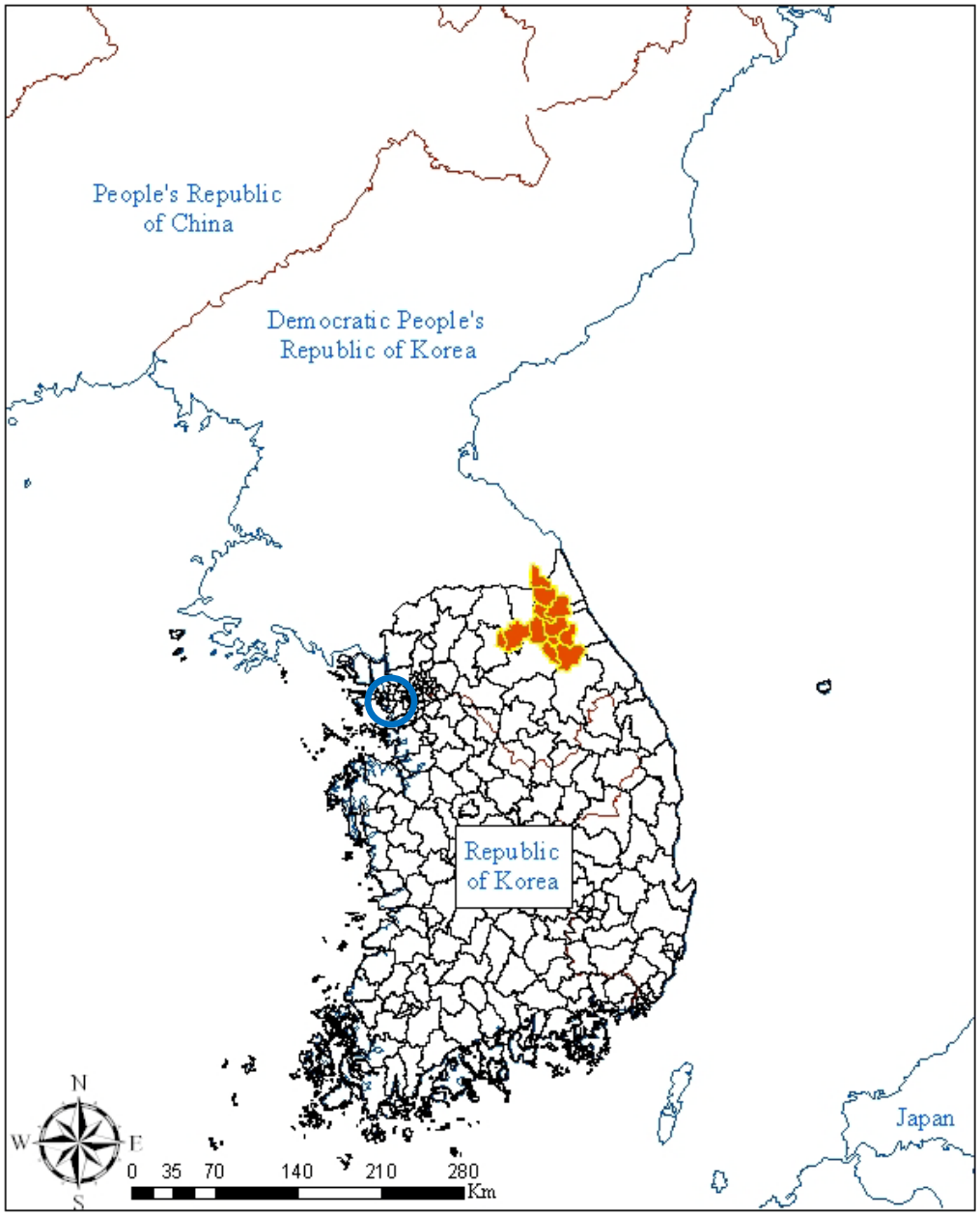
Tractors, Rice, and Mountains: Hydrogeochemistry in Monsoonal South Korea

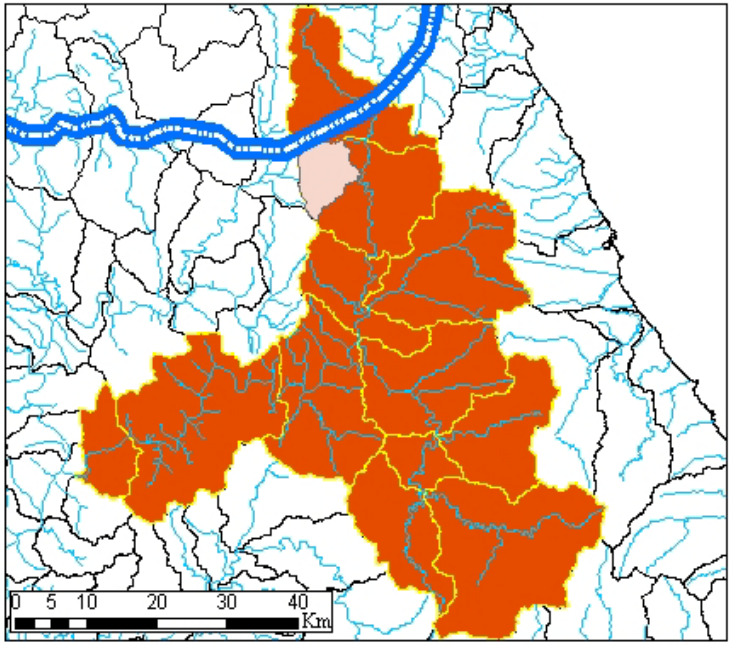
Jae-E Yang, 2006

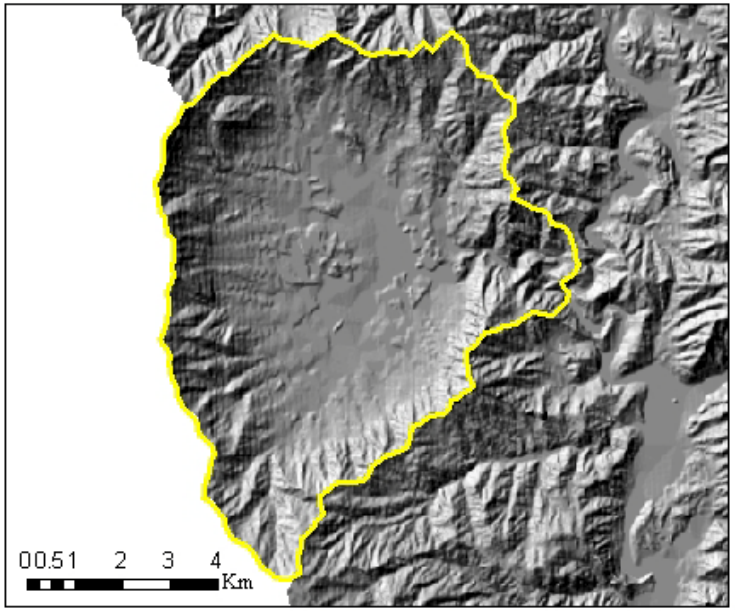
Christopher L. Shope,
Svenja Bartsch, Marianne Ruidisch, Sebastian Arnhold
6 August 2010

