

Evaluating the Response of the Terrestrial Biosphere to Significant Drought

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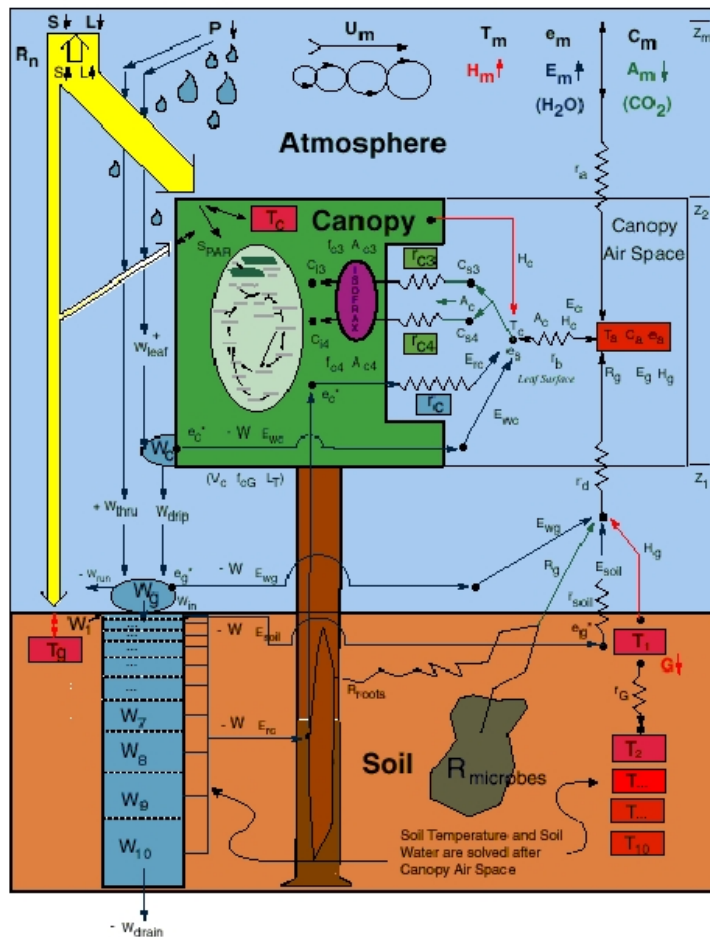
- Introduction
- Methods
- Key Results
- Conclusions and Future Research
- Acknowledgements



Credit: Peripitus, Wikimedia Commons

Introduction: Simple Biosphere Model 3 (SiB)

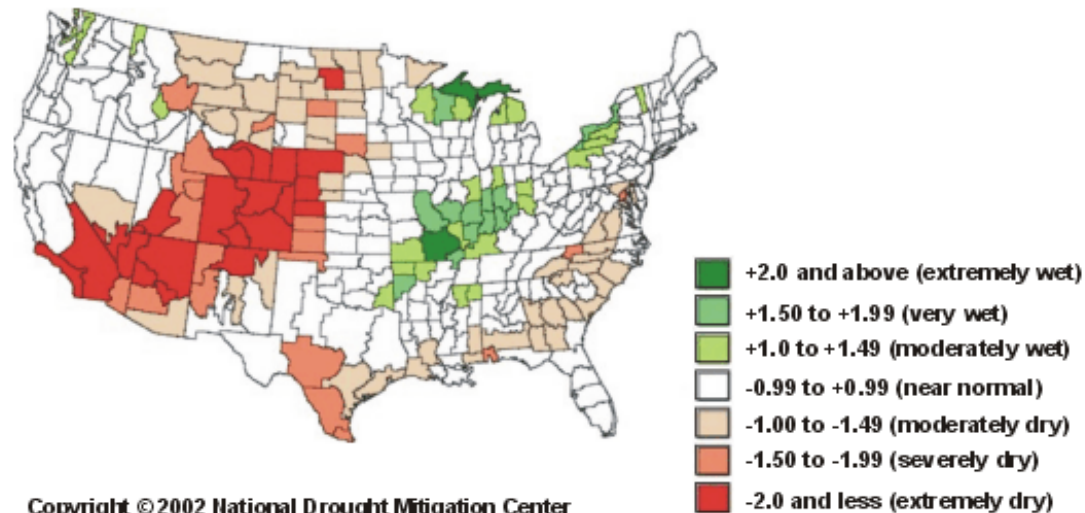
Simple Biosphere Model, version 3.0



- National Centers for Environmental Prediction (NCEP) reanalysis data
- Scaled with Global Precipitation Climatology Project (GPCP) data
- See Sellers et al. 1986, Baker et al. 2010

Introduction: Standardized Precipitation Index (SPI)

