

# The Velocity of Climate Change: 2011

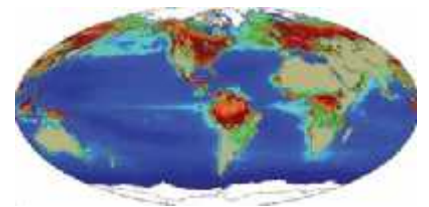
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[www.global-ecology.org](http://www.global-ecology.org)

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Year 2060: The search for a breakthrough technology to solve climate change continues.

IT'S A TIME MACHINE WE HOPE WILL TAKE US BACK 50 YEARS WHEN WE SHOULD HAVE PUT A PRICE ON CARBON.

WE BETTER HURRY!

NO! THAT'S THE GREAT THING ABOUT THIS TECHNOLOGY!

TALS

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# Article 2 of the UNFCCC

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

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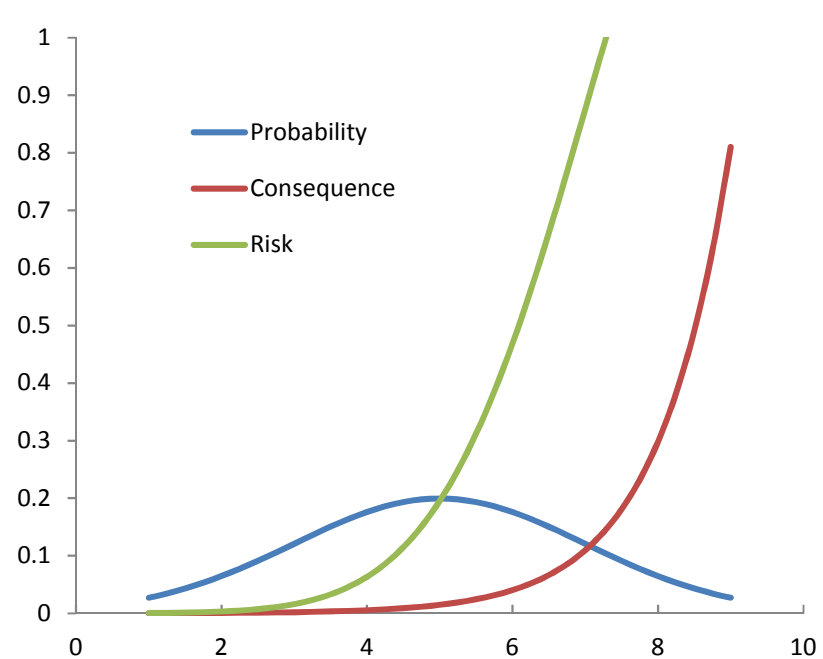
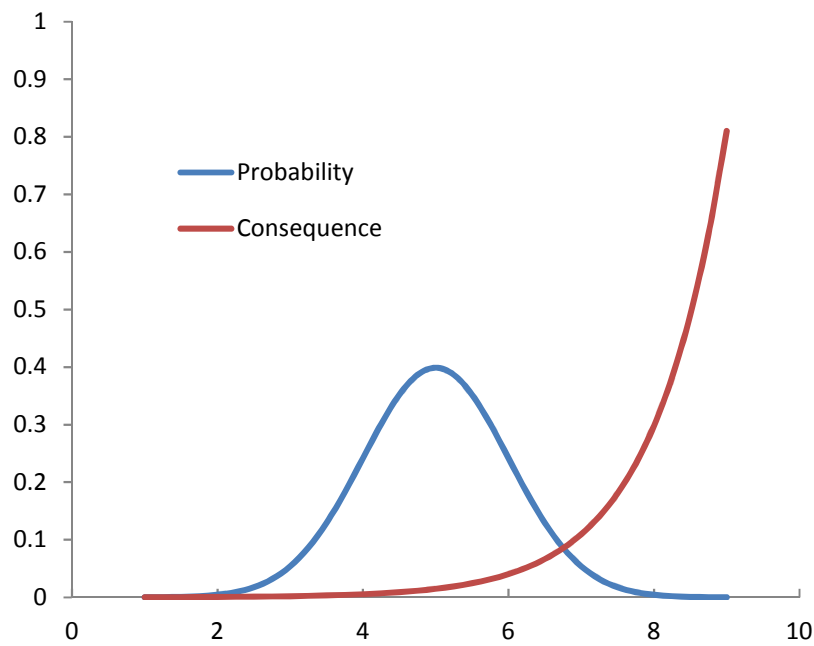
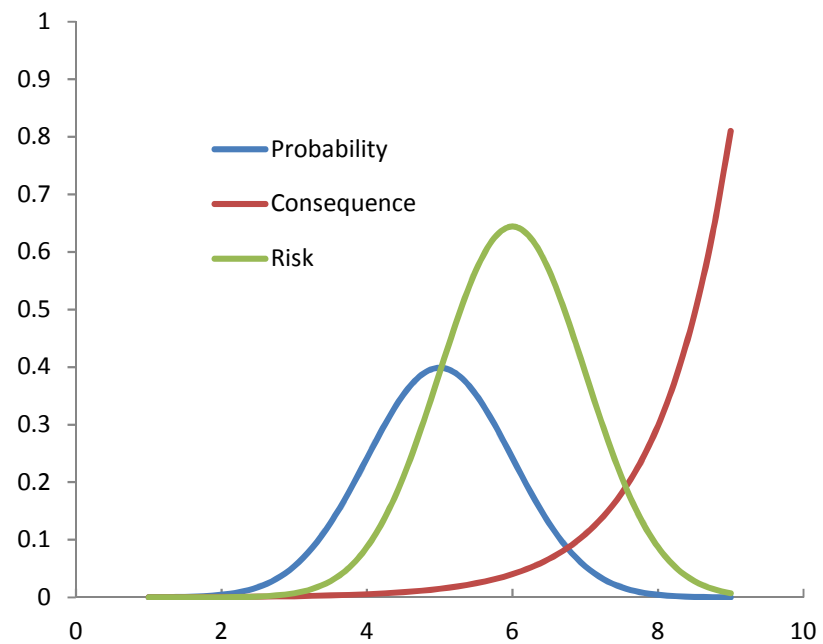
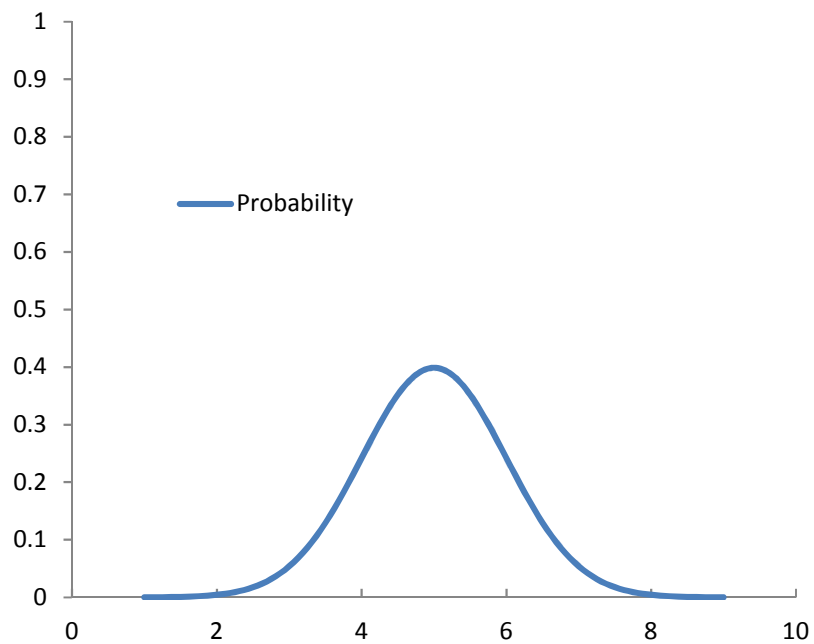
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# Three Messages

