

# Tractors, Rice, and Mountains: Hydrogeochemistry in Monsoonal South Korea

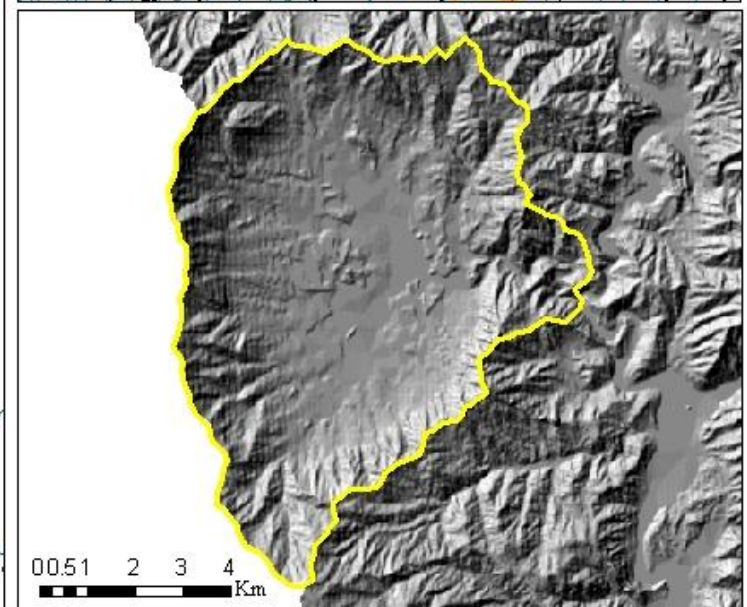
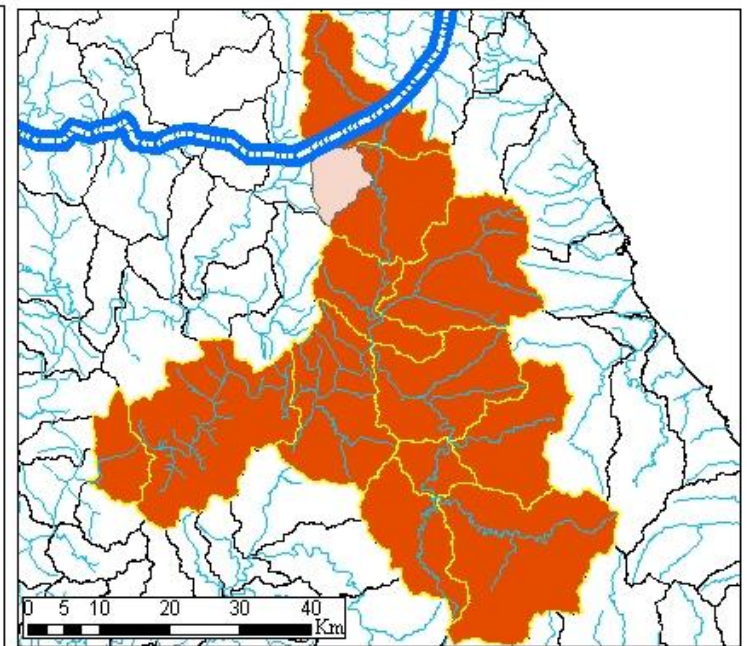
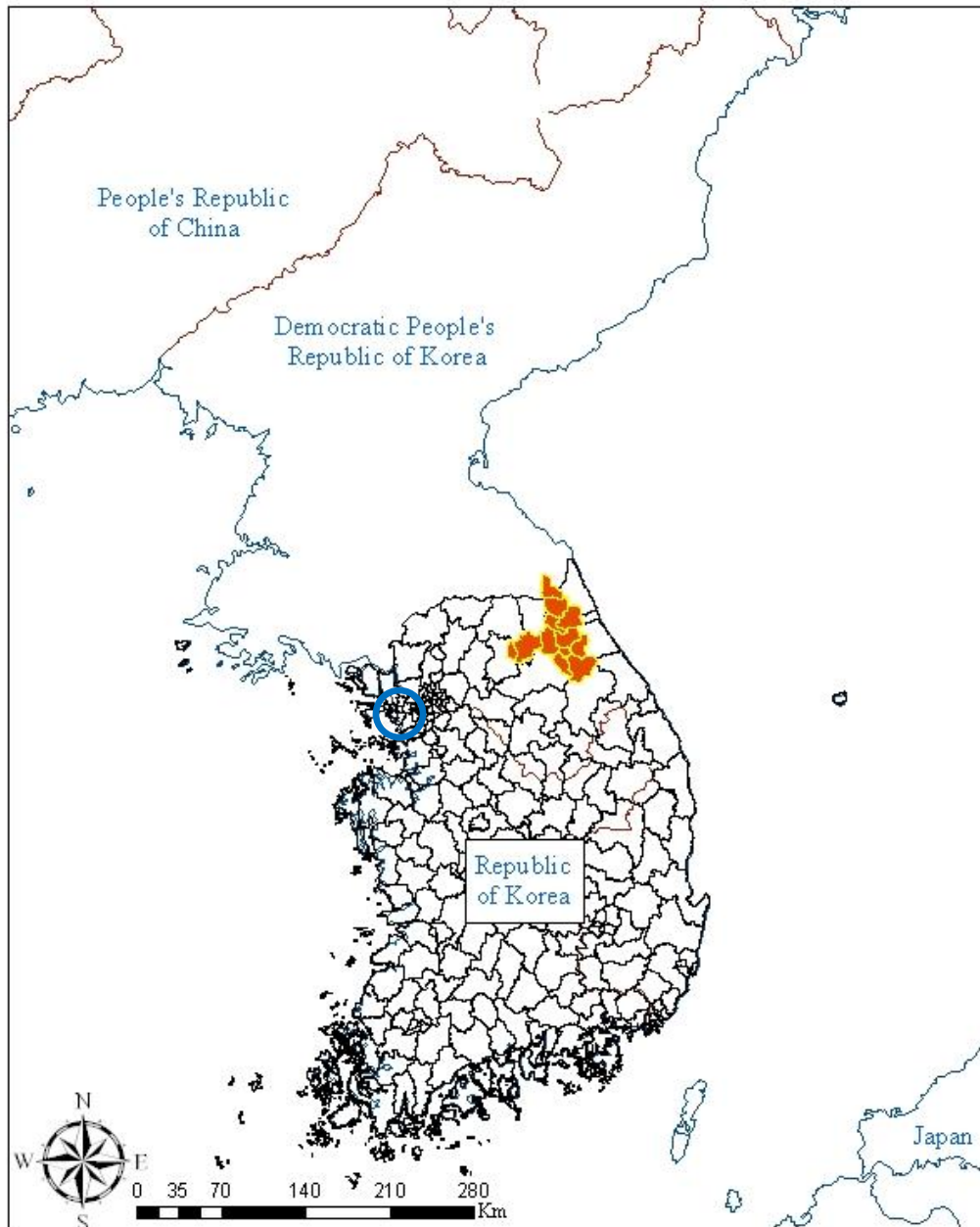


Jae-E Yang, 2006

Christopher L. Shope  
4 August 2010

2010 International SWAT Conference  
Ilsan, South Korea

# Study Area Location





# Presentation Outline

- Why this study is necessary
- General project approach and interests
- Local field projects and decision making
- Conceptual, numerical, and distributed models of the catchment
- Some early results
- Where do we go from here?



