From 1908 to 1917 Extension Division’s famous “College on Wheels,” an educational train, operated across the state. This annual trek included several cars for livestock and exhibits of modern farm machinery and farming practices. College faculty exhibited livestock and delivered instruction to farmers and their families who welcomed them with great excitement.
They learned years ago that healthy soils and clean water are essential for a bountiful harvest. Before the advent of agricultural research, early settlers plowed and planted the land until the soil was worn out. Then they moved on to another plot to repeat the cycle. In fact, the University of Georgia was named a land grant institution in 1862 to provide education in agriculture and the mechanical arts. In 1887 its responsibilities expanded to conduct research on farming methods that would maintain the integrity of the state’s natural resources. Early scientific research at land grant colleges and experiment stations focused on restoring the proper nutrient balance to the soil.

Conservation practices introduced in the early 1900s included:
- crop rotation to reduce soil pathogens
- diversified farming to prevent insect infestations
- contour farming to stop erosion

Extending agricultural research from university scientists to state farmers became a challenge at the turn of the 20th century. Farmers were Georgia’s first environmentalists.

Knowledge is developed through observation and experience, science and experiment. There is no place in science for opinion, for dogma, for authority. Experiment is the great instrument of investigation. It resembles experience, indeed it is experience under a new form, but is more condensed, more rapid in its work and more fruitful of results.

University of Georgia State College of Agriculture and Mechanic Arts, Agricultural Experiment, Station Bulletin No. 2, January 1889, Athens, Ga., “Factors in Agricultural Investigations.”

A forerunner to Georgia Extension was the Farmers’ Institute movement. Trucks transported exhibits; popular agenda items included cattle breeding, manures, soils and buttermaking.

Farmers were Georgia’s first environmentalists.

They learned years ago that healthy soils and clean water are essential for a bountiful harvest. Before the advent of agricultural research, early settlers plowed and planted the land until the soil was worn out. Then they moved on to another plot to repeat the cycle. In fact, the University of Georgia was named a land grant institution in 1862 to provide education in agriculture and the mechanical arts. In 1887 its responsibilities expanded to conduct research on farming methods that would maintain the integrity of the state’s natural resources. Early scientific research at land grant colleges and experiment stations focused on restoring the proper nutrient balance to the soil.

Conservation practices introduced in the early 1900s included:
- crop rotation to reduce soil pathogens
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- contour farming to stop erosion

Extending agricultural research from university scientists to state farmers became a challenge at the turn of the 20th century.
century. In 1911, university scientists along with politicians and farm animals boarded a train on a 47-day tour to take “revolutionary agricultural practices” to Georgians. The trip marked the beginning of the Cooperative Extension Service. Today, University of Georgia Extension agents work in 157 counties providing expertise to farmers, homeowners, and local governments on rural and urban agricultural and natural resource issues, 4-H education, family and consumer sciences, and forestry issues.

After World War II, commercial fertilizers and pesticides were introduced as part of the “Green Revolution.” Yield per acre increased 16 fold from 1919 to the present. However, in the late 1960s it became evident that excess chemical use could have an adverse effect on the very environment farmers relied on for their livelihood. Congress directed research funding to find ways to reduce pesticide use.

As a result, agricultural scientists developed Integrated Pest Management (IPM), a program that promotes cultural, biological and mechanical pest control methods as substitutes for chemical pesticide use. In ongoing research, scientists look at various crops and ways to reduce pest infestation without chemicals. The Cotton IPM Program reduced pesticide applications from 16 in 1986 to 1.9 in 2001.

Fertilizer run-off into surface water can also be a problem. Today, scientists study the minimum amount of fertilizer crops require to produce the greatest economic benefit. Farmers map the fertility of their fields using soil sampling and global positioning devices. Through precision agriculture, nutrients are applied only where the soil needs them. The horticulture industry uses time-release fertilizers to avoid chemical runoff from urban landscapes.

In the late 20th century, Georgia’s population exploded. Between 1990 to 2000, nearly 2 million people were added. People also migrated from rural to urban areas. The small family farm changed to a highly managed production unit using the latest technological innovation to remain profitable while providing consumers with an abundant and safe food supply. The number of farms has decreased dramatically while the size of the farm has increased. Total cultivated acreage in Georgia agriculture is rapidly shifting from traditional row crops to highly valued fruits and vegetables, turf, nursery and pine trees. Environmental awareness and environmental stewardship increased among producers of traditional and emerging crops.

At the turn of the 21st century, 72 percent of Georgia’s 8.2 million citizens live in urban areas which strain natural resources. Water quality and quantity, air quality, land use management and food safety are high priority issues for government officials. In 1991, the University of Georgia College of Agriculture added Environmental Sciences to its title to emphasize the expanding role of environmental protection in its research and extension programs. The college now includes urban agricultural and environmental issues. This year’s environmental report highlights many research and extension programs having urban implications. In contrast, last year’s environmental report (http://unit.caes.uga.edu/oes/report.html) focused on rural agricultural production.

Today, about 100 scientists are engaged in environmental research in areas such as:

- Reduction of excess irrigation on farms and urban landscapes;
- Surface water testing for pharmaceuticals;
- Economic analysis on the future of biofuels in Georgia;
- Effects of global warming on agriculture;

### Georgia’s Population Increase and Demographic Changes

<table>
<thead>
<tr>
<th>Years</th>
<th>1920</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>2.9</td>
<td>8.2</td>
</tr>
<tr>
<td>Rural/urban (%)</td>
<td>75/25</td>
<td>28/72</td>
</tr>
<tr>
<td>Number of farmers</td>
<td>310,731</td>
<td>50,000</td>
</tr>
<tr>
<td>Land in agriculture (acres)</td>
<td>25.5 million</td>
<td>11 million</td>
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</table>
Our scientists, educators and Extension agents have responded to the environmental demands of the 21st century by adding new academic majors such as:

- Environmental economics and management;
- Environmental soil science;
- Environmental health science; and
- Agriscience and environmental systems.

The college has established interdisciplinary centers of excellence that include:

- Center for Urban Agriculture
- Center for Food Safety
- Center for Internet Imaging and Database Systems
- National Environmentally Sound Production Agriculture Laboratory

The county Extension agents quickly extend research to producers, homeowners, agribusinesses, and local governments in Georgia on a variety of environmental issues. They receive training in areas such as urban and agricultural stormwater management, water conservation and integrated pest management. As environmental priorities change so does agent training. This flexibility allows the College of Agricultural and Environmental Sciences to respond quickly to the environmental challenges of the 21st century.

For more information, visit http://unit.caes.uga.edu/oes/

Robert N. Shulstad
Assistant Dean for Research
Director – Office of Environmental Sciences
Water quality and water quantity concerns still rank first among environmental issues in Georgia. The tri-state water compacts among Georgia, Alabama and Florida are yet unresolved. Approximately 6,400 miles of Georgia’s rivers and streams are either partially or totally unable to support their designated uses. A five-year drought prompted the Georgia Environmental Protection Division to declare a moratorium on new water permits in the Flint River Basin where state agriculture is strongest. The college responded to these challenges with a variety of research and extension programs. Scientists discovered that antidepressants which pass through waste water plants into streams can retard the development of fish and frogs. They also studied whether cattle wading in streams affect water quality. The Department of Defense awarded college scientists a grant to help military installations comply with water regulations. Finally, Extension engineers conducted audits of outdoor watering for urban homeowners and commercial establishments and devised a simple method for farmers to conserve irrigation water.

Mobile Laboratory Audits Urban Landscape Irrigation

In summer, urban water bills can soar as much as 50 percent due to outdoor watering. In times of severe drought as we experienced recently, irrigating outdoor landscapes is often restricted and even banned. Therefore, every drop of water applied to plants must count. Kerry Harrison, biological and agricultural engineer, designed a mobile laboratory to evaluate the efficiency of commercial and residential irrigation systems in Douglas County. Fourteen irrigation (metered) users, representing greater than 7 percent of the total, were audited. The monitored landscapes were split evenly between residential and commercial accounts. The auditing team looked at sprinkler types, selection of nozzles, areas covered, off-site application and pressure conditions at near and far sprinklers.

