

Harvesting Pine Straw for Profit

Questions Landowners Should Ask Themselves

Production of nontimber forest products such as pine straw can be a good way for forestland owners to earn an income, especially when traditional timber markets are down. Pine straw consists of the needles that fall from pine trees. Freshly fallen needles can be raked and sold to retailers, landscapers, and others who use the material as ground cover.

Pine straw production is often compatible with other land uses, but landowners need to consider several factors before beginning pine straw harvesting on their land. This publication includes questions landowners should ask themselves to determine if pine straw production is right for them. It also provides a brief overview, in three sections, of issues related to the production and harvesting of pine straw:

- What landowners need to know about their property
- What landowners need to know about their objectives and management strategies
- What landowners need to know about the pine straw market

Note: A consulting forester can help provide answers to many of the site- or treatment-specific questions posed in this publication.

Property

Not all forestland—or even all land forested with pines—is appropriate for pine straw harvesting. Landowners must know certain market or production requirements and understand that their objectives must match what is biologically possible on a site.

Questions to ask:

What species is growing?

Alabama has three pine species that are common to the state and that produce straw frequently used across the Southeast as landscape mulch. Loblolly pine (*Pinus taeda*) is often grown in plantations and accounts



Figure 1. The widely spaced rows of longleaf pine in this stand are conducive to mechanical pine straw harvests. (Photo credit: Becky Barlow)

for more than half of the pine volume in the South. Needles of the loblolly pine are usually 5 to 9 inches long and occur in clusters of three, sometimes four. Slash pine (*Pinus elliottii*) is native to coastal areas and often grows in wet areas, such as near swamps. Its needles are usually 6 to 11 inches long and occur in clusters of two or three. Longleaf pine (*Pinus palustris*) grows better than other tree species in sandy, well-drained soils, but it will grow in almost any soil except prairie soils. Longleaf pine needles are approximately 8 to 18 inches long and usually occur in clusters of three.

Pine straw suppliers and retailers usually prefer species with long needles (like longleaf or slash pine). Longer needle length facilitates collection, has slower deterioration rates, and allows needles to lock and stay in place, providing enhanced mulching benefits. Some buyers prefer loblolly because the needles lay flatter and retain their initial appearance (rather than settling over time), but loblolly does not usually bring a price premium. According to a report from the University of Georgia, prices paid to landowners for loblolly pine straw range from \$0.25 to \$0.30 per bale while pine straw from longleaf ranges from \$0.40 to \$1.00 per bale.

How much pine straw will the stand produce?

The amount of pine straw produced depends on several stand conditions. Among the major factors are basal area, age, and site index. Basal area is a measurement of density; it is the area of the cross sections of tree trunks at 4.5 feet and is usually reported in square feet per acre. Stands with higher basal areas tend to produce higher amounts of pine straw. For more information on basal area, see Extension publication ANR-1371, “Basal Area: A Measure Made for Management.” The amount of needle fall may also depend on the age of trees in the stand. Stands suitable for pine straw harvesting are usually raked starting when they are around 6 to 10 years old and continue to be raked regularly until the first thinning. The maximum yield for pine straw is estimated to be around age 15. As trees mature, pine straw productivity will decline. Site index is a measure of the overall productivity of a site and is based on the average heights of the tallest trees in a stand at a given base age. Site index can also affect the amount of needles produced—a stand with a higher site index will likely yield higher amounts of pine straw.

A number of publications provide estimates for pine straw yields based on different stand characteristics. Table 1 shows how yields may vary widely depending on location, species, basal area, stand age, and site index. Landowners should consider the variability of pine straw and use caution when determining expected yields or income from pine straw harvesting operations.

Are the stand characteristics favorable for pine straw harvesting?

A number of stand characteristics determine the suitability of the stand for pine straw harvesting. Landowners need to understand how these characteristics affect efficiency and profitability of pine straw operations. Pine straw can be collected from both natural stands and plantations. It is frequently collected from plantations (figure 1) where evenly spaced trees facilitate mechanical gathering in which needles are collected and bundled using a tractor-powered baler. Pine straw harvesting in natural stands is often done by hand-raking and by using a simple box baler (figure 2). Because harvesters can maneuver between trees more easily than equipment can, there may be fewer preparations involved than if the site were a plantation to be mechanically harvested.

