WaSSI: Modeling Impacts of Global Change on Ecosystem Services

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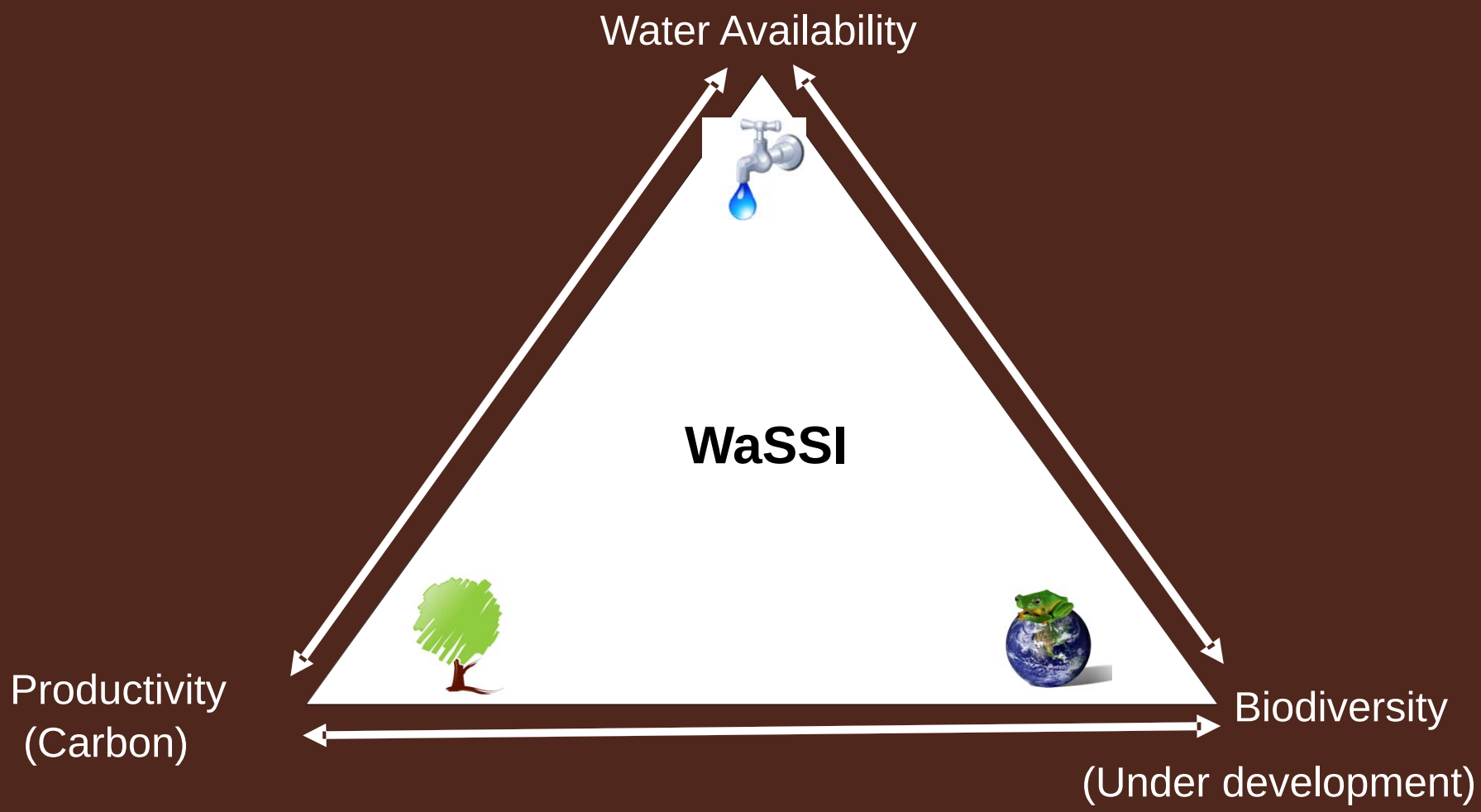
Key Issues for climate change

