Replacing Regional Factors with Adjustments to Land Simulation Targets

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Topics

- Regional Factors in P532
- Motivation and Objectives for Eliminating Regional Factors
- Proposed Strategy for Adjusting Land Simulation Targets without Regional Factors

P5.3.2 Land Simulation Targets Crops

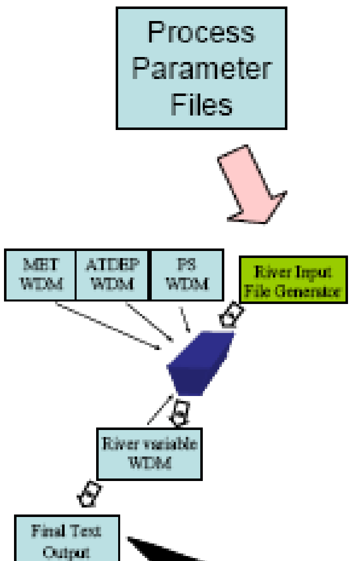
- Determine median export from literature
- For each land segment, calculate net nutrient input: fertilizer + manure + fixation – crop uptake
- $\frac{land\ simulation\ target}{literature\ median} : \frac{segment\ net\ nutrient\ input}{median\ nutrient\ input}$
  - Where range of targets is confined to lie between the 25th and 75th percentile of literature values

Regional Factors

- Regional Factors are multiplicative factors applied to land-river segments used to reduce bias in river calibration
  - Gaged Watersheds: Bias in average annual nutrient loads between ESTIMATOR and P5
  - Ungaged Watersheds (Eastern Shore and Western Shore): Bias between observed and simulated TN and TP concentrations
- Regional Factors are meant to account for differences in transport in land processes
- Calculated within river automated river calibration

Nested Optimization

River Calibration



- Assume the sensitivity of the simulation to each parameter
- Determine an appropriate adjustment direction for each parameter
- Take a small step in that direction

- Calculate necessary EOS to unbias the calibration
- Adjust EOS by that amount

Motivations for New Approach

- Watershed Model is mostly accounting tool: there should be no surprises in Watershed Model results
- Multiple Modeling Approach: Integrate results from other models (ex. SPARROW) to represent transport processes at smaller scale than Watershed Model

Goals

- Replace regional factors with modifications to land simulation targets incorporating transport factors
- Remove calculations from river calibration

Elements

- Base modifications on empirical load estimates for river reaches
- Establish modification on a clear physical (geology, soils) basis that represents effects of transport

General Strategy

1. Start with Input Information:
   1. LU acreage
   2. Empirical load estimates (EL) in river network
   3. Preliminary LU Loading Rate Targets (lbs/ac/yr)
   4. Take into account preliminary reach delivery factors (RDF), BMPs
2. For each EL, calculate total upstream edge-of-stream (EOS) load = Σ LU targets*LU acres*RDF
3. Assume EL=EOS*Function (Transport Factors)
4. Solve for Function (Transport Factors)

Possible Empirical Load Estimates

- SPARROW calibration data set (FLUXMASTER)
- Calibrated SPARROW model
- Load Estimates for USGS non-tidal network
- Possible enhancements to non-tidal network:
  - City of Baltimore
- Can estimates from smaller scale watersheds be used?

Possible Transport Factors

Nitrogen	Phosphorus
SAPRROW Land-to-Water Factors	
Enhanced Vegetative Index	Soil erodibility
Mean Soil Available Water Capacity	Percent Hydrologic Group A Soils
Groundwater Recharge	Percent Coastal Plain
% Area in Piedmont Carbonate	Precipitation
SPARROW Source Factors	
Travel Time in Small Reaches	Area in Siliciclastic Rock
	Area in Crystalline Rock
Other	
	Soil Test Results