Stand density (the number of trees per acre) and the spacing of trees (distance between trees or rows in



Figure 2. Hand raking pine straw in a planted longleaf pine stand in south Alabama. (Photo credit: Becky Barlow)

plantations) also affect the feasibility of harvesting and the baling technique used. Commercial raking operations often bale mechanically. Needles are collected by tractor-drawn rakes and then bundled together. Optimum row spacing depends on the size of the equipment to be used, but at least 8 feet is usually needed between rows of trees. Mechanical harvesting may require pruning of lower limbs from trees. To protect health and quality of standing trees, do this pruning by hand (figure 3).

What property characteristics are conducive to pine straw harvesting?

Certain property characteristics are conducive to harvesting pine straw just as they are with harvesting for timber. If a stand is to be mechanically raked, accessibility requirements are important to accommodate machinery (for example, the presence of entry roads or tree rows wide enough to safely operate a tractor). A stand may need to be commercially mowed or have large debris removed to gain or maintain access. The stand needs to be flat with few or no terraces. A sloping stand, especially a natural stand where vegetation has not been controlled, is not an ideal site for mechanical harvesting of pine straw.

Pine straw sales are largely unregulated and illegal raking (known as poaching) occurs, so landowners should consider ways to minimize such risks. Another consideration is storage. Often after the pine straw is baled, it is loaded onto a closed trailer where it remains until it is hauled to the retailer or other sale point; therefore, the site may need to accommodate such a trailer for whatever length of time it takes to complete harvesting operations.

Objectives and Management Strategies

Pine straw harvesting does not fit every landowner's needs. When considering pine straw harvesting, landowners must examine their overall objectives and decide whether pine straw would hinder other land uses, such as managing for wildlife or timber production, that may involve treatments incompatible with pine straw operations. Plans for wildlife habitat may call for wide tree spacing and fewer trees per acre (for example, bobwhite quail plans often call for fewer than 400 trees per acre to provide sufficient sunlight and retain seed-producing plants). This is not ideal for pine straw production. Because pine straw harvesting requires limiting understory debris and vegetation that often serve as habitat and food for animals, straw removal may not be a good fit for landowner objectives (figure 4). Other land use objectives, however, may be compatible with pine straw. In fact, many silvicultural practices used for timber management may also be applied when managing for pine straw. Whatever decisions are made regarding the land, a management plan should be in place and continually evaluated.

Questions to ask:

How will fertilizer treatments affect pine straw production?

On low fertility sites and those cut over or with low water-holding capacity, fertilizer can increase production of pine straw. If fertilizer is not used on stands raked annually, diameter growth may decline significantly for several years after raking ceases. However, on highly fertile sites and old fields with good nutrient and water-holding capacity, fertilizer has not proven to increase pine straw yields beyond one year. Reports



Figure 3. Hand pruning of lower branches facilitates mechanical harvesting of pine straw and can improve tree form. (Photo credit: Becky Barlow)

show that in unthinned stands with high basal area, fertilizer and annual raking can lead to increased tree mortality and disease.

According to one source, fertilization on nutrient-limited sites has been shown to generate a return on investment through increased pine straw production. The need to fertilize may also depend on what species of pine you have; different species respond to fertilization in different ways. Loblolly stands are likely to need fertilization more than stands of other species. In fact, overfertilization in longleaf forests can make trees more susceptible to insects and diseases, such as pitch canker.

A laboratory analysis of the soil and needles can identify nutrient deficiencies and help determine if fertilization is needed on your lands. Such analyses can also determine likelihood of response to fertilizer in terms of timber production. For more information on soil samples and testing, see Extension publications ANR-0006-A, "Home Soil Testing: Taking a Sample," and ANR-0006-B, "Home Soil Testing: Using the Soil Test Report."

How will herbicide treatments affect pine straw production?

Good competition control is necessary to keep raked stands clean. Early herbicide treatments ensure that a landowner can harvest needles from a higher percentage of the stand. Harvesting pine straw opens the forest floor, facilitating new undergrowth. A herbicide regime, therefore, may be necessary to control herbaceous material and hardwoods to maximize quality pine straw production.

How will prescribed burning affect pine straw production?

As with all silvicultural treatments, use and scheduling of prescribed burning depend on landowner objectives and stand conditions. Burning is commonly applied before the first pine straw harvest. Regular burning may also continue during pine straw harvest years (for example, to promote grass growth for wildlife). If properly timed, burning can help control growth of unwanted species, such as hardwoods, and also promote needle drop.