2010 International SWAT Conference
Ilsan, South Korea

Haean Study Area Location







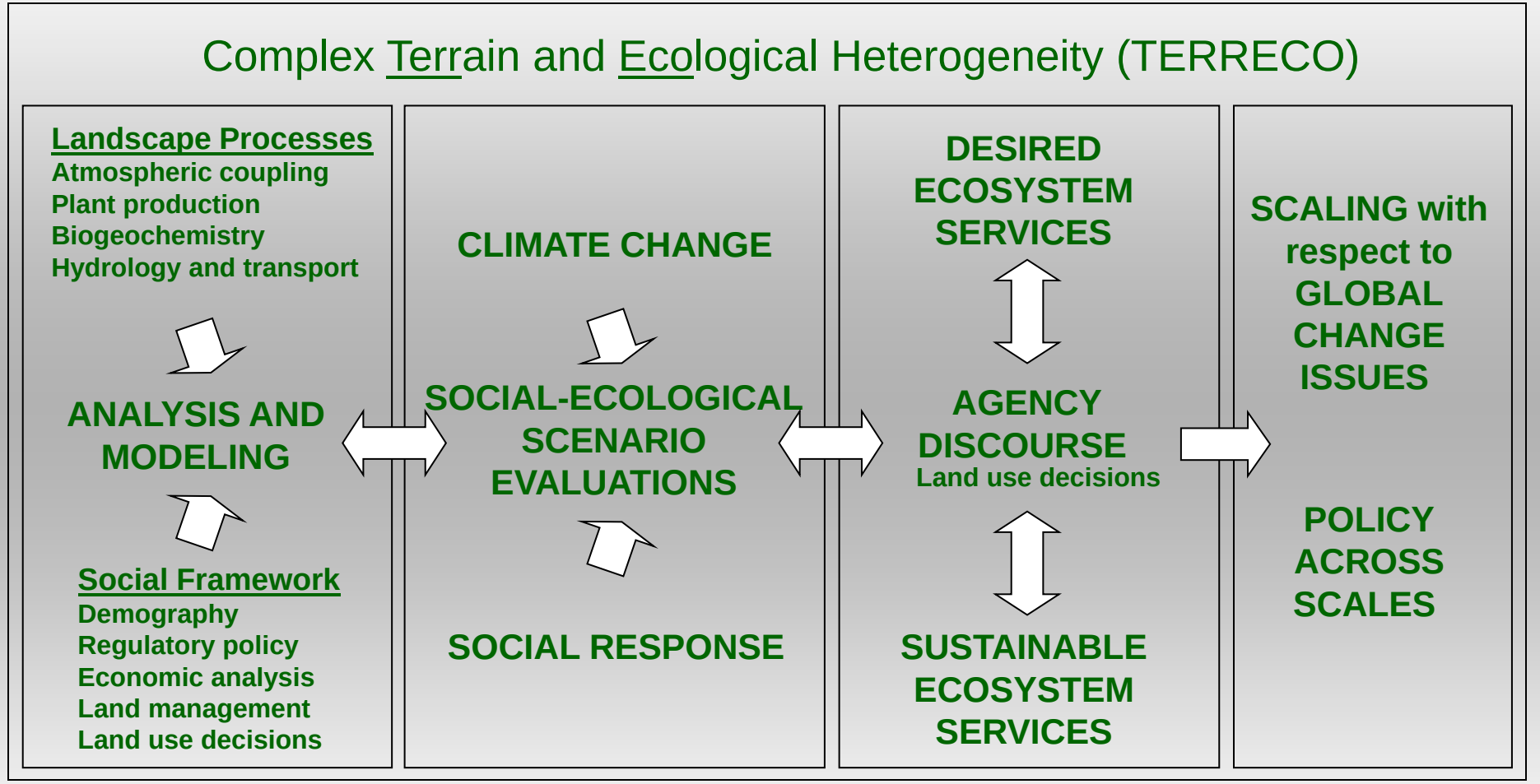
Shope Presentation Outline

- 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, particularly encroached areas.
- 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

