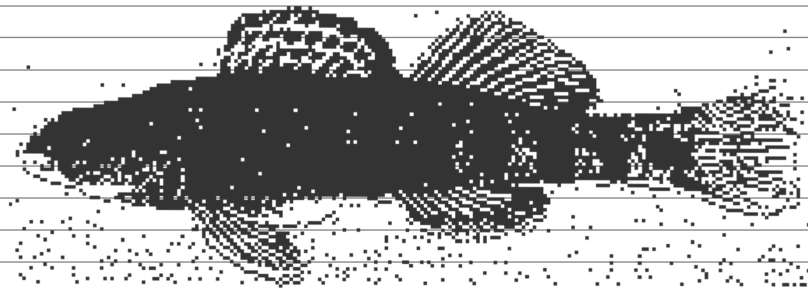

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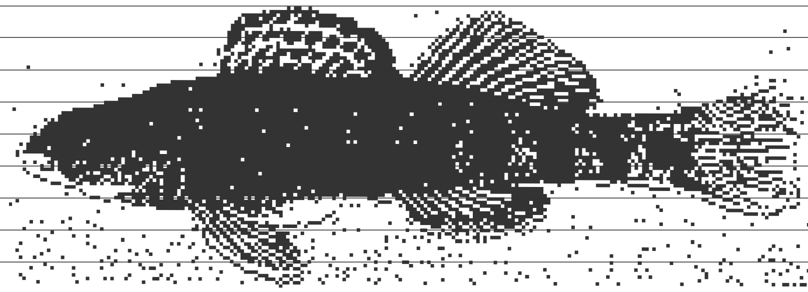


THE ETOWAH INITIATIVE

INTRODUCTION

Although industrial pollution controls have eliminated the release of billions of pounds of pollutants since the inception of federal legislation in the 1970's, information on long-term progress shows few significant positive trends in water quality (Adler, 1994). While improvements do reflect sewage treatment and industrial controls, deterioration continues due to polluted runoff which includes sediment, agricultural fertilizers and pesticides, bacteria and other pathogens from feedlots, toxic metals and acids from mines, silt from logging, and a range of chemicals from urban surfaces.

In the past 30 years, both nitrates and phosphorous have increased dramatically in surface waters due to wide-spread fertilizer use and large-scale animal production in U.S. agriculture. A review by Smith et al. (1995) reported that over 71% of U.S. cropland (300 million acres) occurred in watersheds where the concentration of at least four surface water contaminants (dissolved nitrates, total phosphorus, fecal coliform bacteria, suspended sediment) exceeded accepted levels. Unpredictable weather patterns as well as agricultural practices that fail to consider runoff can lead to the pollution of water resources from animal waste. Organic waste, nutrients, and pathogens are the principal pollutants associated with animal wastes. In light of the dominant presence of the poultry industry in Georgia, this presentation will focus on pollution from animal waste and specifically address chicken farms in the Etowah River basin.

THE ETOWAH RIVER AND LAKE ALLATOONA

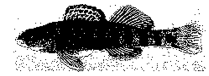
The Lake Allatoona Clean Lakes Study, commissioned by the Georgia Environmental Protection Division(EPD) and completed in 1998, reported the trophic status of Lake Allatoona as strongly mesotrophic to eutrophic depending on location and date to the high nutrient levels. The report identified phosphorous as the limiting nutrient in Lake Allatoona and thus the key factor in controlling eutrophication.

Eutrophication, caused by an overloading of nutrients, specifically nitrogen(N) and phosphorus(P), can significantly impair the intended uses of a waterbody. While all plants require nutrients for growth, an overabundance can lead to rapid plant growth and accompanying problems. Eutrophic waters often experience blooms of algae. When the algae die, their decomposition by bacteria consumes oxygen in the water, stressing or killing other aquatic life. Additionally, certain algal species that develop into large blooms have the capability of producing toxins, which can lead to problems such as scums, odors, fish kills, and can interfere with recreation. Because of the negative impact excess nutrients have on aquatic life, drinking water quality, and human activity, nutrient loading has become a focus for water protection efforts.

