Watershed Lab Connections

North Appalachian Experimental Watershed

Coshocton, Ohio

An outdoor laboratory for land and water management research

Agricultural Research Service

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In the last issue of "Watershed Lab Connections", we highlighted the wealth of data collected by the North Appalachian Experimental Watershed (NAEW), and provided information on our project on applying manure to frozen soils. In this issue, we are highlighting the impacts of a NAEW project to provide the scientific basis for application rates of paper-mill byproducts to aid in reclamation of surface mines.

Inside this issue:

Beneficial Use of Paper-Mill Byproduct Provides a Winning Solution for Industry, Government, Researchers, and the Environment

Paper mills generate a large amount of byproduct that consists of a mixture of fibers too short to make paper, clay, and lime. This material can be beneficially used by applying it to land that has been surface mined for coal production. When applied at high rates for this purpose, however, it may adversely impact the quality of the water that runs off from the reclaimed sites. In a field-plot study conducted by NAEW scientists, the effect of applying paper mill byproduct was investigated at 0, 100, and 300 tons per acre on the amount and quality of runoff on 9 runoff plots. Control plots were mulched with hay and fertilized at planting, but the other plots were only amended with byproduct.

Paper-mill byproduct spreading on runoff plot at 300 tons/acre with flow sampling instrumentation.

We found that the byproduct at the higher rates drastically reduced runoff 4- to 6-fold and decreased erosion from 20 tons/acre to less than 0.4 tons/acre compared to the control plots. *The study showed that byproduct material decreased the amount of runoff and soil erosion while improving the growth of grasses used to reclaim the mine. Moreover, it may have more persistent beneficial effects by increasing soil organic matter to greater extent.* Initially, the runoff from plots that were amended with byproduct was low in dissolved oxygen and contained large amounts of dissolved organic matter that may negatively impact aquatic life if it directly enters streams. This impact on water quality, however, was mainly observed in the first 2.5 months after the byproduct was applied. Additionally, *there was little overall difference between the 100 and 300 per acre rates on water quality at the end of the study, maximizing the amount of byproduct that can be applied to mined lands.*

0 tons/acre **300 tons/acre**

Paper-mill byproduct increases the organic content of reclaimed soil.

Paper mill and coal mine operators and government regulators are using the results from this study to revise regulations regarding land application of paper-mill byproducts to reclaim surface mines. The results of the NAEW study also have enabled paper-mill operators to reduce the frequency of costly stream sampling. The study will also help in designing reclamation practices that increase the beneficial effects of paper-mill byproduct usage while decreasing the potential negative effects on water quality. Moreover, this study will be useful in designing studies of other byproduct materials . A technical paper written on this study was published by NAEW Scientists Dr. Martin Shipitalo and Dr. James Bonta, and received an award from the All-Ohio Chapter of the Soil and Water Conservation Society. For more information, please contact Dr. Shipitalo or Dr. Bonta.

NEW Grant Funds for NAEW to Investigate Effects of Climate Change on Corn-Production Systems in the Midwest

What is the project about?

The NAEW is excited to be a partner in a new $20,000,000 USDA-National Institute of Food and Agriculture (NIFA) funded Coordinated Agricultural Project (CAP) grant to determine the effects of climate change on corn-productions systems in the Midwest US titled, "**Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems**". The project will focus on keeping Midwest corn-based cropping systems resilient in the face of future climate uncertainties. Nine land-grant universities and two USDA-ARS institutions across eight Midwest states from Iowa to Ohio will collaborate on the project. Forty two scientists from these institutions will collect and analyze data over the next five years. This region produces eight billion bushels of corn, which is 64 % of the annual harvest in the United States. The grant is one of three $20,000,000 grants funded this year.

