St. Joe CEAP

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USDA

National Soil Erosion Research Laboratory

Agricultural Research Service

United States Department Of Agriculture
Agricultural Research Service

Agriculture Policy/Environmental eXtender (APEX) Modeling at the St. Joseph River Watershed

APEX Modeling

Given the difficulty and cost associated with monitoring conservation practices for water quality purposes, computer generated hydrologic models such as the Agriculture Policy/Environmental eXtender (APEX) can be implemented to estimate sediment load and nutrient transport from agricultural fields and small watersheds.

The development of the APEX model requires input data (i.e. soil, land-use, meteorological) as well as monitored data to simulate the environmental and management conditions observed in the field.

Modeled Sites

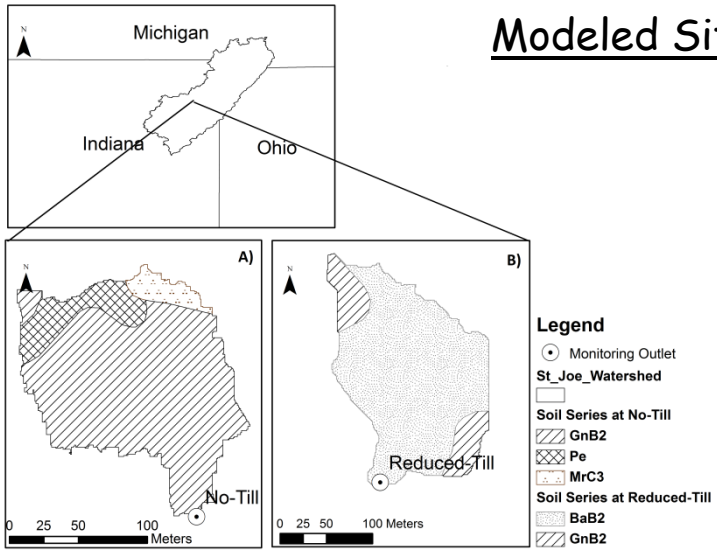
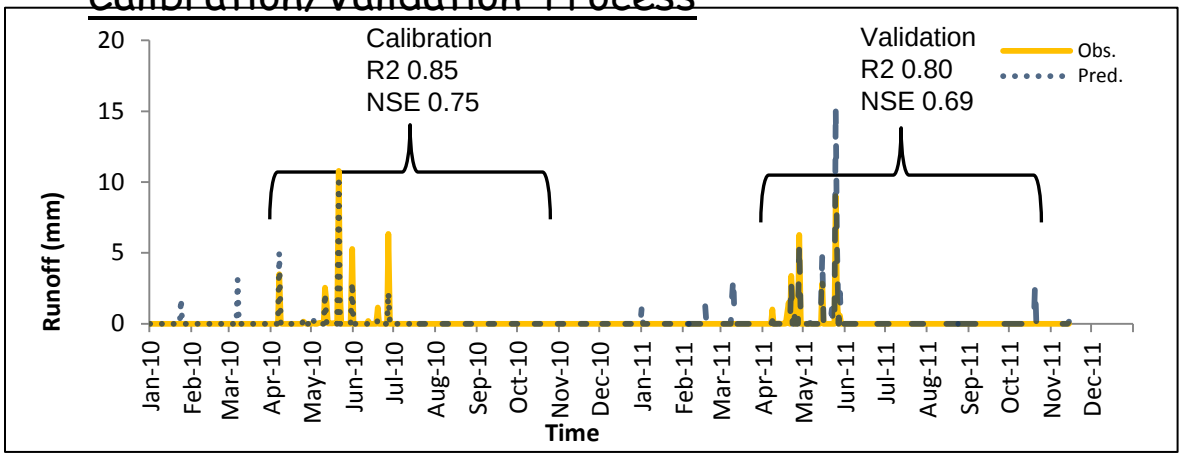


Fig. 1. Locations of monitoring fields in St. Joseph Watershed. A) Watershed delineation at No-Till. B) Watershed delineation at Reduced-Till.

Calibration/Validation Process



Through the calibration process the different parameters in APEX are adjusted to emulate the observed data. This is done for every variable of interest. Validation on the other hand is the comparison of the calibrated model to additional observed data to measure the accuracy of the model.

Fig. 2 Daily average discharge calibration and validation

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Environmental and Economic Impact of Conservation Practices

Environmental

Using the results at the edge-of-field for the simulated conservation practices, we can estimate the environmental impact of incorporating these conservation practices at Wildcat Creek Watershed.

Table 2. Cumulative estimate of reductions soil loss and nutrient transport at Wildcat Creek during a two year corn/soybean rotation (2010-2011).

	Cumulative Values for Simulated Scenarios at Watershed (No-till, Mulch, Cover1 Cover2 and Forage)	Baseline (Conventional Till)	Total Reductions Compared to Baseline
Total Sediments (Mg)	1867	10277	**8,600**
Total TP (kg)	4380	14473	**10,100**
Total SP (kg)	2017	4643	**2,600**
Total SN (kg)	2469	4575	**2,100**
Total N-Tile (kg)	206132	277807	**71,700**

According to the results, the examined conservation practices and their extent at Wildcat Creek will reduce the amount of sediment, TP, SP, SN and SN-Tile by 82%, 70%, 56%, 46% and 25% compared to conventional tillage practices.

Economic

Cumulative cost savings estimate from reductions in soil loss and nutrient transport at Wildcat Creek during a two year corn/soybean rotation (2010-2011).

