

HUMAN CLIMATE HORIZONS

NEW RELEASE: IMPACTS ON AGRICULTURE

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Human
Development
Report
Office





Climate
Impact Lab



U N

D P

HUMAN CLIMATE HORIZONS DATA PLATFORM

A window into possible futures: Global and hyperlocal impacts of climate change on people and human development worldwide, with three emission scenarios, covering the entire 21st century.

horizons.hdr.undp.org



WHAT IS HUMAN CLIMATE HORIZONS

**Worldwide
coverage
with over
24,000
subnational
regions**

**3 time
horizons over
the entire
21st century;
3 emission
scenarios**

**Standardized
geographies/
published
methodologie
s/hazard
data from
IPCC**

**Open digital
public good**

**Multi-
dimensional
assessment
of climate
risks**

- Partnership between UNDP and Climate Impact Lab
- Expands our understanding of impacts of climate change on people and human development. What could be our potential futures in scenarios of +1.8, +2.7 or higher temperature change?
- Equips policymakers with the means to understand the potential costs, and gather efforts around mitigation strategies, both locally and globally.
- Enhances agency and empowers individuals and communities to play a role in shaping the path forward.

MULTIDIMENSIONAL ASSESSMENTS: A GROWING SPECTRUM OF INDICATORS

New release (2025)

Hazard indicator (impact on **agriculture / crop yields**)

- ↳ Temperature trends and rainfall patterns

Impact indicators

- ↳ Percent change in annual yields/production of the staple crops (cassava, corn, rice, soy, sorghum, and wheat)

Previous releases:

Hazard indicator

- ↳ **Temperature change**

Hazard indicator

- ↳ **Sea level rise**

Impact indicators

- ↳ Mortality
- ↳ Labor productivity
- ↳ Energy use

Impact indicators

- ↳ Share of population living in expanded floodplains
- ↳ Share of region under mean sea level (%)
- ↳ Area under mean sea level (km²)



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HUMAN CLIMATE HORIZONS

AGRICULTURAL YIELD IMPACTS

NEW INDICATORS ON HUMAN CLIMATE HORIZONS

The new projections show the projected impacts of climate change on agricultural yields for six staple crops: **maize, rice, wheat, soy, cassava, and sorghum**, across more than 100 countries and over 19,000 subnational regions worldwide.

Data are available for three periods—**the near term** (2020–2039), **mid-century** (2040–2059), and **end of the century** (2080–2099)—and **two emissions pathways** (RCP 4.5 and RCP 8.5).

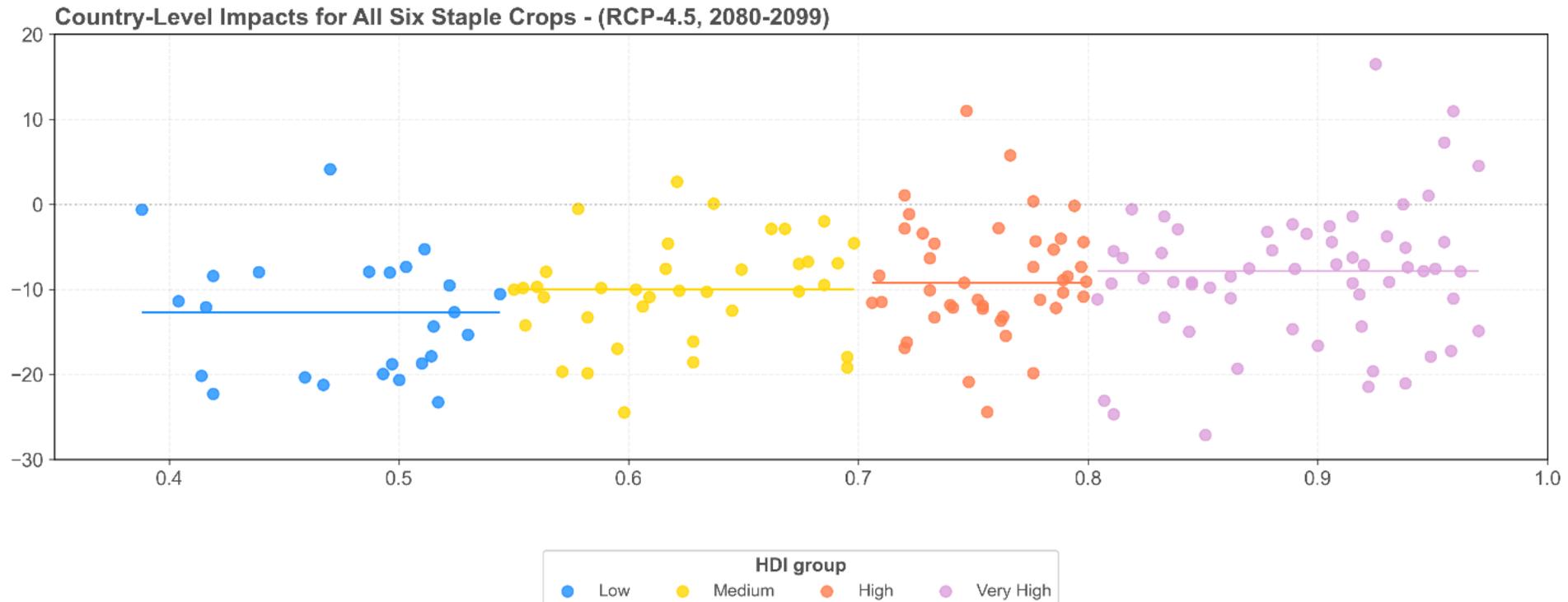
Together, these data provide a high-resolution, empirically grounded view of how warming under different emissions trajectories could affect food systems and, through them, human development outcomes.

