Zen and the Art of Soil Science Education

By Barrett Kays

Elizabeth A. Driscoll, 4-H Youth Extension Specialist, grew up learning the Zen of climbing and hiding in trees as a young girl in Okemos, Mich. The self-proclaimed tomboy finally came down to earth in 2001 after she found her place as the education coordinator of the Michigan 4-H Children’s Garden.

Driscoll quickly learned how to hook, reel in and captivate children about plants and soils. One day, she demonstrated exploding Jewelweed seed pods to a group of 3- and 4-year-old children.

“They were really excited and got so involved that they had seeds flying everywhere,” she said. “It was a mind-blowing experience for them, but perhaps not the best seed for broadcasting in the university demonstration gardens.”

These early experiences taught Driscoll to dress up, stage and produce her educational acts as pseudo-theatrical events.

“It is about finding the mystery or secrets in soil science and then passionately sharing them,” she said. She found that it can be difficult to dress up soils for such events, but she has learned to collect soils by color, texture and unusual properties, such as highly micaceous soils. Can you imagine how to stage a slick micaceous event? Well, Driscoll knows how.

She came to NC State in 2006 and has quickly jumped into staging magical events for elementary, middle and high school students across the state. She is the department’s number-one horticulture, crops and soils ambassador, and of course, part-time “Zen Master.”

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From the Department Head

The North Carolina Cooperative Extension Service profoundly touches the lives of citizens in every county of our state, in both rural and urban settings. Extension at its core is local, for this is where support for county programs and engagement with county agents and staff first takes root. And yet at the same time, Extension’s reach is broad and deep by virtue of the partnerships formed with state and federal organizations.

The Department of Soil Science is proud of its Extension heritage and the myriad of working relationships that have been developed over many decades. Moreover, these relationships are integrated into the overall fabric of the Department, with meaningful and visible outcomes in our research and teaching programs as well. This integration will serve us well going forward, as the increasingly interconnected world in which we live benefits from our collective abilities, with Extension acting as the bridge across the state and even around the world.

The Department’s outreach activities span a broad spectrum of agricultural and environmental issues important to rural and urban communities. This issue of Soil Science Solutions strives to capture some of our Extension engagements, ranging from youth programs to diverse agricultural systems to partnerships with various government agencies. Follow the energetic Liz Driscoll, 4-H Youth Extension Specialist, and how she introduces the amazing world of soils to young, inquisitive minds. In the western part of our state, you’ll have the opportunity to learn how Dr. Greg Hoyt and Dr. Ron Gehl are using their soil fertility and management expertise to enable specialty crop growers to thrive in a competitive production environment. Each of their programs is also a shining illustration of how applied research is meshed with extension programming.

At the county level, take note of Tim Smith’s efforts as Extension Director in Chowan County and a graduate of our Department, to ensure that farmers’ nutrient management goals are realized with the best available scientific information. Just as these county level partnerships are important dimensions of our Extension activities, so too have been relationships forged with state and federal agencies. You’ll read about these relationships and the “ties that bind” our Department with a multitude of agencies over the decades.

North Carolina Cooperative Extension and the Department of Soil Science have a bright future. We look forward to meeting a wide range of outreach and engagement needs so that we may continue to serve and have a meaningful impact for citizens of North Carolina.
Crop diversity and cropping practices have radically changed over the years, especially in the mountain and western Piedmont regions of North Carolina. Traditional crops are now only a small slice of the farm production in the region. Today there is a significantly greater reliance on specialty crops. Across the state, specialty crops made up 45 percent of all farm crop income in 2010. North Carolina’s specialty crops ranked third in all farm income in 2010 and were only exceeded by broiler and hog operations.

The Soil Science Department’s presence in the mountains dates back to 1958 when Dr. Jim Shelton was assigned to the Mountain Horticultural Crops Research and Extension Center (MHCREC), along with a horticulturalist. In 1981, Dr. Greg Hoyt started his work at the MHCREC. Hoyt has developed new cropping systems for both conventional and organic farms. He also started strip and no-tillage research in 1982 to provide guidance to farmers on erosion control, buildup of soil organic matter, improved weed control and efficient use of inorganic fertilizer.

Hoyt refers to these new approaches as “alternative conservation management systems.” He, along with other faculty at the center, also have developed a comprehensive approach for organic farms that includes organic fertilizers, alternative cropping techniques and new approaches to pest management.

After many years of research, Hoyt has developed ways to reduce nutrient leaching, increase yields, reduce farming costs and improve water quality of mountain streams through his research analysis that relies on detailed temporal and spatial monitoring of nitrate concentration within soil profiles and across soil landscapes. Graduate students have used long-term tillage systems established by Hoyt as a resource for master’s and doctoral programs, investigating topics such as soil organic matter, microorganisms and water quality.

