Abstract
Rivers in watersheds dominated by agriculture throughout the US are impounded by excess sediment, a significant portion of which comes from non-field, near-channeled sources. Both land-use and climate may have been implicated in altering river flows and thereby increasing stream-channel erosion and sediment loading. In the wetland-rich landscape of the upper Mississippi basin, twentieth century crop conversions have lead to an intensification of artificial drainage, which is a critical component of modern agriculture. At the same time, much of the region has experienced increased annual rainfall. Uncertainty remains as to whether increased streamflows and channel erosion is the result of increased rainfall or increased drainage. We review here the evidence from the past 70 years in Minnesota watersheds over the past 70 years. Watersheds with large land-use changes had increased in annual and seasonal water yields of >50% since 1940. On average, change in precipitation and crop waqntertranspiration explained les than half of the increase, with the remainder highly correlated with artificial drainage and loss of depressed area. Rivers with increased flow have experienced channel widening of 10-40% highlighting a source of sediment sediments addressed by agricultural best management practices.

1. Erosion and turbidity are serious problems in the Corn Belt of the Upper Midwest USA

2. Streambank and bluff erosion is at least half of the problem

3. Channels are widening because of increased flows

4. So why has flow increased?

4a. Because precipitation has increased?
Yes, somewhat.

4b. Because soybeans have replaced perennials?
Yes, but only a little.

4c. Because artificial drainage has reduced evapotranspiration by eliminating wetlands, minimizing ephemeral ponding, and reducing soil moisture? Yes, by a lot.

5. How can we distinguish between these three drivers: precipitation, crop conversion, and drainage? With some basic math.

CONCLUSION:
- About 35% of flow increase is due to increased precipitation and conversion to soybeans
- >50% of the flow increase is due to artificial drainage that has reduced ET from the landscape