USDA National Agroforestry Center

Inside Agroforestry

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Originial photo courtesy of Kasten Dumroese

Small, but mighty

IT'S true, there is a relatively small budget for agroforestry research and there are a limited number of scientists working in the field.

However, with strong partnerships and a focused research program, the USDA National Agroforestry Center (NAC) is rooted in fertile soil and takes advantage of being a GMO (government modified organization) that is a unique hybrid of Forest Service Research, State & Private Forestry, and the Natural Resources Conservation Service.

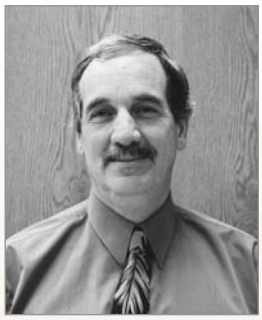
Similar to the improved seedlings above, NAC is a small research facility with enhanced productivity. By cultivating partnerships and leveraging resources, valuable tools and information are unleashed that are answering the right questions that pay off big in the field.

Take a look inside this issue of "Inside Agroforestry" for the latest information about what is happening with agroforestry research.

Inside

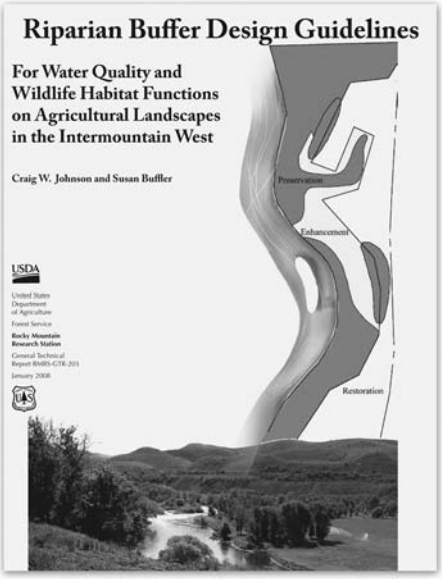
NAC Director's Corner

A commentary on the status of agroforestry by Dr. Greg Ruark, NAC Program Manager



In search of answers

TREES in an agroforestry system are intended to be *Working Trees* that produce conservation and/or economic benefits. However, research is often needed to help landowners achieve these intended goals. When trees are incorporated into on-going farm or ranch operation, or an existing tract of forest is modified, science helps us to understand how an intended agroforestry system functions to produce the desired benefits. Examples include studies done to determine the most effective planting density and arrangement of shelterbelts for reducing wind velocity in adjacent crop fields in order to lessen soil erosion and evapotranspiration loss. Other studies help determine the best mixture of trees, shrubs, grasses, and other plants to establish in a denuded riparian zone to restore a functioning riparian forest ecosystem that can protect water quality, reinforce stream banks, and enhance wildlife habitat. Spatial models provide insight into where in a watershed to locate upland and riparian buffers to optimize conservation benefits at the landscape scale. Research also develops the maintenance protocols to keep agroforestry practices economically productive and environmentally functioning. In situations where a tract of forest already exists, agroforestry research is studying ways to modify the understory to encourage the propagation and growth of a wide variety of commercially valuable non-timber forest produces, such as black cohosh, goldenseal, and ramps. This includes efforts to determine nursery protocol for producing and outplanting many species of native understory plants. To help improve economics, silvopasture research is providing landowners the information needed to blend timber production, livestock grazing, and wildlife benefits on the same tract of land. Although the national investment in agroforestry research has been modest, significant progress has been made to clearly demonstrate the high potential that agroforestry practices hold for landowners.



Riparian Buffer Design Guidelines

For Water Quality and Wildlife Habitat Functions on Agricultural Landscapes in the Intermountain West

By Craig W. Johnson and Susan Buffler

THIS handbook provides a step-by-step protocol for determining optimal (variable) buffer widths for water quality and wildlife that maximize riparian ecosystem benefits and minimize the loss of productive farm and ranch land. It contains a companion CD including a case study, data forms, worksheets, reference appendices, and other informational material.

General Technical Report RMRS-GTR-203 available at *www.fs.fed.us/rm/publications/* or at *http://treesearch.fs.fed.us/pubs/viewpub.jsp?index=29201*.

NAC scientists are researching site, landscape, and regional scale applications of agroforestry.

