



# A Win-Win on Agricultural Lands

## CREATING WILDLIFE HABITAT THROUGH AGROFORESTRY

By Gary Bentrup



Credit: Cara Bentrup

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The 2014 Farm Bill reduces conservation program spending by \$6 billion—the first decrease in conservation funding by a Farm Bill since the inclusion of conservation incentives in 1985. These funding cuts will impact habitat enhancement on private lands, typically accomplished through Farm Bill incentive programs such as the Conservation Reserve Program (CRP) and the Wildlife Habitat Incentives Program (WHIP). CRP lands alone will shrink from 32 million acres in the previous Farm Bill to 24 million acres by 2017 (NWF 2014). So the question becomes: What other options can produce economic benefits for ranchers and farmers while also providing wildlife benefits?

One key option in the toolbox is agroforestry—the intentional combination of agriculture and forestry to create an integrated and sustainable land-use system for the benefit of both landowners and wildlife. This integrated approach is essential, given that

nearly 51 percent of land use in the U.S. is dedicated to agricultural production (Nickerson et al. 2011). Farms and ranches are therefore a critical piece in the conservation puzzle, as actions taken on these working landscapes have an impact on wildlife and the health of ecosystems.

### Agroforestry and Wildlife

There are five basic types of agroforestry in the U.S., broadly known as alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks. Such approaches can be designed and managed as multipurpose systems that support food, fiber, and energy production while reducing negative environmental impacts and providing clean water, wildlife habitat, and other public services.

The types of wildlife that can benefit from such agroforestry practices will vary with region and eco-type and depend on the landscape context and size of the area and the types, spatial configuration, and age of the plantings. Alone or in combination, agroforestry approaches can provide multiple benefits to wildlife, as the following brief examples illustrate:

**Protect Aquatic Habitats.** Agroforestry practices provide living cover, which intercepts sediment, nutrients, and other materials in surface runoff and in shallow subsurface water flow, preventing them from getting into streams, lakes, or wetlands. Riparian forest buffers can also reduce bank erosion and in-stream sedimentation, and help maintain water temperatures for cold water fisheries.

In the Tucannon River in Washington, for example, spring Chinook salmon (*Oncorhynchus tshawytscha*) runs hit a low of 54 fish in 1995 and juvenile salmonids were absent in lower reaches of the river. Since 1999, over 1,100 acres of riparian forest buffers and other restoration measures have been implemented, reducing summer water temperatures by about 10 degrees Fahrenheit (Smith 2012). Young salmon are now using areas of the river that were previously too warm for them, and returning



Credit: Catherine Bukowski

**Forest Farming:** West Virginia landowner Dave Carman, right, discusses his forest 'crop' of false unicorn with USFS Research Forest Products Technologist Jim Chamberlain. False unicorn is a native medicinal plant with a market value upwards of \$50 per dried pound for the roots.

Chinook adults have increased in number to 1,239 in the year 2012 (Gallinat and Ross 2013).

**Stabilize Habitat.** Croplands are subject to frequent disturbances that can impact shelter and food sources for wildlife. Agroforestry practices offer more constant habitat in these shifting landscapes, and the woody structure and associated understory increase niche diversity. For example, often surrounded by an ephemeral sea of annual crops, multi-row windbreaks (created with woody species such as green ash, Osage orange, black walnut, and hackberry) can provide valuable year-around habitat for over 108 bird species and 28 species of mammals in the Midwest (Johnson and Beck 1988).

**Restore Forests.** Only 4 percent of longleaf pine forests remain in the eight states of the southeast coastal plain, a preferred forest type of the red-cockaded woodpecker (RCW) (*Picoides borealis*) (Franklin 2008). RCWs require large tracts of mature pine stands, with an open understory free of mid-story hardwoods. Silvopasture—the practice of combining forestry and rotational grazing—can create this habitat condition by using livestock to control understory vegetation. Annual income from livestock and long-term income from timber production give silvopasture an economic advantage over traditional forestry as a means to restore longleaf pine forests—land expectation values estimated at approximately \$1,800 more per acre over an 80-year rotation when compared to traditional forest plantation management (Stainback and Alavalapati 2004).

