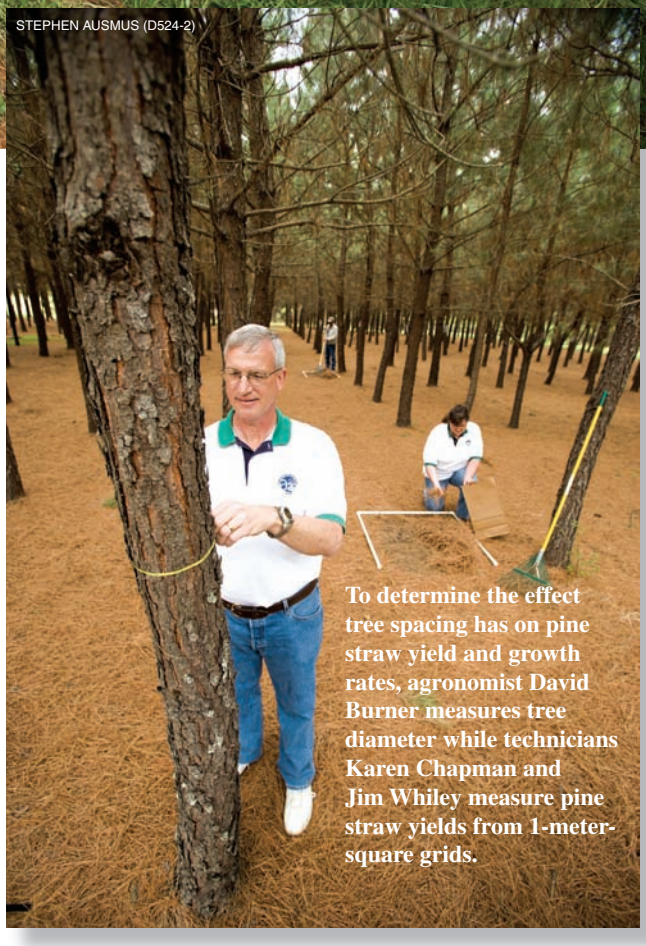
STEPHEN AUSMUS (D525-31)

Pining for Profits and Healthy Forests

The left part of this pine stand is unfertilized, unplanted, and covered with pine straw. The right side is planted with a ryegrass cover crop that has been fertilized.

STEPHEN AUSMUS (D524-2)



To determine the effect tree spacing has on pine straw yield and growth rates, agronomist David Burner measures tree diameter while technicians Karen Chapman and Jim Whiley measure pine straw yields from 1-meter-square grids.

Agricultural Research Service (ARS) scientists in Arkansas want commercial growers of pine trees to get the most from their stands without harming the land on which the trees grow.

Raising pine is a multimillion-dollar business that constitutes essential portions of the U.S. lumber and paper industries. But it has a major economic drawback: It can take 30 years or more for a stand to mature and turn a profit.

That's why Daniel Pote and David Burner, scientists at ARS's Dale Bumpers Small Farms Research Center in Booneville, are studying 60 acres of pine trees at and near the center that have been devoted to research on environmentally friendly ways to boost growers' earnings.

The work of these researchers falls within the center's mission to develop scientific principles and technologies to enhance profitability and sustainability of small-scale farms. The facility is a partnership of two USDA agencies—ARS and

STEPHEN AUSMUS (D525-2)

To determine forage quality and nitrogen content, soil scientist Dan Pote (left) and technician Steve Haller collect samples of cool-season forage (annual ryegrass) planted in the alleys of a 21-year-old loblolly pine stand.

the Natural Resources Conservation Service—and the University of Arkansas.

One way pine growers increase profits is by harvesting fallen pine needles, called "straw," for use as landscaping mulch. "But even with these needles in the equation, it takes awhile before the pine stands generate significant money," says Burner, an agronomist. "It takes 8 to 10 years before you can harvest pine straw from a stand, depending on tree spacing and other factors. After about 15 years, you can conduct thinning, where you cut down and sell your worst trees. Then it will be at least another decade before you can process your best wood."