Original photo: NAC file photo

NAC Research: covering a lot of ground

Kimberly Stuhr
Technology Transfer Specialist / *Inside Agroforestry* Editor, Lincoln, NE

THE wonderful thing about agroforestry is that agroforestry practices, properly located and designed, can help tackle environmental and production issues at many levels.

Traditional agroforestry practices, like windbreaks, riparian forest buffers, and alley cropping are rooted in farm and ranch lands where they convert land back to permanent vegetation and help improve and diversify a landowner's income. Here, agroforestry conserves soil, reduces home and farm energy consumption, and diversifies and protects crops and livestock.

When carefully planned and designed, agroforestry also addresses non-farm issues, like enhancing outdoor education and aesthetics. Many, small- to mid-sized acreage homeowners are more motivated by scenery, wildlife, and privacy than they are by production. Consequently, a network of agroforestry natural areas and parks among agricultural, acreage, and urban developments provide these amenities to homeowners, all the while creating a sense of place and community.

While agroforestry practices on farms and in and around communities are busy reducing soil erosion, increasing crop production, and creating greenways they are providing additional benefits to the public. These benefits, like water quality, wildlife habitat, pollination services, and carbon storage are called ecosystem services and are extremely important socially, economically, and ecologically.

The unique collaborative approach used by scientists at the USDA National Agroforestry Center has far-reaching effects. By identifying technology gaps and working with partners, they are strategically developing conservation and production technologies for private lands. These tools and methods influence the way individual landowners do business and the benefits we all derive from it.

Some assembly required * tools included

Mike Dosskey, Research Riparian Ecologist; **Gary Bentrup,** Research Landscape Planner; Lincoln, NE

TOOL development guides most of the tree-based buffer research at NAC. NAC researchers in Lincoln review and organize scientific knowledge and then synthesize and distill that knowledge into a form that helps land managers make everyday decisions about where to install a practice, how to design it, and how to manage it in order to achieve desired results. These tools help to ensure that agroforestry practices will be successful.

Deciding what tools to work on is a constant challenge. We continually assess the needs of field professionals through frequent discussions with NAC technology transfer specialists, in-house and external NRCS partners, and through organized conferences and user forums. There are a lot of demands and our research group is small, so the list must be prioritized. Ideas that float to the top are those that are in higher demand, have the greatest potential for national or regional impact, fill a larger information gap, and can be produced the quickest.

Next, we look for opportunities to combine our limited resources with those of partners who have similar interests, including universities, nongovernmental organizations, and government agencies. Buffer-type agroforestry practices (*e.g.*, riparian forest buffers, windbreaks) have received a great deal of attention over the last several years.

Producing tools can be as straightforward as reviewing and synthesizing information found in scientific papers and translating it into agroforestry-focused guidelines. Often, however, new research is needed to fill critical information gaps before a useful tool can be developed. This can involve field experiments and mathematical modeling. Conducting new research can significantly increase the time and resources it takes to produce a new product.

Here are five tools that NAC researchers have developed to help you plan and design agroforestry buffers:

Buffer$ cost/benefit tool

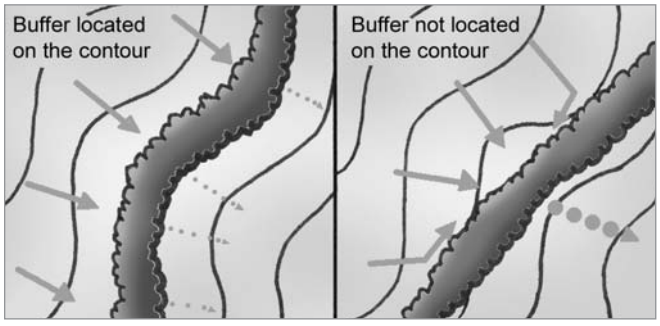
Buffer$, was developed to promote the economic benefits of adopting agroforestry practices to landowners. It computes the economic costs and benefits of installing and managing buffer practices over the long term. Buffer$ can be ordered or downloaded from NAC at *www.unl.edu/nac/buffer$.htm*.

Conservation buffer guidelines

Another design tool was developed to be a comprehensive source of information to design vegetative buffers for any of several different agroforestry benefits, including water quality, wildlife, aesthetics, soil protection, economic opportunities, and public health and safety. Over 1400 research papers from diverse scientific disciplines were reviewed and synthesized into a manageable set of illustrated, easy-to-understand, design guidelines. Numerous partners with varied expertise helped review and refine them. This tool is now in the process of being published and will be posted on the NAC website when it becomes available.

