 contiguous acres.

Herbicide Purpose	Generalized Definition
Herbaceous Weed Control	Alter micro-climates to be less suitable for various non-woody weeds.
Invasive Species Control	It may be used for invasive species management; however, herbicide selection and rate are highly dependent on many factors.
Understory Species Control	Management of brush, small trees, and shrubs growing under a forest canopy.
Expose Mineral Soil	Eradication of herbaceous and woody material through herbicide to prepare a seed bed.

Application Method	Generalized Definition
Aerial	Herbicide application via aerial application. More commonly used in more extensive stands or forested tracts with multiple stands receiving an application. Standard modes of application include helicopter and agricultural aircraft.
Manual (ex. Backpack Sprayer)	Herbicide application via a manual ground-based application. More commonly used in stands with a developed canopy, areas in or adjacent to sensitive ecosystems, and select and spot treatment is needed. Standard modes of application include backpack sprayers.
Mechanical (ex. Tanker and Boom)	Herbicide application via a mechanical ground-based application. More commonly used in stands with a developed canopy and small to scattered stands. Standard application modes include tanker, boom, and industrial mister and fan.

PRESCRIBED BURNING SITE PREP.

The removal and reduction of vegetation through controlled uses of fire to prepare a seed bed, improve soil nutrients, and increase soil fungal development. Often used to mimic natural or historical conditions and should be completed by or with the assistance of trained professionals.

The cost of using prescribed burning as a site prep method was reported by 10 individuals across the Lake States and averaged $169 per acre.

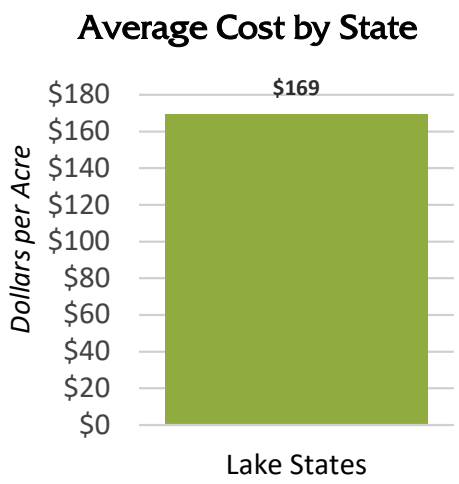
Michigan had the highest average cost per acre, followed by Wisconsin, and then Minnesota, which had the lowest average cost per acre.

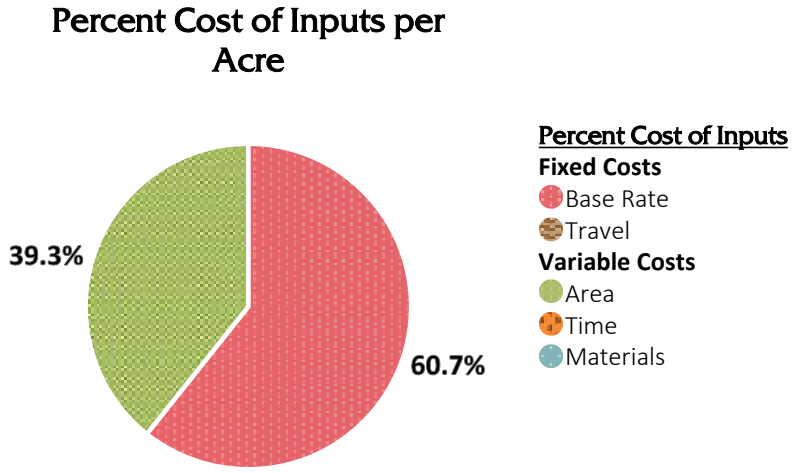
Understory species control was the most common reason for using prescribed burning.

Average Cost and area needed of Prescribed Burning as Site Prep. assessed in the Lake States in 2022.

Activity Name Site Prep: Prescribed Burning	Average Cost ($/acre)		Area (acres)	*Count* *(n)*
Purpose and Ignition of Fire				
Expose Mineral Soil	*	*	*	*2*
Herbaceous Weed Control	*	*	*	*2*
Invasive Species Control	*	*	*	*2*
Pest Control	*	*	*	*1*
Understory Species Control	*	*	*	*4*
Site Prep Average	**$169**	**± 21**	**10**	***5***

The most responses (60%) came from cost-share practices (3) for family-owned forests (5). Michigan had two observations, two four from Minnesota, and one from Wisconsin. Note the requirements guiding the use of cost-share funding distorts described frequencies. (indicates not enough responses)*





Forest practitioners generally assessed the cost of site preparation with prescribed burning using base rate and area. Fixed costs are estimated at $1,125 per tract plus $73 per acre, for at least 10 contiguous acres.

Burn Purpose	Generalized Definition
Herbaceous Weed Control	Alter micro-climates to be less suitable for various non-woody weeds.
Invasive Species Control	May be used for invasive species management however is highly dependent on many factors.
Pest Control	Alter micro-climates to be less suitable for various insects and diseases.
Understory Species Control	Management of brush, small trees, and shrubs growing under a forest canopy.
Expose Mineral Soil	The removal and reduction of vegetation through controlled uses of fire to prepare a seed bed, improve soil nutrients, and increase soil fungal development.

TREE PLANTING

The active planting of various tree species for afforestation or reforestation efforts.

The cost of planting trees was reported by 23 individuals across the Lake States and averaged $347 per acre.

Wisconsin's average was $340 per acre. Michigan's average cost per acre at $291.

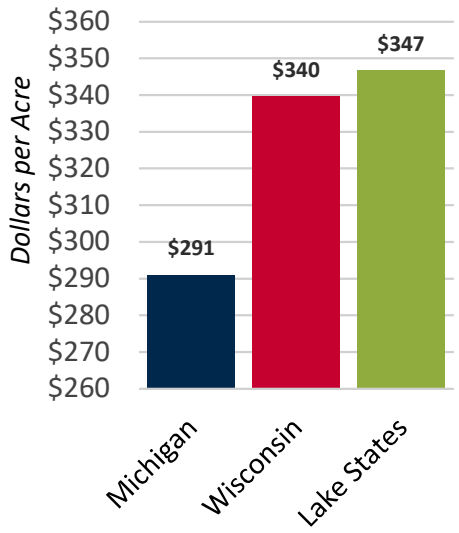
Containerized red pine seedling was the most planted species. Planted by hand, the cost was observed at $244 per acre and ranged $10 if practiced on 197 acres.