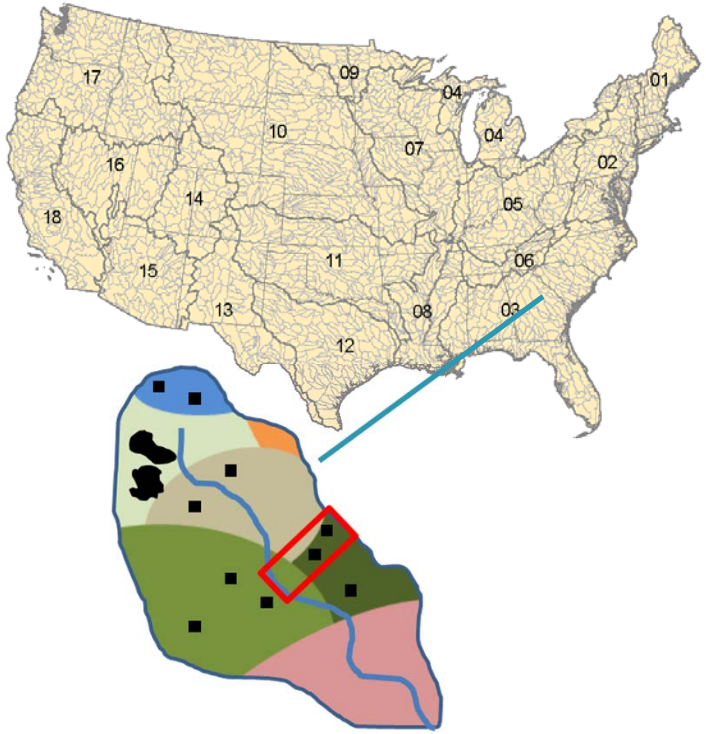
- Adaptation
  - Options for increasing water availability
- Mitigation
  - Opportunities to increase carbon sequestration
- Tradeoffs between managing for water or for carbon

WaSSI Ecosystem Services Model



Watershed and Land Cover Based

8-digit HUC Watersheds of the U.S.



Water

ET=f(PET, PPT, LAI, SM)

Sun et al., Ecohydrology,2011

$Q_{out} = Q_{in} + Q_{gen} - WU$

Caldwell et al., HESS, 2012

Carbon

NEE=f(ET)

Sun et al., JGR, 2011

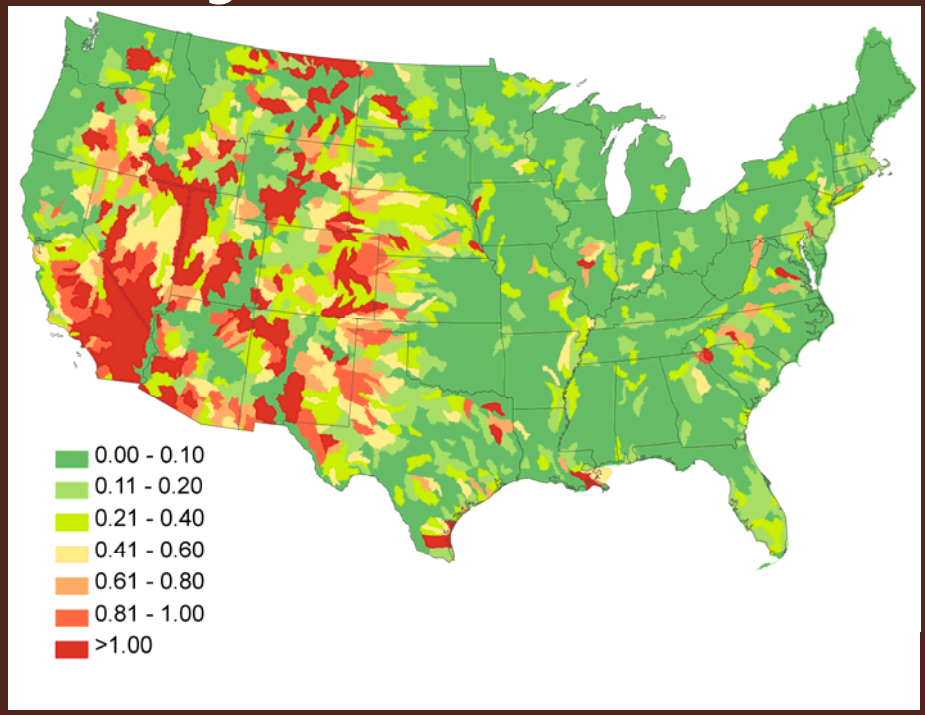
Water Supply Stress Index (WaSSI)