Draining an area of 1,860 square miles of north Georgia, the Etowah River is the major tributary of Lake Allatoona and the major source of phosphorous loading in the reservoir. Limnological data suggest that most of the phosphorous in the Etowah is from rural nonpoint sources, and EPD's Coosa River Basin Draft Plan indicates these rural sources are largely responsible for the trophic status of Lake Allatoona. An effective nutrient control strategy for Lake Allatoona must therefore include strategies for nutrient reduction in the Etowah watershed.

Nutrient standards have not yet been established for water segments in the basin although promulgation of such standards appears imminent as the Lake Allatoona Study was completed earlier this year. Georgia's Lake Water Quality statute OCGA Section 12-5-23.1 requires EPD to set water quality standards for Georgia lakes upon completion of an approved study for each lake. These water quality standards must include numerical criteria for specific water quality parameters including fecal coliform and nutrients. Under the statute, EPD must develop numerical criteria not only for the lake itself, but also for each of its major tributary streams. The Etowah River is the major tributary of Lake Allatoona; therefore, under the statute, nutrient limits must be established for the river. Draft recommendations for numerical loading limits are expected to be published next year.

The lake water quality statute requires EPD to monitor on a regular basis to ensure that the lake and its major tributaries reaches and maintains these water quality standards. Both point sources such as wastewater treatment facilities and nonpoint sources will be called upon to reduce nutrient discharges.



THE POULTRY INDUSTRY: A KEY PLAYER

In 1993, the Soil Conservation Service (now Natural Resource Conservation Service or NRCS) completed a study to identify hydrologic units in Georgia with high potential for nonpoint source pollution resulting from agricultural land uses. The study concluded that while there is not a major statewide agricultural pollution problem, some watersheds in the basin do have sufficient agricultural loadings to impair their designated uses.

Georgia leads the nation in poultry production. In 1997, Georgia ranked first in the production and sale value of broilers, layers, and eggs. Poultry accounted for 47% of all agricultural profits generated in Georgia and generated over $2.5 billion in revenue (GA Dept of Agriculture, 1998). Millions of broilers are produced annually in each of the counties in the Etowah basin. While providing significant revenues to the region, this highly concentrated industry also presents certain challenges.

The Natural Resource Conservation Service estimated in 1991 that there were 93,285,000 broilers and 342,000 laying hens in the Etowah River Basin (see also Table 1). Using the estimates that manure production of poultry equal 25 pounds of manure per broiler and 40 pounds per laying hen annually (Vest, 1996), over two billion pounds of poultry manure is produced annually in the basin. Not only is a high volume of animal waste produced in north Georgia, but poultry litter merits a particular concern because it contains high concentrations of nitrogen and phosphorous. (See Table 2). Chickens in particular do not absorb phosphorus well, so most of the phosphorus they eat is excreted in their manure.

The poultry industry is somewhat unique in that large corporations, known as integrators, control the thousands of poultry growers who raise the birds under contract. The integrators supply chickens and feed to growers who raise the birds for six to eight weeks before they are returned to the integrators. Most poultry farms consist of four to six houses, with 15,000- 20,000 birds per house. Because several flocks will be raised each year, a commercial broiler house will typically produce more than 100,000 broilers per year, and the trend is moving toward even larger operations. The most common method of litter management involves lining the broiler houses with wood shavings or sawdust that combines with the manure to form semi-solid or solid waste. The poultry house is cleaned out after every four to six flocks and the litter is stacked and stored until it is applied to crops or pastures. Under the current regime, the contract growers are responsible for the management and disposal of the poultry waste and dead birds. The integrators maintain ownership of the live birds and eggs.

Table 1: Broiler Production by County

COUNTY	Annual broilers produced
Cherokee	24 million
Dawson	20 million
Forsyth	38 million
Pickins	19 million
Lumpkin	no data given

Source: UGA Cooperative Extension Service, 1996

Table 2. Typical daily production and chemical characteristics of fresh manures (based on 1000kg live animal mass per day).

