Impact of Subsurface Drainage on Water Availability in the Red River Basin

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Justification:
A wet weather cycle in the Red River Basin region since 1993 has brought the groundwater level closer to the soil surface. Subsurface drainage (SSD) is an effective way to maintain crop production where shallow groundwater exists over a low permeability soil or where soil salinity has been increased due to high water tables. Releasing drainage water from the field to a surface water system can alter the hydrology and water quality (water availability), which, in turn, can disrupt the existing ecology and hydrological balance of the regional watershed and wetlands.

Objectives:
(1) To conduct comprehensive measurements of the water mass balances of drained and undrained fields, with emphases on validation of evapotranspiration ET estimates by satellite-based remote sensing model (SEBAL) using a suite of ground-based measurements, including eddy correlation, scintillometer, and soil water balance methods, and on their inter-comparison;
(2) To develop remote sensing algorithms for identifying fields with SSD installed;
(3) To extend results from this seed grant project to a larger spatial scale, watershed or regional project.

Progress to date:
A 47 ha test site located at Fairmount, Richland County, North Dakota, has been chosen to compare the evapotranspiration (ET) rates between drained and undrained field. Permanent alleys have been constructed to install piezometers, neutron probe access tubes, and weather station instruments. ET was measured by an eddy correlation method in the drained field. Sensible heat flux was measured and compared by a scintillometer and the eddy correlation system for five days when Landsat satellite was passing above the field. Corresponding satellite images were also purchased to calculate the ET by SEBAL method. Soil moisture was measured by a neutron probe at a biweekly schedule. Water level was also measured at a biweekly schedule. Crop yield results indicated that the corn field with the SSD has a 5% higher yield than that undrained. Two complimentary programs were used to monitor the water quality and soil quality change due to water table management.

Impacts:
None reported