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# Research Brief: Freeze-Thaw Effects on Soil and Bank Erosion and on Bank Stability

## Issue

Freeze-thaw- (FT) induced processes affect erosion and bank failure along river, lake, and reservoir systems. Previous research has found that

- Soil FT effects are some of the least understood aspects of overland soil erosion and sediment stability processes.
- Soil and bank erosion and bank mass failures induced by soil FT cycling are major processes that contribute sediment to aquatic systems.

Baseline data on FT activities could provide better descriptions of long-term processes on bank and shore erosion, reservoir infilling, and shoreline evolution and slumping. Such data could fill knowledge gaps for regional sediment models by providing seasonal variations in sediment sources and data on bank morphology, erosion rates, and sediment budgets.

## Objective

The objective of this research is to provide data on local- and regional-scale sediment mobilization and erosion that allows a better understanding of

- Dominant processes in overland and bank erosion where seasonal soil frost forms.
- Relationships between soil erodibility, bank-failure susceptibility, soil-moisture redistribution, and thaw weakening caused by soil FT.

## Research/Design

Currently, erosion models use soil erodibility coefficients that are not adjusted to account for major seasonal variations caused by FT-induced soil moisture and structure changes. Research will include the following:

- Designing and completing lab experiments that relate erosion of a frost-susceptible soil to FT weakening, soil moisture, slope, and overland flow rate.
- Using field sites with different soils and hydrology in coordination with other regional sediment management researchers.
- Measuring seasonal changes in soil moisture and strength to define FT weakening.
- Relating these changes to the number of FT cycles, the depth of ground frost, and the antecedent soil moisture conditions.
- Measuring sediment lost by water erosion and bank failures during spring thaw.
- Measuring the rate of recovery of soil strength to pre-FT conditions.
- Developing seasonally adjusted erodibility coefficients from lab and field data.

## Application

Knowledge gained from this project will advance the Corps' capabilities to understand sediment processes and manage sediment resources in cold climates as

found in the upper Mississippi, Illinois, Ohio, and Missouri River systems. Results will supply knowledge on erosion by FT processes to the work on the Watershed Scale TMDL Model and the Regional Sediment Model.

**Products**

Links and information will be posted here. View online at http://rsm.usace.army.mil.

**Research Team**

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