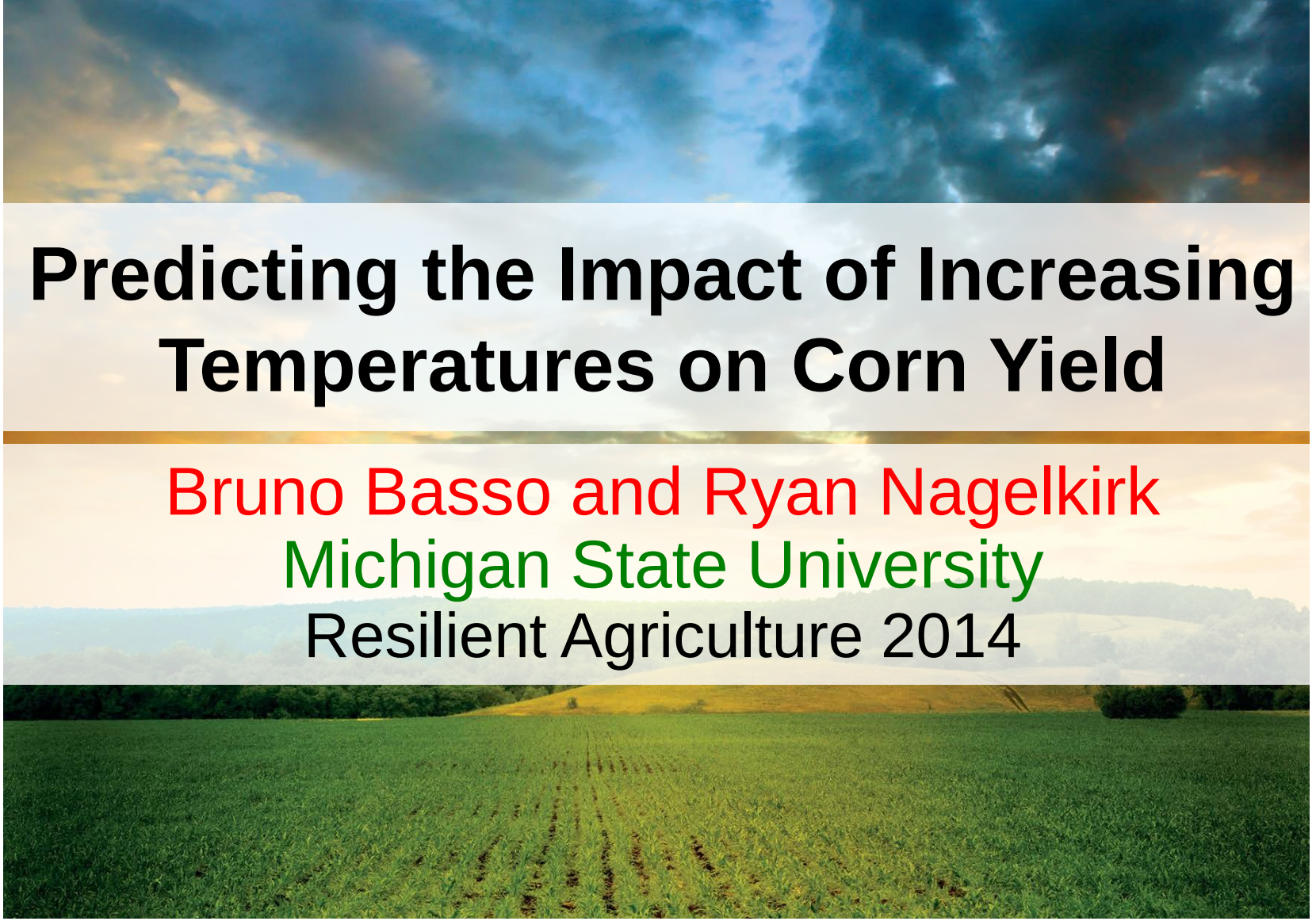

Predicting the Impact of Increasing Temperatures on Corn Yield

Bruno Basso and Ryan Nagelkirk
Michigan State University

Resilient Agriculture 2014

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CROPS, CLIMATE, CULTURE AND CHANGE

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This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190:
Cropping Systems Coordinated Agricultural Project: Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems

Simulation of crop biomass

$$B_t = g * d$$

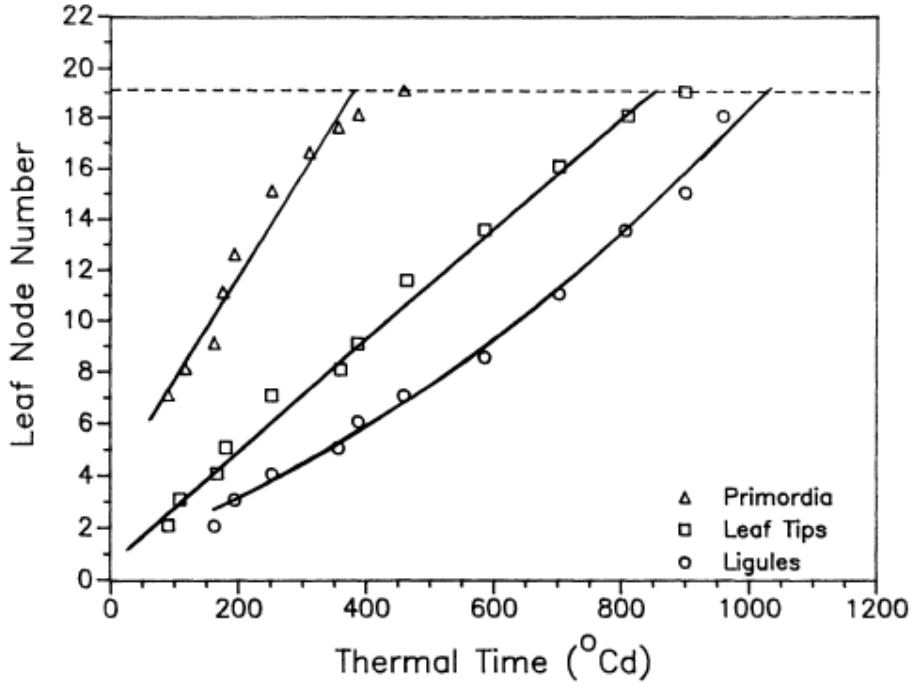
where:

B_t = Total biomass

g = Average growth rate

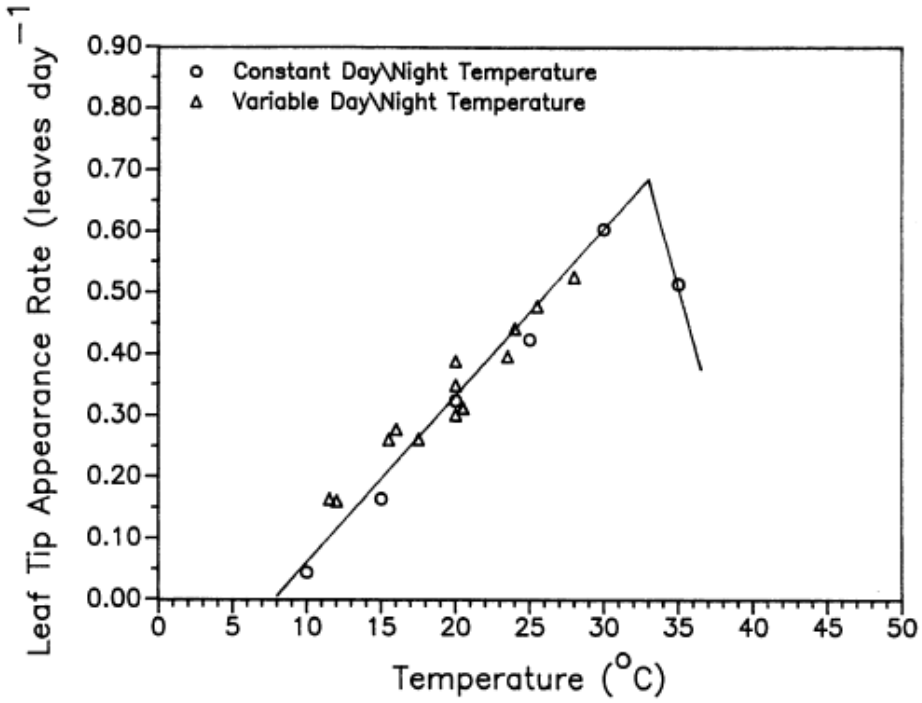
D = growth duration

The economic yield of a crop is the fraction of B_t that is partioned to grain



Leaf primordia, leaf tip,
and ligule numbers of maize
as function of thermal time

Data from Zur et al., (1989)

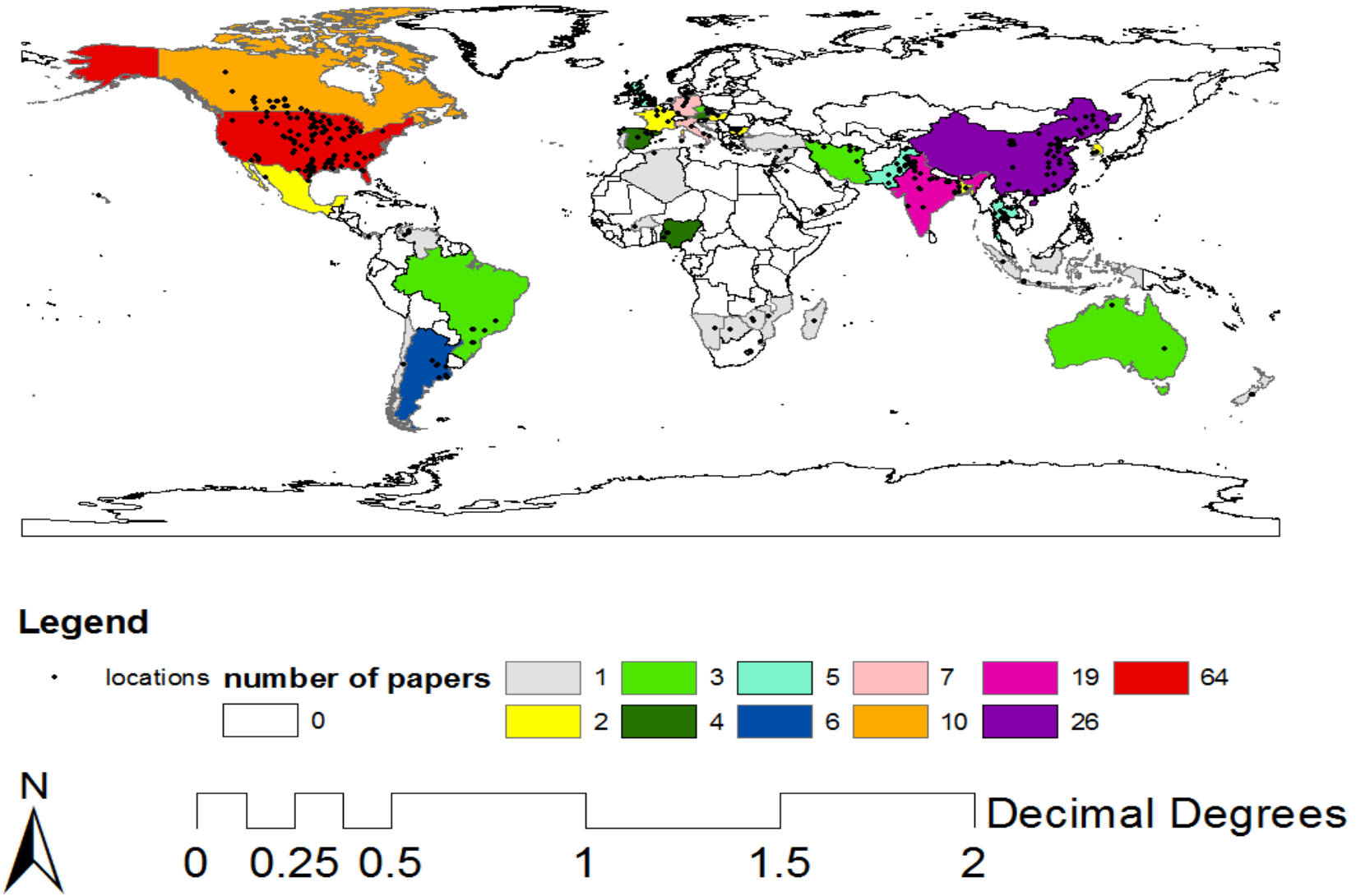


Maize leaf-tip appearance
Rate at constant and variable
Day and night temperature

