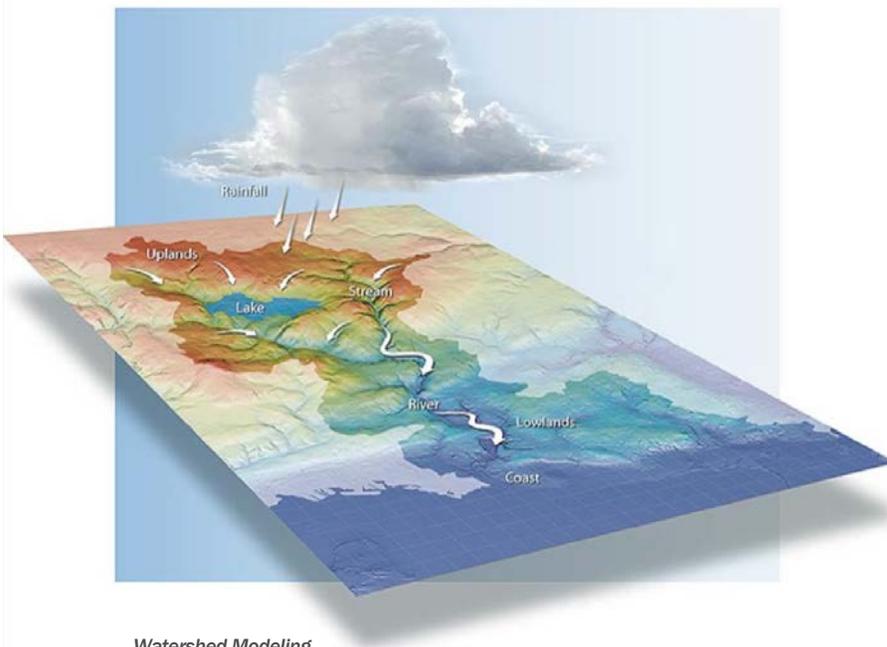


Water Sustainability Assessment for Energy Production

Life Cycle Water Footprint and Watershed Modeling



Watershed Modeling

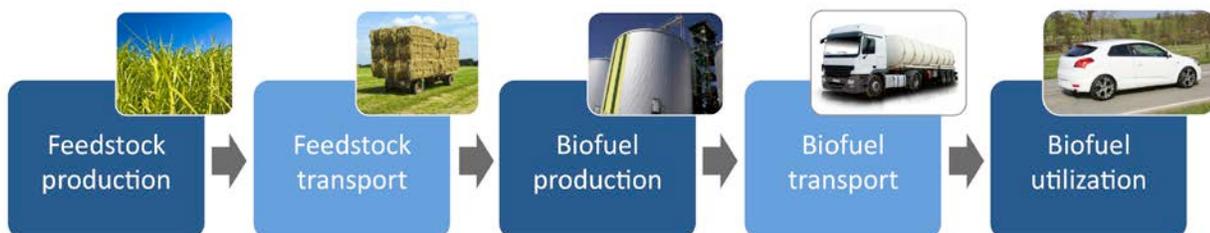
Water use and chemical release are two key issues associated with water sustainability for energy development. Agriculture and power generation account for more than 80% of the total water withdrawal in the U.S. Historically, agriculture plays a major role in contributing to an increase in nutrient loading in the watershed and accumulations downstream. Increased energy production would increase water demand and potentially accelerate the impact on water quality.

Goal

Argonne is conducting analysis to quantify relationships between energy production and the water quality and water resource availability needed to demonstrate long-term sustainability of the energy sector. Our goal is to provide consistent and defensible analysis to identify region-specific future production scenarios that are able to meet increased energy demand while maintaining water sustainability.

Approach

Argonne is developing an analytical framework to account for the *freshwater footprint* of fuel pathways that is tied to various feedstock and to examine the impacts of increased production on water quality as assessed at a regional scale. This framework would allow analyses of production technology, water type, fuel source, and estimated water consumption for a projected production target. For decision makers, the tools developed through this project will enable them to make a quick estimate of regional water use for fuel feedstock planning and fuel processing facility siting.



Biofuel Water Footprint Assessment

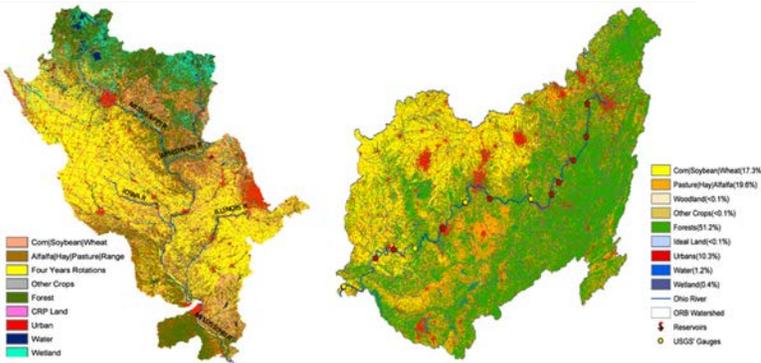




Water Quality Assessment for Large-Scale Biofuel Feedstock Production in the Mississippi River Basin

Argonne is developing quantitative relationships between increased biofuel production through land conversion and water quality and water resource availability at a river basin scale by employing a geospatial watershed model (SWAT). This task develops a suite of SWAT model applications for the tributary river basins in the greater Mississippi River Basin, from which an estimate of the impacts on water resource and water quality in the Gulf of Mexico can be developed. Argonne's work includes:

- Developing the SWAT applications for the Mississippi River Basin by implementing biofuel feedstock-specific requirements for model parameterization through a rigorous process
- Examining the impact of the projected Billion-ton biomass production (DOE 2011) on water resource and water quality with geospatial distribution
- Evaluating the impacts of climate change and competing water use from the growth of multiple competing sectors



Upper Mississippi River Basin

Ohio River Basin

Water Footprint Accounting for Biofuels and Emerging Fuels

Argonne is developing a life-cycle water-use assessment for biofuels, electricity, and other fuels for the entire U.S. at the county scale. This would allow analyses of production technology, water type, fuel source, and estimated water withdrawal and consumption for projected production targets in the future. Argonne's work includes:

- Assessing life cycle water footprint for ethanol (from corn, stover, switchgrass, and miscanthus) and biodiesel (from soybean and algae) to provide a quantitative estimate of blue^a water, green^b water, and grey^c water use with spatial distribution at national, regional, state, and county scale
- Developing an interactive water life cycle tool that equipped with mapping capability for scenario development and analysis by stake holders, policy makers, and researchers
- Estimating blue water use in the major life cycle stages of conventional and non-conventional petroleum gasoline, geothermal energy, shale gas, and electricity generated from various fossil and renewable energy sources

- blue water – surface and ground water can be withdrawn for irrigation and other human use
- green water – soil moisture formed by rain fall and available for plant uptake
- grey water – volume equivalent water required to dilute pollutants load down to meet ambient water quality standard

