PINE STRAW FEASIBILITY STUDY

Great Lakes Region

GLACIERLAND
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CREDITS

Glacierland Resource Conservation and Development (RC&D) is a 501(c)(3) non-profit, rural/urban development council whose mission is to:

- Coordinate and enhance resource conservation and rural and urban opportunities in northeast Wisconsin through private and public partnerships.

Glacierland's vision is to:

- [Maintain] a coalition of citizens, local government, and agency personnel working for the better management of all resources in the Glacierland RC&D area, including the right to farm that is environmentally friendly.

As a part of their mission/vision, Glacierland RC&D obtained a Rural Community Assistance grant through the USDA Forest Service. The purpose of this study is to determine the feasibility of pine straw production in the Great Lakes Region (Michigan, Minnesota, and Wisconsin).

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EXECUTIVE SUMMARY

In the Southern United States, pine straw has been used extensively as a mulching/landscaping product, with limited use outside of that region. In many parts of the country, including the Lakes States region, pine straw has been viewed as a nuisance to be removed rather than a cover to be applied.

Based on many differences in the two regions, the Great Lakes Region will probably never see pine straw become as popular as it is in the Southern United States; however, there are opportunities to use pine straw in a variety of applications. Identifying pine stands that can be used for the collection of pine straw and/or managing pine stands to make pine straw collection easier and more economical are the biggest issues on the supply side. On the demand side, gaining acceptance as a mulch product will be the biggest obstacle for pine straw to overcome in making it as a viable product in the Great Lakes Region.

Factors, such as the increased emphasis being put on biomass energy production, could affect bark and wood chip mulch by potentially creating a higher value for it as fuel. This will potentially create an opportunity for pine straw to capture part of the market previously monopolized by these two traditional mulches. The greatest potential would be in areas that have pine plantations within 100 miles of urban areas where the distance to market would not be a major issue.

Harvesting practices could be adapted in the long-term that would make pine straw collection easier, such as concentrating slash during harvesting operations and having stumps cut as low as possible so as not to impede the collection process. Most plantings over the last 30 years will allow for easier collecting prior to harvest because row spacing has been seven feet or greater as compared to six feet or less prior to that time.

Issues to address concerning the collection/use of pine straw are:

- Collection Process (lack of prior experience)
- Identifying Pine Plantations where Pine Straw Collection is Viable
- Having Information Available on Collection Methods and Markets
- Identifying the Best Packaging Method for Delivery and Sale
- Developing Markets and Outlets for Pine Straw

Pine straw collection, especially in areas that have a history of wildfire occurrence, could have a significant impact by reducing the fuel load, thus making fires less intense, easier to control, and potentially lessen the damage to trees. This could especially be an issue in areas around homes and other high-value property where reducing the fire hazard is the most critical.

Currently, the greatest potential for pine straw collection would be as a 'cottage industry' where landowners and/or entrepreneurs could collect pine straw as compared to commercial collection operations. As with any "new" product, increased market demand could quickly change the dynamics of pine straw collection and take it to the next level.

HISTORY OF PINE STRAW USE

Pine straw has been a popular landscape ground cover throughout the South for the past 25 years. It is one of the most widely used mulches for all size projects from residential flowerbeds to industrial complexes and highway landscapes[i].

Pine needles interlock and hold together during hard rains and heavy winds, even on sloping landscapes. Because pine needles interlock, pine straw will not wash out of beds like other mulches. The fine texture and uniform color of pine straw is more aesthetically pleasing to some people. Its attractive, earthy look brings out the color, contrast, and texture of landscapes.

EXISTING MARKETS FOR PINE STRAW – WHAT USES

Geographically, most pine straw markets are in the Southern United States with a slow but steady expansion both northward and westward. Pine straw is available on a limited basis in markets throughout the country, but outside of the Southern United States, it is very limited and sporadic.

Pine straw sold for mulch to garden and nursery stores, landscape businesses, and strawberry producers is a good source of supplemental income to landowners in many southern States, particularly Louisiana, North Carolina, South Carolina, Florida, and Georgia. Longleaf and slash pine produce the preferred straw because of their longer needle length, which makes them easier to bale and transport. [ii]

Market Competition

Wide ranges of products are used for mulch, with bark and wood chips being the most popular in the Great Lakes Region. In the appendix, a cost comparison table compares southern pine straw to other popular southern mulches. Pine straw compares very favorably to these other mulches in cost per area covered. However, pine straw also condenses and decomposes quicker than many other types of mulch, but it does not have to be removed; it can have fresh straw added to the existing pine straw bed each year.

Whereas many mulches allow water runoff (rain and/or irrigation), pine straw allows water to flow through it to the soil underneath. The same quality by which pine straw allows for water to flow through it also helps to conserve soil moisture by reducing water evaporation rates and moisture loss. Pine straw also has the added benefit of reducing erosion caused by wind and rain-splash impact and adhering well to slopes thus not washing away as easily as other mulches during heavy rain

A potential plus for pine straw markets in the Great Lakes Region is the increased emphasis on biomass energy production. With the expansion of this industry, there will be increasing markets for bark and wood chips for biomass fuel, thus increasing their value and consequently, making pine straw a more economically attractive alternative.

Benefits of Using Pine Straw for Groundcover

Pine straw

- Is a natural product for trees and plants that is high in nitrogen thus decomposes into a fertilizer
- deters weeds
- is ecology-minded
- insulates tender roots from temperature extremes, keeping the soil warm during cold spells and cool during warm spells[ii]
- conserves soil moisture by reducing water evaporation rates and moisture loss [vii]
- encourages water infiltration into the soil and reduces runoff [vii]
- eliminates erosion caused by wind and rain-splash impact [vii]
- adheres well to slopes and does not wash away as easily as other mulches during heavy rain
- does not have to be removed; putting fresh straw on top of the old revitalizes the color
- is preferred by many landscape personnel because it is easier to work with than wood chip products
- keeps some vegetables from forming mildew, mold, or developing rot
- retains moisture in the soil and around plants better than other mulches [vii]

PINE STRAW OUTPUT

Tree Age

Generally, depending on tree spacing, pine plantations in the Great Lakes Region are approximately 15 years old before the tree crowns shade out the undergrowth and allow a bed of pine needles to form. Unless the stand is pruned however, the lower branches would make collection of pine straw very difficult. If it were pruned, the branches would need to be removed or piled to allow for efficient pine straw collection.