Category	Dairy	Beef	Swine	Layer	Broiler	Turkey
Mature animal weight	640	360	61	1.8	0.9	6.8
kg/day:						
Total manure	86	58	84	64	85	47
Total solids	12	8.5	11	16	22	12
Total N	0.45	0.34	0.52	0.84	1.1	0.62
Total P	0.09	0.18	0.34	0.61	2.80	0.51

Source: Mikkelsen and Gilliam, 1995

Recognizing poultry waste as a valuable source of plant nutrients, growers often apply the litter to cropland. However, many simply do not have enough land on which to apply the manure. When manure is applied in amounts that exceed the rate at which plants can absorb the nutrients, or to ground that is saturated, frozen, or otherwise unable to absorb the litter, nutrients are likely to be carried from the application site and eventually into surrounding water bodies.

Currently, no state regulations exist concerning the handling and disposal of poultry litter. Several state and federal agencies do exist to provide financial and technical assistance to poultry and other agricultural operations in voluntarily managing their resources responsibly as explained below.

NPS POLLUTION CONTROL STRATEGIES

In treating point source pollution, uniform technological treatments are required of dischargers. Nonpoint source(NPS) pollution by definition is diffuse and lacks a concentrated outflow, making similar technological standards impractical. NPS remediation therefore employs substantially different strategies than are required for point source control. Despite the elusiveness of NPS pollution, a regulatory framework to improve water quality does exist, and is accompanied by an array of educational programs, technologies, and financial assistance available through the United States Department of Agriculture (USDA), the United States Environmental Protection Agency (EPA), and state environmental agencies.

REGULATION

Beginning in the 1960s in response to massive fish kills in the Midwest and shellfish bed closures in New England, states such as Kansas and New York began to regulate control of discharges from animal feedlot operations. The first federal involvement with livestock and poultry runoff originated with the U.S. Army Corps of Engineers in 1971 as they were extended the authority to issue permits for all discharges of industrial wastes into navigable streams and their tributaries. That same year, the U.S. District Court in Washington, DC ordered an environmental impact statement to be filed for each permit issued. This effectively ended the program since funds were not available to compile the reports (review in Martin, 1997).

These incidents led to the origin of Section 306 of the 1972 Federal Water Pollution Control Act (Clean Water Act) which designated feedlots as point sources and therefore subject to the National Pollutant Discharge Elimination System(NPDES) permit program. Effluent guidelines and performance standards were applicable only to discharges of pollutants from concentrated animal feeding operations defined as those feedlots with more than 1000 animal units. In 1987, amendments were made to the Clean Water Act stating that storm water discharges from animal feeding operations not under NPDES permit may still be subject to regulation as sources of industrial discharges. Furthermore, the scope of the NPDES program has been extended by the USEPA and the judiciary to include certain forms of nonpoint source pollution (review in Martin, 1997).

The federal Clean Water Act has the potential to affect agricultural operations, although it has not had much impact in Georgia. Not many operations in Georgia fall under the federal regulations' definition of concentrated animal feeding operations, and no poultry houses are permitted as such. However, the USDA/EPA's new joint draft strategy suggests that poultry operations that stack waste in areas exposed to rainfall may qualify as CAFOs and therefore point sources if the number of animals meet the regulatory definition of concentrated animal feeding operations at 40 C.F.R. Part 122.

Other states have addressed nutrient management concerns in a stricter fashion. Although the state of Georgia and the Etowah Basin have to consider the unique characteristics of the region which may require customized animal waste management approaches, it is useful to examine the regulatory actions taken by other state and local governments.

Oklahoma

The Oklahoma regulations are fairly demanding. State Department of Agriculture rule 35: 17-5-1 requires ALL commercial poultry operations of 1,000 broilers or more to have a waste management plan addressing nitrogen and phosphorous. Soil and litter testing is required and records must be maintained. Any litter that cannot be used on the premises must be moved off the site, preferably to a non-nutrient threatened watershed.