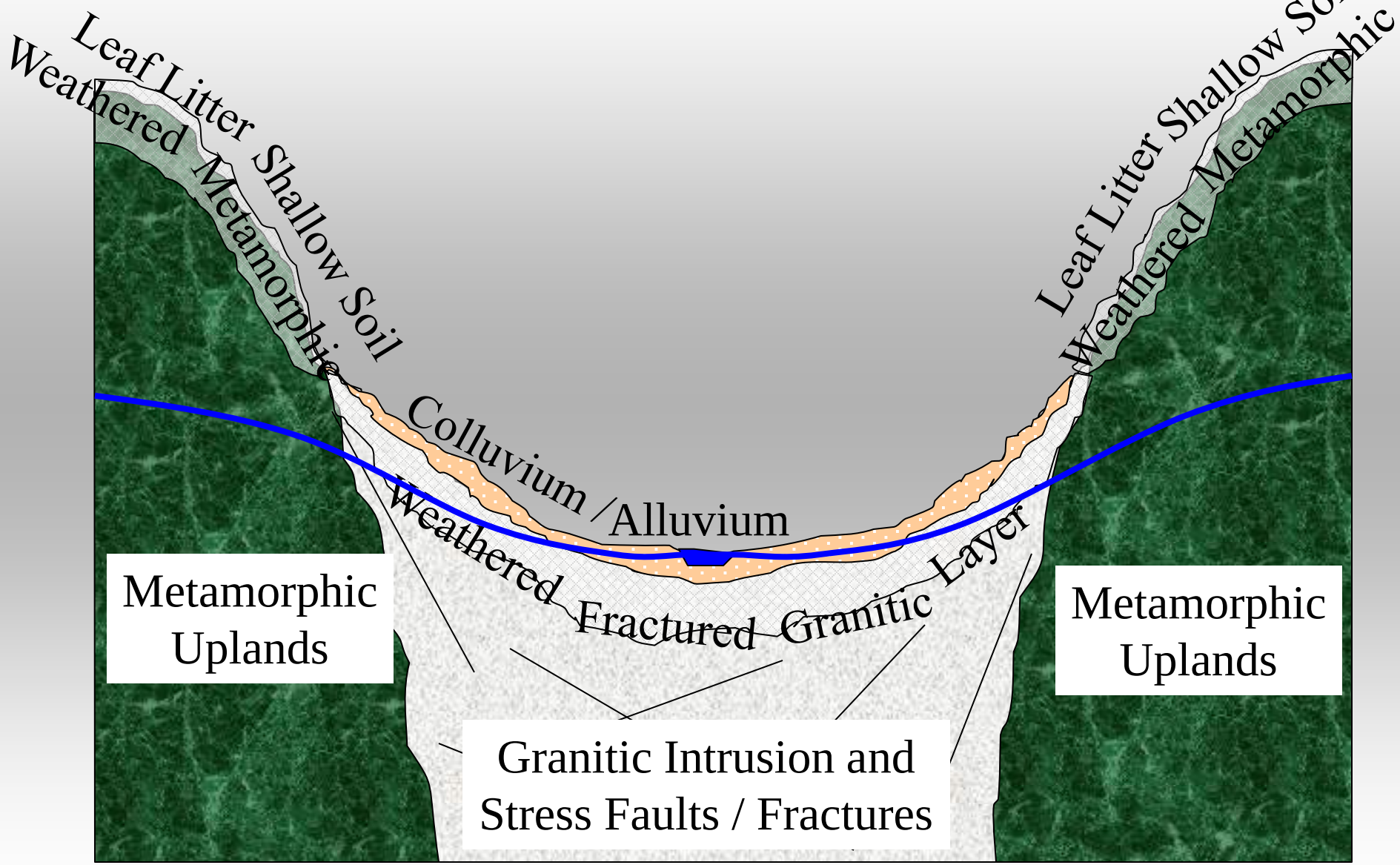


Tenhunen et. al., 2010

Local Field Studies for Modeling Effort

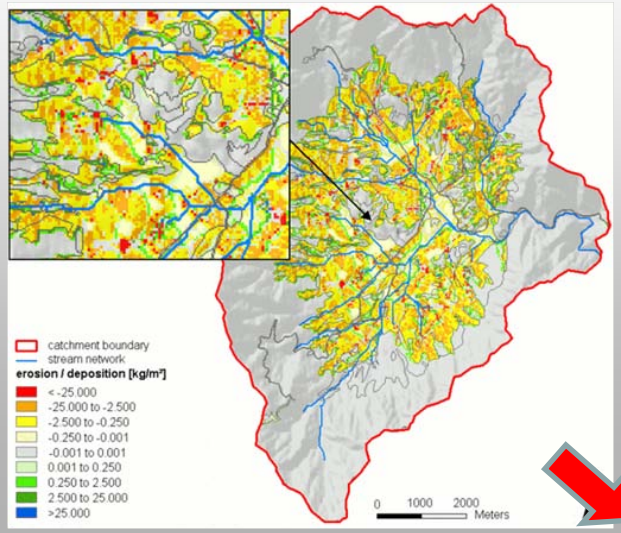
- Yearly change in land use and local decisions.
- Climate conditions on carbon uptake and crops
- Fertilizer input and agricultural efficiency
- Insects, pests, birds and new biological controls
- Soil structure and biogeochemical responses.
- Water quality and quantity and material transport
- Local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