$$\text{WaSSI} = \frac{\text{Demand}}{\text{Supply}}$$

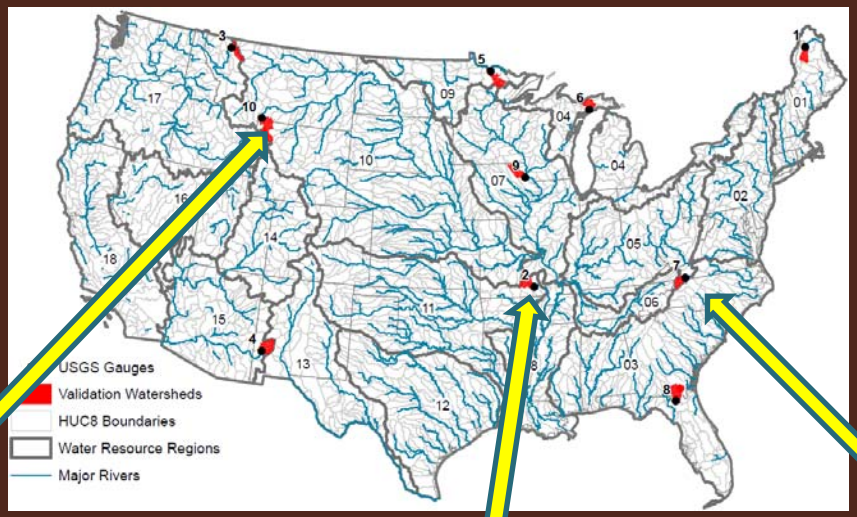
Sectors

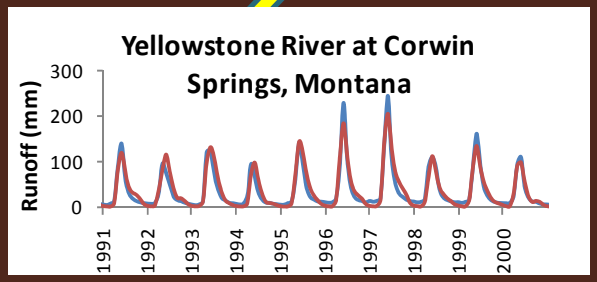
1. Domestic
2. Industrial
3. Irrigation
4. Thermopower
5. Mining
6. Livestock
7. Public Supply
8. Aquaculture

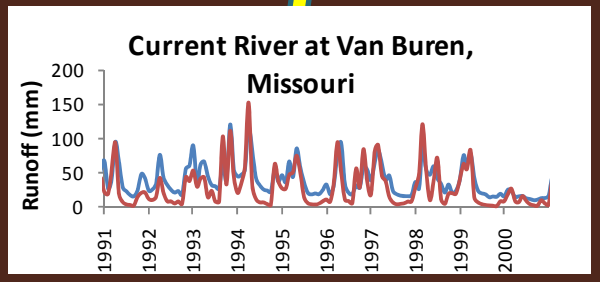
1981-2000 WaSSI

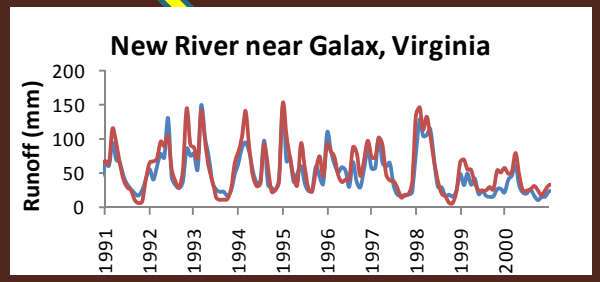


Continental scale validation (~850 km²)