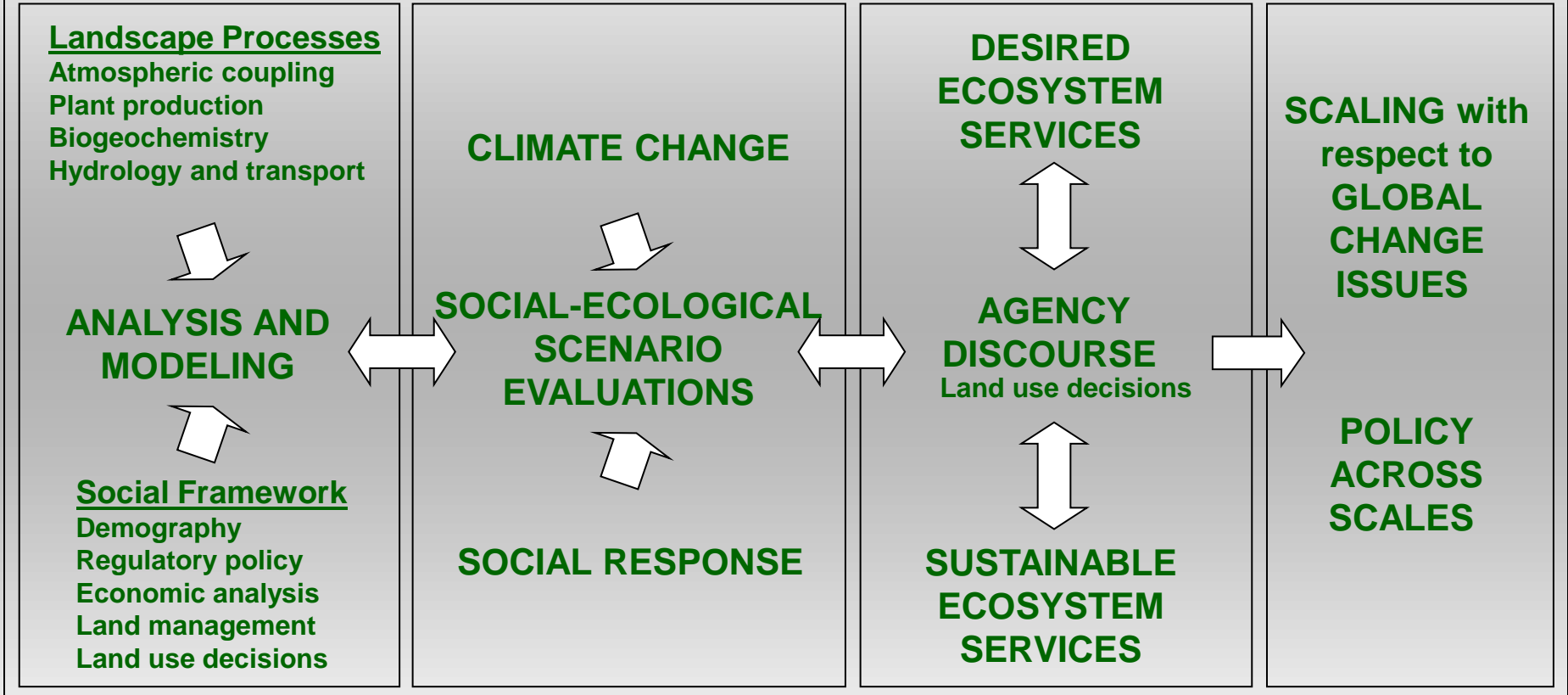
# Major Research Problems

- High phosphorous and nitrate concentrations in agricultural setting
- Very steep mountainous and forested slopes
- Monsoonal erosion of the landscape during peak flow events
- High sediment transport increasing TSS and P
- Increase of erosion over time – tractors vs sediment
- Different crop management techniques like rice
- Very strong agricultural lobby



# Bridging Science within TERRECO

## Complex Terrain and Ecological Heterogeneity (TERRECO)

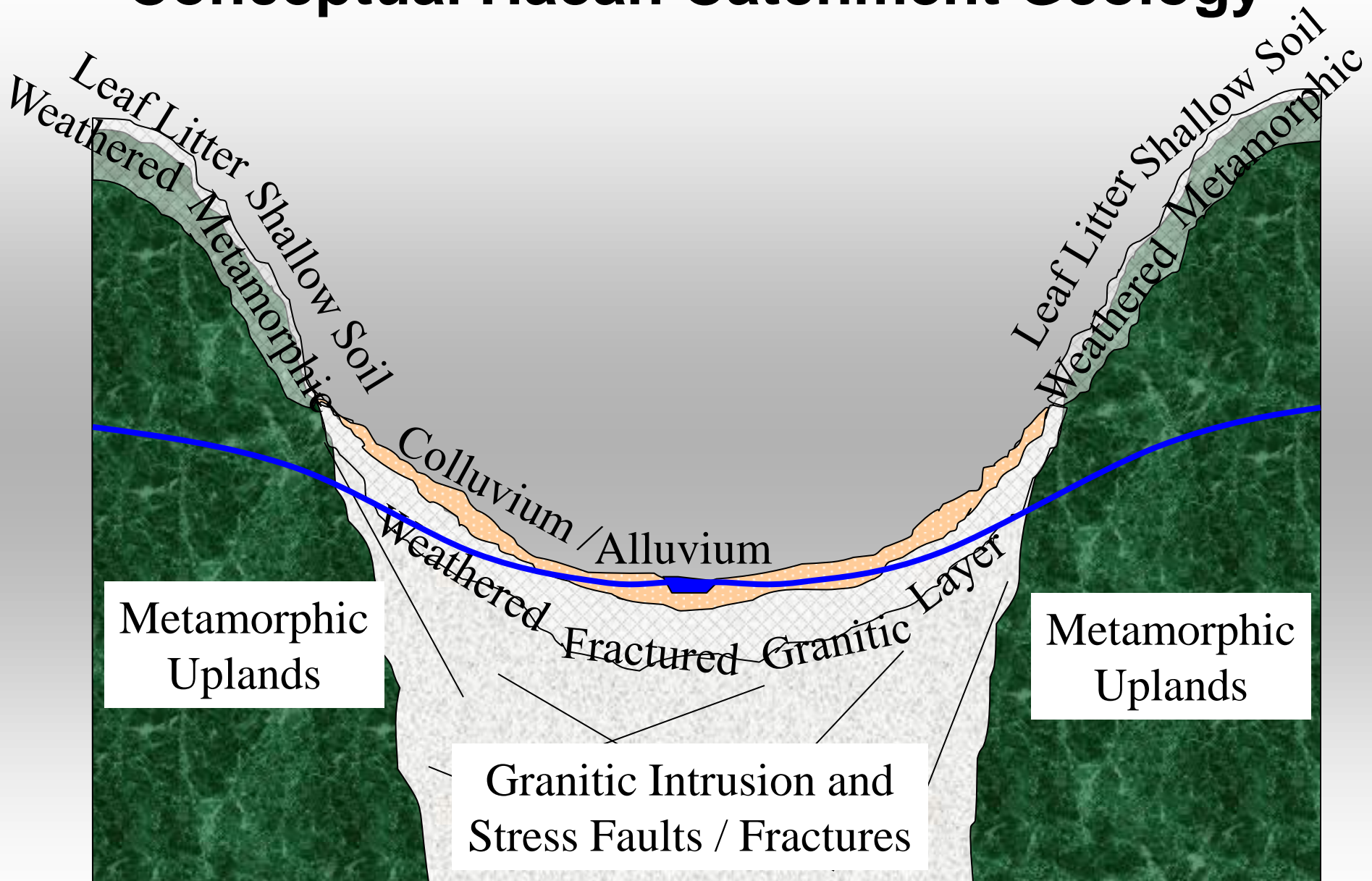


# Local Field Studies for Modeling Effort

- Yearly change in land use and local decisions.
- Climate conditions on carbon uptake and crops
- Fertilizer input and agricultural efficiency
- Insects, pests, birds and new biological controls
- Soil structure and biogeochemical responses.
- Water quality and quantity and material transport
- Local stakeholder interests and decisions



