**University of Minnesota**
**College of Agriculture, Food, and Environmental Sciences**

**Third Annual**
William E. Larson and Raymond R. Allmaras
# Emerging Issues in Soil and Water Lecture Series

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April 15, 2005
2:00-3:45 PM
335 Borlaug Hall
University of Minnesota

## Agricultural Drainage: Impacts on Hydrology, Crop Production, and Water Quality

**Abstract**

Drainage, the process of removing excess water from the land, is essential for agriculture on many of the world's most productive lands. Approximately 25 % of the cropland in the United States and Canada requires some form of man made or artificial drainage for efficient agricultural production. On a global basis, about 180 million ha, an area equivalent to the whole of the cropland base in the USA, requires drainage. The primary purpose of drainage is to provide soil water conditions that are favorable for crop growth and soil management. In humid regions, drainage is needed to provide trafficable conditions for conducting field operations in a timely manner, and to protect the crop form excessive soil water and the lack of aeration. On irrigated arid and semi-arid lands, drainage is needed to control salinity and sustain the soil's capacity to produce crops. Subsurface drainage has also been used to reduce surface runoff, erosion, and the loss, to surface waters, of phosphorus and other constituents. However, all of the impacts of drainage have not been positive. Drainage has enabled land use changes, which has resulted in the conversion of over half of our nation's original wetlands, with losses exceeding 90% in some states. This has resulted in serious negative water quality and ecological impacts. Subsurface drainage increases losses of nitrate nitrogen to surface waters, with the increased nitrate loads representing a cost to local users, as well as, to the environment downstream. The best-known example is in the Mississippi drainage basin, where nitrate losses from subsurface drained land in the Midwest have been identified as a primary source of excess nitrogen responsible for a large hypoxic zone in the Gulf of Mexico. Recognition of the negative impacts of drainage has led to an evolution of the objectives of drainage system design and management. It has also led to the development of methods for reducing those impacts and to continued research and development to improve those methods. Examples of regional, national and international drainage issues will be presented in the lecture, and the effects of drainage design and management on hydrology, crop yields, and drainage water quality will be discussed.