Average Cost and area needed of Tree Planting with various methods and root stock assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Regeneration Establishment	($/acre)		(acres)	*(n)*
Tree Planting				
Method of Planting	$266	± 22	40	*9*
Hand Planting	*	*	*	*3*
Machine Planting	*	*	*	*3*
Rotary Seeding	*	*	*	*3*
Planted Tree Species				
Black Walnut	*	*	*	*1*
Jack Pine	*	*	*	*1*
Oak Mixed	*	*	*	*3*
Red Pine	$339	± 32	158	*12*
Spruce Mixed	*	*	*	*3*
White Pine	*	*	*	*1*
Planting Method and Root Stock				
Hand Planting				
Bare Root Stock	*	*	*	*3*
Containerized Root Stock	$177	± 22	237	*5*
Machine Planting				
Bare Root Stock	*	*	*	*3*
Planting Average	**$347**	**± 16**	**119**	***23***

The average site described by the largest collection of responses (25%) had a goal of timber (12), moderately well drained upland soils (6), was clear cut recently (9). The most responses (51%) came from private consulting firms (21) practicing in family-owned forests (30). Wisconsin had 17 observations, 9 from Michigan, and 4 from Minnesota. (indicates not enough responses)*

Average Cost by State



Mechanical Equipment	Generalized Definition
Hand Planting	Method of planting where trees are hoed or shoveled into the ground by hand. This method is typically used on rough, rocky, steep, sandy, or inconsistent soils. The planting density is controlled mainly by species and the goals of the stand.
Machine Planting	Method of planting where the soil is mechanically separated, a seedling is placed, and soil is compacted around the seedling. Good on sites with heavy soils, flat ground, or seedlings/saplings with extensive root systems. The planting density is controlled mainly by species and the goals of the stand.
Rotary Seeding	Method of seed dispersal where large amounts of seeds spread across a site. This method often leads to inconsistent regeneration densities similar to natural dissemination events. Seed treatments are encouraged to reduce the consumption of seeds.
Aerial Seeding	Method of seed dispersal where large amounts of seeds spread across a site via aerial means. Often leading to inconsistent regeneration densities across a site and best suited for sites not capable of hand planting. Seed treatments are encouraged to reduce the consumption of seeds.

Root Stock	Generalized Definition
Bare Root Stock	Seedlings that have been lifted and removed from the soil.
Containerized Root Stock	Seedlings were grown in tubes (receptacles) individually and kept in soil. Often referred to as plugs.

Planted Species	Scientific Name	Planted Species	Scientific Name
Red Pine	*Pinus resinosa*	**Black Walnut**	*Juglans nigra*
Jack Pine	*Pinus banksiana*	**Oak Mixed**	*Quercus* species
White Pine	*Pinus strobus*	**Hickory Mixed**	*Carya* species
Spruce Mixed	*Picea* species	**Aspen or Birch**	*Populus* or *Betula*
Fir Mixed	*Abies* species	**Mixed Hardwood**	listed species
Tamarack	*Larix laricina*	**Other**	listed species

Forest Management Activity Cost Guide Lake States

Woodlot Economic Project

Keywords: Timber Stand Improvement, Wildlife Exclusion, Pre-commercial Thinning, Pruning, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Timber Stand Improvement							
Wildlife Exclusion Partitioning							
Average Cost	3,984	49	125	26			8
Standard Error	*2,431*	*23*	*63*	*9*			*0*
Pre-Commercial Thinning (PCT)							
Average Cost	515	60	71				100
Standard Error	*337*	*33*	*10*				*0*
Forestland Pruning							
Average Cost	*	*	*				
Standard Error	*	*	*				

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	*Acres*	*($/Ac)*		*n*
Timber Stand Improvement	**553.39**	**13.3**	**26**	**663**	***63***
Wildlife Exclusion Partitioning					
Average Cost	1,886.69	6.3	128	2,449	*21*
Standard Error	*322.66*	*0.9*	*22*	*362*	
Pre-Commercial Thinning (PCT)					
Average Cost	295.82	14.7	7	325	*47*
Standard Error	*16.33*	*1.0*	*1*	*18*	
Forestland Pruning					
Average Cost	*	*	*	*	*4*
Standard Error	*	*	*	*	

WILDLIFE EXCLUSION PARTITIONING

Deterrents and protective devices help to reduce herbivory and competition, increase the likelihood of quality survival, and may assist in locating seedlings later. Different desired species may need multiple deterrents or none depending on long-term goals and other considerations.

The cost of excluding wildlife was reported by 21 individuals across the Lake States and averaged $1,887 per acre.

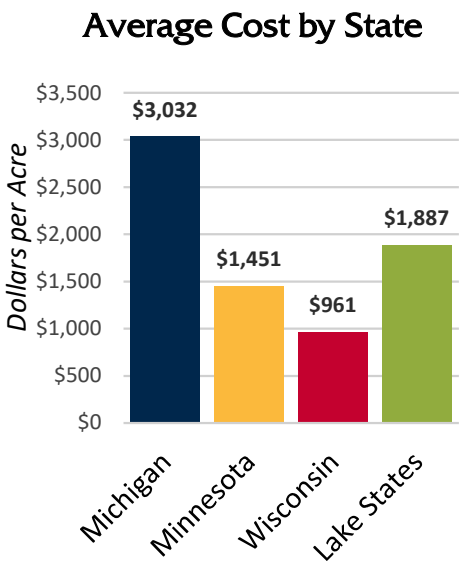
At $3,032, Michigan had the highest average cost per acre and was 216 % higher than Wisconsin, which had the lowest average cost per acre at $961. Minnesota's average was $3,032 per acre.

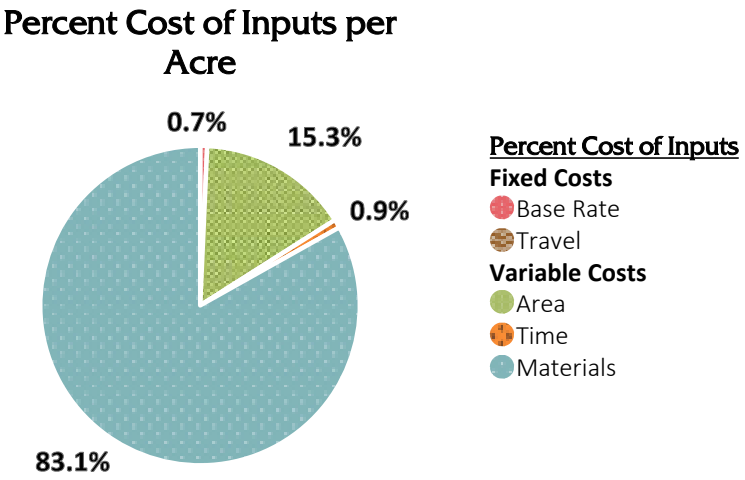
Temporary fencing was the most common wildlife excluding practice and was observed to cost $1,653 per acre and ranged $653 if practiced on 7 acres.

Average Cost and area needed of Wildlife Exclusion Partitioning assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Wildlife Exclusion Partitioning	($/acre)		(acres)	*(n)*
Exclusion Device				
Bud Capping	*	*	*	*4*
Electric Fencing	*	*	*	*1*
Other Wildlife Exclusion	*	*	*	*4*
Permanent Fencing	*	*	*	*2*
Repellent Spray	*	*	*	*3*
Temporary Fencing	$1,653	± 653	7	*11*
Tree Tubes	$1,059	± 393	7	*7*
Weed Mating	$915	± 397	6	*8*
Exclusion Average	**$1,887**	**± 323**	**6**	***21***

The most responses (43%) came from cost-share funding (9) for family-owned forests (18). Minnesota had 7 observations, 6 from Wisconsin, and 5 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of wildlife exclusion partitioning using materials, area, time, and base rate. Fixed costs are estimated at $128 per tract plus $2,449 per acre, for at least 6 contiguous acres.

