

Assessing the Impact of Increased Cultivation of Woody Biomass for Energy Generation Purposes on Water and Matter Balances in Rural Catchments



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German BMBF-Research Programme 'Sustainable Land Management'

Global change poses an enormous challenge for policy, economy, and society (BMBF 2010).

Innovative approaches to our use of natural resources and land are needed to cope simultaneously with:

- Adaptation and mitigation of climate change
- Changing demographic structures
- Conflicts between food and energy supplies and other economic activities

19 projects supported by programme

Sustainable Development of Rural Areas through a Linking-Up of the Producers and Users of Dendromass

AIM - Sustainable production and supply of dendromass from

- **Forests**
- **Short Rotation Coppices**
- **Open Landscapes**

ACTIVITIES -

- **Production:** growing, transport, drying, compacting
- **Usage:** energy generation, industrial processes

LOCATION - Three model regions in Germany

3 Model Regions in Germany 5 Sub-Projects

≈ 80 Partners

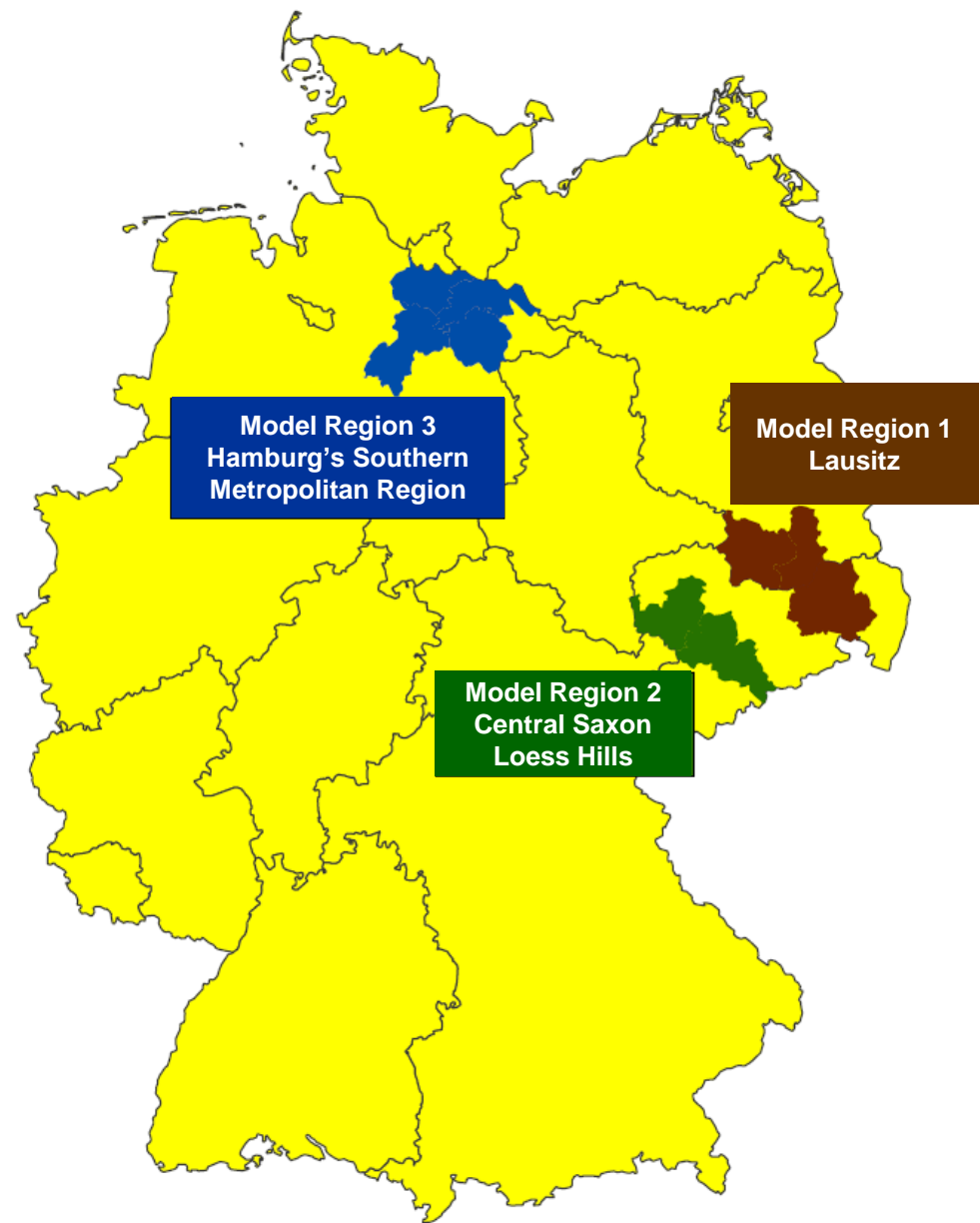
- Universities
- National research agencies
- Stakeholders
 - Farmers
 - Municipalities
 - Federal state authorities
 - Energy Suppliers
 - NGOs

