Impacts of Upstream Disturbances on Downstream Sediment Yield and Morphology in the Presence of Best Management Practices

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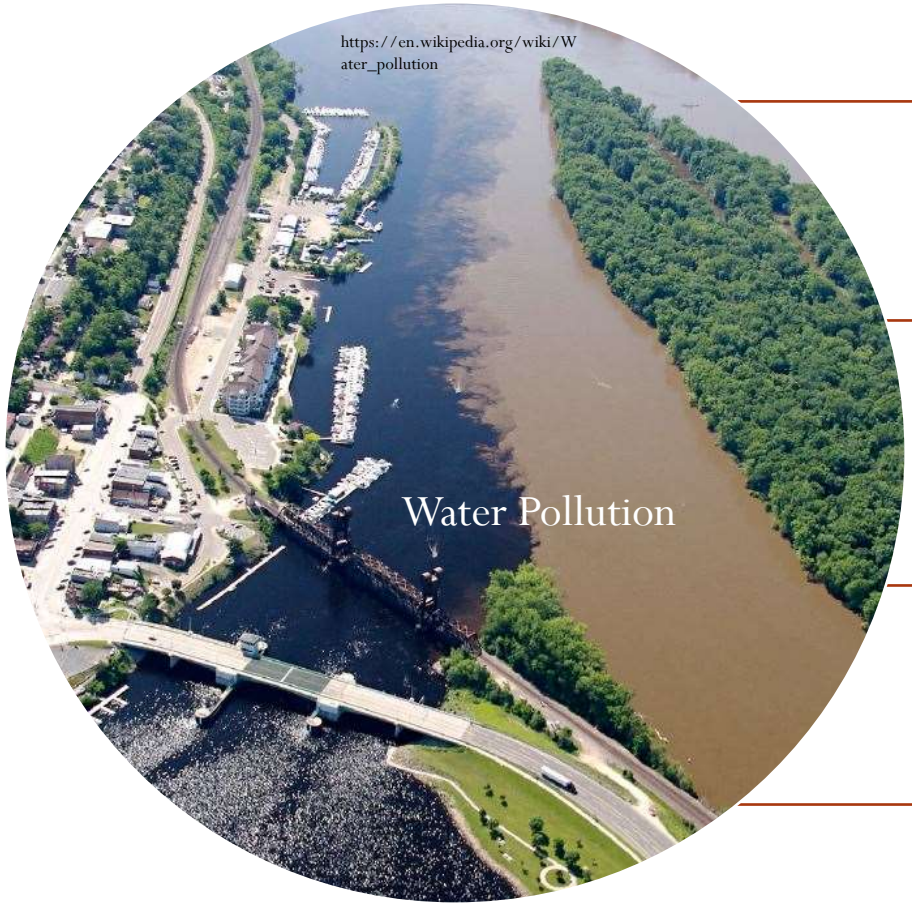
BACKGROUND



Deforestation

Urbanization

Agricultural Practices

Forestry Practices

BACKGROUND

- Forested watersheds provide high quality water
- Forestry practices can adversely impact water quality
- Best Management Practices (BMPs)

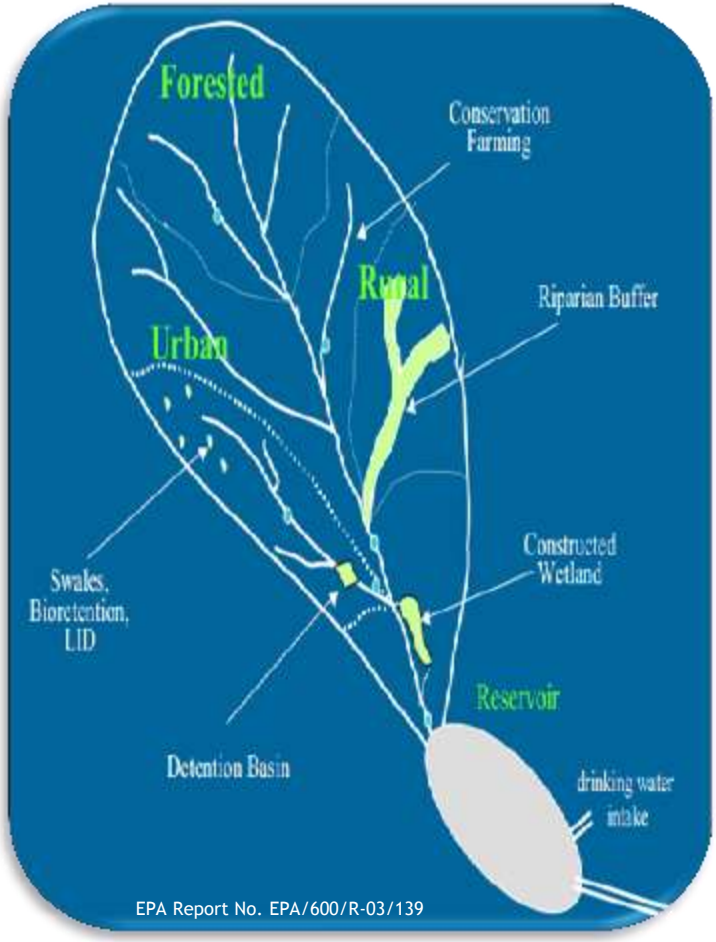
Water bars and turnouts

Broad-based dip

Stream Side Management Zone (SMZ)

