

Managing Water, Energy, Waste and Air Quality in Agriculture

Managing Water, Energy, Waste and Air Quality in Agriculture

V(A). Planned Program (Summary)

1. Name of the Planned Program

Managing Water, Energy, Waste and Air Quality in Agriculture

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	4%	4%	4%	4%
102	Soil, Plant, Water, Nutrient Relationships	7%	7%	7%	7%
104	Protect Soil from Harmful Effects of Natural Elements	7%	7%	7%	7%
111	Conservation and Efficient Use of Water	13%	13%	13%	13%
112	Watershed Protection and Management	17%	17%	17%	17%
131	Alternative Uses of Land	7%	7%	7%	7%
133	Pollution Prevention and Mitigation	21%	21%	21%	21%
141	Air Resource Protection and Management	7%	7%	7%	7%
403	Waste Disposal, Recycling, and Reuse	13%	13%	13%	13%
511	New and Improved Non-Food Products and Processes	4%	4%	4%	4%
Total		100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	8.5	0.5	11.0	1.2
Actual	15.5	0.0	17.6	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c 1333165	1890 Extension	Hatch 1769544	Evans-Allen
	0		0
1862 Matching 1333165	1890 Matching	1862 Matching	1890 Matching
	0	1769544	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Biomicrometeorology - This program examines the surface-atmosphere exchange of gases, turbulence and is generally focused on the exchange between the vegetated-canopy layer and its environment. Molecular

Environmental Science - This research area is focused on providing a fundamental understanding of the processes controlling the cycling, transport, and bioavailability of nutrients and contaminants in the environment. Combining these capabilities with molecular biological (Aomics@) tools is providing new insights into the coupled physical, chemical, and biological processes and mechanisms controlling nutrient and contaminant behavior in the environment.

Nutrient Management - Nutrient management research focuses on the biological and chemical pathways of nutrient cycling in soils, including how environmental factors affect the rates of nutrient cycling. Research methodologies include remote sensing methods and other protocols for mapping the spatial variability of soil properties, ammonia volatilization from surface applied urea fertilizer and animal manures and the development of better methods for the routine determination of soil pH and lime requirement.

Remediation - This area includes abiotic remediation and phytoremediation. Iron in conjunction with metal sulfides has been used for the effective remediation of halogenated solvents in groundwater. Areas of research in phytoremediation include: the use of macrophytes *Schoenoplectus californicus* and *Typha angustifolia* in a pilot constructed wetland for sorption and bio-concentration of mercury, selenium, and arsenic in wastewater, trials using cattail and other wetland species to study remediation of aniline and nitrobenzene derivatives in highly contaminated ground waters of an abandoned chemical plant, sorption of TNT and other explosives on humic-clay mineral complexes, and the use of mushroom compost extract to increase the bioavailability and subsequent biodegradation of high concentrations of PAHs.

Soil Biology and Biochemistry - This area investigates the influences of biological activity on soil structure and function. One focus of research is to understand how soil invertebrates (especially earthworms) affect water-stable aggregate formation and the associated turnover and accumulation of soil organic matter and nutrients. Another research area aims at understanding how microorganisms influence the soil environment, specifically the regions directly surrounding a microbial population. Research tools include standard soil microbiology techniques to study microbial life and soil organic matter, as well as the more advanced techniques of compound specific isotope analysis, nuclear magnetic resonance spectroscopy, and DNA-based methods. In addition to basic understanding of soil processes, these focus areas have implications for environmental quality, conservation management and carbon-sequestration in agricultural and forest soils. **Soil Pedology: Faculty in Pedology** conduct research on the genesis, landscape distribution, and interpretation of soils. An understanding of the processes important to formation and distribution of soils and features across the landscape is the basis for better interpretation of soil suitability for agricultural, silvicultural, and urban uses. Current research is focused on developing a more comprehensive understanding of hydraulic properties of soils and better methods to estimate these properties from soil and landscape properties including investigations of the relationships between redoximorphic features and depth and duration of seasonal saturation; and soil-landscape relationships and their effect on landscape redistribution of water.

Waste Management - The faculty in the waste management area conduct research on land application of industrial and animal wastes (by-products). Industrial by-products studied include coal combustion wastes (fly ash, gypsum), pulp and paper mill wastes, and sewage sludge. Fly ash and ash-organic mixtures have been evaluated as soil amendments and potting mixes and gypsum (CaSO_4) was shown to ameliorate aluminum toxicity effects on turf grasses. Animal wastes include different poultry manures, which are by-products of the large poultry industry in Georgia. Research objectives aim at understanding the chemistry of nutrients, trace metals and organic contaminants in these by-products, and preventing soil/water/crop contamination from land application. The waste management area includes a focus on on-site wastewater (septic) management systems. The purpose is to improve the effectiveness of these systems in treating wastewater. Work in this area has focused on the effect of biomats on water movement from drainfield trenches, the development of state regulations governing on-site systems, and the use of computer models to compare alternative systems.

Water Resources - The effect of non-point sources of pollution on surface water quality is a primary focus. The primary pollutants of concern are phosphorus, sediment, and bacteria. The purpose of the research is to determine the sources of pollution and what effect best management practices (BMPs) have in reducing pollutant loads. Research has also focused on water conservation options through management changes, including turfgrass water management, conservation tillage in row crop areas, and irrigation scheduling for all areas through improved sensing and prediction of soil water deficits and rainfall. Water resource limitations of the state's aquifers and rivers has been the focus of another effort to aid the state in predicting the impact of water withdrawals on stream flows and groundwater levels.

