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In This Issue

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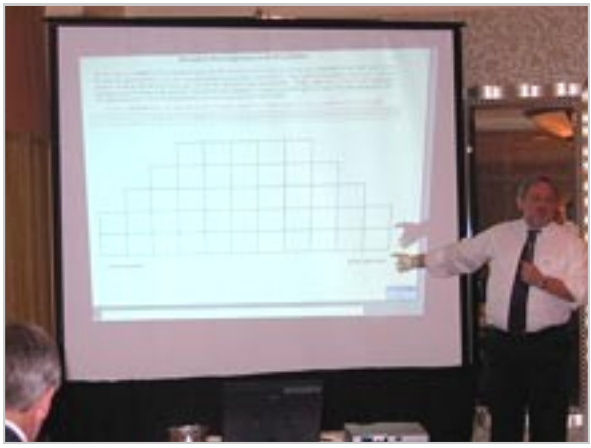
OWRRI Goes to Washington DC for the Annual NIWR Meeting

NIWR Website



Will Focht presenting at NIWR meeting in March 2005.

The OWRRI is one of 54 state and territorial water resources research institutes authorized by the Water Resources Research Act of 1984. The Water Resources Research Institute Program is a Federal-State partnership funded through the U.S. Geological Survey.

Although the funding for each of the state water resources institutes comes through the USGS, the institutes have organized themselves into the National Institutes for Water Resources (NIWR). NIWR holds meetings each March in DC. One purpose of the meeting is to foster collaboration and interaction among the institutes. Dr. Focht, OWRRI Director, presented a preliminary analysis of a survey of the state directors regarding research priorities for their states. The information was well received. In fact, the NIWR Board has asked Dr. Focht to present the survey results at a July meeting cosponsored by NIWR and the University Council of Water Resources. The survey asked the directors to rank the 43 national priorities for water research conducted in the next 10-15 years as presented in the National Research Council's book *Confronting the Nation's Water Problems*. Results of the survey will be included in a future issue of **The *Aqua*homan**.

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Note from the Editor:

Welcome to the second issue of the quarterly newsletter, **The *Aqua*homan**. Each issue will include research news such as notices of research funding opportunities, announcements of upcoming water conferences and symposia, and reports of research findings. **The *Aqua*homan** is intended to serve as a communication link among members of the water resources community. You are encouraged to submit announcements and news items to us to include in future issues. Please send your suggestions to Jennifer Taylor, the OWRRI Outreach Coordinator, at jennita@okstate.edu.

Research News

A Preliminary Report of Progress

by Brian D. Adam and Arthur Stoecker* February 17, 2005

Optimal Selection of Management Practices for Phosphorus Abatement: Using GIS and Economic Methodology in the Modeling of a Watershed

In eastern Oklahoma and western Arkansas, poultry litter from broiler producing operations has saturated the land, causing nitrate leaching and runoff of potassium and phosphorus, harming water supplies. In response to this problem, our research has two objectives.

Objectives:

1. Identify combinations of Best Management Practices (BMPs) that will meet the Total Maximum Daily Loads (TMDLs) for the Eucha-Spavinaw watershed at least cost.

2. Estimate the firm-level costs and benefits of a proposed enterprise to convert poultry litter to methane (for use in generating electricity) and commercially-saleable nitrogen, phosphorus, and potassium fertilizers. If financially feasible, this plant could help meet the TMDLs for the watershed. The amount of litter allocated to this plant and the plant's expected net income/loss will be incorporated into the model from Objective 1 to determine its effect on cost of achieving TMDLs.

Procedures, Objective 1:

For the first objective, a biophysical model has been developed to determine the best management practice (BMP) for each of 695 locations within the Eucha Spavinaw watershed. This model uses Geographic Information System (GIS) data together with a Soil Water Assessment Tool (SWAT) simulation model to identify the lowest cost BMP for each localized piece of land identified by the GIS data that will ensure that overall pollution targets are met.

The BMPs were selected to minimize the total cost to poultry producers within the watershed; the city of Decatur, Arkansas (the source of 25% of the phosphorus entering the lake); and users of water from the watershed. The management practices considered were 1) reduced application of litter, 2) use of alum-treated litter, 3) shipment of litter within and from the watershed, 4) improving the management of overgrazed pasture, 5) converting row crops to pasture, and 6) increased phosphorus abatement at the city of Decatur. The cost of treating water by the city of Tulsa and loss of recreation values to users of lakes Eucha and Spavinaw were also considered. The model was based on an Arcview-SWAT GIS simulation that was formulated and calibrated by Storm et al. (2000) for the Eucha-Spavinaw watershed.