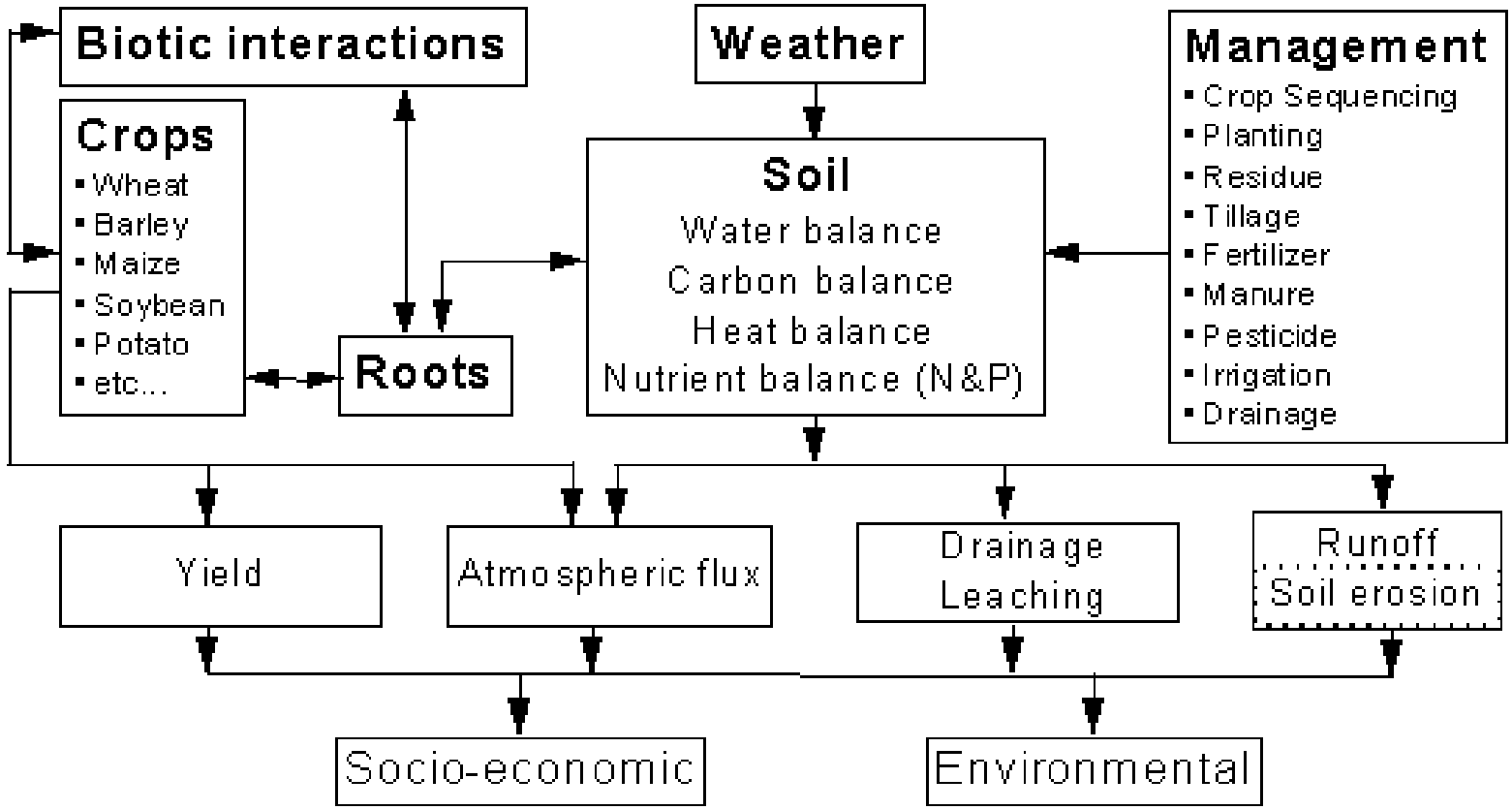
Data from Tollenaar et al., (1979)

Ritchie and NeSmith, 1991

CERES Models validation



SALUS Crop model



(Basso et al., 2006, Basso and Ritchie 2012)