		Reductions at the Watershed	Cost Savings
		Soil Conservation (Tons)	
Topsoil at $37/Tons		8,60[illegible]*	**$159,267**
		Nutrient Reductions at Watershed (lb.)	
Phosphorus Fertilizer (DAP) at	$600/Tons	45,[illegible]*	**$1,347,056**
Nitrogen Fertilizer (UAN-28%) at $350/Tons		414,13[illegible]*	**$258,836**

* Estimates includes reductions by waste utilization practices not shown.

If a farmer applies 188 kg UAN-28% ha^{-1}:

No-Till: 9.8 kg N ha-1 (18%)

Conventional -Till: 17 kg N ha-1 (33%)

Once the APEX project is calibrated and validated it can be use to simulate different management scenarios and predict different variables of interest. The output values can be used to make estimations overtime and at different scales. However, the extrapolation of edge-of-field results to the larger scales assumes similarities in environmental conditions.

Opportunity – Lake Erie a Hot Topic

2011 unprecidented HNAB
2012 very small (in proportion) HNAB
2013 expect an above average HNAB

Agency Priority Goals

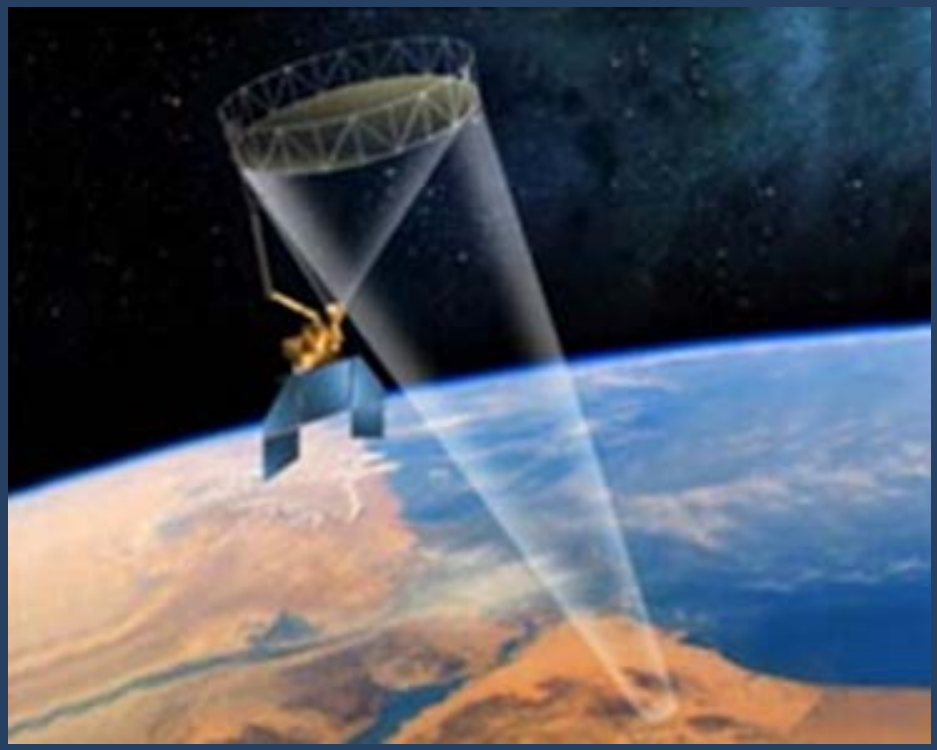
- **Summarizing 12 years of CEAP data**
  - **Determining impact of monitored CPs**
  - **APEX modeling of IN CP**
    - **Hope to get OH and MI soon**
  - **Working with PU to do SWAT modeling**

Environmental Defense Fund

- Placement of CP throughout the landscape continuum
  - In-field/edge-of-field/in-stream
- In preliminary stages
  - Mark Tomer mapping
  - NRCS/SWCD/landowner

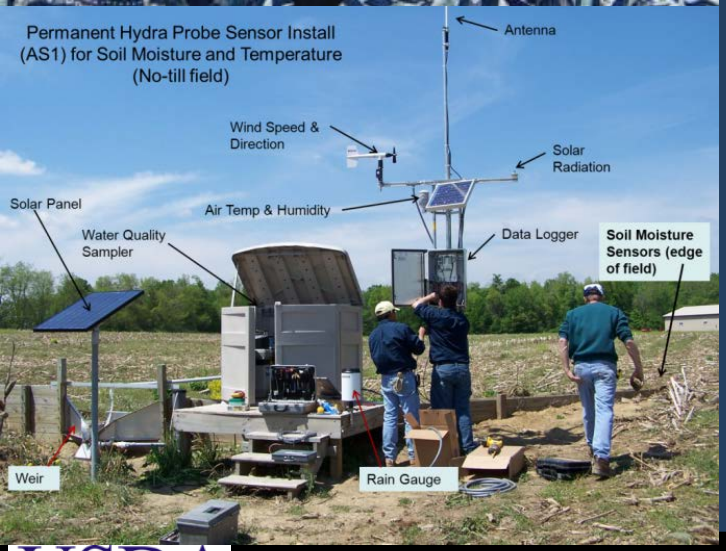
NASA/SMAP

- Soil Moisture Assessment Project
- Preliminary stages
- Expanding soil moisture monitoring network
- Satellite launches in 2014



Winter H_2O Quality Sampling

- 2012/2013 tested at one site
- High capital investment
- Important timeframe for P transport
- Lake Erie algal blooms – P loads Mar-Jun



Personnel

- Gary Heathman retiring August 2
- Integral part of SWAT/AnnAGNPS/RZWQM modeling, soil moisture monitoring and expanding and updating the meteorological observation network for St. Joe CEAP.