In recent years, Hoyt has collaborated on an environmental quality research program with Drs. Deanna Osmond and Julie Grossman to compare nutrient and sediment losses from organic and conventional systems in which both conservation and conventional tillage was used.

Dr. Ron Gehl joined the Center as an assistant professor of soil science. Gehl’s role has been to conduct soil fertility research (continued on page 7)
Riparian buffers can be very effective in protecting water resources from nonpoint source pollutants such as sediment and nutrients.

The Local Movers and Shakers in Agricultural Nutrient Management

By Barrett Kays

Over the last 30 years, soil scientists at NC State University have been researching ways to reduce the environmental impacts associated with crop production. In eastern North Carolina, this has been of considerable interest as a means to control nutrient runoff into the state’s rivers and estuary systems. The Department of Soil Science Extension specialists have developed and are teaching new methods to local Extension agents that will significantly reduce nutrient concentrations in runoff flowing from agricultural fields through the use of conservation farming practices.

The local county Extension agents are on the front line because they are directly providing the training and assistance to farmers on how to implement these new practices. These agents are responsible for assisting in the implementation of nutrient reduction management plans on essentially all of the farms in their counties. Obviously this is a big task and it requires really motivated county agents to orchestrate the management plans across an entire county. Tim Smith, County Agent for Chowan County, is one of those motivated movers and shakers.
As part of his graduate research, Tim Smith monitors the groundwater level in a well located in a riparian buffer near Warsaw, NC.

Smith earned his master’s degree in soil science from NC State. His research focused on the effectiveness of riparian buffers to reduce nitrogen moving into streams. He found that under soil and site conditions characterized by high nitrate leaching, wider buffers were more effective. After graduation, Smith moved back to eastern North Carolina where he worked his family’s 4,000-acre farm in Chowan County. Tim also worked as research specialist at the Vernon James Research and Extension Center in Plymouth, NC. At the center, he became immersed in fine tuning nutrient management practices for corn production in eastern North Carolina.

Now as an agricultural agent and county director in Chowan County, Smith is responsible for providing the most recent agricultural information to his local farmers. He explained that “knowledge of both nutrient management research and the best farming practices are essential.” The local agents must fully understand the abilities of all of their farm operators to effectively work with the entire community and achieve the county wide nutrient reduction goals, he said.

The Department of Soil Science Extension faculty provide the most up to date crop and nutrient management scientific information to the agents through an online technical training program called “Soil Probes.” Soil Probes provides many diverse topics from implementing cover crops to fertilizer management practices.

The Department also provides agents with presentation materials that they use to tailor practices to each of their clients, also giving them direct access to soil science fact sheets and other management strategies (www.soil.ncsu.edu/about/publications.php). County agents use these presentations to start and continue a process referred to as the “diffusion of innovation.”

In order to achieve nutrient management goals, the diffusion of innovation process ultimately relies on the effectiveness of the county agent in communicating with his or her clients. Of course this reliance on the county agents has always been the real key to the effectiveness of Cooperative Extension. We have many highly effective county agents in North Carolina, and if it were not for these local movers and shakers, because they are the backbone to economic and environmental success through the use of ever-expanding scientific knowledge.

Typically the agents provide information to all of their clients, but they also rely on another approach unique to the Extension Service. They ask their most innovative farmers to demonstrate the newest agricultural practices to other farmers in the community. The innovators in the community thereby teach the next group, which are referred to as the early adopters. As this process continues, the most successful practices eventually are adopted by almost the entire farming community. In this way, nutrient management goals are achieved throughout river basins without applying governmental regulations to every farm operation in the state.

It really takes special people to fit this modern scientific role of our county Extension agents. We are proud of our local agents; they are our real movers and shakers, because they are the backbone to economic and environmental success through the use of ever-expanding scientific knowledge.
Over many decades, the Department of Soil Science has participated in numerous cooperative efforts with federal, state and local agencies. Soil fertility research and Extension personnel in the Department have had a strong and continuous working relationship with the North Carolina Department of Agriculture and Consumer Services’ (NCDA&CS) Agronomic Division. Starting in 1948, directors of the soil testing laboratory were also faculty members of the Agronomy Department, later the Soil Science Department, which is true even today. In addition, the Department has had a cooperative working relationship with the experiment stations owned and operated by NCDA&CS.

Also, now with NCDA&CS, the Department provides scientific and technical information to the Division of Soil and Water Conservation (DSWC) and the North Carolina Soil and Water Conservation Commission to enable those entities to fulfill their responsibilities. The Department also is a valuable resource for the North Carolina Association of Soil and Water Conservation Districts, as faculty are frequent presenters at regional and statewide meetings and serve on association committees. Faculty members have served as directors of the DSWG since its inception in 1979. In addition, DSWG has helped with riparian buffer research conducted in the Department.