TP Delivery Variation Factor by Land Segment

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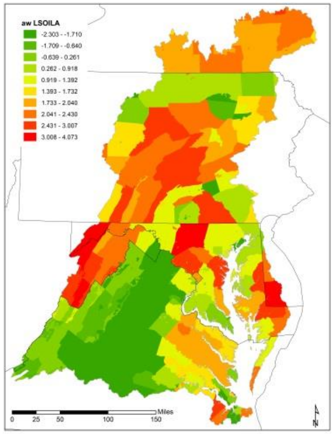
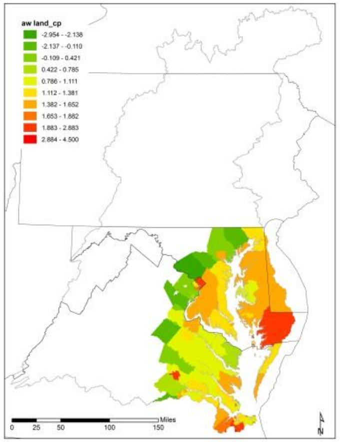
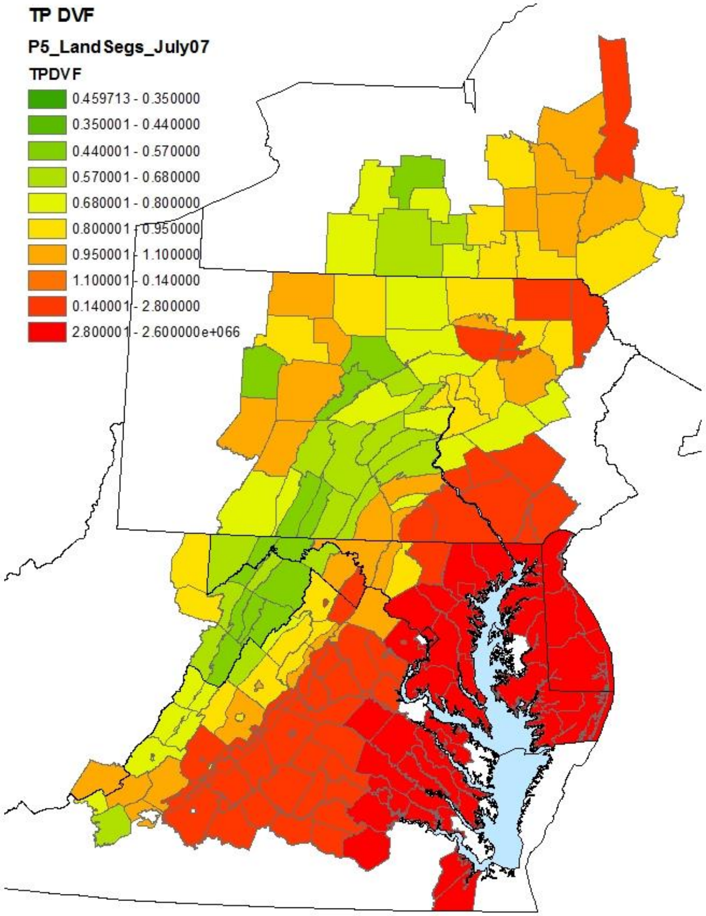
Group A Soils