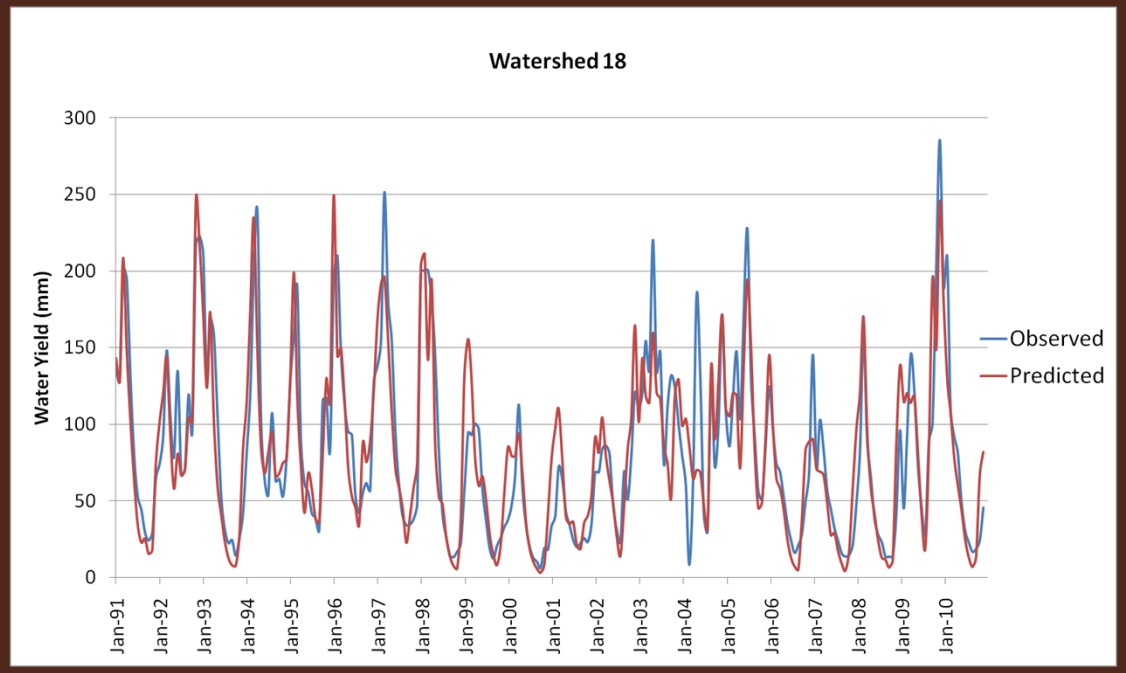


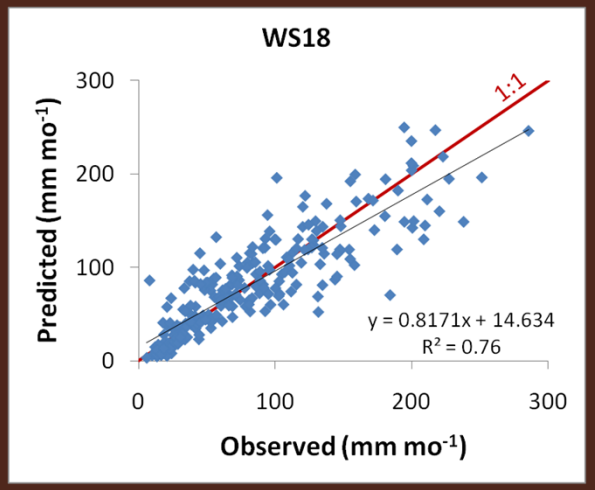


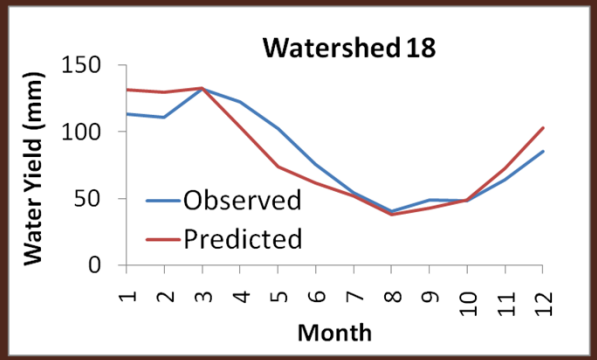
Caldwell et al., HESS, 2012,in press

Fine-scale validation (~0.1 km²)

