USDA Inside Agroforestry
National Agroforestry Center
Summer 2001

Green Infrastructure:

Reconnecting Agriculture & Communities

by Gary Bentrup
Research Landscape Planner, NAC, Lincoln, Nebraska

Is your community growing as fast as mine? There are new housing developments and businesses being constructed everywhere. As I drive along the edge of town I see strip malls, restaurants, and gas stations on one side of the road and farm ground on the other.

The interface between a community and agricultural land is one of major conflict; a "zone of tension." Unfortunately, rural and urban residents often have two completely different sets of goals, lifestyles, and daily activities despite their close proximity.

As the population grows, farmland is being fragmented by low-density commercial and residential development, which greatly increases the edges of contact between urbanized areas and agriculture. The result is an enlarged zone of potential conflict between people on both sides of the issue. For example, urban residents may object to agriculture's influence on the adjacent environment while agrarian neighbors can be resentful of urban intrusion into day-to-day farming activities.

This is where "ecobelts" come in. Ecobelts are a type of "green infrastructure" that are best thought of as linear woody buffers that can ease this zone of tension while providing amenities for rural-urban residents. The articles in this issue illustrate how to reconnect agriculture and communities with ecobelts and other forms of green infrastructure.

Using linear arrangements of tree-based buffers is not a new concept. Tree-based plantings have been used to meet objectives of rural and urban residents for many years.

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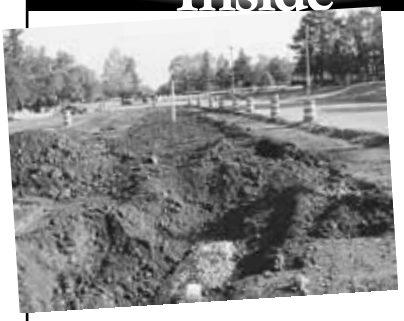
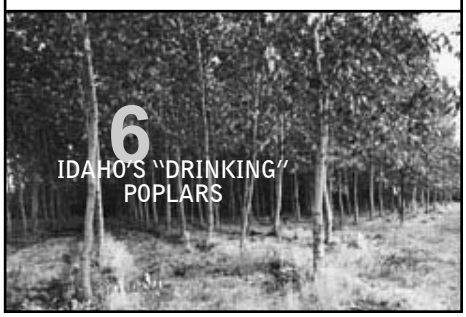




A Big City, A Big Need

Supplying Clean Drinking Water to New York City

Rich Straight
Forest Service Lead Agroforester
NAC, Lincoln, Nebraska

We all know that water is necessary for survival. But, have you ever wondered just how over nine million New York City residents get their water?

As you could probably guess, New York City's water supply system is one of the largest storage and supply systems in the world. On average, 1.3 billion gallons of high quality water are distributed daily through 6,000-miles of water mains. The water is collected from two large drainage areas in up-state New York and stored in 19 reservoirs and three controlled lakes.

New York City, however, does not own the majority of land in its drinking supply watersheds. Therefore, millions of water consumers in the city are directly affected by the actions of the farmers and forest landowners in the foothills of the Catskill Mountains where their water is collected.

see **BIG CITY** on page 7

NAC Director's Corner

A commentary by Center Director, Dr. Greg Ruark

Green Infrastructure for Communities and Agroforestry

Agricultural and forest lands are being converted to residential and commercial developments at an alarming rate. In the U.S. between 1992 and 1997 an average of 2,300,000 acres were converted to new single-family homes each year. Although the nation's population is increasing by 3,000,000 each year, the amount of land converted is far greater than can be justified by population increases alone. Development results in the creation of impervious surfaces, like rooftops, sidewalks, roads, and parking lots. As more and more surfaces are paved the hydrology of the watershed is drastically altered. Precipitation can no longer infiltrate the soil and large volumes of stormwater result. Managing this runoff is a challenge not only for a community, but also for downstream residents of the watershed.

The need to invest in infrastructure, such as roads, bridges, power lines, and sewers to provide the underlying foundation for continuance and growth has long been recognized by communities. In a similar manner communities have recently begun to acknowledge the need for "*green infrastructure*" - a strategically planned and managed interconnected network of green spaces that include: conserved natural areas and features, public and private conservation lands, and private working lands of conservation value. This network can help support native plant and animal species, maintain natural ecological processes and functions, sustain water and air resources, and contribute to the quality of life.

