

# Understanding the Interactions between Climate Change, Agriculture, and Biodiversity in South Africa



Princeton University

Lyndon Estes, Michael Oppenheimer, David Wilcove

University of Massachusetts

Bethany Bradley

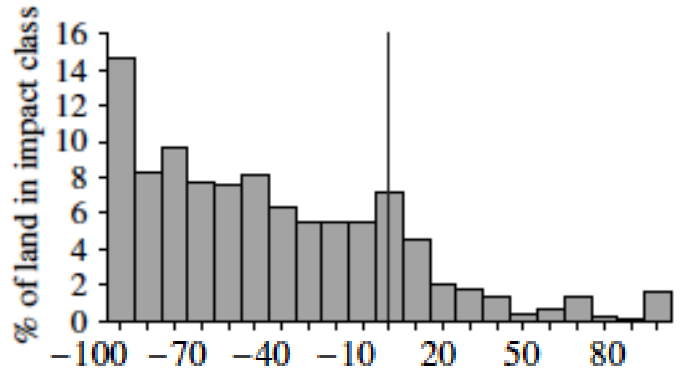
Conservation International

David Hole, Will Turner

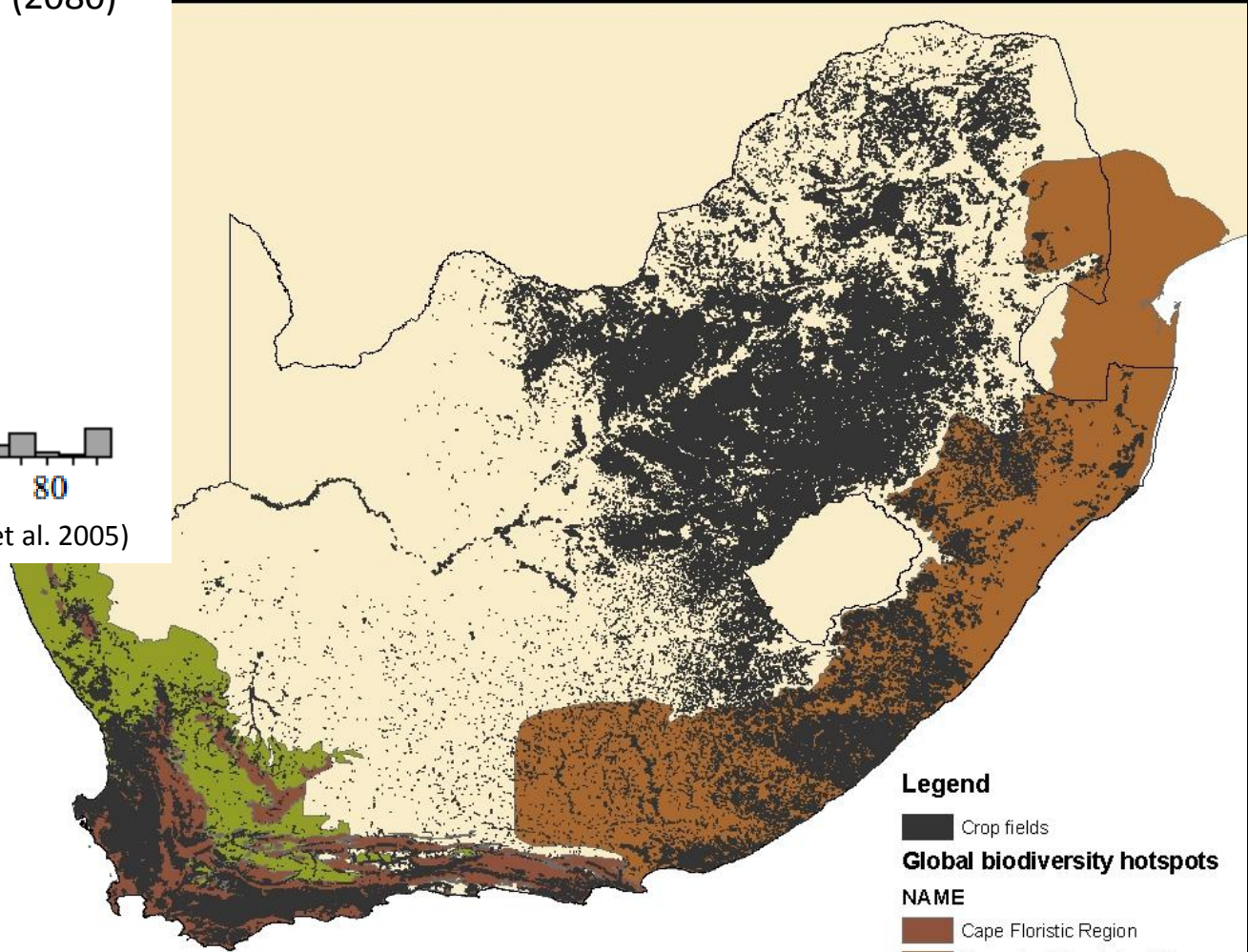
# What about the biodiversity/ecological impacts of humans responding to climate change? Why South Africa, and why agriculture?