6-month SPI through the end of May 2002

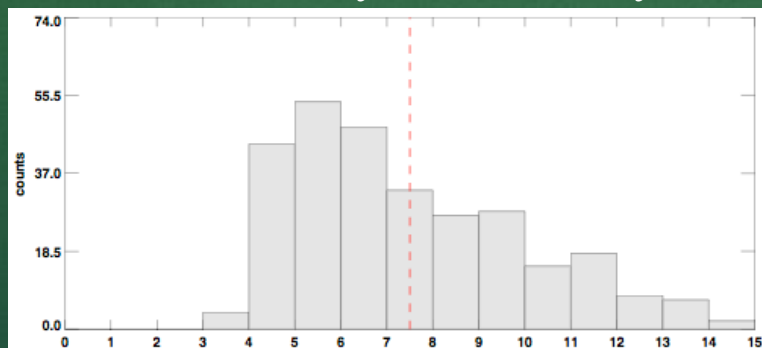


- See McKee et al. 1993

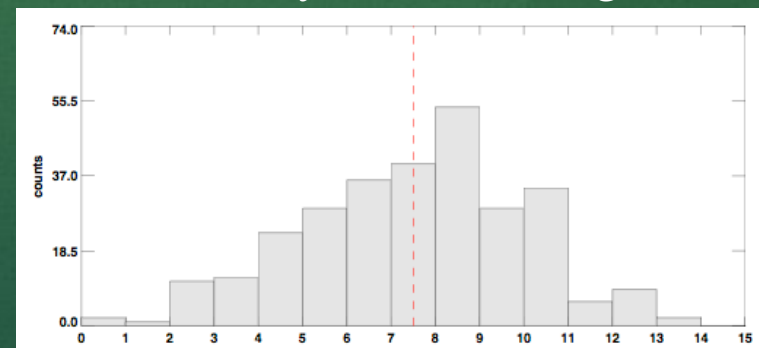
Methods

- SPI maps from SiB3 NCEP Reanalysis data
- “SVI” and non-standardized anomaly maps

Gross Primary Productivity



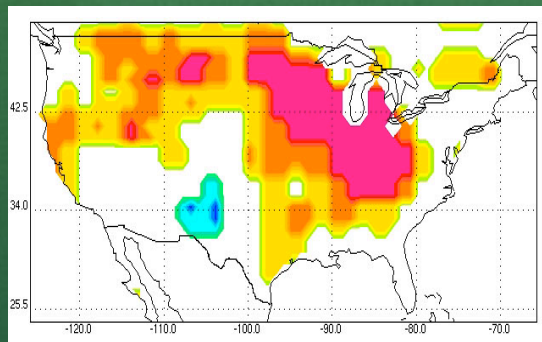
Net Ecosystem Exchange



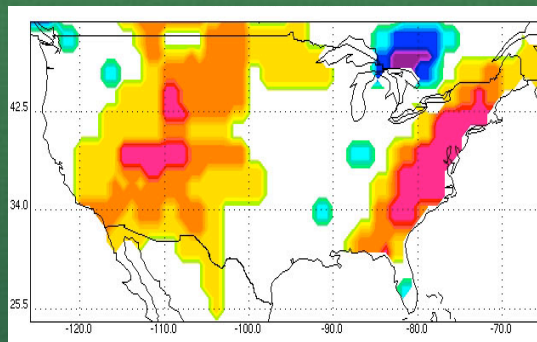
- Qualitative analysis for relationships
 - Duration, intensity, spatial extent
- Plots of response variables from model points

