

BEYOND THE FENCE LINE

Think “landscape.” Act “site scale.”

To address today’s natural resource issues – clean water and air, endangered wildlife, and sustainable ecosystems – we must look beyond our own fence line. Most natural resource activities are implemented at the site scale. However, in order to provide wider public benefit, a broader perspective than that of a single landowner is necessary.

No matter what you call it – a watershed perspective, a landscape perspec-

ive, or regional perspective – looking at the big picture is the best way to effectively address site-level concerns. For example, a system of buffers located strategically along a stream yields noticeable water quality improvements, whereas a solitary riparian forest buffer has little affect on the overall water quality of a stream. Identifying where to place the system of buffers requires an analysis of the larger landscape.

Read on to learn about determining landscape level patterns and for tools to help you plan and implement agroforestry. 🌱

Inside

3 WHERE, OH, WHERE SHOULD MY BUFFER GO?

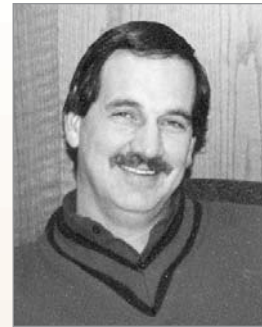
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NAC Director's Corner

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



You can't escape the landscape

THIS issue of *Inside Agroforestry* steps back to get a better view of the landscape. Although conservation practices are typically installed one landowner at a time, their contribution to advancing broader societal goals like wildlife habitat, water quality, and open space can often be heightened by considering the larger context in which they reside. The coordinated implementation and connectedness of individual conservation practices can help achieve landscape-level goals. One concern that agroforestry can help address is that of forest fragmentation. Small patches of forest may be too small and too isolated to provide suitable habitat. Depending on the wildlife species of interest, agroforestry plantings on working agricultural lands can be designed to provide food, nesting, and cover or to connect patches of forest land to provide travel corridors and create the critical size necessary to benefit wildlife. For some species connectivity may not even require that tree cover be contiguous, but simply that distances not be so great as to preclude travel between forest

patches or that agroforestry and forests occur in proximity to surface water resources needed by wildlife.

Increasingly, improving or maintaining environmental benefits, like water quality, will depend on the extent to which rural and urban planning and conservation efforts within a watershed are coordinated. To this end, the concept of “green infrastructure” is currently being used in some communities to bridge conservation efforts across the rural/urban chasm. Fortunately, computerized tools like geographic information systems (GIS) readily allow for the simultaneous consideration of the spatial distribution of multiple natural resources, as well as a wide array of potential user demands. When implemented, a GIS approach can improve planning and help target conservation projects across the landscape. It doesn't escape me that, ultimately, the aggregate societal benefits derived from a multitude of individual site-level conservation practices are exhibited in the landscape. 🌲

Protect our water, from sea to shining sea



WATER quality is often at the heart of conservation activities. NAC's *Working Trees for Water Quality* (WTWQ) brochures have been distributed worldwide to schools, garden clubs, and community board groups, in addition to natural resource professionals.

WTWQ is written and designed at a level to help inform and educate your clients, including community members, landowners, youth, and others. The WTWQ brochure introduces readers to how agroforestry can help protect water quality, while at the same time achieve both landowner and community

objectives. More specifically, the WTWQ publication addresses sources of water resource problems and how to strategically incorporate *Working Trees* into the landscape to restore ecosystem services.

Visit NAC's website, www.unl.edu/nac, for a preview of any *Working Trees* brochures or coordinating displays. You can order publications from the website or, if you prefer, contact Nancy Hammond at hammond@fs.fed.us or fax her at: 402-437-5712. Reserve displays by contacting Ryan Dee at ryandee@fs.fed.us or call 402-437-5178, ext. 14. 🌲



We all “know” that installing conservation practices and agroforestry systems on tilled cropland will produce environmental benefits like cleaner runoff water and more wildlife.