HDRO has expanded the original study (by Hultgren et al. (2025) published in Nature), by aggregating subnational results into national, calorie- and crop-share-weighted net yields—so that climate impacts and risks can be compared at the sovereign-country level against HDI and capacity (a policymaker-relevant lens). The method and findings will be published in an upcoming white paper by HDRO in **March 2026**.

WIDESPREAD CLIMATE IMPACTS ON YIELDS

Climate change is projected to drive widespread declines in staple-crop yields across nearly all countries, regardless of development level or emissions pathway.

More than 90 percent of countries are expected to experience declines in staple-crop yields under both moderate and high emissions pathways by the end of the century—even after accounting for empirically observed adaptation (Figure below).

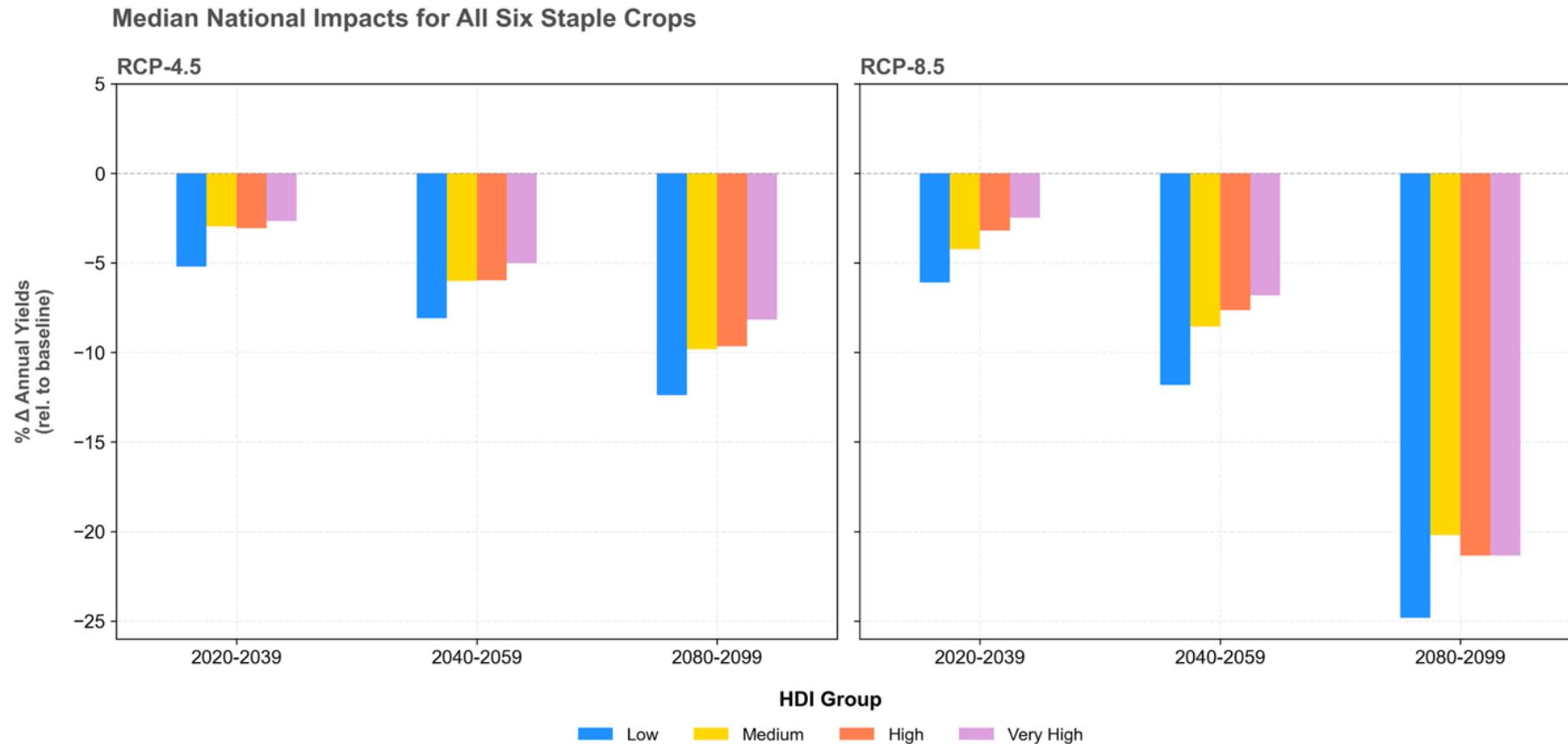


Source: Human Development Report Office analysis of Climate Impact Lab research.