The key to green infrastructure is the pattern of growth and development. Green infrastructure strategies blend economic and social goals with the ecological functions and benefits provided by natural systems. Development occurs in concert with ecosystem protection and is proactive not reactive, systematic not haphazard, holistic not piecemeal, multi-purpose not single focused, and multi-scale not only site-based.

Green infrastructure is comprised of a system of "hubs" and "links". Hubs may include large protected areas such as reserves, parks, forests, rangelands, and farms. Links include conservation corridors, riparian zones along rivers, and greenbelts, and they are the connections that enable the system to work.

This is where agroforestry comes in. Many agroforestry practices that have been developed for agriculture can be modified to be a part of the green infrastructure for communities. Riparian forest buffer can enhance water quality, control stormwater runoff, and protect stream channels, while providing wildlife habitat, recreation opportunities, and other amenities. Linear windbreak designs can be modified and adapted to meet many community needs and to provide a buffer at the rural/urban interface.

The already-popular *Working Trees for Communities* (WTC) Brochure will make its second, new-and-improved debut this fall. As Agroforestry awareness continues to grow so do NAC's *Working Tree* publications. The revised WTC brochure will address many of the same issues as the first brochure including: the rural/urban interface, screening, dust and noise control, and enhancing the environment for people, wildlife and recreation, but will also address storm water management, wastewater management, and green infrastructure.

All of the *Working Trees* brochures are designed to help inform and educate your clients including community members, landowners, youth, and others. They are written for the landowner and developed especially to aid you with publicity and technology transfer to get *Working Trees* applied.

Visit our website for a preview of any of NAC's *Working Trees* brochures or coordinating displays: *www.unl.edu/nac.* You can also order publications from the website or, if you prefer, contact Nancy Hammond at: *nhammond@fs.fed.us* or fax her your request at 402-437-5712.

Topeka, Kansas:
Getting Greener Gets the Job Done

Mark Green, P.E.
Superintendent,
Water Pollution Control Division,
Topeka Department of Public Works

One inch of rain over the entire city of Topeka, Kansas translates to 940 million gallons of stormwater. In Topeka, like most communities, this rainwater collects contaminants as it flows over rooftops, streets, and parking lots and is funneled into storm drains that eventually empty into rivers.

Are expensive concrete channels and underground pipes the only way to handle stormwater? No. Today, "green technologies" use plants and soil to provide new solutions to the old problem of what to do with all of that stormwater.

"Green Topeka" is a partnership that includes NAC, state agencies, Kansas State University, local government, nonprofit organizations, and stakeholders. It was initiated by the City in November 2000 to address water quality and quantity concerns. The partnership is working to develop and implement the Stormwater Master Plan. Green Topeka views stormwater projects holistically and is creating a set of Best Management Practices (BMPs) and "Smart Growth" concepts to address stormwater concerns. Using natural techniques, like existing vegetated drainage ways, focuses stormwater planning on the front end of development projects rather than retrofitting stormwater fixes once growth of an area has occurred.

During the fall of 2000, a Master Drainage Plan for the North Topeka area was developed utilizing input from a multidisciplinary workshop. The Plan's mission is: *To make those improvements required to protect property from flooding in an environmentally friendly and aesthetically pleasing manner while striving to meet all regulatory requirements and community needs and goals ina fiscally responsible manner.*

The Soldier Creek Watershed is a "pilot" planning project in North Topeka that is exploring innovative practices like vegetated swales and constructed wetlands to detain stormwater runoff. The *Working Trees* and other vegetation in these practices, when properly selected and placed, can take up water and assist in absorbing and breaking down contaminants. The lessons learned in this pilot effort will help other communities address their Phase II stormwater program needs and meet Total Maximum Daily Load (TMDL) requirements.

The North Topeka drainage basin flows directly into the Kansas River via Old Soldier Creek. The Master Drainage Plan calls for the following actions:

1) Improve wildlife habitat in the Old Soldier Creek corridor by establishing native prairie grasses and clump tree plantings.