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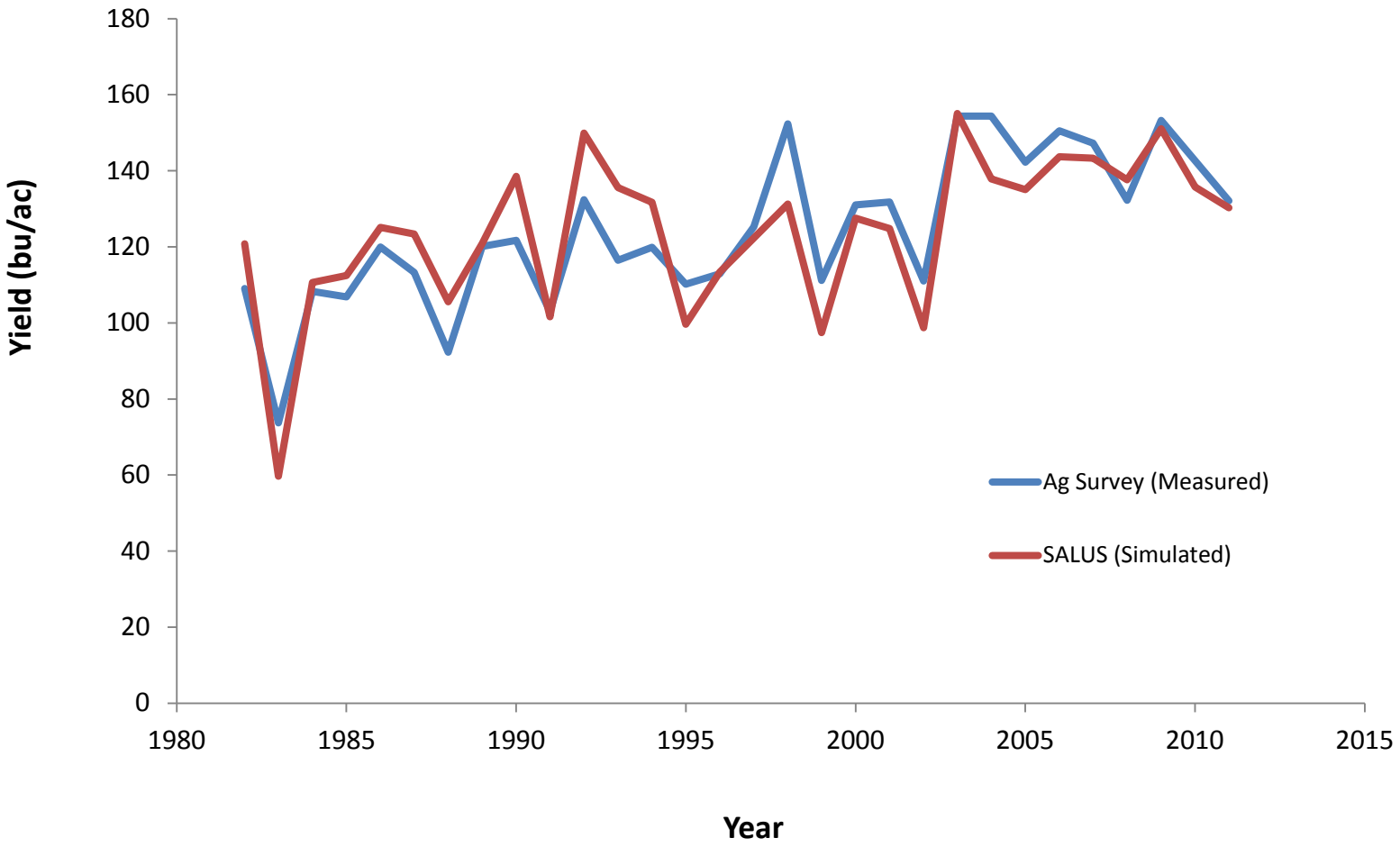
County Average Reported Yield *vs* SALUS Simulation



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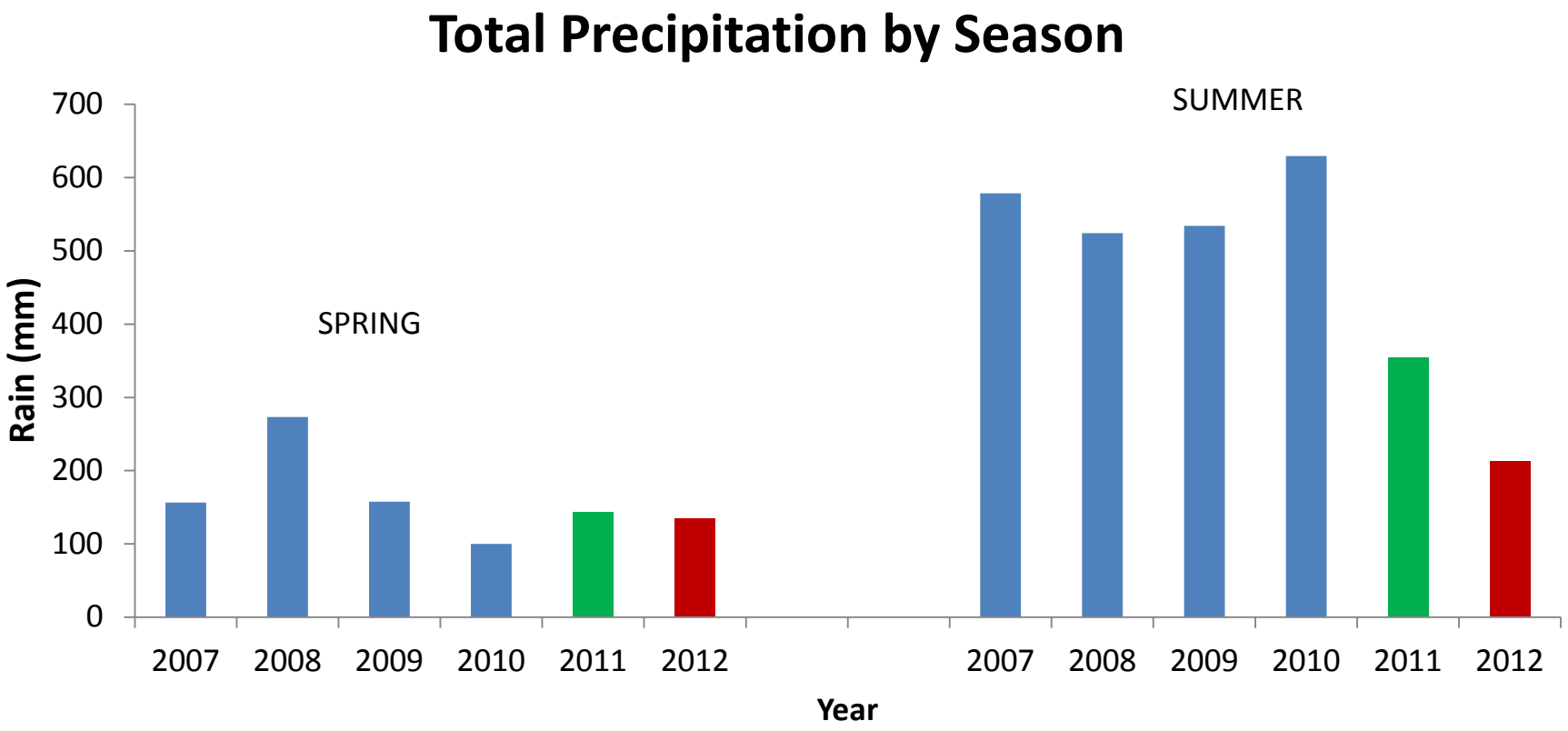
nature climate change