The Department has collaborated with the Natural Resources Conservation Service (NRCS) for many years. As members of the National Cooperative Soil Survey, the Soil Science Department and NRCS have shared responsibility for all soil survey operations in North Carolina. In addition, the Soil Science Department provides faculty expertise to NRCS through its training programs and workshops, as well as through individual consultation. The Department has equipped many students for careers in NRCS, and some of our graduates now hold major leadership positions in the NRCS state office.

The Department has close ties with several divisions in the North Carolina Department of Natural Resources (DENR), including the Division of Land Resources (DLR).

Department research on sediment and erosion control has helped rewrite rules for construction sites both statewide and nationally. The Department also has provided expertise to the North Carolina Sedimentation Control Commission and to local agencies since the 1970s, with faculty members serving on the Commission.

With the Division of Water Quality, the Department’s extension specialists have provided leadership for mandatory river basin accounting tools and nutrient management training, and as science or extension advisors on the Tar-Pamlico, Jordan Lake and Falls Lake basin oversight committees. And the Department has provided nutrient management training for certified nutrient management planners.

Another DENR Division served by the Department since the 1970s is the Division of Forest Resources (DFR). The DFR has a Technical Advisory Committee that frequently addresses issues requiring soils expertise.

The state Department of Transportation has been a strong partner with our department, funding numerous studies with faculty over the years. In addition, the DOT established a certification program through the Department and the Department of Biological and Agricultural Engineering in 2005.

The Department also has assisted the North Carolina Governor’s office, the North Carolina Rural Economic Development Center, the North Carolina Farm Bureau and the State Grange.
Zen Master (continued from page 1)

Last year Driscoll appeared on UNC-TV’s In the Garden with Bryce Lane, in a segment that focused on gardening with children. This single episode was so unusual and creative that it won a Midsouth Regional Emmy® award.

Driscoll founded and became the state coordinator for the Junior Master Gardeners, within the 4-H Plant and Soils Program. She now has more than 1,000 Junior Master Gardeners staging their own garden events.

She created “Soil Solutions,” a 3rd-grade 4-H school enrichment curriculum that consists of eight lessons she teaches to local Extension agents, adult Master Gardeners and elementary teachers in each region of the state. The program reaches more than 6,500 students each year.

In partnership with Melanie McCaleb, an Extension associate in soil science, Driscoll recently developed a 4-H curriculum called “Soil to Seed” that deals with soil erosion, sediment and turbidity control.

Driscoll and her team were among the first in the nation to implement FoodCorps, a new program of the United States Department of Agriculture that serves limited-resource communities. They are partnering with local organizations throughout North Carolina to deliver hands-on nutritional and gardening education and to bring high quality food to school cafeterias.

She also has developed a pilot “Soil Ambassadors” training program to teach soil scientists how to stage imaginative soil educational events in their local schools.

“Liz is knowledgeable, enthusiastic and a breath of fresh air,” according to Steve Gurley, soil scientist and one of Driscoll’s program recruits.

Driscoll is still climbing trees, expanding her educational team and training them to stage unique educational events across North Carolina. She is even recruiting her own daughter, Cora, starting her early by first teaching her the Zen of tree climbing.

Specialty Crops (continued from page 3)

for certain specialty crops, including apples and Christmas trees. He has evaluated solutions to reduce calcium deficiency in apples, a problem that causes significant financial loss to growers by inducing bitter pit disorder in certain cultivars.

His work on Fraser Fir Christmas trees has focused on understanding the changes in soil physical and chemical properties, nutrient uptake and growth characteristics associated with the use of leguminous cover crops.

Recently, Gehl has developed a strong research program focused on the production of potential bioenergy crops. Both perennial and annual grasses are used for bioenergy production. Giant miscanthus and switchgrass, both perennial grasses, are two of the most prominent crops currently under investigation as bioenergy sources. Sweet and forage sorghum, more traditional annual row crops, are also being investigated for use in renewable bioenergy production. Gehl currently has research studies with these crops at over 15 locations from the mountains to the coast.

The federal Biomass Crop Assistance Program provides incentives to growers to start up new operations. Although some North Carolina farmers are eager, they will likely not start production until a biofuel processing plant is located in the state. However, this may be just around the corner, so Gehl’s research program is developing the technical guidance that growers will need to be successful.

“Greg and Ron have served the farmers of Western North Carolina through their excellent research and extension programs for specialty crops,” Osmond said. Serving these niche production systems in the western Piedmont and mountains helps farmers remain competitive, while preserving soil and water resources.”

It is projected that specialty crops will become a more dominant sector of the farm economy across the state in coming years. If that’s the case, then the research at the MHCREC will continue to be in demand to support these growers.

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