Red pine plantations are generally thinned between 20 and 25 years of age. If thinning is done with pine straw collection in mind, tops and branches can be concentrated to make for easier pine straw collection.

Stand Density

In the Southern United States, pine straw production increases as the total basal area per acre increases. In the Great Lakes Region, there has not been any significant collection of pine straw to make accurate judgments. In the collection that was done as part of this study, the volume per acre of collectable pine straw was estimated to be 3.8 tons per acre in a 48-year-old red pine plantation with 130 sq ft of basal area. This figure will vary tremendously depending on tree age, stand density, and soil type.

Season

Needles stay on the branches for about 2 years, after which they turn reddish brown and fall. While needles can fall throughout the year, under normal weather conditions most pine needles drop in September and October.

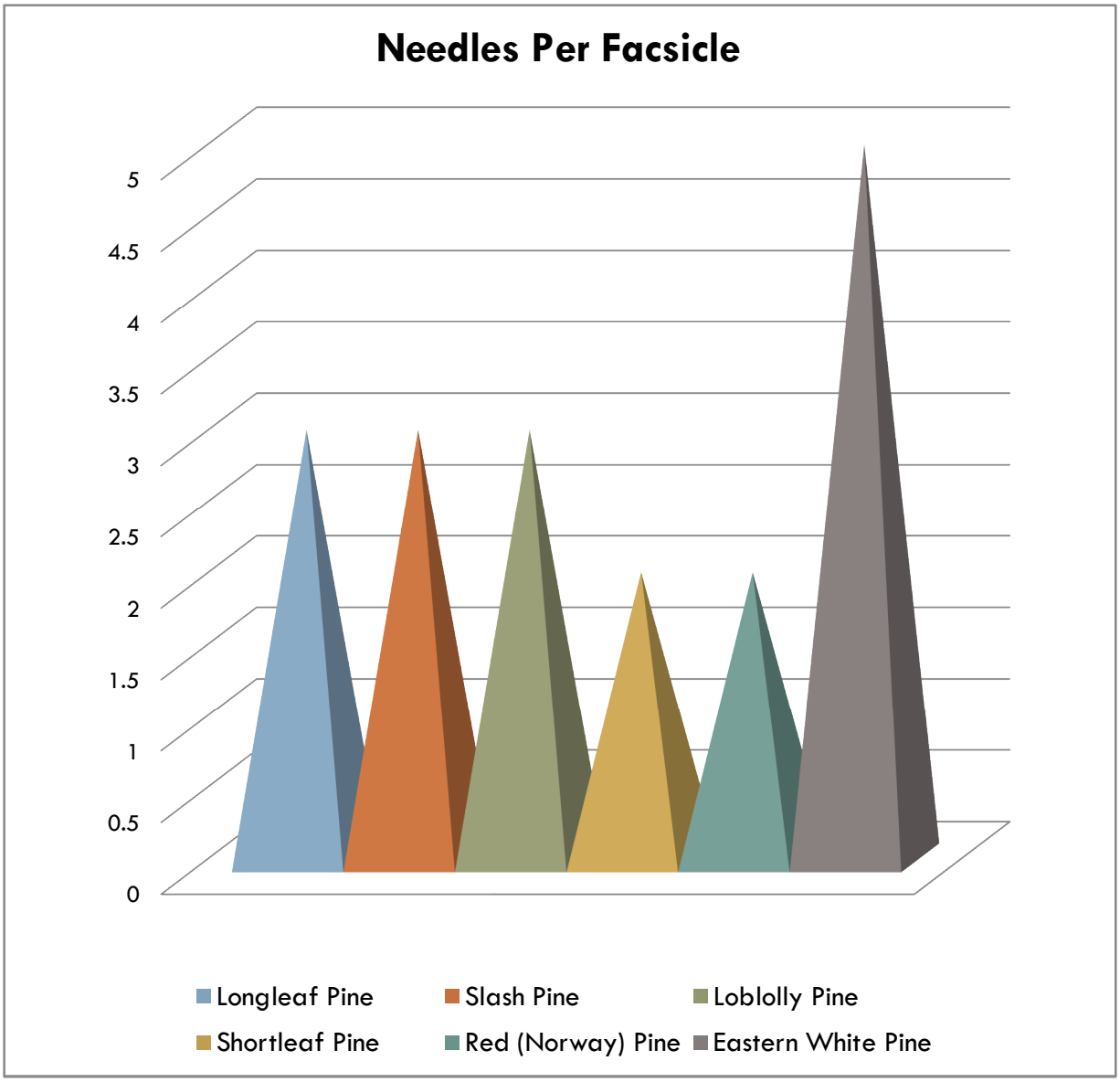
COMPARISON: GREAT LAKES REGION PINE VS. SOUTHERN PINE

Southern Pine species that typically produce pine straw:

- Longleaf Pine
- Slash Pine
- Loblolly Pine
- Shortleaf Pine

Great Lakes Region Pine species with pine straw potential:

