Ecological agriculture for food security and climate resilience

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Climate and agriculture

The two main climate variables are very important to plants (and those who eat them):

- Precipitation
- Temperature
- Taken together, these influence the amount of water in soils and the length of the growing season or seasons.

Yield impacts due to climate change have already been demonstrated

Global maize and wheat production declined by 3.8% and 5.5%, respectively, compared to a counter-factual without climate trends. ...

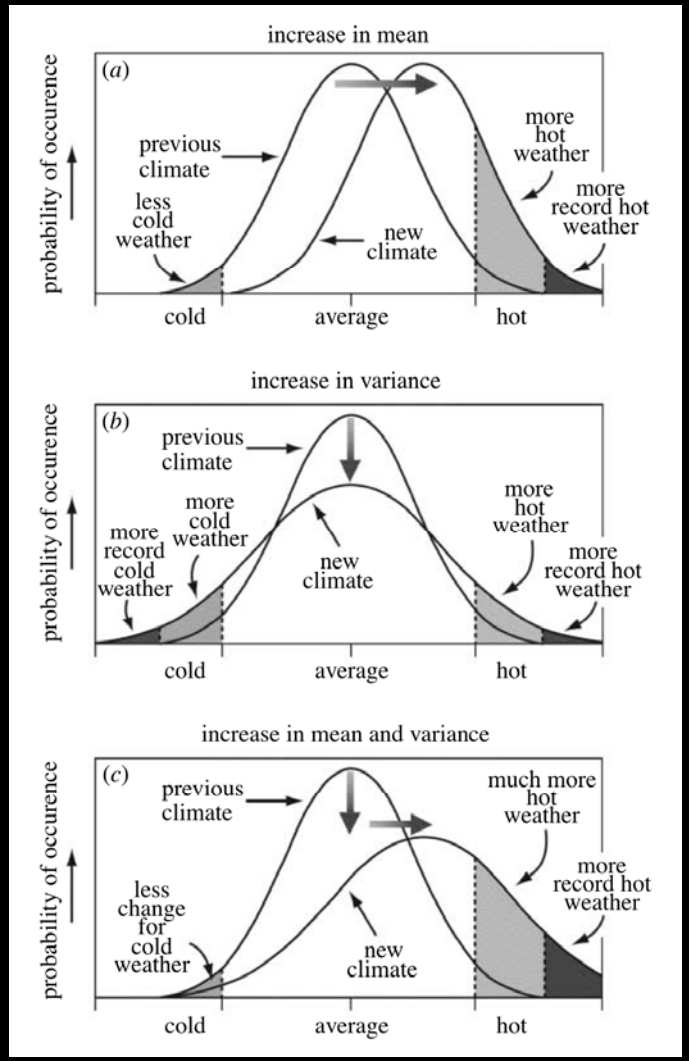
Climate trends were large enough in some countries to offset a significant portion of the increases in average yields that arose from technology, … and other factors.