BACKGROUND

- Even well designed BMPs are present, they may not be effective in protecting water quality
- BMPs may lose their effectiveness in time
- There is a need to understand the impacts of varying source of disturbances on stream water quality and the capacity of BMPs to sustain their effectiveness under these disturbances

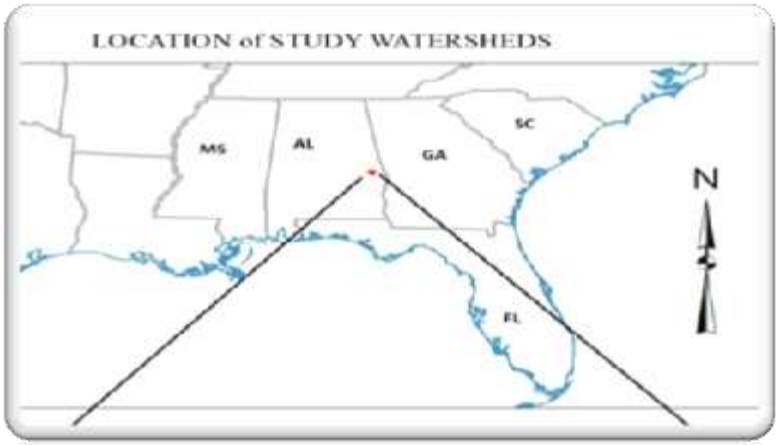


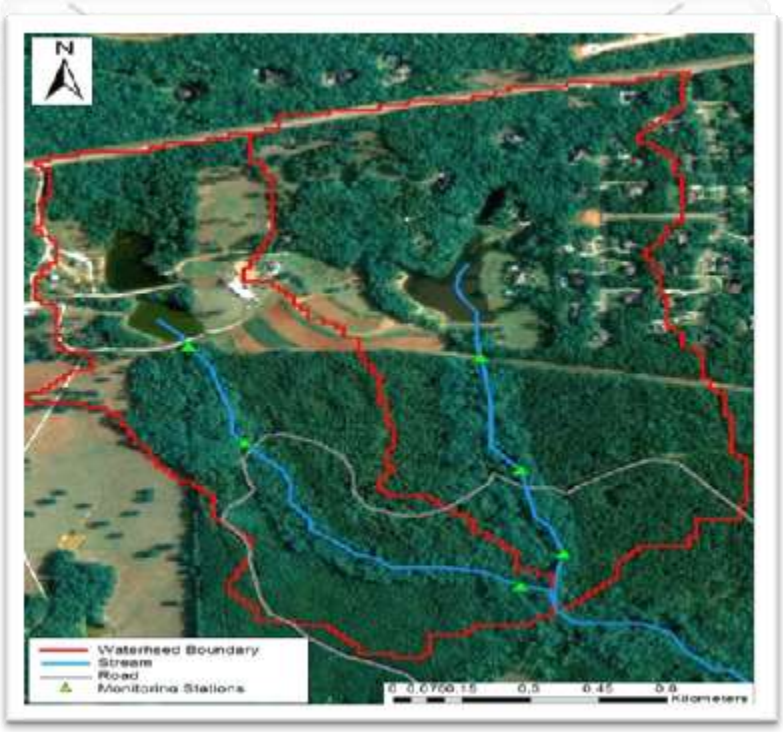
OBJECTIVES

1. Studying the impacts of upstream urban practices on downstream sediment yield in two small watersheds in East Central Alabama