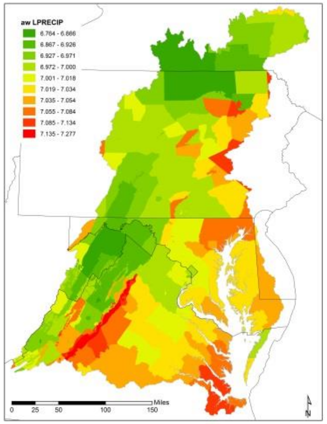


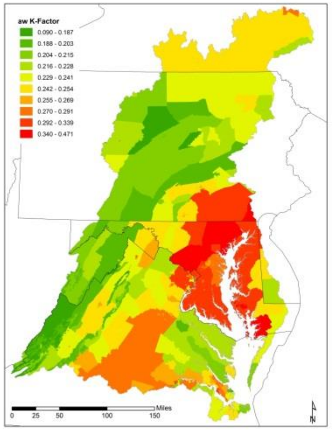


Coastal Plain



Precipitation





K-Factor

TN Delivery Variation Factor by Land Segment

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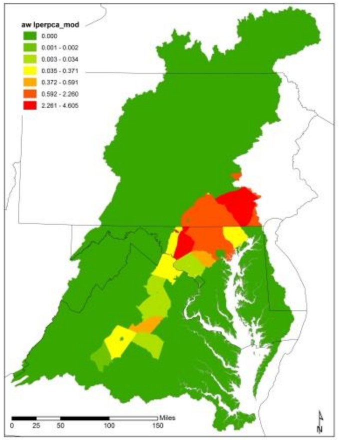
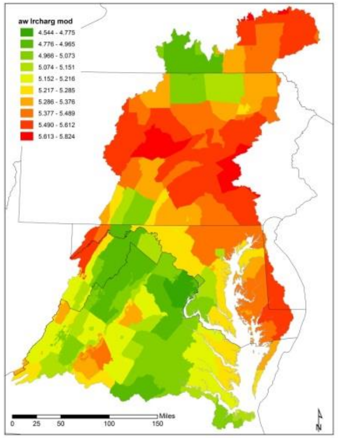
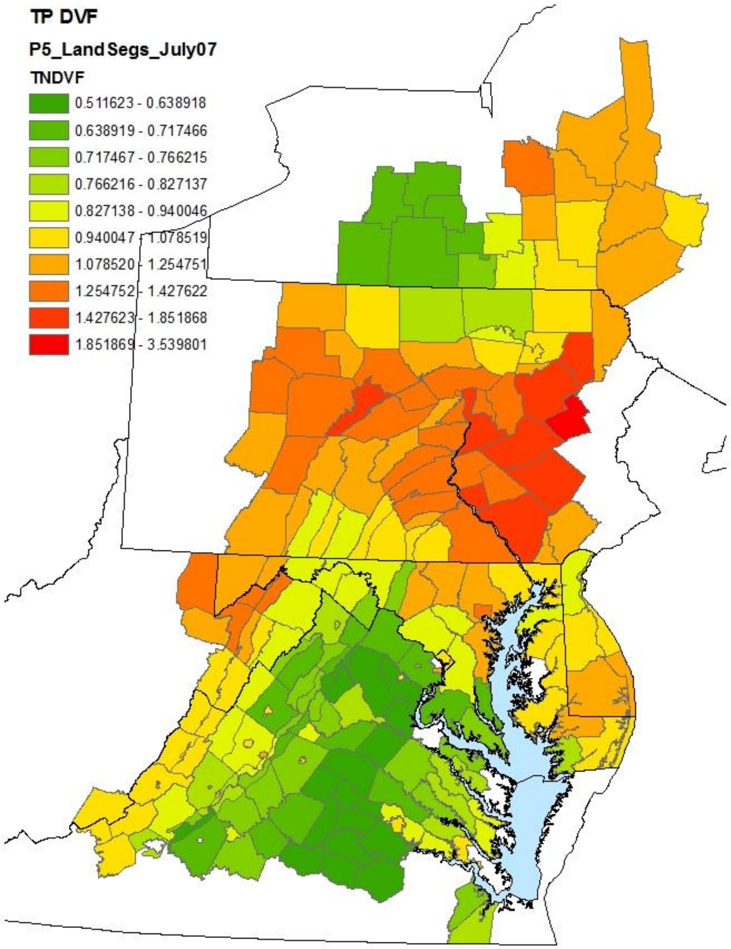
Piedmont Carbonate

