BASING POLICY ON SOUND SCIENCE
USING HUMAN BEHAVIOR MODELS COUPLED WITH PHYSICALLY-BASED MODELS

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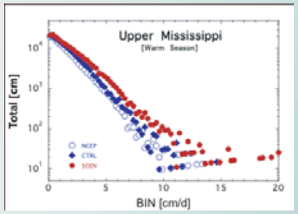
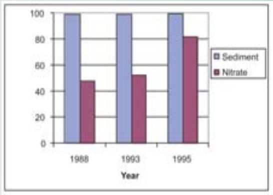
Models help us link *human behavior* with changes in *natural environments* and serve as guides for shaping *public policy*.

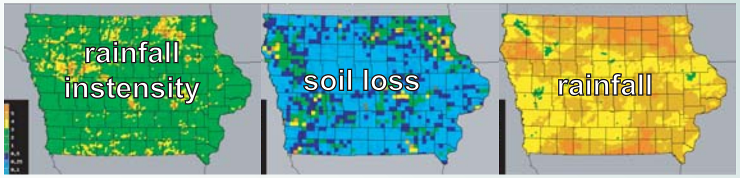
Future scenario climate **(red)** for the Upper Mississippi River Basin has substantially more high-intensity precipitation events compared to present regional climate simulated either from a global model **(blue diamonds)** or observations **(open circles)**.



Riparian buffer zones can be used to protect streams and rivers from sediment and nitrate outflows from agriculture land. Using the Hill-slope scheme of SWAT for an experimental watershed with 50% corn and 50% switchgrass, we calculated a significant reduction in nitrate and sediment. Coupling this scheme with future climate simulated by global and regional climate models will allow us to evaluate water quality scenarios of streams under different land use conditions and different future scenario climates.



The water erosion prediction project model, WEPP, estimates soil erosion based on land management, soil properties, and rainfall characteristics, intensity being the most critical rainfall parameter. Increasing intensity will increase soil loss, which is already 10 to 50 times greater than soil renewal rates in many locations.



Regional Climate
MODEL INPUTS:
regional climate information
land management choices
land use

Biophysical Crop
MODEL INPUTS:
analyzed weather
crop type
soil type

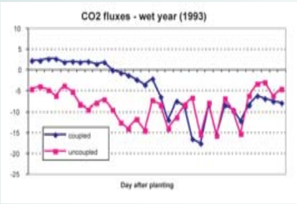
Global Climate Change
MODEL INPUTS:
greenhouse gasses
land uses

Water Quality
MODEL INPUTS:
land management
soil properties
slope length and gradient
break point precipitation.

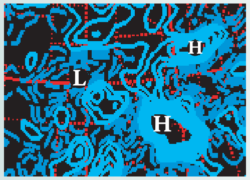
Economic Analysis
MODEL INPUTS:
climate change
government policy
commodity prices.

Butterfly species composition within montane meadows arrayed a long a hydrological gradient in the Greater Yellowstone Ecosystem can be indirectly assessed by the Normalized Difference Vegetation Index, a measure of vegetation biomass and water content. Our results imply that butterfly communities in wet meadows may be most responsive to environmental changes such as drought. Regional and global climate models can be used to project ecological impacts of climate change on highly sensitive montane ecosystems.

Coupling of a crop model interactively into a climate model produces more accurate estimates of CO_2 fluxes from the surface. Uncoupled models over-predict CO2 loss from the surface, particularly in the early part of the growing season.

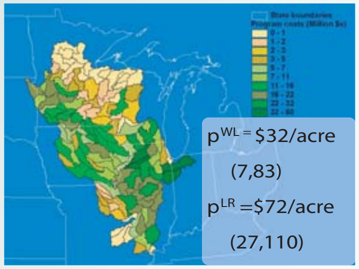


Coupling a crop model to a climate model reveals the importance of crops on moistening the atmosphere and changing precipitation patterns. Differences in precipitation between coupled and uncoupled models give more rain (**H**) in some areas and less rain (**L**) in others.



Economic models are fit from observed data on economic choices, drawing from numerous data sources. The estimated models are used in the simulation system to predict changes in land use and farming practices from changes in prices, government policy, weather, and other external factors so that economic responses are fully integrated into the modeling system.

Predicted Program Costs: $1.4 Billion



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