Sub-Project 1:

- Nature and Resource Protection / Landscape Ecology

Work Package 1.1:

- Water and Matter Balances in the Landscape



Work Package 1.1

Water and Material Balances in the Landscape

Model based registration and assessment of soil and water related landscape functions and ecosystem services considering:

- Forests
- Short rotation woody crop (SRWC) coppices
- Woody biomass in open landscapes

Identification and assessment of potential synergies and risk for water and matter balances

Derivation of control options given by the targeted cultivation of woody biomass



Soil & Hydrological Effects of Conversion to SRWC: Field Studies

Soil Structural Properties

[Blanco-Canqui et al. 2007, Devine et al 2004, Kahle et al. 2005, Messing et al. 1997]

- Strength / stability
- Porosity
- Water retention

Soil Hydraulic Properties

[Bharati et al. 2002, Blanco-Canqui et al. 2007]

- Infiltration
- Water table

Water Quality

[Kort et al. 1998, Lee et al. 2003, Thompson and Luckman 1993]

- Sediment loads
- Nutrient loads

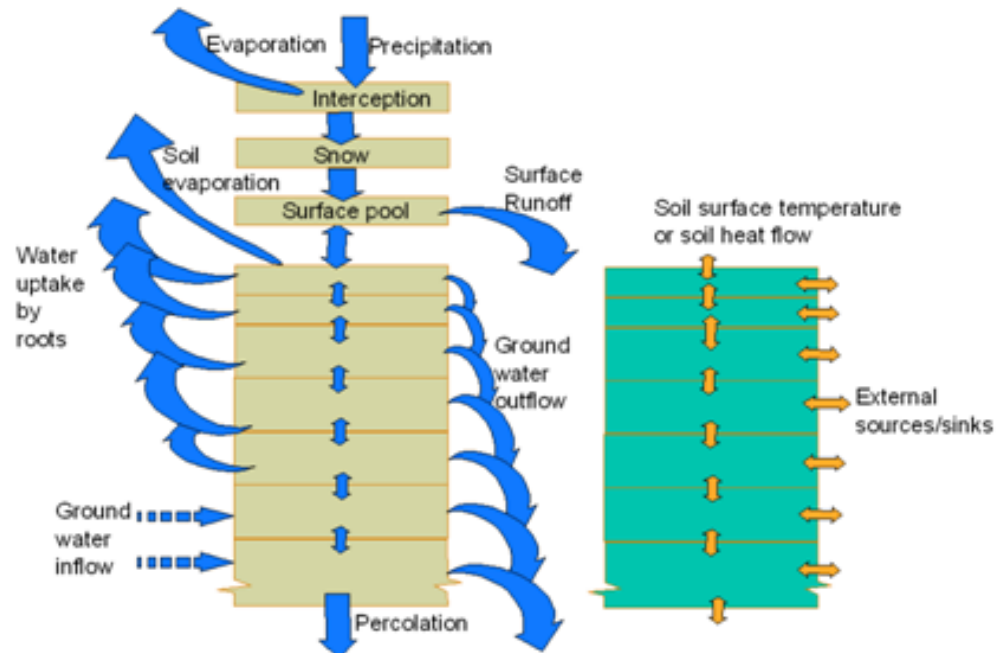
Plot Scale Assessment: CoupModel

CoupModel (Jansson & Karlberg 2004)

Physically-Based 1D-Model

Inputs:

- **Atmosphere** (*daily resolution*):
precipitation, air temperature,
radiation, air humidity, wind speed
- **Plant:**
rooting depth and density, LAI,
plant resistances, stress functions...
- **Soil:**
hydraulic properties Θ - ψ , k - ψ
(multi-layered profile)