Exclusion Device	Generalized Definition
Repellent Spray	Select aromas and flavors can be sprayed onto foliage and buds to discourage herbivory. Sprays are often used following planting to allow seedlings to elongate root tips and fine root hairs. However, sprays are effective for a short time, depending on weather events.
Weed Mating	Various matting options exist, such as mulches and landscape vegetation matting. Although matting reduces the competing vegetation, it may attract rodents or cause fungal concerns if not employed correctly. Mats are labor intensive and generally have high costs.
Bud Capping	Protect the apical meristem and terminal bud to encourage straight seedlings. Caps vary in complexity, expense, and duration. Often attached in the fall to protect buds from herbivory over winter months and are removed, breakdown, or outgrown during the spring of the year. While materials range in cost, they are often time intensive to deploy.
Tree Tubes	Protect the above-ground portion of individual seedlings from herbivory, rubbing, and potentially herbicide drift. Significantly reduce the direct light and can create a greenhouse around the seedling but does not reduce competing vegetation. They are commonly used in high-quality hardwood and areas with high deer browse. Setup and annual upkeep are often not finically justified over time.
Temporary Fencing	Protect the above-ground portion of individual seedlings from herbivory and rubbing, but do not reduce competing vegetation. They are commonly used in high-quality hardwood and areas with high deer browse. Setup and annual upkeep are often not finically justified over time.
Electric Fencing	Protect the above-ground portion of seedlings from herbivory and rubbing, but do not reduce competing vegetation within a designated area. They are commonly used in high-quality hardwood plantations and areas with high deer browse. Therefore, setup and annual upkeep are often not finically justified over time.
Permanent Fencing	Protect the above-ground portion of seedlings from herbivory and rubbing, but do not reduce competing vegetation within a designated area. They are commonly used in high-quality hardwood plantations and areas with high deer browse. Therefore, setup and annual upkeep are often not finically justified over time.

PRE-COMMERCIAL THINNING

The thinning of natural and planted stems before seedlings or samplings reach an economically merchantable size to encourage or for crop tree selection. Costs should be compared with anticipated growth, yield, and future product potential.

The cost of pre-commercial thinning (PCT) was reported by 47 individuals across the Lake States and averaged $296 per acre.

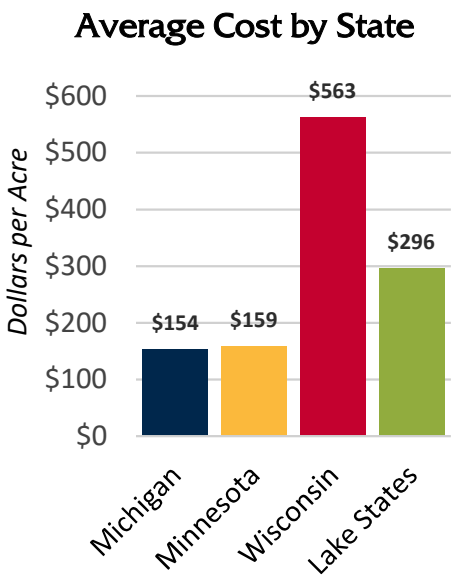
At $563, Wisconsin had the highest average cost per acre and was 266% higher than Michigan at $154 per acre. Minnesota's average was at 154% per acre.

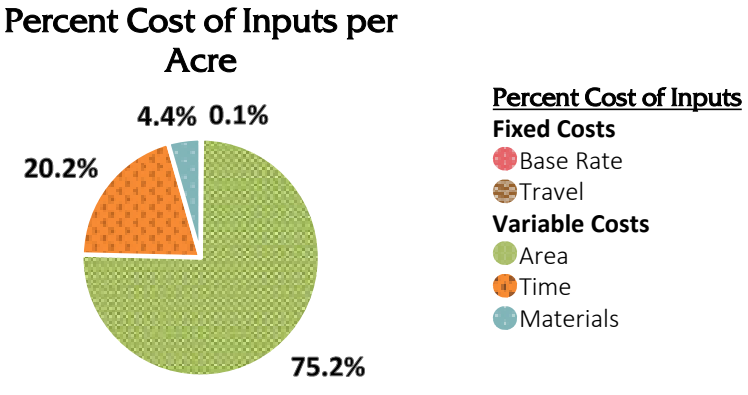
Improving the quality of residual saplings with the use of a chainsaw was the most common PCT practiced and was observed to cost $428 per acre and ranged $137 if practiced on 27 acres.

Average Cost and area needed of Pre-Commercial Thinning assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Pre-Commercial Thinning (PCT)	($/acre)		(acres)	*(n)*
Goal of PCT				
Control Understory Species	$326	± 40	4	*17*
Improve Quality of Residual Trees	$228	± 47	17	*18*
Improve Wildlife Habitat	$304	± 80	17	*10*
Other Goal	$265	± 43	2	*16*
Pests Management	$146	± 20	5	*5*
Reduce Fire Risk	$128	± 14	19	*8*
Reduce Quantity of Residual Stems	$131	± 14	4	*15*
Size of Removed Stems				
Saplings	$428	± 137	27	*6*
Small Saplings	*	*	*	*4*
Type of Equipment Used				
Brush Saw	$409	± 118	24	*6*
Chainsaw	$336	± 101	20	*8*
Hack and Squirt	*	*	*	*3*
Mulcher	$442	± 136	25	*5*
PCT Average	**$296**	**± 16**	**15**	***47***

The most responses (32%) came from cost-share funding (37) for family-owned forests (45). Wisconsin had 17 observations, 16 from Minnesota, and 12 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of pre-commercial thinning using area, time, materials, and distance traveled. Fixed costs are estimated at $7 per tract plus $325 per acre, for at least 15 contiguous acres.

PCT Purpose	Generalized Definition
Improve Quality of Residual Trees	Elimination or suppression of less valuable trees to favor more valuable or desired species.
Reduce Quantity of Residual Stems	Reduce the number of trees in young stands. It prevents stagnation and improves growing conditions for the remaining crop trees.
Improve Wildlife Habitat	Increase overall species diversity by maintaining or enhancing structural habitat diversity.
Control Understory Species	Management of brush, small trees, and shrubs growing under a forest canopy.
Reduce Fire Risk	Increasing the height of canopy reduces the risk of a canopy fire or the installation of fuel breaks to mitigate risks of fire spreading.
Pests Management	Increasing the height of the canopy promotes air flow and alters micro-climates that may be suitable for various insects and diseases.

Size of Removed Stems	Generalized Definition
Small Saplings	Between 1 to 3 inches in diameter. Seedling to sapling-sized trees can often be controlled using herbicide, hack and squirt, brush saw, or fecon mulcher. Commonly done to improve quality, reduce the quantity, control understory woody species, reduce risks from foliar fungi, and pest control.
Saplings	Between 3 to 9 inches in diameter. Sapling to pole-sized trees can often be controlled using hack and squirt, brush saw, chainsaw, or fecon mulchers. Commonly done to improve quality, reduce the quantity, control understory woody species, reduce the risk of canopy fire, reduce risks from foliar fungi, and control pests.

Equipment Type	Generalized Definition
Hack and Squirt	Also known as "cut-n-treat," this method involves removing bark and applying a basal bark herbicide.
Brush Saw	Hand or motorized brush saw, clearing saw, or brush cutter for brush, branches, and small trees.
Chainsaw	Portable motorized saw that cuts with teeth attached to a rotating chain for limbing and tree felling.
Mulcher	Reducing the size of woody material through wood chipping, shredding, and mulching.