Conceptual Haean Catchment Geology

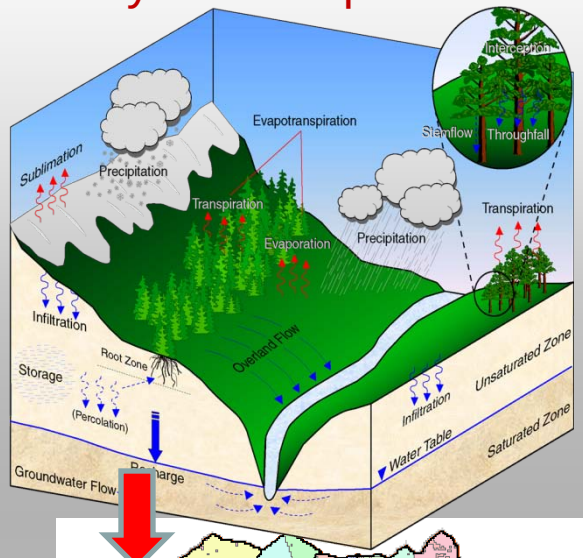


Some Focused and Project-Wide Models

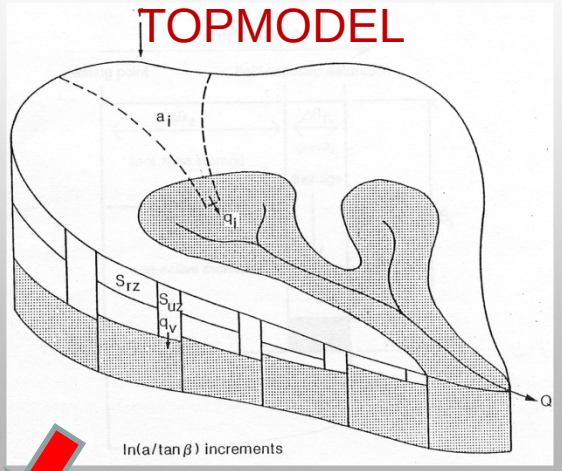
EROSION 3-D

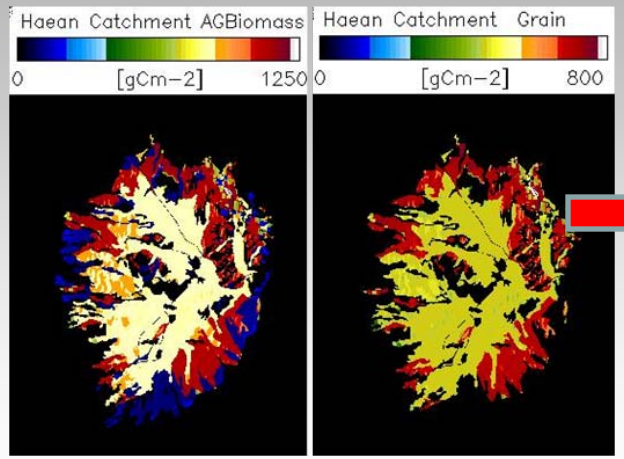


HydroGeoSphere

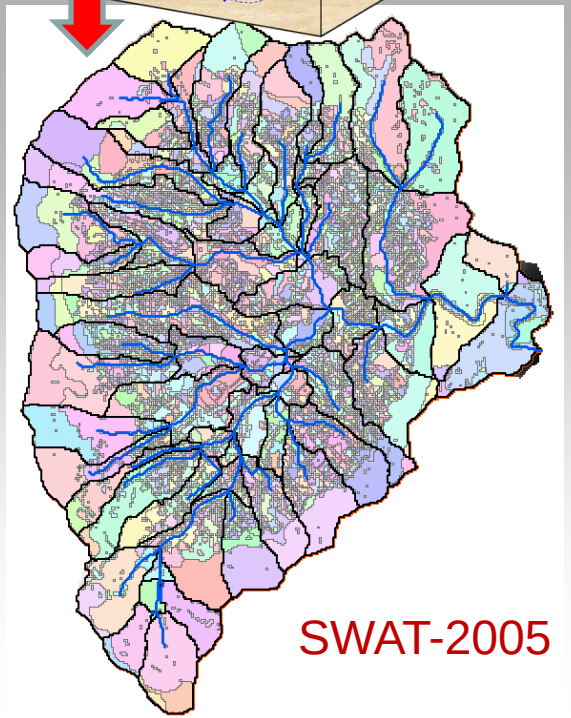


TOPMODEL