2) Construct a wetland system to serve as a stormwater retention facility at Garfield Park (just before Old Soldier Creek empties into the Kansas River). This wetland was a result of the design workshop that produced a new, separated storm/sewer system routed to Old Soldier Creek, thereby causing the aging pump station (in need of over $4 million in repairs) to become obsolete. Environmentally this helps in two ways; eliminates raw sewage overflows into the Kansas River, reducing the nutrient load and provides enhanced treatment of storm events through a constructed wetlands. The retention facility will also enhance an existing community center by providing aesthetic views and educational opportunities.

3) Develop an all-accessible hiking and biking trail within the Old Soldier Creek corridor. Create interpretive signs describing its role of vegetation in stormwater management. (The city has requested funding for this portion of the project under the Environmental Programs and Management (EPM) Account in the US Environmental Protection Agencies Fiscal Year 2002 budget).

This series of photos is showing a bioretention system which is a vegetation-based approach to managing stormwater runoff from Topeka's Hillcrest Community Center parking lot.

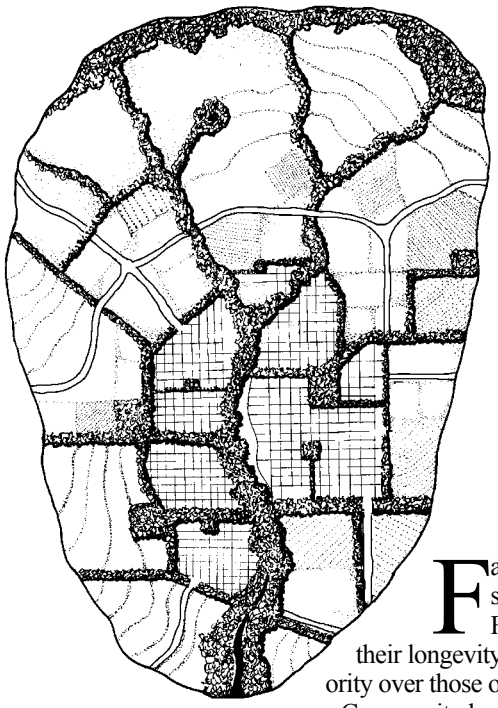
Developing Green Infrastructure will enhance the livability of Topeka with open spaces that work for the people and water quality throughout the watershed.

For more information on Green Topeka, contact Mark Green, 785-368-3851. For more information on developing Green Infrastructure in your community check out these web sites: *www.fs.fed.us/spf/coop/ green_toolkit.htm, http://greeninfrastructure. net*, and *www.topeka.org*

Topeka stormwater goals include:

- Flood and Erosion Control
- Water Quality Protection
- Wetlands/Habitat Management
- Community Acceptance and Education

All of these goals are addressed in the City's stormwater master plan. Flood control and water quality improvement are often interrelated, but cities often approach them in a disjointed and counter productive way. However, "Green Topeka" and the North Topeka Master Drainage Plan" are community-wide efforts that harmonize future projects to alleviate flooding, improve water quality, and enhance neighborhood livability.



A Conceptual Ecobelt Watershed Plan, demonstrates how vegetative barriers can be utilized to connect the rural and urban community and buffer the impacts upon other people.

RECONNECTING THE LANDSCAPE

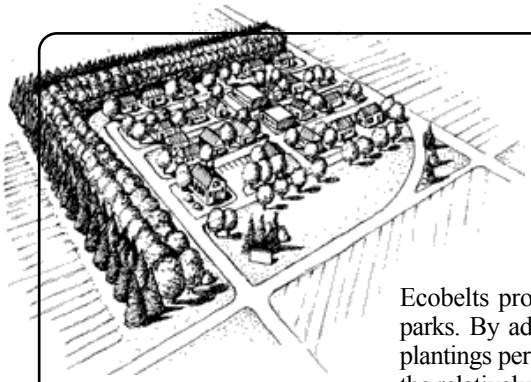
Farms have dominated the U.S. landscape for more than a century. Farmers can rationally argue that their longevity, ownership, and land use take priority over those of people who arrive later on the scene. Community homeowners, however, contend that the growth of cities and towns is inevitable, as well as the infrastructure that comes with urbanization.