2. Observing changes on stream morphology under the impacts of upstream disturbances

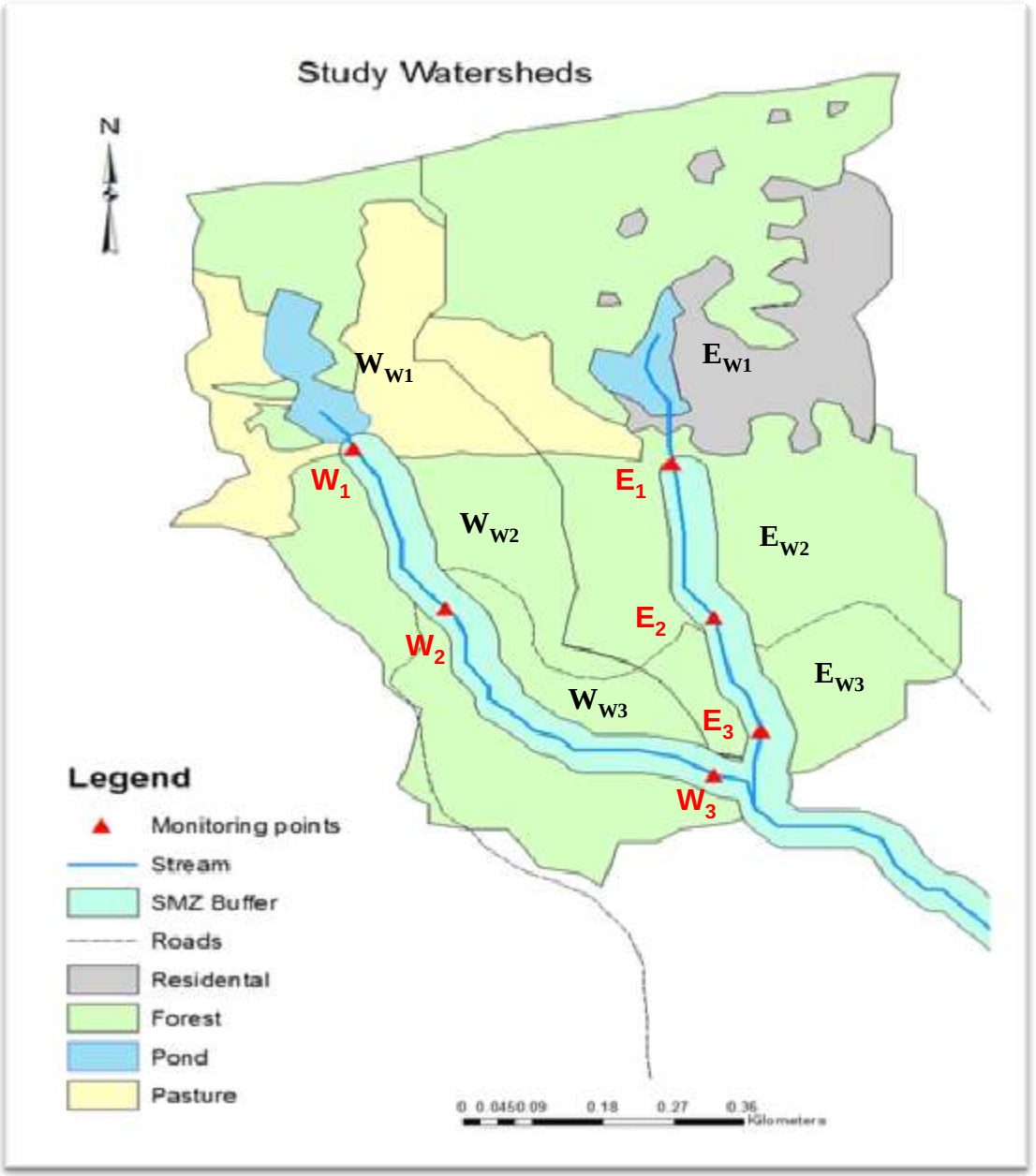
STUDY AREA





- South Auburn
- Managed by SFWS, Auburn University
- Average annual rainfall: ~148cm
- Average slope: <6 %

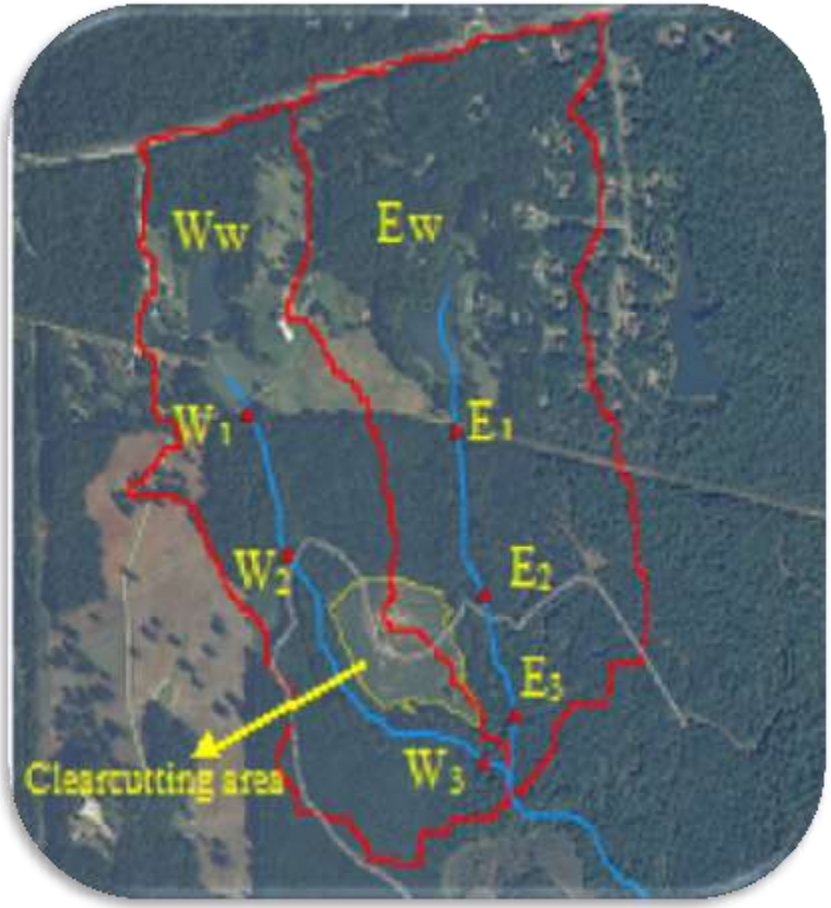
STUDY DESIGN



- Land use/Land cover
- 6 sub-watersheds
- 6 monitoring stations
- SMZs

STUDY DESIGN

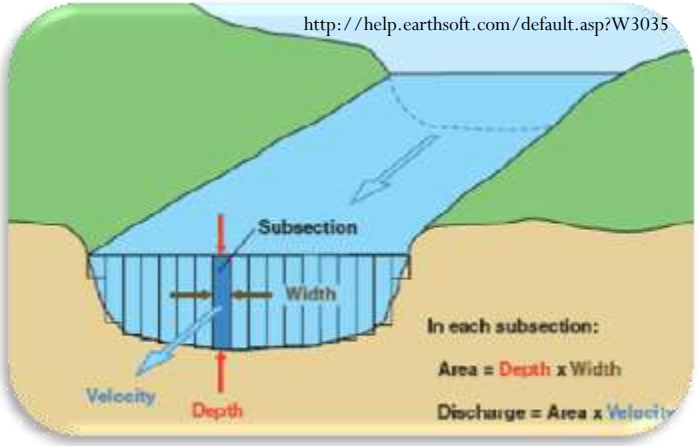
- 2008-2010 study
  - Effectiveness of SMZs
  - 50 % cutting within SMZs
- Current study
  - 5 year post SMZ cutting
  - 6 year post clearcutting