Recommendations to reduce water use included:

- Size nozzles according to the area of coverage to save 40,000 gallons of water per week.
- Adjust application rate for each zone (grass, trees and flowers) to reduce water by 5,000 gallons per week for each system.
- Convert full-circle rotating sprinklers to part-circle to conserve varying amounts of water depending on the
degree of off-site applications.

• Reduce water applications during fall, winter or spring.

With recommendations implemented, 50,000 gallons or 20 percent of water per week can be saved. Small communities can benefit from a mobile irrigation laboratory because they cannot afford to hire personnel to help with outside water management. To conserve water during drought periods, officials may resort to outdoor watering bans. The mobile laboratory examines ways homeowners and commercial users can maintain the beauty of their landscapes while conserving water.

For more information: e-mail Kerry Harrison at kharriso@uga.edu.

**Irrigation Scheduling Made EASY**

*by Kerry Harrison*  

Successful farming relies on applying the correct amount of water on crops. Most farmers do not use scheduling devices because they are too complicated to use and maintain. Agricultural engineers at the College of Agricultural and Environmental Sciences devised EASY Pan, a simple, mechanical system to help farmers determine when to irrigate their crops and how much water to apply. It is made from readily available parts such as a wash tub and toilet bowl float. Farmers can read it from the edge of the field. The EASY pan, as shown in Figure 1, takes into account the water in the soil, water used by the crop, and water applied by a sprinkler system or through rainfall. Tests indicate EASY Pan irrigation recommendations are comparable to computer-based models. The end result: EASY Pan is an easy way for farmers to conserve water and save money.

*Kerry Harrison is an Extension engineer in the Biological and Agricultural Engineering Department. He provides outreach for the engineering aspects of soil and water programming in Georgia.*

**Bleckley Farmers Save Water and Money—**

Two Bleckley County farmers tested EASY Pan on their 180 and 235 acre farms. The savings:

- **13.8 million gallons of water** or one irrigation event
- **$2,755** for diesel fuel to run the water pumps

![FIGURE 1. EASY Pan, a simple, mechanical system, helps farmers determine when to irrigate their crops and how much water to apply.](image-url)

**Antidepressants Delay Fish, Frog Development**

*by Cat Holmes*

Researchers at the University of Georgia led by Marsha Black of the College of Agricultural and Environmental Sciences Department of Environmental Health Sciences have found that low-level exposure to a common class of antidepressants found in streams and ponds delays both development in fish and metamorphosis in frogs. The scientists are studying the toxicity of a widely used group of antidepressants called selective serotonin re-uptake inhibitors (SSRIs). The study has important environmental implications because some of these widely-prescribed drugs, which include Prozac, Zoloft, Paxil and Celexa, have been found in low concentrations in surface water, particularly waste water.

**Fish**

The researchers found that low concentrations of fluoxetine (Prozac), the most commonly prescribed SSRI, significantly slowed development in Gambusia, or mosquitofish, which are often used to study toxicity on aquatic organisms.

“We found that male sexual development slowed by two to four weeks,” said Ted Henry, a UGA researcher who also worked on the project. When the fish were 80 to 85 days old, he said, the
sexual maturity of those exposed to low levels of fluoxetine was significantly delayed. However, by the end of the study, when the fish were 145 days old, the same fish had caught up developmentally with the unexposed fish.

“We’re scratching our heads right now as to exactly what this means,” Black said. “But we know that in water, timing is everything. Reproduction for some species is timed to coincide with algae blooms for example. And possibly, if sexual development is delayed, timing of reproduction could be affected and you could see some population impact.”

For the next phase of the study, the researchers will more closely examine the reproductive tissue of the fish affected by fluoxetine. Are they able to reproduce? Is there a reduction in the number of embryos? Or is there no ultimate effect?

“These are some of the questions we’d like to answer,” Black said. “There are still a lot of unanswered questions.”

**Frogs**

The researchers also found that metamorphosis in frogs exposed to low levels of fluoxetine took longer than usual (figure 2). For frogs, particularly the land-based frogs of North America, such a delay could be a matter of life and death, Black said, because frog eggs are often laid in temporary water beds — ephemeral ponds and wetlands that dry up.

“If the tadpoles have not developed and undergone metamorphosis by the time the water has evaporated, they’ll dessicate up in surface water, Black said.

The researchers strongly suspect that results implicate a disruption of thyroid function and will carry out further research this spring to confirm or deny their suspicions. “We know that the thyroid levels peak with metamorphic climax, when the legs and arms form and the tail resorbs,” Black said. “We believe that fluoxetine inhibits the thyroid, so we’re measuring the thyroid hormone levels next.”

**SSRIs in the Environment**

The number of prescriptions for SSRIs has exploded since Prozac first came on the market 15 years ago. SSRIs are most often prescribed for depression but are also used to treat anxiety, panic disorder, obsessive compulsive disorder, eating disorders, and social phobia. Because they are prescribed for chronic conditions, people take them for months or years, increasing the likelihood of build-

“*If the tadpoles have not developed and undergone metamorphosis by the time the water has evaporated, they’ll dessicate with the ponds.*” — Marsha Black

FIGURE 2. Frog exposed to low levels of fluoxetine (right) without arms and legs as compared to normal frog development (left).
taminants such as nitrogen and phosphorus. University of Georgia scientists examined the difference between the impact of dairy herds and beef herds on stream quality.

**Dairy Cattle Study**

Zack Thomas, an ecology student, monitored water quality on a stream that runs through a 10-acre pasture where 15 to 30 heifers graze near Eatonton. He took samples on a tributary of Gladey Creek during a period when the cattle had full access and after it was fenced. The results showed a dramatic improvement in stream water quality when cattle access was restricted by the fence. Aquatic invertebrates also showed an improvement in diversity and habitat quality after the fence was closed. The results for fecal coliform, phosphorus and ammonium are shown in figures 3 and 4. Limiting stream access allowed buffer vegetation to make a remarkable recovery. (See photos on cover, upper right-hand corner.)

**Beef Cattle Study**

The second project looks at how beef cattle affect stream quality and how much time cattle spend in streams. Many studies show how much fecal matter cattle produce per live weight and its nutrient and bacteria concentrations. However, little is known about the amount of time cattle spend wading in streams.

Monte Matthews, a student in the Department of Crop and Soil Sciences, performed this experiment at the University of Georgia Central Research and Education Center. Two small tributary streams to Gladey Creek flow through two 25-acre fields. The upstream fields were fenced for approximately eight years. In the downstream fields, the cattle have direct access to the stream. Each acre contains one cow and one calf.

To determine the amount of time cattle spend in the streams, two to four cows in each unfenced pasture wore global positioning system collars. The collars took a measurement every five minutes. The GPS has an accuracy of less than 10 feet.

Average E. coli and suspended sediment concentrations in water leaving the unfenced pastures were much higher than the fenced pastures, showing the direct effect of cattle on stream quality.

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**FIGURE 3.** Average FC concentrations at the reference sampling site (upstream of the field) and pasture sampling site (downstream of the field) in the pre-fencing and post-fencing periods.

**FIGURE 4.** Average soluble reactive phosphorus (SRP) concentrations (left) and ammonium (NH$_4$) concentrations (right) in the pre-fencing and post-fencing periods.
comparing E. coli stream concentrations from dairy and beef cattle where cattle can wade in the streams, studies show dairy cattle have a higher impact on stream quality than beef cattle. This is likely due to a higher grazing density. Average concentrations of sediment and phosphorus in baseflow samples are similar at all sampling sites and showed very little effect of cattle (table 1).

Results also show cattle spend about 10 percent of their time wading in streams in the summer months. That time in streams drops off to 2 percent in the winter months.