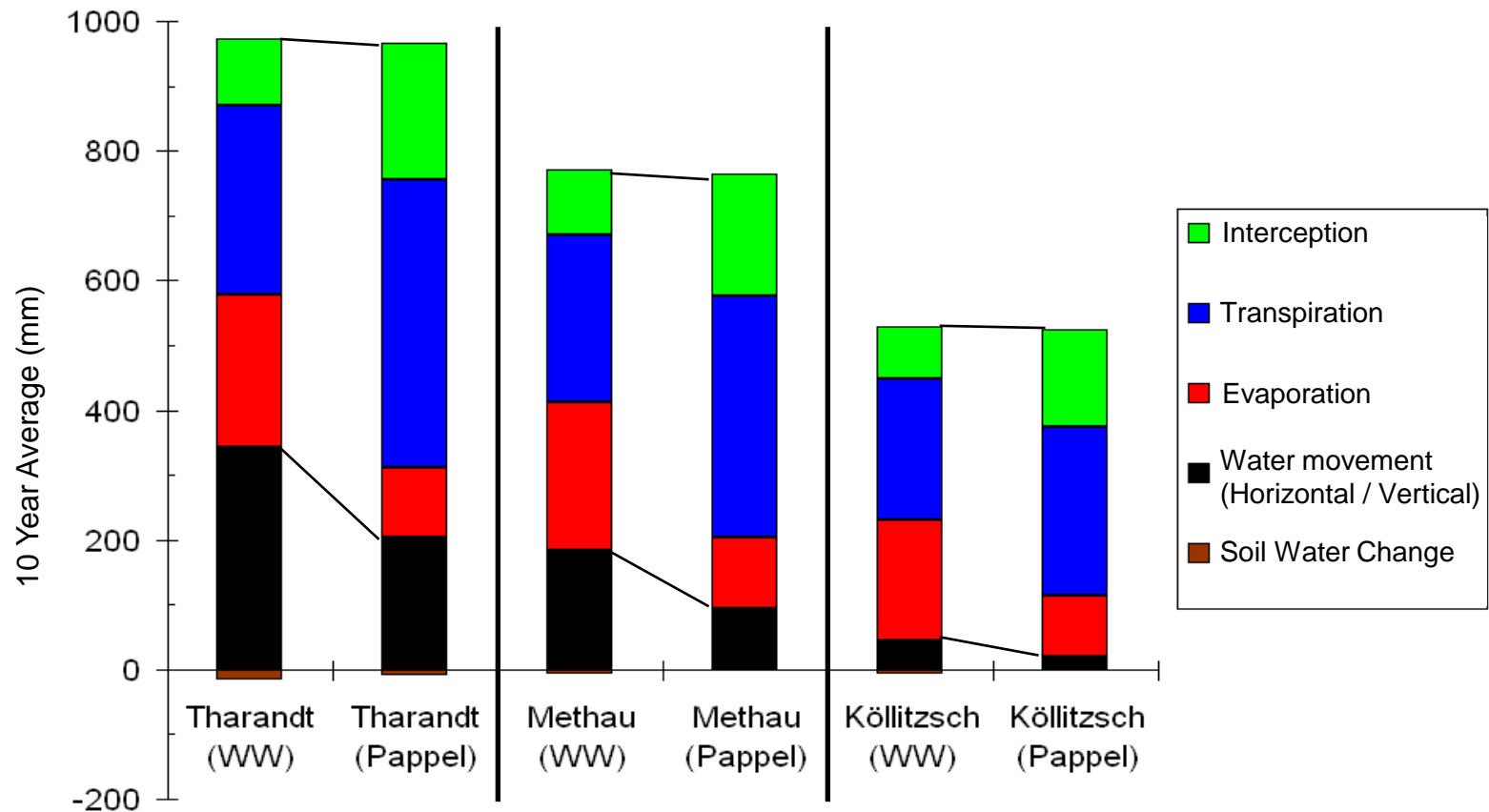


Royal Institute of Technology, Dept. of Land and
Water Resources Engineering, Stockholm (Sweden)