Buffer placement tool for water quality

This tool identifies locations in a landscape, both riparian and upland, where soil and slope conditions would enable a buffer to be more effective for reducing sediment and nutrient loads to streams. For many years riparian forest and other vegetative buffers have been recommended as a water quality improvement practice, yet watershed managers have lacked quantitative tools for guiding their placement and



see **Tools** on page 10

Diverse stakeholders enhance research

Working with volunteer citizen scientists requires extra effort. Many aren't involved with mainstream research; just finding them is a challenge.

James Chamberlain
USFS Research Scientist, Non-Timber Forest Products, Blacksburg, VA

NON-TIMBER forest resources are diverse, just like the people who harvest, process, and consume them. The people are eclectic and actually an enigma to most foresters and natural resource managers. Identifying, contacting, and working with these people to improve forest resource management are challenging at best. Few research institutions have endeavored to do so. The USDA National Agroforestry Center is an exception. Jim Chamberlain, a non-timber forest products (NTFP) researcher located at Virginia Tech University has been working directly with collectors and harvesters of NTFPs to find ways to better manage the resources from whence they originate.

Beginning in 2001, Chamberlain made a concerted effort to find and work with harvesters and related industry folks. Unlike the timber industry, there are no directories of NTFP enterprises. His initial efforts focused on collectors of ramps, smelly potent wild onions that are the mainstay for annual festivals organized by local civic groups. That first year, he visited churches, fire departments, rescue squads, county extension offices, local roadside markets, and small "mom-and-pop" stores, in search of organizers of the unique ramp festivals in western North Carolina.

After identifying about a dozen groups, the next challenge was to convince them that his motives were altruistic. Many

Many local NTFP collectors are skeptical that a government scientist would really be interested in finding ways to ensure that they can harvest plants from natural forests into perpetuity. *NAC file photo*

were skeptical that a government scientist could really be interested in finding ways to ensure that they could harvest ramps from national forests in perpetuity. The first group sent him off to one patch, while the main group went to their traditional digging place. Understandably, they didn't want to reveal their main source of ramps. Through perseverance and open communication, these challenges have been overcome, and today Chamberlain is welcomed by the group to harvest in their staple patch. Working with other NTFP harvesters presented challenges as well.

Herbalists and natural healers use medicinal plants that are collected from natural forests. Black cohosh is native to the Appalachian Mountains and is used to treat menopausal symptoms. Increased market demand, coupled with a lack of knowledge about managing this important forest resource, prompted the Medicinal Plant Working Group, part of the Plant Conservation Alliance, of which the Forest Service is a member, teamed up with the Garden Club of America, to address conservation concerns regarding this species. The goal of this volunteer citizen-scientist effort was to examine the impacts of harvesting and generate the knowledge necessary to support sound recommendations on how to best manage the black cohosh resources.

In 2005, Chamberlain joined the team, strengthening the group's research effort. Permanent long-term research plots were established in two locations in the Blue Ridge Mountains. Initial plans were to measure and harvest these sites annually, using volunteer citizen scientists. The first year more than 20 volunteers showed up to help collect data from the southern site. Only seven volunteers came out for the northern site. All went well that year and the future looked promising. The next year, most of the volunteers showed up to collect data on the northern site. But, data collection on the southern site had to be cancelled due to lack of volunteers. With more outreach to more groups, the project was able to attract enough volunteers to collect data on the southern site, this past year.

Those interested in NTFPs have not been in the mainstream of Forest Service research and development. Just finding these people is a challenge. Convincing harvesters and industry folks to open up and share their knowledge takes time and requires transparent communication. Collecting reliable and consistent data from volunteer citizen scientists requires extra effort as well. But, the benefits of increasing the diversity of Forest Service clientele, reaching out to under-served community members, and folks that may be skeptical of the government are well worth the effort.

Product-driven research

NAC's goal is to catalyze, facilitate, and accelerate research critical to the development of targeted tree-based conservation and production technologies for private lands. The small staff accomplishes this by relying on partnerships and external infrastructure to leverage the resources needed.

Michele Schoeneberger
Research Program Leader / Soil Scientist, Lincoln, NE

THE USDA National Agroforestry Center's (NAC) *modis operendi* (MO or method of operations) is all about catalyzing, facilitating, and accelerating agroforestry technology development and delivery at a national scale as efficiently as possible. "Bigger bang per buffer buck," as we like to say; something we are only able to accomplish by leveraging resources through partnerships.