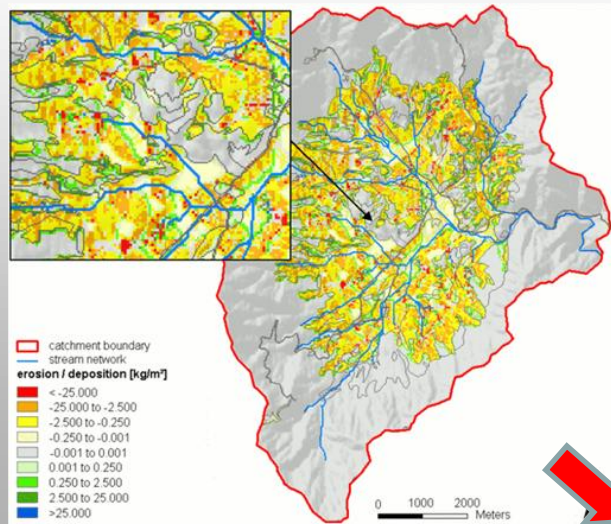
# Conceptual Haeen Catchment Geology



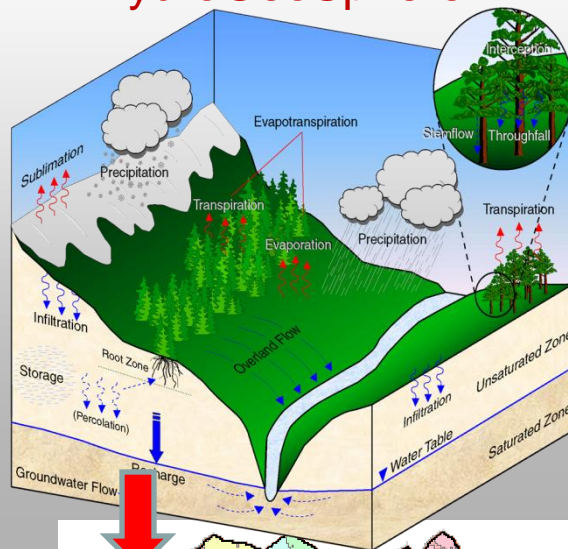


# Some Focused and Project-Wide Models

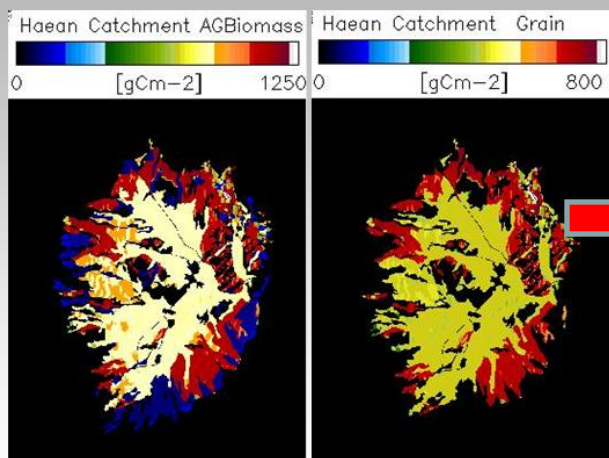
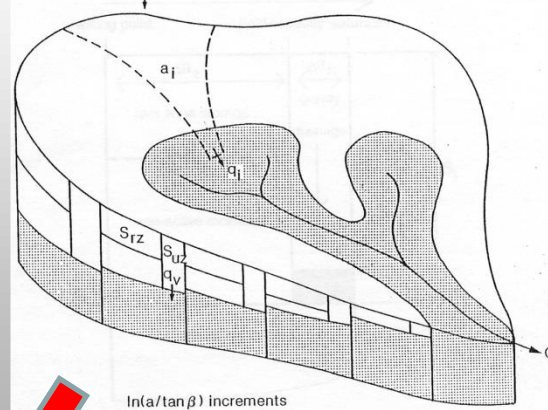
## EROSION 3-D