ARTICLE PREVIEW

NATURE CLIMATE CHANGE | CORRESPONDENCE

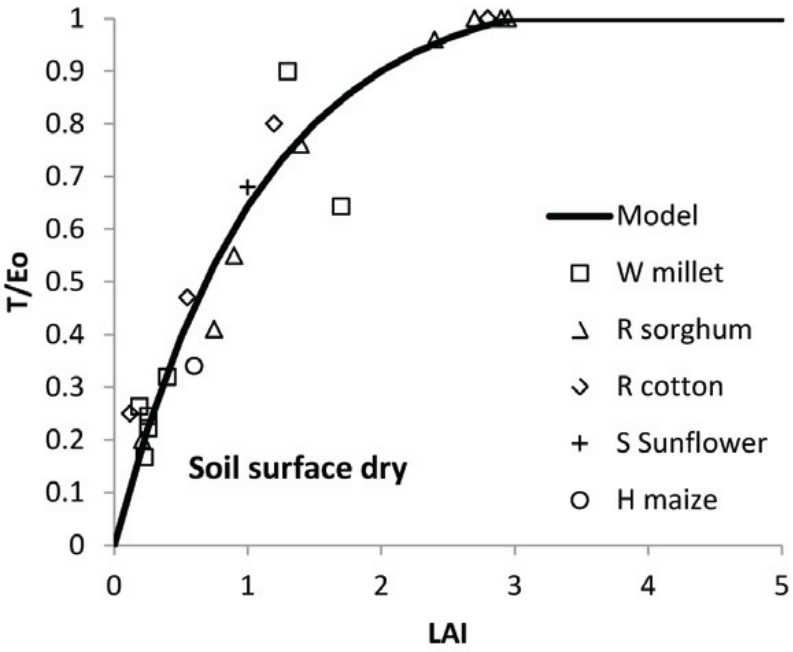
Temperature and drought effects on maize yield

Bruno Basso & Joe Ritchie

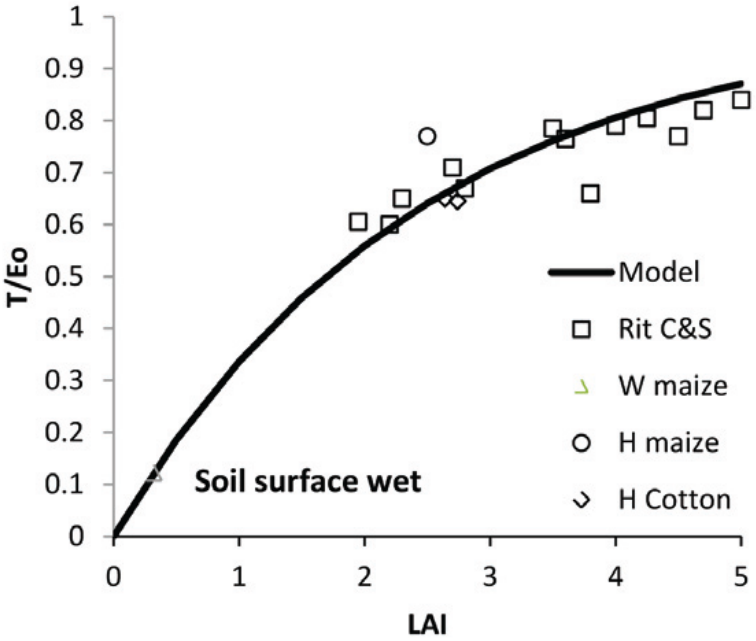


Basso and Ritchie, 2014 Nature Climate Change

a



b



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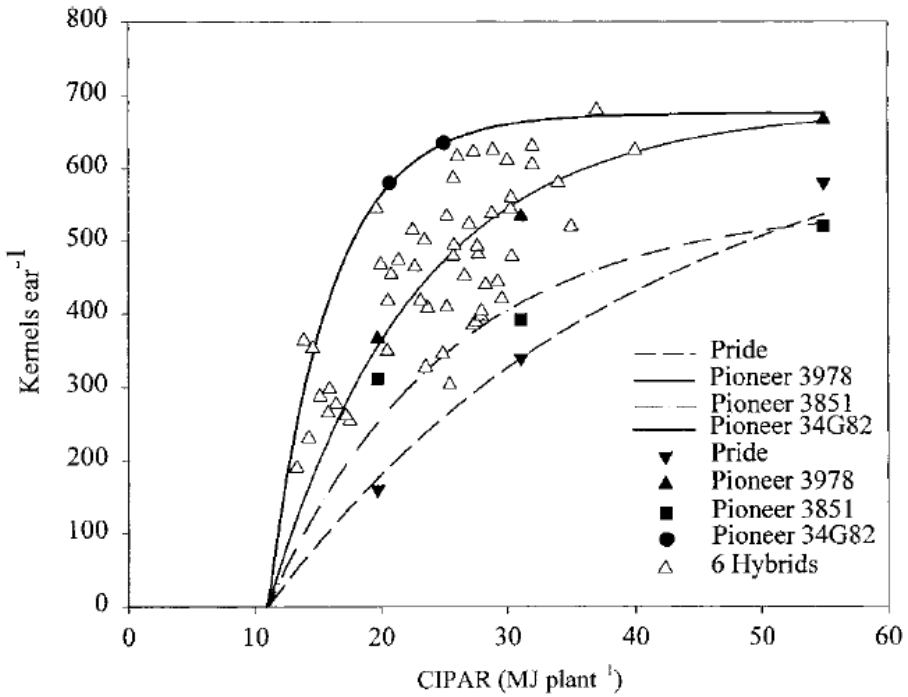
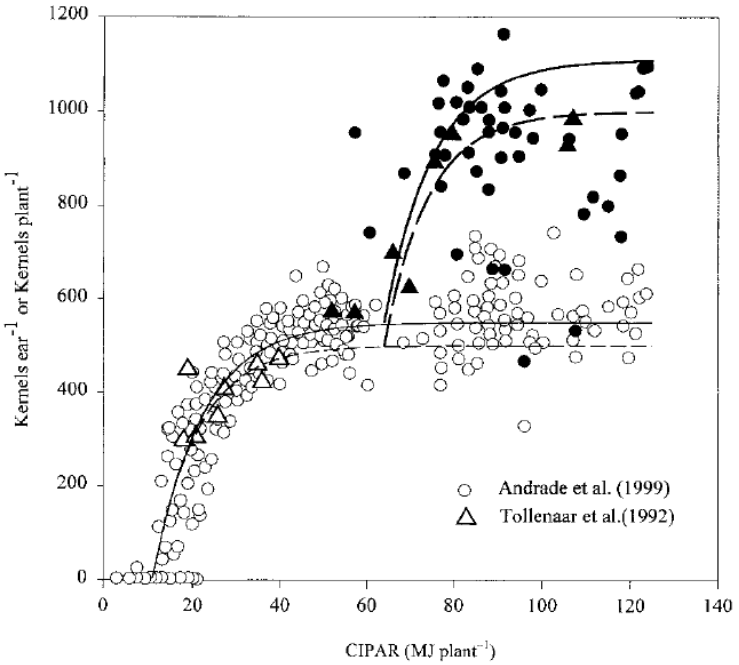
Kernel number