Results: SPI Maps

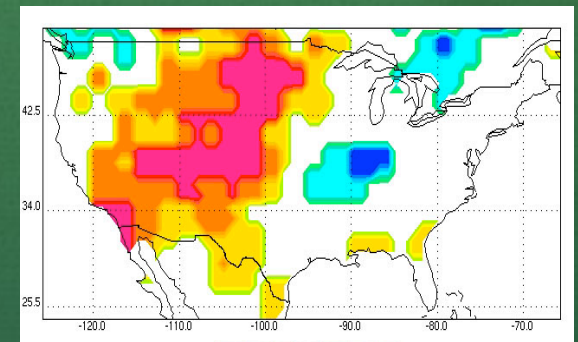
U.S. Midwest – 1988



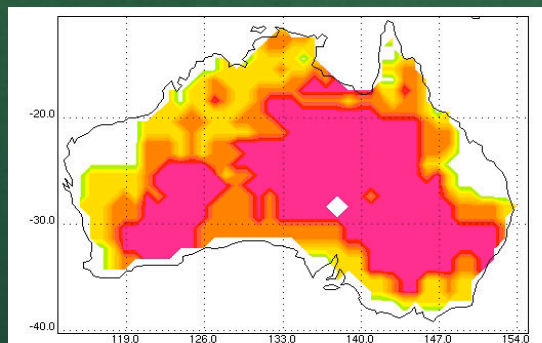
U.S. Southeast – 2000



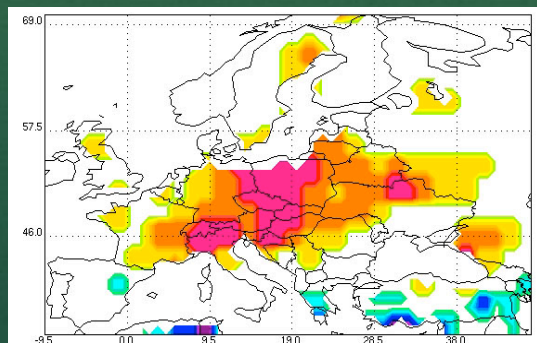
U.S. Southwest – 2002



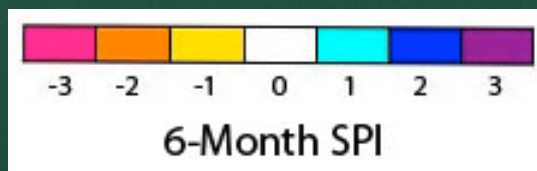
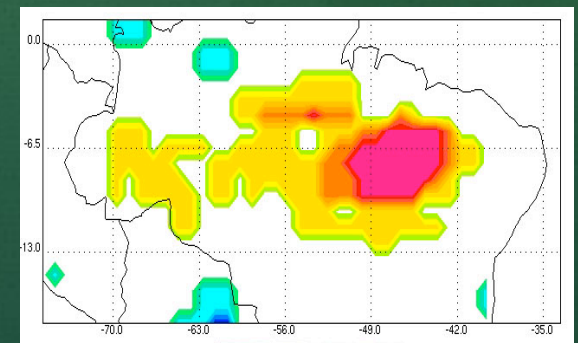
Australia – 2002



Europe – 2003



Amazon – 2005

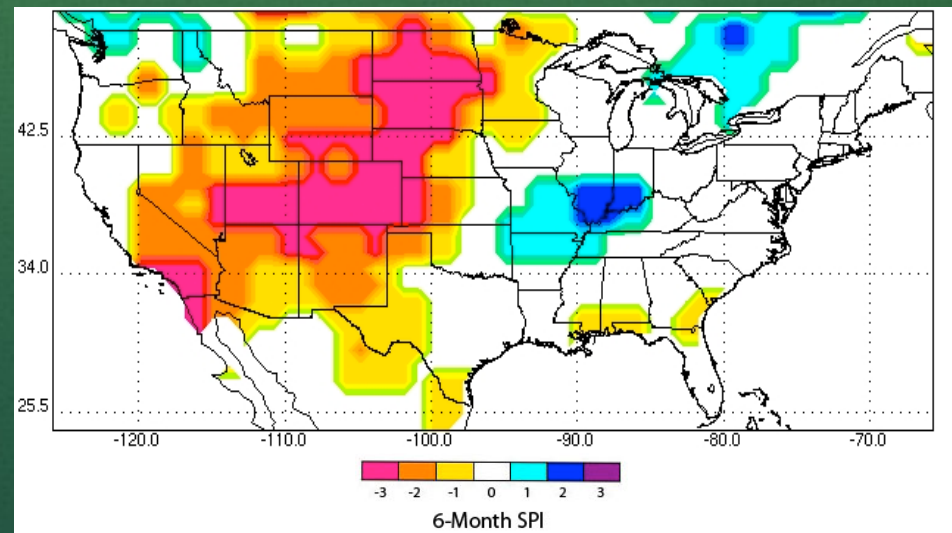
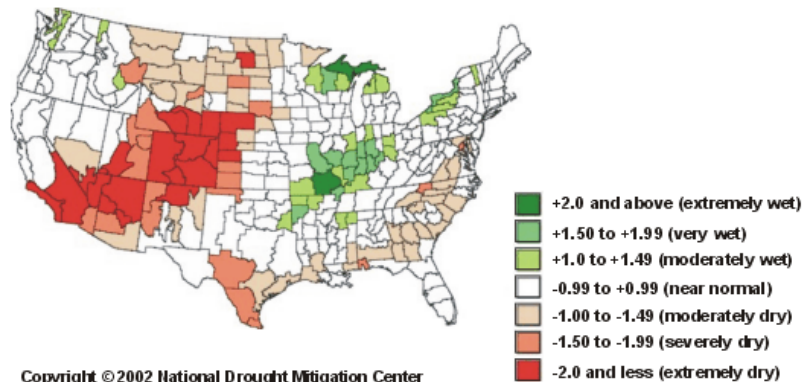