Note: Average percent deviations from historical baseline yield trajectories, averaged for cassava, maize, rice, sorghum, soy, and wheat at the country level, weighted within-country across crops by relative cropping shares (country-varying) and caloric densities of each staple (equivalent crop-wise constants in all countries). Low-HDI countries show the largest declines. Residual losses after empirically observed adaptation; shaded bands = inter-model IQR. Countries with less than 0.1% of staple-cropped land area are excluded (n=19).

DISPROPORTIONATE IMPACTS IN LOW-HDI COUNTRIES

Low-HDI countries face the steepest proportional declines in staple-crop yields, and these losses could translate into the greatest livelihood and food-security risks due to limited adaptive capacity.



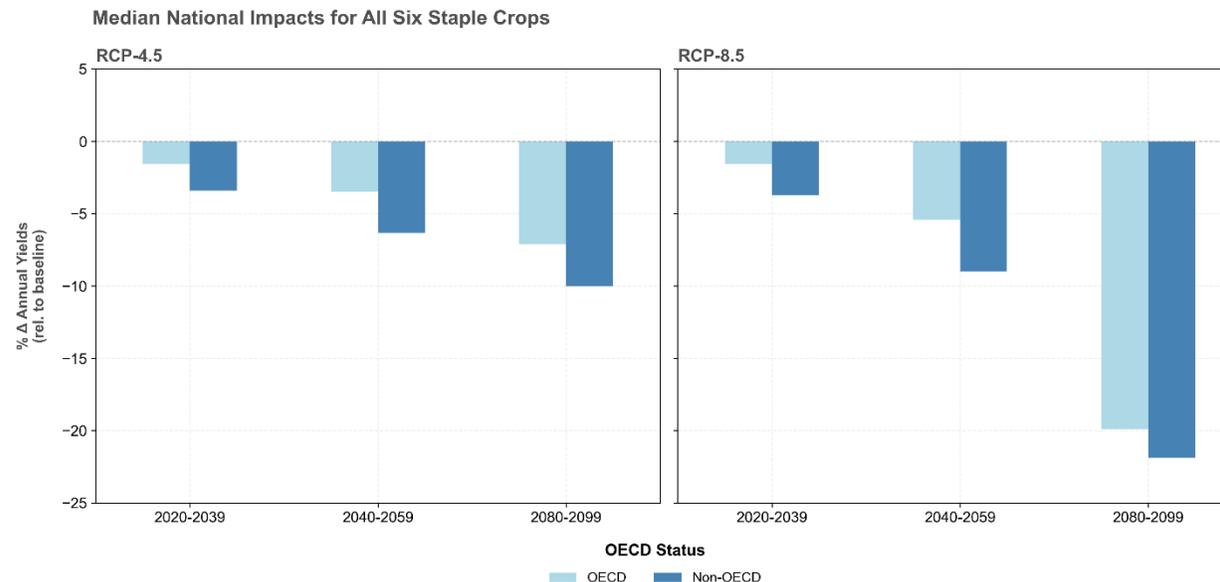
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BREADBASKETS UNDER PRESSURE