But, after years of conservation work across the country, these environmental benefits have been difficult to confirm at whole watershed and landscape scales.

In October 2006, scientists and technicians who work to quantify the benefits of conservation practices on agricultural land met in Kansas City to discuss this problem. They concluded that environmental benefits at the landscape scale will accrue to a greater extent if conservation practices are applied on sites where there is greater need than if the same practices were applied evenly across the landscape. Furthermore, by “targeting” conservation practices within landscapes and watersheds, the costs of achieving substantial benefits will be reduced.

This conclusion may seem like common sense, but applying targeting isn’t so easy. Current Federal conservation programs have an “equal access” obligation that promotes widespread distribution of funds among landowners, rather than targeting the funds to a critical few. Also, targeted conservation requires sci-

entifically valid tools to accurately identify critical locations. On this point, the conferees concluded that enough scientific information exists to be able to conduct targeted con-

servation, but this information still needs to be translated into planning and design tools that are easy to use.

NAC scientists are actively engaged in the development of tools that support a targeted approach to the placement and design of agroforestry and conservation systems. Spatial information like soil surveys, topography, land use, and land cover are easy to obtain and provide powerful planning information when mapped using a Geographical Information System (GIS) computer program. NAC scientists have used this approach to identify suitable locations to grow agroforestry products, locate critical barriers and gaps in wildlife corridors, and to identify more effective locations to install water quality buffers. *See **Making connections with GIS** on Page 5 for more information.*

A book including the plenary papers presented at the Kansas City conference, as well as summaries of discussion sessions, will be published this spring by the Soil and Water Conservation Society, headquartered in Ankeny, Iowa. 🌱



Restoring the Delta

Restoring bottomland hardwood forests on Mississippi Delta cropland has become a primary strategy to reestablish critical habitat and improve water quality.

Photo by Lynn Betts, USDA Natural Resources Conservation Service

Mike Dosskey

Research Ecologist, USDA National Agroforestry Center, Lincoln, NE

THE broad fertile floodplain of the Mississippi River “Delta” extending from Cairo, Illinois to New Orleans, Louisiana, was once covered with dense bottomland hardwood forests. Today, there is regional and international concern about the loss of important environmental services stemming from the clearing of those forests.

Two-thirds of this alluvial valley has been converted to intensively farmed crops like cotton, soy-

beans, and rice. Only 25 percent of the original forest area remains, most of that in southern Louisiana. Elsewhere, in Louisiana, Mississippi, Arkansas, and Missouri, small remnant patches of forest are widely scattered among vast fields of cultivated crops.

Concern about the loss of forest land in the region has been growing since the 1970s after it became apparent that populations of many bird species that migrate along the Mississippi Flyway were rapidly declining. Draining wet-

see **Delta** on page 10

Flyway essential for migratory birds



THE Lower Mississippi Alluvial Valley (LMAV), another name for the Mississippi Delta region, is a critical stopover for song birds, shorebirds, and waterfowl that migrate between wintering areas around the Gulf of Mexico and Caribbean region and summer habitats across North America. Several countries along this route have become particularly concerned with declining populations of birds that breed only in bottomland hardwood forests

in the LMAV, including the Swainson’s Warbler, Cerulean Warbler, Prothonotary Warbler, and Northern Parula.

Unfortunately, some forest-breeding birds are already thought to have become extinct, including the Bachman’s Warbler and the Ivory-billed Woodpecker. The Ivory-billed Woodpecker is notable because of recent unconfirmed sightings in remnant forests along the White River in Arkansas – the first in more than 50 years. 🌳



The brown areas along this stream identify critical habitat gaps that could be addressed with riparian forest buffers consisting of income-producing woody floral species.