Researchers will begin collecting data on carbon, nitrogen, and water movement this spring from 21 research sites in the eight states. The team will integrate field and climate data to create models and evaluate crop-management practices. A data base of plot, field, farm, and watershed data will be combined with climate data to develop scenarios based on different practices. The project will help identify corn-based cropping systems that are productive and resilient in the face of weather uncertainties and risks. Farmers in the regions will have opportunities to participate in on-farm research, and will be asked if the results are economically viable, socially acceptable, and environmentally sensible. The project includes training of teachers and the next generation of scientists to better understand the relationships between climate shifts and agriculture.

The long-term national outcome is to reduce the use of energy, nitrogen, and water by 10% and increase carbon stored in the soil by 15% through resilient agriculture systems. The grant includes hydrologists, soils scientists, sociologists, agronomists, and natural-resource scientists.

What will the Coshocton NAEW lab do?

The NAEW will participate in:

1. **historical data analyses**
2. **modeling efforts**
3. **field studies focused on sustainability and changing climate**
4. **watershed scaling investigations**

The NAEW will furnish historical watershed runoff, water quality, and soil-carbon data under different cropping sequences, and provide historical weather and lysimeter data. *These data, the only data like it in the US*, will be used to help calibrate and verify watershed models, and will be used for projecting impacts of climate change on these production systems. Additionally, the NAEW will evaluate, using our field monitoring infrastructure, new sustainable practices at the small watershed scale that will require less fertilizer and no pesticides. Some of the experimental areas will focus on sustainability by investigating organic agriculture and will receive no pesticides or mineral fertilizers. Another area of focus will be evaluating NAEW historical weather, runoff, water-quality, soil-carbon, and other unique NAEW data to determine present impacts of changing climate. These analyses will not only potentially show what parts of the hydrological cycle might be changing under a changing climate (e.g., soil moisture, evapotranspiration), but will also give guidance to modeling on how water is actually redistributed in the hydrological cycle. Finally, another area of investigation will involve quantifying how runoff is generated from small to large areas ("scaling" up of hydrological results) to guide watershed modeling efforts. For more information, please contact Dr. James Bonta.

Do You Need Documentation of Weather Data for Comprehensive Nutrient Management Plans (CNMP)?

The NAEW provides weather data required for CNMPs on its web site (www.ars.usda.gov/mwa/coshocton). Just click on the file in the upper right corner of the web site for the year of interest. The web site is updated monthly.

NAEW Collaborations

The NAEW collaborates with universities and others on grants and other projects. Current projects include:

- Research project investigating how climate change affects corn production in the Midwest (USDA NIFA-funded 3/2011). Iowa State is the lead university – see article above.
- Proposed project titled, "Quantifying the spatial location of small-scale land management changes in large watersheds using hydrological modeling" (USDA NIFA-pending 5/2011). This project will investigate methods to quantify farm-field conservation practices and their impact at a larger downstream point for purposes of water-quality trading. This project will use much of the NAEW small watershed data in data analyses and in watershed modeling. This proposed work is in collaboration with The Ohio State University.
- Collaborative project with The Ohio State University on water-quality trading in the Scioto River Basin in Ohio (active).
- Collaborative project with The Ohio State University on water-quality in the Sugar Creek Basin in Ohio (active).
- Collaborative planning grant with the University of New Hampshire titled, "Seed Grant Proposal: Towards Sustainable Food, Fuel, and Forests in New England" (USDA-NIFA, pending). June 2011.
- Planning grant for organic agriculture (USDA NIFA – funded 3/2010) titled, "Environmental Sustainability of Organic Farming Systems: On-Farm, Experimental, and Watershed Assessments". This is a collaboration with The Ohio State University, USDA-Agricultural Research Service (Coshocton, OH and Beaver, WV locations), Small Farm Institute, Organic Valley, Central State University, Rodale Institute, and Discovery Farms (U. of Wisconsin).
- The NAEW is collaborating with Ohio State University/Ohio Agricultural Research and Development Center in Wooster, Ohio on a 3 year grant from CSREES' (now NIFA) Organic Agriculture Research and Extension Initiative. The project is studying the impacts of organic animal production systems on water quality and quantity in Ohio. The NAEW portion is to use NAEW small experimental watersheds in a side-by-side comparison to investigate environmental impacts of transitioning to certified organic beef production in continuous grazing and management intensive grazing systems.
- A collaborative project with Nancy Shappell, USDA-ARS, Fargo, ND, who is looking at estrogenic activity in runoff following winter application of manure.
- OSU grad student projects
  - ♦ Effects of biochar on soil quality and crop productivity
  - ♦ Assessing and improving soil quality in degraded urban soils
  - ♦ Greenhouse gas emissions under different crop management practices
  - ♦ Water quality trading
  - ♦ Climate change data evaluation using NAEW historical data

