

Tillage and Erosion Survey Program

Program Update

January 2018

Project Objectives	Highlights of Work for 2018
- Develop a long-term program to systematically collect tillage (crop residue after planting) data and soil erosion estimates to analyze trends in adoption and retention of agricultural soil and water management practices, - Track tillage trends, cover crop adoption, and land cover in the 67 county area with greater than 30% of land dedicated to row crop production, and - Quantify and track, on multiple scales, trends in average annual and daily soil loss due to wind and water erosion. - Provide data to support targeting of conservation programs.	- Deployment of the Daily Erosion Project Website Statewide, - Development of methods to assess wind erosion within the Daily Erosion Project, - Establishment of a technical review committee, - Educational campaign on the projects results, and - Providing access to data on a county and watershed basis.

Partners

- University of Minnesota: Department of Soil, Water and Climate, and
- Iowa State University: Department of Agricultural and Biosystems Engineering.

Benefits

- Remote sensing methodology is efficient and lays the foundation for a cost-effective, long-term data collection program to collect data on implementation and/or adoption of high residue cropping systems and cover crops,
- Provides daily (storm event) and annual average estimates of soil erosion, which will benefit targeting of conservation practices by conservation organizations,
- Consistent data collection across jurisdictions, reducing human error/bias in estimating crop residue,
- Ability to analyze archived Landsat imagery and fill in the gaps when tillage transect survey was not conducted (2007 – 2015),
- Measures voluntary conservation done by farmers,
- Baseline data to monitor adoption and effects of soil conservation efforts at both the watershed scale and state-wide,
- Inform public and policy-makers of the current status of Minnesota's soil resource as well as trends in conservation and resource protection over time,
- Enhance water quality modeling efforts and watershed planning goal setting, and
- Data can be used with models and toolkits to provide targeted BMP recommendations.

Products

- Maps and raster datasets of crop residue cover, conservation tillage, cover crop adoption,
- County and HUC-12 GIS layers with scaled wind and water erosion estimates,
- GIS database of residue cover, cover crop cover/land cover, and model parameters for water and wind erosion estimates,
- Public online portal for data access and visualization of erosion estimates (expands the Daily Erosion Project into Minnesota), and
- Annual reports and trend analysis for spring residue cover and fall vegetative cover.

Methods

- Utilize remote sensing technologies to assess crop residue cover using Landsat satellite imagery,
- Collect ground truth data to calibrate and measure accuracy of remote sensing algorithms,
- Ground truth data collection in Stearns, Redwood, Blue Earth, Fillmore, Lincoln, Clay, and Polk counties,
- Use USDA-developed models, WEPP and RUSLE2, to estimate wind and water erosion, and
- Convene a stakeholder committee to provide feedback and direction.

What has been completed as of December 2017?

- Field validation data collection has been completed and analyzed for 2016 data and is currently being analyzed for 2017,
- The University of Minnesota has been utilizing the 2016 and 2017 field data collected from the spring and fall to ground truth correlations of actual residue and cover crop information to predicted outcomes based on satellite remote sensing analysis,
- Database, digital elevation model, and base layer creation for the Daily Erosion Project (DEP) is well underway and will be completed in early 2018 by Iowa State University staff, and
- The University of Minnesota is developing methods for quantifying wind erosion and working with Iowa State University on incorporating wind erosion results in the DEP.

Examples of preliminary work

Spring Crop Residue Cover:

The University of Minnesota staff has been working cooperatively with partner Soil and Water Conservation District staff in a few targeted counties to collect on the ground, field validation data for crop residue. The U of M adopted a more rigorous data collection and analysis methodology for 2017, which will increase the confidence of the validation data. The images below show a sample of data collected in the field within two different corn fields:



Figure 1: 98% residue (Corn)

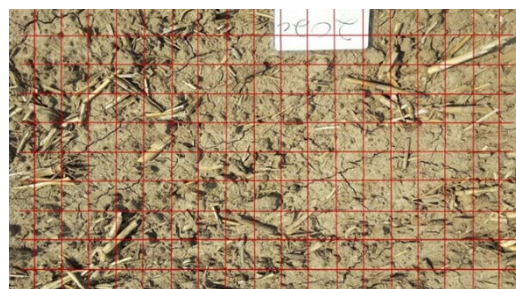


Figure 2: 17% residue (Corn)

Work continues on refining the methodology to correlate the remote sensing satellite imagery analysis to estimate spring crop residue cover estimates. The image Figure 3 shows the preliminary analysis from 2016 in southwestern Minnesota.