- The period of active ear elongation could be defined from 227 degree-days before silking to 100 degree-days after silking (base temperature, 8°C)





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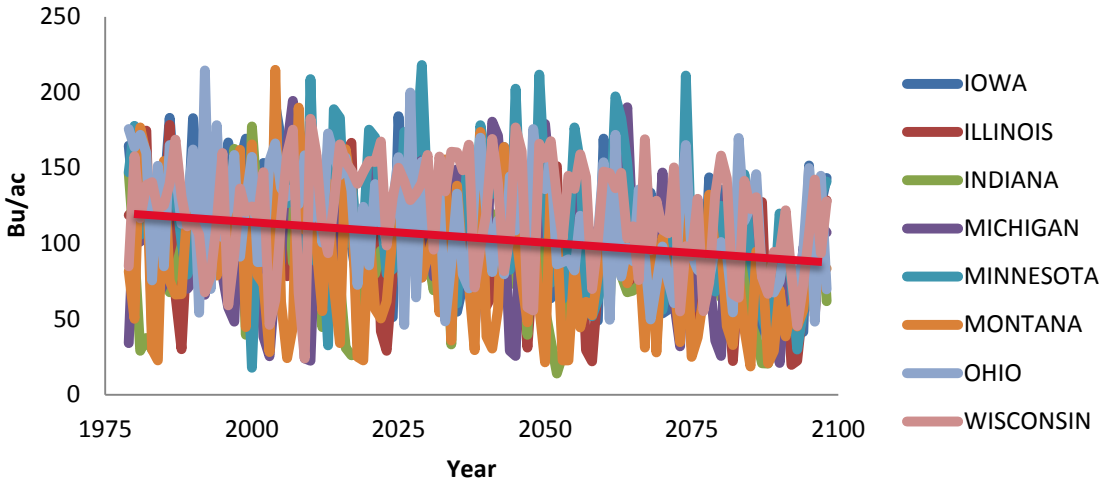
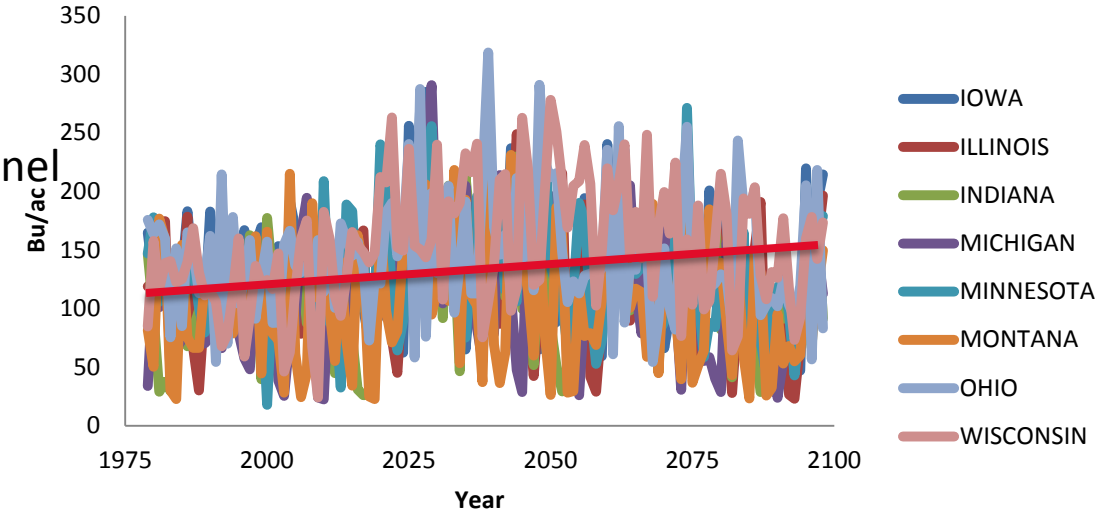
Simulations of sites in Sustainable Corn Project - No Adaptation



Simulations of sites in Sustainable Corn Project with Adaptation



Planted 10 days earlier (April 15) new cultivar with higher number kernel number and filling rate, deeper rooting systems