NAC's Research & Development (R&D) programs seek to provide the scientific basis required for information and technology development. Needless to say, given the variety of practices and settings into which these technologies are applied nationally, this is a daunting task and R&D must rely on NAC's MO to address the research needs out there.

So how does NAC's R&D Program, a relatively small program, accomplish this?

Under the newly realigned research work unit at the Southern Research Station, NAC's R&D internal program is focused in four main areas:

Photo by Lynn Betts, USDA NRCS

Tree-based buffer tools and technologies to restore ecosystem services on agricultural and rural/urban lands

page 4

NAC file photo

Photo by Greg Ruark

Silvopasture

page 9

Photo courtesy of Kasten Dumroese

Non-timber forest products

page 5

Nursery and restoration technologies

page 8

Works with TT&A Program

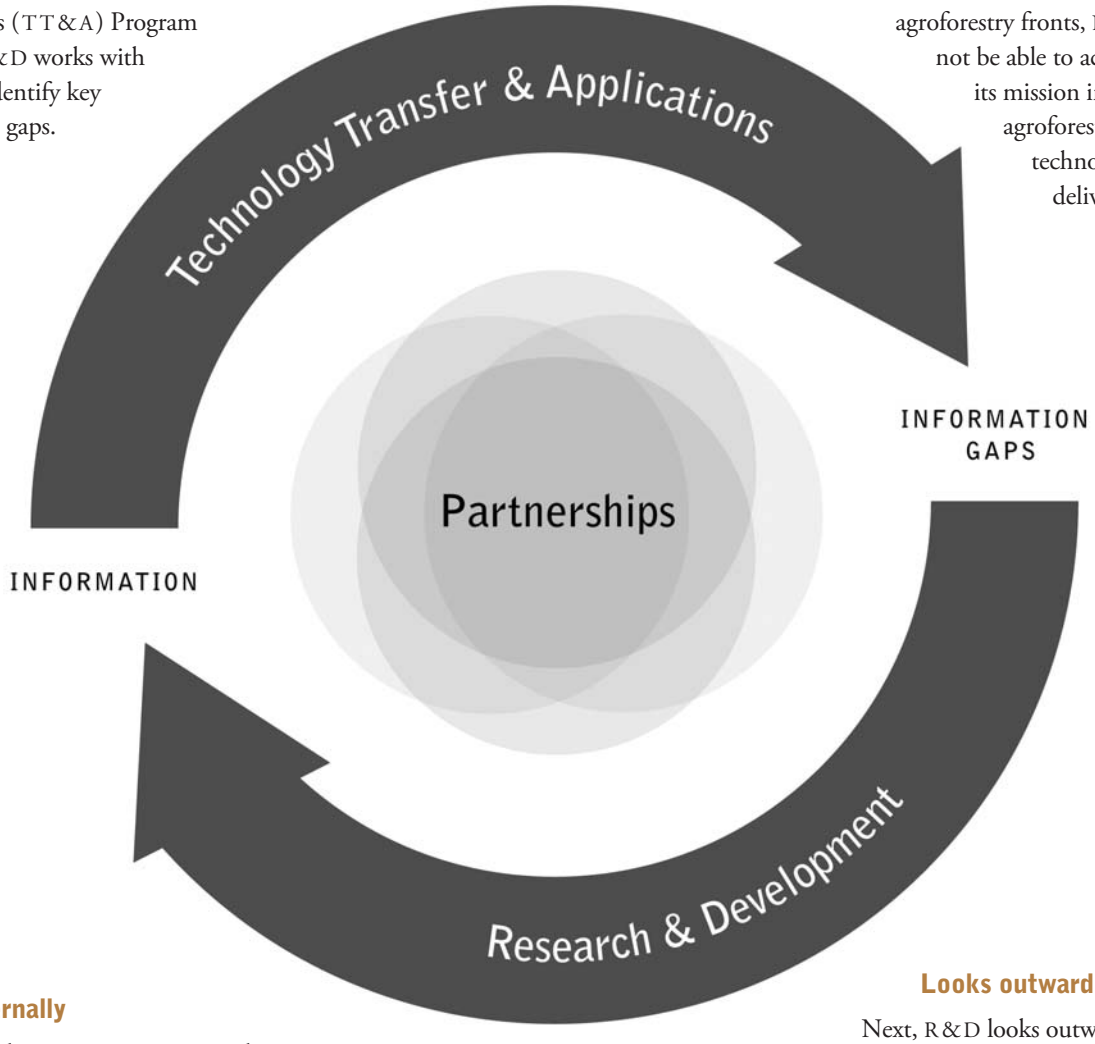
By being directly coupled to the Technology Transfer and Applications (TT&A) Program at NAC, R&D works with TT&A to identify key information gaps.