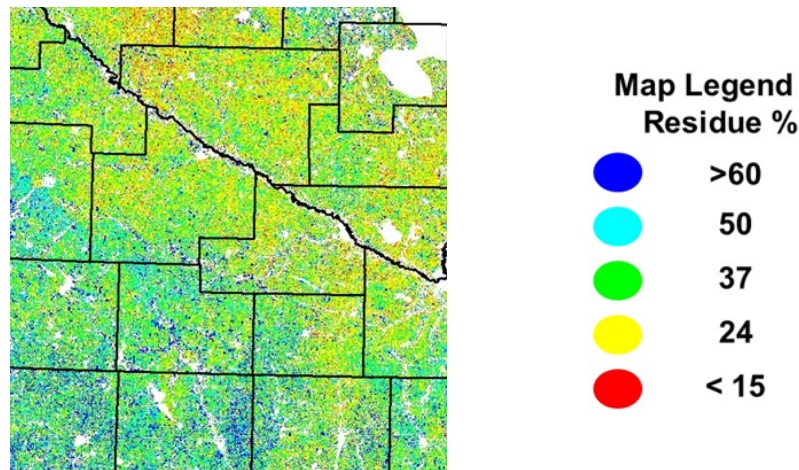


Figure 3: Preliminary 2016 spring crop residue data

Fall Cover Crops:

University of Minnesota staff have also been collecting field validation data for the presence of fall cover crops in 2016 and 2017. They are utilizing remote sensing analysis to make correlations to the presence of living cover, which is represented by red spectral images in figure 4 below. Data from 2017 was just recently collected and will be analyzed over the next few months.

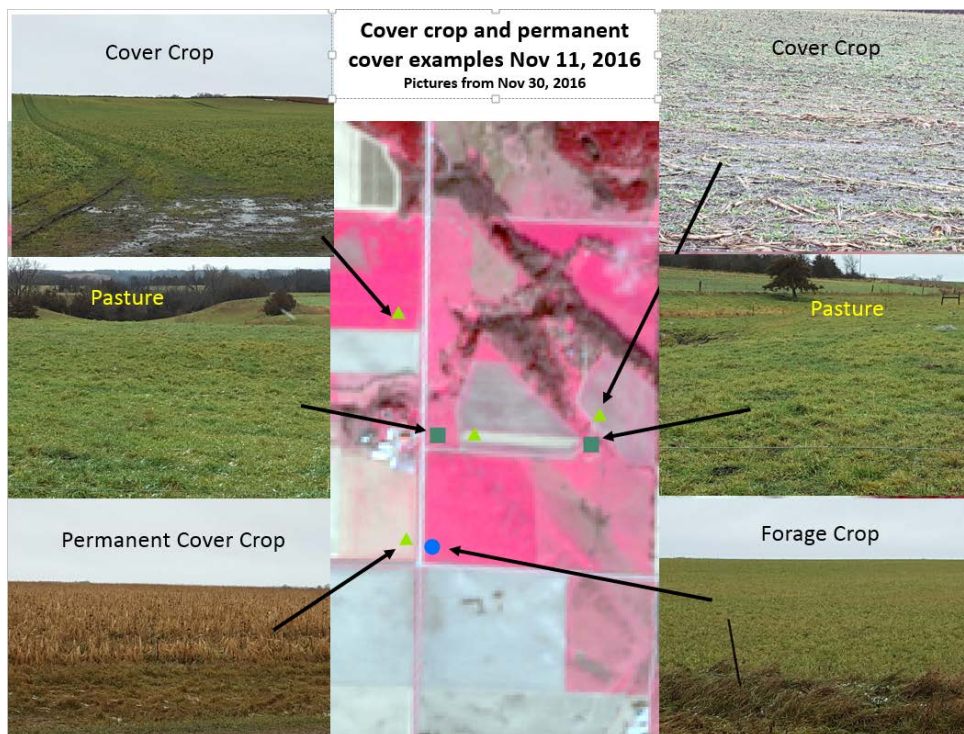


Figure 4: Example of preliminary 2016 fall cover crop analysis

Daily Erosion Project Website Application:

Dr. Brian Gelder with Iowa State University (ISU) is the principal investigator in developing the Daily Erosion Project website application for Minnesota. This application, which was developed by ISU and the USDA Agricultural Research Service (ARS), has already been deployed for the State of Iowa and Kansas and is currently being updated for our project with Minnesota, as well as parts of Illinois, Wisconsin, Missouri, and Nebraska. Dr. Gelder and his colleagues at Iowa State have been working on a number of data layers for Minnesota that are required for this web application, which include: soils, weather, agricultural land management, and topography. This application is underlined by the USDA's Water Erosion Prediction Project (WEPP) model for predicting soil erosion. One of the larger undertakings of this project is the development a hydro-conditioned, digital elevation model (DEM) that helps route water and sediment within the application. Dr. Gelder has developed an automated process to create the DEM for Minnesota's Daily Erosion Project application. BWSR is working with University of Minnesota and Minnesota Department of Natural Resources staff to provide quality control and assurance of this data layer.