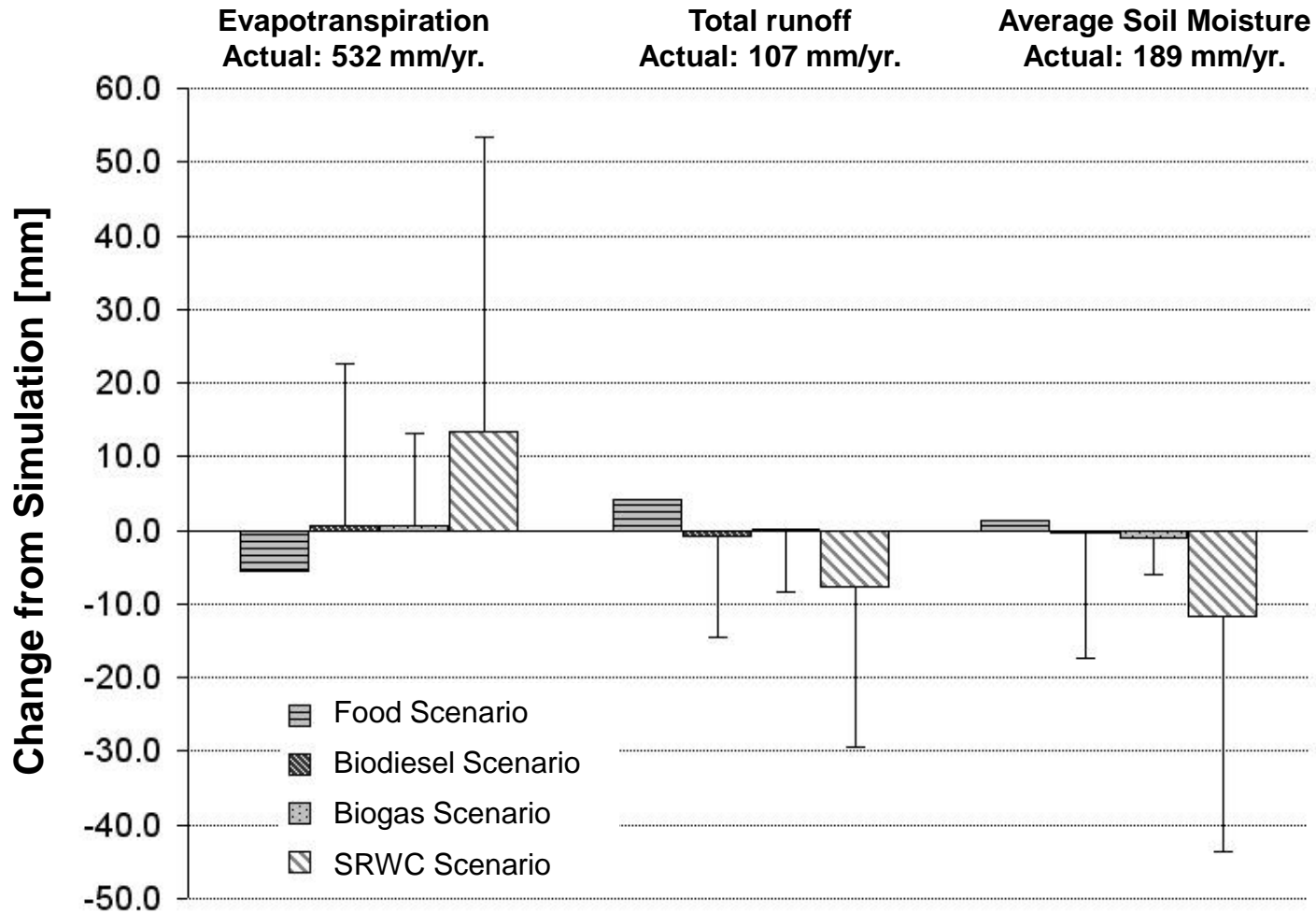
<http://amov.ce.kth.se/coup>

Plot Scale Assessment: CoupModel

Comparison of Poplar & Winter Wheat (\approx 10 yr. Simulation)