Today, sprawling urban developments adjoin ongoing agricultural and forest land enterprises. This not only creates an abrupt, and sometimes harsh visual and physical interface, but also one that is highly charged politically.

Part of the conflict in this zone of rural and urban boundaries grows from an urban population that has become increasingly distanced socially from their agrarian neighbors despite their close proximity. In the past many urban residents had agrarian relatives who provided a tangible connection to agriculture. However, with increasing job specialization and agricultural production efficiency, fewer and fewer people have this familial connection.

Most initiatives to address this zone of tension have used a we-or-they approach. Projects were designed to meet the objectives of one or the other, but not both. Urban objectives in this interface often are achieved by creating vegetative barriers or greenbelts that are protected from further encroachment of the city, and which can screen the community from the effects of farming. Approaches to protect agricultural interests in this zone include special zoning or tax codes that provide exemption for farmers if they continue to make productive agricultural use of the land instead of selling it for development. In each case, the area between farm and city is viewed as one of conflict, of competition for space and resources, and of no-win compromise solutions that neither side may view as optimum from its point of view. The social and increasingly important ecologic needs to reconnect these two sectors demand a more proactive planning approach for the interface that links rather than separates these two land uses.

The use of tree-based buffers, linear arrangements of



By manipulating the composition, arrangement, and placement of plantings within the landscape, we can alter the level of expression of ecologic functions in an attempt to attain the environmental outcomes we desire.

Woody Buffers

Ecobelts provide more than just shade and beauty, bike trails, and links to parks. By adding structural diversity to the landscape, these tree-based linear plantings perform ecologic functions that can have significance far greater than the relatively small amount of land they occupy.

Ecological Functions Created by Tree-Based Buffers

- **Habitat:** provides resources (e.g., food, shelter, reproductive cover) to support wildlife.
- **Conduit:** conveys energy, water, genes, nutrients, seeds, organisms, and other elements.
- **Filter/Barrier:** intercepts wind, wind-blown particles, surface/subsurface water and nutrients.
- **Sink:** receives and retains objects and substances that originate in the adjacent land.
- **Source:** releases objects and substances into the adjacent land.

How Agroforestry Applies to Communities

by Gary Bentrup
Research Landscape Planner, NAC, Lincoln, Nebraska

Working Trees, in the landscape is not a new concept. From the ancient hedgerows in Europe and the shelterbelts in the Great Plains to the greenways or linear parkways in the center of urban establishments, these tree-based plantings have been used to meet objectives of rural and urban residents.

It could be argued that the placement of a woody barrier between urban and rural people creates additional types of distance (reduced human communications, partial solutions to serious differences, and reinforced "us versus them" opinions. Therefore during the creation of an ecobelt system, a sense of shared ownership must be established by involving urban and rural residents in the design, implementation and management process. Previously, buffers have been applied anywhere on the landscape and only addressed individual needs. A coordinated ecobelt system can address the needs of the entire community.

Riparian Forest Buffers are natural or planted streamside plantings composed of trees, shrubs, and grasses that buffer nonpoint source pollution of waterways from adjacent land use. They also provide bank protection, protect aquatic environments, improve wildlife habitat, and increase biodiversity.

Windbreaks are planted strips of one to multiple rows of vegetation. Normally serving as upland buffers, these strips intercept the wind, creating a modified microclimate downwind. Windbreaks are planted to reduce blowing soil, dust, and snow and to protect plants, animals, buildings, recreation areas, roads, and communities.

Special Applications is a catchall category for different practices that can address the many opportunities to use trees and shrubs for specific agricultural or community concerns, such as disposal of liquid and solid wastes.

Ecobelts that incorporate agroforestry practices can address challenges at the rural/urban interface while reconnecting agriculture and communities. For more information on Ecobelts, visit NAC's website at *www.unl.edu/nac*

We-They:
Defining the Challenge

The most obvious conflicts between farm families and neighboring city homeowners at the rural-urban boundary revolve around their differences in goals, life experiences, expectations, and tolerance. Many activities, and even discomforts, on the farm are an accepted part of farm life. These same situations may be highly uncomfortable and unexpected by a family that has always lived in an urban setting before moving to the city limits. Likewise, many challenges faced by city dwellers may be an accepted part of their environment, but completely foreign and out-of-step with people in the countryside.

