Incorporating nutrient flow into overland flow and groundwater models to better predict ecological response across large scales

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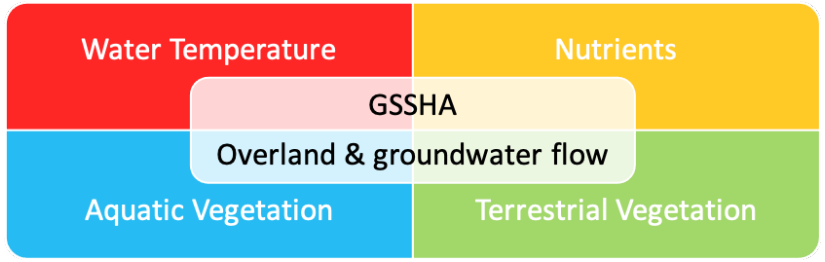
Problem Statement

Current models cannot simulate nutrient flow across watershed scales, which prevents accurate prediction of how native and nuisance species will spatially distribute themselves across a landscape. Objective: Incorporate nutrient flow into the Gridded Surface Sub-surface Hydrologic Analysis (GSSHA) model and couple the nutrient model with ERDC's multi-species vegetation model.

Technical Approach

Phase I. Water quality simulation capabilities (**GSSHA-WQ**)



- Complete/extend existing water temperature simulation capabilities in GSSHA for overland flow (runoff) & streams
  - Temperature controls water quality kinetics rates
- Link in-stream nutrient kinetics with GSSHA
  - Nutrient Simulation Module (NSM) provides kinetics
- Develop overland and sub-surface nutrient models

Technical Approach Cont'd

Phase II. Integrated nutrient & vegetation simulation capabilities

- Link the GSSHA-WQ with ERDC's multi-species vegetation model for aquatic plants
- Link the GSSHA-WQ with ERDC's multi-species vegetation model for terrestrial plants

Schedule

- Award contracts; initiate water temperature & nutrient simulation capability development, Q4/FY20
- Complete water temperature development, Q1/FY21
  - Deliverables: model and technical note
- Develop nutrient simulation capabilities, Q4/FY21
  - Deliverables: GSSHA-WQ model (model, visualization, user interface, and database) & 4 technical notes
- Link GSSHA-WQ with aquatic plants model, Q4/FY22
  - Deliverables: Integrated model & 4 technical notes
- Link GSSHA-WQ with terrestrial plants model, Q4/FY23
  - Deliverables: Final integrated nutrient-vegetation model & 4 technical notes

ANSRP Ecological Modeling Congressional Interest

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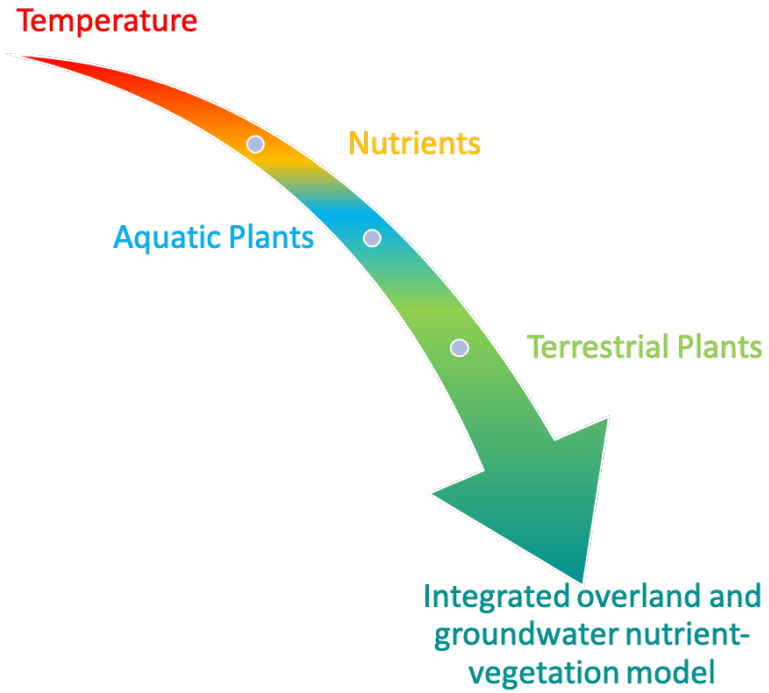

Value statement for USACE operations

Integrating nutrient flow with multi-species vegetation models will enable accurate simulation of native and nuisance species distribution across watersheds.

Deliverables by Year

- FY20: Contracts awarded, WQ development initiated
- FY21: GSSHA-WQ model capable of simulating overland and stream water temperature and nutrient flow; 4 technical notes
- FY22: GSSHA-WQ linked with aquatic plants model; 4 technical notes
- FY23: GSSHA-WQ linked with terrestrial plants model; final product; 4 technical notes

	Qtr1	Qtr2	Qtr3	Qtr4
FY20	0	25	125	150
FY21	75	75	75	75
FY22	75	75	75	75

Forecasting Project Hurdles

- Data exchange between models
- Observed data for calibration/validation (flow, water quality, and vegetation)
  - Use existing data, but may require travel in FY22-23