In the Lower Mississippi Alluvial Valley, declining populations of neotropical migratory birds have prompted restoration efforts of bottomland hardwood (BLH) forests (LMVJV 2014). Restoration strategies call for a 0.3-to-0.6-mile-wide buffer zone around a core BLH forest patch, a challenging requirement that can more than double the required forested area (Mueller et al. 1999). Using fast-growing tree species, agroforestry practices such as alley cropping and silvopasture can create early successional forest structure to function as those buffer zones (Dosskey et al. 2012). This approach can turn smaller, less-viable BLH forest patches (of 5,000 to 10,000 acres) into effective interior habitat and offer options for landowners who are not interested in converting their lands to BLH forests.



Credit: USDA-USFS National Agroforestry Center

**Riparian Forest Buffers:** Streamside plantings of trees, shrubs, and grasses serve as buffers that reduce water pollution and bank erosion, protect aquatic environments, and enhance wildlife habitat.



Credit: University of Missouri

**Alley Cropping:** Widely spaced rows of high-value trees such as black walnut and pecan create alleyways for crops, an additional source of cash flow for landowners, and provide habitat for birds and other wildlife species.



Credit: USDA-USFS National Agroforestry Center

**Windbreaks:** Rows of trees and shrubs planted in agricultural fields can reduce wind speed and the aerial spread of pesticides. In addition, they can improve crop yields, reduce soil erosion, improve water-efficiency, and protect livestock.



Credit: USDA-USFS National Agroforestry Center

**Silvopasture:** This agroforestry approach combines forestry, forage, and livestock production on the same field. The trees are managed for wood and, at the same time, provide shade and shelter for livestock as well as wildlife habitat.



Credit: Jessa Cruz

Blue blooms of native California lilac and other native shrubs and perennials form part of a one-mile-long hedgerow in Yolo County, California. Hedgerows have been shown to increase pollination activity from native bees and provide crop protection by harboring beneficial native insects over crop pests by a margin of three to one.

**Manage Pesticide Risks.** Current farming methods rely heavily on pesticides, which can have harmful effects on sensitive wildlife, particularly insects, amphibians, fish, and other aquatic species. Windbreaks, hedgerows, riparian buffers, or alley cropping can help contain drifting pesticides. Tree and shrub layers provide a large surface area over which particles of pesticides may adhere, and also provide wind-speed reduction at the application site, reducing the movement of pesticides off their target. In addition, woody species incorporated directly into cropping systems can reduce pesticide use by providing essential habitat for beneficial predators of crop pests. An alfalfa-walnut alley cropping system in eastern Missouri, for example, supported twice as many predators and parasitic hymenoptera and half as many pest herbivores as did alfalfa alone (Stamps et al. 2002).

**Restore Connectivity.** Agroforestry can decrease the impacts of habitat fragmentation by reducing habitat isolation if plantings are well planned and connected with other habitats. For example, in the Tensas River basin in northern Louisiana, a study documented corridor use by the threatened Louisiana black bear (*Ursus americanus luteolus*). In an area dominated by extensive crop fields, bears used riparian forest buffers, ranging in width from 15 to 250 feet, to travel between hardwood patches (Anderson 1997).

**Reduce Land Conversion.** Between 1982 and 2010, 24,125,400 acres of agricultural land were converted to developed uses—an area

approximately the size of Indiana (USDA 2013). Such conversion can transform farms and ranches into fragmented and extensively modified urban or suburban patches, much to the detriment of wildlife. Agroforestry can reduce such conversion by diversifying short- and long-term income sources, giving landowners economically-sustainable alternatives to selling their land for development. For example, the Travis family has saved their northern Illinois farm by using their 26-acre woodlot for forest farming (NAC 2006). “Harvesting and selling wild onions known as ramps from our woodlot generates almost 70 percent of our total farm income,” says landowner Marty Travis.