Making connections with GIS

Gary Bentrup & Todd Kellerman
Research Landscape Planner & GIS Specialist, USDA National Agroforestry Center, Lincoln, NE

THE myriad of issues facing landowners and the public can seem overwhelming at times. Taking advantage of Geographic Information Systems (GIS) can help you make sense out of this complex assortment of concerns. GIS data layers can be used to analyze the landscape to determine where issues are relevant and what potential actions are necessary to achieve multiple objectives. Fortunately, data layers for soils, slope, and landcover already exist in many areas.

Aldo Leopold said that everything is connected to everything else, and landscape analysis using GIS can reveal those important, but sometimes hidden, interconnections. By better understanding these interconnections, we can identify potential areas of conflict and compatibility in our proposed conservation systems. For instance, a proposed conservation system may improve water quality but because of its location in the watershed, could potentially harm a sensitive wildlife species. Without a landscape perspective and GIS, this conflict may go unnoticed but instead an appropriate compromise can be achieved.

In other cases, we can identify areas where several issues are compatible. NAC has developed several landscape-scale assessments for water quality, wildlife habitat, and agroforestry specialty products. One assessment identifies vegeta-

tion gaps in riparian corridors that, if restored would facilitate wildlife movement while another assessment distinguishes where vegetated buffers can have the greatest impact on improving water quality. One of NAC's agroforestry specialty products assessments has identified suitable locations where decorative woody florals, like curly willow and red-twig dogwood, can be grown. University of Nebraska researchers have shown potential annual net returns ranging from \$300 to \$3,000 per 1,000 feet at four- to six-foot plant spacing. By combining these assessment results, areas are identified where riparian buffers can be located to improve habitat connectivity and protect water quality while offering landowners the option to grow a product for profit.

Getting Started

Although you may not have the time or resources to develop GIS skills, check with your agency or organization to see if there are GIS specialists who can assist you with the assessment process. One of the main benefits of landscape-scale assessments is that once a particular assessment is complete, it can be used repeatedly for many site-scale planning and design efforts. Landscape assessments are best developed with participation from a variety of resource experts like wildlife biologists, foresters, and economists in addition to landowners and the public. See the **GIS landscape planning toolbox** for resources on the assessment process. 🌱

GIS landscape planning toolbox

GIS maps illustrate where agroforestry plantings can be installed to enhance wildlife habitat, protect water quality, and increase economic diversity. To learn more about these individual assessments, check out these publications:

- Design with Nature. 1995. By I. McHarg. Wiley, New York.
- The Living Landscape: An Ecological Approach to Landscape Planning. 2000. By F. Steiner. McGraw-Hill, New York.
- Managing Natural Resources with GIS. 1998. By L. Lang. ESRI Press, Redlands, CA.
- Agroforestry Specialty Product Assessments, www.unl.edu/nac/research/2002agroforestrygis.pdf
- Riparian Connectivity Assessment, www.unl.edu/nac/research/2004riparianconnectivity.pdf
- USDA Geospatial Data Gateway, <http://datagateway.nrcs.usda.gov>
- Water Quality Assessment, www.unl.edu/nac/research/2006soilsurveys.pdf



ZOOM

BY GARY WELLS,
LANDSCAPE
ARCHITECT;
USDA NATIONAL
DESIGN,
CONSTRUCTION,
& SOIL
MECHANICS
CENTER;
LINCOLN, NE

MAGNIFY YOUR PLANNING EFFECTIVENESS

TODAY, as natural resource professionals, we are called on to manage numerous issues that combine to make up a complex landscape picture. The challenge is being able to see the details without losing site of the big picture. Like viewing the landscape through a camera lens in which you can see the overall composition of the landscape picture or zoom in close to focus on one item without all the distractions.

There are coordinated efforts in some parts of the country, like the Chesapeake Bay watershed and New York City's

water supply watershed. These types of funded planning activities identify issues and concerns with a panoramic view while getting a close-up view with individual landowners. For example, the Chesapeake Bay project examined the entire drainage area to identify problem sources and solutions to a range of resource concerns. One of the agroforestry management activities that is being applied is riparian forest buffers. Planners were able to identify where individual buffers should be located based on the larger watershed perspective.