The rule also requires integrators to inspect all facilities contracted by the integrator and review records and compliance with the animal waste management plan. In addition, integrators are required to provide mandatory education seminars on waste management for the poultry farmers. Thus, Oklahoma's approach requires both the integrators and the growers to take specific action to ensure poultry litter is managed effectively.

Texas

In Texas, the rules of the Texas Natural Resource Conservation Commission (30 TAC 327.21) require commercial livestock and poultry operations using land application for disposal of waste to apply the waste so that no runoff will adversely affect the quality of receiving water. Operators must manage the collection, storage, and disposal of liquid and solid waste in accordance with recognized practices of good agricultural management, including isolating all solid waste materials retained on-site from run-on storm waters by dikes, terraces, berms, ditches or other structures so as to retain all rainfall which comes in contact with the stockpiled solid waste material.

Pennsylvania

The Pennsylvania Nutrient Management Act (1993) requires a nutrient management plan that demonstrates that waste is being safely collected and disposed of for all concentrated animal feeding operations.

Maryland

The Maryland legislature recently passed the Water Quality Improvement Act of 1998. This Act requires all agricultural operations with more than eight animal units (one animal unit equals 1,000 pounds live weight) to have and to implement a nitrogen and phosphorous based nutrient management plan by 2005. A $250 fine may be imposed for failing to submit a nutrient management plan, and additional fines may be levied for failure to implement the plan.

Significantly, the Maryland Water Quality Act also recognizes that integrators have some responsibility for the nutrient management problem. The Act specifically recognizes integrator responsibility by requiring that by Dec. 31, 2000, all contract feed for poultry "must include phytase or some other enzyme that reduces phosphorous to the maximum extent that is commercially and biologically feasible."

North Carolina

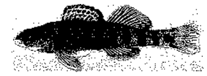
The 1993 North Carolina Water Quality Nondischarge Rule requires animal waste management plans for all farms meeting the definition of a feedlot. A newer law, Senate Bill 1217, ratified in 1996, also requires operator certification for each operator of a feedlot. Each operator must attend 10 hours of training and instruction on animal waste management. The Act also requires operators to maintain their education by completing six more hours of training every three years.

Virginia

As part of the effort to reduce nutrient loading in the Chesapeake Bay, some local ordinances in Virginia require vegetative stream buffers for farmland. However, the buffer requirement can be reduced if a farmer demonstrates that his management practices provide the same protection as a buffer would. Other local ordinances include the Rockingham County ordinance, adopted in 1988, requiring all poultry operations to have a nutrient management plan and an approved storage site for poultry waste.

Georgia

Georgia currently has no regulations governing the storage or disposal of poultry litter.



MANAGEMENT PRACTICES AND INCENTIVES

Due to the difficulty in targeting and quantifying nonpoint source pollution, management of land-use activities has been the most commonly used strategy to mitigate NPS pollution. Best Management Practices(BMPs) have been adapted by many states as guidance for various land use activities in accordance with specific climatic, physiographic, hydrologic, and edaphic(soil) conditions, as well as in consideration of the variety of management systems in place(Chen et al. 1993). This approach exists in both voluntary and regulated programs, although the most common approach in Georgia has been through voluntary adoption of less-polluting practices. A combination of tactics are employed to decrease nutrient-laden runoff:

1) Developing and implementing a nutrient management plan. This is the most important BMP. Soil and manure are evaluated for nutrient availability, and a nutrient budget is developed for the planned crops. Nutrient management plans delineate appropriate time and rate of application, nutrient placement (broadcast vs. furrow application), fertilizer product and crop selection, and irrigation management. Periodic monitoring of soil and plants allows accurate adjustment of manure or fertilizer depending on existing nutrient levels. The common method of assigning application rates has been based on nitrogen needs, but this has lead to the overapplication of phosphorus. Phosphorus, although a limiting nutrient, is needed in smaller quantities by plants than is nitrogen.