This research supports the Extension service recommendations, which are:
- Fence streams to prevent cattle from entering,
- Provide an alternative source of water,
- Vegetate the stream buffer.

For more information: e-mail David Radcliff at dradclif@uga.edu.

David Radcliff is a professor in the Crop and Soil Sciences Department. This work was done with Miguel Cabrera (Crop and Soil Sciences), Judy Meyer (Institute of Ecology), and Mark McCann (formerly Animal and Dairy Science.)

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**Scientists Help Military Meet Water Regulations**

*by Susan M. Varlamoff*

In a partnership that is unique in the nation, scientists from the University of Georgia College of Agricultural and Environmental Sciences are assisting southeastern military installations comply with water regulations. The Clean Water Act, Safe Drinking Water Act, National Pollutant Discharge Elimination System and Total Maximum Daily Loads all require military bases to reduce pollution entering nearby rivers and streams. Failure to do so may result in new treatment requirements or restrictions on an installation’s waste water treatment plant permit. Either could significantly impact military budgets and operations.

Through funding from a Department of Defense pollution prevention grant, a Watershed Advisory Board was established to provide direction for the project. Membership includes:
- Federal and state government officials with expertise in pollution prevention, water resources planning, and policy and regulations;
- Water managers, planners, pollution prevention specialists and natural resource managers from southeastern military bases in EPA Region 4;
- Water quality and water quantity scientists from Region 4 southeastern universities.

The eight-state southeastern region of the Department of Defense contains 65 military bases as seen in figure 5. This represents 20 percent of the U.S. total. Many southern bases train the infantry, which involves tearing up the ground with tanks and mortar fire. Unvegetated ground can cause stormwater runoff problems for nearby rivers and streams.

Southeastern land grant universities have formed a collaboration to combine training and expertise on water issues through the Cooperative State Research, Education, and Extension Service Southern Regional Water Quality Program. Linking water managers working for military facilities in the DoD Region 4 Pollution Prevention Partnership with scientists conducting research at southeastern land grant universities is an important goal of the one-year grant.

“Military facilities offer a controlled environment for a scientist to tackle watershed problems,” said David Gattie, a research engineer with UGA’s Watershed Team. “We look forward to working with the bases on the many challenges they face regarding water issues.”

Using a survey developed by the Natural Resources Conservation Service, the Steering Committee asked all military bases to rank 14 water issues from highest to lowest priority. Some installations have dealt successfully with water issues while others struggle to address them. Military environmental specialists expressed a strong interest in sharing case studies and plans within and between service branches. Transferring successful strategies saves resources and time.

**Technology Transfer**

Workshops are provided in the areas of top priority. The final Water Supply and Conservation workshop is scheduled for the spring of 2004. It will bring
together water scientists from southeastern universities and military environmental managers for the purpose of networking.

Web Site – Rather than sift through pages of federal and state regulatory Web sites, military water managers requested the information be available on one Web site. The College of Agricultural and Environmental Sciences Office of Communications developed a Web site with links to federal regulations, state regulatory agencies, university scientists and their areas of expertise, military case studies, educational material and upcoming events.

Water Conservation Study – A graduate environmental economics student prepared a study of water conservation practices used on some military bases. It will be posted on the Web site for the purpose of information exchange.

“The project has earned the acronym PRAISE because it fulfills the mission of my organization,” said Viv Verma, Eastern Region Program Manager for Water and Natural Resources Programs for the Air Force Center for Environmental Excellence. “PRAISE stands for Partnering between universities, regulators, and services; Regulatory awareness; Assistance to installations; Interservice coordination to reach consensus on areas of concern; Staff advisory services; and Education and training.”

For more information: visit http://interests.caes.uga.edu/watershed/.

Susan M. Varlamoff is a program coordinator for the Office of Environmental Sciences and has worked in the environmental field for 21 years.

Areas of high concern:
1. NPDES Stormwater Phase II
2. NPDES Erosion and Sediment Control
3. Water Supply

Pollution Prevention Tools and Techniques
College of Agricultural and Environmental Sciences scientists proposed the following:

- Compilation of resources such as regulations, policies and guidance available on a Web site.
- Information exchange and communications via the Web site, e-mail, listserv and workshops.
- Education and training through workshops, training and Web site.
- Technical and regulatory assistance such as on-site training and pilot projects.

![FIGURE 5. DOD Region 4 P2 Partners](image-url)
Survey Shows Public Values Wilderness Land

by April Reese

A recent study conducted by a University of Georgia and U.S. Forest Service research team indicates 80 percent of the public is glad to know wilderness land is out there, whether they use it or not.

Almost 40 years ago, Congress passed the Wilderness Act, which restricted grazing, mining, timber cutting, and mechanized vehicles in protected areas. It began with 9.1 million acres. Now, 4.4 percent of the continental United States is protected as wilderness land. Alaska contains about 60 percent of the total protected land areas in the United States.

The act defines wilderness land as “an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.”

Georgia has 485,000 acres protected under the National Wilderness Preservation System. The Okefenokee National Wildlife Refuge is the largest of these areas, encompassing 396,000 acres of the 438,000-acre swamp.

John Bergstrom, an economist with UGA’s College of Agricultural and Environmental Sciences, and U.S. Forest Service research colleagues Ken Cordell and Michael Bowker, have been conducting a national study to determine how people view and value wilderness areas.

“Findings indicate broad support for the concept of wilderness, based mostly on the ecological, environmental quality, and non-use values respondents believe wildland protection provides.” — John Bergstrom
Survey says...

- 44.4 percent reported they knew the National Wilderness Preservation System existed.
- 55.7 percent said the amount of protected land was inadequate (majority of these respondents were 55 years of age or younger).
- 78.9 percent ranked protecting water quality as the most important value.
- More than 70 percent of the respondents consider protecting wildlife habitat, protecting air quality, protecting wilderness for future generations, and protecting endangered species to be either "very or extremely important."
- Least important factor was the amount of income generated for the tourist industry. Scientific study, recreational opportunities and providing spiritual inspiration also received low marks, even though close to half of those surveyed ranked these values as "very or extremely important."
- Across income, education, lifestyle, gender, race, employment status and age groups, there were no statistical differences in the way people assign values to wilderness.
- Young people and women were more likely to visit wilderness areas.

and non-use values respondents believe wildland protection provides," Bergstrom said.

For more information: e-mail John Bergstrom at jbergstrom@agecon.uga.edu.

April Reese is a student writer with the University of Georgia College of Agricultural and Environmental Sciences.

Environmentally Friendly Farming Catching On

by Sharon Omahen

Farmers don’t plow their fields when they use conservation tillage systems. This saves them labor and fuel, adds nutrients to the soil, and reduces erosion and runoff.

"Today, more and more farmers are looking for ways to build up their soil," said Julia Gaskin, a land application specialist with the University of Georgia College of Agricultural and Environmental Sciences. "Not plowing or harrowing the soil is just one way."

Gaskin works with U.S. Department of Agriculture counterparts and the Georgia Conservation Tillage Alliance to educate farmers statewide on the benefits of conservation tillage systems.

Holds soil in place

Conservation tillage systems as shown in figure 6 encourage farmers to follow a main crop with a cover crop. "Cover crops hold the soil in place and provide organic matter," Gaskin said. The next crop is planted into the cover crop’s debris. Gaskin said this reduces soil crusting, allowing more water to soak into the soil rather than running across it.

"As a result, the soil can hold more water," Gaskin said. "And holds it in the root zone. Research conducted at UGA and the USDA Agricultural Research Service has shown this water-holding

“When farmers use conservation tillage systems, they plant more efficiently, and there’s less erosion and fewer pollutants." — Julia Gaskin

FIGURE 6. Examples of no-till cotton (left) and no-till soybeans (right).
power can mean the difference in getting a crop through the common small summer droughts.”