Results: U.S. Southwest 2002

May 2002 National Climatic Data Center SPI 6-Month

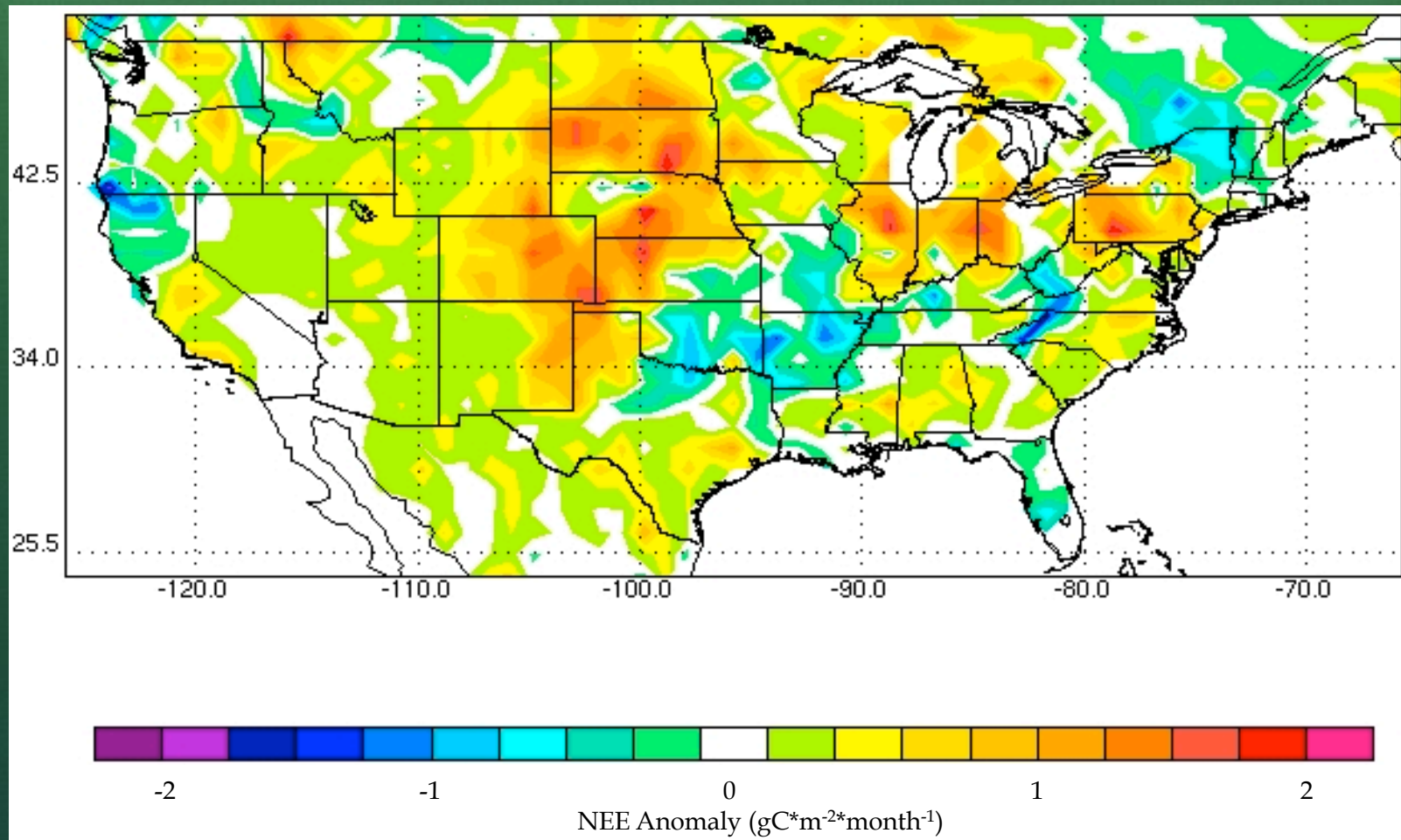
May 2002 SiB3 NCEP Reanalysis SPI 6-Month

