The Society for engineering in agricultural, food, and biological systems

IN DEFENSE OF SOIL AND WATER RESOURCES IN THE UNITED STATES: SOIL EROSION RESEARCH PRIORITIES

A position paper of the American Society of Agricultural Engineers

Position

Our soil resource is vital to the survival of the human race. Not only does it provide the literal foundation of our existence, it is the source of most of the agricultural products that sustain us and our way of life—food, fiber, timber, and energy. Because damages to soil quality are nearly always permanent, preservation of this resource is critically important to maintaining agricultural productivity and environmental quality.

One of the most widespread threats to soil quality is wind and water erosion, an ever-occurring process that impacts our lives in numerous ways, the direst of which is lost food production. It is estimated that soil erosion is damaging the productivity of 29% (112 million acres) of U.S. cropland and is adversely affecting the ecological health of 39% (145 million acres) of rangeland.

In addition to on-site soil loss, erosion results in off-site sediment movement that can cause problems downstream. Sediment can deposit and clog drainage ways, increase potential for flooding, decrease reservoir capacity, and carry nutrients and pesticides that degrade water quality. Current assessments by the U.S. Environmental Protection Agency of impaired water bodies indicate that 40% of the stream miles and 45% of the lake and reservoir areas are impaired because of sediment. Therefore, minimizing erosion is not only important for saving the soil, it is essential for preserving potable water resources and improving water and air quality.

Engineers and others have made progress over past decades to understand and control erosion. However, the pressures of increased population on land use and agricultural production continually create new and additional soil erosion problems. Funding of innovative research to identify and develop new or improved practices/systems for successfully combating soil erosion is of paramount importance for obtaining a significant reduction in the rate of erosion in the future.

American Society of Agricultural Engineers

2950 Niles Road, St. Joseph MI 49085-9659 USA | 269.429.0300 | Fax 269.429.3852 | hq@asae.org | www.asae.org

Recommendations

- Federal and state governments, and their agencies, need to increase their support for soil erosion research. Research support has been dwindling at a time when new erosion and related problems need to be addressed to maintain an affordable, abundant, safe, and secure food supply.

- Increased educational efforts and financial incentives are needed to implement both currently acceptable and newly generated technologies to reduce soil erosion and sediment transport. Given the current agricultural economy, it is unreasonable to expect producers alone to bear the risk and financial burdens of implementing new and sometimes costly practices.

- New programs are needed to reward good stewards of the land who are already using soil conservation practices, in order that those practices are maintained. Rather than only addressing new problems and problem areas, special efforts are needed to maintain the progress already made toward a sustainable agricultural system.

Background

Soil erosion is a complex process encompassing detachment, transport, and deposition, and is caused by wind, water, and physical disturbance. Soil erosion reduces land productivity, challenges agricultural sustainability, and degrades soil, air, and water quality. Indirectly, soil erosion also degrades environmental quality through contaminants attached to the sediment. Soil erosion interacts strongly with the global carbon cycle and climate change processes. In some conditions, these impacts are so severe that they reduce quality of life and economic well being, and, in poorer nations, they can even threaten survival.

Substantial progress has been made over the past 50 years in understanding erosion and sediment transport and their impact on the environment. This understanding has led to the development and adoption of a wide variety of erosion control practices. But problems caused by erosion and sediment continue and much remains to be accomplished. The increased awareness of erosion impacts on air and water quality and on global climate change raise new challenges for erosion researchers in three key areas: Wind erosion, Water erosion, and Quantification of erosion.

Research into the detachment, transport, and deposition of soil must be a high priority in order to better define these processes and their potential consequences. With this information, better control methods can be developed and implemented.

Soil erosion research must rapidly evolve and improved strategies must be developed to respond to the new and increasing demands of erosion assessment and resource conservation. High-priority examples include strategies for monitoring erosion as it varies in time and space, along with assessment of off-site impacts.

There must also be an effort to increase the awareness of policymakers and the general public of the impact of erosion and sediment transport on food production and overall environmental quality and the need for continued support of efforts to assess these impacts in order to maintain a secure food supply and protect the environment.

Erosion researchers and field practitioners have identified the following as the most critical challenges that must be addressed over the next 5 to 20 years.

- Long-term and large-scale coordinated monitoring and broad data collection efforts. This allows researchers to better ascertain the impacts of land management policies and practices on erosion, sediment delivery, and the resulting degradation of soil, air, and water resources. These efforts must more fully reflect the spatial and temporal scale of erosion and its impacts, and the topographic complexity of the processes.

- Greater interdisciplinary efforts in developing erosion prediction and control technology, and for ensuring better adoption of those technologies at the local level. Land managers and end users must be more involved in the entire process in order to increase the rate of adoption.

- More effective, better-organized and useful methods of collection of erosion data and the development of tools to enable more productive data sharing.

- Continued work on understanding the fundamental processes involved in both erosion and sediment transport by water, wind, and physical disturbance, and in how best to model those phenomena. Although our understanding has increased greatly over the past decades, there are still some substantial gaps, including such processes as stream bank and gully erosion, transport and deposition processes, effects of sediment on biotic integrity, the role of dust in climate change, etc.

- Efforts to significantly increase our understanding of the transport of sediment by wind or water, and the off-site impacts of this sediment on air and water quality.

Successfully addressing these issues will result in a greater understanding of erosion and sediment transport processes, leading to improved erosion control practices and better tools for land-use planners. This will ultimately result in more effective and efficient protection of the soil, air, and water resources.

This consensus document was developed by the American Society of Agricultural Engineers, with input from participants of the symposium "Soil Erosion Research for the 21st Century," sponsored by ASAE and thirteen other professional societies and agencies. ASAE, the Society for engineering in agricultural, food, and biological systems, has 9000 members worldwide and a long history of leadership in solving problems related to erosion control and soil and water quality. ASAE members are uniquely qualified to generate new technical information on soil erosion, translate that information into more effective practices, and ensure that those who produce the world's agricultural goods are educated accordingly.

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A detailed symposium statement relative to soil erosion research needs is available online at http://horizon.nserl.purdue.edu/~flanagan/erosymp/statement.htm.

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