- Need for risk-based framing
- Need to tackle the hard stuff
  - Agriculture: Human factors
  - Ecosystems: Mortality
- The role of velocity

Risk = probability x consequence

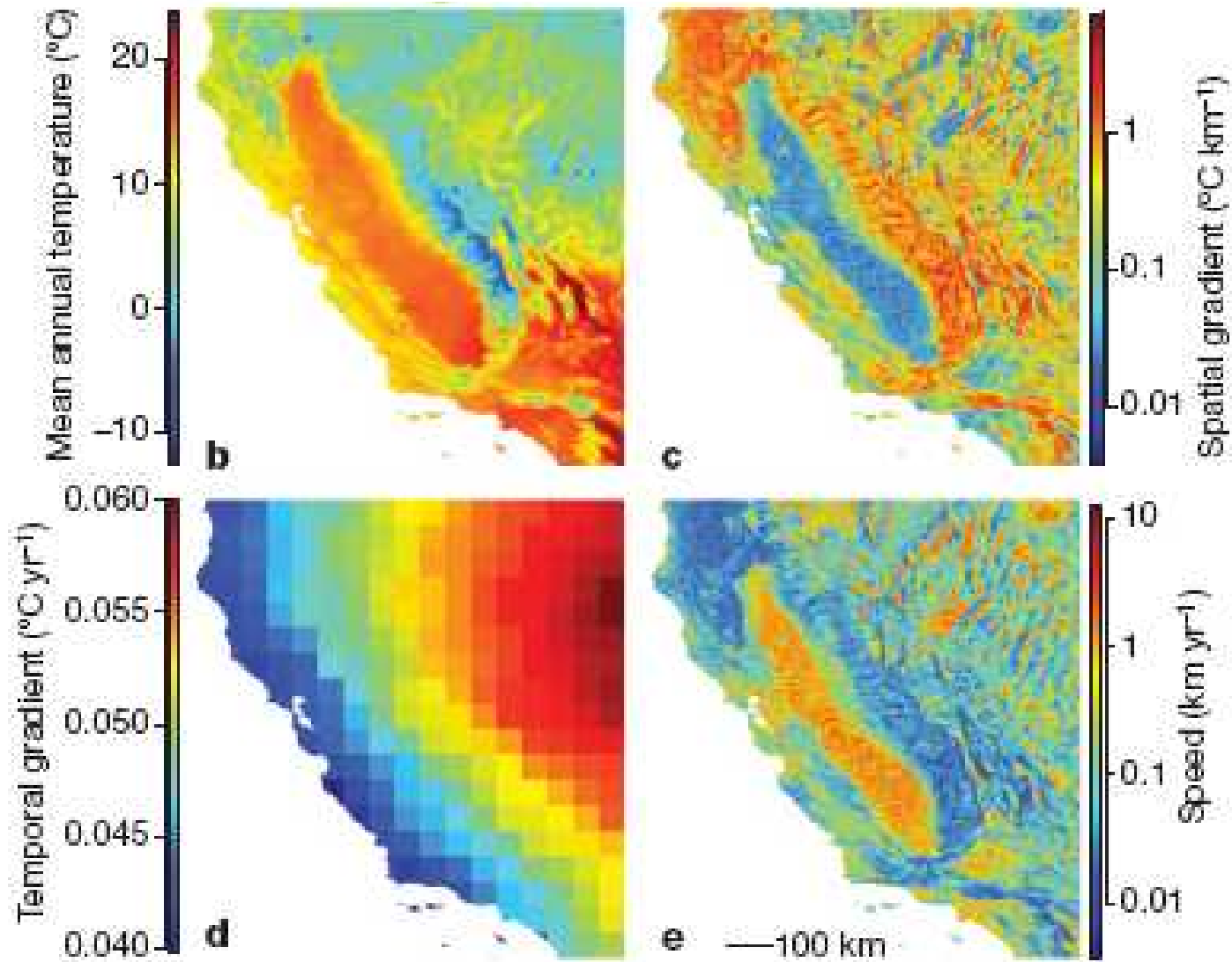




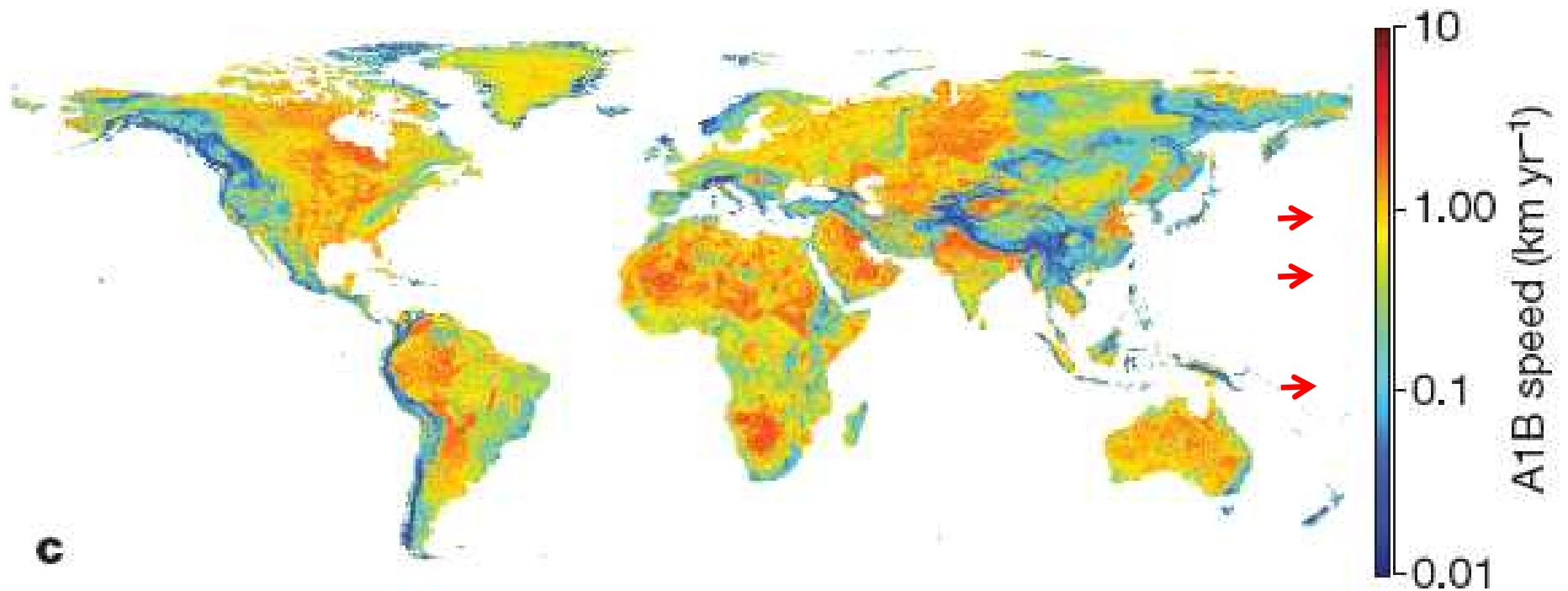
# The velocity of climate change

- How fast is the climate changing?
- How fast ecosystems and agriculture respond?
- How fast can people and societies respond – adaptation?
- How fast can people and societies respond – mitigation?

# The velocity of climate change



$$(\text{°/yr}) / (\text{°/km}) = (\text{km/yr})$$



1. Tropical and subtropical coniferous forests, 0.08



2. Temperate coniferous forests, 0.11



3. Montane grasslands and shrublands, 0.11



4. Mediterranean forests, woodlands and scrub, 0.26



5. Tundra, 0.29



6. Tropical and subtropical moist broadleaf forests, 0.33



7. Temperate broadleaf and mixed forests, 0.35



0.001 0.01 0.1 1 10  
Speed (km yr<sup>-1</sup>)

8. Tropical and subtropical dry broadleaf forests, 0.42



9. Boreal forests/taiga, 0.43



10. Temperate grasslands, savannas and shrublands, 0.59



11. Tropical and subtropical grasslands, savannas, shrublands, 0.67



12. Deserts and xeric shrublands, 0.71



13. Mangroves, 0.95



14. Flooded grasslands and savannas, 1.26



0.001 0.01 0.1 1 10  
Speed (km yr<sup>-1</sup>)