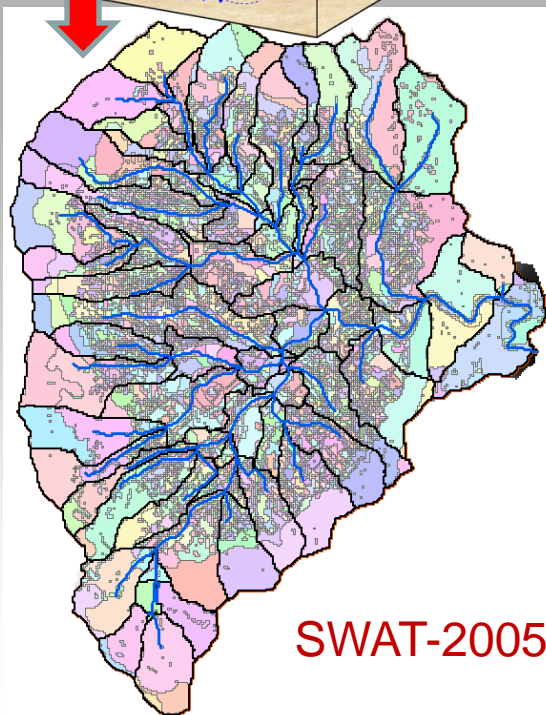
## HydroGeoSphere



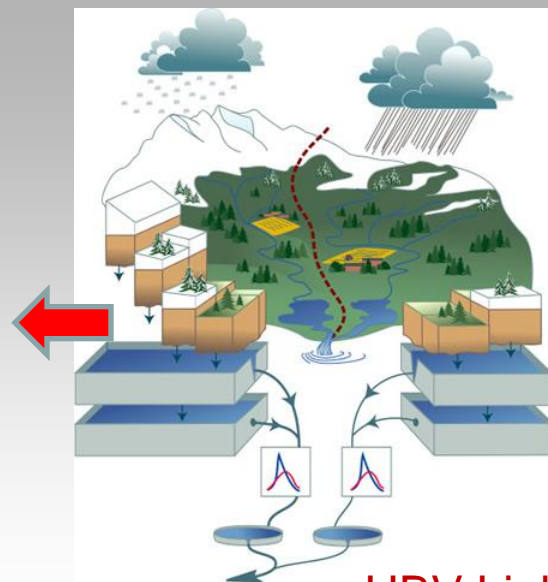
## TOPMODEL



## PIXGRO



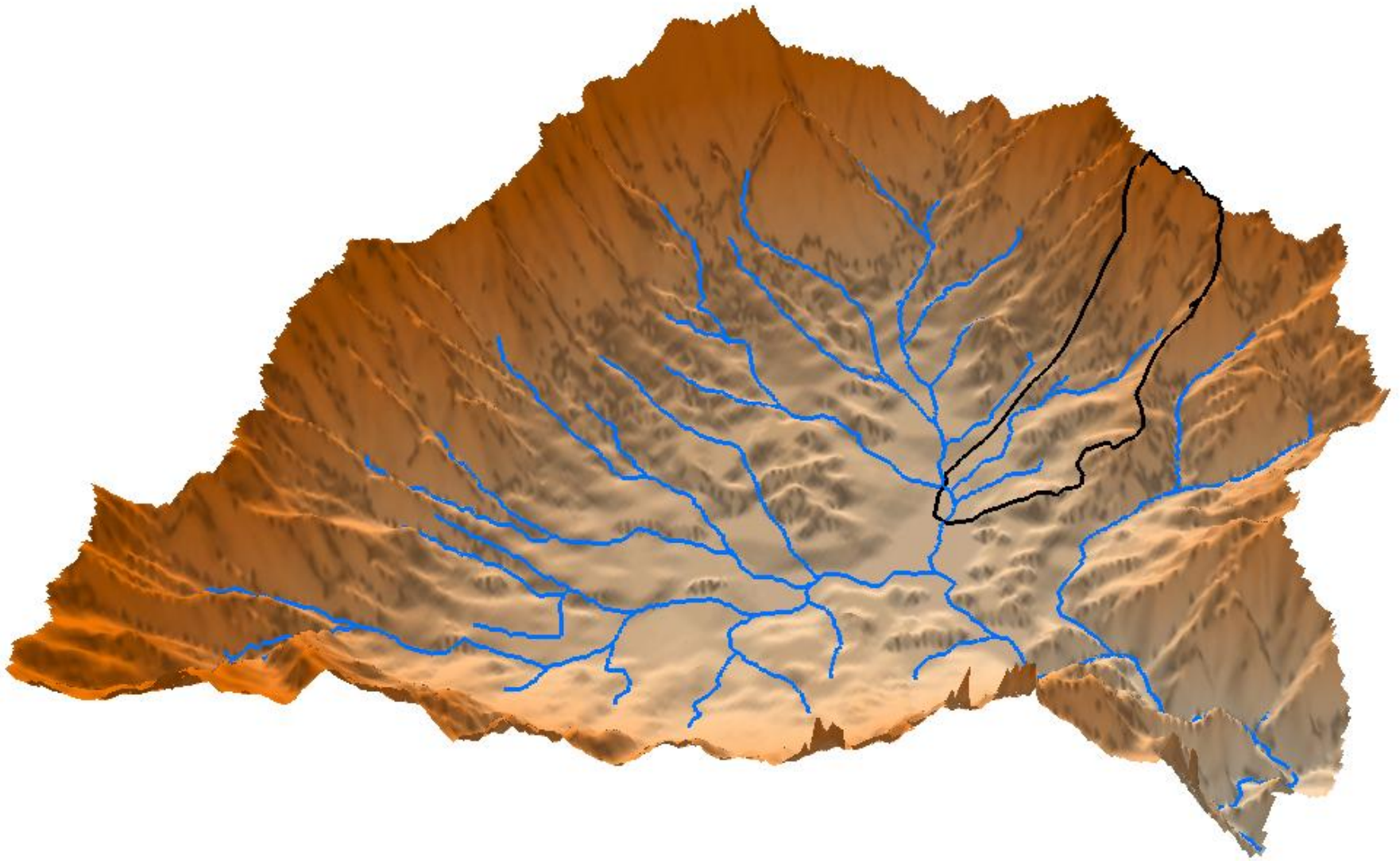
## SWAT-2005



## HBV-Light



# Haeian Catchment Topography



# Land Use / Crop Identification

Land Use / Crop Type Percentage

Forest-Evergreen

Rice

Range-Grasses

Potato

Sugarcane

Forest-Deciduous

Southwestern US (Arid) Range

Green Beans

Cabbage

Alfalfa

Orchard

Tobacco

Corn

Transportation

Residential-Low Density

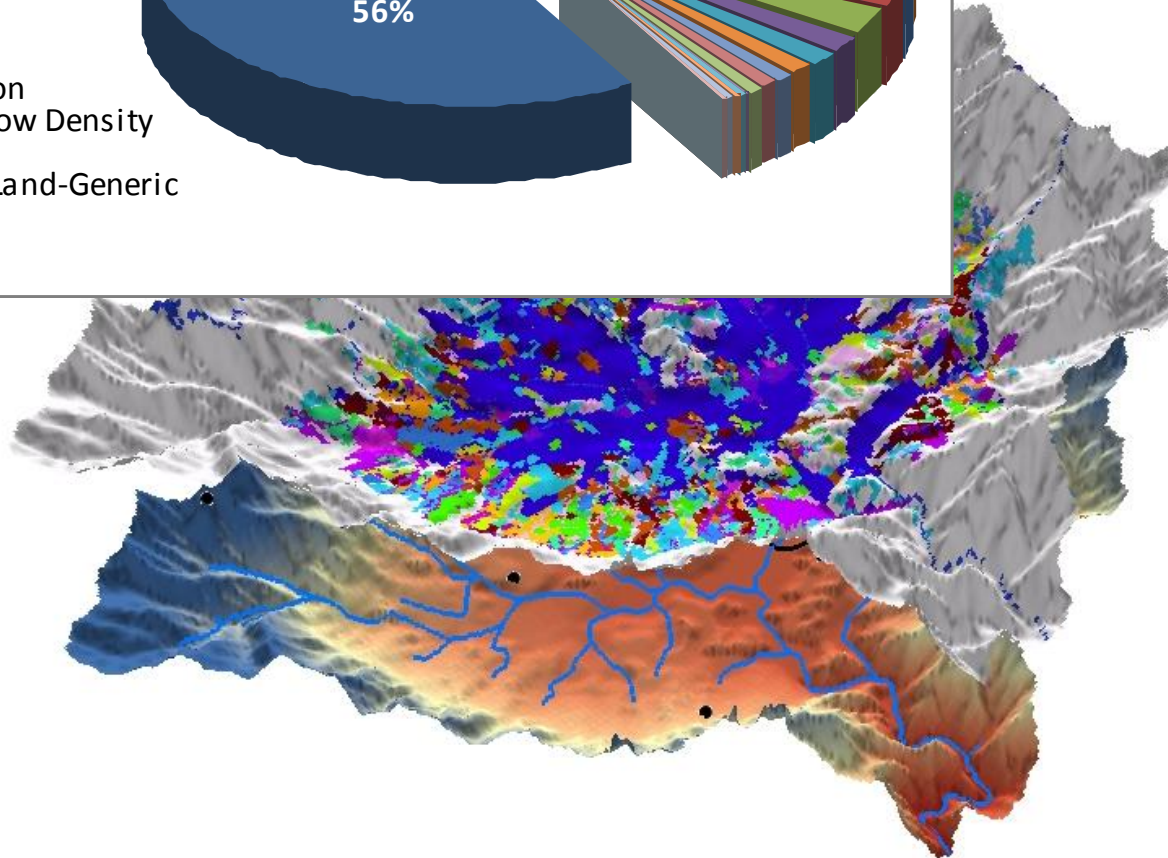
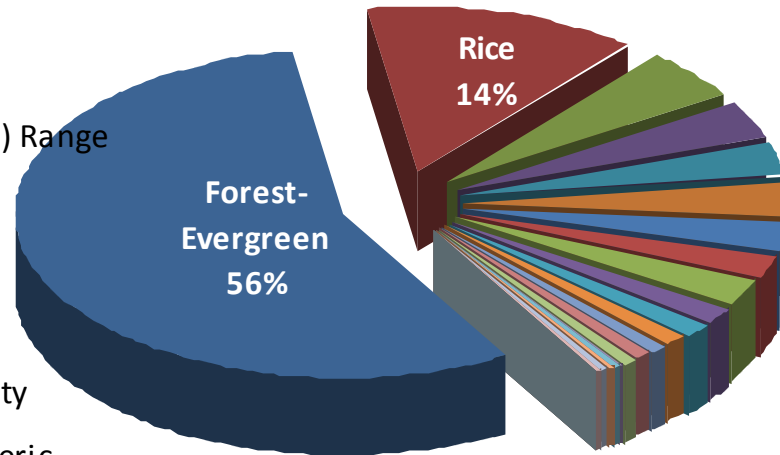
Cantaloupe