Conservation tillage is helping improve farming’s image, too. “Agriculture is often viewed as a polluter, so it’s important for people to realize that farmers are working to improve the environment,” she said. “When farmers use conservation tillage systems, they plant more efficiently, and there’s less erosion and fewer pollutants.”

The USDA Natural Resource Conservation Service has shown that if a farmer plants cotton conventionally in loamy sand on a 5 percent slope, he could lose as much as 13 tons of soil per acre each year to erosion.

Benefits streams, too

“In the Piedmont, that amount would be a lot higher,” said NRCS state agronomist Jimmy Dean. “By leaving just 70 percent of the soil covered with crop residue on the field, a farmer can literally prevent tons of soil from running off into a stream.” That’s good for their fields and the streams. “There’s no question this can be a big benefit to our state’s water quality,” he said.

The USDA Natural Resources Conservation Service reports that 28 percent of the row crops in Georgia are grown using conservation tillage. That includes 31 percent of the cotton, 50 percent of the soybeans and 33 percent of the corn.

“UGA research has shown that increasing soil organic matter creates a soil with more beneficial predators,” Gaskin said. “These can help control the pests, because there’s a natural system of checks and balances.”

But for all its soil and environmental benefits, conservation tillage is catching on for other reasons.

Reduces fuel and labor costs

“Farmers are reducing their fuel costs because they’re making fewer passes over the field,” Gaskin said. “Their irrigation costs are down because the soil holds more water. And their crops’ yields are up.”

According to the NRCS, Georgia has more no-till cotton and peanut production than any other state. This is credited to the efforts of six conservation tillage alliances.

For more information: e-mail Julia Gaskin at jgaskin@engr.uga.edu or visit the Georgia Conservation Tillage Alliance at www.gcta-ga.org.

Sharon Omahen is a news editor for the University of Georgia College of Agricultural and Environmental Sciences.

Building Digital Networks for Plant Conservation

by James M. Affolter

Did you know that the Hairy Rattleweed is an endangered plant found in only two counties of southeast Georgia and nowhere else in the world? The Georgia Department of Natural Resources lists 103 plants as endangered, threatened, unusual or rare. Although many people study rare plants in Georgia and the southeast, the information is scattered in diverse institutions and geographic locations. Retrieval is a cumbersome process for professional investigators, and nearly impossible for the public.

The University of Georgia Department of Horticulture through the State Botanical Garden of Georgia developed the Southeastern Rare Plant Information Network (www.serpin.org/) in collaboration with Duke University to consolidate the information. SERPIN is an interactive database that provides information on federal- and state-listed plants. It includes 500 species of rare plants in North and South Carolina, Georgia and Florida.

Powerful search tools enable users to construct complex queries based on such information as a species’ protected status, habitat, and taxonomic classification. The plant profile screens are also linked to the Google “Image Search” function, providing multiple images from Internet sources for most species in the database.

Project collaborators at Duke University have added more than 1,500 references to the bibliographic portion of the SERPIN database. More than 75 conservation and library professionals have entered their names to the “SERPIN
Contacts” database, with descriptions of their areas of professional expertise, geographical location, and services and materials they make available to researchers, educators and the public. All the information in the database is accessible to both specialists and the general public, providing a rich interface between professional conservation scientists, teachers, students and the general public.

James Affolter is an associate professor in the Department of Horticulture and director of research for the State Botanical Garden of Georgia. He can be contacted at affolter@uga.edu.

Seed Storage Facility Is Modern-Day Noah’s Ark

by Sharon Omahen

If the unthinkable should ever happen and all the crops in the United States had to be replenished, Gary Pederson’s staff would be overnight heroes. Pederson heads the Plant Genetic Resources Conservation Unit of the U.S. Department of Agriculture’s Agricultural Research Service. The unit is on the University of Georgia College of Agricultural and Environmental Sciences’ Griffin, Ga., campus.

The USDA-ARS plant germ plasm system includes a main seed storage facility in Fort Collins, Colo., and repositories like the one in Griffin in Geneva, N.Y.; Pullman, Wash.; and Ames, Iowa. Collectively, these facilities serve as a modern-day Noah’s ark for crops worldwide.

“The reality behind why our facility is here and why it’s funded is to preserve genetic variability of crops for use today and in the future,” Pederson said. “We currently house more than 82,000 seed or germ plasm samples of more than 1,430 crop species from more than 180 countries.”

“Long-term preservation of these materials is something everyone sees value in,” he said. “If we had to stock our facility today, we couldn’t do it. Many of these samples were collected years ago throughout the world. Today, the native plants may no longer be found in these areas, or access may be difficult.”

The seed bank is stored either as seeds or as germ plasm or “plantlets.” “Most of our collection is stored as seeds,” Pederson said. “But we also store tissue cultures of crops like sweet potatoes. We actually have 700 cultures of sweet potatoes alone.”

Seeds are stored either at refrigeration (40 degrees Fahrenheit) or freezer temperatures (zero degrees). “Most crops last longer at zero degrees,” Pederson said. “Some hard-seeded crops like sorghum can last 30 to 50 years.” Seeds in the refrigerated collection are stored in resealable bags for easy access when requests are made. Those in the freezer storage are placed in heat-sealed foil envelopes.

Though the collection is intended for long-term preservation, it’s being used every day. “Scientists from across the globe request our materials for use in their research projects,” Pederson said. “For instance, we house the national peanut collection, many of which are wild relatives of the varieties we eat. These wild relatives can be very useful in breeding new varieties because they may carry disease resistance, be more drought-tolerant or produce greater yields.”

Other countries request samples of their native germ plasm as their own seed collection was lost or incomplete, he said. The requests also come from nontraditional researchers. “Epcot has requested seeds for planting demonstration plots, and we’ve had requests for seeds of plants used historically in paper-making,” Pederson said.

“In the past few years, we’ve averaged requests for 30,000 samples each year,” he said. “It shows that researchers are interested in and are using the germ plasm we maintain here.”

For more information, e-mail Gary Pederson at pederson@griffin.uga.edu.
Air pollution is choking metro Atlanta. The U.S. Environmental Protection Agency named 13 Atlanta metropolitan counties as “serious” nonattainment areas for ground-level ozone. The principal cause — exhaust from gasoline powered vehicles. Global warming, an international air pollution problem, is caused by excess carbon dioxide in the atmosphere from burning fossil fuels. University of Georgia researchers in the departments of Agricultural and Applied Economics and Biological and Agricultural Engineering are looking to biofuels derived from vegetable and animal by-products as a way to reduce smog choked cities. Biofuels emit lower levels of noxious gases. A pilot project is under way to make electricity by burning chicken litter. A crop and soil scientist is examining how much forest canopy is needed to mop up the excess atmospheric carbon dioxide responsible for global warming. In addition, visiting scientists are conducting experiments to see how global warming may affect agriculture.

Does Georgia Have a Biofuel Future?

by John C. McKissick

Skyrocketing oil and gas prices, poor air quality in cities and depressed farm prices provide a unique opportunity for Georgians to consider biofuels for an energy source. Biofuels — those made from vegetable and animal byproducts instead of petroleum — and the feasibility of producing them in the state were addressed in two economic studies undertaken by the Center for Agribusiness and Economic Development of the College of Agricultural and Environmental Sciences. Researchers looked at whether Georgia’s food and fiber production industries can contribute to energy supplies, reduce toxic emissions and add value to Georgia’s economy.

Powering diesel engines off the “fat of the land”

Georgia is a leader in animal production (poultry) and vegetable oil production (peanuts, soybeans and cottonseed). In addition, the state’s restaurants and food service industries employ large amounts of vegetable oils. Spent restaurant fats and rendered poultry fats are available as feedstocks.

Nearly 1 billion pounds of oils and fats are produced annually, of which 334 million pounds can used for biodiesel. Biodiesel can make significant reductions in certain exhaust emissions, improve air quality and generate income from animal fat and spent vegetable oil. A big advantage: Existing diesel engines and equipment don’t need to be altered in order to use it. B-20 (a product made of 20 percent biodiesel and 80 percent diesel) can go right in the same gas tanks, using the same engines.