Major global breadbaskets in high- and very-high-HDI countries are also vulnerable, and even moderate declines in these regions carry outsized global consequences.

Comparisons between OECD and non-OECD countries show sizeable declines in major breadbasket economies (Figure below). Because these countries account for large shares of global production, yield losses translate into substantial reductions in total calories when weighted by cropped area with potential ripple effects across global food markets that could widen development gaps.



Source: Human Development Report Office and Climate Impact Lab.

Note: Average percent deviations from historical baseline yield trajectories for cassava, maize, rice, sorghum, soy, and wheat at the country level, weighted across crops by relative (country-varying) cropping shares and (globally-constant) caloric densities. Low-HDI countries show the largest declines. Residual losses after empirically observed adaptation; shaded bands = inter-model IQR.

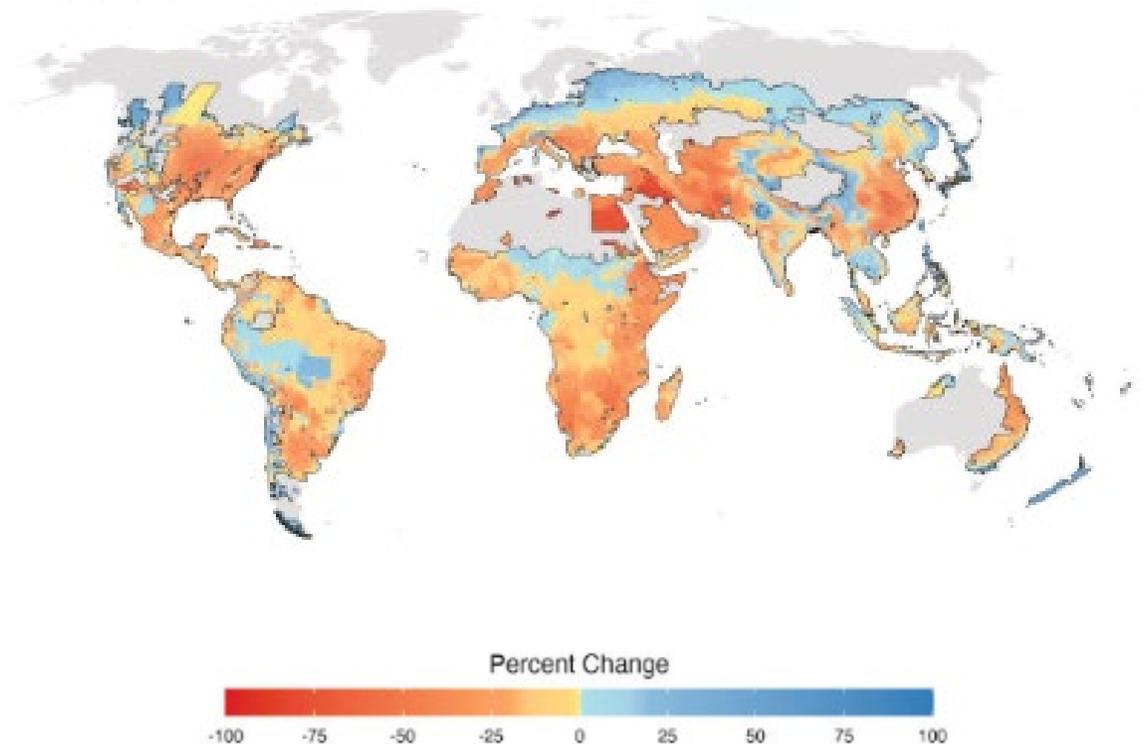
DISTRIBUTION OF IMPACTS: CORN (MAIZE)

The grain belt of the United States, Eastern China, Central Asia, Southern Africa and the Middle East **see the greatest impacts**, with **corn yields declining by about 40 percent** by the end of the century under a scenario with unchecked climate change (very high emissions scenario).