6-month SPI through the end of May 2002



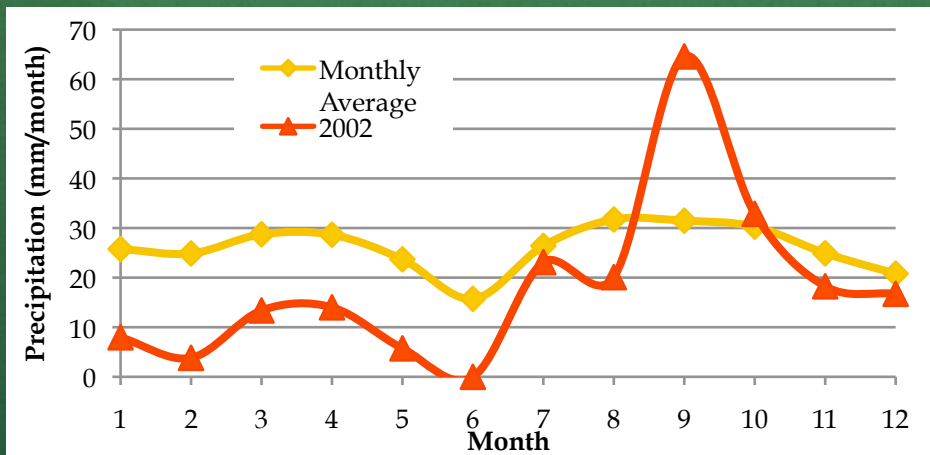
Results: U.S. Southwest 2002

June 2002 SiB NEE Anomaly

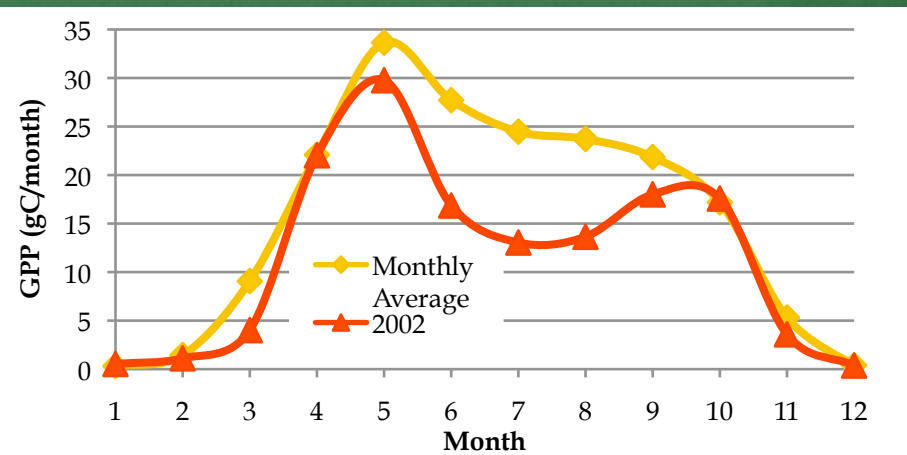


Results: U.S. Southwest 2002