The feedstock is the dominant factor in determining the final production cost. Feedstock prices range from $0.06 to $0.50. If feedstock is acquired at $0.15 per pound average cost, this fee would represent about 75 percent of the total production cost.

The actual equipment and facility costs of producing biodiesel were found to be a relatively small proportion of the total costs. A 15 million gallon plant in Georgia would use approximately one-third of the estimated available feedstock supply produced in Georgia. The plant could replace about 75 million gallons (if blended at 20 percent) of Georgia’s estimated 1.5 billion gallon diesel market.

To be competitive at current diesel fuel prices, feedstock costs must be 10 cents a
pound or less. However, the difference in production cost could be managed by a Georgia policy that could subsidize production costs or eliminate state taxes on Georgia-produced biodiesel using state feedstock.

Georgia legislators and policy-makers met to discuss ways to encourage the processing and distribution of biodiesel in Georgia with biodiesel industry leaders from around the country. Former President Jimmy Carter addressed the Georgia Biodiesel Summit sponsored by the University of Georgia College of Agricultural and Environmental Sciences and the Center for Emerging Crops and Technologies.

“What we are looking for today is what specifically Georgia needs to do — the Legislature and department heads — to make sure the research and development, agriculture and the environment all come together to alleviate any impediments that might not even be detectable now but have been identified by industry,” Carter said. “Adding value to Georgia farm products, such as through biodiesel processing, is one of the best ways to improve Georgia’s farm economy,” said Gale Buchanan, CAES dean and director.

“What we have to do at the university is provide the education and the information-delivery and hope we can get industry interested,” Buchanan said. “This meeting today is where you get something off the ground. We hope it’s the start of something important for Georgia.”

Making electricity from poultry poop?

Research suggests using biomass to generate electricity is economically feasible. Biomass is plant material or agricultural animal waste used to produce energy.

Currently, Georgia’s electrical energy supply relies primarily on fossil fuel and nuclear power. A 1999 study showed the following:

- 64 percent – Coal
- 27 percent – Nuclear
- 4 percent – Natural Gas
- 2.3 percent – Hydroelectric
- 2.6 percent – Biomass

Biomass is not a dense product and therefore cannot be transported great distances. To evaluate the potential for farm-produced biomass to be used for electricity, the supply of biomass had to be evaluated by county.

The supply, price and fuel characteristics of 14 biomass farm products were estimated. Most of the biomass evaluated are byproducts of farming. These are cotton stalks, gin trash, peanut and pecan hulls, poultry litter, pine bark, wood harvest residue and chips, corn stalks, and excess grass hay. A few other crops, switchgrass and kenaf, could be grown primarily for energy production.

Of the 14 biomass products evaluated, pecan hulls and gin trash had lower BTU costs than coal, which is the lowest priced fossil fuel. Pine bark, poultry litter and peanut hulls came in with lower BTU costs than natural gas, the second lowest cost fossil fuel. Finally, research determined that wood chips, wood residue, grass hay and cotton stalks had lower BTU costs than petroleum, the highest priced fuel source.

Figure 8 shows estimated farm-produced biomass for each county expressed in BTUs.

The study analyzed four electric generation technologies in use today: direct fire, co-fire, gasification and pyrolysis. For each technology, three facilities were evaluated for size, biomass needed and electricity generated.

Direct Fire – The burning of biomass with excess air produces hot flue gases, which generates hot flue gases and then steam in the heat exchange of the boiler.

Co-fire – This practice introduces biomass as a supplementary energy source in high-efficiency boilers.

Gasification – The chemical conversion of biomass in an atmosphere of steam or air to produce a medium or low calorific gas. This “biogas” is then used as a fuel in a power generation plant that includes a gas turbine generator for power production and a waste heat boiler that emits steam.

Pyrolysis – A process that involves heating biomass in the absence of oxygen.

Each production technology was modeled to learn the estimated cost of
Manure to Electricity

“If we do it right, we’re already the Saudi Arabia of the United States with the potential chicken litter has as an energy source,” said John McKissick, director of the University of Georgia’s Center for Agribusiness and Economic Development.

Georgia is the largest source of poultry manure in the United States generating 1.5 million tons a year. It may be a source of water pollution because it contains phosphorous and nitrogen. However, when burned, it is a good source of energy. And the only byproduct is an odorless ash.

Earth Resources Inc. received a $1.13 million grant from the U.S. Department of Energy and U.S. Department of Agriculture to explore the possibility of burning chicken litter to generate electricity. A small-scale working model is in operation in Carnesville, the center of Georgia’s poultry industry. Each day, the plant takes three tons of manure to power 25 homes. The plan is to build and test a full-scale plant to process 220 tons of manure to supply electricity to 6,000 homes.

What could be an environmental liability is now an alternative energy source.

producing electricity for each kilowatt-hour. The biomass feed stock was studied at three price levels: $10, $20 and $35 for each ton of wet biomass. The cost analysis includes a 1.8 cent per kwh federal tax incentive. The estimated biomass production costs are compared with 1999 average electricity prices in figure 9.

The large-scale gasification unit with the lowest biomass price came close to a competitive situation without further subsidy or incentive. Georgia has sufficient farm-produced biomass to supply 50 such generating plants. Each large gasification unit can produce about 167 million kwh per year or enough power for more than 140,000 homes. Farm-produced biomass could supply 12 percent of the total electrical demand in the state or 31 percent of the residential demand.

Some states offer tax incentives for biomass production. Many states, including Georgia, allow power companies to sell customers “green energy” at higher costs. Unfortunately, current green power programs in Georgia do not offer biomass.

At the recent Georgia Biofuels Symposium held at the University of Georgia, keynote speaker Helen Chum of the National Renewable Energy Laboratory said, “In the same way that petroleum refineries transformed the 20th century, biofuels will transform the 21st century. Georgia has a lot of potential to become a leader in this field, as we move from a petro-economy to a bio-economy.”

For more information: e-mail John McKissick at jmckissick@agecon.uga.edu

John McKissick is a professor, an Extension economist and coordinator for the Center for Agribusiness and Economic Development.

Researchers Track Greenhouse Gases in Forests

by Sharon Omahen

How can we mitigate global warming short of selling our SUVs? Two scientists who work at the University of Georgia College of Agricultural and Environmental Sciences have received a three-year grant from the Department of Energy to measure the flow of greenhouse gases into southeastern forest canopies.

Monique Leclerc, a professor, and
Anandakumar Karipot, an assistant research scientist, both work in the UGA Laboratory for Environmental Physics on the CAES campus in Griffin.

**Climate change and greenhouse gases**

“Our lab has done a lot of research into improving methods of evaluating the amount of carbon sequestered in plant canopies,” Leclerc said. “The (U.S.) Department of Energy is very interested in this type of research because climate change is such a big concern.”

Greenhouse gases absorb and hold some of the heat radiating from the earth, which causes the air temperature to rise. In a nutshell, that’s the “greenhouse effect” involved in global warming.

Plants use the carbon in the carbon dioxide molecules as building blocks in their growth. Over countless years, vast amounts of plant residues form coal, oil, and other fossil fuels. Burning these fuels releases carbon dioxide back into the air.

But how much carbon does the burning release into the air? And how much do plants take out, and how fast do they do it?

**How many more trees will help?**

Pinpointing answers to these questions will help scientists know how many trees, crops and other plants are needed to take out the excess carbon that fuelburning is putting into the air. Leclerc said scientists are studying many aspects of climate change worldwide. But they still don’t know enough for their measurement tools to be truly accurate.

“As a nation, we need to know how much carbon is taken up by different ecosystems,” she said, “and then pull this information together at a continental level.”