Changes in cereal productivity (2080)

southern Africa,  
current cultivated land



Change in crop suitability index (Fischer et al. 2005)



## Legend

- Crop fields
- Global biodiversity hotspots**
- NAME
- Cape Floristic Region
- Maputaland-Pondoland-Albany
- Succulent Karoo

Plus good data...

# Predicting how human adaptation to climate change will affect biodiversity: a case study from South Africa

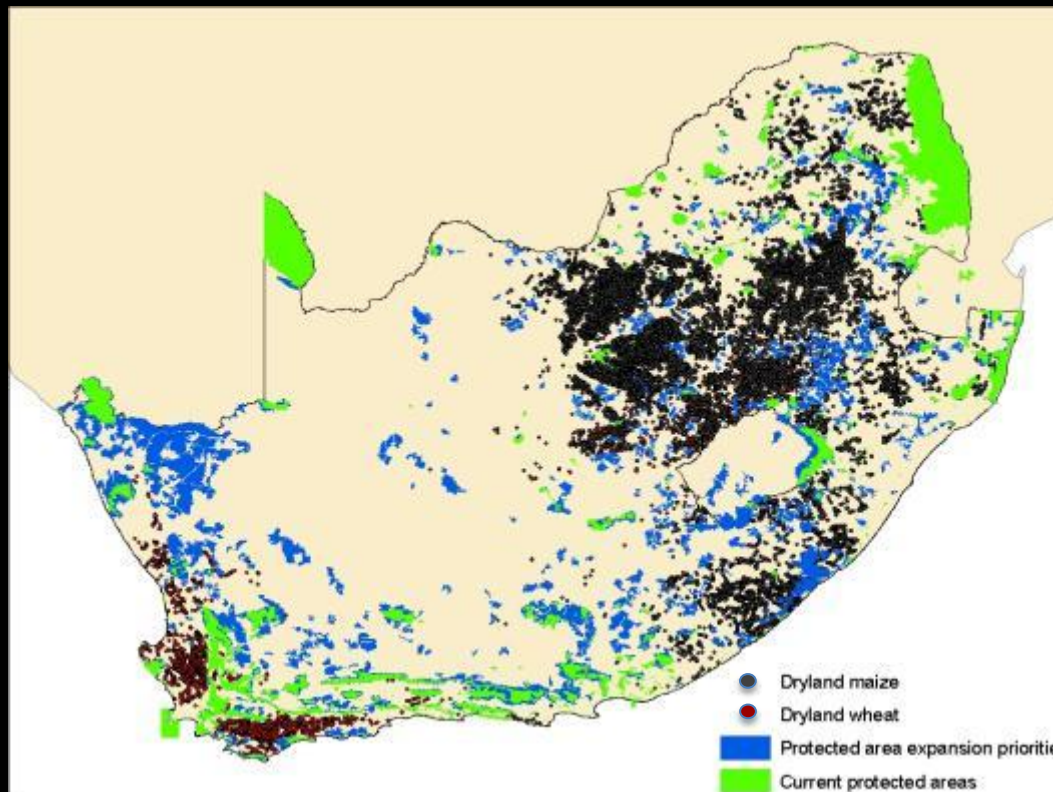
Bethany Bradley, Lyndon Estes, David Hole, Stephen Holness, Michael Oppenheimer, Will Turner, David Wilcove