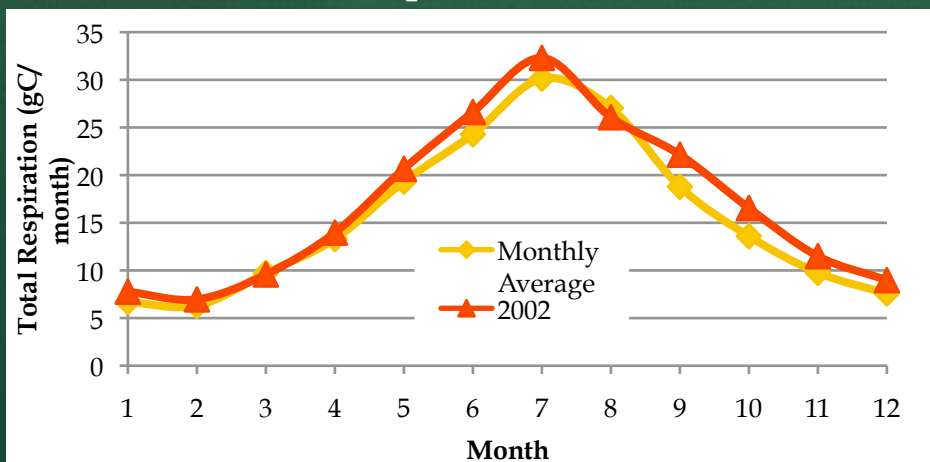
Precipitation



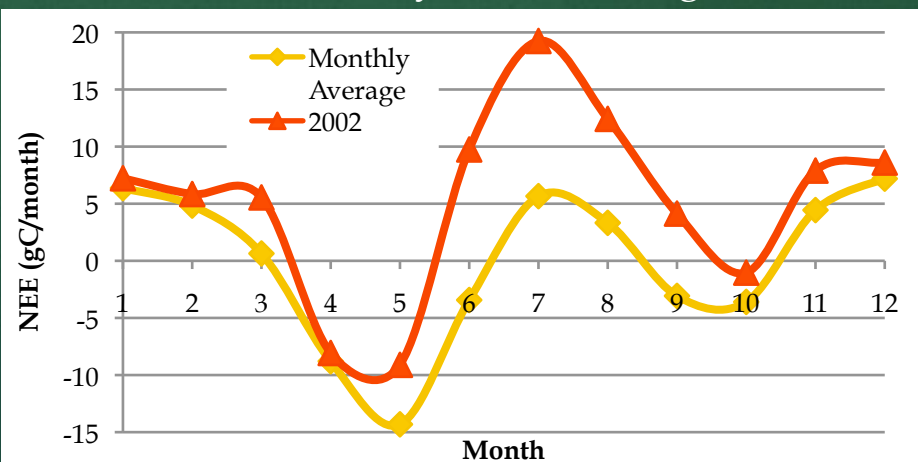
Gross Primary Productivity



Respiration

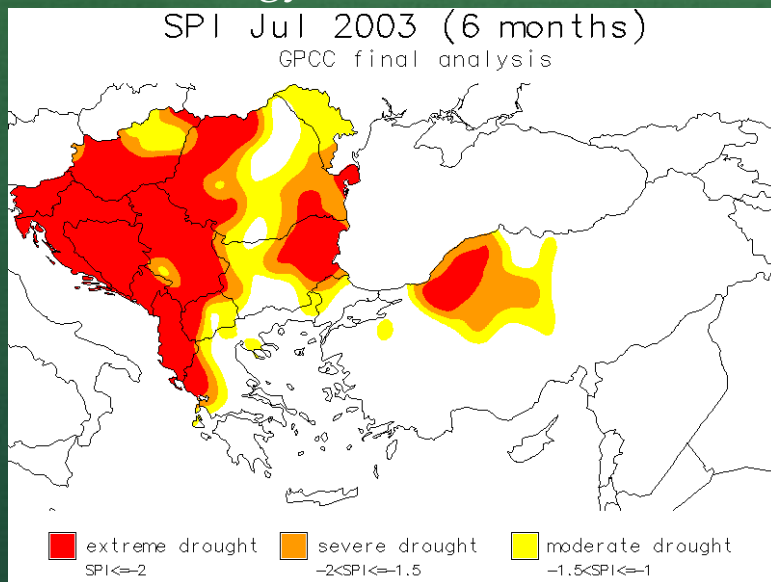


Net Ecosystem Exchange