## Balancing Economics and Ecology

For all the benefits agroforestry practices can have, they may also prove detrimental to certain wildlife populations if they are located, designed, and managed inappropriately. For example, the creation of poorly designed edge habitat may benefit generalist species over specialists, promote parasitism, make prey species more vulnerable to predators, and facilitate movement of invasive flora and fauna. Hence, wildlife biologists should be involved in agroforestry projects to ensure the systems are designed to achieve desired wildlife goals and minimize potential negative impacts.

From California’s Central Valley croplands to southeastern pasturelands to New England woodlots, wildlife biologists are assisting private landowners and other resource professionals in implementing agroforestry systems that accomplish wildlife stewardship while producing economic services. Biologists from governmental agencies, nonprofit organizations, and consulting companies are using their expertise to benefit game and non-game wildlife as well as imperiled species.

In Tennessee, for example, riverine systems are biological hotspots where numerous fish and mussel species are at risk. More than 100 species of fish and mussels are listed as either federally threatened or endangered or are considered at risk, with many of them sensitive to water quality and riparian habitat conditions. As part of species recovery plans, the U.S. Fish and Wildlife Service (FWS) through their



Partners for Fish and Wildlife program (PFW) are relying on riparian forest buffers to enhance in-stream water quality and restore riparian functions. “Approximately 15 to 20 miles of riparian forest buffers are implemented each year in Tennessee,” says Bryan Watkins, a FWS private lands biologist. “These buffers are planted with native hickories and oaks, but we also rely on natural regeneration to aid in creating rich flora diversity.” While project monitoring data are still being collected, a recent land-cover assessment in the upper Tennessee River basin revealed that riparian buffers supported imperiled species by providing critical habitat functions such as shade cover, bank stability, and detrital input (Keck et al. 2014).

In another case from the southeast, in 2012 the nonprofit Appalachian Sustainable Development (ASD) group began a partnership with PFW to develop riparian buffers along streams in Virginia where private landowners had been reluctant to establish buffers due to concerns about losing productive croplands. The new buffers incorporate non-timber forest products (NTFPs)—such as medicinal herbs, decorative florals, craft materials, and edible fruits and nuts—that can be harvested and sold for a profit, providing a crop alternative and economic incentive for landowners to establish riparian buffers.

The NTFPs in this case include fruit- and nut-bearing plants such as plum, elderberry, blackberry, pawpaw, mulberry, persimmon, serviceberry, and shagbark hickory. One landowner couple is incorporating the fruit into their goat’s milk products for profit (i.e., elderberry goat cheese and pawpaw goat’s milk ice cream) while others plan to sell the fruits and nuts directly. As a result of this collaboration, 3.2 acres of NTFP riparian buffers were successfully created with the consent of four landowners in 2013, and more acreage is planned for 2014.

It’s impossible to consider the economics of food production without also considering the essential role of insect pollinators. More than 30 percent of our food production relies on insect pollination, overwhelmingly provided by European honey bees and wild native bees (Klein et al. 2007). Wild native bees number more than 4,000 species in North America and pollinate crops worth \$3 billion annually in the U.S. (Losey and Vaughan 2006). Yet wild native bees are in decline, particularly some species of bumble

bees, whose relative abundance has plummeted by 96 percent (Cameron et al. 2011). Habitat loss, pesticide misuse, and pathogens are some of the factors contributing to this decline (NRC 2007).

The Xerces Society, a nonprofit organization dedicated to invertebrate conservation, is promoting the use of native plant hedgerows as a means to support wild bees and other pollinators. In addition to providing floral resources, nesting sites, and pesticide-free havens for pollinators,



Credit: Nancy Adamson

this agroforestry practice can be used to control soil erosion, enhance habitat for beneficial insects and other wildlife, reduce water pollution, stabilize waterways, and enhance visual aesthetics (Adamson et al. 2011).