To determine overlap between:

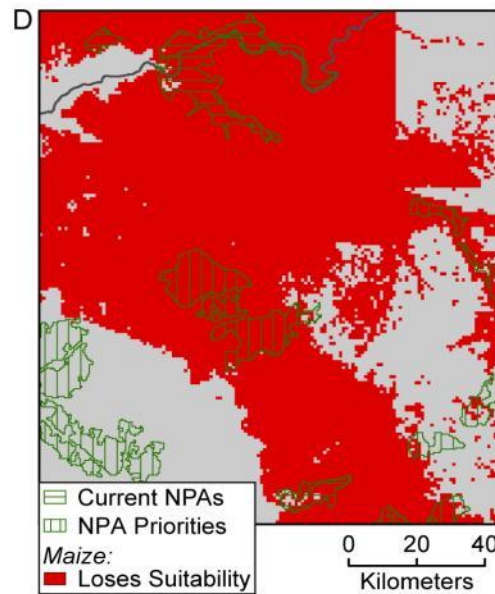
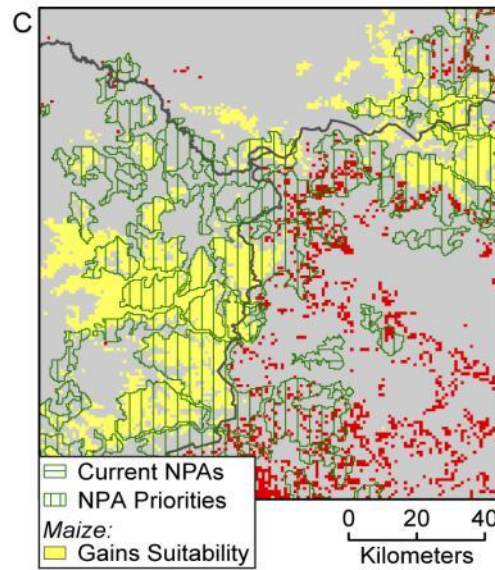
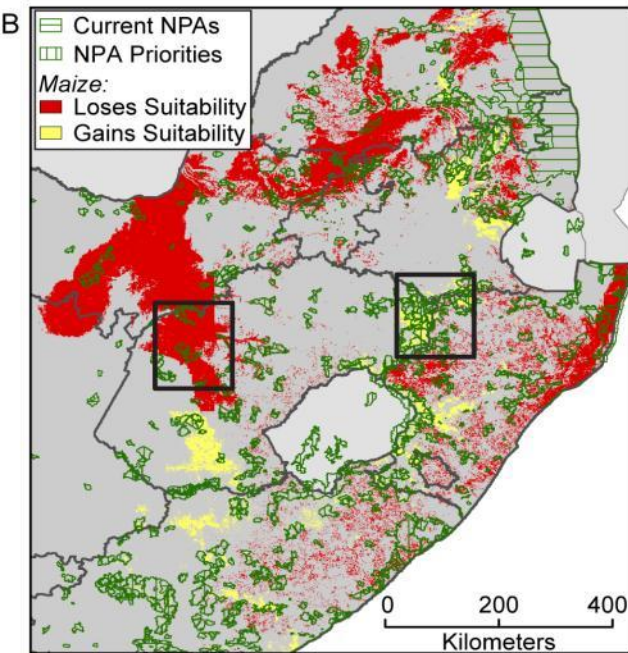
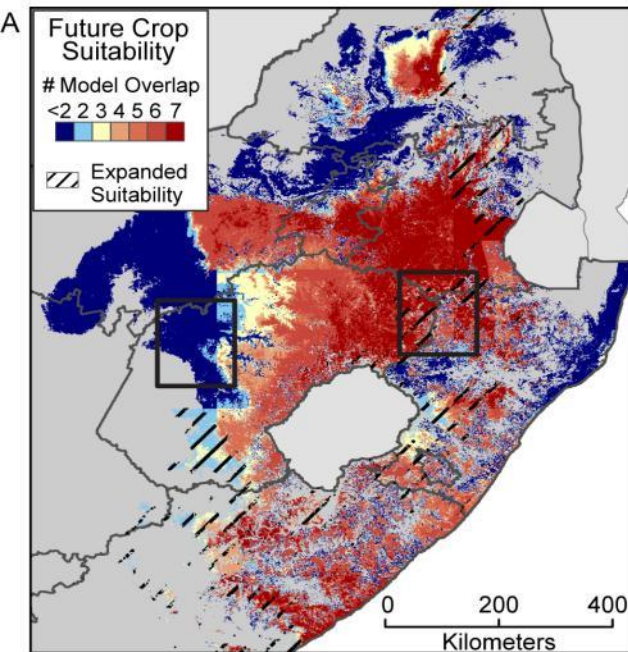
- Wheat and maize suitability in 2050
- Protected areas + PA priorities