Watershed 18, Coweeta, NC



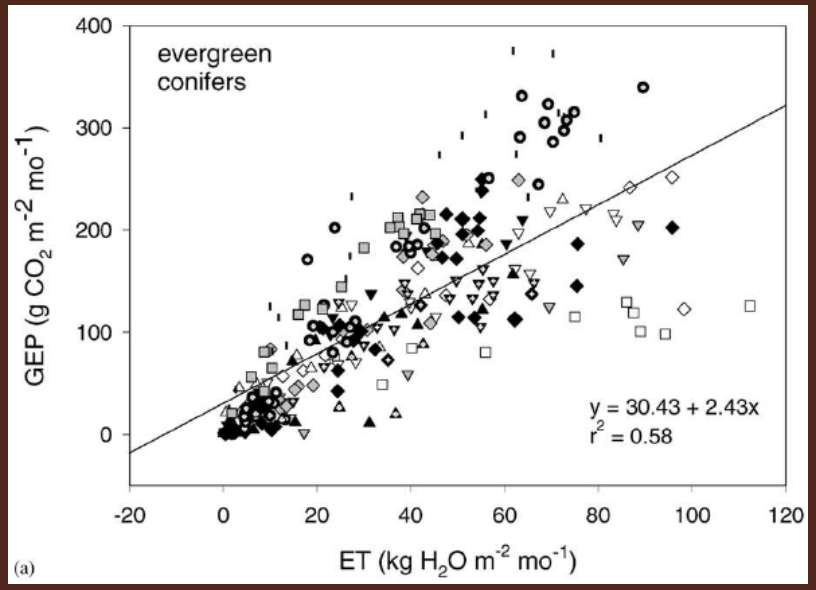




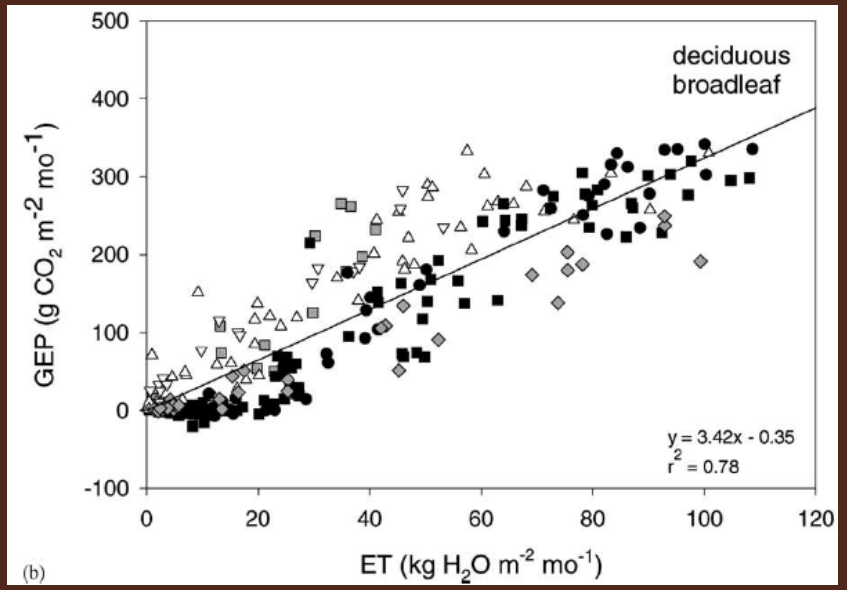
Mean Annual Bias: -6.6 mm (-0.7%)
Monthly NSE: 0.75