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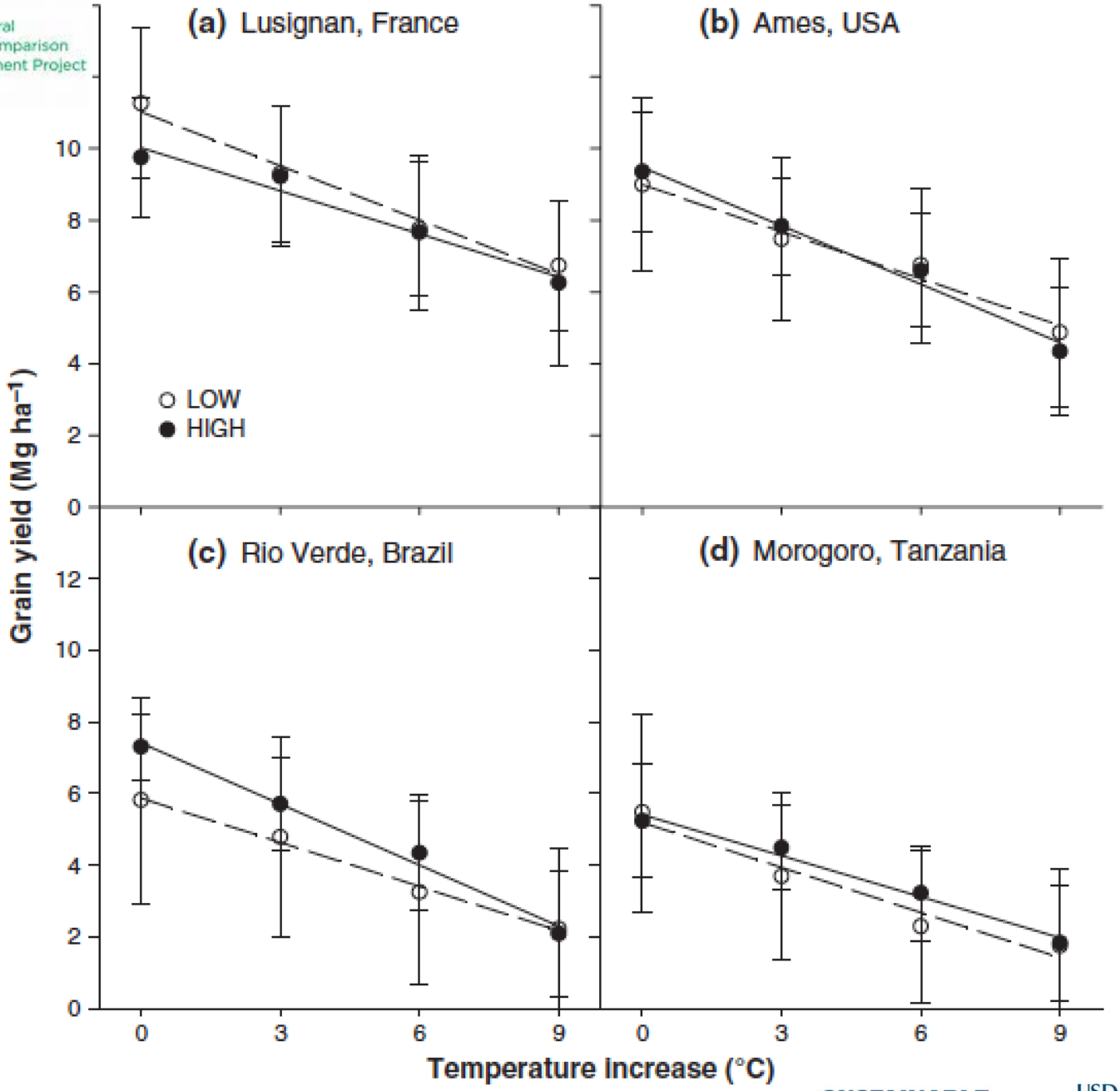
AgMIP The Agricultural Model Intercomparison and Improvement Project

Ensemble of 19 crop models



Bassu et al., 2014 Global Change Biology

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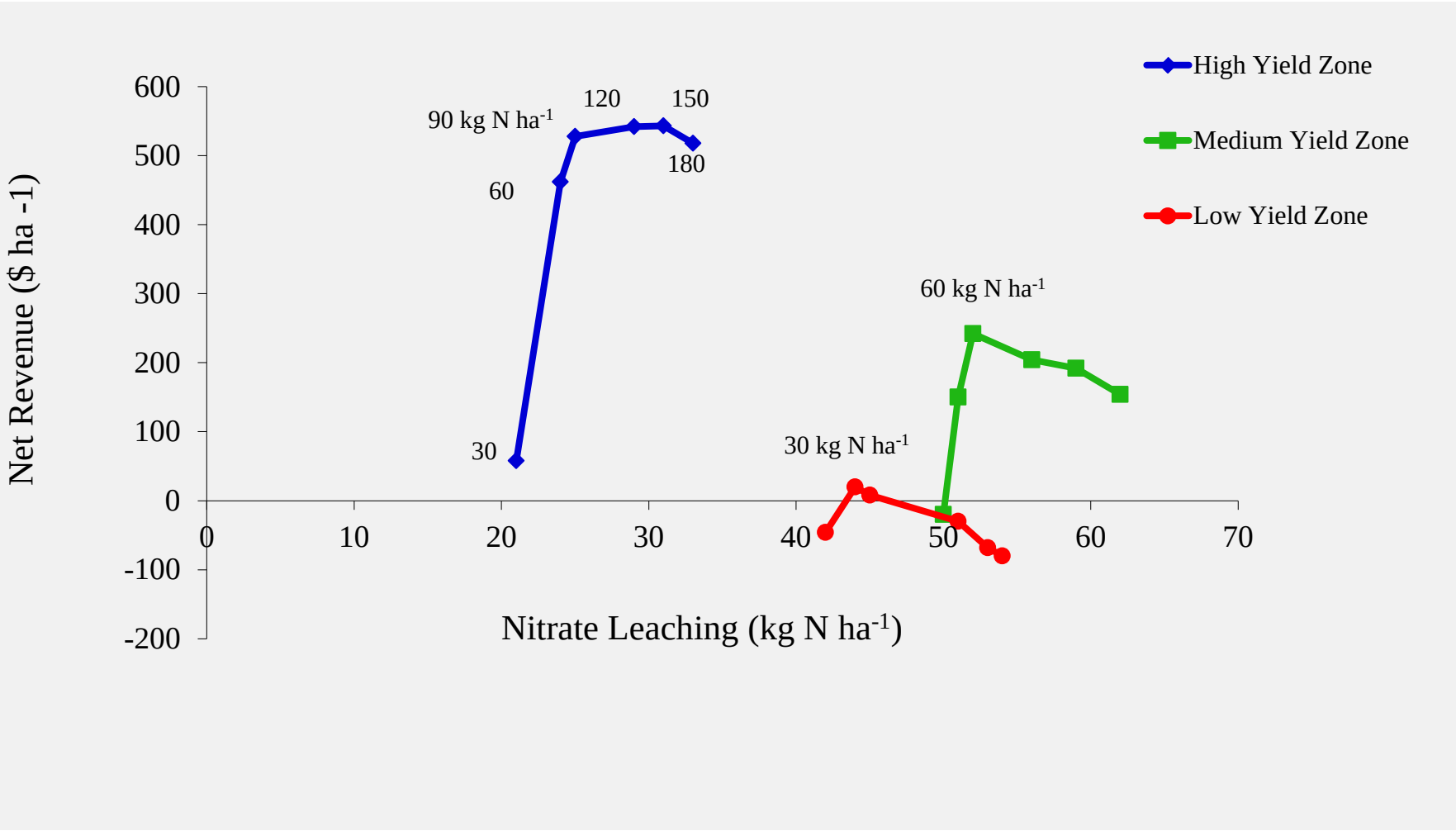
Strategic and tactical N management using SALUS