New 5-Year Research Plan under Development

NAEW scientists are developing a new 5-yr research plan. The plan will take advantage of our strengths – the permanent NAEW small-watershed monitoring infrastructure and the long-term runoff, water-quality, lysimeter, weather, and soil-carbon data base. The specific objectives are:

1. Quantify the effects of land use (e.g., cropland, pastureland, urban) on soil quality, surface and subsurface flows, and the transport of agricultural chemicals and sediment.

2. Conduct studies to support modeling efforts that analyze the impacts of management practices and climate change for unmonitored watersheds.

If you have a research need, we would be glad to explore how it might be incorporated into the 5- yr plan. Please contact Dr. James Bonta for additional information.

NAEW Possibly Closing?

The NAEW has been identified for possible closure in FY2012 as proposed in the President's budget for FY2012. Nine other ARS locations in other parts of the country have been identified as well. Initial steps by the House support this budget. A firm decision on this proposal has **NOT** been made by Congress. More information can be found at : http://www.obpa.usda.gov/16ars2012notes.pdf (pp 16/38 and 16/43).

NAEW Awards, Invitations, and Publications (Since 10/2010)

NAEW Awards

- Dr. Shipitalo was selected as the 2011 recipient of the Conservation Research Award from the Soil and Water Conservation Society. Award to be presented at the annual meeting in Washington, D.C. 17-20 July 2011.

NAEW Invitations

- Dr. Shipitalo gave invited presentation on filter sock research at Soil Science Society of America Annual Meeting 1 November 2010.
- Drs. Shipitalo and Bonta were invited to attend conference on Biodiversity at the Danish Embassy in Washington, D.C. 16 December 2010.
- Dr. Shipitalo invited to give a guest lecture to an OSU Earth Science class on 19 January 2011.
- Dr. Shipitalo gave invited presentation at Tri-State No-till Conference in West Middlesex, PA on 1 February 2011.
- Dr. Bonta was invited to make presentation to The Ohio State University Agricultural Engineering Seminar on the NAEW, collaboration with OSU, and technology transfer in Columbus, OH, April 2011.
- Dr. Shipitalo gave invited presentation at the Southwest Regional PA No-Till Conference in Latrobe, PA on 2 February 2011.
- Dr. Owens was invited to host a session and make an oral presentation on pasture management and water quality at the 2011 Northeast Pasture Consortium annual meeting. The meeting was held in State College, PA on Feb 1 & 2. He also had a poster in the poster session.
- Dr. Owens has been invited to make a presentation at the 2011 Crop Management School in Ocean City, MD, November 15-17. The topic will be "Pasture management strategies to minimize nutrient losses in surface runoff and subsurface flow" based on research at the North Appalachian Experimental Watershed near Coshocton, OH.
- Dr. Bonta was invited to become a member of the Industrial Adivsory Council for the Environmental Engineering program at Central State University, May 2011.
- Dr. Shipitalo has been invited to participate in a Biopore Workshop sponsored by the University of Potsdam, Germany on 17-19 October 2011. Travel costs to be paid by the German Research Foundation (DFG).