- Red (Norway) Pine
- Eastern White Pine



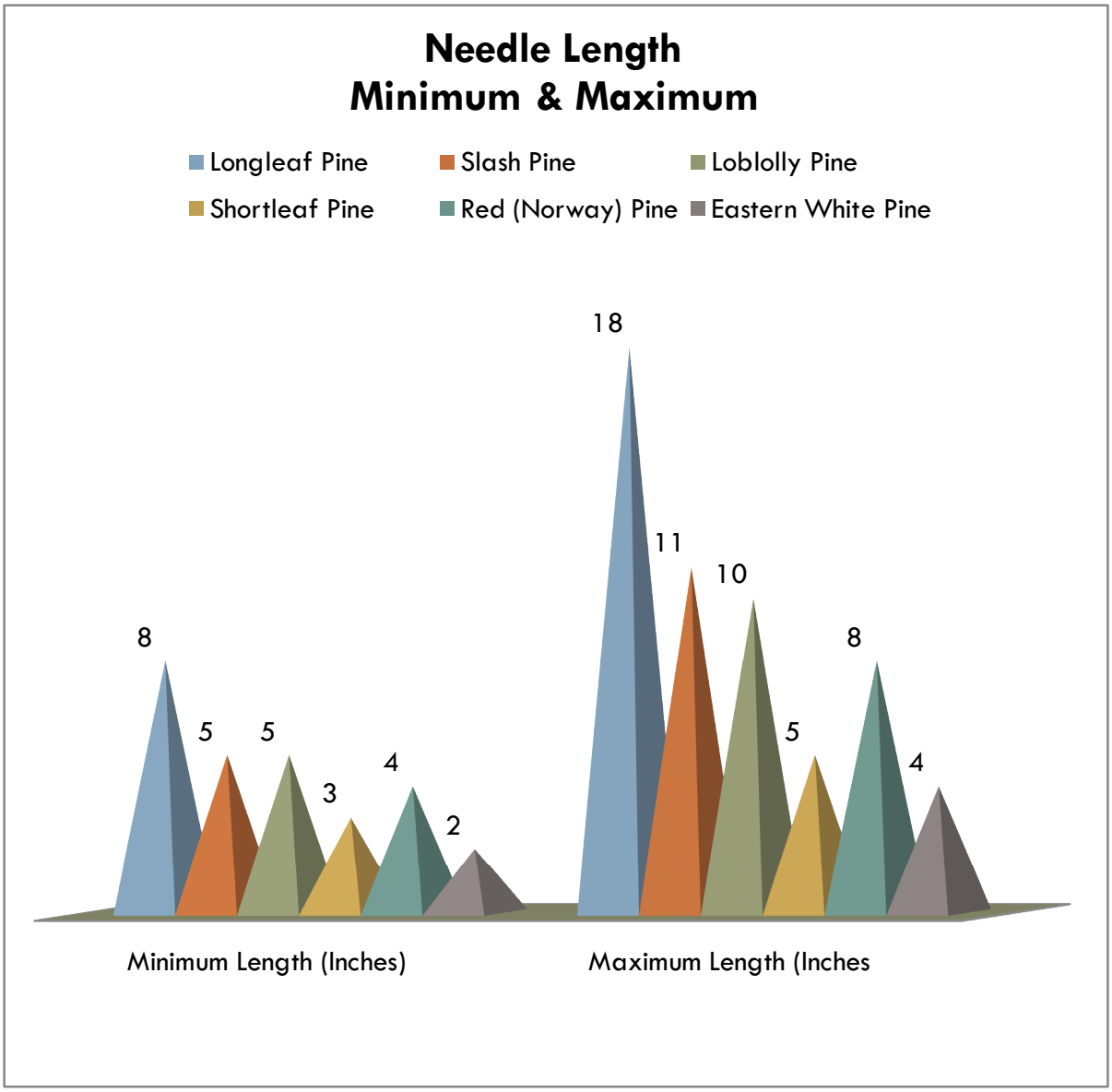
GREAT LAKES REGION PINE SPECIES: PINE STRAW FEASIBILITY

Red Pine/Norway Pine.....Longest needled pine in the Great Lakes Region. A popular plantation tree; it has the most potential for pine straw use in the Great Lakes Region.

White Pine .....Shorter needles than red pine; not widely planted except for Christmas trees; limited potential for pine straw.

Jack Pine ....Needles are too short for effective use.

Scotch Pine .....Needles are too short for effective use.



Factors Affecting Great Lakes Region Red Pine Straw Collection

- Stand Density vs. Spacing
- Thinned vs. Not Thinned
- Pruned vs. Not Pruned
- Soil Productivity (Undergrowth or Nutrient Depletion Issues)
- Original Survival (Density)
- Furrowing on Initial Planting
- Site Access
- Pure vs. Mixed Species Plantings
- Labor Availability
- Distance to Markets
- Other Factors Affecting Markets (i.e. Biomass usage has caused mulch prices to double in the last five years in some parts of southern Wisconsin)
- Small size (<10 acres) of many plantations

PINE STRAW AVAILABILITY IN THE GREAT LAKES REGION

Great Lakes Region Pine Straw Cost/Availability

In that collection of pine straw has not been done to any substantial degree in the Great Lakes Region, attitude towards or policy for the collection of this product has not been formulated. Here is a broad based observation of landowner categories.

NATIONAL FORESTS

The National Forests in the Great Lakes Region have not addressed pine straw collection in their current plans or policies. It was not seen as an issue that could not be addressed within a six month or less period to come up with a system for addressing the collection of pine straw.

STATE FORESTS

In the state forests in the Upper Great Lakes Region, it has not been addressed; however, there did not appear to be any issues in creating a policy if interest in collecting pine straw did arise.

COUNTY FORESTS

An informal survey of several County Forests within the region showed openness to the possibility of pine straw collection. None of them had an issue with developing a policy/payment system that would be similar to what is already done for boughs or firewood.

INDUSTRIAL OWNERSHIPS

In an informal survey of industrial landowners, this again was not seen as an issue that could not be readily addressed if there was interest in pine straw collection

NON-INDUSTRIAL PRIVATE LANDOWNERS

Managed Forest Law (WI): Unless collection of pine straw causes damage to the trees and/or created erosion potential, there would be no issue with collecting pine straw on Managed Forest Law lands. Because it is not a cut product, no yield tax would have to paid on any pine straw removed from Managed Forest Law properties.

Other Private Land: This could of course vary with the thousands of landowners throughout the Great Lakes Region, but in all likelihood, it could provide a supplemental income opportunity for these landowners.

Red & White Pine Plantation Acreage for Michigan[iii], Minnesota[iv] , & Wisconsin[v]

RED PINE PLANTATION ACREAGE (2004)							
State	0-20 Years	21-40 Years	41-60 Years	61-80 Years	81-100 Years	100-120 Years	**Total:**
Michigan	51,942	216,350	289,545	51,223	5,360	1,610	**616,028**
Minnesota	84,309	103,379	27,622	16,387	3,124	5,418	**240,236**
Wisconsin	97,760	231,662	159,224	21,921	3,138	0	**513,703**
Totals:	**234,011**	**551,391**	**476,391**	**89,531**	**11,622**	**7,028**	**1,369,967**

EASTERN WHITE PINE PLANTATION ACREAGE (2004)							
State	0-20 Years	21-40 Years	41-60 Years	61-80 Years	81-100 Years	100-120 Years	**Total:**
Michigan	1,842	12,304	15,596	3,011	0	0	**32,753**
Minnesota	3,548	0	2,836	0	0	0	**6,384**
Wisconsin	9,750	28,501	22,251	5,230	2,933	0	**68,665**
Totals:	**15,140**	**40,805**	**40,683**	**8,241**	**2,933**	**0**	**107,802**

Based on the research that was conducted as part of this study, a best estimate would be that 5-10% of the plantation acreage would be acceptable, as is, for pine straw collection. This still represents a sizable acreage, but identifying these specific sites would be a major task. However, with some site preparation and alteration of harvesting practices, this percentage could potentially double or triple. There might also be some opportunity for pine straw collection in natural pine stands; however, plantations will generally present the best opportunity.