With the DOE grant funds, Leclerc and Karipot will work with researchers at the University of California at Berkeley, University of New Hampshire, University of Florida and Brookhaven National Laboratory.

“We will release six different tracers inside the canopy and then trace their movement,” she said.

Leclerc and her colleagues will be using perfluorocarbons, manmade gases, as tracers. They will release them at different levels in forest canopies and then monitor how fast they move and where.

“The concept is exactly the same in corn, sorghum, or cotton field canopies,” she said. “It would just be more difficult to track in these plant canopies because the instruments would have to be very, very small.”

**Improving the current tracking model**

The team’s main goal is to test and improve a model for tracking gases like carbon dioxide within and above plant canopies. “The long-term view is to mitigate climate change,” Leclerc said. “We have to have a better knowledge of where gases come from in order to measure things like carbon fluxes.”

Americans could help reduce carbon in the air by driving smaller cars. “But no one wants to give up their SUV,” she said. “Climate change is here to stay, and it’s a real problem. As a scientist, I’m truly concerned.”

For more information: e-mail Monique Leclerc at melclerc@griffin.uga.edu or visit the Web site at www.griffin.uga.edu/cscsi/MLECLERC/research2.htm.

**Envirotron Research Looks at Global Warming**

Can global warming affect our food production? Visiting scientists from Mexico and South Korea are looking at this possibility by conducting research experiments in the Georgia Envirotron.

The Envirotron, located on the University of Georgia Griffin campus, is a laboratory containing nine chambers with separate controls for light, temperature, humidity and carbon dioxide. The laboratory provides scientists the opportunity to create varying environments for their research experiments.

Scientists believe human activities, such as burning fossil fuels, have increased levels of carbon dioxide 25 percent since the Industrial Revolution. Current carbon dioxide levels are expected to double by the turn of the century. As carbon dioxide levels increase, temperature rises. According to the Intergovernmental Panel on Climate Change, global surface temperature is expected to increase 1.0 to 3.4 degrees centigrade by 2100.

Abelardo Nunez, a visiting scientist from Mexico’s National Institute of Horticultural Research, has spent a year growing different crops, including maize, soybeans and dry beans, at varying temperatures and carbon dioxide levels in the Envirotron chambers. He tested scenarios that may be expected in Mexico with future global warming trends.

Dry beans, which are the main source of protein for low-income farmers, represent an important staple in the Mexican diet. Preliminary research shows that dry beans are very sensitive to global warming. Test results indicate that an average increase from 25 degrees C (77 degrees F) to 30 degrees C (86 degrees) could have a devastating effect on yield, which may decrease as much as 80 percent.

Only cool regions such as Michigan where dry beans are important may reap the benefits of global warming. On the other hand, crops such as maize may adapt better to higher temperatures and carbon dioxide levels in the future. Georgia farmers may be growing peanuts in Blairsville and citrus in South Georgia.

For more information: e-mail Ian Flitcroft, Envirotron manager, at ian@gaes.griffin.peachnet.edu or visit http://www.griffin.uga.edu/envirotron.htm.


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ith 76 million cases of foodborne illness cropping up each year in the United States according to the Centers for Disease Control and Prevention, research opportunities abound for University of Georgia food safety scientists. Maintaining a healthy, pathogen-free food source from producer to market to restaurant remains a challenge. Of the 6.2 billion people in the world today, 840 million are malnourished. Third World countries struggle to provide adequate nutrition for their populations, especially children. College of Agricultural and Environmental Sciences scientists are fortifying baby food and peanut butter to provide added nutrients to Third World babies and citizens. Lastly, researchers from the University of Georgia and the Georgia Institute of Technology are collaborating to prevent Georgia’s food and water supply from becoming targets of terrorism.

Good Agricultural Practices for Farmers
by Susan M. Varlamoff

The potential liability resulting from illness linked to fresh produce could devastate Georgia agriculture, the state’s biggest industry. The fresh segment of Georgia’s agricultural industry provides $5.7 billion annually to Georgia’s economy. With the incidence of foodborne illness increasing, President Clinton issued a food safety initiative in 1997. As a result, the Food and Drug Administration and the U.S. Department of Agriculture wrote a guidance document to address microbial food safety hazards and good agricultural and management practices for fruit and vegetable growers, packers and shippers. In 1999, fresh produce retailers in Georgia requested third-party certification to document that individual farms and packing facilities use good agricultural practices.

Faculty at the University of Georgia Department of Food Science and Technology and the Department of Horticulture seized the opportunity to develop a Georgia model based on federal recommendations for a cost-effective, industry-sanctioned food safety certification program. A representative of the Georgia Fruit and Vegetable Growers Association worked with faculty to develop a manual to help farmers identify sources of pathogens and ways to minimize the risk of disease. It provides procedures and documentation forms for farmers to devise standard operating procedures specific for their farms. The Georgia Crop Improvement Association, the Georgia Department of Agriculture and the Cooperative Extension Service provided input. Produce buyers for Kroger and Publix approved the program.

Good agricultural practices include the following:
Preventing Foodborne Illness in Institutions

With an increasing number of meals being eaten away from home, there is greater risk of contracting foodborne illness. The Food and Drug Administration estimates that 2 percent to 3 percent of all foodborne illness leads to secondary long-term illness. *E. coli* can cause kidney failure, *Salmonella* can result in serious infections and *Listeria* may cause meningitis. Infants, young children, the elderly and those with weakened immune systems are at risk. With good personal hygiene and proper food handling, most cases of foodborne illness can be prevented. Even though Georgia does not have state mandated training and certification of food service personnel, Cooperative Extension Service family and consumer sciences agents team up with environmental health specialists to provide training at the local level.

ServSafe® – A certification training for restaurant managers, food distributors, health-care and day-care providers, and senior facilities is provided in counties throughout Georgia. Principles taught are:

- Introduction to food safety
- Food hazards
- Personal hygiene
- Purchasing safe foods
- Food storage

Fight BAC!® – A children’s program taught to preschool and young students emphasizes proper hand washing and simple food safety tips such as don’t cross-contaminate food, cook to proper temperature and refrigerate promptly.

Head Start and kindergarten students in Hancock County were shown hand-washing techniques using Glo Germ™, a product that glows under a black light when hands are not completely cleaned. Teachers reported that there were no clean hands on the first washing. It took two and three hand washings before all students were successful.  

William Hurst is a professor of food science and technology who specializes in Hazard Analysis Critical Control Point and GAP Food Safety training programs. He can be contacted at bhurst@uga.edu.
black hair,” he said. “This is just one sign of lack of protein or low protein.”

Sometimes cultural practices prevent parents in underdeveloped countries from providing their children a protein food even when it’s available, he said.

“For example, in Nigeria, some parents won’t give the children eggs because they think it will make them want to steal eggs,” Phillips said. “Of course, this is not true of educated people. But it’s an old myth, similar to many still in existence in our own society.”

**Made from local crops**

To address this growing health issue, Phillips and UGA graduate student Yvonne Mensa-Wilmot, a native of Ghana in West Africa, developed a high-protein weaning food from crops indigenous to the region. The formula is designed for children 6 to 9 months old.

“Our weaning formula is a combination of cowpeas, peanuts and corn, which are all staple crops in the area,” Phillips said. “This is the key. The products have to be readily available. And the mothers have to be able to prepare the food.”

Phillips said an alternative would be for small-scale entrepreneurs to formulate and process the food into a form that requires only mixing with hot water.

A research project was funded by the U.S. Agency for International Development’s Bean/Cowpea Collaborative Research Support Program. As part of the project, UGA researchers traveled to Africa to survey mothers’ responses to the new food and their willingness to accept and use it.

“A few years after introducing the new foods to several villages in Ghana, the results are dramatic. In one case, Phillips visited a child that was 2 years old and so malnourished he was unable to walk. Just a few months after adding the new porridge to his diet, he was much stronger and able to walk again. “It’s truly remarkable to see,” Phillips said. “The hospitals were full of little starving, red-haired children. And now the hospital cribs are empty, because the children are no longer starving.”