Carbon & Water Relationships

Evergreen Conifers



Deciduous Broadleaf



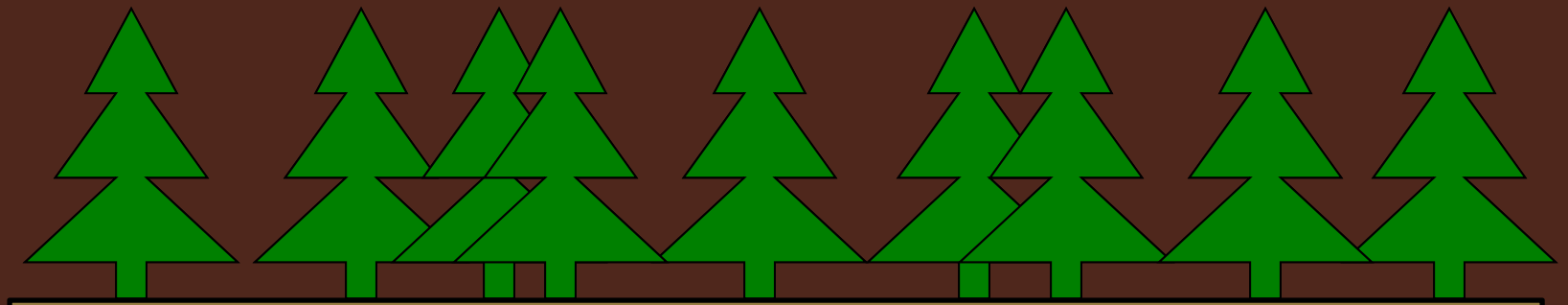
(Law et al., 2002)

Ecosystem Productivity (Carbon)

