The field trip includes three stops: 1) RiverLab, 2) Allerton Trust Farm, and 3) Sangamon River Floodplain. The discipline leaders will describe ongoing research activities at "critical interfaces" of the near-surface, root-soil, and river-floodplain environments in the Critical Zone. These critical interfaces are zones of transition between different aspects of the landscape system, and play a disproportionate role in regulating material fluxes through storage, transport, and transformation, often through threshold responses and intermittent connectivity across interfaces. Specifically, interactions among water, dissolved and suspended material, and gases at interfaces depend upon and influence geologic and geomorphic processes, the chemical composition of constituents, biological activities of microbes, higher organisms and associated ecological communities. Meanwhile, all critical interfaces are impacted by intensive agricultural practices, which do not function uniformly across time and space.

STOP 1: RiverLab

21 Bridge Street, Monticello IL (40.030846°N, -88.588965°W)
(35-minute drive from Champaign)

Leaders: Jenny Druhan and Jinyu Wang (UIUC-ESEC); Erin Bauer (UIUC-ISWS)

Site Overview

A new 'lab-in-the-field' technology installed in July 2021 along the Sangamon River is the first RiverLab (RL) in North America. Within the RL, a 940 Professional IC Vario (Metrohm AG®) is used to obtain continuous, high-frequency measurements of major ions concentrations (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2-}, and NO_3^-) in the river water. The RL deployment at Monticello is unique and novel in that it operates along a river of much greater size than any prior study. Representative sampling of such a relatively large river requires a specially designed intake pumping and delivery system, which was custom fabricated at UIUC and is secured to the river bottom. So far, the geochemical measurements contradict the notion that storms in larger watersheds should exert less influence on mass flux than in smaller watersheds.

From Wang et al. (2023)

Adjacent to the RL is USGS Gage station 05572000 where water data (i.e., river stage and discharge) have been collected since 1908. To augment this data, ISCO sediment samples of suspended load during flood events are being collected using a "Tsurumi Pump"; a more powerful pump.

STOP 2: Allerton Trust Farm
Old Route 47, Monticello IL (40.025024°N, -88.661597°W)
(35-minute from Champaign)

Leaders: Ashlee Dere (U. Nebraska-Omaha); Tim Filley (U. Oklahoma); Lisa Welp (Purdue University); Sean Schaeffer (U. Tennessee-Knoxville)

Site Overview
The field site was initially established to measure water and sediment fluxes from the tile drains into the stream. The site is located along a low-gradient tributary of the Sangamon River and is characterized by its poorly drained loess soils. The Allerton Trust Farm is owned and managed by the Board of Trustees of the University of Illinois and has been the site of natural resources research activities for many years. Using an ISCO sampling device, tile drain water and sediment samples are collected throughout rainfall events. The water samples are collected and processed by the ISWS and then sent to Purdue University for isotopic and nutrient analyses. A weather station at the site provides continuous local meteorological data.

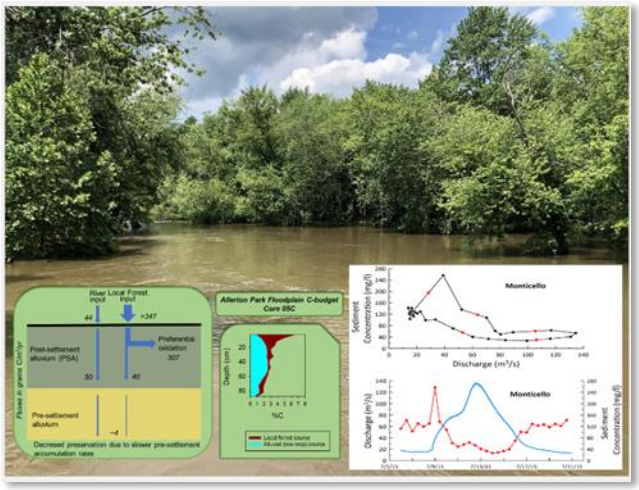
For the current CINet project, a novel management induced reactive zone (MIRZ) system was constructed to support a high-frequency, sensor-based characterization of biogeochemical properties and processes in the *active root zone*. The MIRZ system allows for in-situ monitoring of solutes and gas percolation and migration through the vadose zone of the Ipava silt loam soil. Sensors with data loggers record soil moisture, O_2 and CO_2 soil gas concentrations, temperature, and soil conductivity at four depths (20 cm, 60 cm, 110 cm and 180 cm). In addition, soil gas and soil water (lysimeter) are sampled manually every two weeks during the growing season and analyzed for their geochemistry. A rain table collects rainfall for isotopic analyses to study the fluxes during respiration and photosynthesis when CO_2 and water is exchanged with the atmosphere.

Additional studies of the soil from the MIRZ and in the adjacent area is providing a better understanding of the interface between the biotic and abiotic components of the soil, and further documents how the root zone plays a critical role in nutrient cycling and storage. The presence of microbes and root exudates from vegetation can facilitate or impede nutrient uptake by plants.

STOP 3: Sangamon River Floodplain
Allerton Park, Monticello IL (39.996407°N, -88.650620°W)
(40-minute drive from Champaign, then a 20-minute walk)

Leaders: Bruce Rhoads and Chelsy Salas (UIUC-Geography); Alison Anders (UIUC-ESEC); Neal Blair (Northwestern University)

Site Overview



Agricultural development has transformed the vegetation cover of many landscapes around the world, thereby altering water and sediment fluxes to river systems. Less known is how intensive agricultural practices have affected river dynamics (i.e., rates of sedimentation and lateral migration), particularly in relatively low-relief landscapes like in the US Midwest that have complex histories.

Research undertaken along the Sangamon River for both the IML-CZO, and now CINET, has helped characterize glaciated midwestern watersheds. Since floodplains are important storage areas for river sediment we are interested in knowing how fluvial processes, including lateral and vertical accretion, have evolved over time. Furthermore, our recent work has provided insight into how floodplains are inundated during events of different magnitude. The array of sediment traps and siphon samplers record the spatial and temporal variations in overbank deposition, which has allowed us to explore the seasonal differences in responsiveness of load to changing discharge.

From the carbon perspective, samples from long soil cores and ISCO suspended sediment are being analyzed to determine the sources of organic carbon in the floodplain environment, which appear to have both C3 and C4 signatures.