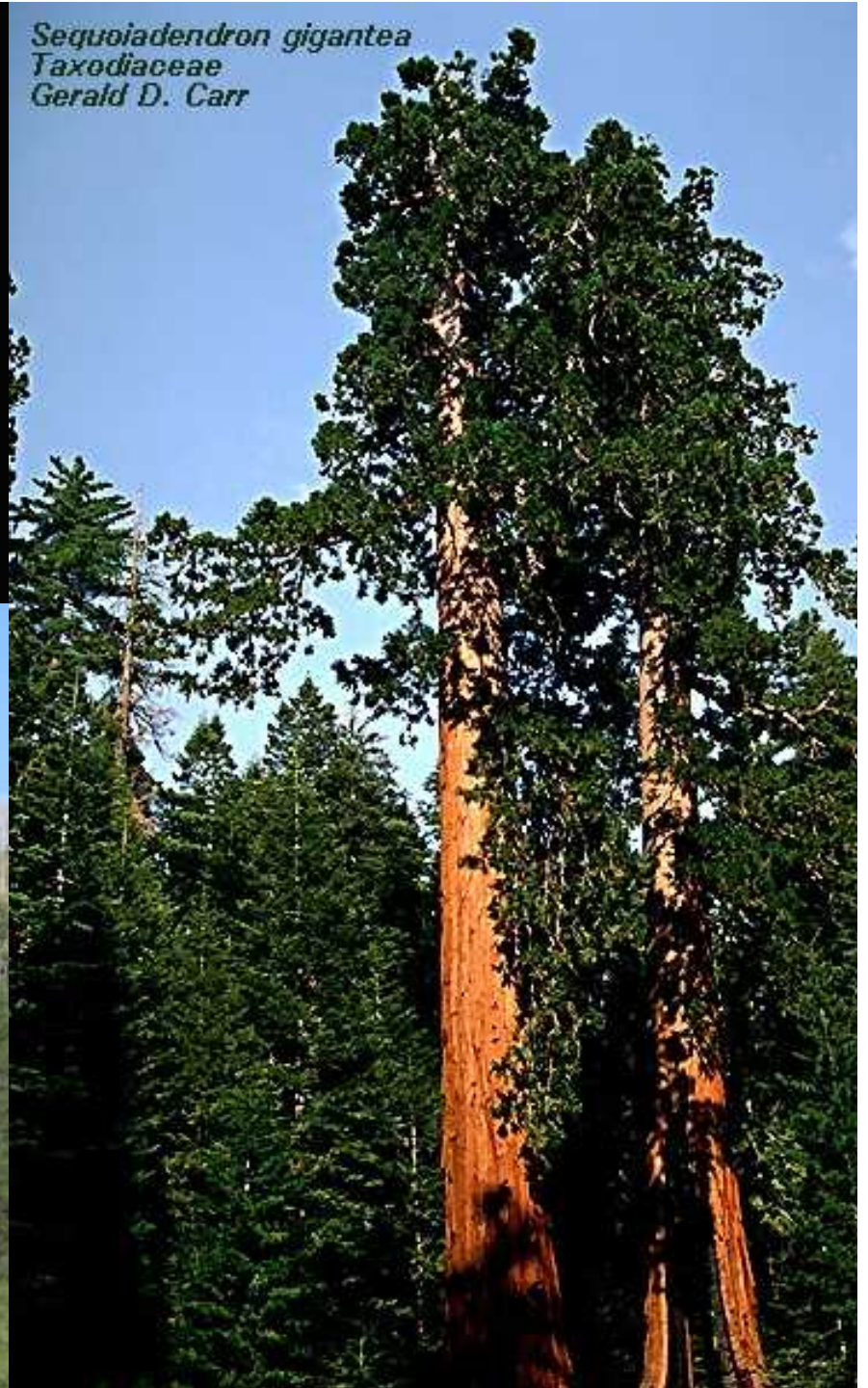




*Euphydryas editha bayensis*



*Centaurea solstitialis*



*Sequoiadendron gigantea*  
Taxodiaceae  
Gerald D. Carr



Angel Watkins, US Forest Service, 2007

