COUNCIL OF SCIENTIFIC SOCIETY PRESIDENTS
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CSSP ISSUE: SUSTAINABLE WATER QUALITY AND QUANTITY

CSSP POSITION: Shift U.S. water research and policy from managing supply to understanding water cycles and related interactions, conserving supply, and managing demand. Support coordinated frontier research to enhance water quality, distribution, and efficient use by industries, agriculture, and people. Discover and deploy many new ideas and technologies into widespread use for equitable, sustained support of both people and our land and water ecosystems.

Background: A safe and adequate supply of water is essential to survival of humanity and of both water and land ecosystems. Quality and quantity of water, a fragile and greatly undervalued resource, largely define human habitation, determine distribution and survival of plant and animal species, govern production of food and fiber. They greatly influence human health, survival, where we live, and the yield of our food crops and livestock.

All life on earth depends on liquid water. The world's water supply is finite. Although 70% of Earth's surface is covered with water, less than 1% is fresh and liquid, and less than 0.0008% is renewable annually for use by people and land and water species. Every three weeks, the entire atmospheric content of 575,000 km^3 of water exchanges between the atmosphere and Earth's surface, providing fresh water as precipitation, but 460,000 km^3 of it falls over oceans. Exchange is slower with groundwater that may be stored over thousands, even millions, of years but exhausted by human use much more rapidly, even in a few generations. Most human water use transfers it from one ecosystem to another.

The 20th Century saw a seven-fold increase in freshwater use by people and 100,000 new chemicals discharged into the water, creating a myriad of crucial, unmet challenges for the future. Evaporation of water from land plants to the atmosphere is an essential component of the water cycle. Land use thus modifies water outputs from the land.

Worldwide, fresh water is becoming limiting due to 1) increased requirements for drinking water, agriculture, and industry by a growing population; 2) shrinking supplies of groundwater; and 3) loss of quality of available water from the impact of human activities. Strategies must be developed and implemented promptly to protect water quality and distribution to sustain humanity and the local and global environments in which we live.

- **Water is a direct human need, serving us in transportation, industry, recreation, aquaculture and irrigation.** Production of food and fiber and maintenance of our global and local ecosystems depend most on water. Agriculture takes > 80% of the water that we use, offering many opportunities for improved conservation.
- **Safe and adequate supply of drinkable water is essential for human survival and habitation. Contaminated water kills 5 million people per year (killing more every year than war in the 20th Century) and makes 30 million ill worldwide.** Contamination of water resources by nutrient excess and other pollutants changes both water and land habitats and their biological components and compromises food and environmental safety. Regional-scale water cycling is connected in complex ways to human health and spread of infectious diseases by mosquito populations, fungi, bacteria and viruses. Research on these dynamics is essential to develop sound management practices and protection from chemical and biological agents. Ecosystem health already is a major determinant of human health.
- **Uneven distribution of both growing populations and availability of drinking water in the US and abroad places demands on local water supplies that cannot be met by continuing current practices;.** For example, in the depletion and rising salinity of Southwestern American rivers and the grand redirection and drying of major rivers in China.
- **Mining of geological groundwater at rates above recharge is not sustainable.** For example, current use lowers groundwater levels in much of West Texas by over a foot per year, whereas recharge from precipitation occurs at a rate of only a few tenths of an inch to a few inches per year.
- **Over 97% of the water supply on earth is in oceans and is too salty for human consumption or agricultural production.** Desalinating ocean water for human use currently significantly increases monetary and energy costs and results in by-products that require special handling to prevent contamination of land sites.
- **Water management has been practiced largely on the local scale.** Much more research is needed at the watershed scale and beyond to understand how the land, rivers, lakes, and reservoirs interact to control supply and quality of our most crucial natural resource.

CSSP CONCLUSION: Challenges of water quality and quantity occur at multiple scales. International research and cooperation are essential if effective solutions are to be found and implemented. As a leader in the global community, we must develop and implement sustainable water management policies that meet the needs of people and of the ecosystems of this nation and the world and sustain the economic well-being and the health and safety of our people. The USA must end the fragmented policies and uncoordinated water resources research of the past century. A committed, enlarged, and focused research and development program is essential to meet needs for daily existence, avoid mass migrations and the collapse of regional economic systems, ensure food and water security and safety, and enable human use of water without destroying the ecosystems upon which we depend. Water is such an important issue that we urge coordinated efforts across all of Congress now to address, act on and solve these problems.

May 2002

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