Identifies information gaps

These gaps are tackled by first doing "research" – looking to see if information already exists out "on the shelves" and can readily be pulled in, or if needed, modified or synthesized to fit the specific demand and current context.

Partnerships

You will note in the articles in this issue of "Inside Agroforestry" that even this internal research program relies heavily on collaboration with many different partners. Without the research leadership of other institutions on many other agroforestry fronts, NAC would not be able to accomplish its mission in advancing agroforestry science, technology, and delivery.



Looks internally

When the other avenues are not available for addressing a particular research need, the NAC then looks to its two other options for getting things done: the work is either taken on internally by NAC scientists, or since expertise and resources are limited within NAC's R&D staff, NAC works to facilitate the development of research programs at these other institutions.

Both must be approached very strategically as research dollars and scientists are very limited at the NAC.

Looks outward

Next, R&D looks outward – to see if the information gap is or can be addressed by other research "engines" – such as the USDA Agricultural Research Service, US Geological Survey, or universities. As a means to accelerate and/or better focus these external research efforts, R&D develops cooperative research ventures for financial support. While extra funding is always nice, the real leveraging of resources comes from the collaboration between the scientists themselves at NAC and the external institutions. Many times the data produced from these cooperative research ventures are then utilized by NAC scientists to facilitate additional partnerships in order to go after other extramural funding, such as the CSREES – National Research Initiative programs.

Nursery and Restoration Program:
Synthesizing research and sharing knowledge

Kasten Dumroese
Research Plant Physiologist / National Nursery Specialist, Moscow, ID

NAC's nursery and reforestation tribal emphasis provides American Indians the opportunity to grow their own native plants for cultural, spiritual, medicinal, and restoration activities. *Photo courtesy of Kasten Dumroese*

IN the United States, over 1000 nurseries annually produce more than 1.2 billion seedlings for forest and wildland restoration activities. One of the missions of the USDA National Agroforestry Center's Nursery and Restoration Program is to make the latest scientific information available to those nurseries to help ensure immediate use of new native plant propagation information and outplanting technologies, and promote environmentally and economically sound nursery production practices. For the past several years, additional focus of the program has been delivery of nursery technology information to American Indians.

The Nursery and Restoration Program synthesizes and distributes information in four important ways:

"Forest Nursery Notes" is published twice each year and distributed to over 1000 nursery managers and restoration specialists around the world. Each issue contains several articles synthesizing some of the latest scientific information and providing potential management implications of that work. In addition, each issue has a bibliography of the latest papers dealing with nursery and restoration issues, and subscribers can request a CD containing reprints of most of those articles.

The Native Plant Network is an online, searchable database of techniques for growing specific native plants. Individual nursery managers can upload information they have developed, as well as search for additional information provided by others. Currently the database contains more than 2800 protocols from across the US and Canada.

The Reforestation, Nurseries, and Genetics Resources (RNGR) website, managed by the program, is a searchable database of thousands of publications dealing with nursery production of native plants and subsequent outplanting. Classic publications, like "Tree Planters' Notes" and the "Container Tree Nursery Manual," are available, as well as dozens of nursery proceedings and specialty publications. The site provides information for a range of expertise, from beginners to professionals.

The program's on-going tribal emphasis has enabled American Indians to grow their own native plants for cultural, spiritual, medicinal, and restoration activities. Annual activities include coordination of the Intertribal Nursery Council and a hands-on workshop. Through this emphasis a Cultural Plant Propagation Center was constructed at Moencopi Day School in Tuba City, AZ to foster educational opportunities for Hopi and Navajo school children and produce plants for wildland restoration on the Hopi Reservation.