Preliminary Findings, Objective 1:

Preliminary results indicate that total costs to poultry producers, the city of Decatur, the city of Tulsa, and to recreation users of the lakes would be minimized when total annual phosphorus loads are reduced from 50.6 short tons to approximately 27.5 tons per year.

The table below shows the costs to all parties as annual P loadings are reduced from 50.6 to 19.8 tons per year. Achieving lower annual P loadings reduces the cost of phosphorus pollution but raises the cost of abatement. Total abatement plus damage costs are at a minimum when total phosphorus loading to the lake is reduced to 27.5 short tons (25 metric tons) per year.**

Maximum Phosphorus Loading (tons/year)	Total Abatement Cost for Agricultural Enterprises ($/year)	Total Abatement Cost to Point Source ($/year)	Total Abatement Costs ($)	Total Damage Cost ($/watershed)	Sum of Total Abatement and Damage Costs ($/watershed)
50.6	0	0	0	1,071,335	1,071,335
44.0	20,933	0	20,933	658,335	679,268
38.5	55,136	0	55,136	370,707	425,843
33.0	100,963	0	100,963	152,246	253,209
27.5[a]	**134,672**	**33,113**	**167,785**	**52,281**	**220,066**
22.0	139,446	101,207	240,653	7,693	248,346
19.8	160,688	112,484	273,172	0	273,172

[a] Level of phosphorus that minimizes costs to all parties.

*Dept. of Agricultural Economics, Oklahoma State University

** The USGS land use land cover digital maps indicated the Eucha-Spavinaw basin contained 245,000 acres. However, only 112,000 acres are in agricultural use. There are approximately 32,000 acres of land harvested for hay, 57,500 acres of well maintained pasture, 16,000 acres overgrazed pasture, and only 6,500 acres of cultivated land. Some 957 poultry houses were located from photographic maps. These houses were assumed to produce 92,400 short tons of litter per year. Only 53 short tons of phosphorus from all sources were assumed to enter the lake each year. Of this, 37 tons were attributed to agricultural sources while 12.5 tons originated from the city of Decatur and 3.5 tons originated from forest and other background sources.

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The reduction in annual soluble phosphorus loading to 27.5 tons would be accomplished by the following.

a. Remove 11 of the 12.8 tons of phosphorus currently discharged by the city of Decatur, Arkansas.
b. Apply alum to 70,000 tons (out of 92,400 total tons) of litter. Thus, most of the applied litter would be treated with alum which would reduce the runoff of soluble phosphorus by 75% as compared to the runoff of phosphorus from untreated litter.
c. Apply no more than 1 ton of litter on the 57,500 acres of well maintained pasture.
d. Limit applications of litter to 2.7 tons or less on the 32,000 acres harvested for hay and haul from the basin.
e. Convert all 16,000 acres of overgrazed pasture to well-maintained pasture.
f. Convert 2,700 of the 6,500 acres of row crop to hay land.

The solution indicated that it was not necessary to ship litter out of the basin at the present. The long term prospects are being investigated. Further research is needed to examine the capability of current programs to provide incentives, regulations, or both to relevant parties to implement these changes.

Procedures, Objective 2:
These preliminary results do not consider the beneficial impact of a proposed waste-to-energy plant or the addition of a recently proposed discharge by the city of Centerton, Arkansas. If a waste-to-energy plant were in operation, it could convert some of the litter to energy and saleable fertilizer, further reducing the cost of limiting phosphorus loading. Moreover, under reasonable assumptions, the processing plant may actually be profitable, which would greatly reduce cost of limiting phosphorus loading.

Thus, the second objective of the research is to investigate the economic viability of such a plant. Since a major cost of processing litter is the cost of transporting it to a processing plant, a key feature of the analysis is the GIS analysis. Rather than using straight-line "as the crow flies" map distances between poultry producers and the proposed processing plant, actual road miles are used to calculate transportation cost from each poultry farm to the plant. The difference is potentially significant because of the relatively small number of adequate roads in this region of the state.

Costs of several technologies were considered using economic engineering estimates of both fixed (capital) costs and variable (processing) costs. Since actual production processes and output markets can be quite variable, another key feature of the analysis is the risk assessment of the proposed plant. Since the production process is new, there is uncertainty about the yield of electricity, nitrogen (N), phosphorus (P), and potassium (K) that can be obtained from each ton of litter. In addition, prices of these outputs are uncertain. So, the analysis treats each of these variables as statistically random, with specified probability distributions. The simulation also assumes variability in capacity utilization of the plant, such as might result from operating difficulties or variability in "quality" of litter.