Most of us aren't fortunate enough to work in an area that has a large scale planning effort like this, but you can still work with individual landowners to address greater public issues.

Researchers at NAC recommend looking at your planning area as if through different lenses to get the complete picture. Each lens provides a different magnification and a unique perspective and focuses attention on different aspects of the overall image. Combined, these different lenses help identify and prioritize resource issues.



1 Big picture: Regional reconnaissance

First, gather a reconnaissance of existing information to develop a general overview of environmental conditions and resource issues in your area. The intent is not to invest a lot of time or resources creating data, but to search for existing information to create a portfolio to refer back to as you work with individual landowners to address specific concerns that have a cumulative affect on the landscape.

Numerous government and non-profit organizations have collected resource information and made broad assessments at this scale. You can also look for local plans, like a Conservation District annual plan or an NRCS area wide plan, for more information.



2 Zooming in: Landscape-scale assessment

Next, get a landscape perspective snapshot, which could be a watershed, a county, or some other larger planning unit. The issues identified in the regional reconnaissance provide the basis for the landscape-scale assessment. Each issue is framed in more detail to identify specific assets and problem areas and determine conservation objectives. This assessment captures the general condition of the landscape and how it functions.

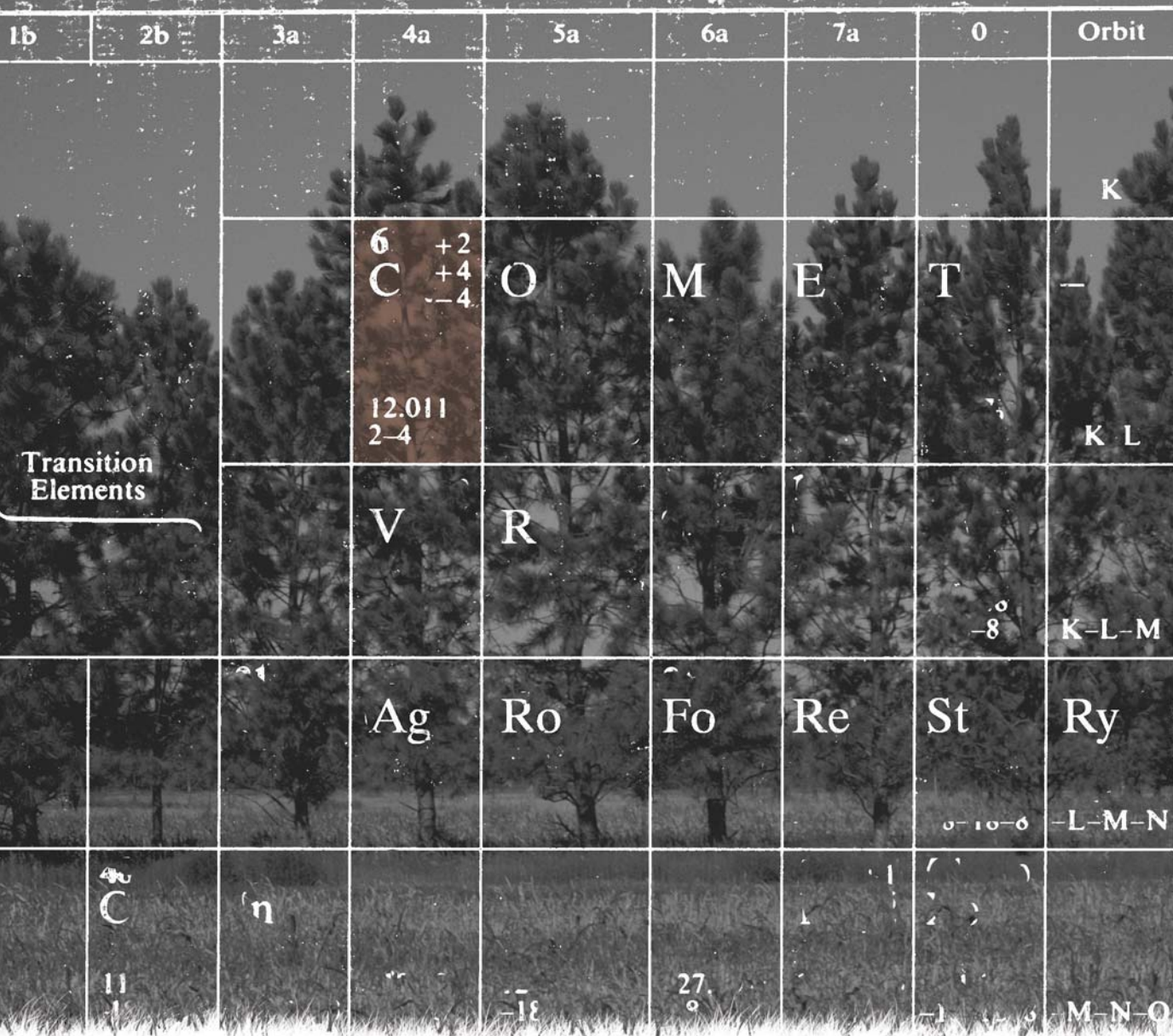
Geographic Information Software (GIS) can be used to collect, organize, and analyze the information. GIS can also evaluate multiple issues simultaneously. The issues identified in the landscape-scale assessment will most likely be addressed by working with individual private landowners.