Agricultural Land-Generic

Commercial

Bell Pepper

Institutional

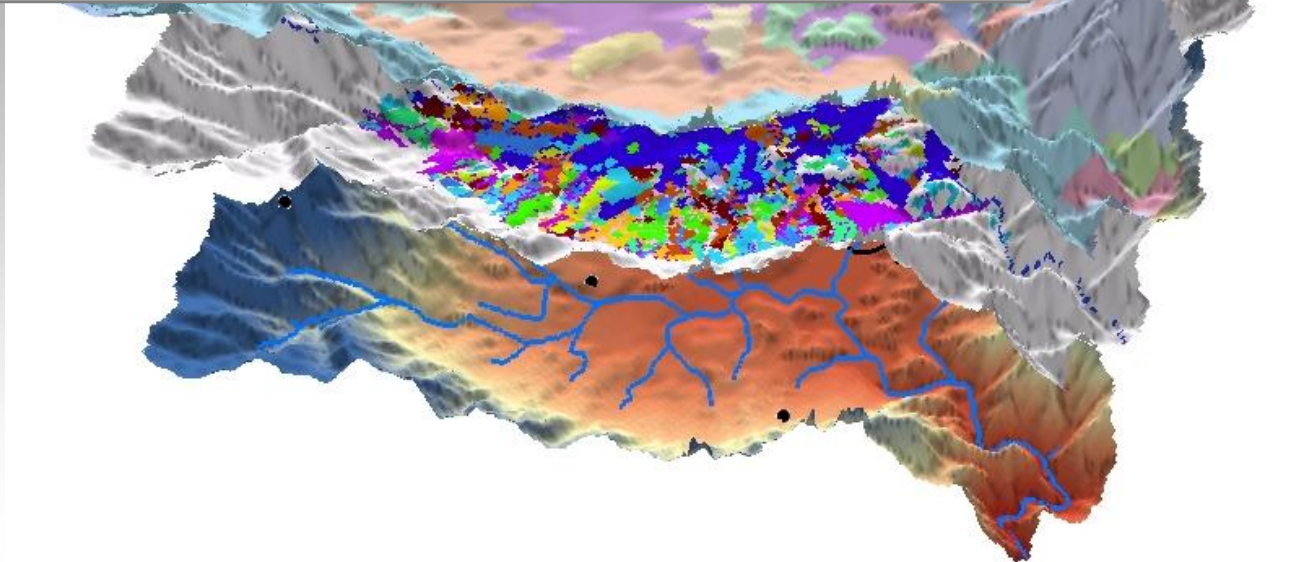
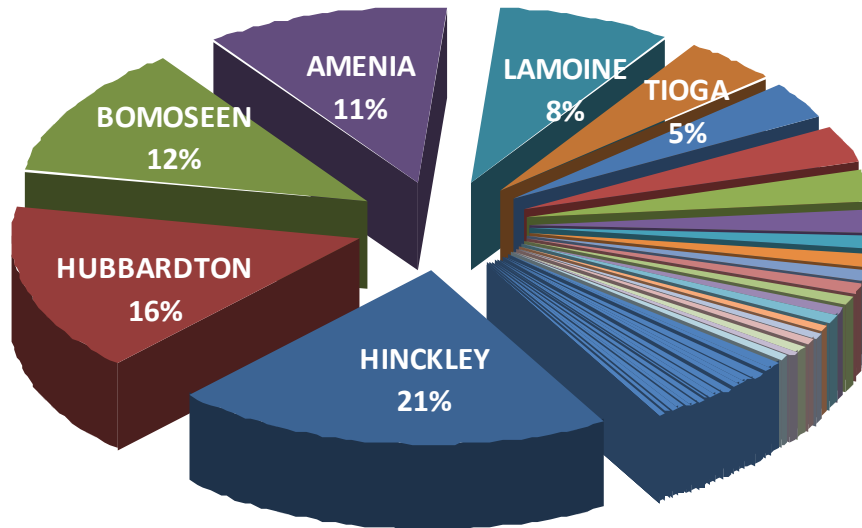




# Surficial Soil Distribution

Soil Distribution Percentage

HINCKLEY  
HUBBARDTON  
BOMOSEEN  
AMENIA  
LAMOINE  
TIOGA  
SHELBURNE  
HERO  
SACO  
GALWAY  
PINNEBOG  
COLRAIN  
GLOVER  
TUNBRIDGE  
PITTSTOWN  
BUXTON  
MERRIMAC  
GEORGIA  
FREDON  
STONE