GREAT LAKES REGION: CASE STUDY – TOMAHAWK, WI

Three different stands were identified and studied for potential pine straw collection in the Tomahawk, WI area with the following results.

Stand 1

This pine stand had been thinned twice. This stand had good soil quality; however, this stand also had a great deal of underbrush and debris and was not suited to pine straw collection without considerable site preparation.

Stand 2

A 1st thinning stand, on poorer soil, had too much debris left from the harvest (mainly tops) to make collection feasible.

Stand 3

The stand is 48-years-old and has been thinned four times; it had experienced a forest fire two years prior to the study, helping to clean up debris. The soil was of poorer quality, which helped to reduce underbrush and natural regeneration. Pine straw was collected from this stand.

The pine straw was collected by raking it together and picking it up with a fork, taking reasonable care to pick up only straw. There were a few pinecones, small twigs, and leaves. This debris amounted to a

very small percentage of the collection. Since it was dry, more than one year of pine needle drop was raked up; however, raking in straw that held any moisture was avoided as much as possible. The pine straw just below the surface had a much darker color than the pine straw on the top layer. It took one hour to measure, rake, and load the pine straw. After collection, the pine straw was laid out to dry during storage.

Area Collected:	**5' X 100'**
Weight*:	**140#**
Volume:**	**17 cu feet (rounded)**
	0.61 cu yards (rounded)

* To determine weight of the pine straw, it was bagged & weighed.
** To determine volume, it was spread out in a 10' X 10' area. Area covered with pine straw was 10' X 10' X 2" deep.

Summary of Findings

It is hard to relate this study to other areas since there are so many variables. The poor quality soil/fire site was clean compared to other sites that were inspected. To find a site this clean will usually require site preparation for harvesting pine straw or collecting pine straw prior to the first thinning.

COLLECTION COSTS

For a start-up industry in the Great Lakes Region, an assumption is made that hand labor would be the primary collection method in the beginning. In the southern United States, there are mechanized operations that use rakes and balers; however, the length of red pine needles would not lend itself to traditional baling methods.

If a viable market develops for pine straw, various collection systems are sure to be tested. Ideas that have been discussed are mechanized raking and bagging, vacuums such as those used on golf courses, and laying down tarps prior to needle drop.

The table below charts collection costs based on different hourly labor rates, with the times used for collection and handling based on a case study. Transportation cost was based on a $2.50 per loaded mile. Payment to the landowner(s) was an arbitrary figure of $30/acre.

Cost of Pine Straw Collection (Per Cubic Yard)

Hourly Rate	Collection	Misc.	Payment to Landowner for Land Use	Transportation	Total
$6.00/hr	$10.02	$2.00	$1.00	$1.50	**$14.52**
$7.00/hr	$11.39	$2.33	$1.00	$1.50	**$16.22**
$8.00/hr	$13.03	$2.67	$1.00	$1.50	**$18.20**
$9.00/hr	$15.03	$3.00	$1.00	$1.50	**$20.53**
$10.00/hr	**$16.70**	**$3.33**	**$1.00**	**$1.50**	**$22.53**

Collection..... 100 minutes/yard (1.67 hours/cubic yard)
Miscellaneous..... Packaging/loading/unloading/transportation
Landowner Payment ....Based on a rate of $30/acre
Transportation..... Based on 45 loaded miles

Other Potential Costs

Depending on the plantation, other costs could include:

- Pruning
- Debris pick-up prior to straw collection
- Treating (herbicide) or removal of understory plants
- Alter harvesting to concentrate or remove logging residue

Costs associated with any of these activities could vary widely depending on the specific plantation. Once they are done, however, the site would potentially be clear for pine straw collection for several years with minimal maintenance.

After the initial collection, other costs beyond those allowed for in the table above could be removing debris from the needles prior to packaging/shipping and/or drying of needles before packaging/shipping. These situations would be very dependent upon the specific site condition(s).

TRANSPORTATION COSTS

The cost of transporting pine straw will be dependent on two main factors:

1. Pre-loading trailers and having the trucker pick them up will not impact the cost of trucking; however, if the trucker has to wait to be loaded, this will have a substantial impact on the transportation cost.
2. Distance to market will be the major deciding determinant of transportation cost. Whether you are charged by the loaded mile or per hour, distance to market is critical to making pine straw a viable product in the Great Lakes Region.

A major drawback of pine straw is its relative light weight. A trailer loaded with pine straw will be a third to half the loaded capacity of most trailers. The more time that is put into compacting pine straw to get as much volume on a load as possible will add more to the labor costs by increasing handling.

Depending on the trailer size and the amount of effort that is put into the compaction of the pine straw, a loaded trailer could have 50-100 cubic yards of pine straw. This would equate to $0.025 to $0.05/cu yard/mile (see table below).

COST PER DELIVERED CUBIC YARD

Distance (Miles)	Cost/Mile (Loaded)	Volume	Cost/Cu Yd
30	$2.50	75 cu yd	**$1.00**
40	$2.50	75 cu yd	**$1.33**
50	$2.50	75 cu yd	**$1.67**
60	$2.50	75 cu yd	**$2.00**
70	$2.50	75 cu yd	**$2.33**
100	$2.50	75 cu yd	**$3.33**
200	**$2.50**	**75 cu yd**	**$6.66**

Distance ..... Cost is based on one-way mileage
Cost/Loaded Mile ..... This covers the entire trip
Average Volume ..... Estimate for typical load
Cost/Cubic Yard ..... Total transport cost per unit

PINE STRAW COLLECTION IMPACTS

Benefits of Pine Straw Collection

There are many benefits to the collection of pine straw. The removal of pine straw from forestlands means:

- Fire Hazard Reduction; Especially Around Homes
- Local Product Used Locally (Positive Economic Impact)

Pine Straw Collection: Site Considerations

Pine straw removal could impact:

- Nutrient Levels — In the Southern United States, fertilization is actually done to make up for the pine straw collection. In the Great Lakes Region, this impact would vary greatly depending on the soil type.
- Moisture Retention — Pine straw holds moisture, which is important for tree survival and growth during summer months and water stress periods.
- Insulation — Pine straw helps insulate the soil from temperature extremes that can reduce tree growth.
- Erosion Control — Pine straw prevents erosion of topsoil.