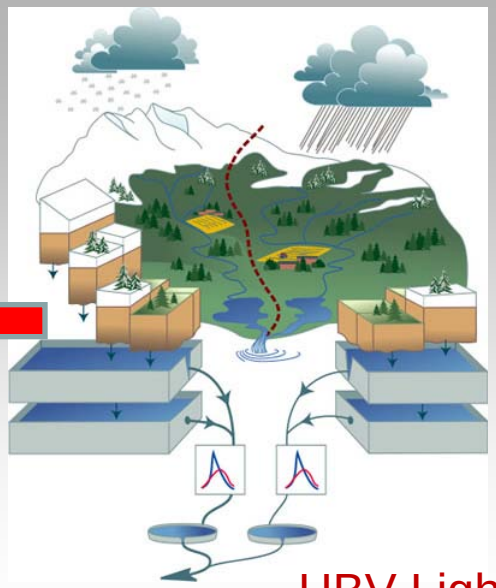




PIXGRO

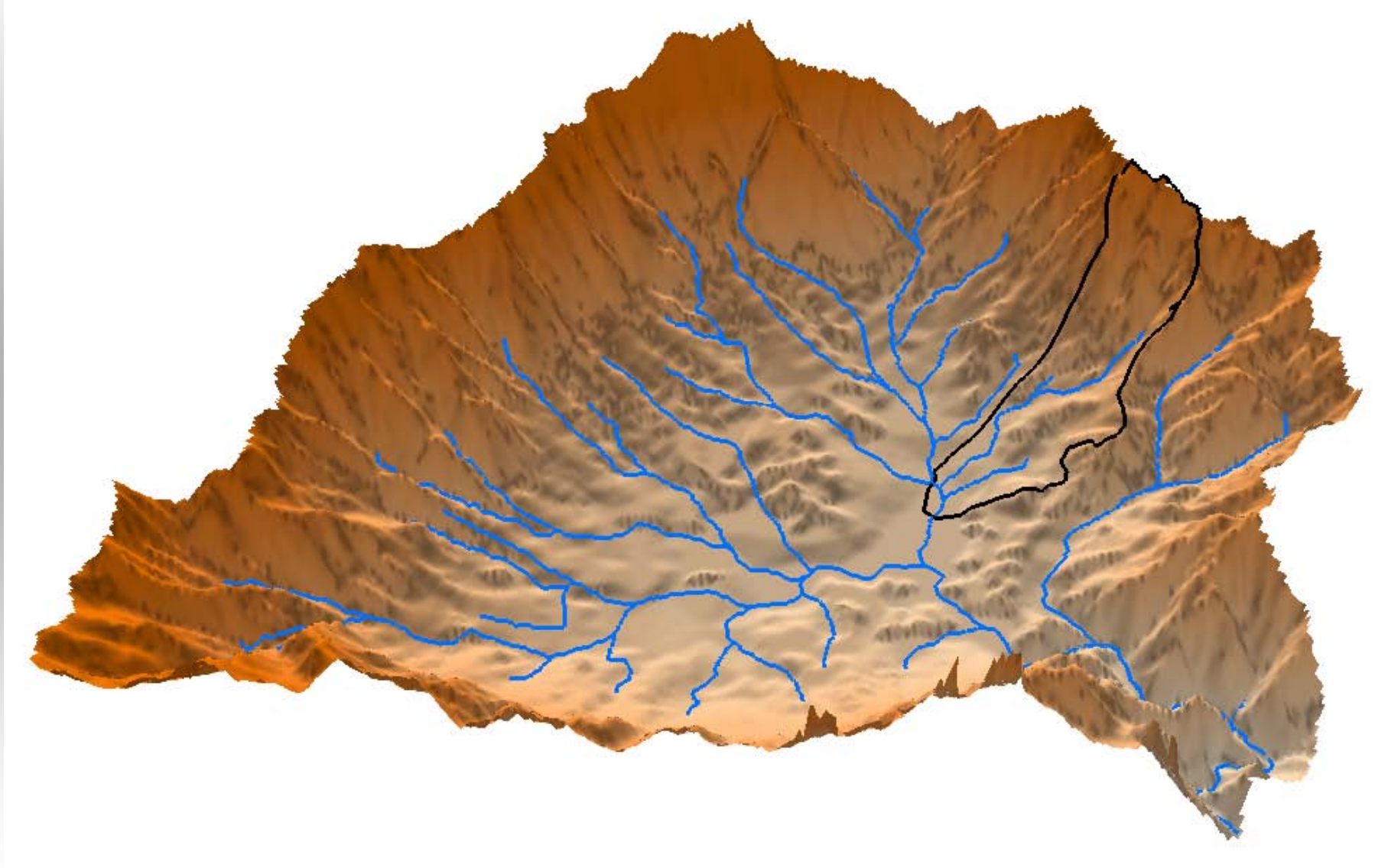


SWAT-2005

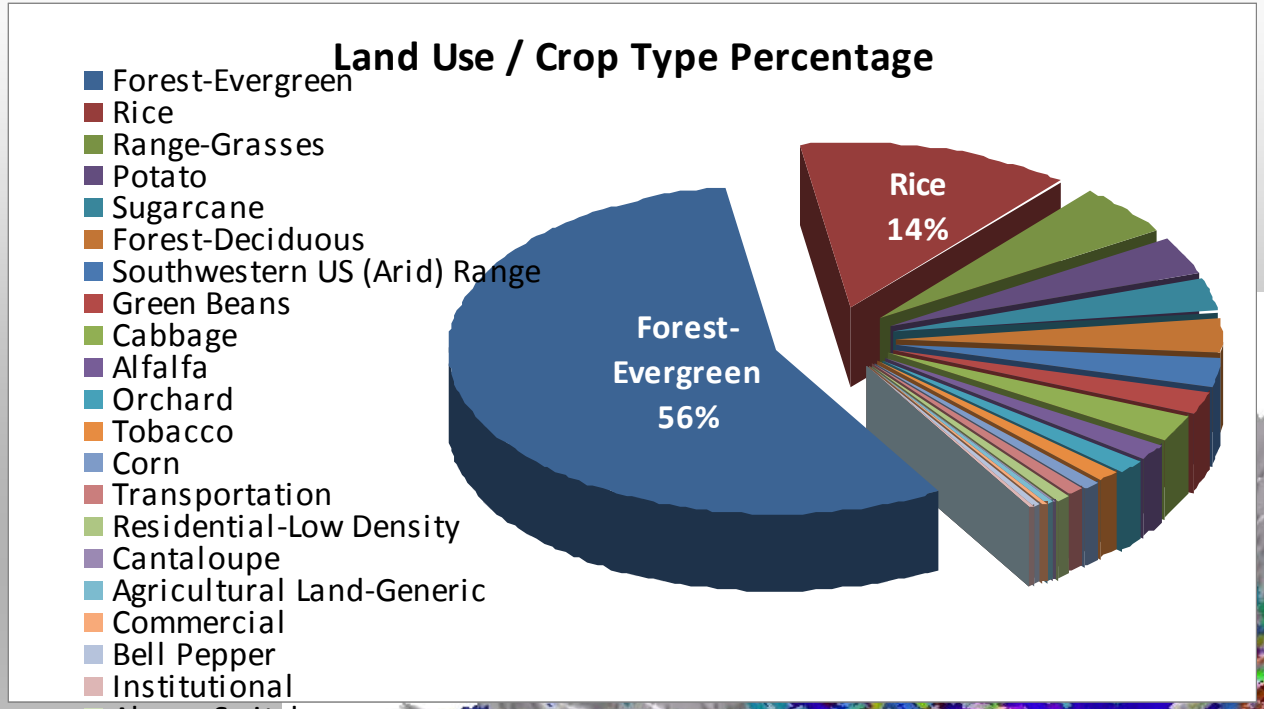


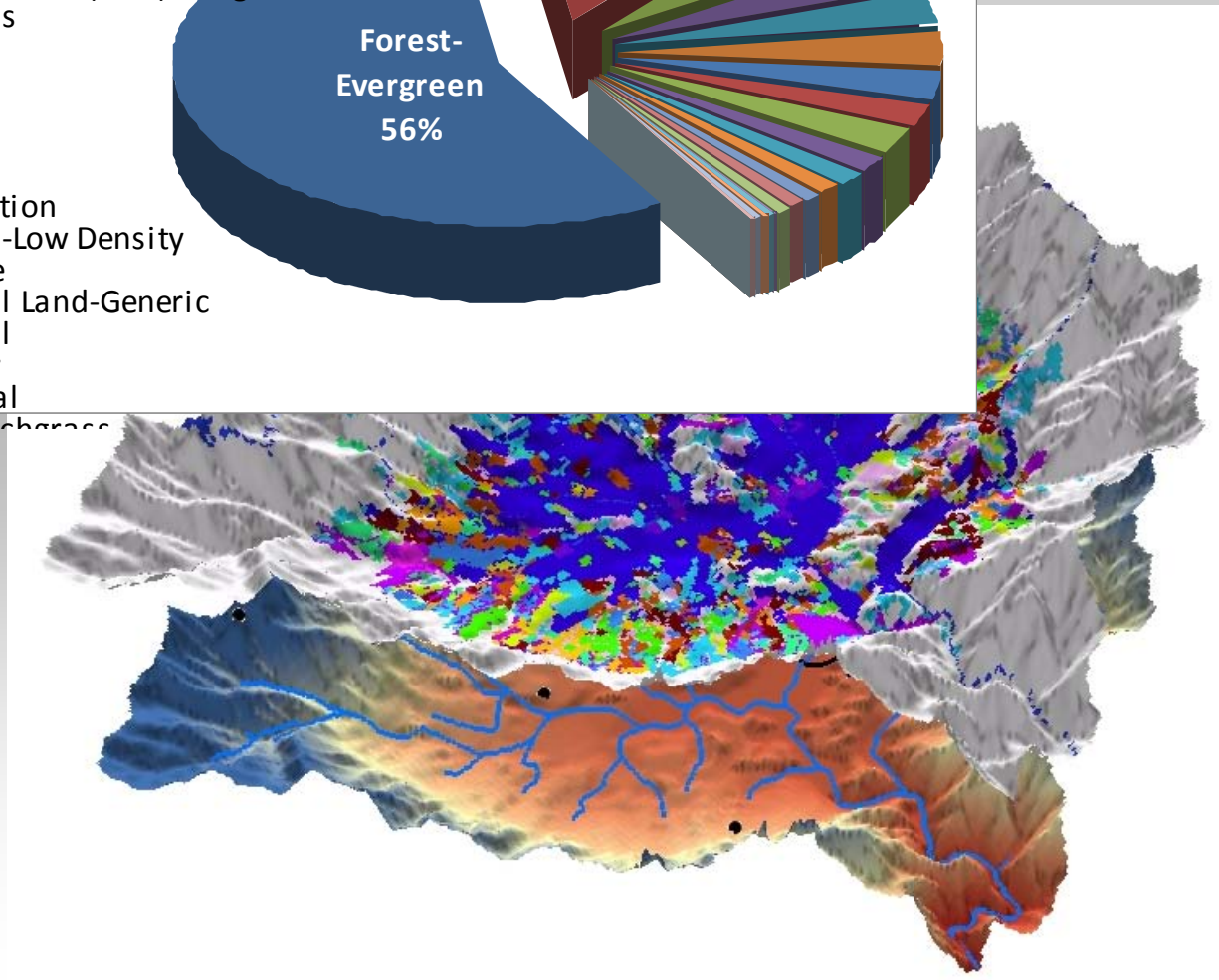
HBV-Light

Haean Catchment Topography

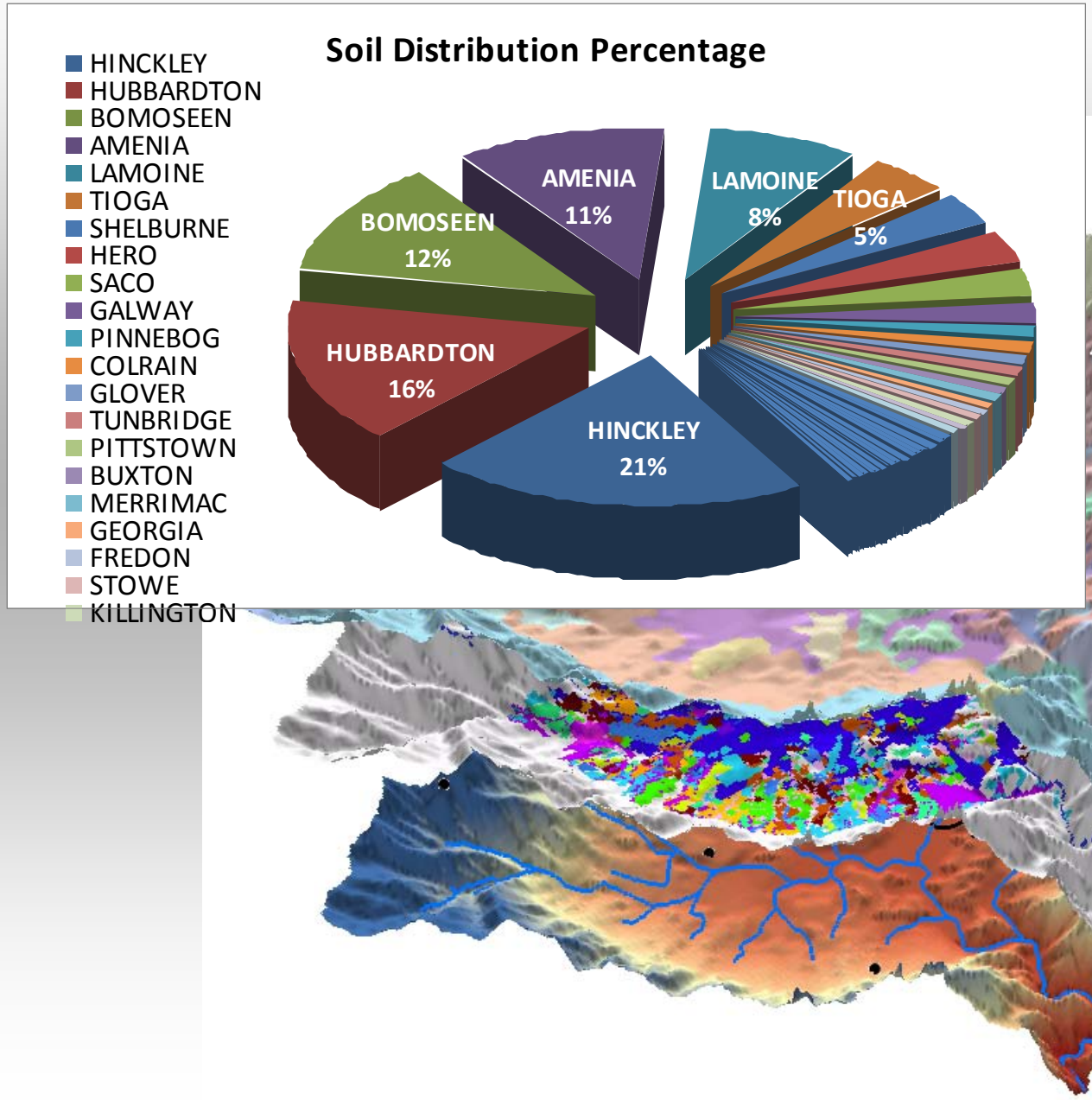


Land Use / Crop Identification