FOREST MANAGEMENT ACTIVITY COST GUIDE LAKE STATES

WOODLOT ECONOMIC PROJECT

Fire and Prescribed Burning

Keywords: Prescribed Burn, Fire Prevention, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Fire & Prescribed Burning							
Prescribed Burn Services							
Average Cost	666		465				
Standard Error	*451*		*111*				
Fire Prevention & Maintenance							
Average Cost		1	28	42			
Standard Error		*0*	*8*	*5*			

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	*Acres*	*($/Ac)*		*n*
Fire & Prescribed Burning	**313.90**	**6.5**	**1132**	**299**	***33***
Prescribed Burn Services					
Average Cost	395.68	6.0	1529	401	*20*
Standard Error	*20.27*	*0.3*	*83*	*23*	
Fire Prevention & Maintenance					
Average Cost	103.79	8.1	23	15	*13*
Standard Error	*10.59*	*0.2*	*5*	*1*	

PRESCRIBED BURN SERVICES

The active use of fire as a management tool is commonly used for developing wildlife habitat, preparing seed beds, and improving soil nutrients. To find professional assistance, visit your states Prescribed Fire Council or Department of Natural Resources webpage.

The cost of prescribed burning was reported by 47 individuals across the Lake States and averaged $296 per acre.

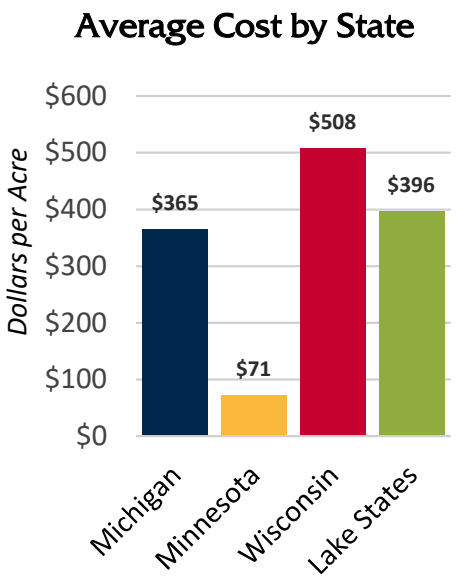
At $508, Wisconsin had the highest average cost per acre and was 613% higher than Minnesota, which had the lowest average cost per acre at $71. Michigan's average was $71 per acre.

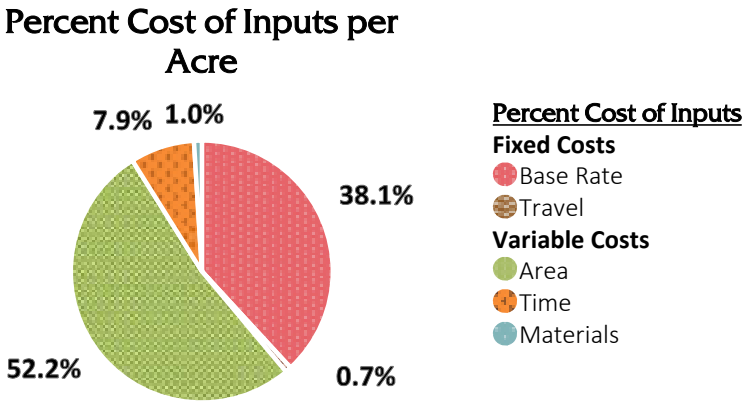
Ecological restoration was one of the most common goals of prescribed burning and was observed to cost $303 per acre and ranged $64 if practiced on 6 acres.

Average Cost and area needed Prescribed Burn Services of assessed in the Lake States in 2022.

Activity Name Prescribed Burn Services	Average Cost ($/acre)		Area (acres)	*Count (n)*
Goal of Prescribed Burning				
Any	*	*	*	*4*
Control Invasive Plants	*	*	*	*2*
Ecological Restoration	$303	± 64	6	*5*
Maintain Fire Regime	$351	± 58	6	*5*
Prepare a Silvicultural Site	*	*	*	*3*
Promote Native Grasses	*	*	*	*3*
Removal of Hazardous Fuels	*	*	*	*2*
Remove Tree and Brush Encroachment	$257	± 70	6	*5*
Restore Wildlife and Bird Habitat	$233	± 62	6	*6*
Burning Average	**$396**	**± 20**	**6**	***20***

Most responses (90%) came from cost-share funds (18) available to family-forest owners (20). Minnesota had 7 responses, 7 from Wisconsin, and 6 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of prescribed burning using area, base rate, time, materials, and distance traveled. Fixed costs are estimated at $1,529 per tract plus $401 per acre, for at least 6 contiguous acres.

Goal	Generalized Definition
Remove Tree and Brush Encroachment	Reduce the number of woody stems.
Removal of Hazardous Fuels	Reduce the presents of ladder fuels or changing spatial arrangement of fuels.
Prepare a Silvicultural Site	The removal and reduction of vegetation through controlled uses of fire to prepare a seed bed, improve soil nutrients, and increase soil fungal development.
Invasive Management	May be used for invasive species management however is highly dependent on many factors.
Promote Native Grasses	Encourage a flush of native grasses.
Perform Ecological Restoration	Mimic natural or historical conditions to reach a desired ecosystem.
Restore Wildlife and Bird Habitat	Mimic natural or historical conditions for specific species of interest.
Maintain Fire Regime	Maintain a regular frequency of fire on a site to maintain a certain ecosystem.

FIRE PREVENTION & MAINTENANCE

Establishing and maintaining fire breaks, fuel breaks, and other fire prevention methods. Such activities help reduce the risk of large fires on the landscape.

The cost of prescribed burning was reported by 13 individuals across the Lake States and averaged $104 per acre.

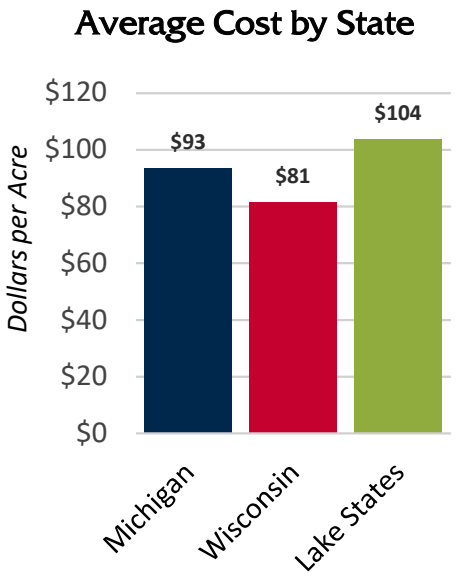
Michigan's average was $93 per acre. Wisconsin's average cost per acre at $81.

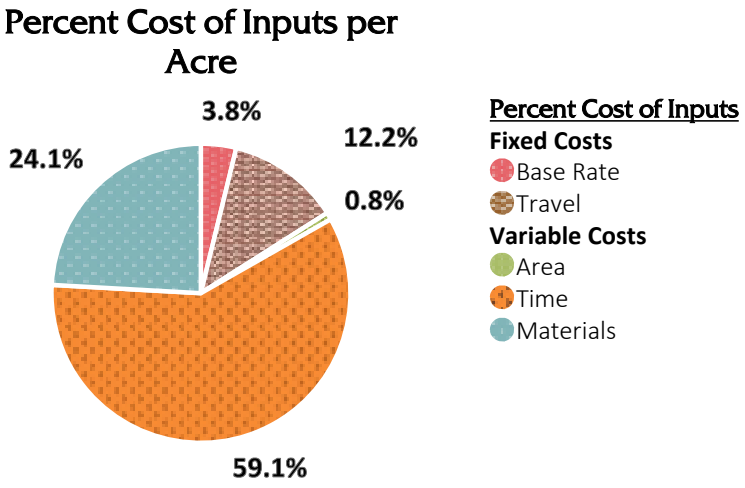
Installing fire prevention methods was the most common goal of fire prevention and was observed to cost $101 per acre and ranged $15 if practiced on 8 acres.