For more information: e-mail Robert Phillips at rphilli@griffin.uga.edu.

**Fortified Peanut Butter Fights Vitamin A Deficiencies**

*by Sharon Omahen*

“Vitamin A deficiency causes eye problems and even blindness in countries like the Philippines and other parts of the world,” said Anna Resurreccion, a food scientist with the University of Georgia College of Agricultural and Environmental Sciences. She and Filipino scientists fortified peanut butter with Vitamin A to reduce deficiencies worldwide.

On the weaning formula project, UGA food scientists worked with Sam Sefa-Dedehand and Esther Sakyi-Dawson. Both are with the Department of Nutrition and Food Science at the University of Ghana-Legon.

A few years after introducing the new peanut butter to Filipino homes, the results are dramatic. In one case, Phillips visited a child that was 2 years old and so malnourished he was unable to walk. Just a few months after adding the new peanut butter to his diet, he was much stronger and able to walk again. “It’s truly remarkable to see,” Phillips said. “The hospitals were full of little starving, red-haired children. And now the hospital cribs are empty, because the children are no longer starving.”

For more information: e-mail Robert Phillips at rphilli@griffin.uga.edu.
Lily’s peanut butter. She grew up in the Philippines and ate Lily’s peanut butter as a child. Now she’s working on another peanut butter formulation that includes compounds known to fight cancer and heart disease.

“The compound is resveratrol, which has been found in wine, grapes and peanuts,” she said. “It’s claimed to be the reason for the ‘French paradox’ or the low incidence of cardiovascular disease in the French population. This peanut butter will be especially attractive to children and other groups who don’t or can’t drink red wine to get the benefits of resveratrol,” she said.

For more information: e-mail Anna Resurrecion at aresurr@griffin.peachnet.edu.

Sharon Omahen is a news editor with the University of Georgia College of Agricultural and Environmental Sciences.

Researchers Prepare for Agroterroristic Attacks

by Sharon Omahen

The U.S. food and water supply could become targets of terrorism, and scientists in Georgia are preparing for such attacks. A joint venture between the University of Georgia and the Georgia Tech Research Institute led to establishing CSAGE, the Center for Security of Agriculture and the Environment.

“The focus of the Center’s research is to counteract the intentional use of pathogens and chemicals to create terror,” CSAGE co-director Jeff Fisher said.

“Areas which could be targeted include areas where animals and food are produced and distributed, fields, water supplies and the atmosphere,” said Fisher, a professor of environmental health at the UGA College of Agricultural and Environmental Sciences. “If a disease was introduced into our animal populations, plant crops or food supply, the value of agriculture would plummet.

Our trading partners would refuse to buy from us, and the U.S. would head into a deep recession.”

Introducing foreign animal diseases like foot-and-mouth disease could decimate the nation’s livestock industry. “We could lose up to $100 billion from our national economy from foot-and-mouth alone,” he said.

This would be a huge blow to Georgia, which many consider the poultry capital of the nation. Georgia farmers constantly fight diseases and pests that pop up in the food chain. “This sensor technology could be used for field detection, warning for food processing, and laboratory analysis,” he said.

UGA scientists are working on mathematical models to help assess the risks that attacks could pose to crops, animals and humans. The success of these projects lies in awareness and education. “The Extension Service at UGA will be used to disseminate agroterror information and educate agricultural personnel across the state.”

“Introducing foreign animal diseases like foot-and-mouth disease could decimate the nation’s livestock industry. ‘We could lose up to $100 billion from our national economy from foot-and-mouth alone,’ he said.

The group would like to present a mock agroterroristic scenario for FBI agents, Georgia Emergency Management Agency officials and others to prepare for actual emergencies.

For more information: e-mail Jeff Fisher at jwfisher@uga.edu or visit http://www.vet.uga.edu/vpp/CSAGE/
Education Can Minimize Pesticide Risks

by Paul Guillebeau

Abundant food and the high standard of living we enjoy in the United States would not be possible without pesticides. But, pesticides are poisons. When improperly applied, they can harm the environment and nontargeted living things including humans. If pesticides wash off the land during a rainstorm into nearby surface water, the ecosystem can be altered. Fish may die, and the drinking water supply may become contaminated.

In 1976, the Georgia Department of Agriculture regulated pesticide applicators to protect human health and the environment against unnecessary risks. Two categories were established:

• Private applicator – Those who apply or supervise the application of restricted-use pesticides (pose a greater threat to man and the environment) to produce a commodity. They include farmers and nursery personnel. Private applicators must complete a three-hour training session (via videotape) and a label review exercise to show they understand how to use restricted-use pesticides safely. The University of Georgia College of Agricultural and Environmental Sciences program certifies approximately 2,100 private applicators each year. In Georgia, there are approximately 20,000 licensed private applicators.

• Commercial applicator – Those who apply herbicides on right-of-ways, and contractors who spray for termites. They must pass a certification test demonstrating their understanding of the regulations, the products and their use. Initially, the failure rate for the certification test was 50 to 80 percent. As a result, in 1989 the University of Georgia CAES prepared a full-day training class for prospective test-takers. Randy Drinkard, a county Extension agent who assisted in preparing the first tutorials, said after the training sessions that the pass rate increased to 80 percent or more. Approximately 1,600 commercial applicator licenses were issued or renewed last year. In Georgia, there are 6,800 licensed commercial applicators. More and more emphasis is placed on Integrated Pest Management. IPM
promotes nontoxic methods of controlling pests. If chemical pesticides are necessary, only pests intended for removal are targeted. Blanket spraying a landscape with pesticides is discouraged because beneficial insects, such as pollinators, are killed as well as pests. In a healthy ecosystem, only 3 percent of insects are pests.

To accommodate the enormous need for pesticide applicator training, Extension specialists transmit an annual workshop via satellite. Local Extension agents provide more than a dozen downlink sites across the state. All satellite sessions are professionally videotaped and edited. Tapes are loaned to county agents for continuing education throughout the year. Licensed applicators must earn a certain number of continuing education credits to maintain their licenses.

Because pesticide applicators are a varied group, materials are constantly being written to meet the changing needs. Materials are available in Spanish because many landscape professionals are Spanish speaking. Training for hearing-impaired applicators is also available. IPM in Schools is a special program designed to minimize toxic effects from pesticides in schools. Pesticides are applied in schools by professional applicators and school employees.

As the needs arise, the College of Agricultural and Environmental Sciences will continue to train pest management professionals and homeowners on how to minimize pesticide risks to man and the environment by using IPM techniques.

For more information on pesticide certification and training in Georgia, visit http://www.agr.state.ga.us/piindex.html. For information on regulations, see http://epa.gov/pesticides.

Paul Guillebeau is an associate professor of entomology and IPM/pesticide coordinator. Reach him at pguillebeau@bugs.ent.uga.edu.
liquids, solids and bulk materials, eliminating an environmental and financial liability.

- Quitman County – Specialized spray nozzles were provided to county farmers along with fliers describing how to properly rinse containers. Six thousand pesticide containers weighing 2,000 pounds were eliminated as a possible source for environmental contamination. One hundred percent of the farmers participated.

- Spalding County – The county grew from a rural community to a suburban area leaving farmers with no way to dispose of pesticides. Fifty-two participants from 11 counties delivered 33,500 pounds of unwanted pesticides. Randy Drinkard, Bartow County Extension agent, said, “It was amazing to see what was turned in — even chlordane and DDT, which have been banned for years and years.”

For more information: e-mail Steve Cole at scole@agr.state.ga.us or visit the Georgia Department of Agriculture Web site at http://www.agr.state.ga.us/html/pesticide_recycling.html

Georgia Master Gardeners
by Marco T. Fonseca

A long growing season, Southern hospitality and strong leadership has produced one of the most successful Master Gardener programs in the country in terms of participation rate and program initiatives. Since 1992, the University of Georgia Cooperative Extension Service has trained more than 5,000 Georgia Master Gardeners.