Consequently, it is important for harvesting operations to leave a layer of straw and organic matter. Harvesting pine straw may have long- term effects on soil chemistry.

Insect & Disease Transmission-Traditional Mulch & Pine Straw[vi]

Improper application of mulch can lead to problems, such as piling wood mulch against the trunk of a tree can keep the bark underneath excessively wet. This wetness can contribute to bark decay.

Wood mulch may come from many sources, including trees and shrubs that have died from a wide range of diseases. Elm trees killed by Dutch elm disease (University of Wisconsin Garden Facts X1076), can serve as breeding areas for native and European elm bark beetles. Bark beetles that breed in logs or firewood from these trees can pick up the fungi that cause Dutch elm disease and carry these fungi from tree to tree. Chipping infected elm trees creates an unfavorable environment for bark beetles, yet there is no scientific literature that describes the level of risk of transmitting the Dutch elm disease fungi from wood chips or bark chunks to healthy elms.

Oak trees killed by oak wilt (see definitions section) can be attractive to several sap-feeding beetles that can potentially pick up the oak wilt fungus and move it in the landscape. This process is affected by moisture and temperature and would likely be disrupted by the chipping and composting process; however, there is not scientific literature that describes the level of risk of transmitting the oak wilt disease fungi from wood chips or bark chunks to healthy oaks.

Recent research at the University of Wisconsin – Madison suggests that wood chip mulches produced from trees suffering from Verticillium wilt (see definitions section) can serve as a source of the fungus that causes the disease. These studies show that Verticillium can survive for at least one year in mulch and that use of this contaminated mulch can lead to Verticillium wilt in both woody and herbaceous plants. Therefore, use of mulches produced from trees with Verticillium wilt should be avoided.

It is possible for some needlecast fungi and shoot blight fungi to survive on dead needles. Diplodia shoot blight (see definitions section), canker and collar rot, are diseases that is harbored in red pine needles and shoots; however, exactly how long certain organisms remain viable and what conditions are necessary to clean the material are unknown.

CONCLUSION

The potential for pine straw collection use in the Great Lakes Region would be mainly in red pine plantations. Some plantations would be immediately available for pine straw collection while others would require site preparation.

Collection would mainly be limited to hand labor to begin with; however, increased market demand could lead to other collection methods. How to package pine straw for market would have to be determined. Obtaining landowner acceptance of pine straw collection should not be a major hurdle. Transportation to market will be somewhat impacted by how the straw is packaged/wrapped.

Establishing pine straw as a viable product and creating market demand is probably the biggest obstacle to overcome. The survey that was done was positive in this regard, in that there was a willingness to try pine straw. The price ranges quoted showed the potential for some market share.

Educational efforts, including handouts and workshops, would go a long way towards establishing pine straw as a viable product in the Great Lakes Region.

DEFINITIONS

Basal Area	A measure of the density or stocking of a forest stand. It is the cross-sectional area of a tree bole (trunk), including the bark, measured at 4.5 feet above the ground. The sum of individual tree basal areas on an acre of land equals the total basal area per acre expressed in square feet per acre
Canker Rot	A fungal disease of woody plants that causes localized damage to the bark
Cleaning	Preparing the stand to rake pine straw by removing ground debris, such as limbs, cones, hardwood leaves and trash, and low hanging limbs that will interfere with mechanical raking and baling
Collar Rot	When large lesions develop at the ground line on stems of transplants or seedlings, the plants may become girdled - a condition known as
Diplodia Shoot Blight	This disease attacks pines and is most damaging to plantings of both exotic and native pine species in 30 Eastern and Central States. The fungus is seldom found in natural pine stands.
Fascicle	a cluster or bundle of needles
Managed Forest Law (MFL)	A Wisconsin law under which landowners can receive tax benefits in exchange for practicing sustainable management of their forested land. The program is administered by the Wisconsin Department of Natural Resources.
Oak Wilt	Oak Wilt is a fungal disease which can quickly kill an oak tree. The tree reacts to the presence of the fungus by plugging its own cambial tissue in an attempt to block the fungus from spreading further. As the area around cambium such as vascular bundle is crucial for delivering nutrients and water to the rest of the plant, this plug prevents them from traveling up the trunk of the tree, eventually killing it.
Pine Straw	The fresh, un-decomposed pine needles that have fallen to the forest floor.
Rotation	The length of time between the initial establishment of a pine plantation and the final harvest.
Understory	All the plants growing under the main canopy of the pine trees
Verticillium Wilt	Verticillium wilt, also called Maple wilt, is a common and serious disease of maples. The destructive soil-borne fungus kills many maples each year throughout North America. Norway maples seem especially sensitive to infection; however, silver, red, sugar, sycamore, and Japanese maples are susceptible.

APPENDIX

1. Mulch Cost Comparison Table[vii]

Mulch Type	Cost * ($/unit)	Coverage (sq feet)	Quantity (# units/sq. ft.)	Cost ($/100 sq ft)
Pine Straw	$14.50/bale	100	1 bale	**$14.50**
Pine Bark	$1.93/bag (3 cubic feet)	12	8.33 bags	**$16.10**
Cypress	$3.39/bag (3 cubic feet)	18	5.56	**$18.80**
Cedar	$3.39/bag (3 cubic feet)	18	5.56	**$18.80**
Red Mulch	$2.19/bag (2 cubic feet)	12	8.33	**$18.30**
Pine Nuggets	**$2.29/bag (2 cubic feet)**	**12**	**8.33**	**$19.10**

* Cost comparison of using Texas Pine Straw mulch versus traditional mulches; comparison prices taken on February 2, 2002 in East Texas from a Lowe's Home Improvement store. Bed thickness used in all examples is 2".

2. Red Pine Plantation – 48 Years Old

#1 Area that had four thinnings and had a forest fire two years prior.

#2 Same area as #1 after pine straw collection.

#3 Same stand as #1 and #2 where fire did not go through.

#4 Another red pine stand in the same area with too much undergrowth for pine straw collection.

