Simulation Modeling and Cartographic Approaches for Prioritizing Non Point Source Subwatersheds in Arkansas

Dharmendra Saraswat[1], Naresh Pai[2] and Phil Tacker[3]

[1]Asst. Professor/Extension Engineer- Geospatial Technologies, University of Arkansas Division of Agriculture, Department of Biological & Agricultural Engineering, Little Rock, Arkansas
[2]PhD Student, University of Arkansas Division of Agriculture, Department of Biological & Agricultural Engineering, Fayetteville, Arkansas
[3]Assoc. Professor/Extension Engineer, University of Arkansas Division of Agriculture , Department of Biological & Agricultural Engineering, Little Rock, Arkansas

Why prioritization is required?

- Limited availability of resources for implementation of watershed management programs require new strategies for maximizing returns.
- Strategies advocating management measures starting from the most critical subwatersheds are likely to be favored by decision makers .
- Prioritization of subwatersheds is thus required to decide the order for taking them up for treatment and for planning conservation measures .

Methodology

- Setup the Soil and Water Assessment Tool (SWAT) model for flow, sediments, and nutrient simulation at subwatershed level.
- Use model simulation results to compare relative contribution to water quality degradation .
- Calculate drainage density and forest cover in subwatersheds.
- Use all the three methods described below to locate critical subwatersheds.

Case Study: L'Anguille River Watershed

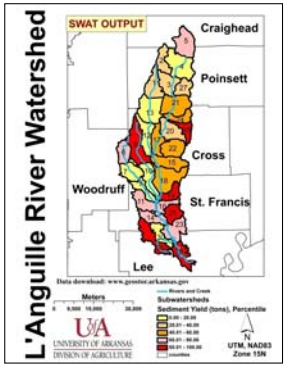
- L'Anguille River Watershed (LRW) is located in the northeastern Arkansas.
- Drainage area: 2429 km^2 (938 mi^2) , landuse: 70% under row crops.
- Entire length of the L'Anguille River not supporting aquatic life (ADEQ, 2008) due to excessive sediment loading from agriculture.
- SWAT model was setup using 12 digit Hydrologic Unit Code (HUC) boundaries as subwatershed boundaries

Method A. Percentile ranking

• Percentile ranking calculated based on monthly sediment yield predicted by SWAT model.

•Percentile definition: a sediment yield percentile of 80% for a particular subwatershed implies that 80% of subwatersheds produced sediment yields lesser than this subwatershed.

•Subwatersheds that produced a percentile of 80% and above were designated priority subwatersheds.



Results

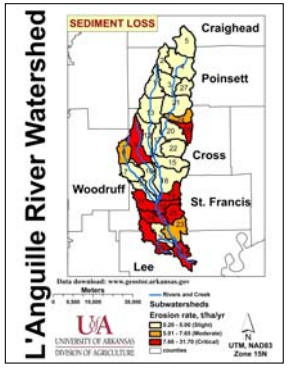
✓Subwatersheds 8, 19, 25, 26, 28 and 29 were designated as priority subwatersheds based on percentile criterion.

Method B. Sediment yield

•The average soil loss due to erosion from croplands in Arkansas – •7.65 t ha^{-1}yr^{-1} (NRCS, 2003).

•Average annual sediment yield calculated from SWAT model simulations for each subwatershed.

•Compare with average soil erosion tolerable rate for identifying the priority subwatersheds.



Results

✓Subwatersheds 8,11, 14,16, 19, 25, 26, 28 and 29 were found to be priority watersheds based on the excess sediment yield.

✓These nine subwatersheds account for 26% of study area but were responsible for producing 72.2% of total annual average sediment yield.

Serial No.	Soil erosion class	Soil erosion range, t ha^{-1}yr^{-1}
1.	Slight	0-5
2.	Moderate	5.01-7.65
3.	Critical	>7.66

Decision Criteria

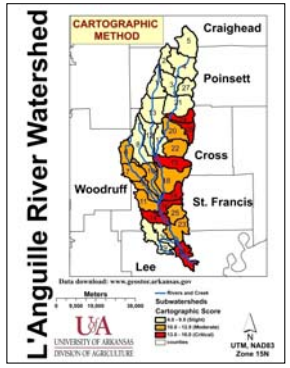
Method C. Cartographic modeling

• Ranking system developed based on annual sediment yield (t ha^{-1} yr^{-1}), forest cover (percent), TP yield (t ha^{-1} yr^{-1}), and drainage density (km/km^2) for each subwatershed.

• Ranges of above listed variables divided into four quartiles.

•Each subwatershed was given scores ranging from 1 to 4 based on the ranges of each variable.

•Scores aggregated to calculate a total score which ranged between 7 and 16. Score of 13 and above was used to designate priority subwatershed.



1= lowest SL, high FC, lowest DD and lowest TP
4= highest SL, lowest FC, highest DD and highest TP

Y = SD+FC+DD+TP

Results

✓Subwatersheds 14, 15, 16,19, 24, 26 and 28 were found to be of high priority .

ACKNOWLEDGEMENTS:
Thanks are due to the Arkansas Natural Resources Commission (ANRC) for funding this project and to the county agents, verification coordinators and crop specialists for assistance in management data collection.

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