Average Cost and area needed Fire Prevention & Maintenance of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Fire Prevention & Maintenance	($/acre)		(acres)	*(n)*
Goal of Fire Maintenance				
Install Fire Prevention Methods	$101	± 15	8	*5*
Other Prevention Goal	*	*	*	*2*
Removal of Thatch & Hazardous Fuel	$172	± 22	10	*5*
Remove Tree and Brush Encroachment	*	*	*	*4*
Prevention Average	$104	± 11	8	*13*

Most responses (78%) came from cost-share funds (10) available to family-forest owners (12). Wisconsin had 5 responses, 4 from Michigan, and 3 from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of fire prevention and maintenance using time, materials, distance traveled, base rate, and area. Fixed costs are estimated at $23 per tract plus $15 per acre, for at least 8 contiguous acres.

Goal	Generalized Definition
Install Fire Prevention Methods	Construction of fuel breaks or other fire-retardant services.
Remove Tree and Brush Encroachment	Reduce the number of woody stems.
Removal of Thatch & Hazardous Fuel	Reduce the presents of ladder fuels or changing spatial arrangement of fuels.
Other Prevention Goal	Other fire-retardant services.

Primary Fuel Type	Generalized Definition
Grass	Fine non-woody fuels primarily grasses.
Brush	Fine to semi-course woody fuels primarily brush.
Timber	Large course woody fuels primarily timber and round wood.

Forest Management Activity Cost Guide Lake States

Woodlot Economic Project

Forest Health and Protection

Keywords: Forest Health, Insect and Disease Mitigation, Invasive Species Removal, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Forest Health & Protection							
Insect and Disease Mitigation							
Average Cost	225	48		89			
Standard Error	*56*	*21*		*1*			
Invasive Species Removal							
Average Cost	533	222	127				
Standard Error	*202*	*74*	*50*				

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	Observations
	($/Ac)	*Acres*	*($/Ac)*		*n*
Forest Health & Protection	**246.88**	**3.8**	**72**	**303**	***46***
Insect and Disease Mitigation					
Average Cost	296.40	5.4	44	114	*12*
Standard Error	*45.14*	*1.0*	*7*	*17*	
Invasive Species Removal					
Average Cost	239.40	3.4	80	357	*41*
Standard Error	*18.15*	*0.2*	*10*	*23*	

INSECT & DISEASE MITIGATION

Preventive and reactive measures of non-native and exotic plants, pathogens, and animals that harm the native ecosystem.

The cost of Insect & Disease Mitigation was reported by 12 individuals across the Lake States and averaged $296 per acre.

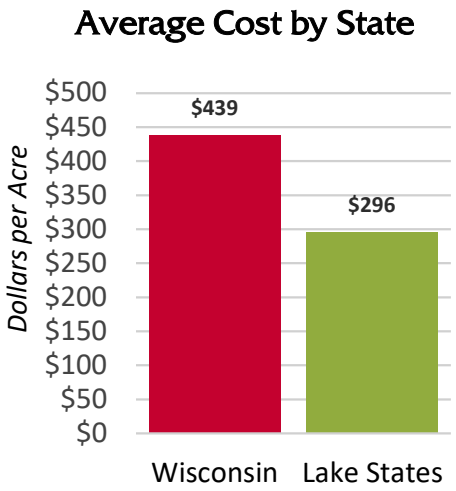
At $439, Wisconsin had the highest average cost per acre, followed by Minnesota and then Michigan

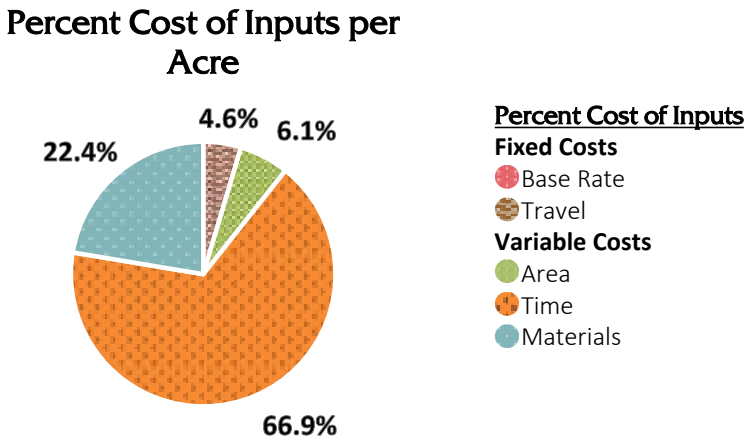
Performing a salvage harvest was the most common method of mitigating forestland insect and diseases and was observed to cost $421 per acre and ranged $92 if practiced on 12 acres.

Average Cost and area needed Insect & Disease Mitigation of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Insect and Disease Mitigation	($/acre)		(acres)	*(n)*
Mitigation Methods				
Chemical Stump Application	$170	± 60	2	*6*
Insecticide & Fungicides	$230	± 57	2	*6*
Salvage Harvest	$421	± 92	12	*8*
Stump Extraction	*	*	*	*2*
Tree Felling	$169	± 51	2	*7*
Vibratory Plow Line	*	*	*	*3*
Mitigation Average	**$296**	**± 45**	**5**	***12***

The most responses (25%) came from private consulting firms (4) for family-owned forests (10). Wisconsin had six observations, four from Michigan, and two from Minnesota. (indicates not enough responses)*





Forest practitioners generally assessed the cost of insect and disease mitigation using time, materials, area, and distance traveled. Fixed costs are estimated at $44 per tract plus $114 per acre, for at least 5.4 contiguous acres.

Goal	Generalized Definition
Insect and Disease Mitigation	General alterations to micro-climates to make less suitable habitat for various insect and diseases.
Insecticide & Fungicides	Application of pesticides such as insecticide or fungicides, to reduce the presents, growth, or health of an undesired species.
Vibratory Plow Line	Disruption of subsurface root grafts through vibratory plow.
Tree Felling	Removal of susceptible trees done to prevent the spread of pests and pathogens.
Salvage Harvest	Removal of dead, damaged, or susceptible trees done to prevent the spread of pests and pathogens and may be used in forest products.
Chemical Stump Application	Application of fungicides to fresh cut stumps or basal bark, to reduce the presents, growth, or health of an undesired species.
Stump Extraction	Removal of tree stumps through various mechanical methods.

INVASIVE SPECIES REMOVAL

A species is considered invasive once it begins to cause harm to the economy, ecosystem, or human health. These species are characterized by the ability to tolerate various environmental conditions and aggressively outcompete native species. These plants and animals can be challenging to eradicate entirely from an area and can be costly to manage.

The cost of Invasive Species Removal was reported by 41 individuals across the Lake States and averaged $239 per acre.

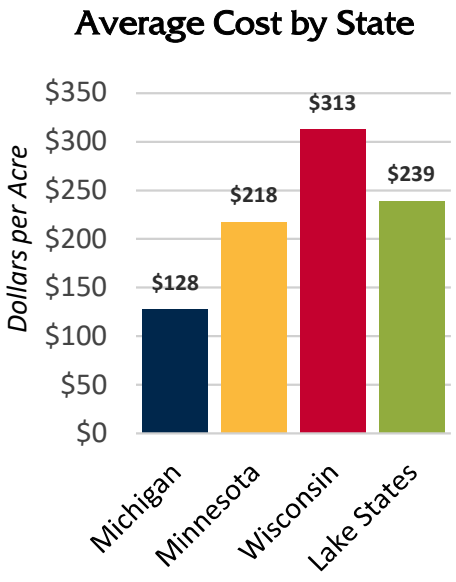
At $313, Wisconsin had the highest average cost per acre and was 145 % higher than Michigan, which had the lowest average cost per acre at $128. Minnesota's average was $218 per acre.