NAEW Publications

- Logsdon, S.D., Green, T.R., Bonta, J.V., Seyfried, M.S., Evett, S.R. 2010. Comparison of electrical and thermal conductivities for soils from five states. Soil Science. 175(6):573-578.
- Owens, L.B., Bonta, J.V., Shipitalo, M.J., Rogers, S. 2011. Effects of Winter Manure Application in Ohio on the Quality of Surface Runoff. Journal of Environmental Quality. 40(1):153-165.
- Stavi, I., Lal, R., Owens, L.B. 2011. Effects of cattle grazing during the dormant season on soil surface hydrology and physical quality in a moist-temperate region. Ecohydrology. 4(1):106-114.
- Lorenz, K., Lal, R., Shipitalo, M.J. 2011. Stabilized soil organic carbon pools in subsoils under forest are potential sinks for atmospheric CO2. Forest Science. 57(1):19-25.

- Pappas, E.A., Huang, C., Bonta, J.V. 2011. Do Upslope Impervious Surfaces Impact the Run-on/Runoff Relationship? Journal of Hydrologic Engineering. 16(4):345-350.
- Owens, L.B., Shipitalo, M.J. 2011. Sediment-bound and dissolved carbon concentration and transport from a small pastured watershed. Agriculture, Ecosystems and Environment. 141(1-2):162-166.
- Dinku, M.E, Fisher, D.S., Owens, L.B., Jenkins, M.B., Schomberg, H.H., Tebes-Stevens, C.L., Bonta, J.V. 2011.Runoff water quality during drought in a zero-order Georgia Piedmont pasture: nitrogen and total organic carbon. Journal of Environmental Quality. 40(3):969-979.

Other NAEW Activities

Dr. Owens participated in the 2011 Earth Day activities at the AEP's Coshocton plant. Along with Don Lightell, NAEW biological science technician, they hosted a soils stop which was visited by several elementary school classes. The Earth Day activities had 26 possible stations and hosted 800 5th and 6th grade students from 4 school districts.

NAEW Tours and Meetings

10/2010:	Organic Sustainability Stakeholder's/Researcher's meeting and tour held at the NAEW
11/2010:	OARDC Administration Meeting at the NAEW
	Ohio Stormwater Association Meeting
12/2010:	ODNR/OEPA meeting regarding streamflow monitoring in SE Ohio
	Advisory Meeting at Zane State College
	Rodale Institute regarding collaboration on an organic sustainability grant
	Washington DC meeting at Danish Embassy
	Ohio Stormwater Association Meeting
1/2011:	Northeast Pasture Consortium meeting at State College, PA
2/2011:	Corn systems coordinated agricultural project meeting in Chicago
	ODNR Meeting regarding the Grand Lake St. Marys Watershed
	Ohio Stormwater Association
3/2011:	Ohio Food and Agriculture Council Meeting
	OSU— Dr. Lal's soil physics class & international visiting scientists
	Tour of NAEW for Coshocton Port Authority
4/2011:	Organic records meeting – OSU and NAEW personnel
	Water Quality Integrated Organic Team for joint OSU-OARDC/NAEW organic grazing project
	Ohio Stormwater Association
	Tour of NAEW for Senator Brown's aide
5/2011:	Tour of NAEW for Central State University – two water-related classes and faculty members
	Johnson-Humrickhouse Museum's club for young adults Generation X/Y
	Ohio Stormwater Association Conference at Columbus, Ohio
	Tour of NAEW for ARS scientist from University Park, PA – exploring scientific collaboration
	Honey Ridge Amish School in Holmes County
	Tour of NAEW for Kent State University – geology class
	Tour of NAEW for Agricultural Technical Institute (Wooster, OH)– soil erosion modeling class
6/2011:	Tour of NAEW for OSU Agricultural Engineering faculty member and graduate students to explore potential collaboration regarding sprinkler application of disinfected wastewater
7/2011:	NRCS tour and meeting for new agency interns

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