Gross
Ecosystem
Productivity

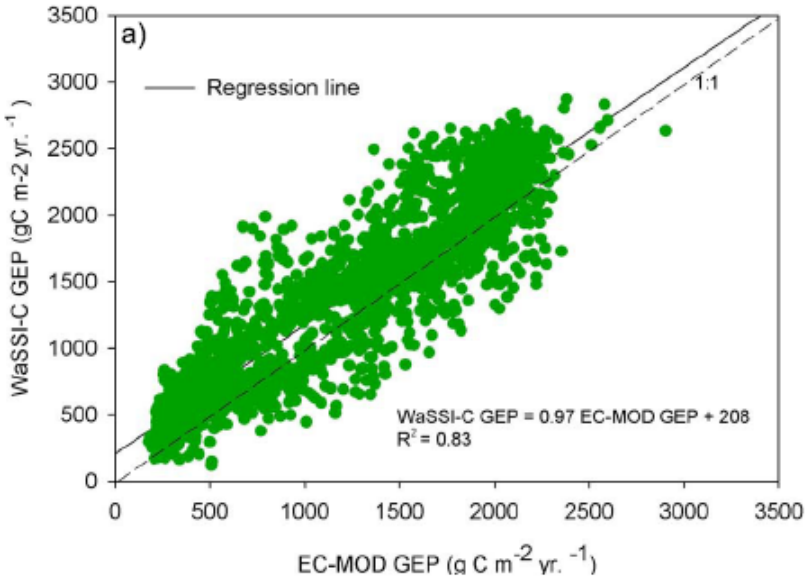
Ecosystem
Respiration

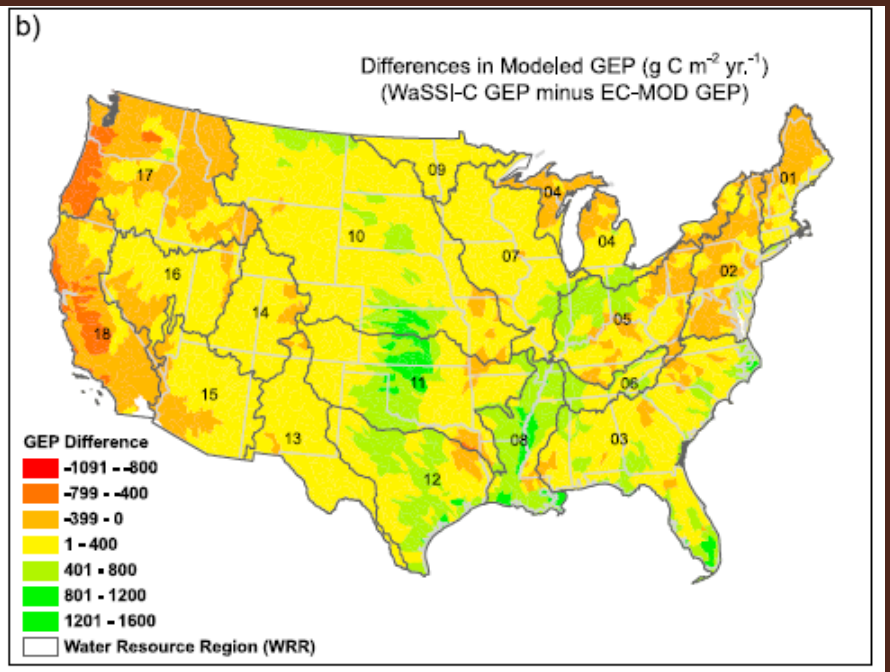
Net Ecosystem
Exchange



Sun et al., JGR, 2011

Carbon Validation





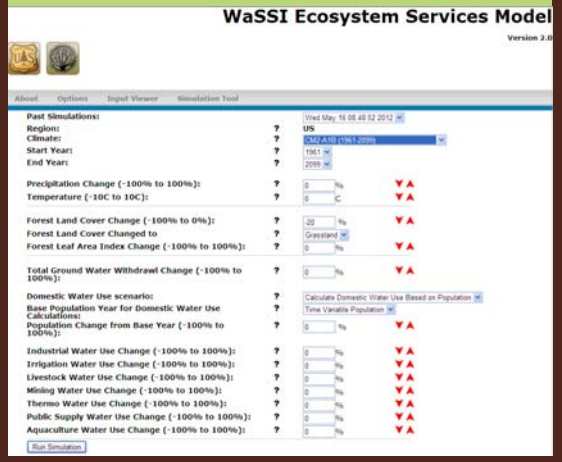
Sun et al., JGR, 2011

How WaSSI can be useful for resource management?

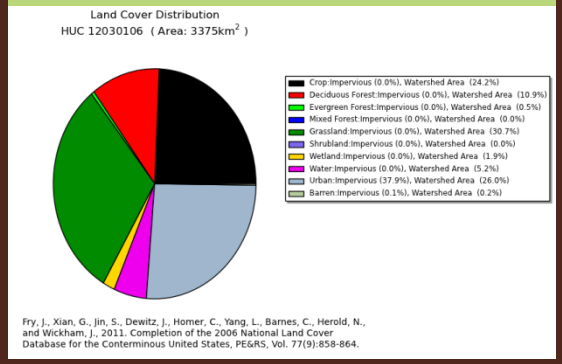
- Help answer the "So what?" questions of climate predictions
  - What effect might climate change have on magnitude and timing of water yield?
  - Carbon sequestration?
- Assess sensitivity to management options for climate change mitigation and adaptation
  - How can forest management mitigate climate change impacts on water supply?
  - What are the tradeoffs of water management with carbon sequestration?
  - What is the effect of forest land conversion to other uses on water yield and carbon?
- And many others…

www.forestthreats.org/research/tools/WaSSI

Create Scenario



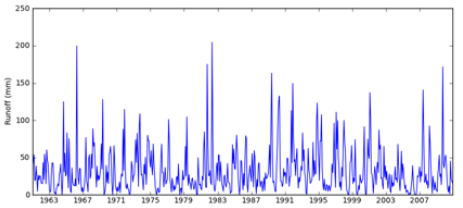
View Inputs



WaSSI Ecosystem Services Model

View Outputs

Time Series



Map View