Take advantage of RNGR's online resources

- Reforestation, Nurseries, and Genetics Resources (RNGR) Database – A searchable compilation of nursery and reforestation publications from 1950 through present.
  http://rngr.net/
- Growing Forest Tree Seedlings At Home – An easy-to-understand manual targeting small landowners and hobbyists.
  http://rngr.net/Publications/rsah
- Native Plant Network – A searchable database containing more than 2800 protocols for nursery production of native plants.
  www.nativeplantnetwork.org/

By cooperating with others NAC scientists are able to stretch both time and money to answer specific research questions. *Photo by Greg Ruark*

Silvopasture research: leveraging resources

Richard Straight
FS Lead Agroforester, Lincoln, NE

LIMITED staff and tight budgets make it impossible for the USDA National Agroforestry Center, (NAC) to be actively engaged in every aspect of agroforestry research. But through partnering with others, like the Alabama Forestry Commission and local universities, NAC has been effective in driving the research agenda.

Last year, NAC Director, Greg Ruark, gave a presentation about silvopasture management to the Alabama Forestry Commission. Afterwards, Alabama State Forester, Linda Casey, wanted to set up a silvopasture field tour for her leadership staff to discuss new ideas that could support silvopasture research and technology development.

A coordination team with representatives from the US Forest Service – Southern Research Station, local NRCS, NRCS National Technology Support Center in Greensboro, NC, Auburn University, Alabama A&M University, and the Alabama Forestry Commission, toured existing silvopasture sites as well as the Alabama Forestry Commission's Hauss Nursery near Atmore, AL. Two issues rose to the top of discussions; longleaf pine and native grasses and forage to support native wildlife in silvopastures.

Silvopasture is a viable alternative plantation management scheme for private forest owners who face a rapidly changing and challenging market.

The Alabama Forestry Commission sees silvopasture as a viable alternative plantation management scheme for private forest owners who face a rapidly changing and challenging market. Today, these landowners, in addition to pulp and timber sales, are interested in wildlife of all kinds, especially turkey and quail.

Some of the Alabama Forestry Commission's seed production nurseries are going out of production, but not out of ownership, providing an opportunity to establish 80 acres of replicated plots of longleaf and loblolly pine silvopastures with three different forage treatments. Some plots are all native grasses, some are all improved forage grasses, and some are a mixture of native and improved forages.

NAC's technical expertise, coupled with installation and maintenance expenses that the Alabama Forestry Commission is willing to take on is the foundation for answering specific research questions like how to manage wildlife use and forage production of different silvopasture management systems.

agroforestry research websites

1. Treesearch – The largest freely available collection of online forestry research in the world. *www.treesearch.fs.fed.us*
2. Forest Encyclopedia Network – Connects scientific results, conclusions, and impacts with management needs and issues. *www.forestryencyclopedia.net*
3. University of Missouri Center for Agroforestry – Interdisciplinary agroforestry science collaboration. *www.centerforagroforestry.org*
4. University of Florida Center for Subtropical Agroforestry – A multidisciplinary, multi-institutional initiative with activities in research, extension, education, and training. *http://cstaf.ifas.ufl.edu*
5. Agriculture Research Service – Two research sites are involved with agroforestry research: *www.ars.usda.gov/Main/docs.htm?docid=2354* and *www.ars.usda.gov/main/site_main.htm?modecode=19-32-00-00*
6. Agroforestry.net – One of the most comprehensive sources of tropical agroforestry information. *http://agroforestry.net/aflibr.html*
7. Silvopasture in the Southeast – Blog with articles, research, and tools. Serves as a forum to share ideas and experiences. *http://silvopasture.blogspot.com*
8. World Agroforestry Center – uses science to generate knowledge on the complex role of trees in livelihoods and environment. w*ww.worldagroforestrycentre.org*
9. Iowa State University – Includes researchers from forestry, agronomy, animal ecology, earth resources, entomology, and plant pathology. *www.forestry.iastate.edu/res/agroforestry.html*
10. Agroforestry Research Trust – A temperate agroforestry non-profit. *www.agroforestry.co.uk*

Tools

continued from page 4

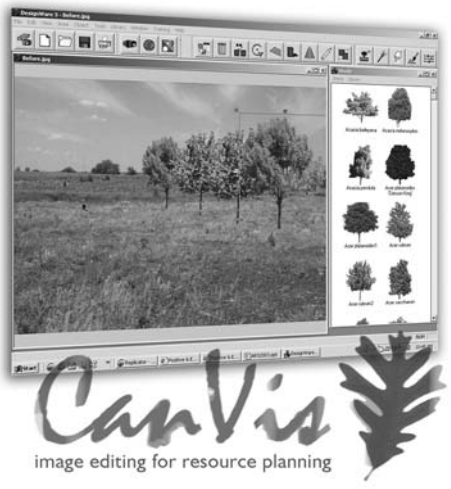
design. This problem is especially acute where regulatory limits such as Total Maximum Daily Load (TMDL) and Maximum Contaminant Level, (MCL), must be met and funding for doing so is limited. The buffer placement tool interprets familiar and widely-available soil surveys to guide you to locations where impact would be greater and away from those locations where impact is likely to be minimal. Visit NAC's website for more information about the buffer placement tool: *www.unl.edu/nac/research/2006soilsurveys.pdf*.