3. Mulch Consumer Survey[vii]

D. R. Smith, C. H. Gilliam, J. H. Edwards, and Bridget K. Behe

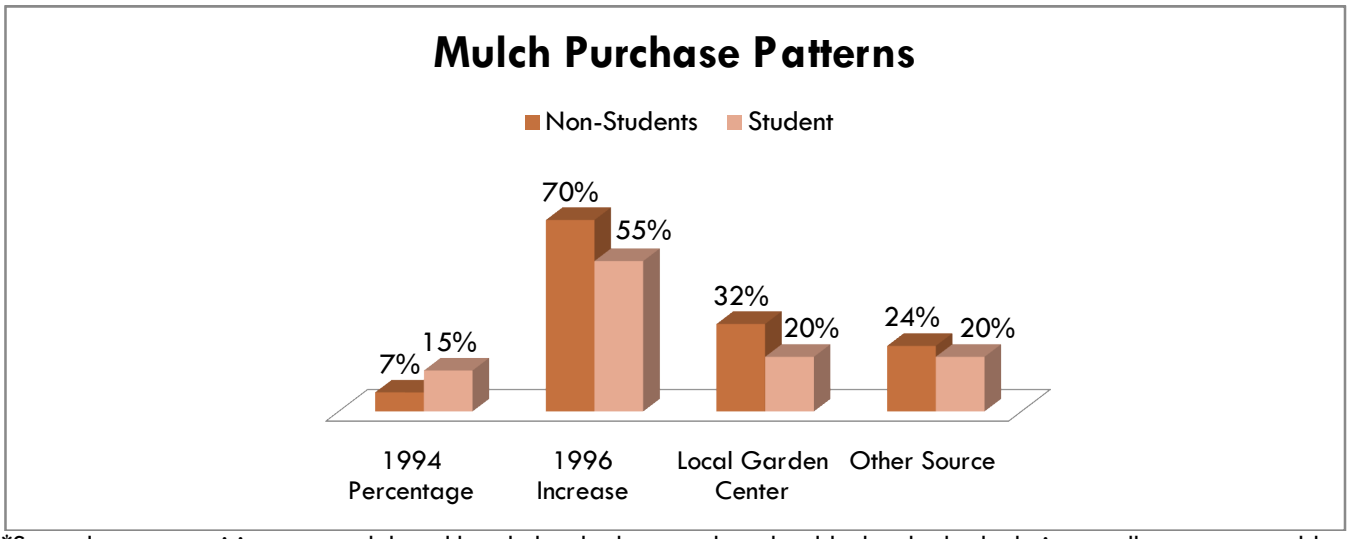
Mulching is a common practice for residential and commercial landscapers and several factors are considered when selecting mulch. Since mulches are used over large areas, they are highly visible in the landscape and should be aesthetically pleasing, durable, and effective. Color is also an important consideration when selecting a mulch and good design uses color contrast to augment a landscape. Mulch should permit water to penetrate into the soil and allow for gas exchange between soil and air, and maintain effectiveness as it decomposes. Other factors affecting mulch selection include weed control, texture, and susceptibility to erosion by wind or water.

Few studies have been conducted to evaluate consumer preferences and attitudes concerning various organic mulches and factors that affect consumer preference for mulch materials. The objective of this study was to evaluate the aesthetic value of three traditional mulches (pine bark, pine straw, and wheat straw), and the two new mulch products (in three different colors), developed from recycled waste paper. Reasons why consumers purchase mulch and the benefits that the consumers anticipated from the mulch were also identified.

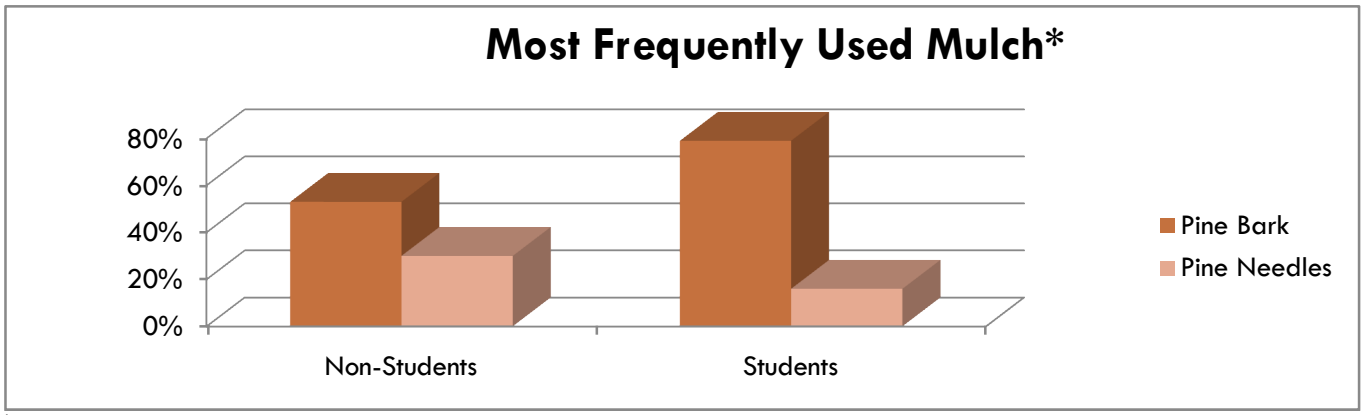
Participants were asked to complete a 13-item survey that requested information on past purchases of mulch, uses for mulch, mulch preference, and demographic information, (age, gender, income level, and education level). They were asked to indicate the time of their most recent purchase of plants and/or mulch, type of mulch purchased, and type of store/garden center from which they made their purchase. Participants were also asked what factors would most affect their decision when purchasing mulch, why they use mulch, and how many years they have gardened.

	(37) Non-Student {Mean age of 42} employed full-time in education related fields in the Auburn area	(25) Students {Mean age of 25} senior-level horticulture class at Auburn University
Demographic Information		
Years Gardened	15	**6**
Residence	92%* Home Ownership	**80%** Rented**
Average Income	**$45,000-$50,000^**	**Under $15,000^^**

* Lived there an average of 8 years (28 years being the maximum)
** Lived there an average of 1 Year
^ 28% earning over $65,000 a year
^^ Difficult to accurately determine their personal income level since several listed their parents' household income; however, 60% reported having annual incomes of less than $15,000



*Several survey participants stated that although they had not purchased mulch, they had raked pine needles to use as mulch.