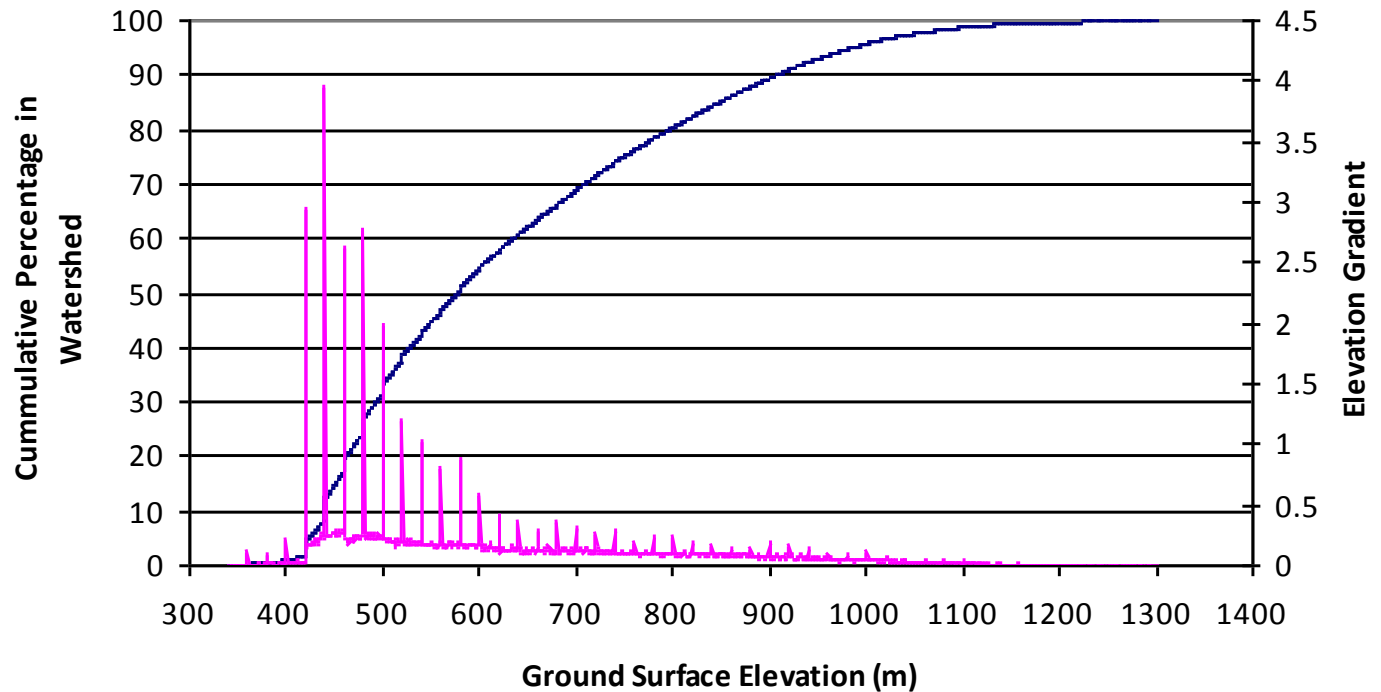


# Topographic Slope Classification

## Topographic Gradient Percentage

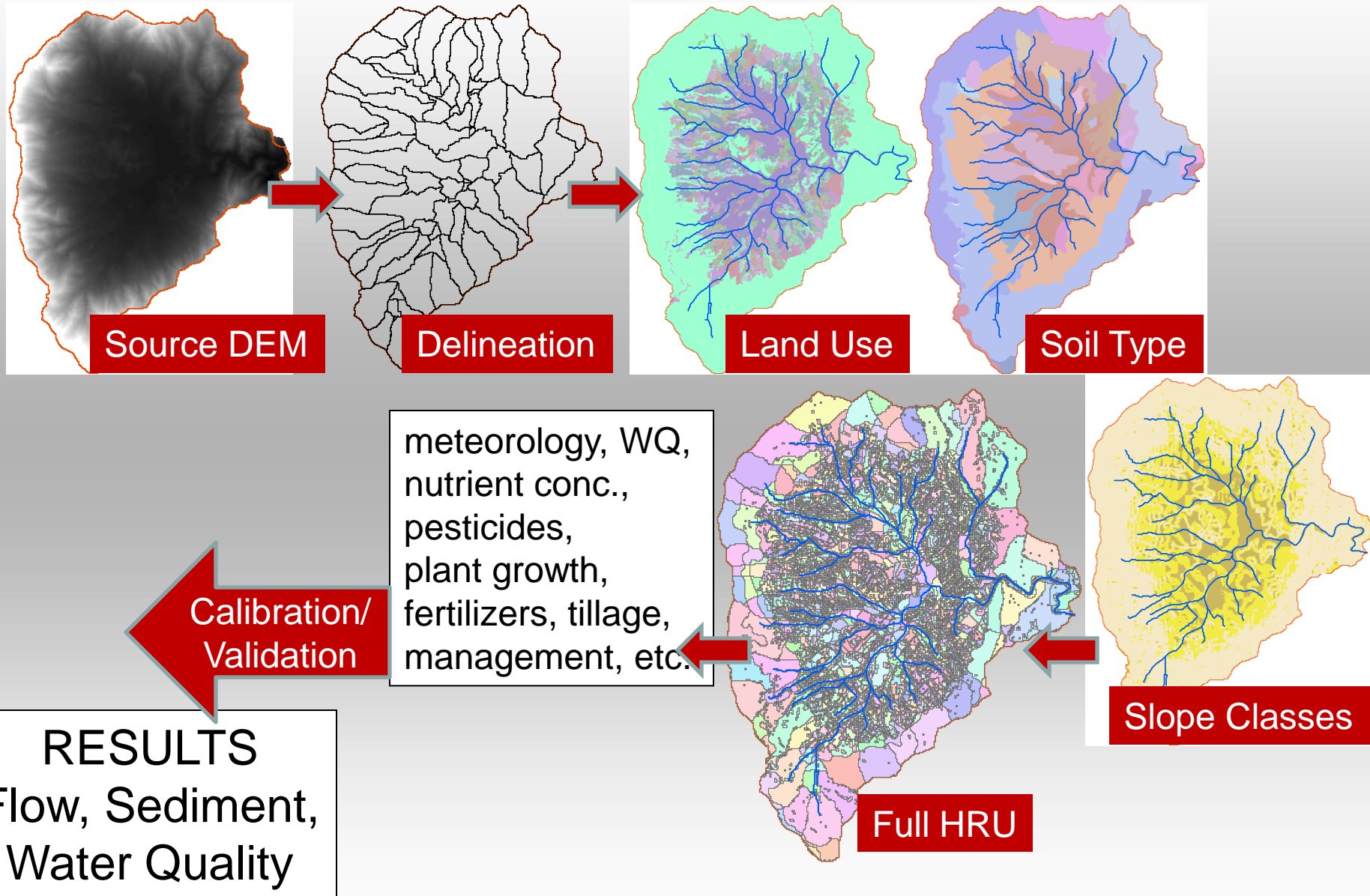
5-20  
28%

## Haeen Catchment Topographic Elevation

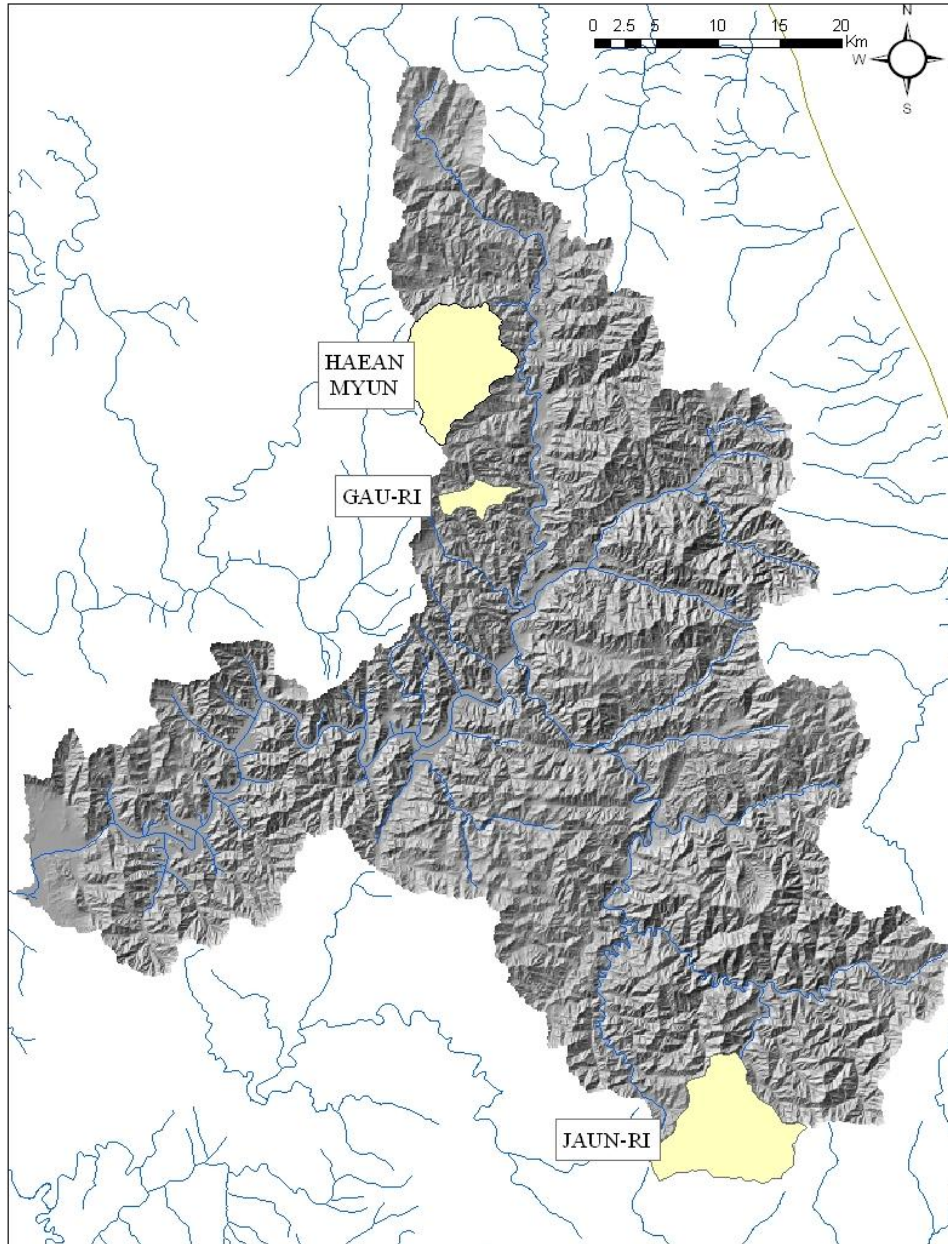




