

RESEARCH PROJECTS, RESULTS, AND POTENTIAL OF THE NAEW AT COSHOCTON, OH

We conduct field-scale research on land management practices to improve water quality, reduce flooding, and to reduce sedimentation, nutrients, and pesticides in water supplies. The NAEW is a resource known for its technical expertise and data used for modeling, and research results that are sought by *many* scientists, universities, agricultural producers, and others worldwide. Examples of current and past contributions by the Coshocton facility follow.

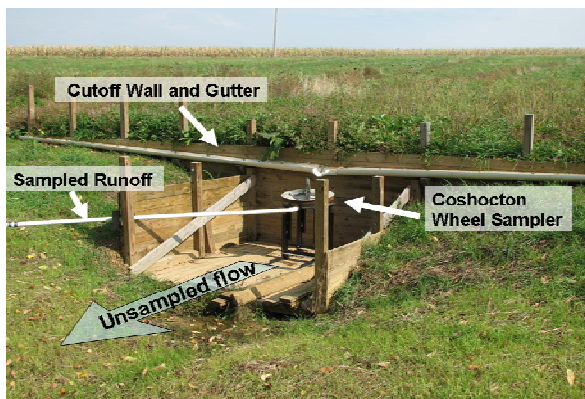
ENERGY

Energy/Biofuel-related research: Research at Coshocton has *demonstrated that removal of large amounts of crop residue for ethanol production can negate many soil quality benefits of long-term no-till.*

Surface mining and reclamation: A landmark comprehensive study on how coal mining and reclamation affects runoff and water quality in surface and ground water was conducted by the NAEW in collaboration with The Ohio State University and three coal companies in Southeast Ohio. *The data collected have provided information to regulators and mining companies, and would provide the baseline data for the investigation of the potential benefits and consequences of the very long-term effects of mining if such a project were initiated.*



FOOD SAFETY AND SECURITY



Pathogens from manure applications: In collaboration with the USEPA, pathogen transport from experimental watersheds and plots having applied beef, turkey, and swine manure are being investigated *to develop science-based guidelines and methods for manure applications by producers to protect water resources and address food safety concerns.*

Pesticide transport: Conservation tillage practices usually rely on herbicides for weed control. *NAEW research has shown that concentrations in some herbicides in runoff can reach levels of concern. These concerns can be addressed by reducing application rates by proper application techniques and selection of pesticides. This research addresses food safety concerns by improving water resources.*



Evaluation of effectiveness of best management practices (BMPs): This project is a current investigation into methods to quantify the effects of BMPs when there are few data, and to account for natural variation in watershed response due to weather. Water quality data from the Coshocton watersheds are being used in this pilot project in collaboration with the USEPA. *These studies are leading to development of simple techniques to analyze complicated watershed water quality responses.*

Filter sock performance evaluation in grassed waterways: Coshocton watershed data have documented the limitations of on-field control of pesticides. An investigation is underway to explore whether waste products from water-treatment plants can be used inexpensively by producers to filter pesticides and nutrients from surface runoff from agricultural land.

Long-term no-till/conservation tillage research: Runoff and erosion are greatly reduced and in some cases almost eliminated due to research results from Coshocton. A significant part of national farm programs administered by the NRCS (Natural Resource Conservation Service) incorporate “no tillage”, a farming practice largely tested and developed at the Coshocton facility in cooperation with The Ohio State University. This system has several features such as improved soil structure and greater biological activity, reduced fuel/energy needs (i.e., fewer trips across the field), yields equal to or greater than those with conventional tillage, yields better during droughts, and increased soil carbon storage especially with manure applications.