STUDY DESIGN

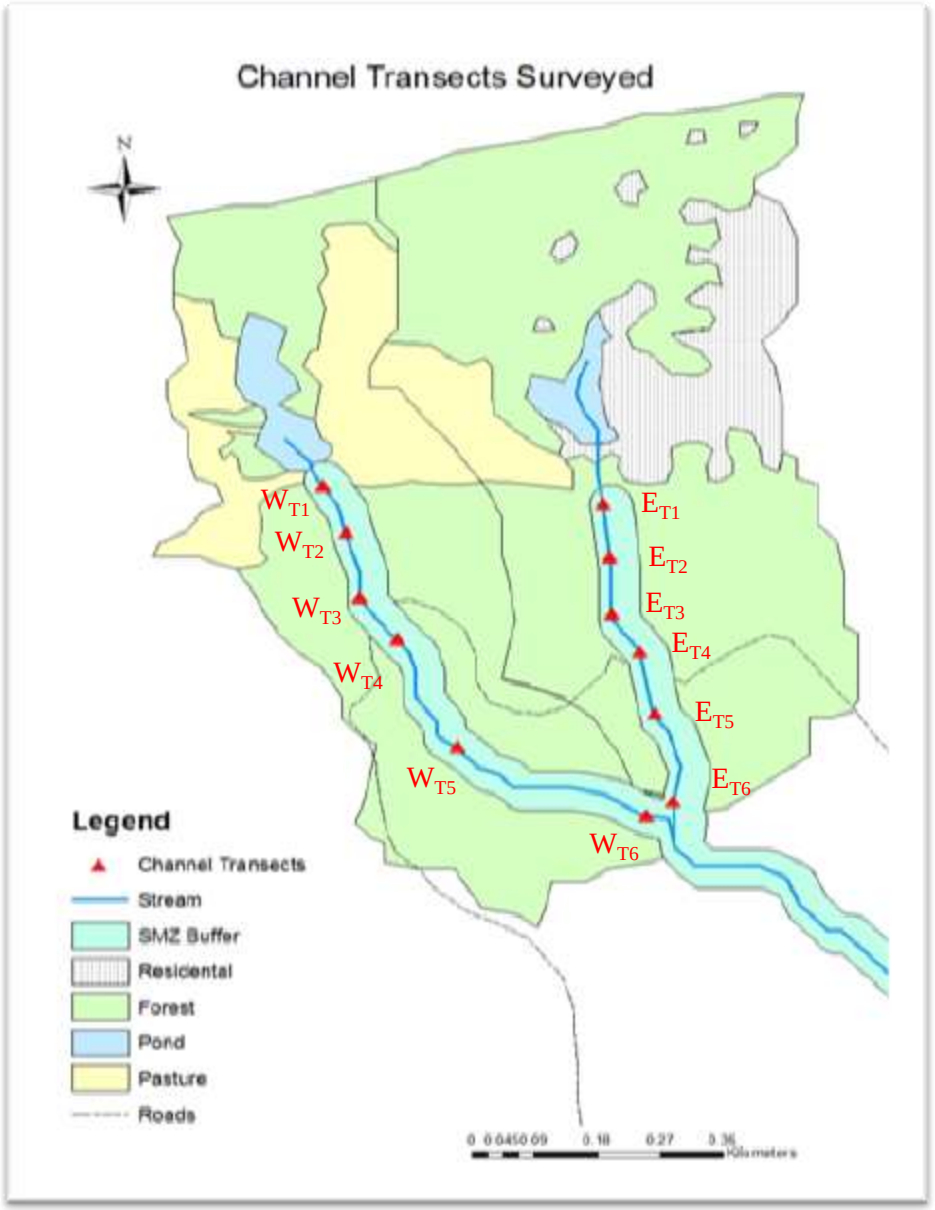
METHODS

- Sediment and hydrologic sampling
  - Water stage measurements using pressure transducers
  - Standard stream cross-sectional velocity profile
  - Rating curves
  - Water samples
  - The 2540 Total Suspended Solids Dried Method



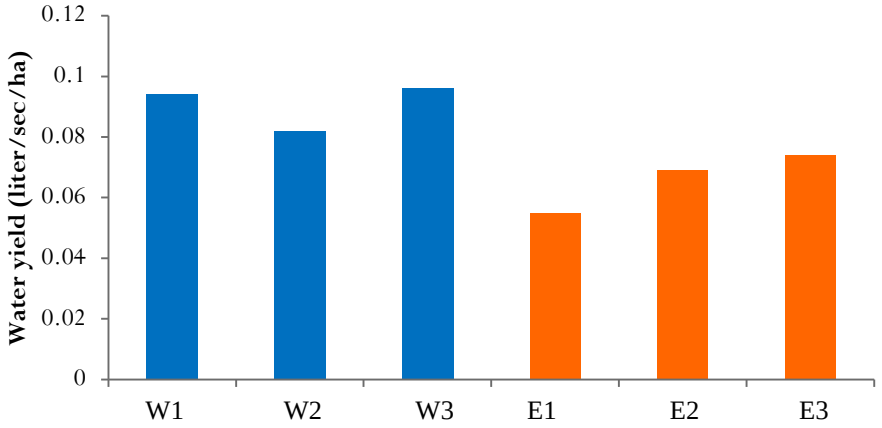
METHODS

- Stream morphology
  - Stream cross section/transect surveys
  - Bankfull cross sectional area
  - Width/depth ratio, Entrenchment ratio
  - Pebble Count
  - Rosgen stream types