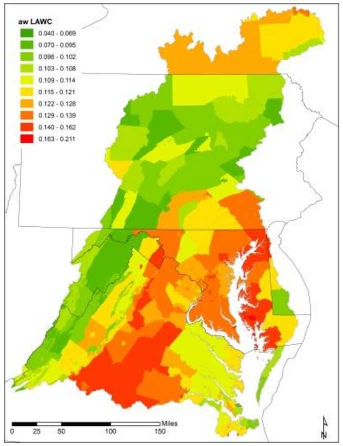


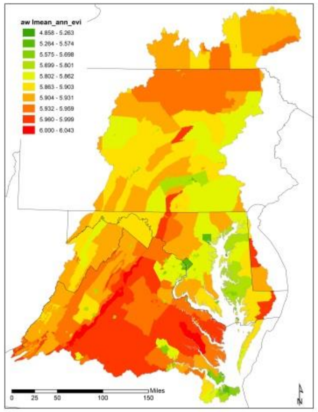


Groundwater Recharge



Soil AWC





Average EVI

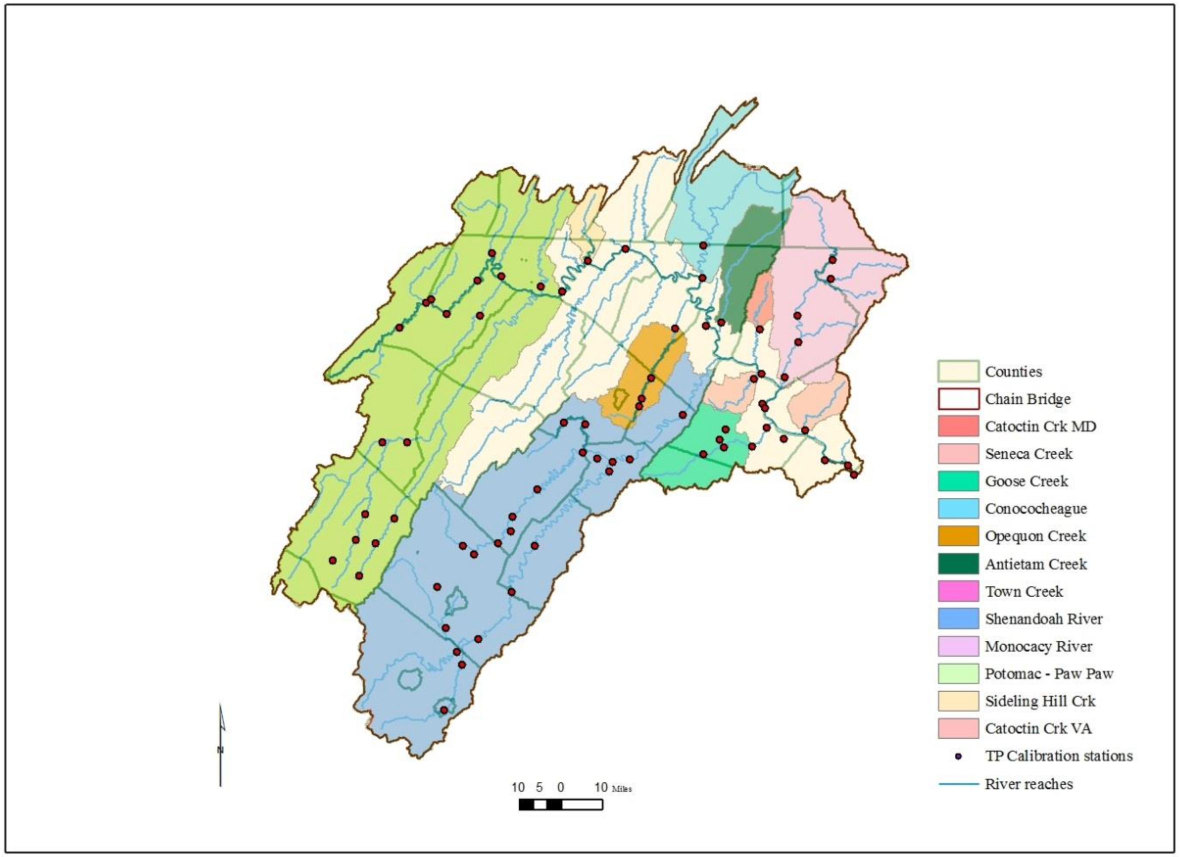
Possible Approach: SPARROW Lite

- Starting point:
  - EOS Loads by land segment based on preliminary (just excess nutrient) land simulation targets
  - Empirical load estimates (EL) from FLUXMASTER/ SPARROW calibration dataset
- $EL = \sum_{i=1}^{\substack{upstream \\ land\ segments}} EOS_i * \exp(\sum_{j=1}^{Factors} c_j * Fij)$
  - c_j: coefficients
  - F_{ij}: SPARROW land-to-water factors
- Solve for c_j by non-linear optimization