Recommendations of BMPs suggest using less poultry litter and supplementing the crop with inorganic nitrogen fertilizer. Another strategy is to base application on nitrogen for a year or two and let phosphorous build-up, then add no litter for a couple of years while applying inorganic nitrogen fertilizer. After levels of phosphorus drop again, an other application of litter can be made.

Manure is generally considered low and variable in nutrient content compared to modern commercial fertilizers and less predictable in terms of nutrient release for crop uptake. Nutrient management plans can help to effectively utilize the plant nutrients from animal waste, and thus encourage its use as fertilizer.

2) Utilizing litter stack houses with an impermeable surface to prevent seepage and run-off. A simple shelter can reduce nitrate leaching and phosphorus loading in the soil surrounding a poultry farm.

3) Planting vegetative filter strips of close-growing grasses to trap sediment and pollutants. Phosphorus readily adheres to soil particles, and so can effectively be prevented from entering surface water by reducing sedimentation. Total phosphorous removal of 60% and total nitrogen removal of approximately 70% have been documented in some studies. (Georgia Soil & Water Conservation Commission, 1994)

4) Maintaining 100 feet of buffer area between surface water sources and litter application sites can protect water sources. Correctly placing growing facilities, manure storage bins, and composting areas in relation to soil and slope may be very effective in reducing runoff. The simple act of preplanning farm layout may prevent a large percent of surface water contamination on each site.

5) On-farm composting of manure has been recognized as a conservation practice and is eligible for cost-sharing. Use of compost on the farm can boost

long-term productivity by maintaining soil quality. The plant nutrients in compost are released slowly, which may be more useful to crops over the course of the growing season. Organic matter enhances soil fertility and structure and contributes to the health of soil biota such as earthworms, beneficial microbes, and fungal symbionts. Compost also represents a possible extra income, if off-site markets such as greenhouses or municipal landscaping operations are available.

On the federal level, the Natural Resource Conservation Service (NRCS) gives technical assistance to local Soil and Water Conservation Districts and farmers. NRCS administers the Farm Bill programs that provide some financial incentives to farmers implementing sound management practices. The Department of Agriculture also supports Resource Conservation & Development Councils (RC&Ds), consisting of organized citizens promoting sound agricultural practices.

On both the state and local level, the Georgia Soil and Water Conservation Commission (GSWCC) is the lead agency for agricultural nonpoint source pollution. The GSWCC develops nonpoint source water quality programs and conducts educational activities. The primary purpose of this commission is to provide guidance and assistance to local Soil and Water Conservation Districts. The Soil and Water Conservation Districts promote the voluntary adoption of agricultural best management practices but have no regulatory authority.

The 1990 Food and Agriculture Conservation and Trade Act authorized the USDA to create the Water Quality Incentive Program (WQIP). Under this program, the Natural Resources Conservation Service's Agricultural Conservation Program distributes direct incentive payments to farmers in order to mitigate the negative impacts of agricultural activities on ground and surface water supplies. Funding levels for WQIP in 1993 were $15 million. The 1996 Farm Act made significant changes in the provision of financial assistance to landowners. The Water Quality Incentives Program was combined with several others under the Environmental Quality Incentive Program (EQIP). EQIP provides financial assistance to farm managers within priority conservation areas and to identified problems outside of priority areas. Contracts will be for 5-10 years and cost-shares up to 75 percent of new practice installment costs (AREI, 1997).

Cooper and Keim (1995) compared the willingness of producers to adopt 5 BMPs (manure crediting, legume crediting, split fertilizer application, irrigation scheduling, and deep soil nitrate testing). This study identified four main factors that contributed to the success of BMP adoption: 1) profitability, 2) noticeable water quality benefit, 3) familiarity with the management tool, and 4) whether the changes were small and inexpensive. Manure crediting was least supported. Without incentive payments, less than 20% of those interviewed expressed interest in participating, and less than half were interested even with a $40/acre payment proposed. Geographic location influenced participation rates as well, reflecting regional differences in dominant crops and animal production, land availability, and environmental problems.