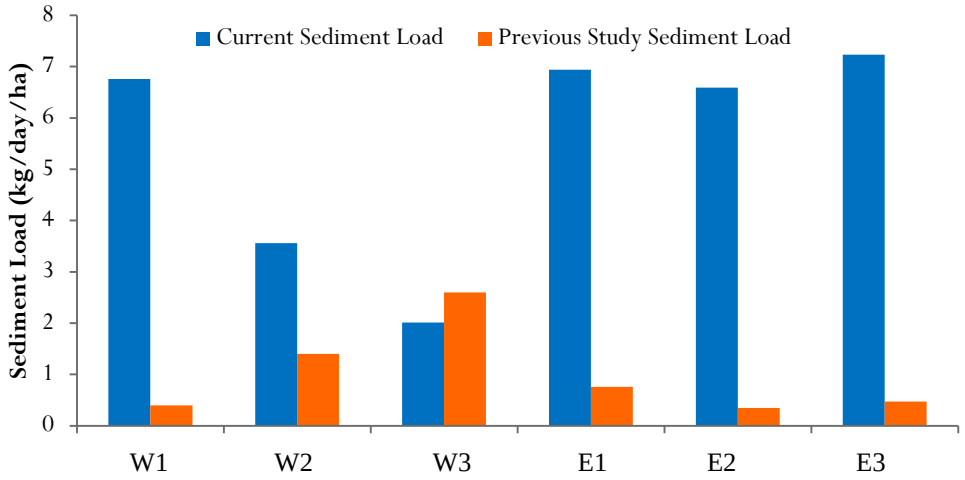


RESULTS and DISCUSSION

- Water Yield

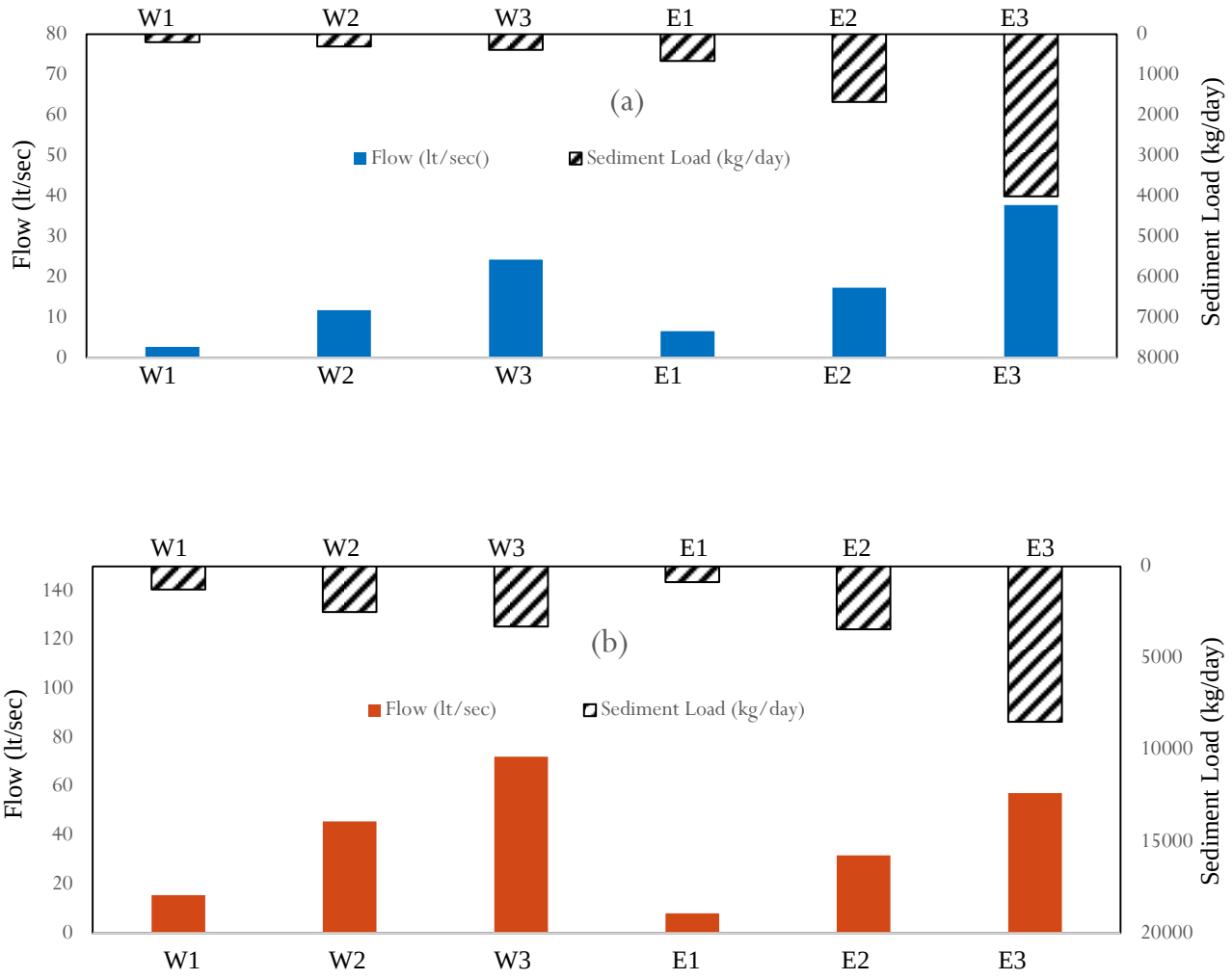


- Sediment Yield



RESULTS and DISCUSSION

- Water and Sediment Yield



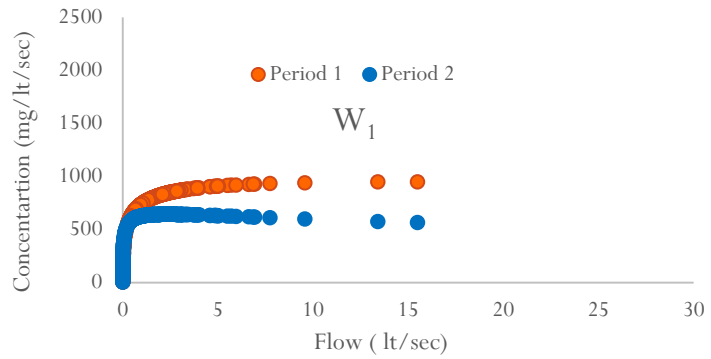
Discharge and sediment load in both W_W and E_W