Adding Bioenergy to the Agroforestry Mix

by Sarah Farmer

The **USDA National Agroforestry Center** (NAC), a partnership between SRS, **Forest Service State and Private Forestry**, and the **USDA Natural Resources Conservation Service**, studies how *Working Trees* (also called agroforestry), can be put to work on farms, ranches, and in communities doing important tasks such as improving water quality, controlling soil erosion, increasing sustainable agricultural production, providing wildlife habitat, and sequestering carbon. Scientists at the NAC investigate the economic and ecological payoffs associated with agroforestry practices and offer tools and training to natural resource professionals so that they in turn can help landowners get the most out of their land. **Michele Schoeneberger**, NAC research project leader, also examines how these same practices, be they windbreaks, riparian forest buffers, or alley cropping systems, can contribute to bioenergy production while providing multiple other services.

Bioenergy is in the spotlight these days, with much interest in identifying alternative biofuel feedstock sources. Fast-growing, energy-rich perennial grasses such as switchgrass—grown as part of an agroforestry system—show particular promise as feedstocks for the next generation of biofuels. Efficient production of transportation fuel from wood is still a ways off, but short-rotation woody crops have been grown in dedicated plantations and used for electric power generation for over a decade, especially in states with renewable portfolio standards in place. Wood can also be cofired in existing coal-powered plants or serve as the primary fuel in the smaller combined heat and power (CHP) and advanced wood combustion (AWC) plants that are popular in Europe and gaining increasing interest in the United States as providing a more local solution.

Working Trees is all about local solutions. "With *Working Trees*

Switchgrass, which can be grown as part of an agroforestry system, shows promise as a feedstock for the next generation of biofuels. (photo by Steve Jurvetson, courtesy of Wikimedia)

practices, you have a system that can do 'double duty,' providing the added conservation services, especially for water-quality protection, needed to make monoculture biomass (both grain and cellulose-based) production more sustainable," says Schoeneberger. "That crop (trees) can also serve as an additional source of biomass for energy use, be it in CHP systems for on-farm, schools or other local use, cofiring, or production of transportation fuels."

Several agroforestry practices lend themselves to this double duty, such as windbreaks planted with fast-growing woody species and riparian forest buffers planted with both perennial herbaceous and fast-growing woody species in the outer zones. This last agroforestry approach expands the benefits that riparian forest buffers already provide by improving soil and water qualities. Working with several other university partners, NAC scientists are evaluating which species combinations and management strategies optimize both the production of biomass and environmental services.

Since windbreaks and riparian forest buffers generally make up only a small part of a farm operation, integrating biomass production into new or existing agroforestry plots could serve as a means for landowners to transition into a cellulosic-based bioenergy production system while minimizing the risk of investing solely in a new production arena. Alley cropping or silvopasture practices provide landowners the opportunity to establish a system that provides revenue from established markets that can be converted to produce biomass feedstocks when the technology is available and markets are favorable.

"Shifts in farm policy, programs, and markets will be necessary to the make adoption of agroforestry practices for bioenergy production more attractive to landowners," says Schoeneberger. One such program, **USDA's Biomass Crop Assistance Program** (BCAP), provides funding for landowners who sell eligible biomass to approved conversion facilities that generate heat, power or biofuels. Through BCAP, eligible producers of qualified renewable crops can receive up to 75 percent of start-up costs, plus annual payments.

Riparian buffers act as "living filters" to protect water quality. (photo by Lynn Betts, courtesy of USDA Natural Resources Conservation Service)

Native grasses in a conservation buffer. (photo by Lynn Betts, courtesy of USDA Natural Resources Conservation Service)

Armed with knowledge from agroforestry research, land managers can choose species and practice designs based on their ability to improve water quality, enhance biodiversity, or other purposes.

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Including biofuel production in the mix will require investigating the bioenergy properties, biomass yield, plant resilience, and potential for invasiveness of biofuel crops. The need for renewable fuel sources is real and here to stay, and woody biomass as part of a larger portfolio of renewable resources offers landowners another way to make money while improving the value of their land. Generating bioenergy from local wood sources can also stimulate local economies, especially when materials are transported less than 50 miles.

Agroforestry practices offer an array of economic, ecological and esthetic rewards. Each day, *Working Trees* show us what they can do—reclaiming soil and water, producing an alternative energy source, providing landowners an additional income source, and improving our quality of life by connecting the landscape with green infrastructure.

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Learn more about *Working Trees* from the USDA National Agroforestry Center: www.unl.edu/nac

Recommended reading:

Bentrup, G. 2008. **Conservation buffers: design guidelines for buffers, corridors, and greenways.** Gen. Tech. Rep. SRS-109. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 110 p.

Schoeneberger, M.; Bentrup, G.; Current, D. [and others]. 2008. **Building bigger better buffers for bioenergy.** Water Resources Impact. 10(3): 22–25.

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The Advantages of Agroforestry

by Chris Fargo-Masuda

The **USDA National Agroforesty Center**, headquartered in Lincoln, NE, develops and delivers technology on a broad suite of agroforestry practices and associated technologies to improve their economic, environmental, and social benefits and increase the use of agroforestry in the United States.

Agroforestry, the blending of agriculture and forestry practices, allows landowners to realize maximum profit from their land. By using a few simple agroforestry practices landowners can realize economic benefits while simultaneously enhancing the sustainability and productivity of their land.

Agroforestry can be grouped into five basic practices:

- **Silvopasture** is the practice of combining forest or timber crops with grazing areas for livestock. Rows of trees are sparsely planted to allow livestock to graze on the grass which grows between. The timber crop is harvested when trees reach maturity.
- **Alley cropping** uses similar practices, with agricultural crops taking the place of livestock between rows of harvestable trees. Crops of corn or soybeans planted between rows of black walnut trees are examples of alley cropping.
- **Riparian forests** and upland buffers are trees and shrubs planted along the banks of streams and bodies of water. These "living filters" protect the health and quality of the waterways by capturing excess nutrients from fertilizers, reducing erosion, and providing food and cover for native wildlife.
- **Windbreaks** use trees as protective barriers for wind-sensitive crops and livestock. Windbreaks reduce erosion, decrease animal mortality by reducing stress, and provide shade. Through the choice of trees, windbreaks can also serve as an income-producing crop by themselves.
- **Forest farming** is the emerging practice of cultivating high-value crops such as ginseng, shitake mushrooms, and decorative ferns in maintained-forests environments. These crops can provide a short-term income while high-quality wood products mature.

In addition to the proven economic benefits of agroforestry practices emerging markets may open a wide array of opportunities. As the effects of climate change create new markets like carbon offsets and demand for biomass energy, agroforestry is poised to benefit.

For more information:

www.unl.edu/nac/

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