The impacts are more moderate in South America and Central Africa are more moderate, **with losses of about 15 percent**, mitigated in part by more rain over a longer period of time.

While parts of northern Europe experience an increase in yields of as much as 10 percent, the Mediterranean sees losses of 40 percent.

Maize



CORN: CHINA IMPACTS

EMISSION SCENARIO ⓘ

High (RCP 8.5) ▾

COUNTRIES & TERRITORIES

China ▾

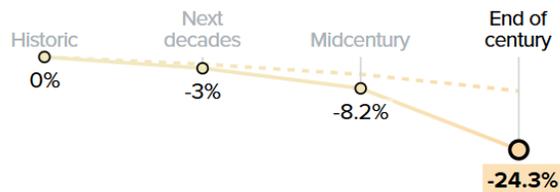
TIME HORIZON

2080-2099 (end of century) ▾

Food Production Impacts

Impact Data

📘 Impact on Corn Crop **-24.3%**
Percent decline



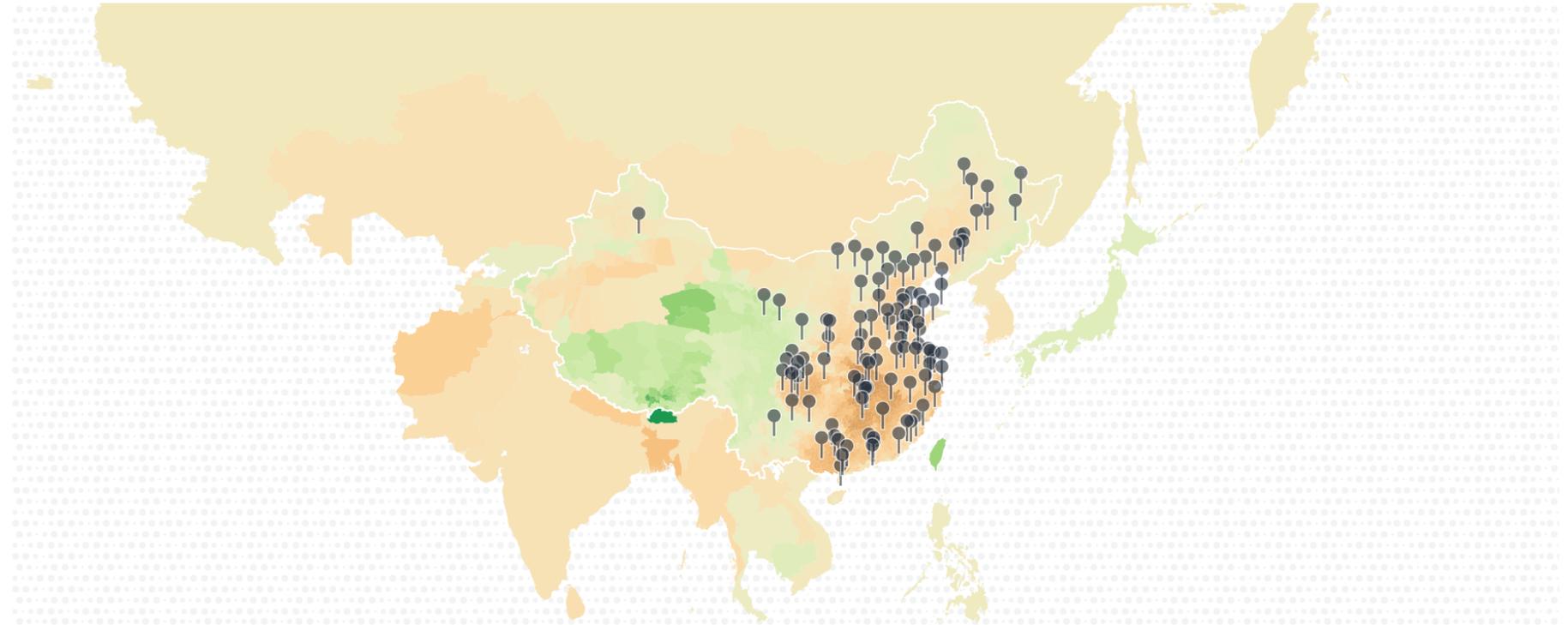
RCP EMISSION SCENARIO

High

Moderate

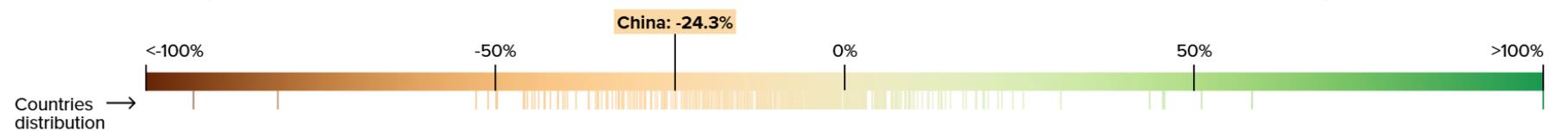
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COMPARE COUNTRIES >



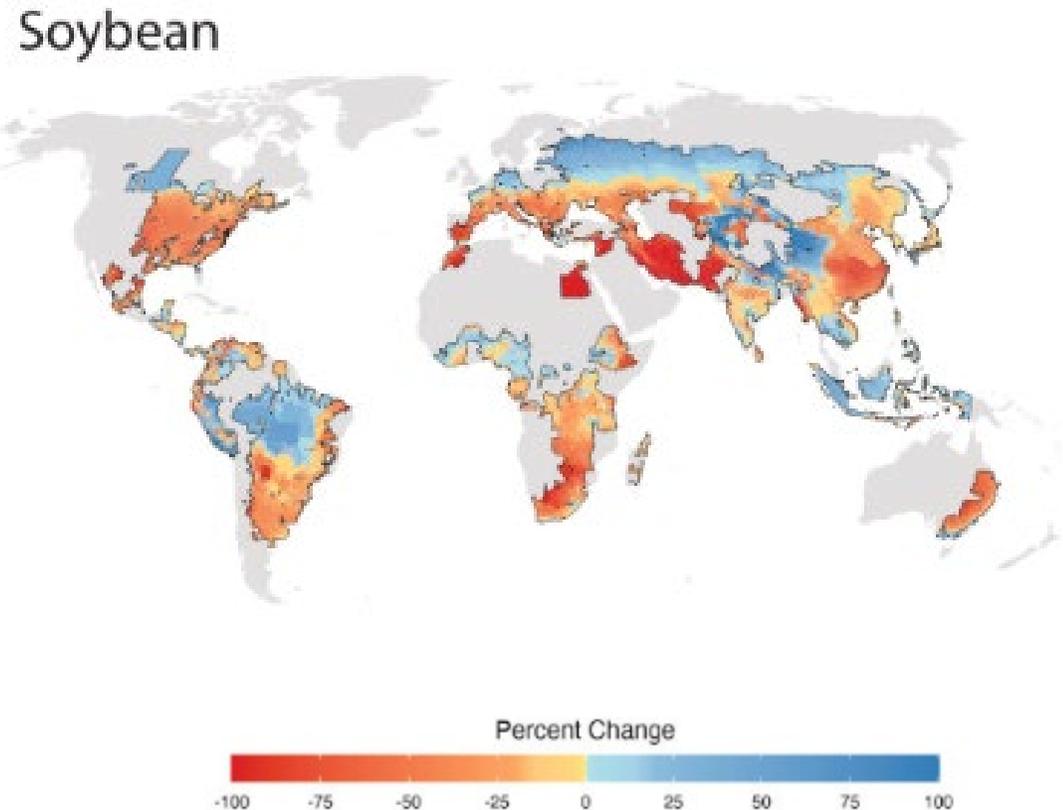
Impact on Corn Crop

Scenario: High (RCP 8.5), undefined



DISTRIBUTION OF IMPACTS: SOYBEAN

The spatial distribution of soybean yield impacts is similar in structure to maize, although magnitudes are accentuated, for example, **about 50% decrease in the USA** and **about 20% increase in wet regions of Brazil** under a high emissions scenario.