3 Close up: Site-scale planning & design

Now, when you focus into the site, the concerns identified in the landscape-scale assessment can be used to guide site-scale planning. Whether the landowner was targeted by the landscape-scale assessment or was just a walk in customer, their concerns still need to be met. The site-scale planning and design process focuses in on specific landowner objectives and blends them with the public goals identified in the landscape assessment.

Specific site conditions need to be inventoried and assessed. GIS can also be used at this scale to organize and analyze data. As alternatives are developed, opportunities to address the greater public concerns can be identified and hopefully implemented as well. 🌱



Existing carbon estimating tools do not account for trees in windbreaks, riparian buffers or other agroforestry practices. COMET-VR will include agroforestry and farm woodlots.

Photo illustration by Ryan Dee

Estimating carbon in agroforestry practices

Miles Merwin

Forester, Air Quality/Atmospheric Change Team, NRCS West National Technology Service Center, Portland, OR

HAVE you ever wondered how much carbon would accumulate and remain stored if you were to plant a windbreak around a crop field or plant trees in a grazed pasture? What would it be worth in ten years?

This isn't just an academic question. Midwestern landowners are already selling

carbon credits accrued for practicing conservation tillage on cropland. Today, emerging trading markets recognize that agroforestry practices can significantly increase carbon storage on farm and range land. Although carbon credits are not likely to be a major source of farm income, they are another economic incentive to reward landowners for utilizing agroforestry and other conservation practices.

CarbOn Management Evaluation Tool for Voluntary Reporting of greenhouse gases (COMET-VR), is an online tool that estimates potential carbon storage. Currently COMET-VR only covers annual cropping

see **COMET-VR** on page 10

“ Without these maps, we couldn't even begin to ponder our future and current policy. SAP has given us a tool to analyze resource information in a way we have not been able to do before.”

