Surface Sediment Erosion from Agricultural Land

This EnviroAtlas national map provides modeled estimates of the movement (flux) of soil particles eroding from the surface of the agricultural fields within each 12-digit hydrologic unit (HUC) in metric tons of soil for 2002. Soil erosion occurs when soil particles are carried from the surfaces of fields by wind or water.

Why is surface sediment erosion from agricultural land important?

Agriculture can affect the quantity and quality of water in streams and waterbodies. Surface sediment erosion from agricultural land can deposit sediment in water bodies. This sediment can cloud water and kill aquatic life. Sediment can carry pollutants that can also harm water quality. Runoff from the surface of fields can carry soil with it; wind can also remove soil from fields. Sometimes sediment in runoff carries pollutants. These include nutrients from fertilizer, pesticides, pathogens such as bacteria, and other contaminants. Surface runoff tends to carry more sediments and pollutants than subsurface water flow.

When sediments are carried to waterways, they can kill aquatic species, fill up reservoirs, and make drinking water harder to treat. Also, because surface runoff can remove topsoil, it can degrade agricultural fields over time. Soil types and condition can affect runoff. For example, when fields do not have enough soil organic matter (plant and animal materials decomposing in the soil) less water infiltrates into soils, which increases runoff and results in more erosion.

Phosphorus (P) and nitrogen (N) can be carried to waterways in eroding soil. P and N are both nutrients that are critical to the existence of life on earth, but excess nutrients in fresh and near-coastal waters can result in algal blooms. Algal blooms can interfere with fishing and recreation and make drinking water difficult to treat; they can produce toxins that can make people sick and cause fish kills. The decay of particularly large blooms can reduce oxygen levels (a condition known as hypoxia) in offshore waters to a point that is too low for many species to survive, which creates “dead zones.”

The impacts of surface sediment erosion can make streams and water bodies less safe for people to use for recreation and drinking water. They can also harm aquatic organisms. Management practices such as tilling fields less often and planting trees and grass near streams (riparian buffers) can reduce surface sediment erosion and protect streams near fields.

How can I use this information?

The map, Surface sediment erosion from agricultural land (tons), can be used to identify potential sources of water pollution and to understand erosion associated with agriculture. They can be viewed with layers describing water demand and agriculture to suggest where erosion might pose a risk to water supply or agricultural productivity. While the model output is based on 2001/2002 data that may not represent current conditions, the information about the movement of sediment at the edge of agricultural fields can be used as a baseline to compare with current and future projections.

How was the data for this map created?

These data were created using the Fertilizer Emissions Scenario Tool for CMAQ (FEST-C). FEST-C combines Meteorology data for 2002 produced by the Weather Research Forecast model v3.4 and wet and dry atmospheric deposition to agricultural soils estimated by bidirectional CMAQ5.2 with field-level biogeochemistry and edge-of-field water movement simulated by the Environmental Policy Integrated Climate (EPIC) model. Simulations were performed for more than 100,000 rectangular grid cells (12km on a side) that form a continuous modeling layer across the conterminous U.S. These EPIC simulations are representative of regional, rather than local-scale conditions and assume conservation tillage on representative soils for specific crops at the HUC-8 (subbasin) scale. Irrigated and rain fed management simulations were

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performed for each of 22 major commercial crops. The results were then aggregated across all agricultural land in a simulation grid cell. In order to pair land use with the meteorological and emission scenarios, the agricultural area in each grid cell was estimated using National Land Cover Database (NLCD) 2001 and US Department of Agriculture (USDA) 2002 Census of Agriculture county-level data. The gridded data are summarized by 12-digit HUC. For detailed information on how this data was generated, see the metadata.

What are the limitations of these data?
EnviroAtlas uses the best data available, but there are still limitations associated with these data. These data layers contain substantial uncertainties; they are based on models and large national geospatial databases. This map reflects assumptions about soil, weather, crop variety, and crop-specific management conditions in each 12-digit hydrologic unit. Given that 2001 and 2002 deposition, land use, and management practices data were used in the model, the data layer may not be representative of current conditions. Early simulation design and performance evaluation for 2002 yield, fertilizer use, and predicted plant and harvest dates are reported in Cooter et al. These simulations represent nutrient applications that roughly follow regional nutrient management practices on the most prevalent agricultural soils as identified in the National Resources Inventory at the HUC-8 level. The use of average grid cell slope could result in the over-estimation of horizontal water and nutrient losses by the model for some crop/soil combinations, particularly for tile drainage systems. Regional-scale studies of edge-of-field N and P losses are not generally available. Comparison of some of these 2002 EPIC nutrient export results for the Upper Mississippi River Basin (UMRB), which lies within the larger Mississippi/Atchafalaya River Basin, to other published modeling studies are presented in Cooter et al. Further comparison of model estimates of crop yield, fertilizer application amounts and timing, crop planting and harvest dates, and irrigation water use agree with USDA and US Geological Survey (USGS) estimates that rely heavily on site-specific survey information representing long-term average conditions in terms of overall spatial pattern and magnitude.

How can I access these data?
EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The NLCD 2001 can be downloaded from the MRLC and the Census of Agriculture can be downloaded from the USDA’s website.

Where can I get more information?
To ask specific questions about this data layer, please contact the EnviroAtlas Team.

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