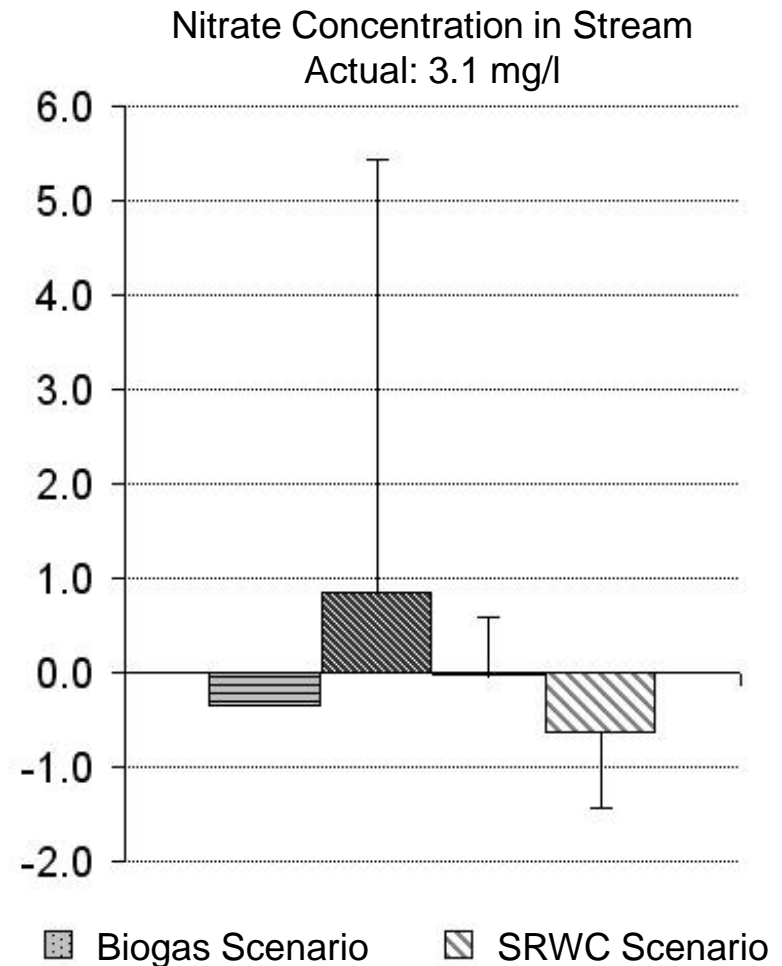
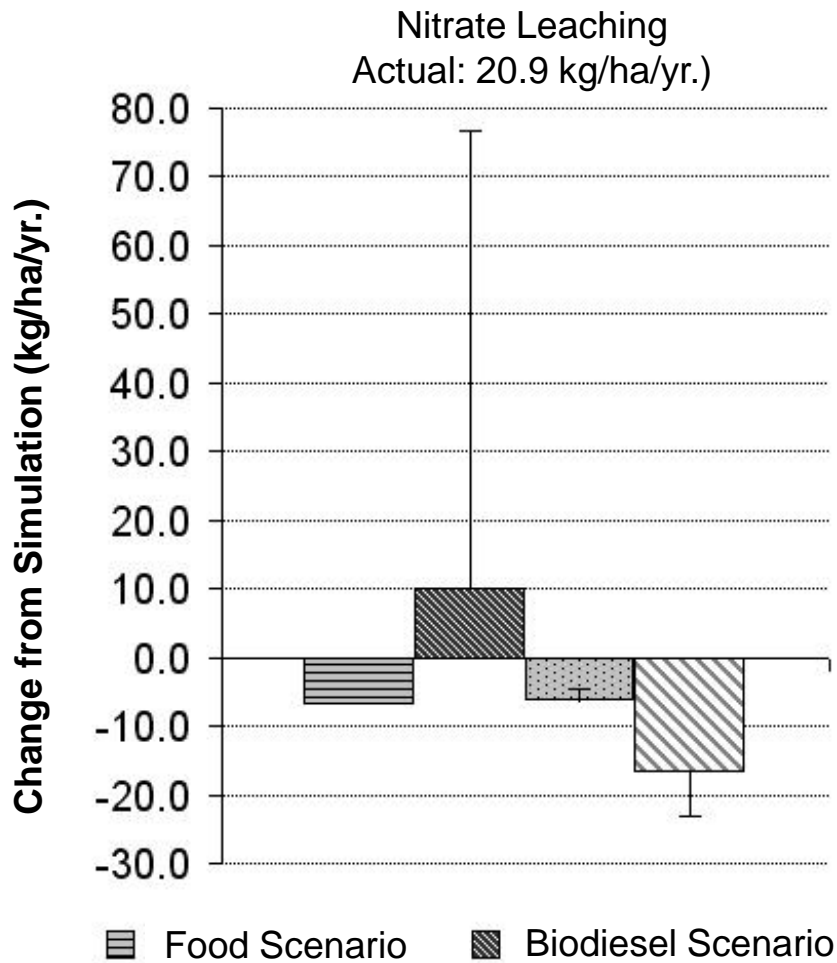
Landscape Scale Assessment: Previous SWAT examinations