Preliminary Findings, Objective 2:
Financial feasibility simulation of the proposed plant over a 20-year planning horizon, using conservative assumptions (although the supplied engineering coefficients have not been verified by us), achieves an internal rate of return on investment of 16%. Years with low or negative returns are few and mild so that viability of the firm is not threatened. This simulation assumes that the firm receives the federal "green energy" tax credit. Without the "green energy" credit, the plant would achieve an internal rate of return of -2%.

Work in Progress
Work in progress is linking these two objectives together, so that the impact of the processing-plant's litter-reducing benefits for the entire watershed can be measured. Preliminary results suggest that including the processing plant in the analysis could significantly reduce the cost of reducing phosphorus loading in the watershed. Further research is needed to verify the engineering coefficients of the processing plant.

Notes from the 2005 NIWR Meeting in Washington D.C.

Research Needs as Defined by US EPA Office of Wetlands, Oceans and Watersheds (OWOW)

At the 2005 National Institute of Water Resources Meeting March 5-8th in Washington DC, OWOW discussed its top priorities for source water assessment and protection research. According to the presentation by Roy Simon and Rebecca Dils of OWOW, source water protection is meant to be a cost effective compliment to treatment to ensure safe drinking water. The top two priorities are Cost-Benefit Analysis of protection versus remediation and doing watershed/ aquifer susceptibility determinations. They identified four additional priorities for source water assessment and protection. Research which sets national and state standards, looks at assessment processes, develops preventive measures and enhances contingency abilities are all high priorities. There are various grant opportunities through the Clean Water Act, Safe Drinking Water Act, EPA-Office of Research and Development, and still others. Even if there is not currently a Request for Applications posted for a particular project, if it is relevant to the aforementioned topics, they highly encourage that the principal investigators contact OWOW.

Update on the Water Resources Research Act

The Water Resources Research Act authorizes a nationwide, state-based network of State Water Resources Research Institutes. This Act must be reauthorized every five years and it will currently expire at the end of FY 2005. The proposed reauthorization of the Water Resources Research Act will again extend the Act's program for five additional years. Each year money must also be appropriated for the Act. In 1991, Congress appropriated over $10,000,000 for the Water Resources Research Institute Program (part of the Act). That number dropped to a low of $4,553,000 appropriated for four years. During the past two years (FY 2004 and 2005) that number rose to $6,500,000. The National Institutes of Water Resources (NIWR) recommends for FY 2006 a funding goal of $8,775,000, of which $7,000,000 is for the base program supporting the state water resources research institutes program and $1,500,000 would support 1:1 competitive matching grants for research addressing regional problems.

Mark Your Calendars!
Oklahoma Water 2005 Conference
OSU-Tulsa
September 27th-28th

For more information visit:
http://environ.okstate.edu/OKWATER

Submit professional and student posters by May 27th!

Pre-Conference Workshops on the 26th.

Conferences

2005 AWWA Water Security Congress

Learning From the Past, Preparing for the Future
April 10–12
Oklahoma City, Oklahoma
Register today at http://www.awwa.org/conferences/congress/register.cfm

National Ground Water Association

2005 Ground Water Summit
April 17-20
San Antonio, Texas
http://www.ngwa.org/e/conf/0504175095.html

9th National Watershed Conference

The Watershed Program at 50: Reflections on the Past and Forecasts for the Future
May 22-25
Fort Mitchell, Kentucky
http://www.watershedcoalition.org/events.html

124th Annual Conference and Exposition

The World's Water Event [SM]
June 12–16, 2005
San Francisco, California
http://www.awwa.org/ace2005/

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Another purpose of the NIWR meeting is to organize the annual visits of the institutes' directors to their state's Congressional member's offices. Dr. Focht and Mike Langston met with the staff of Senators Inhofe and Coburn, and Representatives Boren, Istook, and Lucas. Each office was presented with information about the research funded by the OWRRI over the past two years (including the work by Drs. Adam and Stoecker featured on p. 2). They also discussed the need to have Congress continue this important work by reauthorizing and funding the institutes for the next five years. The OWRRI's mission includes dissemination of research results to state and federal officials; Congressional visits are an important part of making sure our policymakers are informed about the water issues that face Oklahomans.

More information regarding the NIWR meeting can be found on page 3.

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