Sedimentation in the Illinois River Watershed

Background

The Illinois River watershed consists of 28,906 square miles; 85% of which is in Illinois. The Illinois River connects the Great Lakes with the Mississippi River and is essential for commercial enterprises and the transportation of goods. Industrialization along the Illinois River began in the early 1900s. Open dumping and dilution of environmental pollutants were common in the river until the 1972 Clean Water Act. Since then, water quality has improved but is still not back to pre-industrialized conditions. Currently, the two major pollutants are nutrients and sediment. Other trace contaminants include emerging contaminants such as pharmaceuticals and personal care products (PPCPs) and legacy contaminants such as polychlorinated biphenyls (PCBs). Prairie Research Institute scientists are active in finding solutions to return the Illinois River to pre-industrialized water quality conditions. In order to combat sedimentation, Illinois State Water Survey (ISWS) researchers determined the sedimentation rates for the Illinois River and its major tributaries.

Methods & Results

There are 44 sediment monitoring stations in the Illinois River watershed. The stations are managed by different agencies and have different data types (e.g., mean daily, instantaneous suspended sediment data) and monitoring frequency (e.g., daily, weekly). Seventeen of the stations which have mean daily suspended sediment concentration data (spanning from a few years to more than 35 years) and also long-term mean daily water discharge (1981 to 2015) were used to develop sediment-discharge relationships to estimate annual sediment yield as a function of annual discharge. A previously established equation for the non-linear relationship between the two was used:

\[ \log Q_s = a + b (\log Q_w)^c \]

Where:
- \( Q_s \): sediment load in tons;
- \( Q_w \): mean water discharge in cubic feet per second (cfs);
- \( a, b, \) and \( c \): coefficients determined through a regression and optimization procedure.

From the analysis of the discharge and sediment data, the ISWS team determined that the annual water discharge (blue dotted line) for the Illinois river gradually increases in the downstream direction as expected. However, the sediment load drastically increases in the lower Illinois River (brown coloring). They calculated that the average annual sediment load from tributaries is 12.9 million tons. At Valley City, 61 miles from the Illinois-Mississippi River junction and the end of the Illinois River, the average annual sediment load is 5.2 million tons in the river. This means that about 7.8 million tons or 60% of the sediment load is deposited in the Illinois River every year. This sediment dramatically impacts the economic value and environment of the Illinois River.

Solutions

Solutions to sedimentation and sediment loss in the Illinois River Watershed include:

- **Stream and Wetland Restoration**
  Little to no work has been done in this area despite the state setting restoration goals in a 1996 working group for the Illinois River Watershed Management Plan. Solutions need to focus on areas where sediment loss is significant.

- **Conservation Reserve Enhancement Program**
  This federal program is designed to retire frequently flooded and environmentally sensitive cropland to achieve restoration and long-term protection of those areas. The program was for a limited time and may resume in the future.

- **Soil Conservation in Agriculture**
  Implementation of no-till practices on crop lands has helped prevent sediment loss during winter months. However, more can be done by using winter cover crops and riparian buffer zones to treat nutrients and prevent nutrient runoff.

- **Mud-to-Parks**
  This program was developed to make use of dredged sediment from the Illinois River. These nutrient-rich sediments are placed on former industrial lands in Illinois in order to increase the value of the land and provide parks for residents. More about this program can be found in the next display.