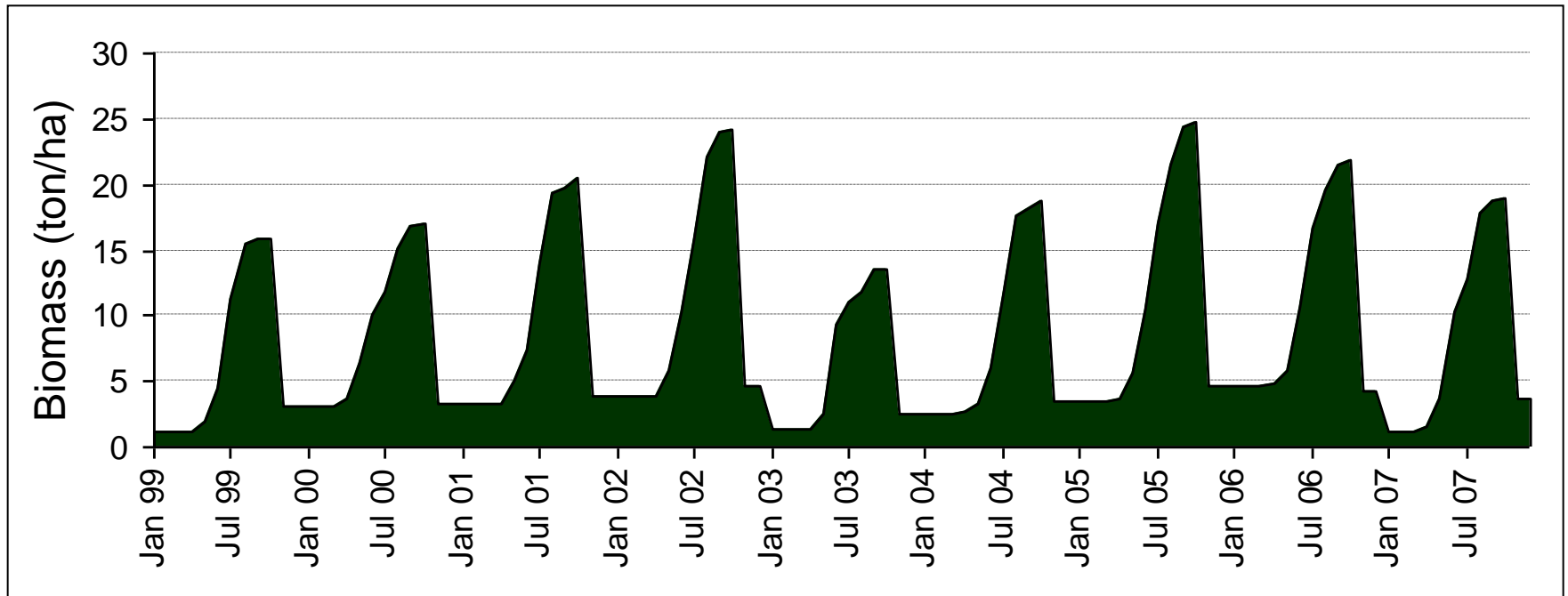
Strauch (2008)

Landscape Scale Assessment:

Previous SWAT examinations



Landscape Scale Assessment: Previous SWAT examinations



Strauch (2008)

Conclusions and Next Steps



- Field studies and plot scale modeling indicate that landscape conversion to SRWC production will impact water and matter fluxes.
- SWAT may provide a valuable tool for examining these changes at the landscape scale.
 - Previous modeling results indicate the potential of this approach.
- Challenge is in effectively up-scaling field / plot scale studies to effective landscape scale evaluations.
 - Effective parameter values
 - Realistic representation of tree growth – particularly at early stages. (LAI development)

Thank you for your attention

Questions?

Comments?

Suggestions?

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