A Few of the Many Outstanding ARS Environmental Advances

An issue of *Agricultural Research* magazine that highlights contributions to the environment would not be complete without listing some notable accomplishments by ARS in this area. The agency has provided many research advances that help minimize the effects of agricultural practices on the environment. Other contributions benefit the environment overall.

Here you'll find just a few selected examples of how the agency has worked to preserve natural resources—not only to sustain U.S. agriculture long into the future, but also to protect the quality of the nation's environment.

STEPHEN AUSMUS (K10003-17)

Plastic from Poultry Feathers

ARS has developed and patented a way to process chicken feathers into plastics and composites that have performance characteristics similar to petroleum-derived products. About 4 billion pounds of feathers are generated each year by the poultry industry, posing a serious waste-disposal problem. But feathers are a pure source of the tough, lightweight protein keratin. The ARS technology turns the keratin into lightweight plastic, comparable in strength and stiffness to polyethylene or polypropylene. Feather plastics can be molded, just like any other plastic, on existing machinery and used in applications that require lightweight, tough plastics. This new technology could solve an environmental problem, raise the value of feathers, and provide a potential substitute for a petroleum-based commodity. This work was conducted at the Environmental Management and Byproduct Utilization Laboratory, Henry A. Wallace Beltsville Agricultural Research Center, Beltsville, Maryland.

Itch-Free, Machine-Washable Wool

ARS has developed a better way to produce bleached, itch-free (biopolished), machine-washable wool suitable for use in military apparel and in commercial textile product lines where synthetic fibers are traditionally used. The work was headed by ARS chemist Jeanette M. Cardamone. The new process is an alternative to conventional chlorination processing, which is not environmentally friendly. The military is especially keen to have itch-free, machine-washable, shrink-resistant wool for clothing because it would be more comfortable and breathable than synthetics. In addition, this specially processed wool burns to a soft ash with a self-extinguishing flame, while synthetics melt and drip-burn to a hard bead that can lodge in open wounds. ARS washable wool technology could increase the demand for domestic wool. This work was conducted at the Fats, Oils, and Animal Coproducts Research Unit, Eastern Regional Research Center, Wyndmoor, Pennsylvania.

PEGGY GREB (K11893-1)

A new biopolishing wool-processing technique can make wool clothing more comfortable. Even the U.S. military is interested.

KEITH WELLER (K6054-9)

Alpine pennycress doesn't just thrive on soils contaminated with zinc and cadmium—it cleans them by removing the excess metals.

Plants That Clean Up Toxic Soils

ARS plant physiologist Leon V. Kochian and ARS agronomist Rufus L. Chaney have studied phytoremediation for several decades, becoming internationally known experts on use of plants to clean up soils contaminated with heavy metals. The method economically decontaminates soil and water that could otherwise pose environmental, agricultural, or human health problems. In phytoremediation, certain plant species known as "metal hyperaccumulators" take up toxic heavy metals such as zinc, cadmium, and nickel through their roots and store them in aboveground plant tissues. The stems and leaves can be harvested and processed to yield valuable materials. Chaney's recent work focuses on practical applications to move ARS technologies into commercial use for improving soil in contaminated rice fields. Kochian's research has focused on identifying genes that control metal hyperaccumulation. The long-term goal is to develop plants better suited for cleaning up contaminated soils. This work is conducted at the U.S. Plant, Soil and Nutrition Laboratory, Ithaca, New York, and at the Environmental Management and Byproduct Utilization Laboratory, Beltsville, Maryland.

Eco-Friendly Hydraulic Fluid for Elevators

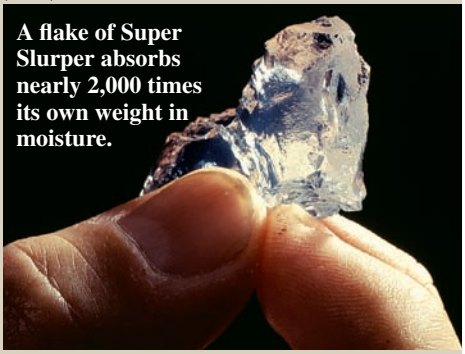
ARS's new vegetable oil-based elevator hydraulic fluid is now being used in the Statue of Liberty on Liberty Island. This new biobased technology meets all industrial performance standards and has high fire resistance. It could replace the conventional mineral oil-based product, which has flammability, environmental toxicity, and disposal problems. ARS chemist Sevim Z. Erhan headed the project. This work was conducted at the Food and Industrial Research Unit, National Center for Agricultural Utilization Research, Peoria, Illinois.

ARS's new vegetable oil-based elevator hydraulic fluid is now being used in the Statue of Liberty.

Super Slurper

ARS scientists created Super Slurper by marrying starch to a synthetic chemical. It can absorb up to 2,000 times its own weight in water. Environmentally, Super Slurper is used as an ingredient in products used to clean up chemical spills. Patents were secured in 1976. Since then, later synthetic versions have given rise to additional synthetic superabsorbents. Over the years, many practical uses for the thirsty absorbents have been found. This work was conducted at the ARS National Center for Agricultural Utilization Research, Peoria, Illinois.

(K839-1)



A flake of Super Slurper absorbs nearly 2,000 times its own weight in moisture.

SCOTT BAUER (K5051-8)

Pennsylvania watershed showing the patchwork quilt of forest, farmland, and other land uses typical of watersheds in MSEA and CEAP studies.

Management System Evaluation Areas (MSEA)

In the early 1990s, ARS took the lead in a USDA water quality program called "MSEA," which was implemented across the Midwest. It was designed to develop and test farming methods that work with nature to preserve and protect water quality. The cornerstone of the program has been a close integration of research, extension, and education. It has resulted in farmers being more efficient with nitrogen fertilizer and herbicide applications at all midwestern MSEA sites. This work has been conducted at ARS laboratories in Iowa, Kansas, Minnesota, Missouri, Nebraska, Ohio, Wisconsin, and the Dakotas.

Soil and Water Assessment Tool (SWAT)

This computer model has led to cleaner water, longer lived reservoirs, and healthier farms and landscapes across the United States and abroad. The program analyzes watersheds to assess the cost-effectiveness of agricultural practices, identifies water quality problems, and searches for improvements, thus spurring farmers' adoption of conservation practices. SWAT is the major model used in CEAP. The model was developed at the Grassland Soil and Water Research Laboratory, Temple, Texas, and then delivered to USDA's Natural Resources Conservation Service and the Texas Agricultural Experiment Station

Conservation Effects Assessment Project (CEAP)

This relatively new USDA project builds on the MSEA program, using some of the same ARS study sites. Its goal is to quantify the value of conservation practices, balancing farm and environmental benefits. There are more than 28 CEAP watersheds involved, with 14 ARS research watersheds contributing about 60 scientists at 15 locations around the country. CEAP is already yielding water quality and economic data, which will be reported this year to the U.S. Office of Management and Budget, farmers, ranchers, and environmental policymakers.

KEITH WELLLER (K8721-1)

In Ames, Iowa, a water sample is collected in MSEA studies to evaluate the effects farm practices have on water quality.

Compiled by **Rosalie Marion Bliss** and **Don Comis,** ARS.