# Challenges

- Forestry
  - Mortality
- Agriculture
  - Yield gaps
  - Thresholds



Rapid, widespread forest die-off

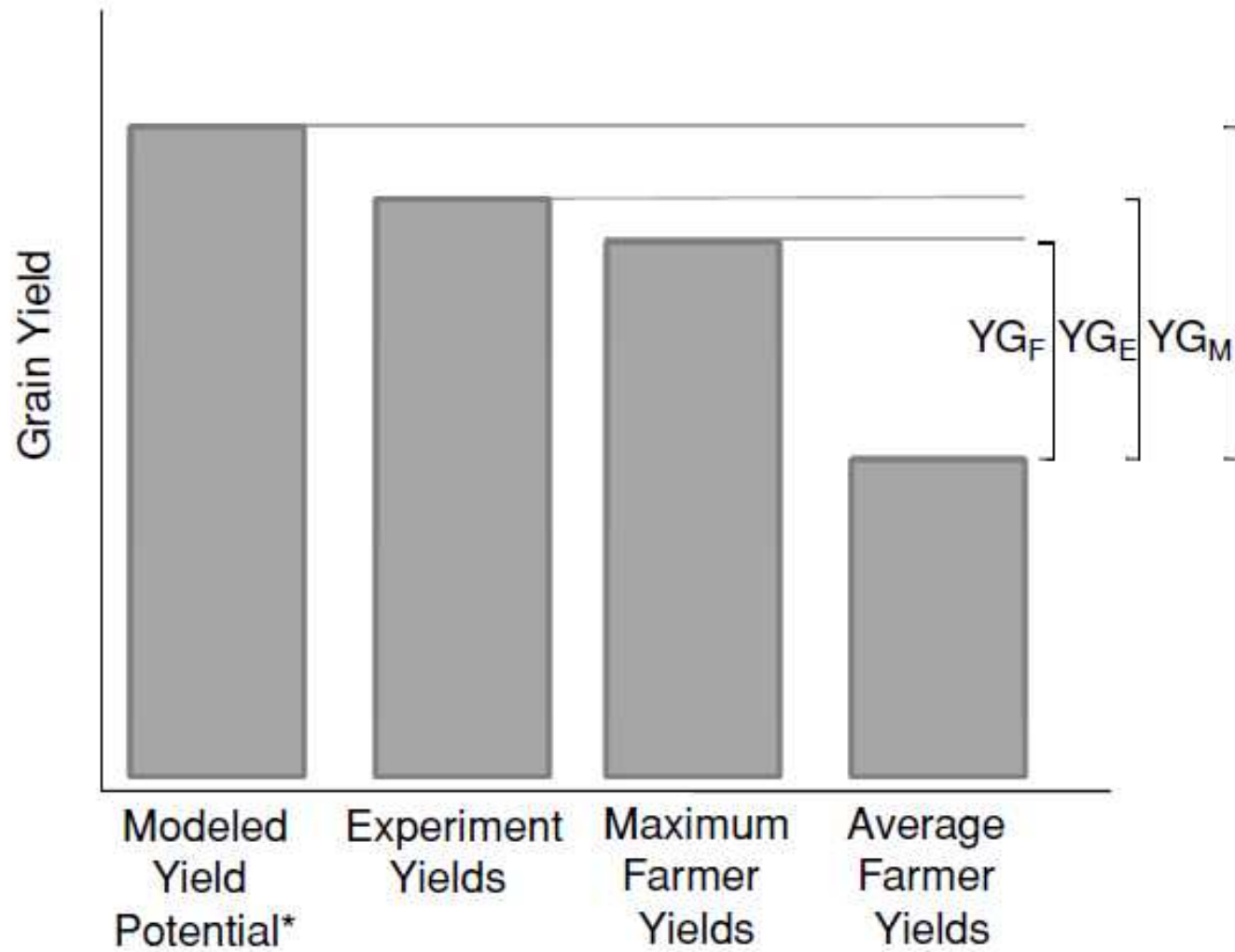


# A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests

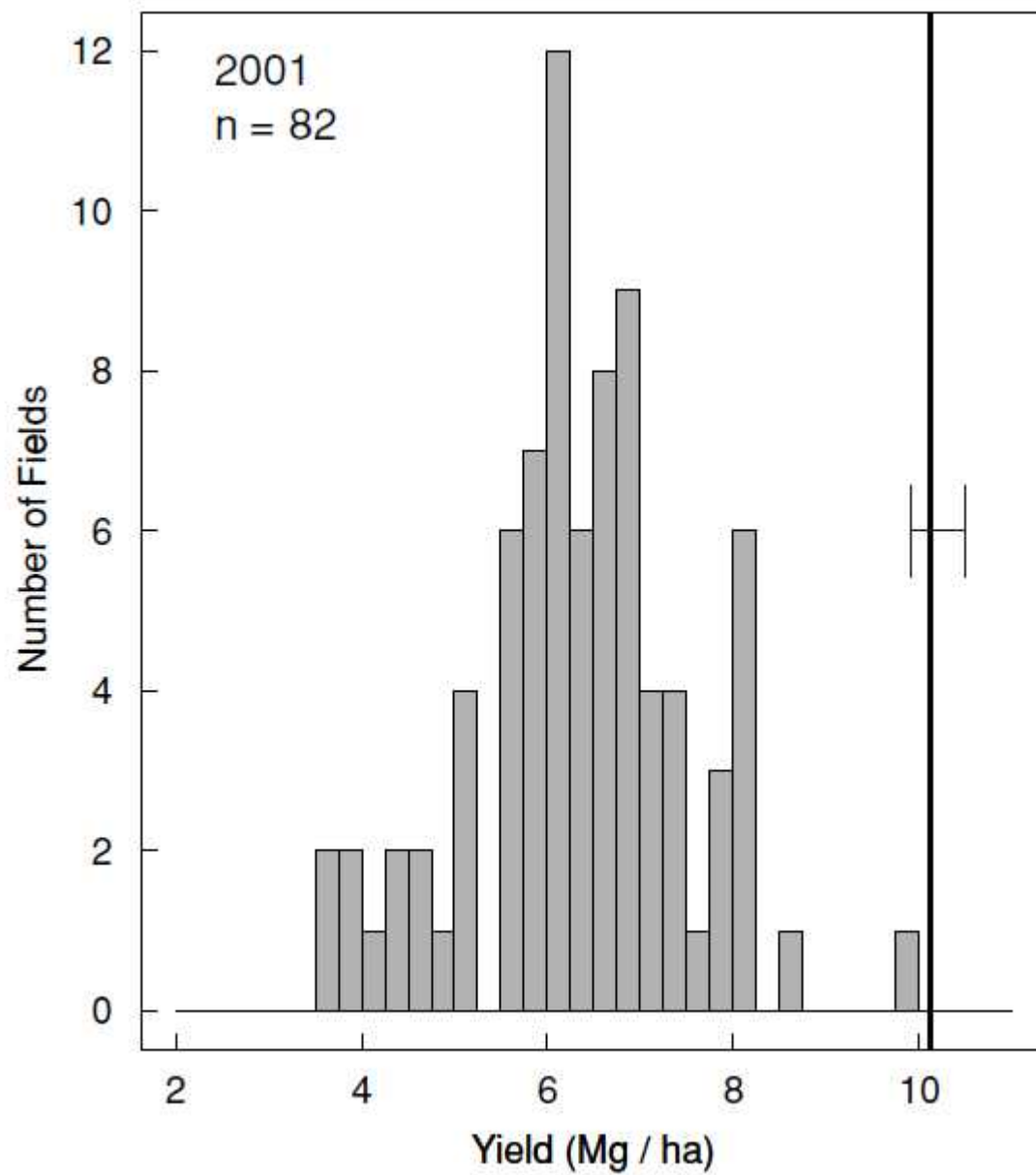


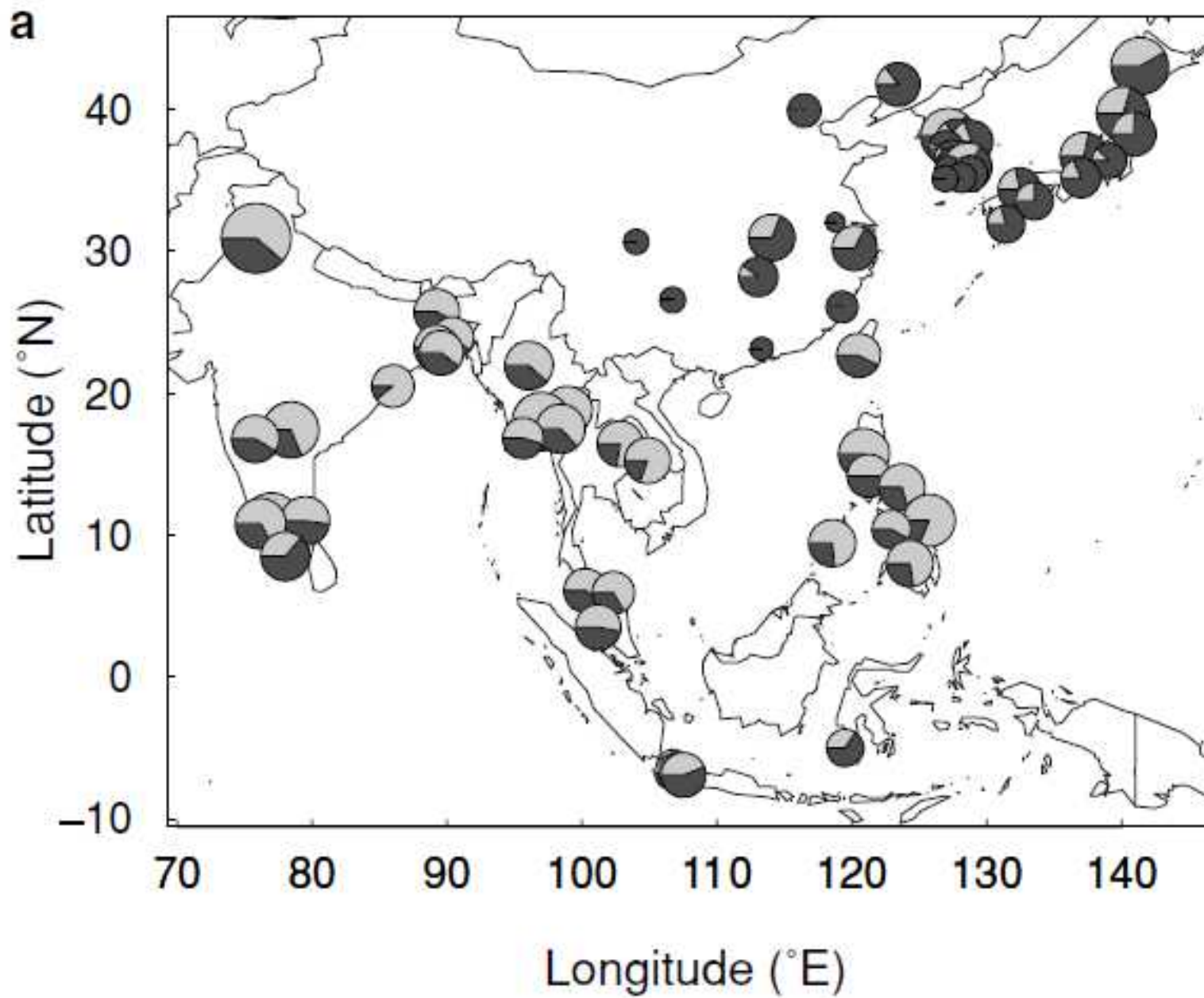
Allen et al. 2010





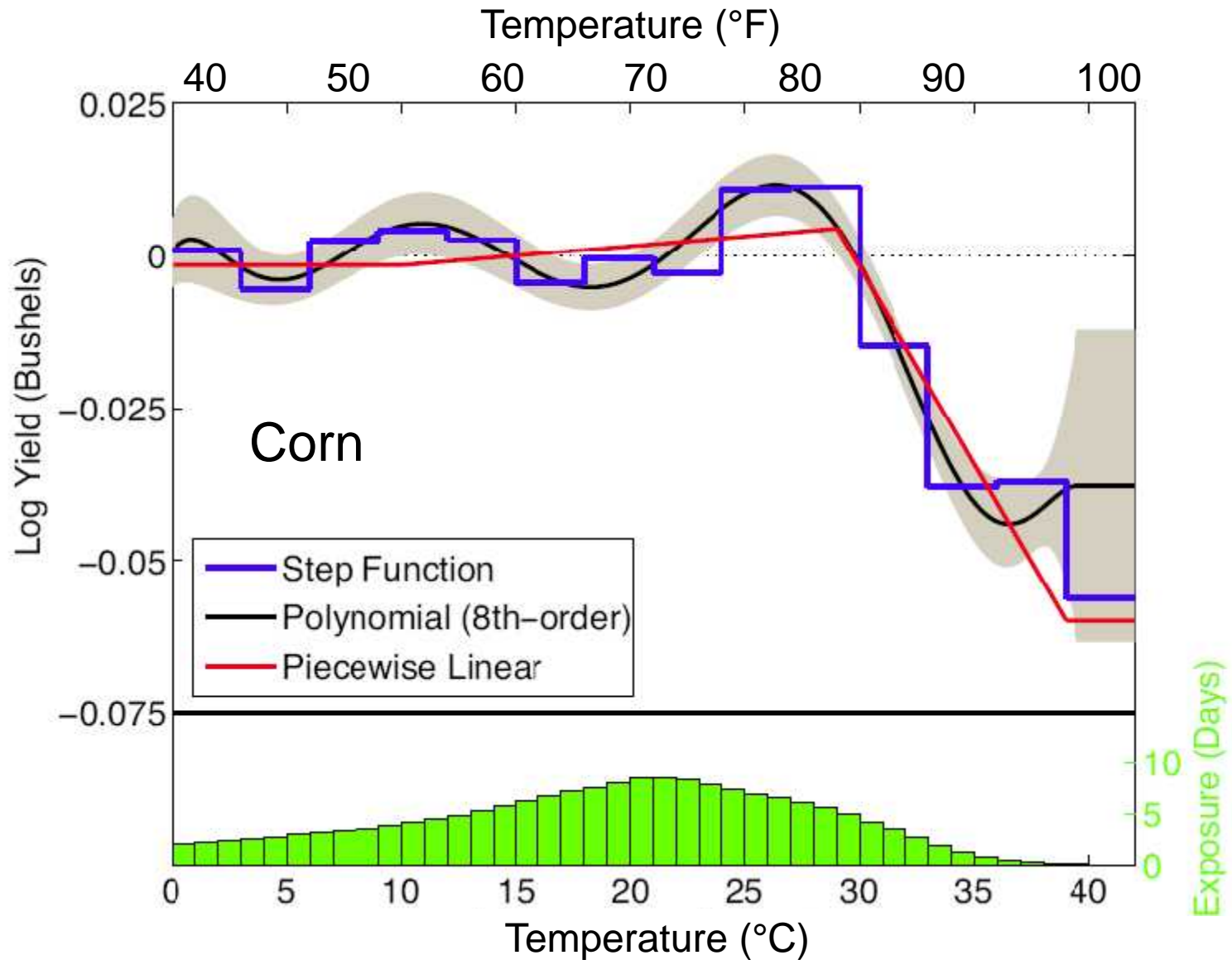
\*Or "water-limited yield potential" in the case of rainfed systems