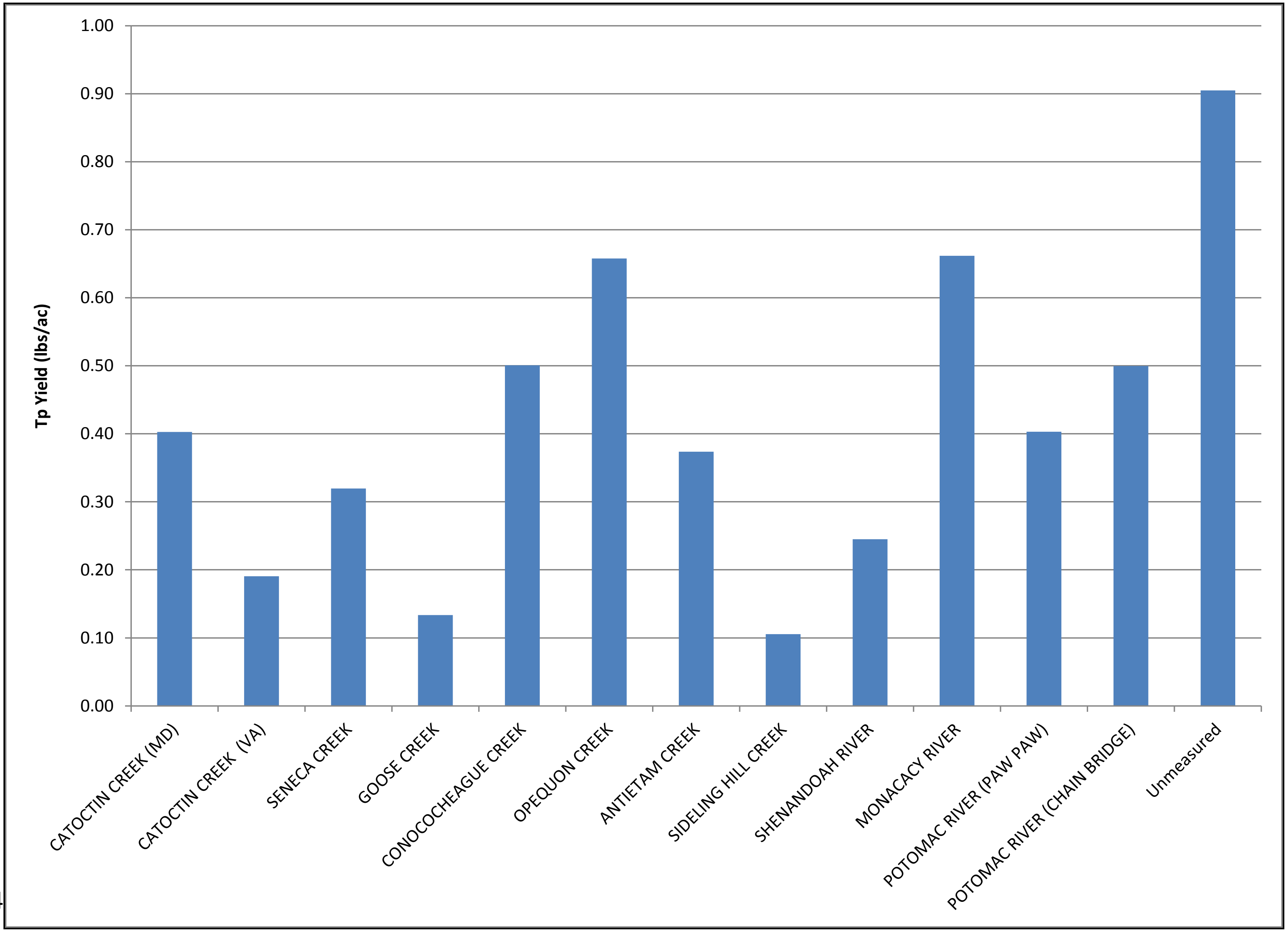
Issues

- Geographical Consistency of Empirical Load Estimates
  – Potomac River Basin TP Loads
- Primacy of RIM Stations

Potomac River Tributary Watersheds



FLUXMASTER Yields
Potomac River Basin



How Does This Fit with Other Parts of Calibration Methodology?

1. Start with preliminary LU load targets and PQUAL parameterization
2. Calculate adjustment to baseflow concentration parameters (if necessary)
3. Apply Regional Factors to surface LU loading rate targets/parameters using adjusted targets
4. Perform River Calibration

Contact Information

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