Steve Koehn, MD

Forest mapping for the future

Karl Dalla Rosa

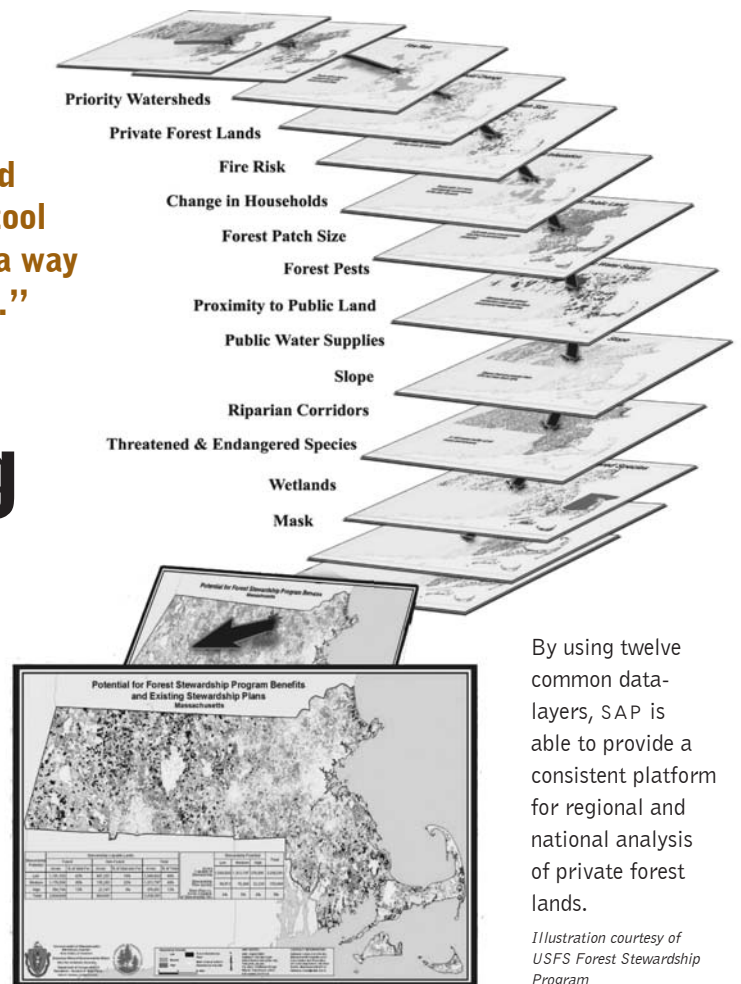
Forest Stewardship Program Manager, USFS, Washington, DC

SINCE it was enacted with the 1990 Farm Bill, the USDA Forest Service's Forest Stewardship Program (FSP) has provided more than 260,000 plans to landowners for the management of approximately 30 million acres across the US. Until recently, state forest agencies delivered the program primarily on a first-come, first-served basis. This approach made the program accessible to all eligible landowners. The Spatial Analysis Program (SAP) enables a resource professional to focus on landowner outreach and technical planning assistance for the landscape areas of highest potential with respect to intended resource management outcomes. SAP also enables program managers to demonstrate that resources are being targeted to maximize return on federal program investment.

Nationally consistent methodology

SAP is comprised of two primary geospatial and tabular components:

1. The statewide assessment of all lands eligible for the Forest Stewardship program takes into consideration the resource richness throughout the state, as well as known threats to the forest and other natural resources; and



By using twelve common data-layers, SAP is able to provide a consistent platform for regional and national analysis of private forest lands.

Illustration courtesy of USFS Forest Stewardship Program

2. The Stewardship Plan database is a spatial inventory of existing Forest Stewardship Plans that the state tracks through time. Every state is required to consider and include as available and applicable, twelve common datalayer themes, important from a federal perspective, to determining resource richness, threats, and opportunities on the landscape where it makes the most sense to focus landowner assistance.

“ We intend to use SAP results, from a programmatic perspective, to target programs toward those areas of greatest potential benefit,” Fred Borman, CT

The SAP assessment and state-based adaptations

States have the option to add appropriate datalayers to their statewide assessment to

see **SAP** on page 11

Delta

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lands and building levees to enable farming the floodplain contributed to the reduction of habitat for migratory waterfowl while forest clearing removed critical breeding habitat for both migratory and resident songbirds. More recently, the negative impacts of agriculture on water quality and the aquatic health of the Mississippi River and the Gulf of Mexico have become widely recognized.

