Water Availability, Watershed Management, and the Impending Global Water Crisis

Water is essential for all life. Maintaining abundant supplies of fresh water will be essential to support Earth's expanding human population in the future. Throughout history, the rise and fall of great civilizations has, in part, hinged on their ability to harness and maintain reliable supplies of clean, fresh water for a variety of uses.

Today, while there may be a greater awareness of water's importance to all living things, we continue to face some of the same challenges encountered by past civilizations, although the scope of those challenges has shifted from the local to the global level.

A new ARS national program, Water Availability and Watershed Management (#211), was created to emphasize the redirection of ARS's water research from field-edge to watershed and landscape scale. The name also reflects the President's priority on ensuring the *availability* of fresh water—a term that includes both quantity and quality.

To address these issues, ARS scientists use both modeling and remote sensing, including satellite reconnaissance, to expand measurements of soil moisture and other hydrologic variables from individual fields to watershed, landscape, regional, or continental scales.

One of the goals of this new national program is to develop management practices that use water more efficiently, including reusing or recycling water, to both preserve freshwater supplies and protect ecosystem functions.

Since ARS became an agency in 1953, when the U.S. population was 160 million people and the world's population was 2.7 billion, we've known that a global water crisis loomed somewhere in the future. With the U.S. population now at 304 million and the world's population at 6.7 billion, this crisis may be just around the corner.

As Earth's population continues to grow, the increased demand for water, and the associated pollution of air and waterways, are combining to cause a scarcity of clean, fresh water.

While an impending global water crisis was predicted as early as the 1950s, it was not known then that this crisis would be compounded by changes in global climate. It is expected that the global water shortage will soon be as critical an issue as the food and energy crises are today.

As it has since the 1950s, ARS continues to develop technologies that help agriculture use less water and return water downstream in a clean condition. But because the quantity of water available for all uses varies with regional climate, important water issues also vary by region.

In the eastern United States, where there is generally sufficient rainfall to support agricultural production, major concerns are related to water quality—where the water goes, how it's used, and how it's kept clean—although the timing and amount of rainfall are also important problems.

In the drier West, water quantity is the more constant problem. Arid regions depend on irrigation to grow crops. That water often comes from aquifers, some of which are drying up. The Ogallala Aquifer Program, which seeks to prolong the life of the Ogallala Aquifer, is one example of how ARS—in partnership with the region's universities—is addressing critical water quantity issues in the West.

In states like California, chronic irrigation leads to increases in both soil and water salinity. There, ARS scientists are developing ways to efficiently remove salts and other impurities from these waters before they are used for irrigation.

In both the midwestern and the eastern United States, ARS researchers have designed new drainage systems that both clean and conserve water. They build wetlands to improve the quality of drainage waters, which can then be stored in reservoirs for later use in irrigation. The overall process removes both phosphorus and nitrogen from drainage waters that would otherwise enter the Gulf of Mexico via the Mississippi River.

To get this job done more rapidly and effectively, ARS has begun a midwestern initiative that links the drainage, turf, and industrial byproducts industries. (See story on page 4.) A good example is the technique of mixing polyacrylamide (PAM) with gypsum—a byproduct of the wallboard industry—to slow erosion and runoff by helping rainwater better infiltrate soil in the Midwest and East. Similarly, in the West, PAM is used to control erosion by improving infiltration of irrigation waters.

In combination, the various research projects that compose this national program provide new information about Earth's water cycle. This knowledge will help ensure that adequate supplies of fresh, clean water will be available to support all aspects of our lives—from growing food and other important crops, to drinking and bathing, to swimming, fishing, and boating—while also supporting important natural ecosystems.

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