Winter burns can help encourage growth of legumes and forbs favored by wildlife species. If scheduled late enough in the season, a winter burn should not affect pine straw raking. Spring burns are often conducted to reduce hardwood species and likely would not interfere with raking operations. Late-summer burns are sometimes used to prepare a site for natural seedling



Figure 4. Because pine straw harvesting requires limiting understory debris and vegetation that often serve as habitat and food for animals, straw removal may not be appropriate for every acre a landowner has. (Photo credit: John Gilbert)

establishment. A burn at this time may also clear the forest floor before needle fall. Remember that burns can influence the effectiveness of other treatments, such as application of herbicide or fertilizer. Consult a professional when making decisions about implementing a burning program.

Natural needle fall is usually heaviest in the fall months (September, October, and November). Time burns before this season to promote needle drop. If raking every other year, schedule burns in off years during whatever season best suits the landowner's needs.

How will thinning affect pine straw production?

Thinning is often a routine part of timber management plans. It can improve and maintain forest health and vigor, often while providing the landowner with mid-rotation income. When a stand is thinned, leftover tree limbs and other debris should be cleaned up before raking straw again. Thinning also opens the stand allowing more sunlight to reach the forest floor, leading to new undergrowth, which may require control. Pine straw harvesting sometimes ends with that first thinning, but once the debris is cleaned up and understory growth is under control, pine straw harvesting can usually resume.

How will pine straw removal affect the site?

Pine straw provides many mulching benefits, making it a valuable commodity among landowners and homeowners. Pine needles provide protection against surface erosion and moderate soil temperature and moisture, and they inhibit growth of weeds. But it's these same characteristics that make pine straw a valuable resource on the forest floor as well.

Pine forests provide important benefits to the environment and to many wildlife species. Studies show that raking increases loss of vegetation species in the understory of longleaf forests. These losses, however, may be temporary. In one study, losses observed and the length of time those effects were experienced differed based on other site conditions. Landowners need to be aware, especially if managing simultaneously for wildlife, that the understory may experience these kinds of disruptions. Landowners should also be vigilant about identifying and controlling invasive species, such as cogongrass. Equipment—even people—can spread seeds when operating in contaminated areas.

How will pine straw removal affect water resources?

Raking pine straw can potentially negatively affect the quality of local water resources. Raking annually can lead to decreased soil infiltration rates, increased runoff volume, greater sediment loads, and increased soil erosion. These effects can be more severe on longer or steeper slopes. Stands with more frequent raking schedules have demonstrated increased concentrations of phosphorus, nitrogen, and carbon in runoff collected following raking of research plots. Pine needles have great water-holding capacity, and litter on the forest floor can also reduce evaporation from the ground surface. Vehicle traffic and use of heavy machinery can also lead to soil compaction, which can lead to increased runoff and reduce plant uptake of water and nutrients. Soil compaction also impedes root growth and can affect soil temperature and decomposition rates of organic matter.

How can negative effects of pine straw harvesting be mitigated?

Negative impacts created by pine straw harvesting may be minimized by less-frequent harvesting schedules and utilization of best management practices (BMPs), especially on steep slopes or soils susceptible to erosion. Recommendations for landowners include leaving organic matter as undisturbed as possible during raking, raking only during dry conditions, raking every other year or every two years, and raking earlier in the season (for example, in October) so additional straw can accumulate postharvest and provide cover until the next harvest. During the interval between pine straw harvests, a cover crop of cool-season grasses can be planted to help protect the soil, suppress growth of weeds, and add soil organic matter. It can also serve as livestock forage.



Figure 5. Pine straw is often baled into round (left) or square (right) bales. (Photo credits: Becky Barlow, photo of round bales, Janice Dyer, photo of square bale.)

Pine Straw Market

Pine straw harvesting operations require some upfront investment from the landowner. One of the biggest expenses is preparing the land and making sure it is clean and free from debris, such as dead wood, pine cones, or tree limbs, and unsuitable vegetation, such as hardwoods, vines, or shrubs. Before making these kinds of investments, landowners must first ensure that there's a market and understand its demands.

Questions to ask:

Is there local demand for pine straw?