during the event of 2/21/2014 (a) and 4/19/2014 (b)

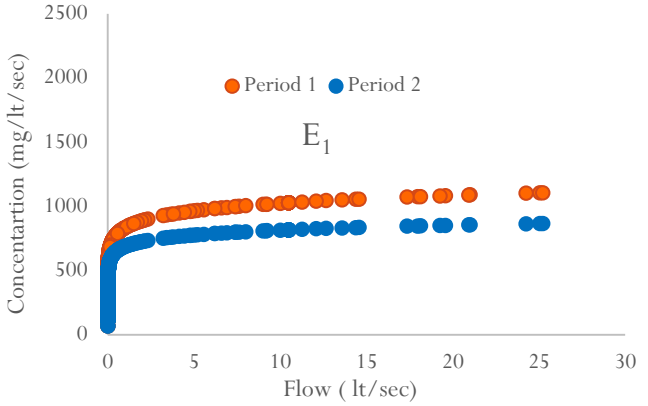
RESULTS and DISCUSSION

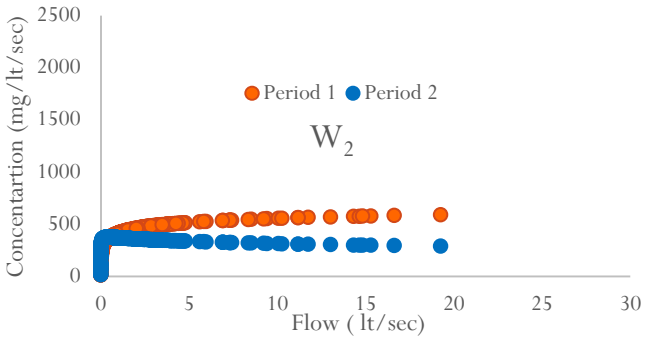
- End of upstream disturbances

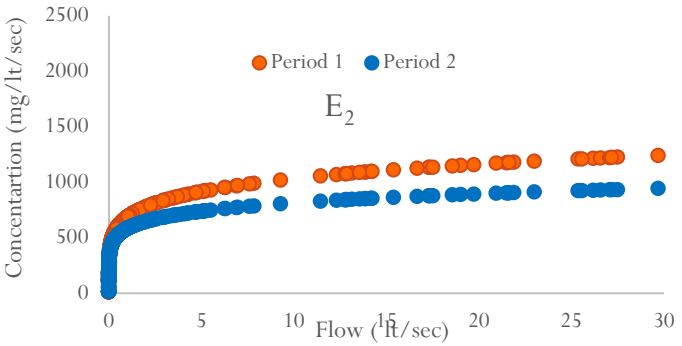
- Decreasing trend in sediment movement to downstream