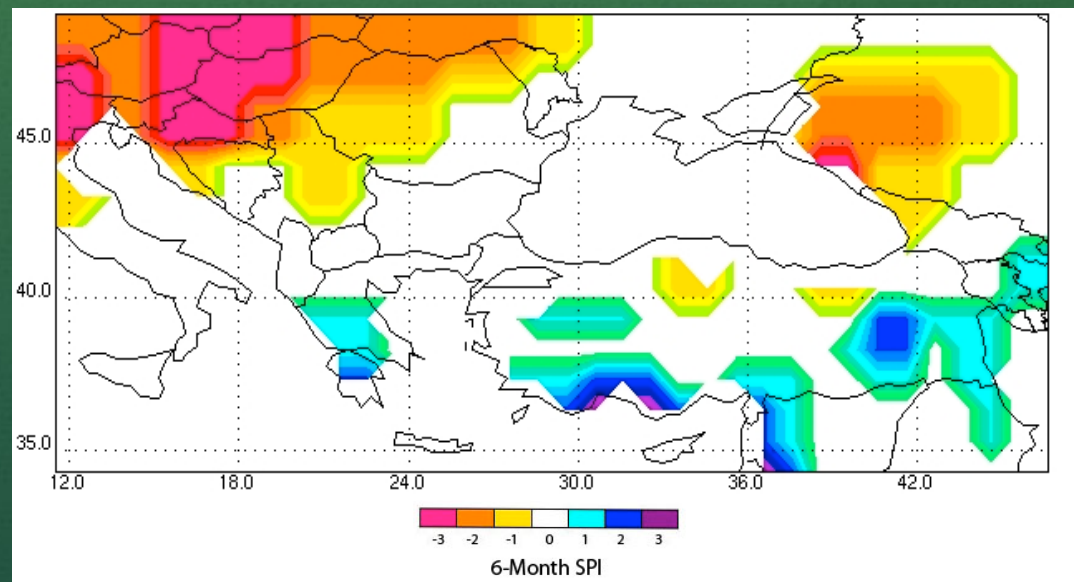


Results: Europe 2003

July 2003 Global Precipitation
Climatology Center SPI 6-Month



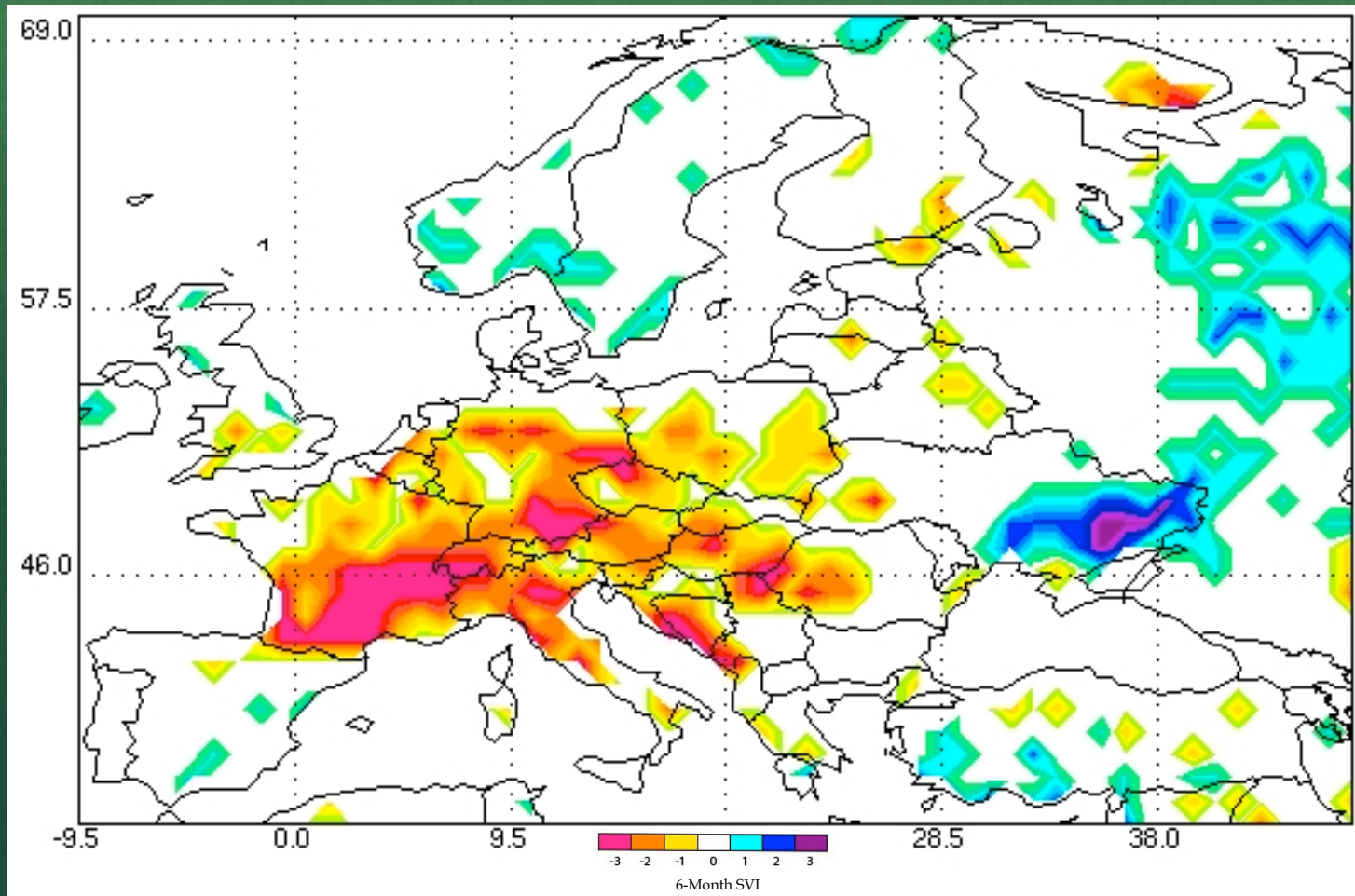
July 2003 SiB3 NCEP Reanalysis SPI 6-Month