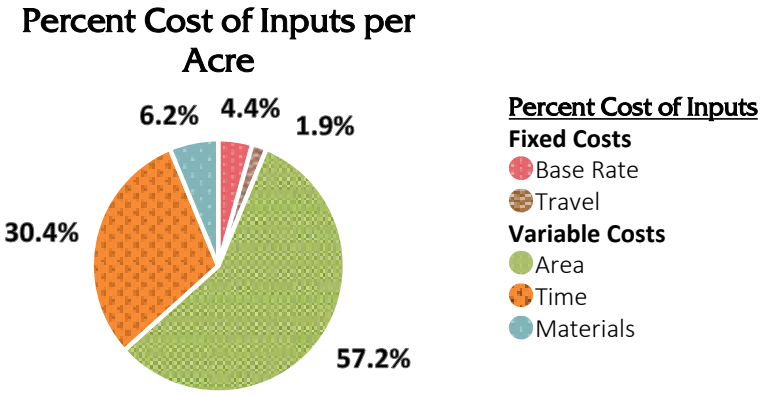
Removing by hand or mechanical was one of the most common methods of invasive species control and was observed to cost $244 per acre and ranged $16 if practiced on 4 acres.

Average Cost and area needed Invasive Species Removal of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Invasive Species Removal	($/acre)		(acres)	*(n)*
Method of Removal				
Animal Control	*	*	*	*1*
Chemical Control	$190	± 25	3	*24*
Fire Control	$186	± 46	2	*9*
Hand & Mechanical Control	$244	± 16	4	*24*
Removal Average	**$239**	**± 18**	**3**	***41***

Most responses (65%) came from cost-share funds (27) available to family-forest owners (37). Wisconsin had 21 observations, 10 from Minnesota, and 6 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of invasive species removal using area, time, materials, area, base rate, and distance traveled. Fixed costs are estimated at $80 per tract plus $357 per acre, for at least 3.4 contiguous acres.

Goal	Generalized Definition
Fire Control	Controlled burning and wildfire management activities to reduce the abundance of a species.
Chemical Control	Application of pesticides such as insecticide or fungicides, to reduce the presents, growth, or health of an undesired species.
Hand & Mechanical Control	Human and mechanical alterations to structure to reduce abundance.
Animal Control	Use of animals to alter to the abundance of undesired species.

Forest Management Activity Cost Guide Lake States

Woodlot Economic Project

Wildlife Habitat Enhancements

Keywords: Land Clearing, Wildlife Forage, Pollinator Seeding, Habitat Enhancement, Cost Analysis, Small-Scale Forestry, Lake States

Project Leaders: Jeremy K. Natzke, *Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point (UWSP);* Paul Doruska, *Professor of Forest Measurements, UWSP;* Melinda Vokoun, *Associate Professor of Forest Economics and Finance, UWSP;* Shuva Gautam*, Professor of Forest Operations and Wood Supply, Laval University;* and Anna Haines*, Professor of Conservation and Community Planning and Extension Specialist, UWSP*.

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Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
	(dollars per acre)						
Wildlife Habitat Enhancements							
Land Clearing Services							
Average Cost	289		52				
Standard Error	*99*		*0*				
Wildlife Forage and Pollinator Seeding							
Average Cost	173	1228	1,788				
Standard Error	*123*	*492*	*1,172*				
Game Species Habitat Structural Enhancement							
Average Cost	88	85	78	31			
Standard Error	*37*	*36*	*51*	*15*			

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre	Relevant Area Needs	Fixed Costs	Variable Costs	*Observations*
	($/Ac)	*Acres*	*($/Ac)*		*n*
Wildlife Habitat Enhancements	**432.65**	**5.4**	**51**	**458**	***122***
Land Clearing Services					
Average Cost	242.37	1.4	35	288	*23*
Standard Error	*29.94*	*0.2*	*3*	*24*	
Wildlife Forage and Pollinator Seeding					
Average Cost	531.51	4.0	18	665	*63*
Standard Error	*26.02*	*0.1*	*1*	*37*	
Game Species Habitat Structural Enhancement					
Average Cost	103.02	10.2	128	56	*26*
Standard Error	*13.20*	*0.7*	*23*	*5*	

LAND CLEARING SERVICES

Clearing land can be done for a variety of purposes, however, here land clearing is for silvicultural, wildlife, or road establishment and management, not development.

The cost of land clearing services was reported by 23 individuals across the Lake States and averaged $242 per acre.

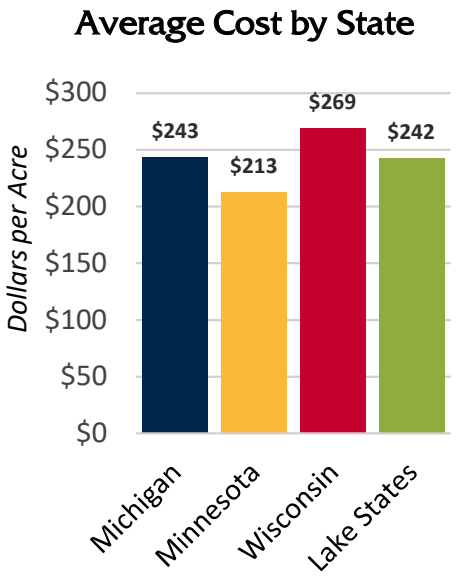
At $269, Wisconsin had the highest average cost per acre and was 26% higher than Minnesota, which had the lowest average cost per acre at $213. Michigan's average was $243 per acre.

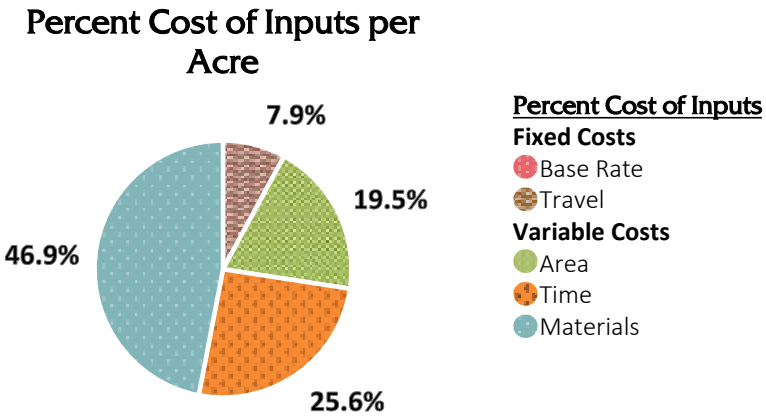
Maintaining forestland opening was the most common land clearing service provided and was observed to cost $374 per acre and ranged $45 if practiced on 1 acre.

Average Cost and area needed Land Clearing Services of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Land Clearing Services	($/acre)		(acres)	*(n)*
Service Provided				
Construction	$205	± 54	2	*7*
Maintenance	$374	± 45	1	*14*
Other	$24	± 4		*7*
Clearing Average	**$242**	**± 30**	**1**	***23***

Most responses (70%) came from cost-share funds (16) available to family-forest owners (22). Minnesota had 8 observations, 8 from Wisconsin, and 6 from Michigan. (indicates not enough responses)*





Forest practitioners generally assessed the cost of land clearing using materials, time, area, and base rate. Fixed costs are estimated at $35 per tract plus $288 per acre, for at least 1.4 contiguous acres.