Burner is examining how spacing and fertilization of 11-year-old trees affect pine straw yield. "A main goal of ours," he says, "is to provide data that can help growers make money from their pine stands during the long rotation while keeping the stands' environment intact and viable."

Needles Protect the Forest

Pote, a soil scientist, is examining this ecological challenge from the standpoint of pine straw harvesting. "These needles have substantial economic and agricultural value," he says. "Not only are they attractive when used as mulch, but they also release nutrients, protect the soil surface from erosion, conserve soil moisture, moderate soil temperature, and inhibit weed growth."

He says horticultural specialists like pine straw because the needles tend to interlock and stay in place better than most other mulches—especially during strong storms—while still retaining a loose, open structure that allows air, nutrients, and water to easily reach the soil surface.

But Pote is concerned that forests and related watersheds from which pine straw is harvested could suffer from the loss of these benefits. "The needles that accumulate on the forest floor absorb the impact of raindrops, slow water runoff, and increase

the land's water-holding capacity. Removing them can leave a forest floor vulnerable to natural damage," he says.

Pote and collaborators, including soil scientist Brandon Grigg of ARS's Soil and Water Research Unit in Baton Rouge, Louisiana, examined whether these environmental concerns are justified and how harvesting practices can minimize water-related damage.

Working in a 16-year-old pine stand with tree spacing of about 10 feet by 5 feet, they compared three pine straw harvesting practices to control plots where no straw was harvested. They simulated rainfall to produce 20 minutes of runoff from each plot and gauged effects of the harvesting on water, soil, and nutrient losses in the runoff.

DAN POTE (D527-1)

Using a rainfall simulator, technician Steve Haller collects runoff from a loblolly pine stand to determine the effects of pine straw harvesting on water, soil, and nutrient losses.

Harvest Less Often

"We found that pine straw harvesting does indeed increase runoff, soil erosion, and some nutrient loss," says Pote. "But these effects were decreased by less frequent harvesting."

Pine straw and forage cover can help pine growers profit in their wait for harvest.

Pote recommends a management plan calling for harvesting every second or third year. "Fungal growth and decay turn the straw that stays on the ground for more than one season into a mat that adds extra protection to the soil," he says. "By the second year, the effects of the harvest seem to be mitigated."

Pote says other methods worthy of consideration include growing forage under the pine-tree canopy to hold the soil in place when straw is removed. "And another, easily applicable management practice would be to harvest the straw earlier in the season—say October instead of December. That way, there can be some needle fall afterwards that will help protect the forest floor for a longer period."

Pote conducted another study in which he examined pine straw harvesting's effects on tree growth and death rates.

He looked at four different management practices, comparing how 24 plots of loblolly pine fared with and without fertilizer additions. "The harvesting had no significant effects on tree growth and overall survival during the 7 years of the study, regardless of fertilizer applications," Pote says. He cautions, though, that other published studies have shown a decrease in tree growth with straw harvest if nutrients aren't added.

Consider Silvopasturing

Meanwhile, Burner is studying how wider applications of agroforestry practices involving pine can boost income from millions of farm acres that are of marginal quality for crop production.

His focus is on silvopasturing—a practice that combines tree growing with forage and livestock production. It may allow for pine production as a long-term investment while generating short-term income from either harvesting pine straw or grazing livestock on cool-season, shade-tolerant forages.

"A goal here is for the grass cover to help minimize soil and water losses between straw harvests," Burner says. "Agroforestry offers the pine industry the potential to decrease financial risk, increase farm receipts through commodity diversification, increase agricultural sustainability, and improve use of natural resources."

Burner says that an essential aspect of pine agroforestry is the spacing and orientation of trees to maximize forage and wood production. "It gives the grower options. At close spacing, pine stands can generate about $500 per acre from each pine straw harvest as soon as 8 years after planting. And several reports have shown that silvopasture practices can produce enough forage for economically viable livestock for about 20 years under typical management schemes."—By **Luis Pons,** ARS.

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