Restoring croplands back to bottomland hardwood forests has become a primary strategy to reestablish critical habitat and improve water quality in the region. Unfortunately, forest clearing and degradation is still outpacing the forest restoration effort.

What's agroforestry got to do with it?

The impact of agroforestry plantings on water quality and other environmental benefits has been repeatedly demonstrated in other parts of the US. A scientific literature review concluded that agroforestry has the potential to restore critical ecological functions in this region.



There is regional and international concern about the loss of bottomland hardwood forest in the Mississippi River Delta which extends from Cairo, Illinois to New Orleans, Louisiana.

Agroforestry-type tree plantings in the Delta provide substantial habitat value for a number of wildlife species-of-concern and can help quicken the pace to restore the environmental services that bottomland forests have traditionally provided.

Locating agroforestry practices near existing bottomland forests will:

- Create habitat buffers around existing forest patches
- Create wildlife corridors between isolated patches of existing forest
- Improve water quality flowing into forest habitat areas
- Enable hydrologic restoration around forested areas

Why agroforestry instead of bottomland forest restoration?

Agroforestry offers landowners profit potential long after their government conservation contracts expire. The need to maintain an annual income, plus satisfying a landowner's desire to remain in some kind of agricultural enterprise, may attract landowners that are not inclined towards restoration. Furthermore, profits to landowners would assure that the land will stay in agroforestry and continue to produce environmental services over the long term. In this way, agroforestry can augment bottomland forest restoration and accelerate restoration of forest functions and values in the Delta. 🌱

COMET-VR

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and pasture, but a new version will include agroforestry and farm woodlots.

COMET-VR, developed by NRCS and Colorado State University, provides an easy-to-use interface to large databases of climate, soils, and crop rotation information. It quickly calculates annual changes over a 10 year period in the amount of carbon stored in crop fields or rangeland. Access the current farm-and-range-only version of COMET-VR at www.cometvr.colostate.edu.

Establishing or maintaining woody vegetation on crop and pasture land in an agroforestry practice can significantly increase the potential for carbon storage

compared to annual cropping alone. Trees and shrubs absorb CO₂ and store carbon in wood, and in any harvested wood products used for durable materials. Also, management practices can either add or subtract stored carbon over the full rotation. For example, using no-till or conservation tillage in alley cropping will increase soil carbon compared to intensive tillage.

To use COMET-VR agroforestry, users will first be asked to provide information about their general location, soils, and extent of the agroforestry practice. Subsequent information will depend on whether they're estimating a row-type agroforestry practice (windbreaks, alley cropping, or silvopasture) or a forest-like practice (forest farming or mature riparian buffers).

To quantify biomass in trees and shrubs in row-type practices, the user will be asked to supply information such as plant genera, row length, spacing, and average trunk diameter. Once user input is complete, COMET-VR will estimate total biomass using diameter-based equations for tree type groups that are applicable throughout the continental US.

After the "baseline" carbon value is estimated, the average growth for each genera group is calculated for the user's state and local region. Growth estimates are based on both forest and windbreak plot data routinely collected by USFS and NRCS.

Watch for an announcement later this year when COMET-VR Agroforestry becomes available for online usage. 🌱

SAP

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respond to state-specific issues, concerns, or resource opportunities. There is no limit to the number of datalayers, but most states have chosen to limit their assessments to include only one or two additional layers. Examples of datalayer additions include: tribal lands (North Dakota), timber growth/timber harvest ratio (West Virginia), forest soils (Iowa), green infrastructure potential (Delaware), historic forested landscapes (Iowa) and agroforestry potential (Colorado). States also have the option to weight the twelve common datalayers by relative importance or critical need with their own scoring method as they compile a composite map identifying program focus areas.