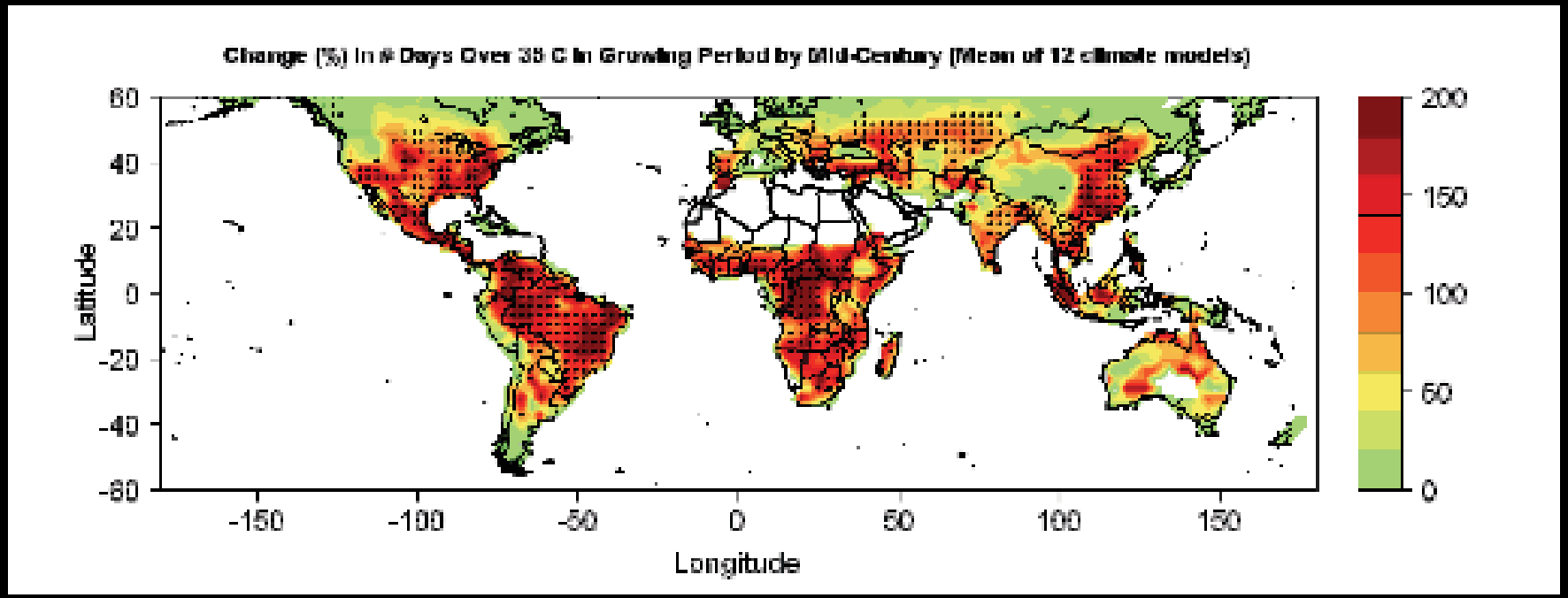
(Lobell *et al.* 2011)

Some expected climatic changes

- More uncertain precipitation, including in the onset of rainy seasons
- Drying in many areas
  - There is medium confidence that droughts will intensify in the 21st century in some seasons and areas, due to reduced precipitation and/or increased evapotranspiration