Source: Drought Management Centre for
Southeastern Europe

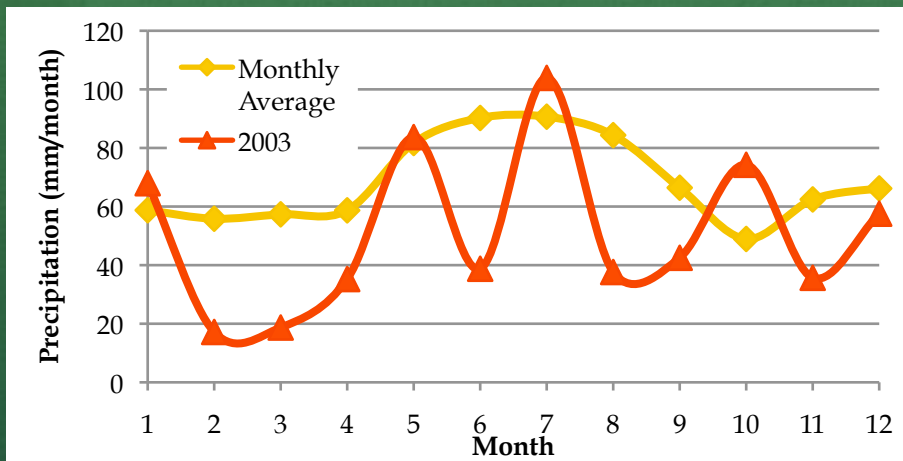
Results: Europe 2003

December 2003 SiB3 NCEP Reanalysis SVI 6-Month – GPP

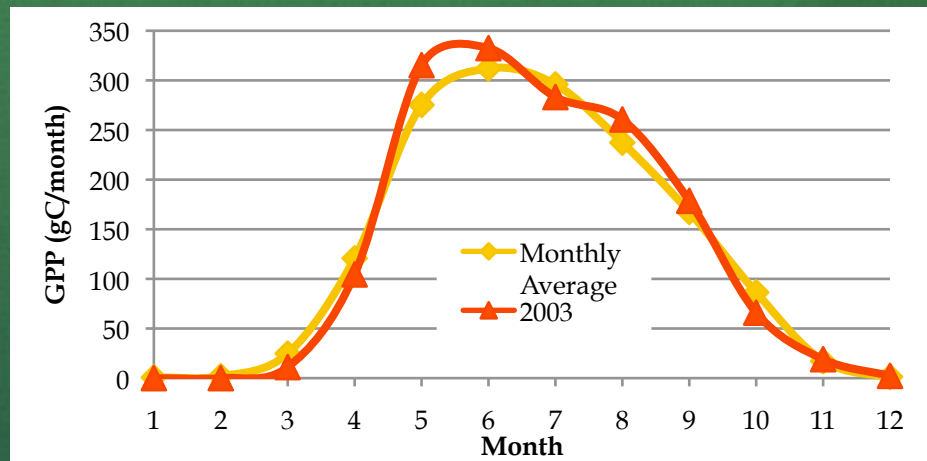


Results: Europe 2003

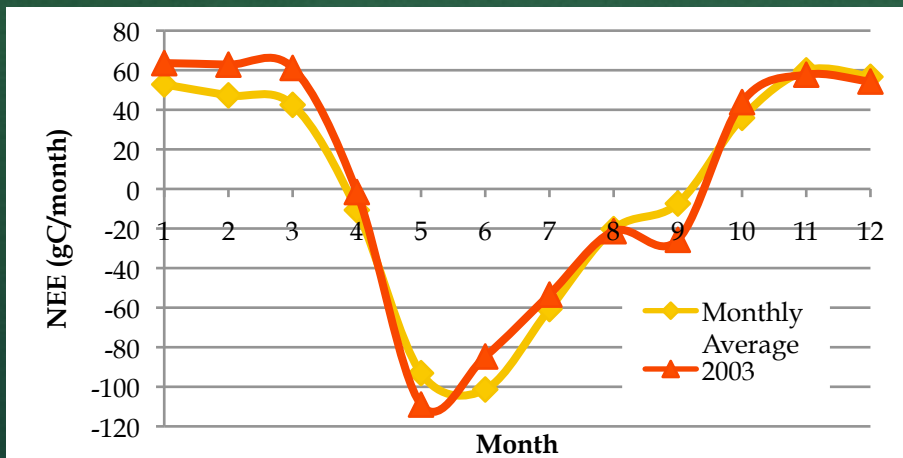
Precipitation



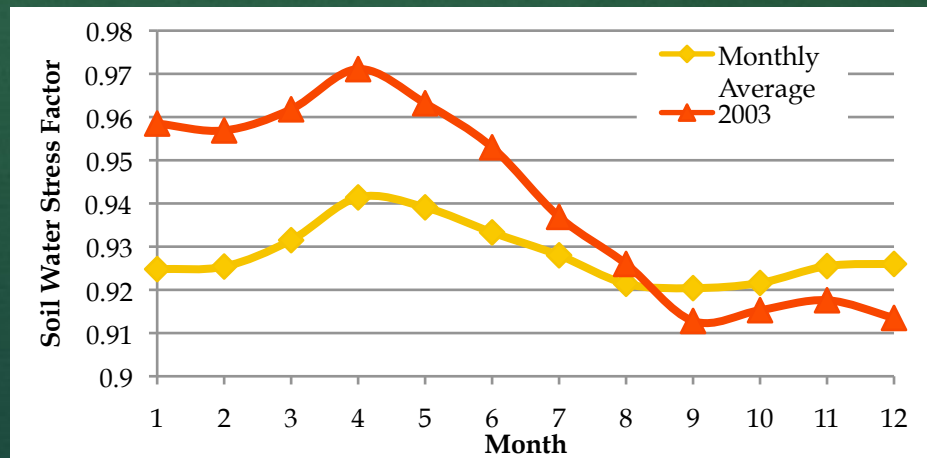
Gross Primary Productivity



Net Ecosystem Exchange



Soil Water Stress Factor



Conclusions and Future Research

- SiB3 can represent drought response well...
 - U.S. Midwest 1988, U.S. Southwest 2002
- ...but this is not always the case!
 - Under-responsive: Southeast 2000, Europe 2003, Amazonia 2005
 - Over-responsive: Australia 2002
 - Not present: U.S. Southeast 1993 and 2005
- Next Steps
 - Objective, quantitative analysis
 - Other drought indices
 - Statistical analysis of variable distributions
 - SiB runs from post-2006

Acknowledgements

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- Howard Drossman, Barbara Whitten, Eric Perramond
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- Sellers, Peter, et al. “Modeling the Exchanges of Energy, Water, and Carbon Between Continents and the Atmosphere”1997.