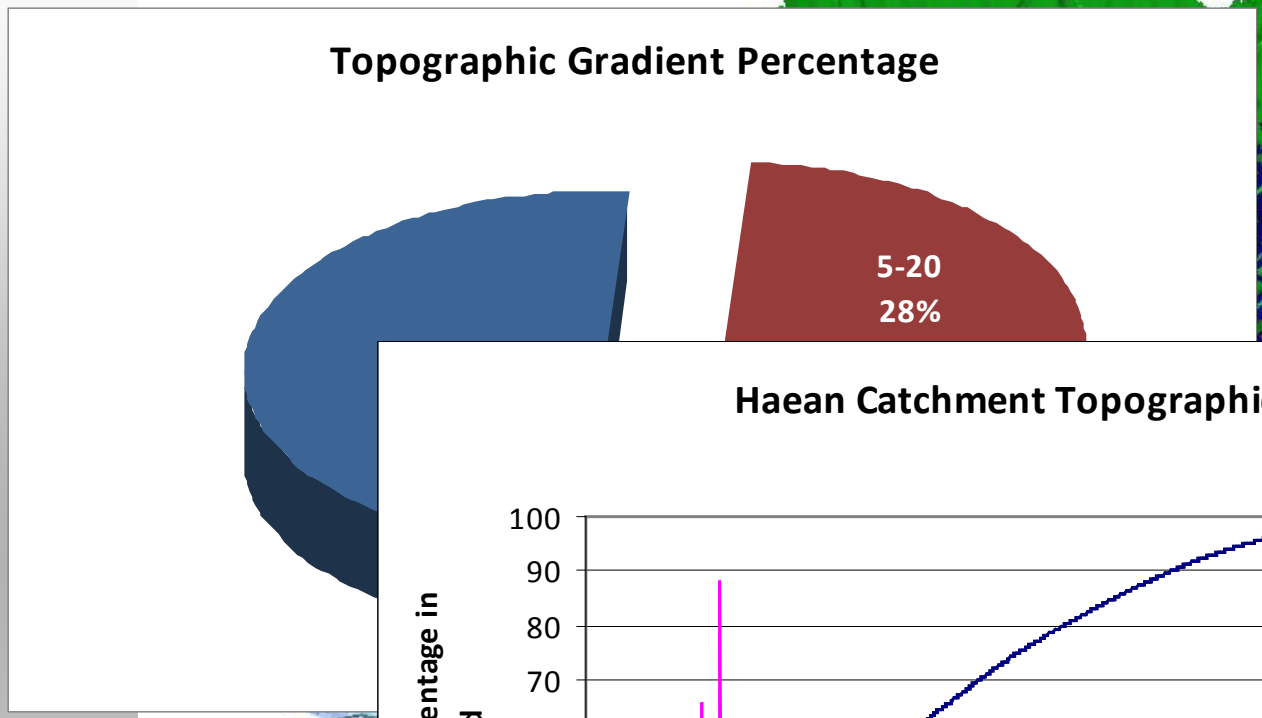


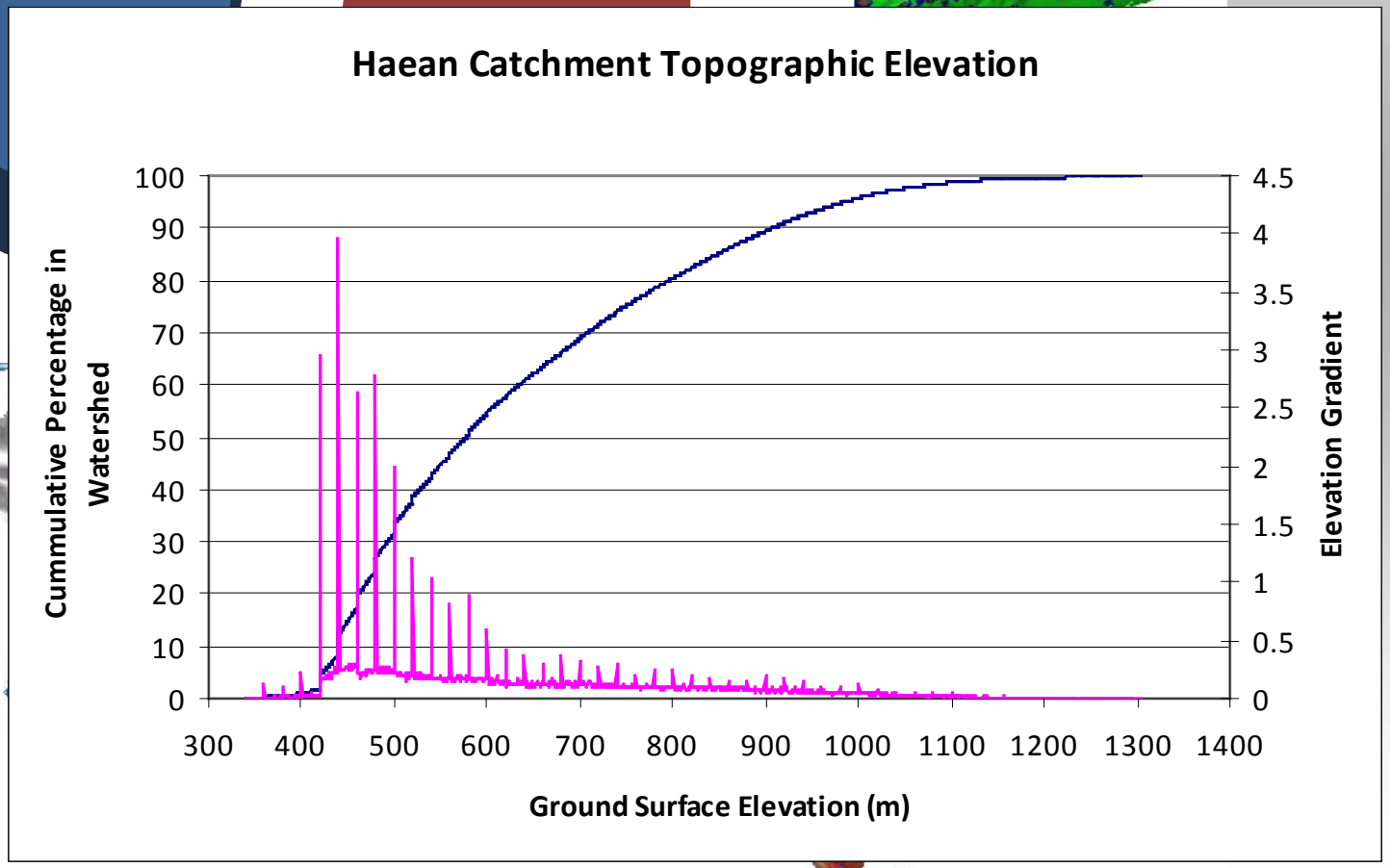


Surficial Soil Distribution

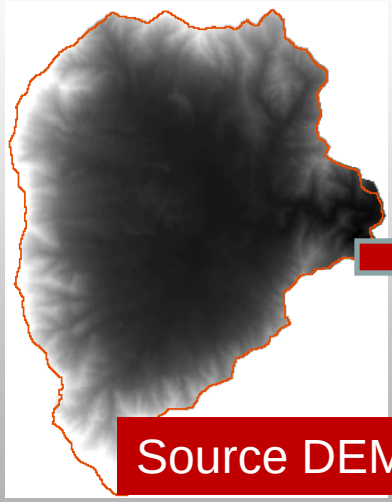


Topographic Slope Classification

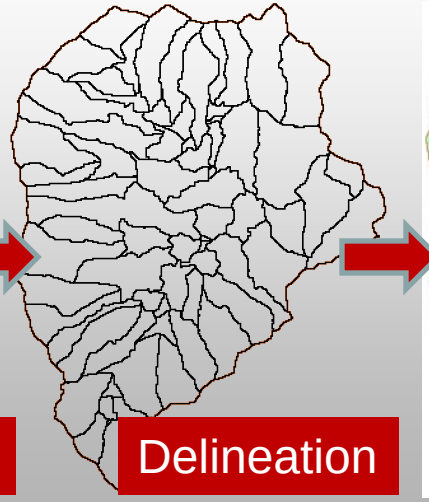




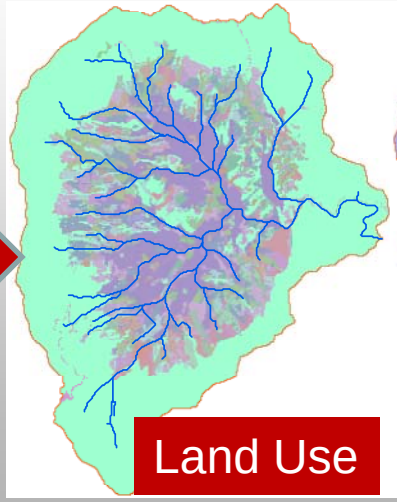
Soil and Water Assessment Tool – SWAT2005