- New extremes for temperature and precipitation
  - It is likely that the frequency of heavy precipitation or the proportion of total rainfall from heavy falls will increase in many areas of the globe.
  - Models project substantial warming in temperature extremes

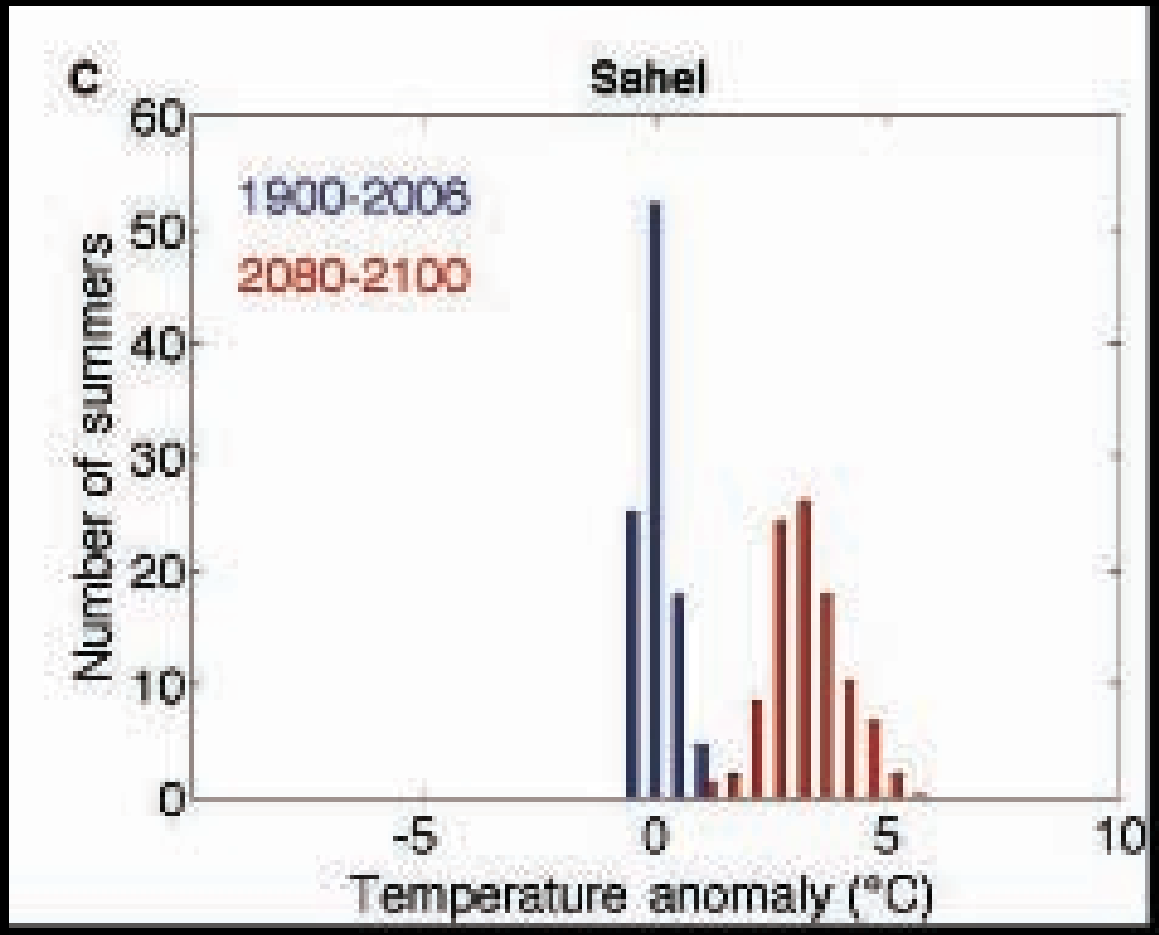
(IPCC SREX 2011)