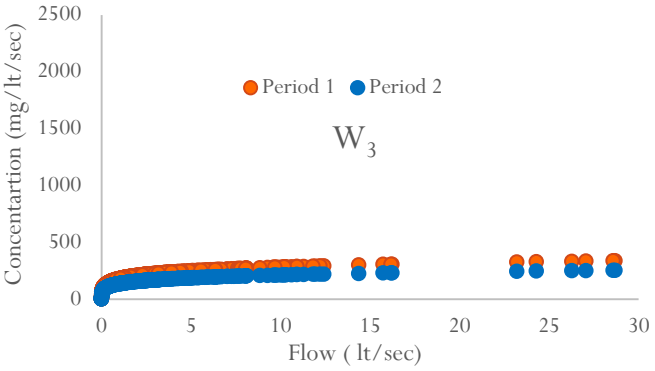
RESULTS and DISCUSSION

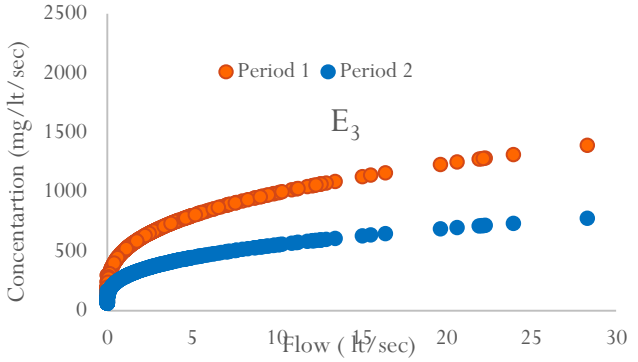








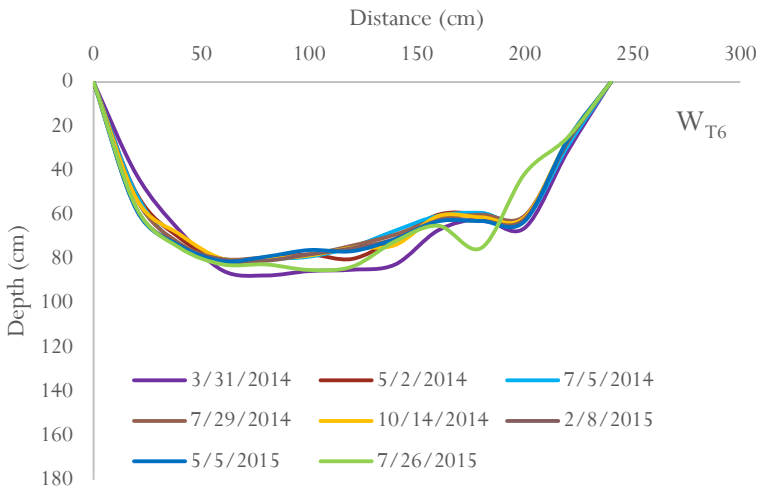


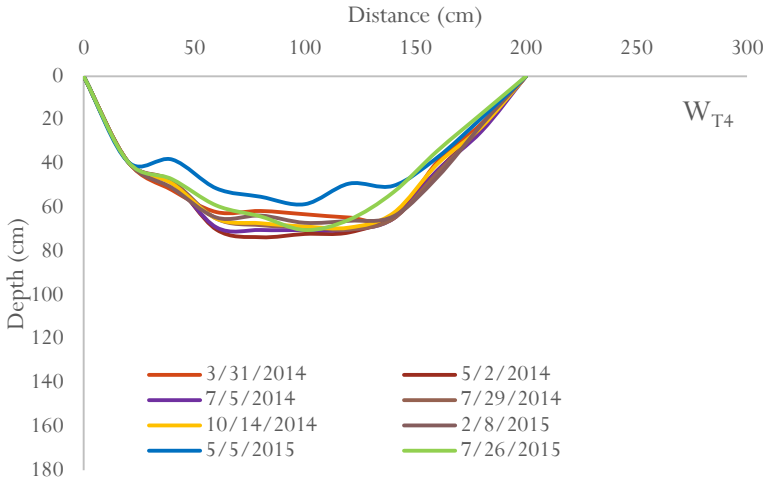


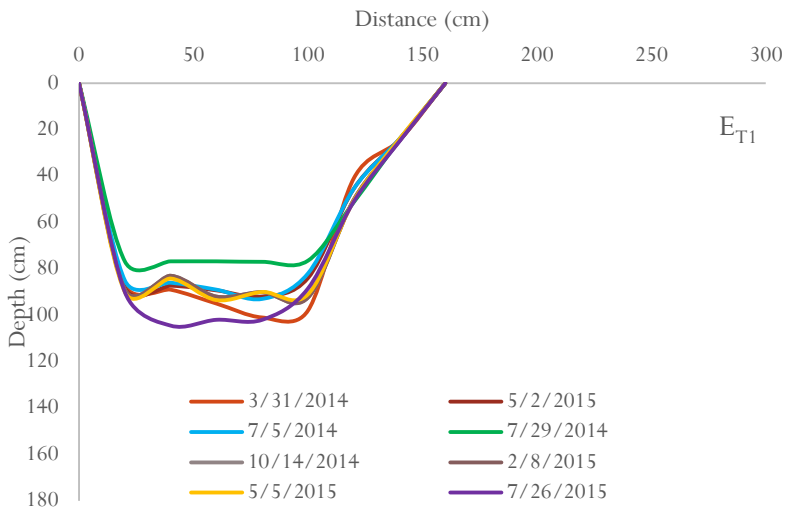
Changes on sediment concentration through time at W_1, W_2, W_3, E_1, E_2, E_3