Buffer width tool for water quality

The buffer width tool enables you to calculate an appropriate buffer width for a given site to achieve the desired level of pollutant reduction. It is a graphical simplification of a complex mathematical model and is designed to be accurate enough for developing cost-effective site designs yet easy enough to use to make quick determinations on a large number and variety of agricultural sites. The buffer width tool focuses on surface runoff and takes agricultural field length, cover management, slope, soil texture, and pollutant type into consideration. This tool is now in the process of being published in an applied research journal, and will be available on the NAC website after it is published.

Research partners have been invaluable in the development of both of these water quality tools. New research by faculty and graduate students at the University of Nebraska and Iowa State University produced the information that these tools were developed from and helped to produce these tools.

CanVis: visual simulation software



CanVis enables a landowner to see what alternative designs will look like on their property. CanVis software is an entry-level program that allows resource professionals to create photo-realistic simulations with minimal computer skills. More information on CanVis is available at *www.unl.edu/nac/simulation/index.htm.*

All NAC tools are available at no cost to users by ordering print or CD versions, or by downloading digital versions, through the NAC website, *www.unl.edu/nac*.

Working Trees for carbon, and bioenergy, too

Michele Schoeneberger
Research Program Leader / Soil Scientist, Lincoln, NE

IN addition to food and fiber production, agricultural lands must address other concerns, such as water quality and wildlife habitat, and are now being looked at to also address the emerging issues of climate change and the need for greater independence on foreign oil. Agroforestry practices can play an important role in achieving these diverse objectives, like food and fiber production, energy, and greenhouse gas mitigation, but, most importantly, they can help link these objectives.

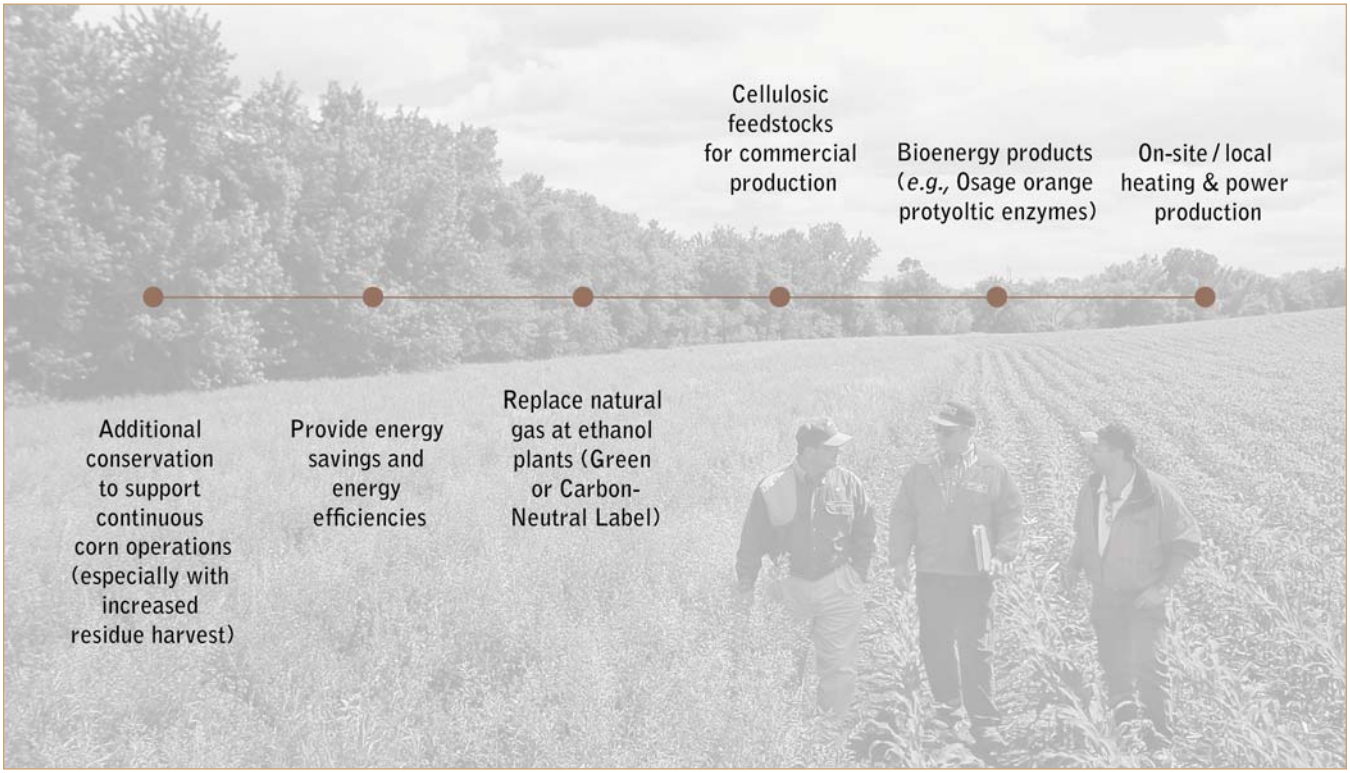
We already know that regardless of the intent for establishing an agroforestry planting, it will mitigate greenhouse gas (GHG) production by sequestering carbon, especially in the aboveground woody components. Agroforestry can also contribute to GHG mitigation through reduction in fertilizer and equipment use, greater irrigation efficiency, and microclimate control of buildings; providing energy savings. These same *Working Trees* plantings also have the potential to play numerous roles in support of agricultural based energy strategies, be it bioenergy production or providing energy savings.