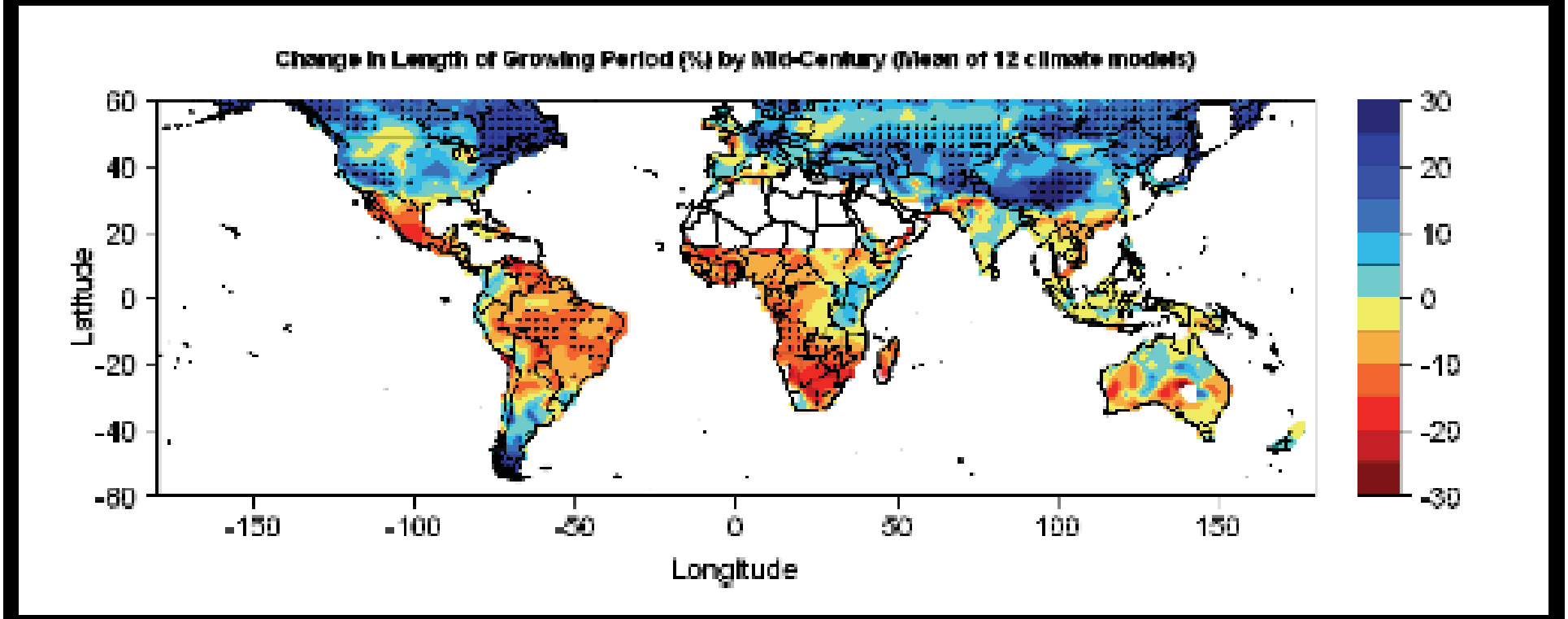

increase in mean
(a)
probability of occurence
previous climate
less cold weather
new climate
more hot weather
more record hot weather
cold
average
hot
increase in variance
(b)
probability of occurence
previous climate
more cold weather
more record cold weather
new climate
more hot weather
more record hot weather
cold
average
hot
increase in mean and variance
(c)
probability of occurence
previous climate
less change for cold weather
new climate
much more hot weather
more record hot weather
cold
average
hot


Change (%) in # Days Over 38 C in Growing Period by Mid-Century (Mean of 12 climate models)
Latitude
60
40
20
0
-20
-40
-60
-150
-100
-50
0
50
100
150
Longitude
200
150
100
50
0

Global temperature rise in the African context

- Current average temperatures across the globe are 0.74°C above the historical reference year of 1905. An average warming of 1.5°C above historical temperatures is expected by 2050.
- For Africa, 2010 was the warmest year on record. 2010 temperatures averaged over Africa were 1.29°C above the long-term average.
- "*The majority of African countries will have novel climates over at least half of their current crop area by 2050*."


c
Sahel
1900-2006
2080-2100
Number of summers
60
50
40
30
20
10
0
-5
0
5
10
Temperature anomaly (°C)


Change in Length of Growing Period (%) by Mid-Century (Mean of 12 climate models)
Latitude
60
40
20
0
-20
-40
-60
-150
-100
-50
0
50
100
150
Longitude
30
20
10
0
-10
-20
-30

Which components of our agricultural systems must we enhance to increase climate resilience?

- Diversity: genetic, species, spatial, economic
- Water-holding and infiltration capacity of soils
- Soil health and productivity
- Water harvesting and storage
- There is an overall need for flexibility in responding to variable weather and climate

Agroecology is climate resilient

The core principles of agroecology include:

recycling nutrients and energy on the farm, rather than introducing external inputs;

integrating crops and livestock;

diversifying species and genetic resources in agroecosystems over time and space;

and focusing on interactions and productivity across the agricultural system, rather than focusing on individual species.

Agroecology is highly knowledge-intensive, based on techniques that are not delivered top-down but developed on the basis of farmers' knowledge and experimentation.

(from DeSchutter 2011)

Resilience elements of ecological agriculture systems

- Diversity of genetic resources and peasant seed systems
- Cropping diversity over space and time, including through agroforestry, agropastoral and silvopastoral systems
- Use of composts and manures, cover cropping and green manures to improve soil health, increase nutrients for enhanced productivity, and augment water-infiltration and water-holding capacity
- Traditional water harvesting and other water management technologies
- Farmer knowledge, in particular the knowledge of women farmers

In contrast, industrial systems are quite vulnerable

- Large scale monocultures
- Dependent on fossil fuels
- Highly external input dependent for fertility
- Dead soils
- Water requirements are high
- And on top of all this, industrial systems emit large amounts of greenhouse gases

Small farmers can cool the planet

"The immense challenge humanity faces of stopping global warming and cooling the planet can only be achieved through a profound shift in agricultural practices toward the sustainable model of production used by indigenous and rural farming peoples, as well as other ancestral models and practices that contribute to solving the problems of agriculture and food sovereignty."

Cochabamba People's Agreement 2010

To be clear, the climate challenge is massive

- Small-scale, agroecological food producers in the United States did not fare well in the recent drought.
- Safety nets that we have in the US are not designed to protect diversified agricultural systems.
- Ecological agriculture can buffer many impacts, but social safety nets are equally important.
- There are very real limits to adaptation.

What are key policy demands for food security under climate change?

- Massive increase in support for ecological agriculture systems
- Support for farmer-to-farmer networks and seed systems
- Improve social safety nets for small-scale food producers
- Transform industrial systems to reduce global food security vulnerabilities

Thank you

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