Using satellite imagery to determine crop residue cover for improving erosion estimates on agricultural lands

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Overview

- EVAAL
- IDEP
- NDTI
- Clark County Data Analysis
- Pleasant Valley EVAAL Analysis
Erosion Vulnerability Assessment for Agricultural Lands

- GIS–based model
- Vulnerability to erosion and nutrient export
- Deprioritizes internally draining areas
Available Datasets

LiDAR

Crop Data

Soils
Erosion Vulnerability Analysis

USLE + SPI - IDA

= EVAAL

Erosion Vulnerability Assessment for Agricultural Lands
Results

USLE

Erosion Vulnerability

NC Areas

Low
Medium
High
EVAAL Website

- Documents
- Tutorial Data
- ArcToolbox

http://dnr.wi.gov/topic/nonpoint/evaal.html
Limitations

- We can’t model what we don’t know
  - Tillage
  - Manure application
  - BMPs
- Erosion must be driving factor
- Does not account for delivery factors or tile drainage
- Cannot “target”, rather “prioritize”
$A = RK(\frac{LS}{P})$

Cropland data layer

Crop Rotations

SNAP-Plus (RUSLE2) → Rotational C Factor

- Poor
- Good
USLE w/ Low C Factor

USLE w/ High C Factor
Iowa Daily Erosion Project

- Daily estimates of rainfall, runoff, and soil erosion for the state of Iowa
- Collaboration:
  - Iowa State University, National Soil Erosion Research Lab, National Laboratory for Agriculture and the Environment, and The University of Iowa
- Updating to use remotely sensed information:
  - Crop rotations
  - Tillage
  - Topography
IDEP Example

Brian Gelder, Iowa State
Satellite Imagery Analysis

- Landsat 7 ETM+
- Normalized Difference Tillage Index
- $\text{NDTI} = \frac{\text{band5} - \text{band7}}{\text{band5} + \text{band7}}$

“Remote Sensing Of Crop Residue Cover Using Multi–temporal Landsat Imagery”
B. Zheng – 2012
NDTI is positively correlated with crop residue cover and green vegetation.

Brian Gelder, Iowa State
- Tillage timing can vary greatly
- Field will have lowest NDTI value right after tillage/planting and before plant emergence
Clark County Transect Data

- Annual data collection
- Includes
  - Crop type
  - Tillage type
  - Percent residue
Landsat 7 ETM+ (surface reflectance)
Scenes from 2011
  ◦ March–August

minNDTI
  ◦ May 16
  ◦ June 1
  ◦ June 17
  ◦ July 3

Averaged for each transect field
Clark County minNDTI

Percent Residue Coverage

min NDTI

0.00 0.05 0.10 0.15 0.20 0.25 0.30

0-15% 16-30% 31-50% 51-75% 75-100%
minNDTI

High: 0.3
Low: 0
Clark County minNDTI

\[ y = 0.0795x + 0.0713 \]

\[ R^2 = 0.9118 \]
Relate to Tillage Types

NDTI

Moldboard (0%–15%)
(15%–75%)
No Till (75%–100%)

0.024337 - 0.083000
0.083001 - 0.131000
0.131001 - 0.300000
Dane Co. transect data
  ◦ Just tillage type – no % residue cover
Analysis for Spring 2010
Pleasant Valley Tillage

Tillage Type
- **Red**: Moldboard
- **Yellow**: No-Till/Non-Ag
- **Green**: No-Till/Non-Ag
Challenges

- **Landsat**
  - Data gaps
  - Clouds
  - Timing/availability

- Validation data

- Computing time/power
Next Steps

- Evaluate automating process
- Determine tillage for multiple years
- Incorporate into EVAAL
- Potentially coordinate with Iowa State
Conclusions

- EVAAL assess erosion vulnerability; can be used to prioritize watershed efforts
- NDTI is positively correlated to crop residue coverage; can be used to infer tillage
- EVAAL results can be improved using satellite derived tillage information
Questions

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