* Other sources have also indicated that mulches obtained from the excess of wood related industries are also popular

Both groups ranked pine bark as the mulch most likely to be purchased, followed by pine needles. Despite the differences between individuals in the two groups (age, income, rent vs. own), there was no difference in selection of the most preferable mulch. Preference of mulch type did not change over time; however, the perception of the aesthetic value of a given mulch did change. For example, the perception of all pellets and pine needles was different in the first and second ratings (see table). All pellets, and particularly the gray, were given a higher aesthetic value in the second rating, while the pine bark and pine needles were given a lower aesthetic value.

Plots were planted with either ageratum or marigold and mulched with one of the nine mulches. Each plot size was 4 feet × 4 feet and contained three plants each of either ageratum or marigold. The nine different mulches were:

1. Pine bark
2. Pine needles
3. Wheat straw
4. Gray recycled paper pellets
5. Gray recycled paper crumble
6. Brown recycled paper pellets
7. Brown recycled paper crumble
8. Rust recycled paper pellets
9. Rust recycled paper crumble

Organic Mulch Preferences: First and Second Rating 6 Weeks Apart [1]				
Mulch	**Non-students**		**Students**	
	First rating*	Second rating	First rating	Second rating
Pine bark	4.6	4.1	4.7	4.6
Pine needles	3.7	3.5	4.2	3.8
Rust crumble	3.5	3.1	3.2	2.9
Brown crumble	3.4	3.0	3.1	2.8
Gray crumble	2.4	2.2	2.0	2.0
Rust pellet	2.1	2.5	2.0	2.2
Brown pellet	2.0	2.3	1.6	1.8
Gray pellet	1.5	2.3	1.4	1.9
Wheat straw	2.7	2.6	3.5	3.2

[1] Mulch rating is based on a scale of 1 - 5: 1 = definitely would not buy, 5 = definitely would buy

* In the initial rating when the plants were young, approximately 75% of the ground (mulch) was exposed.

** The second rating 50% or less of the ground (mulch) was exposed.

The change in aesthetic perception of mulches was not surprising since mulches do change over time. Recycled paper mulches change considerably with changes in the gray-colored mulch more pronounced than the rust or brown. As the gray mulch aged, it became darker and appeared to blend more aesthetically with the surrounding area. The pellets also expanded as they absorbed water and as they began to break down, they lost their 'hard' edges and assumed a softer texture.

The aesthetic perception of pine bark and pine needles also changed over time; however, it decreased rather than increased. In addition, the pine bark tended to wash away from landscaped plots, whereas the paper mulch remained in place. Longer term evaluations than in the current study need to be conducted since mulches are typically replaced at least once a year in landscapes.

In every case, pine bark and pine needles were the most preferred mulches. Comparison of recycled waste paper mulches showed that crumble mulches were favored over pelleted mulches with rust and brown being the most preferred colors. Consumer perception of the aesthetic value of mulch changed over time with pellets improving in perception and all other mulches remaining the same or declining. These results may indicate that even though recycling and environmental issues continue to be of concern, the challenge will be for manufactures of recycled products to gain consumer acceptance of non-traditional commodities entering a market dominated by traditional products.

Both groups considered the soil moisture retention capacity of mulch second only to the aesthetic appeal of the mulch. The majority of the non-students reported that the reason they used mulch was to make the landscape neat (84%) and conserve moisture (73%). Students indicated aesthetics were the primary reason for using mulch (96%), followed by moisture retention (88%).

4. Harvesting Process in the Southern United States[i]

Surprisingly, raking and baling are the easiest and fastest parts of harvesting. Cleanup, gathering, and transporting the bales are more difficult because labor is intensive and expensive. For example, a highly productive crew of five people will require 2 to 3 weeks to prepare, clean, rake, bale, and haul pine straw bales from a typical 30-acre plantation. Harvesting pine straw by machine in typical pine plantations requires the following steps:

1. Remove (prune) the lower limbs of every tree that might block the movement of equipment and laborers within the rows. Prune by hand with machete or special saws for approximately $0.85 per tree, or remove limbs more cost effectively by using a modified cutter attached to a small tractor. Depending on tree height, pruning may not be necessary in hand-raking operations.
2. Remove all trees and shrubs within the baling rows. Special contractual arrangements might be made with a harvester to remove diseased trees within the rows as well.
3. Remove all limbs and other debris from the baling rows. The debris must be picked up or raked off the site. Depositing the debris every seventh row eliminates the need to move the debris great distances and reduces labor cost.
4. Rake the pine needles by hand or by machine into windrows. Exclude any insects (ants), excess litter, grass, and hardwood leaves that might reduce the value of the bale. Low-grade straw that contains extraneous debris or partially decomposed needles may be sold at a discount. Be careful to avoid seeds of noxious weeds, bahia grass, and other plants that might present a problem in landscaping yards or flower beds.

5. Tending Stands for Pine Straw in Texas[i]

Most stands of pine that are being considered for straw harvesting are not yet desirable for straw production. A great deal of effort and planning is required to prepare East Texas stands for harvest of pine straw that is free of cones, leaves, limbs and trash. In fact, at least 2 years of preparation may be required before high quality clean pine straw can be mechanically harvested with minimal effort. Preparation steps include:

Management Plan	Managing a successful forest resource enterprise, like any other business, involves planning and decision-making. A successful management plan includes: 1. Realistic, clear, and concise objectives that define your level of involvement 2. Investigation of the marketing potential of pine straw in your area 3. Knowledge of the biological and management potential and/or concerns of harvesting pine straw on your land 4. Identification of any major limiting factors such as financial or taxation constraints that may limit your success 5. Enlisting the help of professionals
Competition Control	Understory vegetation interferes with raking and reduces the quality of a bale. Control unwanted shrubs, weeds, and trees with herbicides or mowing.
Prune	Remove lower limbs of pines to facilitate harvesting. The lower limbs can interfere with harvesting equipment and/or people. Live limbs not receiving partial light may also cause stress on the crop tree, so pruning may improve wood quality.
Clean	Clear the area of all twigs, pinecones, and tree limbs. This can be done manually on a site that has an especially desirable quantity of straw. Otherwise, mechanically rake all debris, including some straw, and do not harvest straw that year.