Voluntary adoption of an improved management practice is most clearly influenced by producer perceptions of its effect on profitability. Incentive payments encourage adoption of pollution control practices by reducing the financial uncertainty of adopting the practice. Payments reflect estimated changes in cost of production due to the adoption of improved management practices. Cost-sharing pays some or all of the start-up and/or installation costs of implementing less polluting management practices for strategies that require an initial capital investment. As of 1991, cost sharing facilitated an average of 3.2 waste management systems in an average of 743 counties per year since the inception of the Clean Water Act (Fedkiw, 1992). Few studies, however, have quantified the success of these programs.

Efficient cost-sharing may be achieved by supporting several vs. one strategy depending on the targeted pollution. For example, investment in a manure pit combined with manure-N crediting employs two complementary practices. Specifically targeting land eligible for subsidy is possible as well. Contracts can include use of less-polluting technology on more degraded land with the option to implement them on other land, relative to the producer's profit maximizing choice.

Non-voluntary financial incentives include taxes and management requirements as part of loan contracts. Taxes that vary with technology and land quality may be used. For example, a tax on nitrogen fertilizer may vary with how susceptible the amended soil is to leaching. Some loan programs require BMP implementation in order to qualify for the loan.

RECOMMENDATIONS

1) Facilitate development of BMPs and nutrient management plans for all growers, including a self-monitoring component.

Promotion of existing programs for education, technical assistance, and financial incentives must be considered a priority. State and local governments should provide adequate staff and funding in order to provide help to all growers in north Georgia.

Little data exists on the quality of most streams, rivers and lakes in the U.S. Best management practices often are initiated with little knowledge of either the current impacts to water quality from the targeted farm operation, or of the results gained from implementing less-polluting practices. Simple and effective self-monitoring of water quality via low-cost biotic and visual surveys can be done by the farm manager. Cost-sharing often includes paying for chemical analysis of ground and surface water, as well as soil and crop nutrients.

Currently, research undertaken by the University of Georgia Crop and Soil Science Department is tracking the participation in and success of BMPs in a program where farm managers are trained to use monitoring equipment provided by UGA. Problem areas in surface and well water, and subsequent changes in water quality due to management strategies are monitored by the people working with the land. Direct observation and decision-making is done by the farm manager. Preliminary results indicate that interest in participation and (therefore) effectiveness of BMPs are increased through deeper understanding of causality combined with self-determination and proof of positive impacts on water quality (M. Cabrera, pers. comm.).

2) Monitoring for compliance in the short-term should focus on land-use practices.

Evaluation of a farm manager's efforts toward mitigating pollution cannot be based on short-term attainment of ambient water quality because several years of monitoring are necessary to detect changes due to NPS best management. Furthermore, historical land use may retard the evidence of positive results of less-polluting practices. Land subjected to years or decades of nutrient saturation and soil degradation may have a slower reaction time than relatively less problematic land. Until more research exists to quantify time lags and their effects on the recovery of water quality, agencies involved in enforcement or assistance with BMPs should acknowledge this situation when developing their protocol for assessing compliance with NPS pollution reduction programs.

3) Explore the potential for adopting an effluent trading system.

The USEPA advocates the use of effluent trading to achieve water quality objectives. Effluent trading is a method of meeting water quality standards that allows sources to substitute a cost-effective and enforceable mix of controls on other sources of discharge, in lieu of more expensive remediation of their own effluent. It is suggested that a trading arrangement between agriculture and point sources such as waste water treatment facilities could provide a less-expensive control on nutrient loading in the Etowah basin. Point sources fund the implementation of BMPs rather than upgrade their own treatment beyond the minimum technology-based requirements of the Clean Water Act.