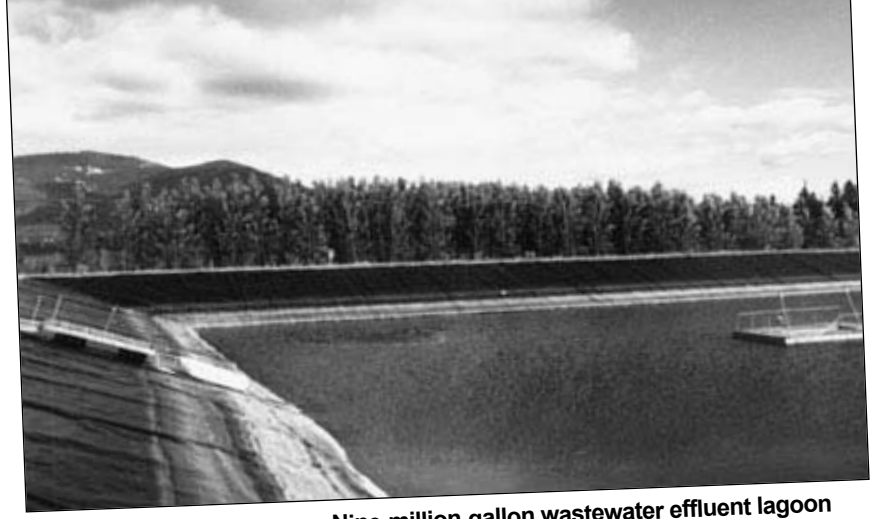
Problems and Different Perspectives at the Rural-Urban Interface

Rural Perspective	PROBLEM	Urban Perspective
	Agricultural-Induced	
Natural part of farm environment	Livestock odors	Unnatural and disgusting
Normal to farm operations	Dust from fields	Hazard to motorists
Accepted part of farming	Noise from equipment/livestock	Disturbs outdoor activities
Essential to reach fields	Slow-moving equipment	Road hazard, slows traffic
Normal farm environment	Insects from livestock	Nuisance to families
Hard to eliminate or control	Herbicide spray drift	Kills yard plants/lawns
Part of farming	Insecticide spray drift	Dangerous to people and pets
	Urban-Induced	
Danger to children/animals/tractors	High-speed traffic	Normal commuter challenge
Harmful to livestock	Dogs in fields	Dogs need open space to run
Harm crops/soil, open gates	Snowmobiles/hiking	People need recreational space
Interferes with operations	Garbage in/near fields	Over-the-fence-out-of-mind
Complication that costs time	Need to lock doors/equipment	Accepted way of life
Interrupts farm operations	Complaints to authorities	Normal problem-solving approach

Source: Stokes, S.N., Watson, A.E., and Mastran, S.S. Saving America's Countryside, 2nd edition, Johns Hopkins University Press, Baltimore, 1997.

Thirsty for Solutions

Poplars Are "Drinking" Up Effluent From Idaho Wastewater Treatment Plant



Nine-million-gallon wastewater effluent lagoon with established trees along side.

Kimberly Stuhr
Technology Transfer Specialist, NAC
Lincoln, Nebraska

The Hayden Area Regional Sewer Board (HARSB) in Hayden, Idaho handles wastewater effluent for about 10,000 to 12,000 people, who create one million gallons of effluent per day. The Sewer Board cannot dump effluent into the Spokane River from June 1 to September 30 each year. What's a Sewer Board Administrator to do during the summer months? How about plant Hybrid Poplar trees to "drink" all that effluent.

That's exactly what Kent Helmer, Administrator for HARSB, did. He, and other members of the Board (representatives from the City of Hayden, Kootenai County, and Hayden Lake Recreational District) are excited about the poplar plantings that they have established. The District owns a total of 475 acres around the treatment plant. Four acres were planted in 1997, another 11 acres were planted this past spring, and they plan to plant another 80 acres in the future. The rest of the land is center pivot irrigated alfalfa and blue grass.

"Community residents are behind us. We're utilizing -- essentially *treating* -- the wastewater ourselves instead of dumping it into the river."