Dual criteria optimization through tested model determines the N rate that minimizes nitrate leaching and increases net revenues for farmers

(Basso et al., 2011; Eur J. Agron 35:215–222)

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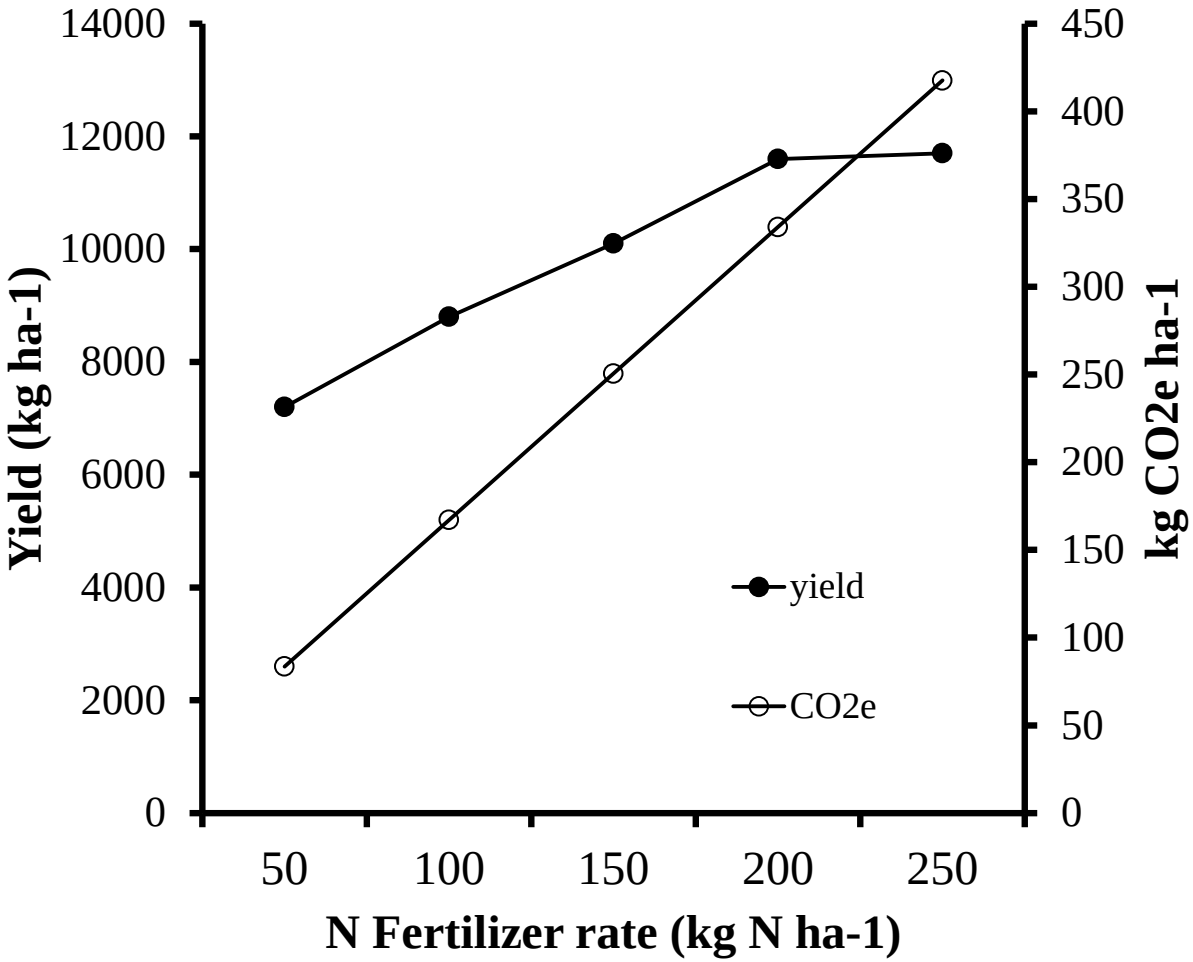
Accounting for global warming potential



Conclusion

Agriculture will need to adapt to climate variability and change

Crop models will play a crucial role in the assessment of the vulnerability of the US food and fiber system to climate extremes and change by identifying strategies that will help to adapt and mitigate to climate change

Sustainable agriculture will require that society appropriately rewards farmers and other agriculturalists for the production of both food and ecosystem services.