Scientists with the USDA National Agroforestry Center's (NAC) Research & Development (R&D) Program have been working to advance the scientific basis and tools needed to optimize agroforestry's potential to address climate and energy issues, to communicate these findings into products that will further the acceptance and adoption of these practices, and increase the awareness and support by policy and program makers. They are working with many collaborators to address critical information gaps that hamper our ability to readily measure, report, and predict carbon in agroforestry plantings. In regards to energy, the scientists are looking at feedstock and bio-product potentials of different woody species, as well as what modifications in species mixtures, arrangements, and size and management of practices would be needed to meet the various roles these plantings could play along the energy continuum.

Three of the most significant projects include:

- Equations for estimating biomass and carbon production in agroforestry tree and shrub species with the University of Nebraska – Lincoln.
- Energy values for agroforestry plant species; potential arrangements/ planting designs with CINRAM – University of Minnesota
- Estimating carbon sequestration and voluntary reporting by an online tool called COMET-VR being developed by the NRCS.

Working Trees serve many functions along an energy continuum. *Original photo by Lynn Betts, USDA NRCS*



Upcoming Events

June 30–July 2, 2008
Summer Specialty Conference: "Riparian Ecosystems and Buffers: Working at the Water's Edge." Virginia Beach, VA. For more information: *http://awra.org/meetings/Virginia_Beach2008/*

August 18–22, 2008
Short Rotation Crops International Conference: "Biofuels, Bioenergy, and Bioproducts from Sustainable Agriculture and Forest Crops." Bloomington, MN. For more information: *www.cinram.umn.edu/srwc/index.html*

September 9–1, 2008
Great Plains Riparian Forest Management Summit. Sioux Falls, SD. For more information: *www.unl.edu/nac/Riparian_Summit.htm*

For more upcoming events, visit our website calendar: *www.unl.edu/nac/calendar.htm*.

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www.unl.edu/nac

Mission

The USDA National Agroforestry Center (NAC) is a partnership of the Forest Service (Research & Development and State & Private Forestry) and the Natural Resources Conservation Service. It is administered by the Forest Service, Southern Research Station; and its program manager and headquarters are located in Huntsville, AL, on the campus of Alabama A&M University, while NAC's staff are located at the University of Nebraska, Lincoln, NE; University of Idaho, Moscow, ID; and in Blacksburg, VA. NAC's purpose is to accelerate the development and application of agroforestry technologies to attain more economically, environmentally, and socially sustainable land use systems. To accomplish its mission, NAC interacts with a national network of partners and cooperators to conduct research, develop technologies and tools, establish demonstrations, and provide useful information to natural resource professionals.

Policy

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