# Soil and Water Assessment Tool – SWAT2005



# Major Sediment Input in Soyang Watershed

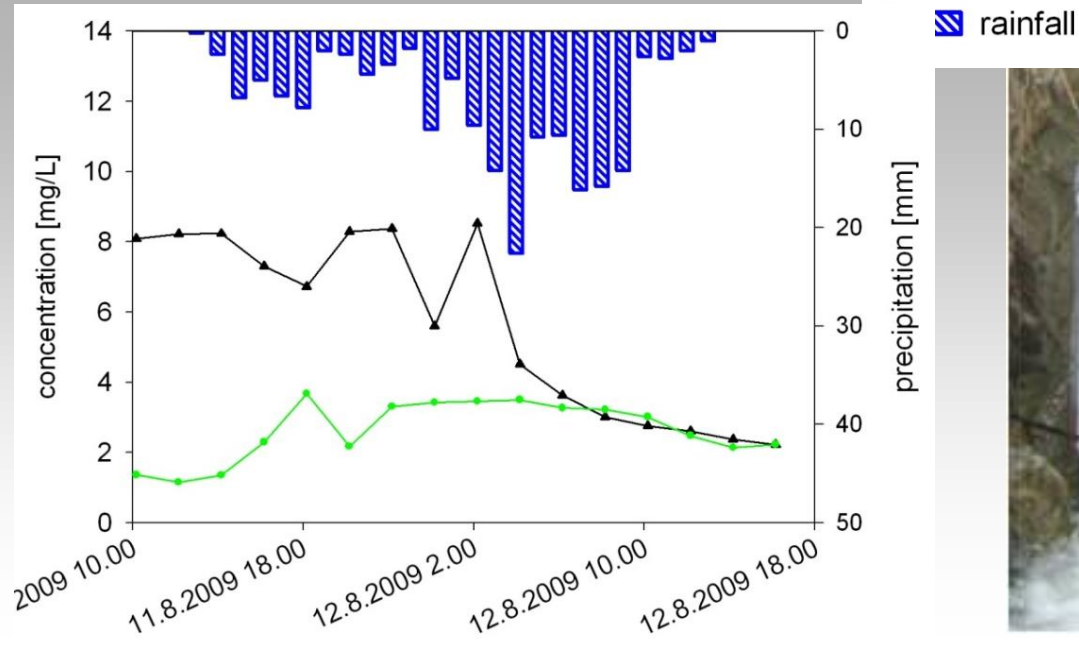
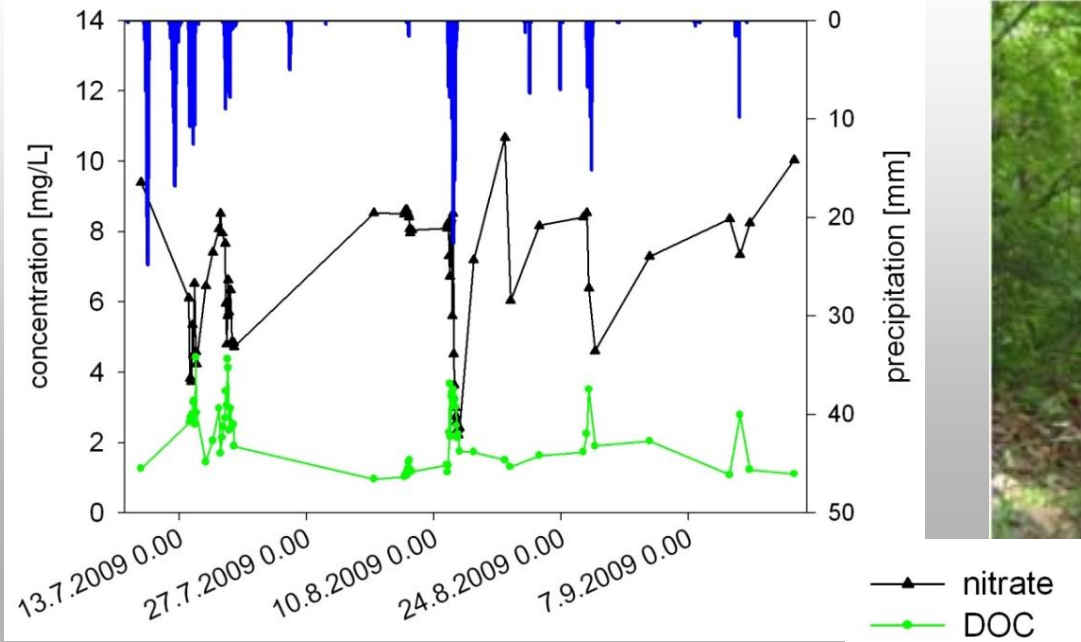


Location	Sediment Load (ton ha <sup>-1</sup> )
Gau-ri	55.3
Hae-an-Myun	39.2
Jaun-ri	23.6