To date there have been numerous projects involving effluent trading throughout the country, including several focused on nutrient reduction between point and nonpoint sources, as is presently being suggested. Dillon Reservoir, CO; Tar-Pamlico Basin, NC; Boone Reservoir, TN; Wicomico River, MD; Honey Creek Watershed, OH; Cherry Creek, CO; Chatfield Basin, CO; Long Island Sound, NY; and Tampa Bay, FL have all addressed nutrient loading with effluent trading projects between point and nonpoint sources. (EPA, Office of Water, Effluent Trading Policy Statement). As water quality standards are set and enforced in the Etowah basin it may be useful to look to these effluent trading projects for direction in formulating a cost-effective approach. The Tar-Pamlico River Basin nutrient trading program in North Carolina will be examined in particular because it has been well-documented and is similar in some respects to the Etowah basin.

Tar-Pamlico Basin, NC

In 1989, the Tar-Pamlico Basin was classified as a nutrient sensitive watershed because of the excessive sediment and nutrient loadings which caused algal blooms and low dissolved oxygen. The Tar-Pamlico Nutrient Sensitive Waters Implementation Strategy set up a nutrient trading program to reduce nutrient loading from point source discharges, but gave dischargers the flexibility to invest in the most cost-effective controls. The basin's major dischargers include municipalities and industry, but most of the major dischargers are publicly owned treatment works. The major sources of nutrient loading in the basin are nonpoint sources from farming and forestry, nonpoint urban runoff, and point source dischargers including a large phosphate mining operation. Agriculture is estimated as the source of 44% of the nutrient loading in the basin.

In 1989, proposed numerical effluent limitations for the basin alarmed point source dischargers who would bear enormous costs to comply with the proposed effluent limitations. Dischargers argued that the effluent limits would cause economic hardship to the public because of the expensive upgrades that would be required. They suggested that a long-term nutrient strategy should affect nonpoint sources as well as point sources. In light of these and other concerns, an alternative nutrient trading option plan was approved in December of 1989.

The nutrient trading program allows a discharger to treat its effluent to meet the nutrient reduction goals by removing an equivalent amount of nutrients from agricultural runoff through the Agricultural Cost Share Program. This program is administered through the State Division of Soil and Water Conservation. In order to establish a trading system, an appropriate trading ratio must be determined. The trading ratio is the amount of nonpoint source control that a point source discharger must undertake to create a credit for a given unit of point source discharge. Under the Tar-Pamlico strategy, a discharger pays $56 per kg of excess nutrient discharges to the nonpoint source control fund administered by the Agricultural Cost Share Program. In addition, point source dischargers make an annual $150,000 administrative payment to fund BMP implementation.

The Tar-Pamlico program is an example of the opportunity that effluent trading poses for community stakeholders in developing alternative solutions for water quality problems. Trading can allow communities to grow and prosper while retaining the commitment to water quality. Not all trading programs have functioned as anticipated, and some concerns exist regarding the enforceability of nonpoint reductions agreed upon in a trading arrangement. An effective effluent trading program must ensure that the total pollutant reduction is the same or greater than what would be achieved if no trade occurred.

The Lake Allatoona report (Kennesaw, 1998) noted that projected increases in local populations will require the upgrading of treatment facilities to maintain permitted discharge from waste treatment facilities. These costly upgrades may be avoided, however, and current nutrient loads from wastewater treatment facilities could be maintained, if nonpoint source loading can be reduced. Effluent trading presents such an opportunity.

There are a couple of contexts in which a nonpoint effluent trade can occur. First, trades can occur through the development of a total maximum daily load (TMDL) or other equivalent analytical framework. A TMDL establishes the loading capacity of a defined watershed area, identifies reductions or remedial activities needed to achieve water quality standards, and recommends allocations for point and nonpoint sources. Sources can then negotiate within the loading capacity determined under the TMDL.

Secondly, trades can occur in the context of a point source permit. In this context, a permittee would arrange a trade with other sources of a pollutant, with approval of the permitting authority. Achievement of the required in-stream water quality would rely on the permittee meeting its limits and on actions by the trading partner. Finally, the trading approach would rely on in-stream water quality data to help ensure that the trade is working as anticipated.