Demand for pine straw may vary from region to region. Landowners should make sure that there is someone who wants to buy pine straw and that their pine straw meets the quality specifications of the buyer. Some buyers have characteristic preferences. For example, they may prefer round bales to square bales (figure 5). Other preferences include baling technique (hand-raked or mechanically baled), bale binding (twine or wire), and species. One of the most important characteristics buyers look for is bales that are free of debris, such as sticks, cones, vines, or leaves. Landowners need to be aware of these preferences and what they require in terms of forest management.

Demand may also vary from season to season. Pine straw can be harvested any time of year but is usually done after the main needle drop in fall (September through November). It is best to harvest straw when it is dry—wet straw is heavier and can mold when baled and stored. Baled pine straw is usually stored on-site in a closed trailer until harvesting operations

are complete. Proper storage is important because peak demand for pine straw from homeowners and landscapers is usually in spring—months after the straw has been harvested.

What type of contract is appropriate?

Landowners can collect pine straw themselves, usually by hand raking and using a box baler (figure 2). Landowners must then not only perform hard manual labor but also market the pine straw themselves, receiving payment on a per-bale basis. This process is labor and time intensive and requires investment in equipment.

Landowners usually sign contracts with a pine straw dealer. Before signing a contract, a landowner may seek sealed bids, especially if he or she has a lot of land with high-quality pine straw. In most cases, contracts between landowners and pine straw dealers are either on a per-bale basis or a per-acre basis. If paid on a per-bale basis, the landowner may be responsible for ensuring a proper bale count. The price should also be for a specified bale size. If paid on a per-acre basis, the landowner is paid a set amount per acre per year, regardless of the number of bales that come off the site. Prices paid will vary depending on the condition of the site and, therefore, should fluctuate with changes in stand condition. The amount paid may also vary depending on the level of involvement by the landowner and his or her willingness to prepare and maintain the stand. It is always a good idea to have a professional look at any contracts before signing.

Are there reliable contractors who can do the work?

Most landowners who have a contract with a pine straw dealer are likely to use harvesters hired by a forest labor contractor. Landowners need to find out whether reliable contractors are available and what distance the workers are willing to travel. When hiring a contractor, it is a good idea to request references or ask others who have used the contractor about their experiences. Landowners also need to make sure any contract they sign specifies conditions of sale, when the baling will occur, when payment will be made, and what will be done about any damage done to trees during the harvesting operations. Landowners or a trusted friend or relative should visit the site during harvesting to make sure that workers are using appropriate management practices and fulfilling contractual obligations.

Summary

Pine straw offers landowners the opportunity to earn short-term income while managing their property for other land uses. However, there are a number of important factors to consider before investing time and money into pine straw harvesting operations. Owners must first consider what is biologically possible on their sites. Second, they must carefully evaluate current management plans and whether pine straw operations would interfere with other land uses and ownership objectives. And, third, before investing in site preparation or signing contracts, landowners must ensure that their product has a market and meets quality specifications.

Table 1. Pine Straw Yields Reported in Publications

Publication	Location	Criteria	Stand/criteria description	Bales per acre per year	Bale size
Dickens et al. 2005	U.S. Southeast	Species	Loblolly Slash Longleaf	150 to 275 125 to 250 80 to 200	NR ¹
Taylor and Foster 2004	Texas	Basal area	Loblolly, 75 sq.ft./ac. Loblolly, 125 sq.ft./ac.	125 175	30 lbs
Duryea 2000	Florida	Age	Longleaf, 6 years Longleaf, 10 years Longleaf, 15 years Longleaf, >15 years	50 to 75 125 to 200 200 to 300 ~200	NR
Hayes et al. 2009	Southeast Georgia	Average	Slash, spacing ranging from 726 to 807 trees per acre, average over nine years	238	NR
Blevins et al. 2005	North Carolina and South Carolina	Site index and basal area	Longleaf, site index of 60, basal area of 80 sq.ft./ac. Longleaf, site index of 90, basal area of 180 sq.ft./ac.	88 192	25 lbs
Gholz et al. 1985	Northern Florida	Age	Slash, average from 6 to 36 years Slash, peak age (15 to 16 years)	115 160	25 lbs
Gresham 1982	Coastal South Carolina	Average weight of pine foliage ²	Loblolly, 90 to 100 years old, basal area of 44 sq.ft./ac. Longleaf, 130 to 140 years old, basal area of 47 sq.ft./ac.	156 74	NR ³

¹NR = not reported

²Excluding wood, fruit, and foliage from other species

³Weights given in kilograms per hectare; converted to pounds per acre and divided by 25 to get estimated number of bales

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