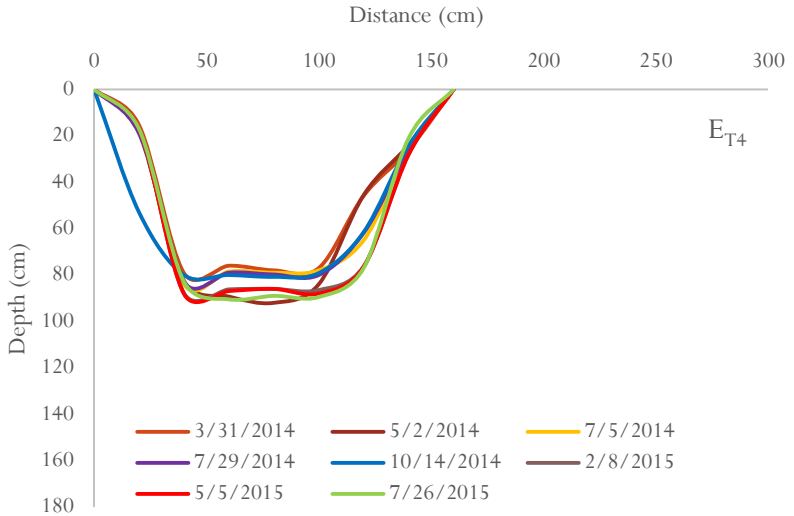
RESULTS and DISCUSSION

- Stream channel transects



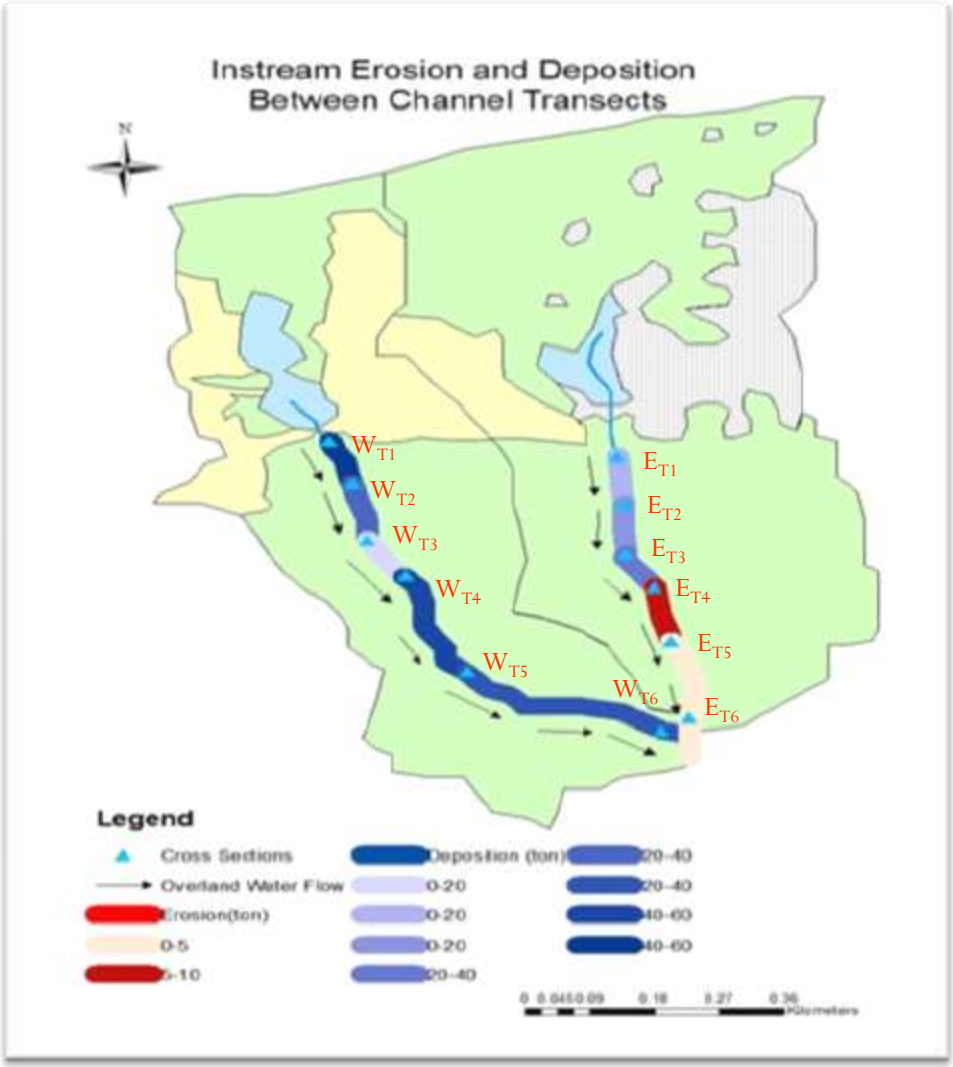






RESULTS and DISCUSSION

Transects	Erosion (ton)	Deposition (ton)	Net (ton)
WT1-WT2	41.4	96.2	+54.8
WT2-WT3	63.2	96.8	+33.6
WT3-WT4	54.0	59.5	+5.5
WT4-WT5	83.1	136.6	+53.6
WT5-WT6	85.8	120.7	+34.9
Total	**327.4**	**509.9**	**182.4**
Total (ha)	**8.6**	**13.3**	**+4.8**
ET1-ET2	39.8	49.8	+10.0
ET2-ET3	32.2	49.4	+17.2
ET3-ET4	17.4	43.4	+26.0
ET4-ET5	58.6	50.8	-7.8
ET5-ET6	66.8	65.5	-1.3
Total	**214.7**	**258.9**	**44.1**
Total (ha)	**4.3**	**5.2**	**+0.9**



RESULTS and DISCUSSION

- Stream channel characteristics

- West Stream
  - Width depth ratio<12
  - Entrenchment ratio >2.2
  - Sinuosity = 1.6
  - Water surface slope = 0.018
  - E5 stream type
- East Stream
  - Width depth ratio>12
  - Entrenchment ratio <1.4
  - Sinuosity = 1.3
  - Water surface slope = 0.014
  - F5 stream type

SUMMARY

- Hydrology and Sediment
  - Substantial amount of sediment yield to downstream
  - Decreasing trend in sediment yield through time
  - Decreasing capacity of SMZs

- Stream Morphology
  - Changes on stream cross sections through time
  - Instream erosion and deposition between channel transects


THANK YOU!
QUESTIONS?