Effluent trading could conceivably occur between agriculture and point sources within the Etowah basin when nutrient standards are developed for the Etowah River. On a larger and perhaps more efficient scale, trading could also occur between agricultural sources and point source dischargers in the Lake Allatoona basin, as there are significantly more point sources beyond those in the Etowah basin that influence the phosphorous levels in Lake Allatoona. It is suggested that the stakeholders in the Etowah basin consider the possibility of effluent trading within the watershed to minimize nutrient loading in the most cost-effective manner.

4) Regional waste facility

Regional-level management of wastes should be initiated in areas with large surplus stocks. Regional municipal composting facilities can offset costs to some extent by utilizing compost in landscaping, nurseries, and roadside cover. Market systems need to be established for waste by-products in order to achieve sustained profits. Private entrepreneurs should be encouraged to begin handling and hauling wastes. Drier wastes such as poultry and cattle manure could be economically hauled for soil additives and feed supplements. Effluent trading programs could provide funding for establishment and maintenance of such a facility. Four out of the top ten priorities listed by attendees of the 1991 Livestock, Poultry, and Aquaculture Waste Management national workshop pertained to development of products from manure and strategies to create a viable market for those products (Schwartz 1992).

CONCLUSION

Pollution control is a contentious issue. Environmental regulations imposed on livestock, dairy, and poultry industries may affect economic viability and international competitiveness of these industries. Increased pollution control costs may force some producers to reduce or cease production, or relocate to areas with less environmental stress. Water quality problems are, however, an economic burden as well. Cropland run-off alone resulted in $2-$8 billion in 1991 losses in recreation and commercial fishing, boating, municipal treatment plants, water storage facilities, and navigable waterways (Feather and Cooper, 1995).

Due to the organization and geographic restrictions of the poultry industry, growers remain dependent upon the larger production company for contracts and are subject to their production guidelines and pricing terms. Additionally, growers may not make substantial profits for years while paying off loans undertaken to construct facilities and buy equipment. In turn, growers perceive few avenues to adopt BMPs, either financially or logistically.

As the integrator stands to make most profit from poultry production and has most control over the organization of the industry, increased responsibility should be assigned to these companies in dealing with excess animal waste. Litigation in Maryland and Virginia has resulted in assessment of fines for pollution from nutrient loading of surface water, and to voluntary efforts by the integrators to train growers in less-polluting management practices.

The federal Clean Water Act drives state regulations, but development of policy and prevention lies within state and local control. Stakeholders in the Etowah basin have much to consider in addressing nutrient loading to surface waters. Management practices that will reduce nutrient loading must be implemented and may soon be required under future regulation if there is a lack of progress in decreasing NPS pollution.

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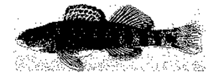

APPENDIX A:
ADDITIONAL SOURCES OF INFORMATION

Websites:

http://www.nrcs.usda.gov/NRCSProg.html USDA Conservation Programs List of financial assistance programs.

http://www.nhq.nrcs.usda.gov/land/home.html USDA State of the Land. Statistics and nice graphics.

http://151.121.66.126/epubs/pdf/ah712/ USDA Economic Research Service. Agricultural Resources and Environmental Indicators, 1996-97. Report on agriculture and water quality issues.

http://www.ces.uga.edu/ UGA College of Ag & Environmental Science Cooperative Extension Service. On-line publications, programs, county contacts.

http://www.bae.uga.edu/extension/pubs/index.html Biological and Agricultural Engineering Extension. On-line publications.

http://www.groundwatersystems.com/agwaste.html CAFO issues and many links to other relevant sites.

http://www.bae.ncsu.edu/bae/programs/extension/wqg/ North Carolina Water Quality Group. On-line publications and bibliography.

Agency Publications:

Risse, L.M. ed. 1997. *Southeastern Sustainable Animal Waste Management Workshop Proceedings*. University of Georgia Animal Waste Awareness in Research and Extention (AWARE) Team. Athens, GA

UGA Institute of Community and Area Development and Georgia EPD. *Nonpoint Source Management in Georgia: A preliminary revision of the Georgia nonpoint source management plan*. 1997.

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