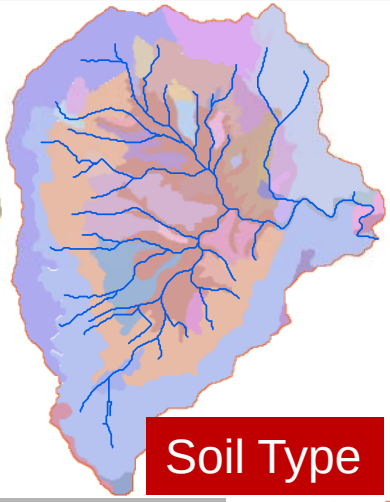
Source DEM



Delineation



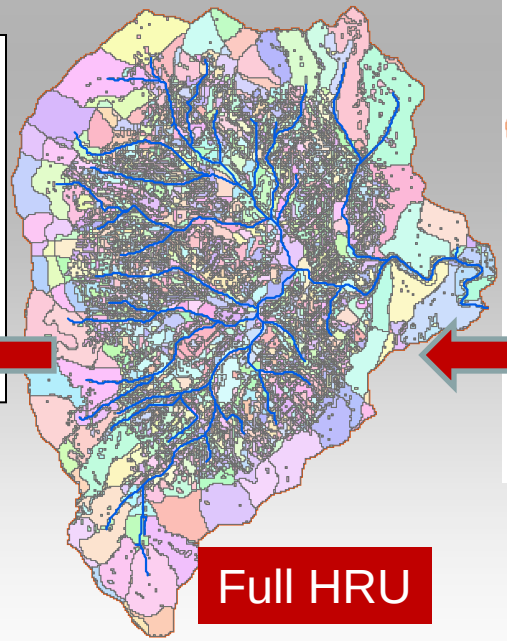
Land Use



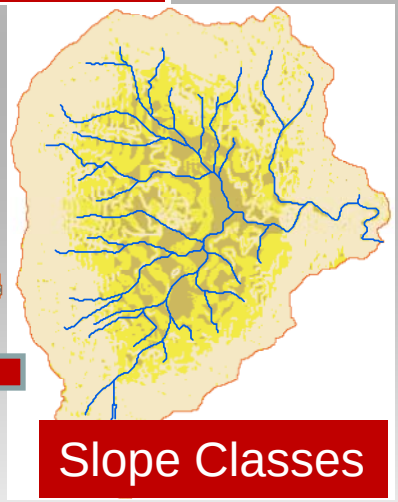
Soil Type

meteorology, WQ,
nutrient conc.,
pesticides,
plant growth,
fertilizers, tillage,
management, etc.

Calibration/
Validation



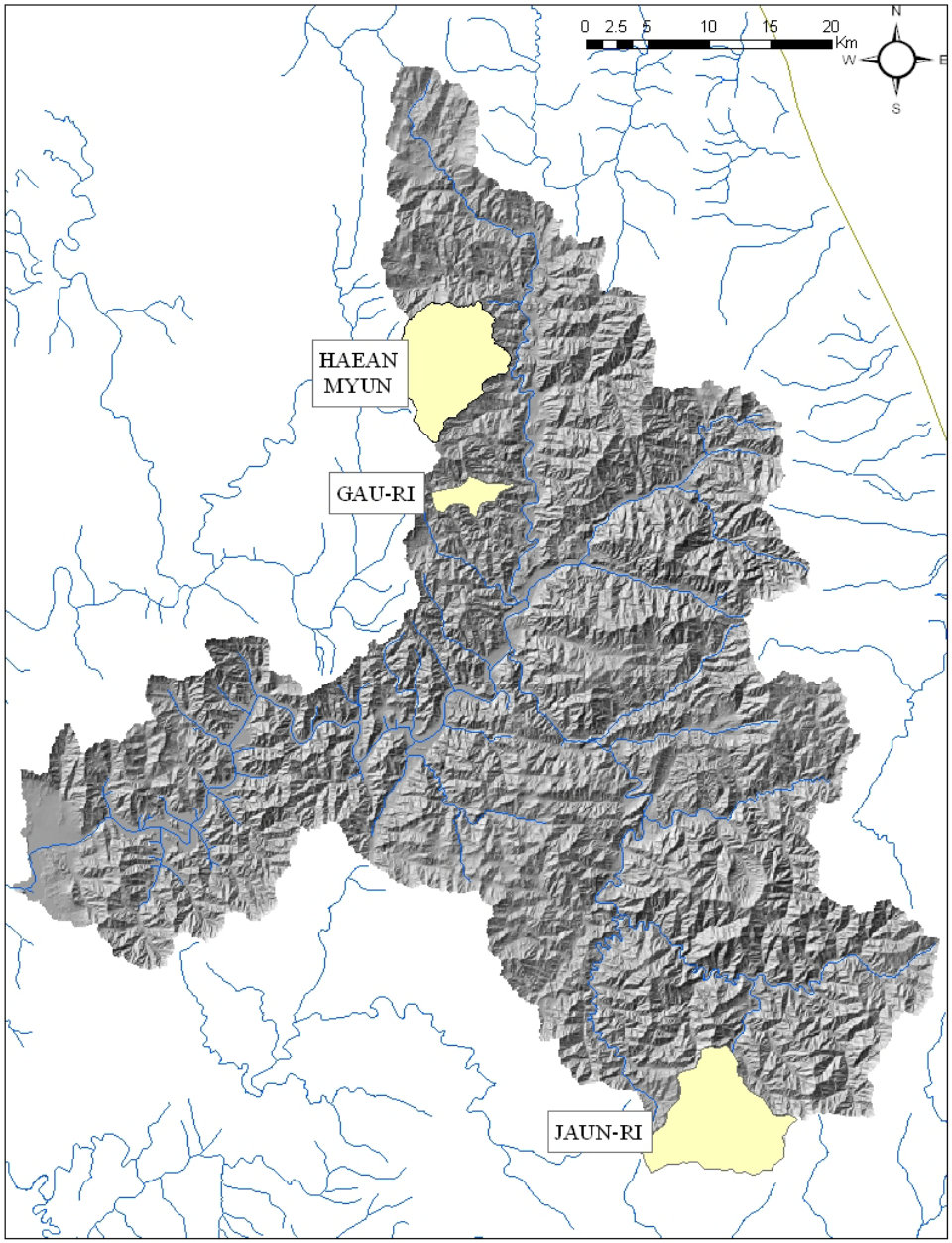
Full HRU



Slope Classes

RESULTS
Flow, Sediment,
Water Quality

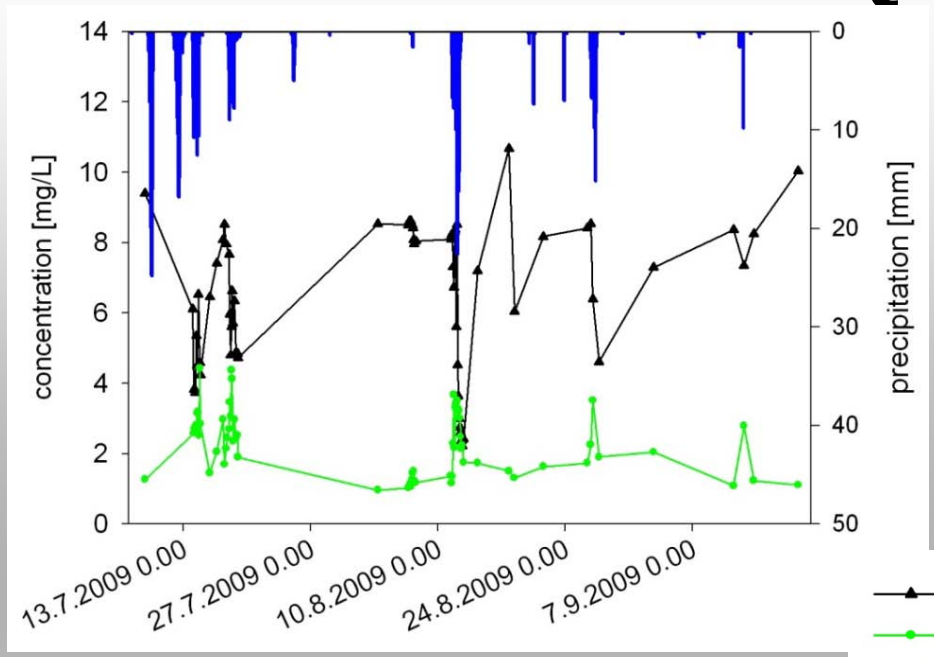
Major Sediment Input in Soyang Watershed