Currently, many of the data layers in final stages of development. In early 2018, USDA will be making a critical update to the soils database inputs. The Daily Erosion Project application for Minnesota will not be deployed statewide until those critical updates have completed. Below are few images of data from the Daily Erosion Project from Iowa. Figure 5 shows the results from a storm event during the summer of 2017, while Figure 6 shows cumulative soil loss for 2017.

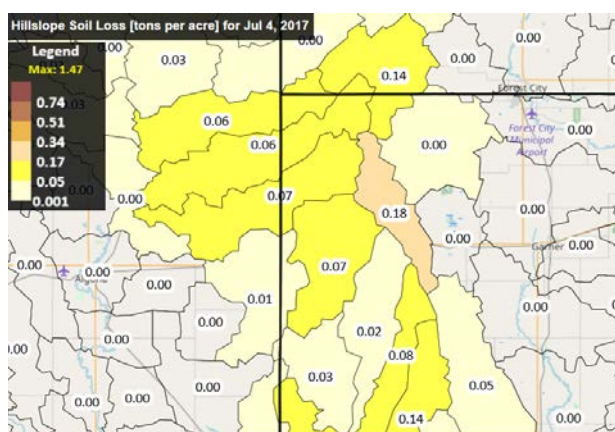


Figure 5: Soil Loss (tons per acre) July 4, 2017 NW Iowa

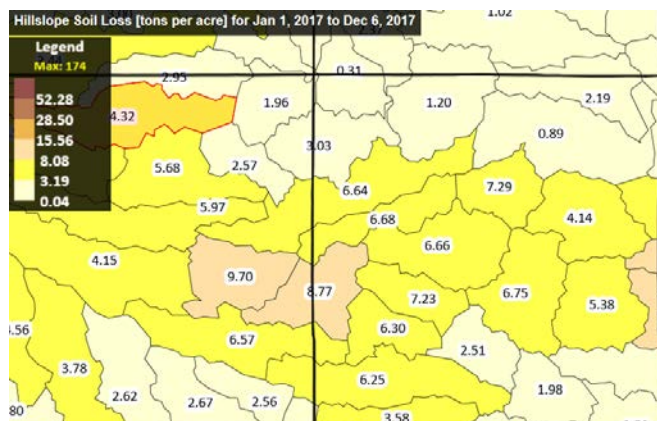


Figure 6: Soil Loss (tons per acre) for 2017 North Central Iowa

What will be completed in 2018?

- Development and deployment of the Daily Erosion Project (DEP): The current DEP website will include data from the 67 agricultural counties in Minnesota that are a part of this project. See existing website: <https://dailyerosion.org/>,
- Add wind erosion estimates into the estimates into the Daily Erosion Project, which is a significant driver for soil erosion in certain parts of Minnesota (ex. Red River Valley and central Minnesota sand plain),
- Finalize the establishment of the methods for collecting soil erosion and cover crop data with the University of Minnesota. In addition, continued refinement of the remote sensing methods utilizing new satellite data that is coming on-line 2018,
- Expanded field data collection in the spring and fall to include identified gaps in landscape and cover types,
- The initial phase of this project will be completed in 2018 and BWSR will be posting analysis and products on the web in the spring of 2018 at: <http://www.bwsr.state.mn.us/>.
- Educational campaign to public and private stakeholders on the results of the project, how to interpret the data, and getting feedback on future data needs from stakeholders.

Future Work

- Crop residue and cover crop estimates: Field validation work will need to continue in the upcoming years to further refine the methodology and to verify the remote sensing results. Also, new satellites will be available in the near future that will help in the remoting sensing analysis for land cover,
- Daily Erosion Project: There will be a need to continue to update the underlying data layers over time and enhance functionality. Iowa State University in cooperation with USDA-Agriculture Research Service (ARS) is looking to add gully and streambank erosion routines into the DEP web application, which would provide valuable information to Minnesota, and
- Exploring new remote sensing techniques, such as Synthetic Aperture Radar Interferometry, that are not sensitive to cloud cover.

Who can I contact for more information?

Matt Drewitz
Minnesota Board of Water and Soil Resources
Reporting and Outcomes Coordinator
Email: matt.drewitz@state.mn.us
Phone: 507-344-2821