How do you become a Master Gardener?

Becoming a certified Georgia Master Gardener is hard work. After a person is accepted into the program, he or she must attend a minimum 40 hours of classroom instruction.

Scientists and specialists teach classes in all areas of gardening including plant physiology, soil preparation, water-wise gardening, pest control, and organic gardening. We assess their learning through midterm and final exams.

The information presented in class and in the textbook reflects the latest available research. Instructors place a strong emphasis on water conservation and environmental protection in gardening. In fact, we teach Best Management Practices for Georgia gardeners to help reduce the amount of pesticides and fertilizers running into urban surface water.

After participants finish the classroom instruction, they are required to complete 50 hours of volunteer service in support of their local Cooperative Extension Service office.

Who are Master Gardeners?

Master Gardeners are business people, doctors, nurses, schoolteachers, television news anchors, homemakers, and retired people of all professions who love gardening. Because the demand for the program is high, many counties have long waiting lists and interview candidates to determine who qualifies. A candidate doesn’t have to be a gardening expert but some basic knowledge, an eagerness to learn and a willingness to volunteer are required.

What kind of community service does a Master Gardener perform?

Georgia Master Gardeners are dedicated volunteers who reach more than 200,000 Georgians each year through a variety of programs. In 2002, they donated 125,000 hours of service to their communities. Our volunteers plant the seeds of environmental awareness and gardening with the next generation. Sara McKenney of Fulton County says, “Part of the mission of the program is to help others to have a better understanding of gardening and ecology.”

Master Gardeners are educators, extending the reach of the University of
Georgia Cooperative Extension Service. They teach classes on topics such as composting, water-wise gardening, lawn care, eco-friendly landscaping, and native plants at botanical gardens, civic groups, and flower and home shows. In partnership with local schools, 4-H clubs, Boys and Girls Clubs of America, youth and scout groups, Master Gardeners pass on a love of growing things and an interest in preserving resources for the future through a wide variety of projects:

- **Junior Master Gardener** - Work with children combining horticultural and environmental science education, leadership and life skills in a fun, hands-on setting. A pilot program for teachers is under way to introduce ecology and gardening into school curriculum.
- **Habitat for Humanity** - Plan and plant landscapes with new homeowners and act as a resource for future gardening questions.
- **Plant a Row for the Hungry** - Grow vegetables and fruits coordinating with local gardeners to deliver the harvest to food pantries and shelters.
- **Community Gardens** - Plan, plant and maintain thousands of gardens and landscape projects at local historical sites, libraries, colleges, museums, hospitals, municipal buildings and parks.
- **Horticultural Therapy** - Work with veterans, children, the elderly, and patients with mental and physical illnesses. With the help of Master Gardeners, horticultural and occupational therapists work with patients to relearn lost motor skills, stimulate senses and provide pleasure through adaptive gardening.
- **Plant Doctor Clinics** - Answer gardening questions for customers at retail outlets in Metro Atlanta and across the state. (A 1999 state gardening survey revealed Georgians prefer to learn about environmentally friendly practices where they purchase plants.)
- **County Extension Office** - Answer calls and assist walk-in clients. Many offices would not be able to meet public demand for information if not for Master Gardeners.

To learn more about becoming a Master Gardener, call your local county extension office.

For more information, visit www.GaMasterGardener.org or e-mail MASTERG@griffin.uga.edu

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**Georgia Master Naturalist**

*by Lamar Zipperer*

Many Georgians want to protect Georgia’s natural resources as evidenced by the approximately 150 environmental organizations available in the state (Georgia Environmental Council http://www.gecweb.org/). However, staying abreast of the latest scientific research and governmental regulations can be daunting. Recognizing a need for adult science-based education, we developed the Georgia Master Naturalist Program in southeast Georgia.

Along Georgia’s coast there are few agricultural operations, but many people are interested in environmental sciences. In speaking with specialists who developed programs in Florida, Mississippi, South Carolina and Texas, I came away with a number of ideas for a Georgia program. I presented them to the county Extension agents in my district. Bryan County agent David Moulder agreed to write the curriculum and find qualified speakers for the first 14-week program. Ginger Perdue and Dave Linvill of Long and Chatham counties assisted. The entire program is coordinated by Mike Mengak, assistant professor of the Warnell School of Forest Resources at the University of Georgia, Athens.

Thirty environmentally enlightened Georgians graduated in the class of 2002. Seven donated 400 hours of service. The program was repeated in 2003. Programs are planned for the Athens and Statesboro areas in 2004.

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**Agenda items included:**

- **Tree Identification** - Georgia Forestry Commission
- **Soils, Hydrology, and Geology** - University of Georgia
- **Bird Identification and Habitat** - U.S. Fish and Wildlife Service
- **Water, Air, and Social Issues** - Skidaway Marine Institute
- **Urban Ecology and Water Quality** - Chatham County Extension Service
- **Barrier Islands, Salt Marshes, Marine Habitat on Sapelo Island** - Georgia Department of Natural Resources and the University of Georgia

For more information: contact David Moulder at dmoulder@uga.edu for Statesboro or Mike Mengak at mmengak@forestry.uga.edu for Athens.

Lamar Zipperer is the East District Agricultural Program Development Coordinator for the Cooperative Extension Service. He has worked 30 years for the Georgia Cooperative Extension Service, principally in Screven County.
Rivers Alive with 4-H Students

Each October, Georgia’s rivers come alive with thousands of volunteers pulling refrigerators, tires, lawn chairs, propane tanks, TVs, computers and balls of all kinds from the water. In 2003, Georgia 4-H’ers in 12 counties participated in Rivers Alive, a state volunteer waterway cleanup held each year. They participated in cleaning up the Chattahoochee River, Suwanee River, Oconee River, Coosa River, Ogeechee River, Ochlockonee River and Lookout Creek. Sponsored by the Georgia Department of Natural Resources, Georgia Adopt-A-Stream, and the Georgia Department of Community Affairs Keep Georgia Beautiful Program, and in cooperation with Help the Hooch, Rivers Alive creates awareness of and involvement in the preservation of Georgia’s water resources.

Georgia has 6,387 miles of streams impaired because of a variety of environmental impacts such as nonpoint source pollution, which includes erosion and sedimentation from construction activity, chemicals from lawn care, nitrogen and phosphorus from farms, and debris.

Know Your Ecological Address

County Extension offices throughout the state enlist 4-H students to protect and improve Georgia’s water quality. Learning your ecological address on a watershed map is the first lesson. The map was created by the Georgia Department of Natural Resources with the Cooperative Extension Service and the Office of Environmental Sciences.

Many county Extension offices begin by teaching environmental issues in the classroom. Topics range from protecting water quality and home well assessment to nutrient management and composting.

Many varieties of curricula are used as resources in preparing these lessons, such as Project WET from the Department of Natural Resources, River of Words — Georgia’s Teacher Guide and the Water Sourcebook from the Water Wise Council. Accompanying these lessons taught by county Extension agents and educational program specialists is the Friends Water Issue, a Georgia Extension Service publication for 4-H’ers.

For a practical lesson in water quality protection, students and adult volunteers head down to the nearby streams and rivers in October to clean up trash as part of Rivers Alive. Carroll, Coweta, Douglas, Heard and Troup counties used grant funding to secure a boat to increase their effectiveness.

“All these kids can see they’re doing something good by helping to keep our rivers beautiful,” said Mike Isbell, Heard County Extension coordinator.

Rivers Alive 2003

• 22,238 volunteers
• 1,306 miles of rivers and streams cleaned
• 355,872 pounds of garbage collected
• 42 dump trucks filled

For more information: contact Mandy Marable, State 4-H Office Extension Specialist for curriculum and staff development, at mmarable@uga.edu or visit the Web site at http://www.riversalive.org.