Goal	Generalized Definition
Construction	Creation of clearing and openings of forested area for forestry and wildlife related purposes.
Maintenance	Maintenance of clearings and openings or alterations to the structure of forested area for forestry and wildlife related purposes.

WILDLIFE FORAGE AND POLLINATOR SEEDING

Planting forage and cover crops can improve biotic diversity in forestland and prairie settings.

The cost of wildlife forage and pollinator seeding was reported by 63 individuals across the Lake States and averaged $532 per acre.

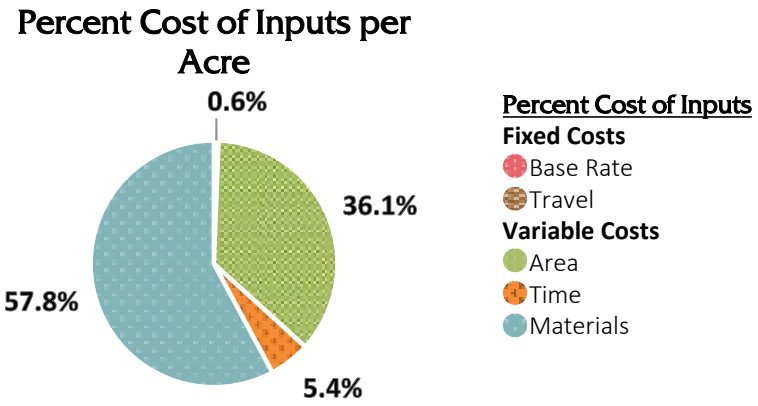
At $269, Wisconsin had the highest average cost per acre and was 26% higher than Minnesota, which had the lowest average cost per acre at $213. Michigan's average was $243 per acre.

Planting miscellaneous species was the most common type of planting and was observed to cost $374 per acre and ranged $47.

Average Cost and area needed Wildlife Forage and Pollinator Seeding of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Wildlife Forage and Pollinator Seeding	($/acre)		(acres)	*(n)*
Type of Plant				
Cool Season Grasses	*	*	*	*3*
Forbs	$431	± 70	4	*11*
Hard Mast Species	$504	± 20		*6*
Legumes	*	*	*	*4*
Miscellaneous Species	$374	± 47		*23*
Pollinator Habitat	$556	± 48	4	*19*
Shrubs	$685	± 64	4	*20*
Soft Mast Species	$350	± 67	2	*9*
Warm Season Grasses	$625	± 166	5	*5*
Planting Average	**$532**	**± 26**	**4**	***63***

Most responses (89%) came from cost-share funds (56) available to family-forest owners (61). Wisconsin had 22 observations, 21 from Minnesota, and 16 from Michigan. (indicates not enough responses)*



Forest practitioners generally assessed the cost of wildlife forage and pollinator seeding materials, area, time, and distance traveled. Fixed costs are estimated at $18 per tract plus $665 per acre, for at least 4 contiguous acres.

Goal	Generalized Definition
Warm Season Grasses	C4 grasses that thrive and photosynthesis in warmer environments and green up in the late spring. Examples include Bermuda, St. Augustine, zoysiagrass and buffalo grass.
Cool Season Grasses	C3 grasses that thrive and photosynthesis in cooler environments and green up early in the spring. Examples include bluegrass, ryegrass, fescue and bentgrass.
Legumes	Plants that produce beans, peas, and nut that enhance soil through nitrogen fixation.
Forbs	Forbs and herbs include perennial, flowering, herbaceous, broadleaf plants that are not grass-like.
Pollinator Habitat	A variety of flowering plants that prefer or require the use of pollinators for propagation.
Shrubs	Relatively small and short woody plant.
Soft Mast Species	Plants producing fruits, berries, catkins, or other fleshy and edible structure.
Hard Mast Species	Plants producing nuts, nutlets, cones, or other rigid and edible structure.
Miscellaneous Species	Any type of planted species.

GAME SPECIES' HABITAT STRUCTURAL ENHANCEMENTS

Improving and altering habitat structures with human made resources.

The cost of habitat structural enhancements was reported by 26 individuals across the Lake States and averaged $103 per acre.

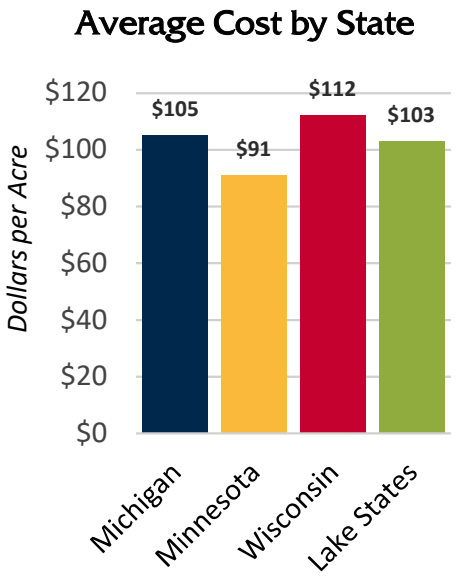
At $112, Wisconsin had the highest average cost per acre and was 23% higher than Minnesota, which had the lowest average cost per acre at $91. Michigan's average was $105 per acre.

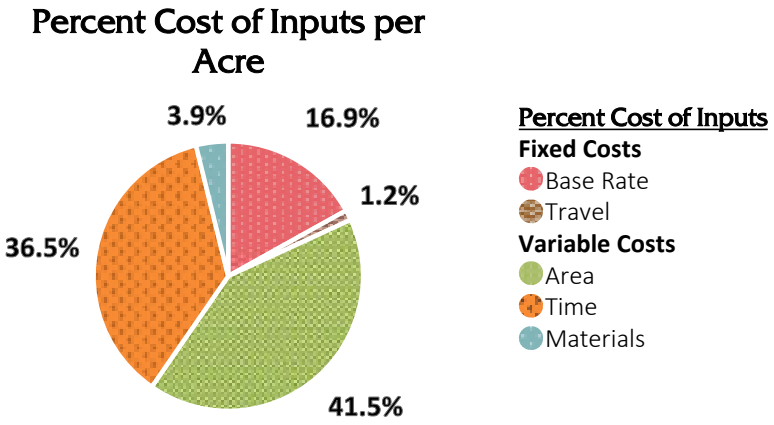
Other habitat enhancement actives were the most common service provided and was observed to cost $158 per acre and ranged $26 if practiced on 15 acres.

Average Cost and area needed Game Species' Habitat Structural Enhancements of assessed in the Lake States in 2022.

Activity Name	Average Cost		Area	*Count*
Habitat Structural Enhancements	($/acre)		(acres)	*(n)*
Structural Enhancement				
Cavity and Snags Retention	$50	± 6	13	*12*
Nesting Boxes	*	*	*	*3*
Other Habitat Enhancement	$158	± 26	10	*15*
Roost Poles and Platforms	*	*	*	*1*
Structure Average	**$103**	**± 13**	**10**	***26***

Most responses (58%) came from cost-share funds (15) available to family-forest owners (23). Michigan had 10 observations, 7 from Minnesota, and 6 from Wisconsin. (indicates not enough responses)*





Forest practitioners generally assessed the cost of habitat structural enhancement using area, time, base rate, materials, and distance traveled. Fixed costs are estimated at $128 per tract plus $56 per acre, for at least 10 contiguous acres.