Last year 38,000 gallons of wastewater was applied daily to the four-acre plantation. The maintenance supervisor soon noted that the poplars could use twice as much wastewater as the alfalfa. The goal of the poplar plantation is to have the trees "drink up" about 500,000 gallons/day, which is about 50 percent of the total discharge.

Establishment costs average $2,500 per acre. That may sound like a lot but according to Helmer, "This alternative is much less expensive than building an additional constructed treatment system to polish the wastewater."

Helmer emphasizes that, "Community residents are behind us. We're utilizing - essentially *treating* - the wastewater ourselves instead of dumping it into the river. It's better for the environment and it's better for the people." Helmer continues, "We regularly give tours of the plant to natural resource professionals, college students, and professors. The response we've gotten is that they're all eager to learn more. In fact, everyone I talk to is excited about it. When I get into a conversation with someone on the telephone about our trees, I almost can't get them off."

Clearly the primary purpose of the trees has been for wastewater disposal. Accordingly, Helmer and the other Board members haven't really developed a market for the trees yet. Their first thought was to harvest the trees for wood chips, but it appears that the wood chip market just isn't there. So, the current plan is to harvest the trees for sawlogs when they are 10- to 12-years old. Helmer says that, "We understand that a market for sawlogs exists but we haven't actually talked with the mills yet. We're fairly new at this and we're still learning."

Helmer adds, "Another benefit of the trees is wildlife. We've seen pheasants, deer, elk, and a moose." Satisfied, Helmer adds that, "We pride ourselves in having one of the nicest plantations around.

This operation is an excellent example of using trees to protect water quality. The Sewer Board members' ability to think broad-mindedly about this technology will benefit their entire wastewater treatment operation. Eventually, seeking out markets for the poplar will be an important addition to this already-successful endeavor.

In 10 to 12 years these poplar trees will be harvested for sawlogs. Until that time they will protect water quality and provide wildlife habitat.

Big City
continued from page 1

Concerned over maintaining their outstanding drinking water quality, New York City proposed watershed management regulations in 1990. The agricultural community, and later the forestry community, expressed concern that regulations would place a financial burden on the communities and industries within the New York City watershed. A question was posed, "Why not teach and encourage individuals how to protect water quality in ways that will stimulate business and allow them to prosper, instead of encumbering them with stringent regulations?" Fortunately, New York City listened to these concerns and responded with a landmark decision to fund a voluntary program. A partnership between New York City and the agricultural community led to the creation of the Watershed Agricultural Council (WAC).

WAC's mission is to assist the agricultural and forestry communities in adopting operational and management techniques that protect water quality, as well as enhance economic competitiveness and viability.

To accomplish this mission, WAC developed several programs with funding from the NYC Department of Environmental Protection and the USDA Forest Service, each designed to reach different parts of the agriculture and forestry community. Notably, the Riparian Planning and the Economic Development programs.

The *Riparian Forest Buffers Program* was created to help protect and restore streamside resources in NYC's watershed region. The program provides technical assistance and cost-sharing for buffer projects, often in conjunction with the USDA Conservation Reserve Enhancement Program (CREP) effort in the watershed. It also created a network of funding and professional resources to promote riparian buffer restoration in the Catskills. This network enables landowners and other residents to better understand the value and condition of their riparian corridors, and to easily locate people who can help in designing and completing projects.

Under the *Economic Development Program,* New York City residents support those farmers who are protecting their water supply. Restaurants, green markets, and purveyors in NYC have committed to purchasing herbs, produce, meats, and fish grown by farmers in the watershed. This kind of market support helps producers to venture into new product markets.; allowing producers to ease into forest farming or alley cropping systems to produce things like mushrooms, nutraceuticals, and vegetable crops.

The WAC programs enable farmers to control their own destiny while enhancing the protection of the quality of the New York City water supply. WAC reconciles environmental, economic, and public health concerns based on scientific research and local leadership.

For more information, visit WACs website at: *www.nycwatershed.org* or contact WAC at 607-865-7790.