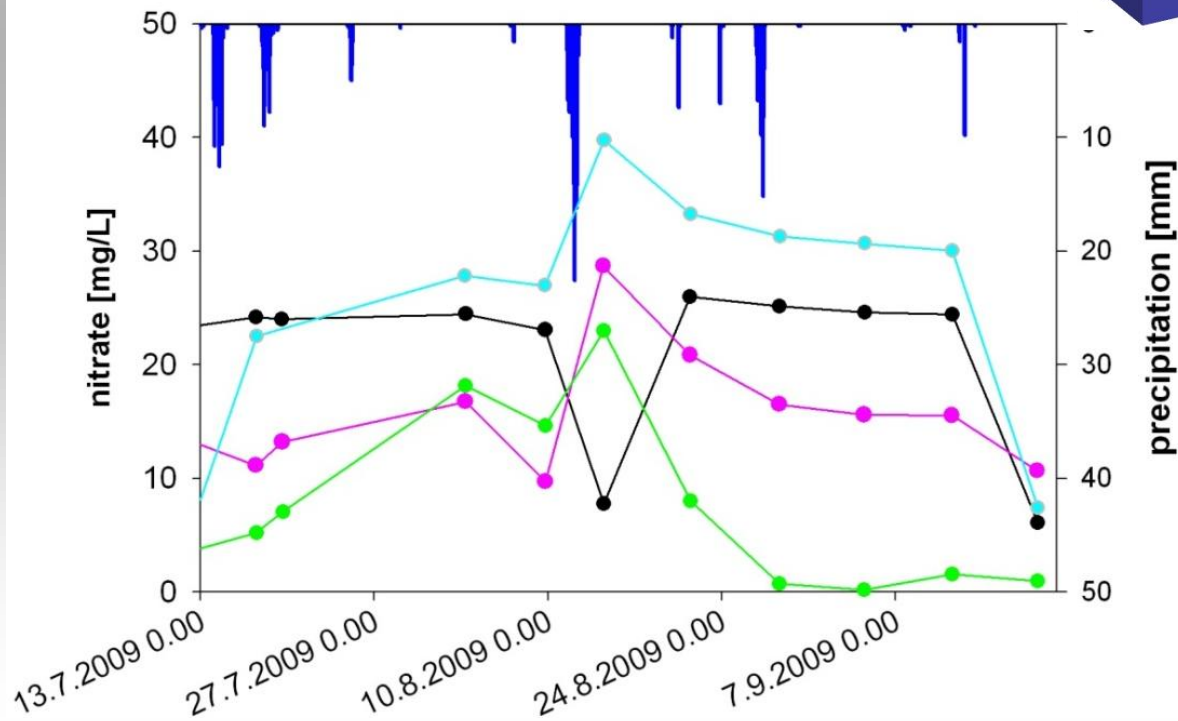
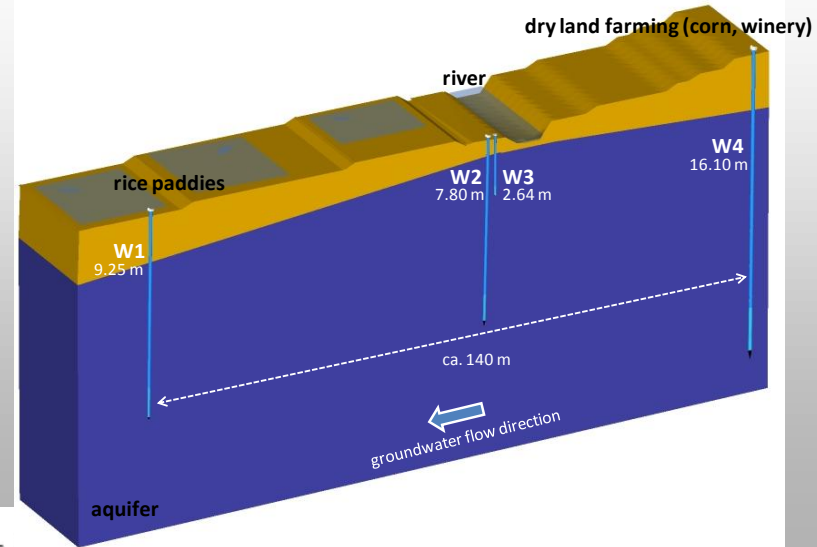
**Gwang-Sam Kim, 2010**



# Surface Water Quality Responses



# Groundwater Water Quality

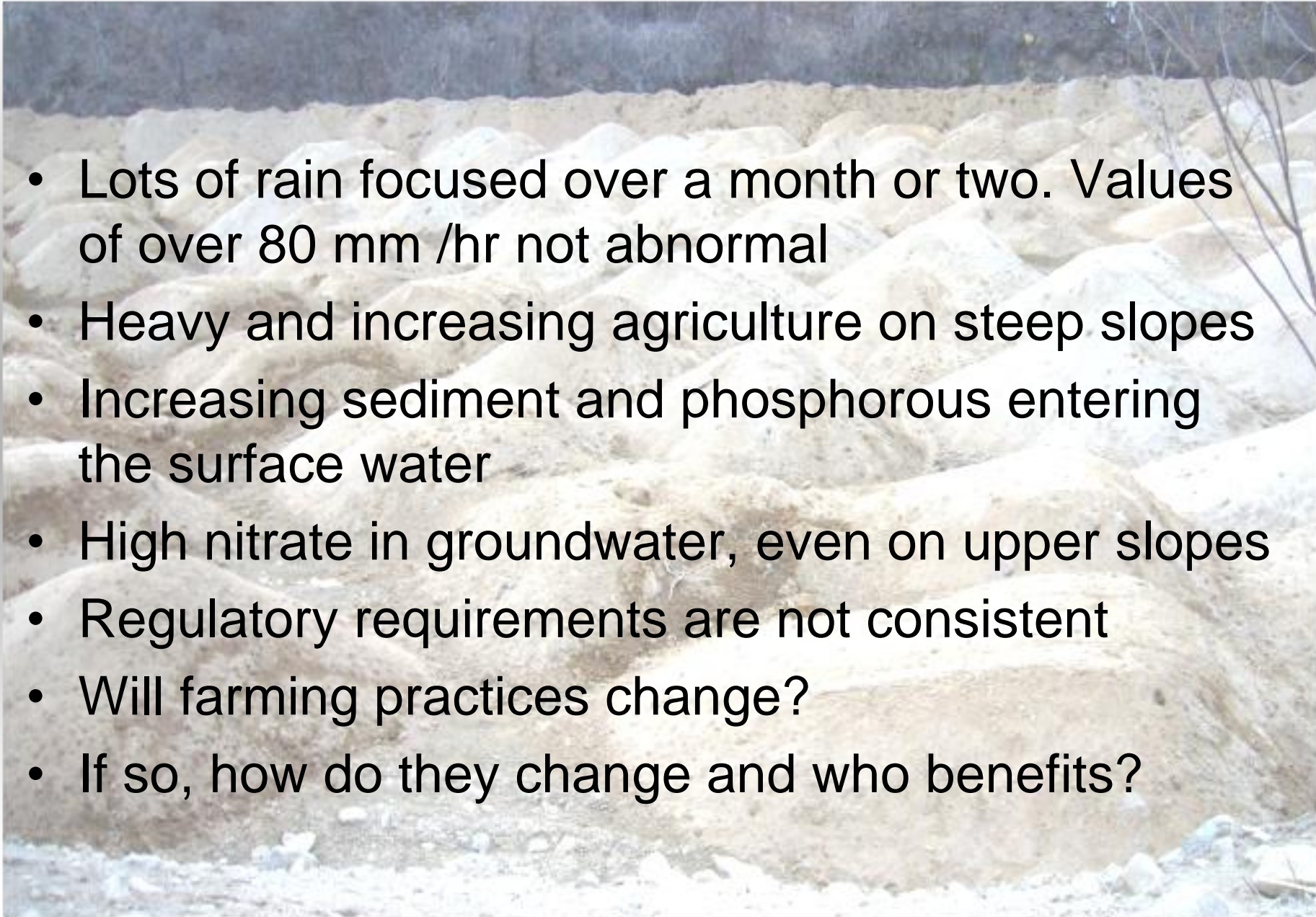




# Research Questions

- Variations in land use, natural or intensive use
- Climate change effects on WQ and quantity
- Social hierarchies and economic incentives as drivers
- Process based biogeochemical responses along elevation gradient
- GW effect comparison between irrigation and peak flow event recharge
- Estimations in ungauged or limited basins
- Sensitivity and measurement uncertainties throughout the system

# Conclusions

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- Lots of rain focused over a month or two. Values of over 80 mm /hr not abnormal
  - Heavy and increasing agriculture on steep slopes
  - Increasing sediment and phosphorous entering the surface water
  - High nitrate in groundwater, even on upper slopes
  - Regulatory requirements are not consistent
  - Will farming practices change?
  - If so, how do they change and who benefits?



# Questions?