Goal	Generalized Definition
Cavity and Snags Retention	Maintaining standing trees during a timber harvest that have cavities, holes, sluffing bark, etm. to provide standing habitat diversity and structure.
Nesting Boxes	Installation of artificial nesting structures to improve wildlife habitat.
Roost Poles and Platforms	Installation of artificial poles and platforms structures for roosting or nesting.
Bat Boxes	Installation of artificial roosting structures for bats.
Other Habitat Enhancement	Non-denoted habitat enhancements.

Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
			(dollars per acre)				
Forest Management Planning							
Forest Management Plan							
Average Cost	149	113	89	49	20	43	14
Standard Error	*243*	*64*	*8*	*10*	*8*	*8*	*5*
Forest Inventory							
Average Cost	29	18	34	20		26	5
Standard Error	*8*	*9*	*5*	*4*		*6*	*0*
Geographic Information Systems and Cartography							
Average Cost			25	12		4	1
Standard Error			*0*	*4*		*2*	*0*
Timber Sale Administration							
Geographic Information Systems and Cartography							
Average Cost			17	23		5	
Standard Error			*5*	*4*		*3*	
Timber Marking							
Average Cost	204	92	80	70		60	
Standard Error	*76*	*25*	*12*	*21*		*23*	
Timber Sale Setup, and Administration							
Average Cost	153	73	83	53		83	
Standard Error	*104*	*14*	*24*	*12*		*21*	
Regeneration Establishment							
Site Prep: Mechanical Equipment							
Average Cost	501		45	89			
Standard Error	*164*		*26*	*41*			
Site Prep: Herbicide Application							
Average Cost	207	191	173	133		59	
Standard Error	*39*	*80*	*12*	*98*		*9*	
Site Prep: Prescribed Burning							
Average Cost			185				
Standard Error			*161*				
Tree Planting							
Average Cost	447	405	349	103		75	206
Standard Error	*144*	*138*	*170*	*39*		*4*	*78*

Average cost to practices by ranges of minimum area needed reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Range of Acres						
	1-4	5-9	10-19	20-29	30-39	40-79	80+
			(dollars per acre)				
Timber Stand Improvement							
Wildlife Exclusion Partitioning							
Average Cost	3,984	49	125	26			8
Standard Error	*2,431*	*23*	*63*	*9*			*0*
Pre-Commercial Thinning (PCT)							
Average Cost	515	60	71				100
Standard Error	*337*	*33*	*10*				*0*
Forestland Pruning							
Average Cost	*	*	*				
Standard Error	*	*	*				
Fire & Prescribed Burning							
Prescribed Burn Services							
Average Cost	666		465				
Standard Error	*451*		*111*				
Fire Prevention & Maintenance							
Average Cost		1	28	42			
Standard Error		*0*	*8*	*5*			
Forest Health & Protection							
Insect and Disease Mitigation							
Average Cost	225	48		89			
Standard Error	*56*	*21*		*1*			
Invasive Species Removal							
Average Cost	533	222	127				
Standard Error	*202*	*74*	*50*				
Wildlife Habitat Enhancements							
Land Clearing Services							
Average Cost	289		52				
Standard Error	*99*		*0*				
Wildlife Forage and Pollinator Seeding							
Average Cost	173	1,228	1,788				
Standard Error	*123*	*492*	*1,172*				
Game Species Habitat Structural Enhancement							
Average Cost	88	85	78	31			
Standard Error	*37*	*36*	*51*	*15*			

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre ($/Ac)	Relevant Area Needs (Acres)	Fixed ($/Ac)	Variable ($/Ac)	Observations (n)
Forest Management Planning	**36.54**	**60.2**	**196**	**27**	***70***
Forest Management Plan					
Average Cost	57.23	140.7	389	44	*61*
Standard Error	*8.60*	*45.2*	*28*	*9*	
Forest Inventory					
Average Cost	25.12	20.4	110	19	*44*
Standard Error	*0.90*	*0.9*	*12*	*1*	
Geographic Information Systems and Cartography					
Average Cost	10.53	29.0	121	4	*10*
Standard Error	*0.90*	*1.8*	*7*	*0*	
Timber Sale Administration	**68.06**	**18.9**	**165**	**57**	***53***
Geographic Information Systems and Cartography					
Average Cost	16.33	23.3	161	7	*10*
Standard Error	*1.08*	*1.2*	*11*	*1*	
Timber Marking					
Average Cost	79.49	16.3	93	75	*51*
Standard Error	*4.19*	*0.7*	*13*	*4*	
Timber Sale Setup, and Administration					
Average Cost	70.60	19.3	194	57	*41*
Standard Error	*2.60*	*0.6*	*15*	*2*	
Regeneration Establishment	**246.26**	**39.8**	**182**	**228**	***67***
Site Prep: Mechanical Equipment					
Average Cost	218.56	9.6	50	232	*11*
Standard Error	*15.22*	*0.5*	*19*	*17*	
Site Prep: Herbicide Application					
Average Cost	127.89	14.0	30	157	*23*
Standard Error	*4.13*	*0.9*	*6*	*9*	
Site Prep: Prescribed Burning					
Average Cost	169.22	10.0	1,125	73	*5*
Standard Error	*20.93*	*0.0*	*140*	*9*	
Tree Planting					
Average Cost	346.66	118.5		244	*23*
Standard Error	*16.07*	*17.5*		*10*	

Average cost to practices, minimum area needed, and cost inputs reported in the Lake States Forest Management Activity Cost Guide in the spring of 2022.

	Overall Average		Average Costs		
	Cost Per Acre ($/Ac)	Relevant Area Needs (Acres)	Fixed ($/Ac)	Variable ($/Ac)	Observations (n)
Timber Stand Improvement	**553.39**	**13.3**	**26**	**663**	***63***
Wildlife Exclusion Partitioning					
Average Cost	1,886.69	6.3	128	2,449	*21*
Standard Error	*322.66*	*0.9*	*22*	*362*	
Pre-Commercial Thinning (PCT)					
Average Cost	295.82	14.7	7	325	*47*
Standard Error	*16.33*	*1.0*	*1*	*18*	
Forestland Pruning					
Average Cost	*	*	*	*	*4*
Standard Error	*	*	*	*	
Fire & Prescribed Burning	**313.90**	**6.5**	**1,132**	**299**	***33***
Prescribed Burn Services					
Average Cost	395.68	6.0	1,529	401	*20*
Standard Error	*20.27*	*0.3*	*83*	*23*	
Fire Prevention & Maintenance					
Average Cost	103.79	8.1	23	15	*13*
Standard Error	*10.59*	*0.2*	*5*	*1*	
Forest Health & Protection	**246.88**	**3.8**	**72**	**303**	***46***
Insect and Disease Mitigation					
Average Cost	296.40	5.4	44	114	*12*
Standard Error	*45.14*	*1.0*	*7*	*17*	
Invasive Species Removal					
Average Cost	239.40	3.4	80	357	*41*
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Land Clearing Services					
Average Cost	242.37	1.4	35	288	*23*
Standard Error	*29.94*	*0.2*	*3*	*24*	
Wildlife Forage and Pollinator Seeding					
Average Cost	531.51	4.0	18	665	*63*
Standard Error	*26.02*	*0.1*	*1*	*37*	
Game Species Habitat Structural Enhancement					
Average Cost	103.02	10.2	128	56	*26*
Standard Error	*13.20*	*0.7*	*23*	*5*	