6. Survey of Landscapers – Results

GENERAL SURVEY INFORMATION

Surveys Sent Out: 485		
Total Operable Surveys	457	
Return:	8%	
	Total Sent	Total Returned
Sent to Wisconsin:	379	32
Sent to Minneapolis, Minnesota:	32	1
Sent to Chicago, Illinois:	74	1
Responses With No State Listed:	0	2

GENERAL YES OR NO QUESTIONS (35* TOTAL RESPONSES)

Question	Yes	No
Have you ever used pine straw mulch?	8	27
If you have, was it a positive experience?	6	0
Would you be willing to try pine straw mulch if it was readily available?	30	5
Would bagged or bulk pine straw be of more interest to you**?	Bagged 10	Bulk 27

* Note: 1 out of the 36 responses had comments only

** Note: Some responses included bags and bulk

ARE THERE ANY CONCERNS OR ISSUES YOU HAVE IN REGARD TO PINE STRAW MULCH?

Acidity Concerns:	
Is this an issue with plants other than acid levels?	WI
What soil acidity problems does pine straw produce when decaying?	WI
Does it change soil pH?	WI
Does it have a HEG affect with soil pH?	WI
I would be concerned about the acidity of the pine needles around some shrubs and perennials.	
Long-term affect on soils, positive and negative (lower pH?)	MN
Nitrogen take-up from soil as it decomposes?	WI
Soil pH effects?	WI
The acid in the soil from the pine straw	WI
What would the acidity levels be?	WI
Aesthetic Concerns:	
Color choices?	WI
Cost and Appearance	WI
Does it come in colored – how long does it hold color if dyed?	WI
Does it hold its color?	WI
Does it look like shredded hardwood mulch?	WI
Freshness?	WI
How it would look spread out. In my opinion, I don't think it would look nice.	
Length of time it may maintain its color?	WI
Ecological Concerns:	
Do animals get into it?	WI
Affect on plants, positive and negative	MN
Are there positive environmental reasons for using (e.g. less trucking of Cyprus from south)	MN
Does it add nutrients or elements to the soil?	WI
Does it break down into the soil?	WI
If it would affect the plants	WI

Disease Concerns:	
Disease importation?	WI
Disease issues?	WI
Does it harbor insects or disease?	WI
Does it kill greenery where it is applied?	WI
Insect concerns?	WI
Fire Concerns:	
Fire danger?	WI
Fire hazard seems greater?	WI
Fire Hazard?	WI
Safety?	WI
Harvesting:	
How is the product harvested?	WI
Availability?	WI
Environmental – will this stuff be "mined" to the detriment of forest ecology?	MN
How would it be distributed?	WI
I would prefer pine straw bales the size of standard straw bales	WI
People around here consider it garbage, they pay to dispose of it	
People around here do everything they can to get rid of pine needles.	WI
Timeliness of delivery?	WI
White or Scotch Pine?	WI
Is it processed or harvested?	WI
General Comments:	
Is it stickly – slivers or difficult walking on it?	WI
What is pine straw?	WI
Have tried for years to promote leaving pine straw around evergreens as they drop. People HATE it, it's ugly to them.	
Not sure, have never seen it used anywhere. Unfamiliar with matter.	IL
Do not know enough about the product to comment	WI
Respond Please	WI
Sounds good, keep us in mind.	WI
I need more info	WI
I have seen this extensively in the South, a challenge will be to get consumers in this area to catch on. It is great!	WI
Very interested and would be willing to help	WI
Size/Use:	
What are the available sizes?	WI
Can it be used as winter mulch for protection of perennials? (Weed seed free winter mulches practically unavailable)	MN
Does it blow away?	WI
Does it wash away or blow away with wind and rain?	WI
How long would it hold up compared to mulch?	WI
How long would it last?	WI
How often is it replaced?	WI
Is it more likely to blow around?	WI
Is it weed seed free?	MN
Is the moisture retention as good as traditional mulches?	WI
It needs to be clean and free of other material; no twigs or bark.	WI
Length of time exposed to elements before deterioration.	WI
Longevity as mulch?	WI
Longevity?	WI
We use hydro seeding for our lawn installations now; could this product be used for lawn applications?	WI
Weed suppression performance	MN
What is the breakdown period?	WI
What would the application be – bedding or cover?	WI
Would consider using it depending on residential and industrial depending on interest.	WI

GENERAL MARKET PRICE

What price range would pine straw mulch have to be in to be competitive with other mulches?

Q3 – Unit (26 Responses)		
Per Cubic Yard	**Their Range**	**Response Ratio**
$5-$10	$5 $6-$10 $7-$10 $7-$10 $8-$10 $8-$10 $8-$12 $8-$13	8/26
$10-$15	$10 $10-$12 $10-$12 $10-$12 $10-$13 $10-$15 $10-$16 $10-$18	8/26
$15-$20	$15-$18 $15-$18 $15-$20 $18-$30	4/26
$20-$30	$20-$25 $20-$27 $20-$36 $22-$33 $27-$34	5/26
$30+	$30-$34	1/26

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[i] Producing Pine Straw in East Texas Forests, Texas Cooperative Extension, The Texas A&M university System

[ii] Pine straw as a Ground Cover Mulch; http://texaspinestraw.tamu.edu/introduction.html

[iii] The Forest Inventory Map Maker 2.1; Reportyr 2004 notes: Annual 05 of 05 sub-cycles - includes growth removals and mortality: http://ncrs2.fs.fed.us/4801/fiadb/

[iv] The Forest Inventory Map Maker 2.1; Reportyr 2004 notes: Annual 100% 2000-2004 current volume 20% growth removals and mortality: http://ncrs2.fs.fed.us/4801/fiadb/

[v] The Forest Inventory Map Maker 2.1; Reportyr 2004 notes: Annual 05 of 05 sub-cycles - includes growth removals and mortality: http://ncrs2.fs.fed.us/4801/fiadb/

[vi] UW Extension, university of Wisconsin Garden Facts, 'Wood Mulch and Tree Health', Jane Cummings-Carlson, Wisconsin Dept. of Natural Resources; John Kyhl, Wisconsin Dept. of Natural Resources; Gina Foreman, UW-Madison Plant Pathology; Brian Hudelson, UW-Madison Plant Pathology

[vii] 'What Consumers Want from Organic Mulches', *D. R. Smith, C. H. Gilliam, J. H. Edwards, and Bridget K. Behe,* www.ag.auburn.edu/aaes/communications/publications/orna mentals99/control/organic.html