Plan database

The Forest Service has been working with the Colorado State Forest Service and Environmental Systems Research Institute, Inc. (ESRI) to develop a web-based data entry tool (Web-DET) that will automatically store spatial and resource data for individual properties as Forest Stewardship plans are written. Web-DET will also remind field

We have incorporated [SAP] into our reporting system to demonstrate to our Commission where the work is getting done and where the funds are being invested,” Bob Krepps, MO

foresters and consultants when prescribed management activities are due to be carried out and store accomplishment

and resource trend data. All of this data can be automatically fed into State, Regional and National databases so that reporting needs are met on a continuous basis and data is always current.

Final products

Final SAP products include a series of maps that combine datalayers of the statewide assessment with the stewardship plan geodatabase to assess existing stewardship tracts and their relationship to the lands eligible for the Forest Stewardship Program. As states complete SAP assessments and plan databases they are publishing their maps and

detailed methodologies on the SAP website: www.fs.fed.us/na/sap. 🌲

Spatial analysis benefits Iowa

IOWA State Forester Paul Tauke says, “Our GIS reporting system allowed us to capture data that were previously locked in filing cabinets that were spread out over 13 forestry districts. Today we can analyze those data to visually convey what our forestry staff is doing and where. It also serves as an analysis tool to identify potential forest resource threats or concerns.”

The Iowa Department of Natural Resources Forestry Bureau seriously began to explore using a GIS-based reporting system in 2003. With financial assistance from USDA Forest Service’s Northeastern Area, they were able to develop and map the forest resource areas of greatest concern and also to data mine forest stewardship landowner files back to 1990. Realizing that a historical data set, while useful, would be of limited utility, the Forestry Bureau developed a system that would allow the district foresters to continue to build on the historical database.

With help from the Department’s GIS staff and the State’s 16 District Foresters,

Data is collected for every stand or area if applicable. These include:

- Landowner contact information
- Plan date
- Stand number
- Acres
- Species planted
- Date planted
- Harvest type
- Harvest date
- Overstory species associations
- Understory species association
- Regeneration information
- Presence of significant woody or herbaceous plants
- Forest health problems
- Identification of invasive species
- Average stand DBH
- Management prescription
- Date management prescription is completed
- Important stand features (plant, animal, mineral)
- Cost-share program used to complete practice
- General comments

a system was developed that affixed an attribute table to every forest stand that the forester’s digitized. When foresters create a landowner management plan they create a map using ArcGIS software. Each unique stand or area is digitized and an attribute table is maintained.

Iowa has used this information to estimate a 26,000-acre backlog for forestry practices that could utilize a 5.5 million dollar backlog for forestry cost-share dol-

lars in 39 priority counties in the State. This information has helped raise the awareness of forestry needs with NRCS and the State EQIP committee.

According to Tauke, “Iowa’s private lands foresters have always had a great story to tell; GIS mapping provides a visual tool to share that story internally within the District and externally with our partner state and federal agencies, with legislators, and with the people of Iowa.” 🌲



Upcoming Events

June 25–27, 2007

American Water Resources Association (AWRA) Summer Specialty Conference: "Emerging Contaminants Of Concern In The Environment: Issues, Investigations, And Solutions." Vail, CO. Contact: William Battaglin, 303–236–4882 x256, wbattagl@usgs.gov, www.awra.org/meetings/Vail2007/index.html.

July 21–25, 2007

Soil And Water Conservation Society (SWCS) 2007 Annual Conference: "Conservation Challenges In A Changing Landscape." Tampa, FL. <http://www.swcs.org/index.cfm?nodeID=10373&audienceID=1>.

America's Forests." Portland, OR. Contact: SAF, 866–897–8720, <http://www.safconvention.org/natcon-07>.

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

October 23–27, 2007

Society Of American Foresters 2007 National Convention: "SAF: Sustaining



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www.unl.edu/nac

Mission

The USDA National Agroforestry Center (NAC) is a partnership of the Forest Service (Research and Development and State and 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.

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