Both new and enhanced processes for treatment and utilization of animal manures will be provided to producers through extension and continuing education activities.

Georgia participates in several regional coordination meetings and conferences and attended the national program meeting in 2008, and provided leadership in several areas. We led national and regional efforts in the area of animal waste management. At the national level, the Livestock and Poultry Environmental Learning Center was created and offered numerous webcasts and training opportunities (See www.extension.org/animal+manure+management). The regional team hosted four sessions and a workshop at the Southern Region Water meeting in 2007 and hosted two regional workshops in 2008. The Georgia project team was involved in each of the region's three focus areas. Regional tools that insure that CAFO's and other individuals developing nutrient management plans can do so as easy as possible were developed and distributed. UGA faculty were also very involved in regional efforts related to drinking water and human health where an interactive multi-media educational video using down-well video camera photography to educate well owners on the importance of proper well construction and maintenance was created. UGA faculty supported regional efforts for on-site treatment and community Wastewater/Solid waste management. UGA also hired our first Watershed agent that provided an education network in the

Managing Water, Energy, Waste and Air Quality in Agriculture

Upper Oconee watershed. UGA faculty were involved in numerous projects providing watershed education at the local level and facilitating the development of effective resources that focus on TMDL implementation, modeling, and nutrient trading programs.

The team continued to provide mandated certification workshops for operators and planners. Numerous meetings were conducted locally on using animal manures as fertilizer in response to high input costs. Faculty have worked with a wide variety of audiences including policy makers, youth, farmers, and concerned citizens.

Ecosystem services, land application of manure, irrigation management, provision of recreational trails, and management of waters for ecosystem services in the midst of a drought have been assessed to estimate their economic value. Regulations have been examined with respect to irrigation management, stream and water management, and public good provisions to see how optimal mechanisms can be designed to maximize the net public benefits.

2. Brief description of the target audience

The primary extension audiences are county agents, farmers, growers, industry representatives, environmental professionals, consultants, contractors, media, regulatory and policy representatives, and scientific peers.

These programs have the potential to impact all Georgians. While farmers and rural audiences will be the primary focus for most activities, urban audiences, county agents, county government officials, regulatory agency personnel, and consultants and other professionals will also be impacted.

Public sector (federal and state) decision-makers, environmental concerns and interest groups, natural resource users.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	3500	15000	100	100
2008	3930	11500	390	490

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year	Target
Plan:	1
2008:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	0	
2008	0	0	53

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

Number of educational contact hours generated from formal educational programs presented to county extension agents by state faculty directly associated with this planned program.

Year	Target	Actual
2008	310	202

Output #2

Output Measure

Number of educational contact hours generated from formal educational programs presented directly to clientele by state faculty directly associated with this planned program.

Year	Target	Actual
2008	2900	790

Output #3

Output Measure

Number of significant publications including referred journals articles, bulletins and extension publications.

Year	Target	Actual
2008	68	46

V(G). State Defined Outcomes

O No.	Outcome Name
1	Number of additional direct extension contacts made by volunteers, staff, or county agents not receiving federal funds as a direct outcome of the work of federally funded faculty associated with this planned program.
2	Percentage of program participants reporting increased knowledge after program participation.
3	Percentage of program participants who indicated a plan to adopt one or more of the practices recommended in this program.
4	Collaborative research projects with the Natural Resources Conservation Service and the Georgia Soil and Water Conservation Commission

Outcome #1

1. Outcome Measures

Not reporting on this Outcome for this Annual Report

2. Associated Institution Types

3a. Outcome Type:

3b. Quantitative Outcome

Year	Quantitative Target	Actual
------	---------------------	--------

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
---------	----------------

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Because of the drought, more emphasis was placed on water conservation issues and less on water quality issues than the planned initially called for.

Regulations and the interpretation and enforcement of the rules is constantly evolving and impacting our programs. The increases in fertilizer prices is positively influencing the value of animal manures and increasing off-farm demand. In addition, the national push for biofuels is influencing nutrient management as animal diets are changing due to the high costs of corn. Finally, drought has impacted many producers as some have cut herd sizes due to a lack of feed. The economy is also causing hardships for producers resulting in less funding available for on-farm environmental improvements.

Drought conditions in Georgia led to examination of how to best manage water resources in a drought to protect human uses and the value of ecosystem services. Government regulations were key to designing best management practices for manure land applications.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

After Only (post program)

Retrospective (post program)

During (during program)

Case Study

Evaluation Results

In Georgia, we did not conduct evaluation studies in 2007 although we contributed to regional evaluation efforts that are available on the website above. In 2008, we continued to contribute to regional evaluation efforts and launched an evaluation of our State water conservation efforts, however, this evaluation is ongoing.

Most of the feedback has been positive. County agents and other stakeholders continue to request assistance through the program which indicates some level of satisfaction in the service they receive.

Irrigation management projects and the valuation of various non-market goods are continuing to be evaluated to see if the recommendations made are accurate and being adopted.

Key Items of Evaluation