Implications for conservation?



# Example: Maize Suitability in 2050



## Suitability lost

- 13.8 - 14.3 million ha (~38 %)
- Overlaps with
- 125 – 135 PAs (1.6 – 1.7 m ha)
  - 510,000 – 540,000 ha PA expansion areas

## Suitability Gained

- 2.4 – 2.7 million ha
- Overlaps with
- 151 – 173 PAs (760,000 – 800,000 ha)
  - 570,000 – 590,000 ha PA expansion areas

# Conservation Implications

Change	Consequence
<b>Agriculture suitability increases</b>	
<i>Generally</i>	<ul style="list-style-type: none"> <li>• Expansion of cropland could lead to habitat fragmentation, reduced connectivity, and introduction of invasive species</li> <li>• Expansion of cropland into new areas could increase threats to a range of species and habitats, creating new urgent conservation priorities and increasing the burden on conservation resources.</li> </ul>
<i>In situ</i>	<ul style="list-style-type: none"> <li>• Conversion of native ecosystems in marginal lands to crops if prices increase</li> <li>• Agricultural intensification due to economic benefits</li> </ul>
<i>Adjacent to and within protected areas</i>	<ul style="list-style-type: none"> <li>• Reserve isolation due to agricultural development in buffer areas</li> <li>• Social pressure to open protected areas to farming to avoid food scarcity</li> <li>• Illegal subsistence farming</li> </ul>
<i>In PA expansion priorities</i>	<ul style="list-style-type: none"> <li>• Increased demand for land could trigger rising land prices and lesser land acquisition for conservation</li> <li>• Loss of expansion opportunities as land is transformed</li> </ul>
<b>Agricultural suitability decreases</b>	
<i>In situ</i>	<ul style="list-style-type: none"> <li>• Increased use of fertilizers in response to crop loss could threaten surrounding native ecosystems</li> <li>• Diversion of water resources could threaten riparian habitat</li> <li>• Agriculture abandonment creates restoration opportunities</li> </ul>
<i>Adjacent to protected areas</i>	<ul style="list-style-type: none"> <li>• Increased human dependence on natural resources (e.g., fuel wood, bushmeat) threatens protected ecosystems</li> </ul>
<i>In PA expansion priorities</i>	<ul style="list-style-type: none"> <li>• Decreased demand for land could trigger declines in land prices and greater land acquisition for conservation</li> </ul>

# Symposium- Cape Town, 17-18 August 2011

## AIMS:

- Discuss results of the research
- To determine how this work can contribute to agricultural and conservation planning in SA;
- To discuss policy implications for the work
- To compare this work with related research;
- To share datasets and methods arising from this work

# Symposium- Cape Town, 17-18 August 2011

## Call for Presentations and Data

1. Climate change impacts on South African agriculture/livestock/forestry;
2. Climate change impacts on South African flora, fauna, and ecosystem services;
3. Social responses or livelihood decisions in response to climate change;
4. Conservation planning/design for climate change

[lestes@princeton.edu](mailto:lestes@princeton.edu)

# AGRICULTURE AND CLIMATE CHANGE

Internationally- move towards **CLIMATE SMART AGRICULTURE:**

- FAO definition: *agricultural approach shifts to ensure:*
  - Food security
  - Climate change- ecosystem based adaptation (*maintain and protect ecosystems and their services to help people adapt*)
  - Sustainable land management
  - Includes, water security and assists mitigation (by *reducing emissions*).....

**SA on the road to a climate smart agriculture???**