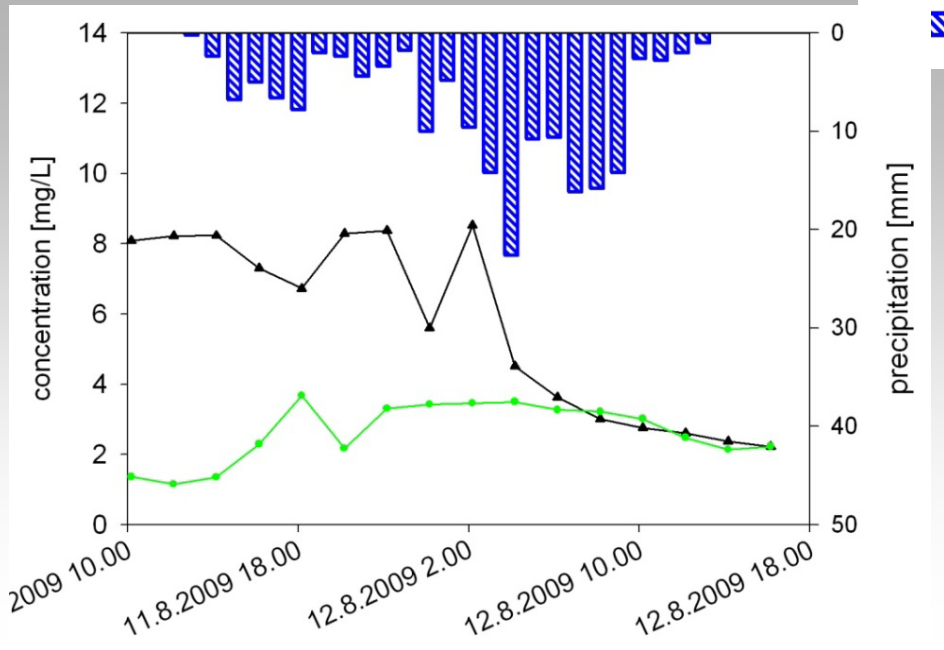


Location	Sediment Load (ton ha^{-1})
Gau-ri	55.3
Haean-Myun	39.2
Jaun-ri	23.6

Gwang-Sam Kim, 2010

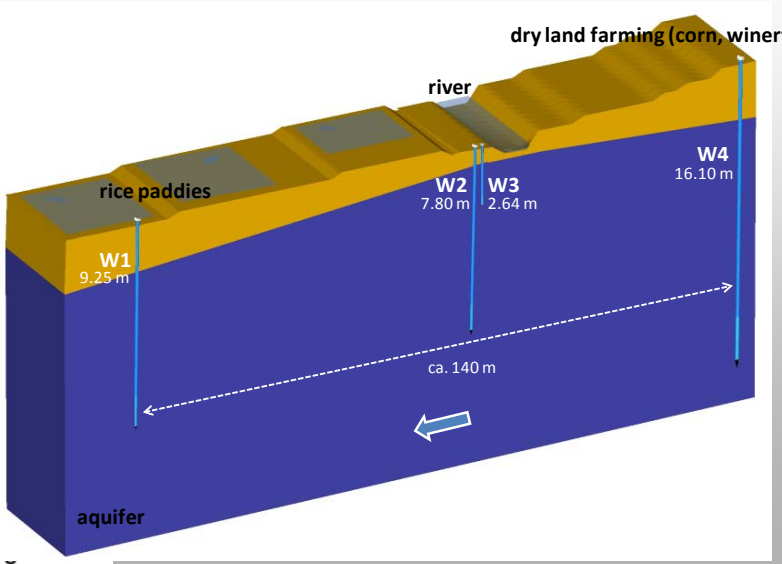
Surface Water Quality Responses

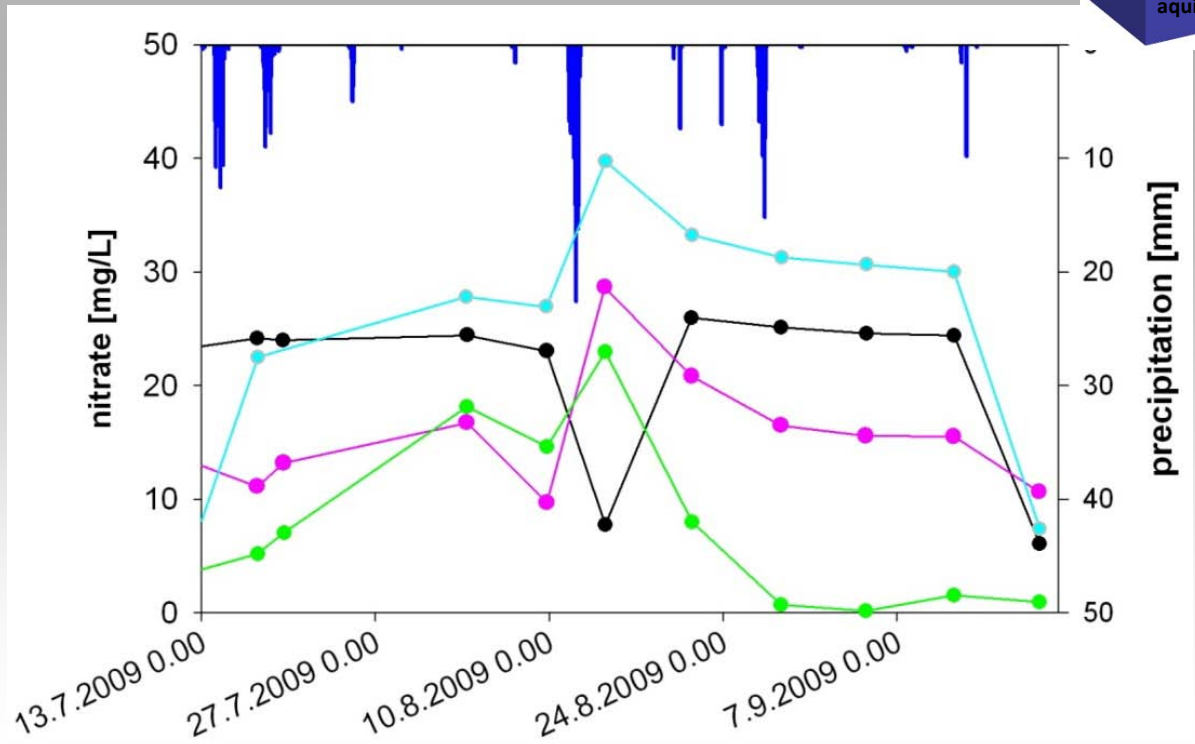




nitrate
DOC
rainfall

Groundwater Water Quality





Conclusions

- Lots of rain focused over a few months. Values of over 80 mm /hr, 250 mm/event 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?