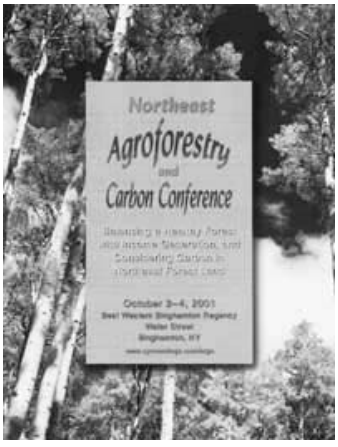
Northeast Agroforestry and Carbon Conference

Binghampton Regency Hotel in Binghampton, New York
October 2- 4, 2001

The conference will bring together a diverse group of participants to share information and explore new opportunities for balancing interests in income generation, local community development and forest health. The conference will emphasize forest farming high-value understory products and tree crop management together with other innovative strategies for improving the sustainable productivity of private woodlands. The Conference will also explore the significance of carbon in the Northeast.

For further information contact Mark Grennan at (518) 828-4385 extension 105, *mark.grennan@ny.usda.gov*.

REGISTER ONLINE: *www.syrmeetings.com/agro*.



Syracuse, New York:
Following New York City's Lead

Syracuse, New York is pursuing a "filtration avoidance" policy to assure a future supply of healthy drinking water from Skaneateles Lake, one of the Finger Lakes. The city established the Skaneateles Lake Watershed Agricultural Program (SLWAP) to assist farmers in protecting the lake's water quality. Modeled after New York City's program, Syracuse hopes to avoid spending between $45 and $60 million for filtration. Like New York City, it has one of the few remaining unfiltered water systems in the country. Both cities opted for conservation on the land and pollution prevention, instead of filtration, to safeguard their water supplies.

Jeff Ten Eyck, SLWAP Manager, says the goal is to show farmers that "we can help protect the lake and save you some money in the process. We develop a whole-farm plan that encompasses Federal, state, and local programs so farmers have just one plan that incorporates and meets everybody's needs."

At 1,200 acres, Chris and Rick Fesko's farm on the hillside east of Skaneateles Lake is the largest farm in the watershed with the largest number of livestock. The Feskos have been cooperating with the Onondaga Soil and Water Conservation District (SWCD) for several years. In addition, they will be adding new best management practices through SLWAP including a barnyard runoff management system, buffer strips, and fencing cattle out of small streams. Chris thinks it's basic: "The whole thing is, we need soil to farm with and that's where it begins. We've had buffers for eons because we don't want erosion. We don't have much topsoil because we're up on top [above Skaneateles Lake]. We could have wind erosion, but we don't because we have planted trees—the 200 trees that I planted 10 years ago are big now." Chris draws the analogy to wine making: "you filter and filter it until it is clear, as our buffers are filtering the water of Skaneateles Lake."

Source: adapted from Buffer Success Stories, NRCS web site.
www.nhq.nrcs.usda.gov/CCS/ny3skan
www.nhq.nrcs.usda.gov/CCS/ny2ero

Upcoming Events

October 2-4, 2001
Northeast Agroforestry and Carbon Conference. Binghamton, NY. Contact: Mark Grennan, Phone: 518-828-4385 ext. 105; *mark.grennan@ny.usda.gov.* Register online: *www.syrmeetings.com/agro.*

October 29-November 2, 2001
5th Symposium of the IUFRO Extension Working Party. Lorne, Victoria, Australia. Contact: Rowan Reid, Phone: 03 8344 5011, Fax: 03 9349 417.

November 8-9, 2001
Working Landscapes in the Midwest. Lake Lawn Resort, Delavan, WI. Contact: Marin, Phone: 612-870-3436. *wlinfo@iatp.org; www.workinglandscapes.org.*

November 8-10, 2001
Hidden Forest Values: Non-Timber Forest Products in Alaska. Anchorage, AK. Contact: Mitch Michaud, *wmmichaud@ak.nrcs.usda.gov;* Phone: 907-283-8732.

November 12-13, 2001
13th Annual Symposium: Wildlife Habitat Council. Renaissance Washington D.C. Hotel. Contact: WHC at (301) 588-8994 or *WHC@wildlifehc.org.*

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www.unl.edu/nac

Mission

The National Agroforestry Center (NAC) is a partnership of the USDA Forest Service, Research & Development (Rocky Mountain Research Station) and State & Private Forestry and the USDA Natural Resources Conservation Service. The Center'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, the Center 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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