Biofuel Feedstocks

A Decision Support Tool for Water Management on Sugarcane Fields

Background

Hawaiian Commercial & Sugarcane Company (HC&S) consumes 270 million gallons of water every day on its 35,000 acres plantation, with 71% of irrigation water originating from rainforests via 76 miles of ditches and tunnels while the remaining 29% is supplemental ground water. *It has been recognized that the availability of water is the most critical variable that affects sustainability of Maui's sugar production.*
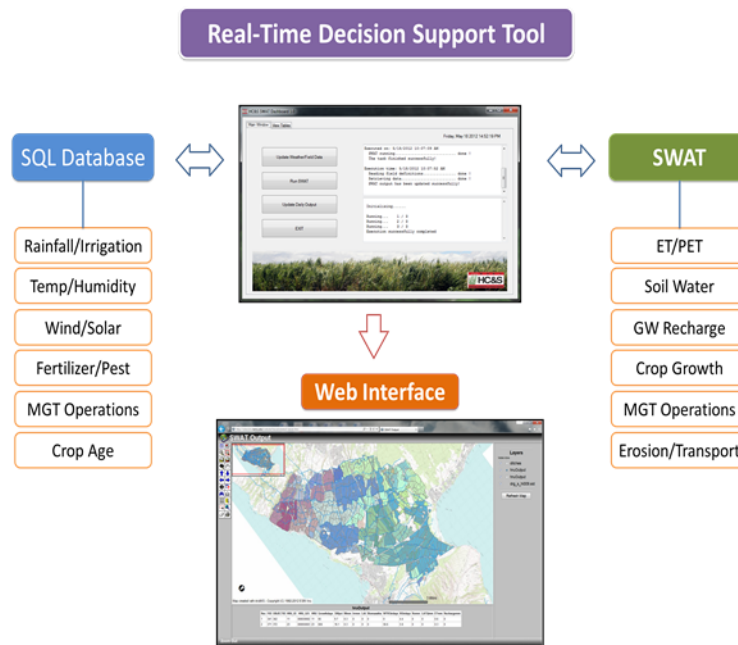
Objective

The overall objective of the project is to develop a decision support system to determine the feasibility of biofuel production and sustainability on the HC&S sugarcane lands in Maui, Hawaii.

SWAT model

SWAT (Soil and Water Assessment Tool) is a river basin, or watershed, scale model developed to quantify and predict the impacts of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds with varying soils, land use, and management conditions over long periods of time.

Modeling Components

- Hydrologic Balance
- Nitrogen and Phosphorous Cycles
- Pesticide Dynamics
- Plant Growth
- Management Options
  - Tillage
  - Planting/Harvesting
  - Fertilization
- Pathogens
- Carbon Dynamics
- Channel Processes
- Ponds and Reservoirs

Real-Time Decision Support Tool

SQL Database

- Rainfall/Irrigation
- Temp/Humidity
- Wind/Solar
- Fertilizer/Pest
- MGT Operations
- Crop Age

SWAT

- ET/PET
- Soil Water
- GW Recharge
- Crop Growth
- MGT Operations
- Erosion/Transport

Web Interface

Impacts

Phase I: Smarter Irrigation Management

- Use SWAT to model current moisture condition of sugarcane fields by simulating the complete water cycle including irrigation, root uptake, and groundwater recharge
- Modify SWAT to semi-real time mode for day-to-day operations feeding on an onsite relational database
- Support HC&S's irrigation management decisions using a Web-based application and visualization service

Phase II: Island Scale Assessment

- Develop and analyze island-wide scenarios related to the impact of bioenergy feedstock development
- Conduct environmental risk assessment for alternative biofuel feedstock production
- Assess the sustainability of the agricultural system on the island under impact of various scenarios of water availability and climate change
- Explore the applicability of SWAT on other islands and countries in the Pacific Basin, and the mainland U.S.

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