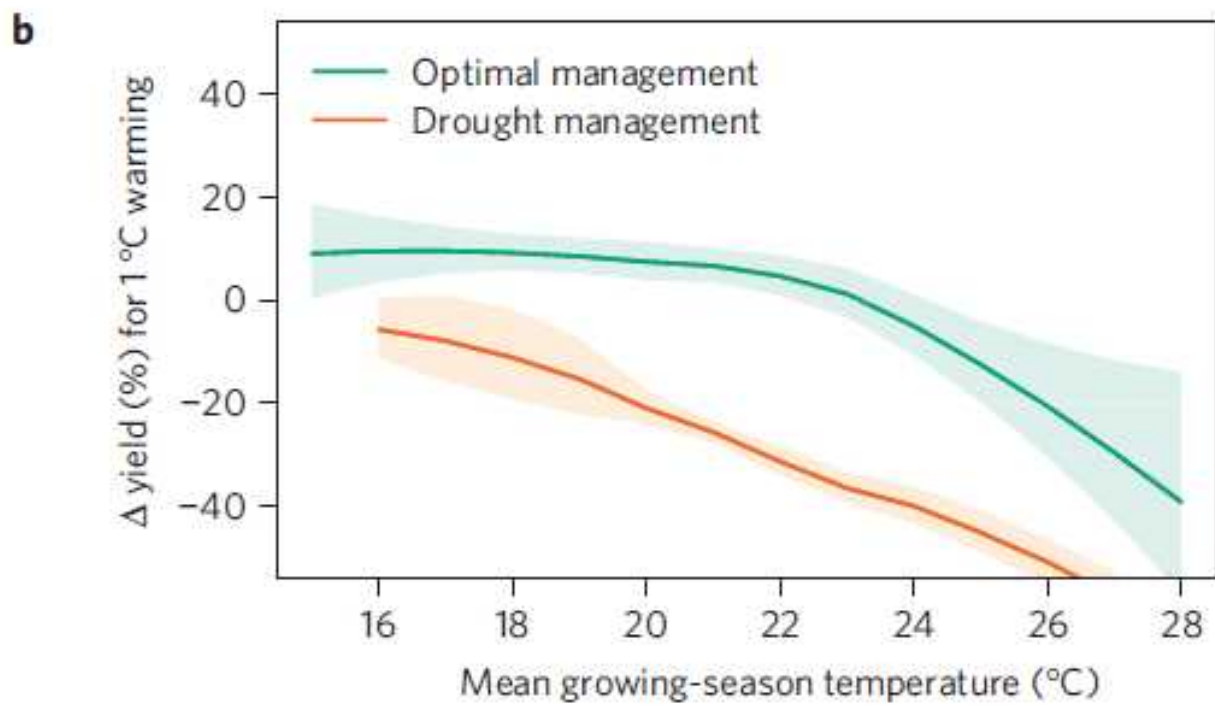
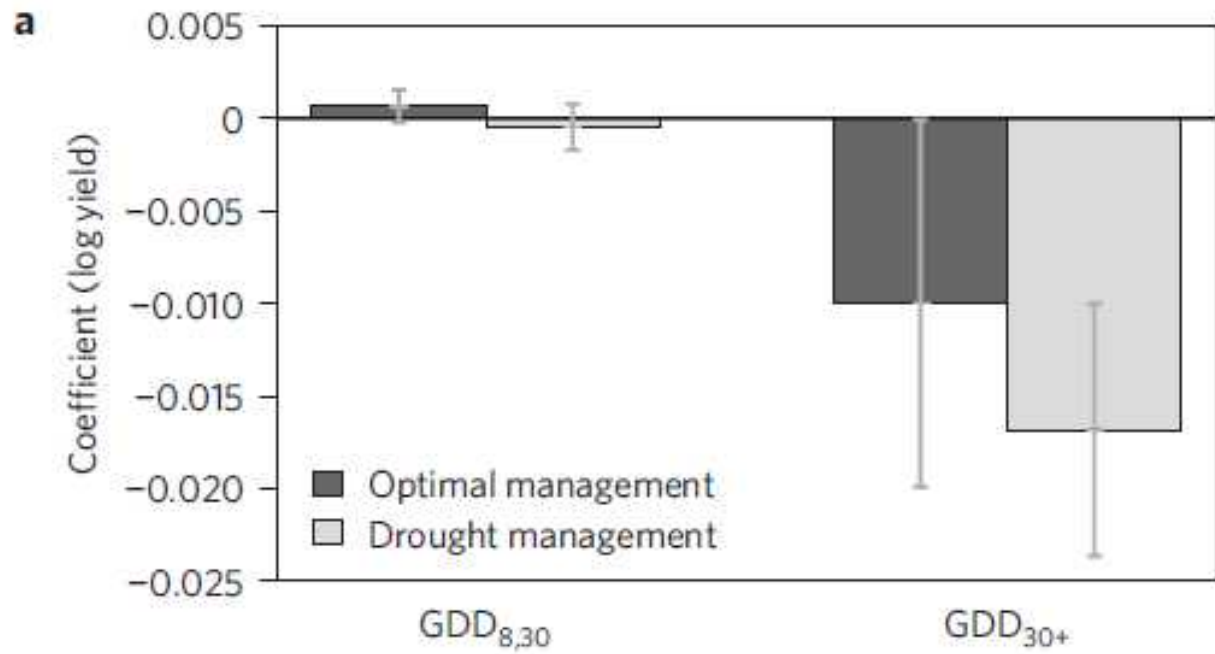