Xerces’ biologists publish guides for hedgerow plantings and offer training to farmers and officials interested in using this practice. Based on their efforts and their many partners, over 17 miles of hedgerows have been installed in Yolo County, California since 2010. “These hedgerows have been shown to provide increases in crop pollination services from native bees and pest control by natural enemies in adjacent fields, such that the establishment costs for a hedgerow could easily be recouped in six to nine years,” says Xerces’ pollinator specialist Jessa Cruz. “In addition, native bee species richness is at least 50 percent greater in the hedgerows than in control sites.” Given such results, interest in this multi-purpose practice is growing.

A southeastern blueberry bee (*Habropoda laboriosa*) visits a redbud tree in a Florida hedgerow. This bee species is considered the most efficient pollinator of southern rabbiteye blueberries, as the flowers require buzz pollination, and *H. laboriosa* is one of the few bees that exhibit this behavior.



Credit: Richard Straight

Missouri farmer Terry Durham discusses growing elderberries in an alley-cropping system. Use of elderberry fruit and flowers—for wine, juice, jelly, and dietary supplements—is on the rise, making this a valuable crop. Durham's talk was part of a week-long training for growers and natural resource professionals from seven states, hosted by the Agroforestry Center of the University of Missouri.

## Forest Service Efforts

Agroforestry as a sustainable land-use strategy is gaining traction and widespread support, particularly since the release of the [USDA Agroforestry Strategic Framework](#) in 2011. The Framework provides a roadmap on how USDA agencies, partners, and landowners together can expand agroforestry to achieve agricultural production with natural resource conservation. This growing momentum has been documented in [Agroforestry: USDA Reports to America](#), which provides information from 2011 and 2012 on the department's support for agroforestry told through case studies of farmers and woodland owners using agroforestry practices.

For example, using USDA financial and technical assistance programs, the regional Alaska Native Cooperation called Sealaska thinned its young-growth forests near Kake to promote their forest farming operations for Alaskan wild blueberry. Sealaska manages 30,000 acres for timber, wildlife, and understory plants so that its shareholders—all tribal members—can hunt, fish, and gather. Residents are able to harvest 200 pounds of blueberries at a time and can earn more than \$600 for a day's work—a significant wage in a town where the per capita income is slightly more than \$22,000 per year ([USDA 2012](#)). Managing for the blueberries has also increased the diversity of plants in the understory, enhancing habitat for wildlife such as Sitka black-tailed deer (*Odocoileus hemionus sitkensis*).

Serving as the USDA's primary center for developing and delivering agroforestry science and technology is the National Agroforestry Center (NAC) located in Lincoln, Nebraska. NAC is a unique partnership between two branches of the U.S. Forest Service (USFS)—Research and Development and State and Private Forestry—and the Natural Resources Conservation Service (NRCS). This collaboration is charged with conducting research, developing technologies and tools, coordinating trainings, and delivering technical information. NAC also relies on an extensive network of partners including Agricultural Research Service, National Institute of Food and Agriculture, universities, and others to carry out its mission.

One of NAC's most valued activities is synthesizing and distilling scientific information on agroforestry into actionable tools. For example, a report titled "Riparian Buffer Design Guidelines for Water Quality and Wildlife Habitat Functions on Agricultural Landscapes in the Intermountain West" ([Johnson and Buffler 2008](#)) presents a procedure for determining buffer widths and management techniques to optimize riparian ecosystem benefits. Another tool is [Agroforestry Notes](#), a technical note series that provides information in a useful how-to format, with wildlife-based topics such as designing agroforestry practices for pollinators, upland birds, and other species.

With increasing demands from society for limited resources, agroforestry will likely be one source of solutions as people find it increasingly necessary to achieve multiple social, economic, and ecological objectives on the same plot of land. Indications are that this is a growing field, so wildlife biologists of the future may want to consider incorporating agroforestry into their career development. As one student who recently completed an agroforestry class at Virginia Tech states, "It changed the way I look at problem-solving. Instead of insulating factors, taking a holistic approach is very real-world applicable and valuable." ■

*This article has been reviewed by subject-matter experts.*



For a complete bibliography and additional resources, go to [news.wildlife.org/twp](http://news.wildlife.org/twp).