156 CHANGE IN SEDIMENT LOAD DUE TO CHANGE IN FUTURE PRECIPITATION

USACE CLIMATE PREPAREDNESS AND RESILIENCE

Background

- Sedimentation was listed by the EPA as one of the top five leading causes of impairment to assessed rivers and streams in 1998, 2000, and 2002.
- Measurements of mean annual watershed sediment load, derived from long-term measurements of suspended sediment concentration and streamflow, are usually not available at locations of interest.
- This indicator uses average annual suspended sediment loads predicted by multivariate regression models that rely on available basin characteristics (e.g. precipitation, land use) for ungaged river locations.[1]
- Predictions of annual sediment loads under baseline and projected precipitation regimes are used to assess changes in sediment loading.
- Higher values suggest higher vulnerability relative to other watersheds.

THIS INDICATOR MEASURES CHANGES IN THE AVERAGE ANNUAL SEDIMENT LOAD IN RESPONSE TO FUTURE CHANGES IN PRECIPITATION.

Data Sources

Data Source	Description	Spatial Resolution	Temporal Resolution
Regional regression model developed by Roman et al.[1]	Average annual suspended sediment loads	2-digit hydrologic unit code (HUC-2) watersheds	1971-2000
22 general circulation models	Average annual precipitation	HUC-4 watershed	2040-2060 and 2080-2100

This Indicator Was Used to Assess the Vulnerability of Six of USACE's Eight Business Lines

Business Line	Importance Weight (Varies from 1 to 2 for USACE)
Navigation	1.5
Ecosystem Restoration	1.5
Hydropower	1.2
Recreation	1
Water Supply	2
Regulatory	1.5

Calculation

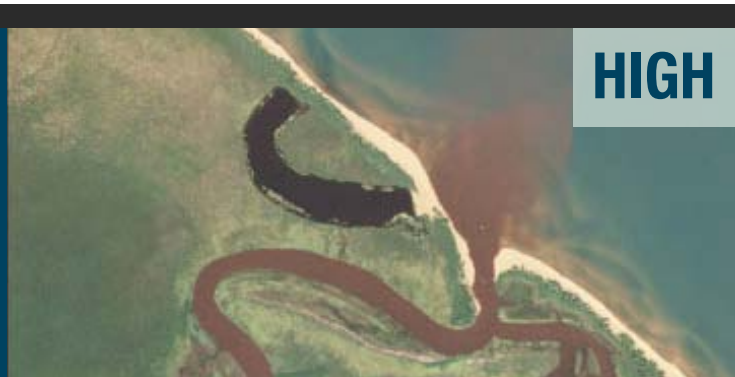
- Using average annual sediment load (S) and average annual precipitation (P) from the regression model, calculate precipitation elasticity of sediment load for the HUC-2 watershed (ε), for the years 1971-2000: $\varepsilon = \frac{\frac{\Delta S}{S}}{\frac{\Delta P}{P}}$

  where ΔS = change in suspended sediment load from the average for a specific year and ΔP = change in precipitation from the average for a specific year.
- Calculate the projected indicator value (I) for a HUC-4 watershed: $I = \varepsilon * \frac{P_f - P_p}{P_p}$

  where ε = median elasticity for the period 1971-2000, P_f = future average annual precipitation[2] (i.e., 2040-2060 or 2080-2100), and P_p = the average precipitation for 1971-2000.

[1] Roman, D., Vogel, R.M., and G.E. Schwarz. 2012. Regional Regression Models of Watershed Suspended-Sediment Discharge for the Eastern United States. Journal of Hydrology. (472-473):53-62.
[2] Indicator values were calculated for two scenarios (a wet and a dry future) and two time periods (2040-2060 and 2080-2100).

HIGH INDICATOR VALUE
Sediment loads are likely to increase in response to increased future precipitation at this site in Wisconsin.



Lake Superior, WI - Courtesy of USDA