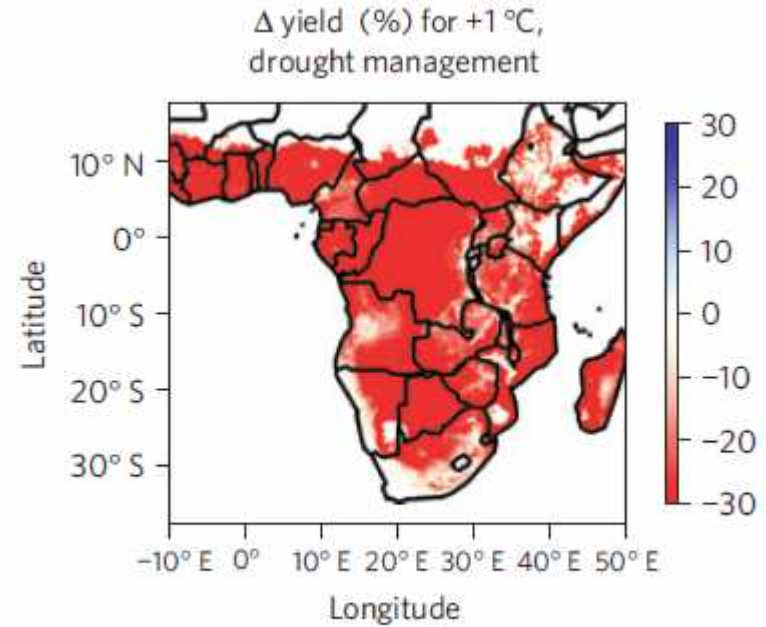
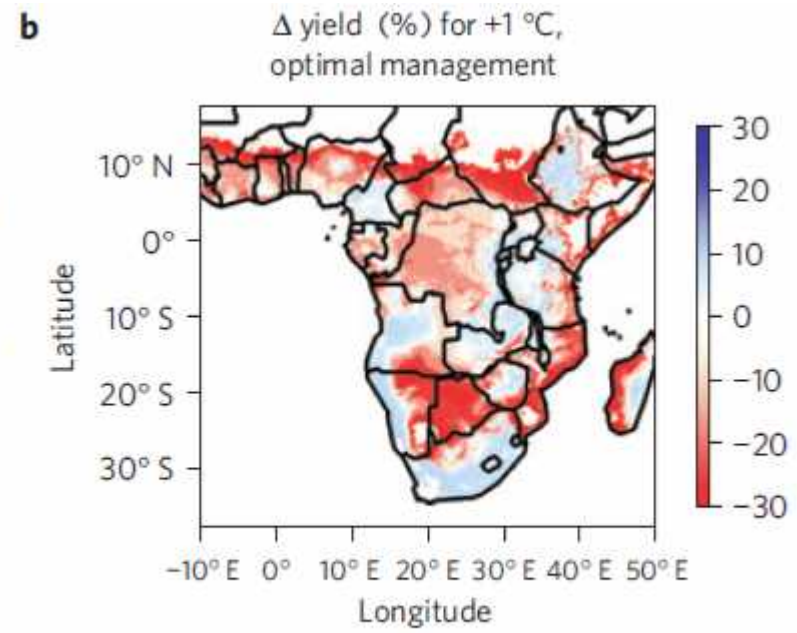
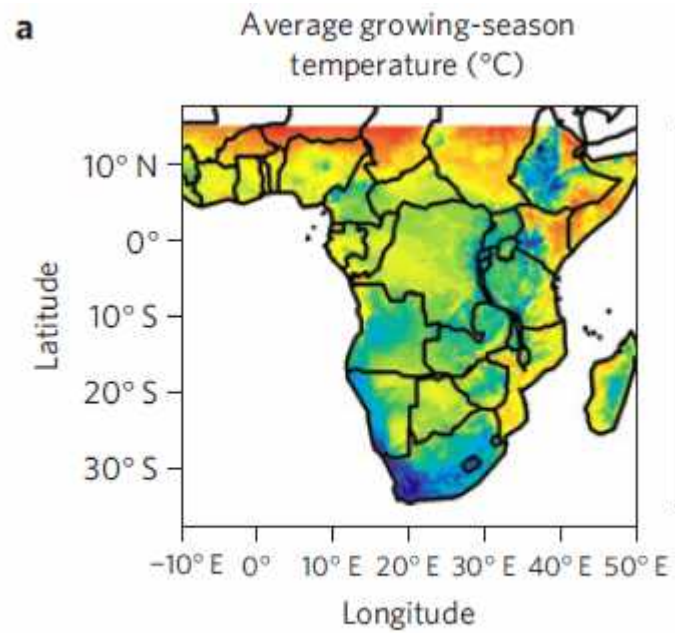
Lobell et al. ARER 2009

# US crop yields: Threshold behavior





Lobell et al. Nature  
Climate Change 2011



Lobell et al. Nature  
Climate Change 2011

- The role of velocity?
  - Which ecosystem outcomes
  - Which farmer decisions
- Integrating risk