



Evaluating the Environmental Efficiency of Dryland Farms and the Haean Catchment with SWAT Model



University of Bayreuth



Ganga Ram Maharjan¹, Trung Thanh Nguyen¹, Chris Shope² and John Tenhunen¹

¹BayCEER UBT, ²U.S. Geological Survey, Salt Lake City

Contact: mhjgaram@gmail.com

1. Introduction

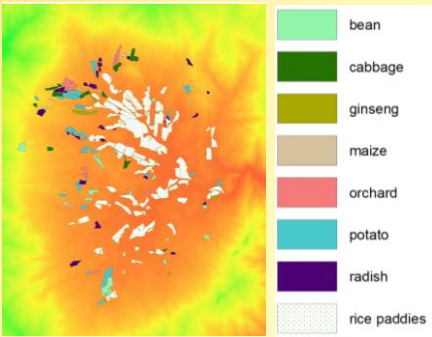
The clearing of forests and agricultural intensification can lead to serious water quality deterioration at local and regional scales due to increased nonpoint source pollution to rivers and streams. In the Soyang Watershed, especially the Haean and Jawoon Catchments export large amounts of nutrients due to excess fertilization and sediments during monsoon rains. The model SWAT (Soil Water Assessment Tool) will be used to quantify these exports and their spatially distributed contributions.

The objectives of this study are:

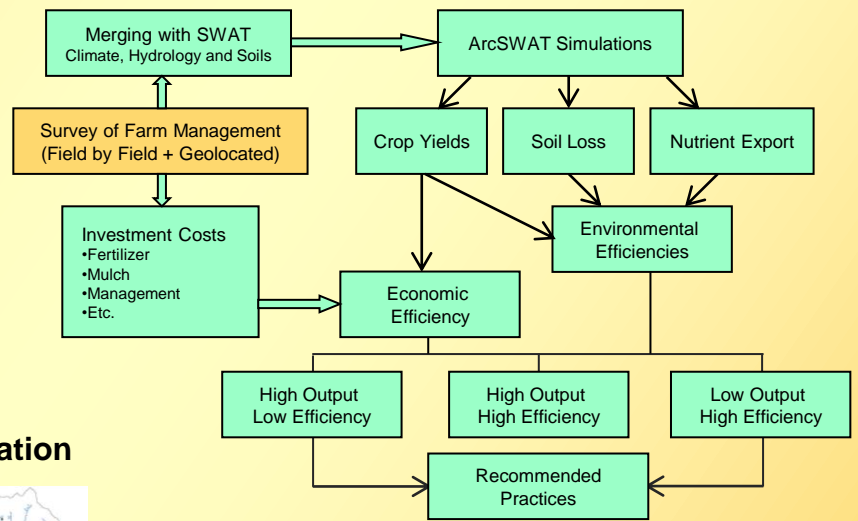
- To evaluate the environmental efficiency of the predominantly agricultural Haean Catchment (agricultural yields vs. environmental impacts on water quality) as influenced by climate, land use and agricultural management.
- To evaluate the environmental efficiency of individual farms that have been studied in the Haean Catchment as determined by topographic location, crops planted, and imposed management.
- To generalize results and recommend potential best farm management methods from the standpoint of environmental efficiencies.

2. Research Approach

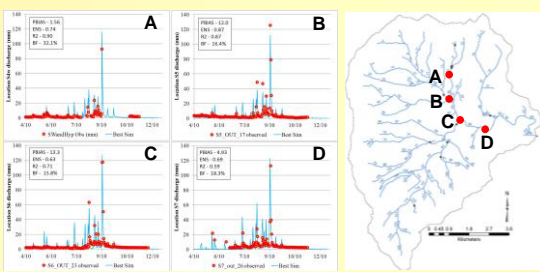
SWAT has been adapted to include strong elevation influences on climate, characteristics of the natural forest soils and properties of the manipulated soils in dryland fields. Cohort 1 studies on farm economics allowed the geolocation of specific farms, where management measures, investments, and profits are known. Based on 2009/2010 observed land use, monitored climate and defined management practices, yields, soil loss, and nutrient export from individual farms will be estimated. Thus, farms in different slope positions can be evaluated in terms of environmental efficiency, leading to new recommendations in farming practices. Together with Dr. Thanh Nguyen, the evaluations will also be carried out in terms of economic efficiencies (see poster: *Economic Trade-offs and Optimization of Ecosystem Services in Soyang Watershed of South Korea*).



Location of farm fields with defined outputs and management.



3. Current Work on SWAT Calibration

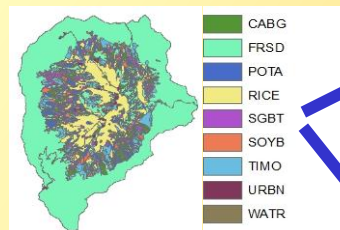


SWAT model has so far been calibrated with current land use for flow at locations throughout the catchment and with several metrics. Locations vary by drainage contribution from 1st order to the catchment outlet. The next steps are together with others to calibrate losses of sediment, N and P as well as plant production. After calibration is completed, efficiency of individual farm fields will be studied in the context of climate and land use change scenarios

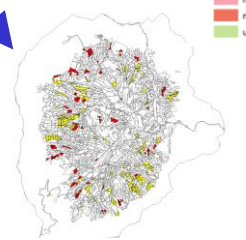
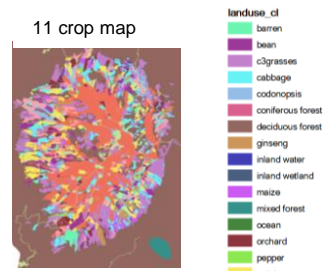
Additional Work Carried Out to Date:

Maharjan GR, Park YS, Kim NW, Shin DS, Choi JW, Hyun GW, Jeon J-H, Ok YS, Lim KJ 2012 Evaluation of SWAT sub-daily runoff estimation at small agricultural watershed in Korea. Front. Environ. Science Eng. doi:10.1007/s11783-012-0418-7

4. Land Use Scenarios



Simplified 5 crop land use map – most common crops as well as those studied intensively (cf. Lindner et al. Poster)



Expanding ginseng (yellow) and orchards (red) in 2010

Initial land use change scenarios will include parameterizing SWAT for additional crops (11 crop map) and studying the ongoing change to expanded planting of ginseng and orchards to control soil erosion.