Winter application of manure on frozen soil: Plots have been established to measure impacts on runoff water quality resulting from manure application to frozen ground, following NRCS guidelines. *The results from this project will examine whether suggested stream setbacks can be reduced to maximize the area that a producer can use for safe manure applications that will not become water-resource concerns.*

INDUSTRIAL BYPRODUCTS

Paper mill byproducts: The benefits and disadvantages of using paper mill byproducts as a reclamation aid for revegetating surface-mined land is currently being investigated in collaboration with the Ohio state agencies, a mining company, and a paper mill company. *This study will provide guidance to regulators, mine operators, and the paper-mill industry on allowable limits of this useful industrial byproduct to control erosion.*

FLOODING



Urbanization and flooding: A new project that examines the effects of increased imperviousness, and spatial location of imperviousness (e.g., rooftops, roads, etc.), on experimental watersheds, as well as best management practices that will reduce runoff volumes and peak flows. *Knowledge gained from this project will help municipalities and other entities reduce flooding, flood damage, and save lives.*

Precipitation modeling: The long-term precipitation records of the NAEW are being used as the primary data source for developing concepts for computer generation of short-time increment precipitation intensities as they vary with season and location in the US. *This model is useful where long precipitation or short-time increment records do not exist for modeling water resources. It is being developed to help the NRCS with modeling watersheds to implement national conservation programs.*

CLIMATE CHANGE

Climate change – effects on grazing and storms: The long-term data base at Coshocton is useful for evaluating the changes in weather, runoff, erosion, and evapotranspiration, and water quality due to possible changing climate. *Current studies are investigating whether climate change increases the length of the grazing season, and whether storm characteristics might be altered due to changing climate.*

GRAZING



Environmental impacts of grazing systems:

The NAEW monitoring infrastructure allowed *environmental recommendations for fertilizer application rates to pastures to be developed.* A new management-intensive grazing (MIG) project is investigating the water-resource benefits of frequent rotation of livestock between small paddocks in a pasture. This comprehensive evaluation is being conducted with The Ohio State University, and includes impacts on surface and subsurface water

quality, animal health, and changes in plant species. *Benefits of MIG to the producer include extended grazing season, less cost, meat and dairy products with improved human health benefits, and more leisure time. This project is a pilot for a full environmental dairy research facility that we wish to establish.*

CROPPING SYSTEMS

Crop rotations: An extensive study of the effects of crop rotation and soil type in the early history of the NAEW indicated that most soil loss occurred when row crops were produced and that *most of this soil loss was due to a few infrequent severe storms. This finding suggests that conservation practices must be able to control soil loss attributable to the few extreme events in order to be effective.*

SOIL CARBON

Carbon sequestration: An experimental watershed at Coshocton with the longest record of runoff worldwide with over 40 years of continuous no-till corn has been the source of much research related to soil carbon sequestration. *This and other watersheds have enabled the evaluation of the effects of land management on stored carbon that can help infiltrate water, and provide a scientific basis for carbon-credit trading.*



WATERSHED SCIENCE



Preferential movement of water in soil:

Investigations have been conducted on how preferred pathways through the soil (earthworm burrows and soil cracks) affect runoff and water quality. *These studies have developed fundamental knowledge of the fate of water and chemicals in soil water, and have been used in modeling studies, and to develop best-management practices to control movement of liquid manure to drain tiles. This work at Coshocton is recognized worldwide.*

Runoff estimation:

The “curve number” (CN) method is an engineering tool used to estimate runoff volumes from watersheds. Much of the original developmental work on the CN method was conducted using Coshocton data. *Today, data from Coshocton are still used in new CN developments and are used as examples in new documentation. The CN method is used for water resources engineering worldwide, and is often mandated by statute.*

Instrumentation: The NAEW has developed and adapted many hydrological and water-quality instruments including the original Coshocton wheel water sampler, the Coshocton vane sampler, large particle sampler, drip-flow meter and sampler, hydraulic studies of the drop-box weir, the adaptation of the Coshocton wheel for the drop-box weir, precipitation gauge, natural precipitation infiltrometer, worm-burrow infiltrometer, and rainfall simulator for macropore studies. *These instruments have been developed to achieve NAEW research objectives and are used by the scientific community in water-resources research.*



Other research: Throughout the history of the NAEW, numerous research projects have investigated many other aspects of watershed science including: rain gauges, soil moisture, evapotranspiration, landfill caps, watershed modeling, ground-water recharge, interflow, natural precipitation infiltration, and erosion control.