SOYBEAN: USA IMPACTS

High (RCP 8.5) ▼

COUNTRIES & TERRITORIES

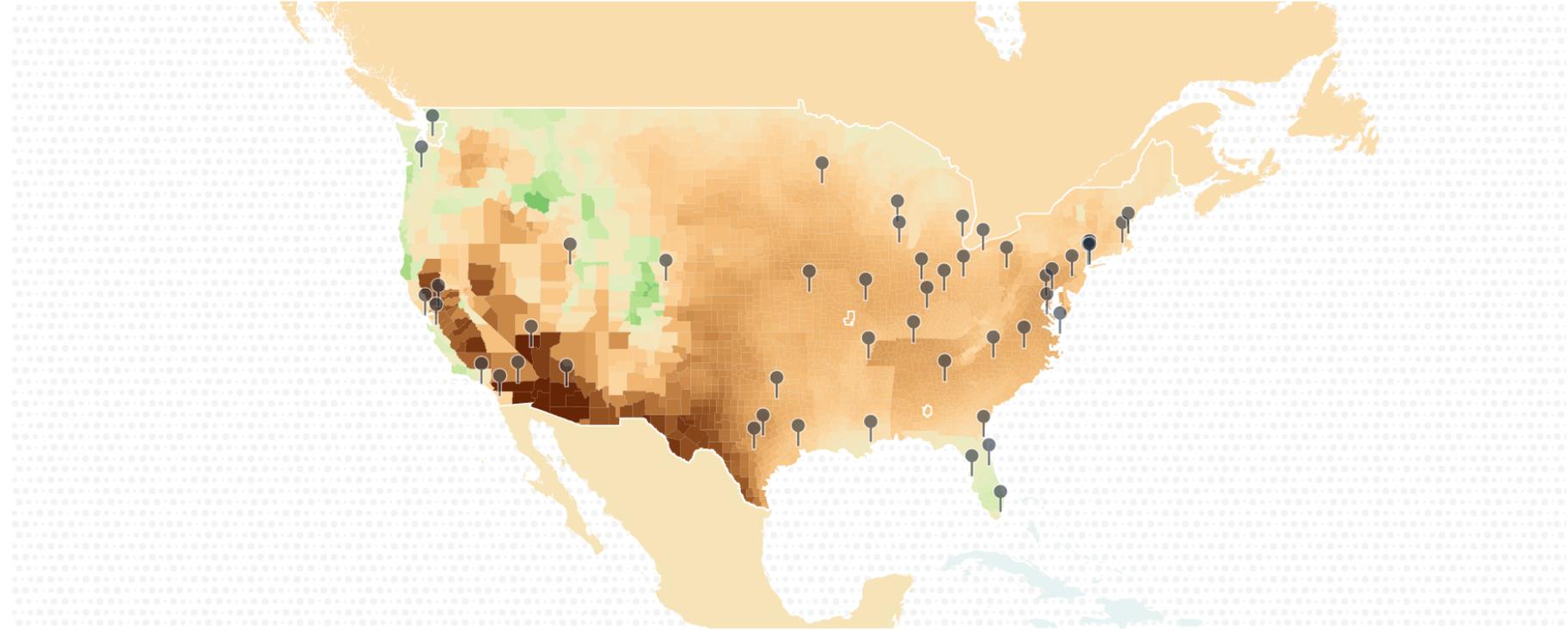
United States ▼

TIME HORIZON

2080-2099 (end of century) ▼

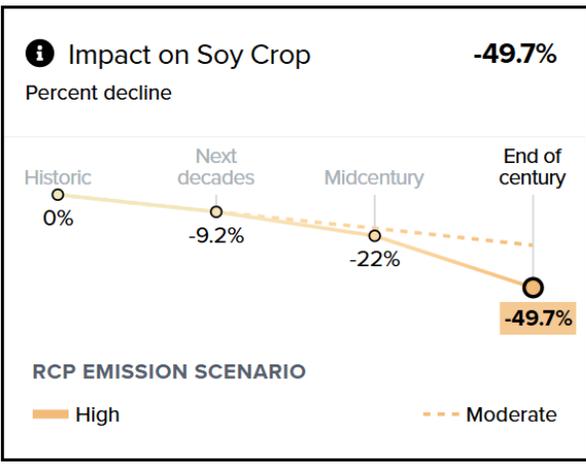
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COMPARE COUNTRIES ➤



Food Production Impacts

Impact Data



Impact on Soy Crop

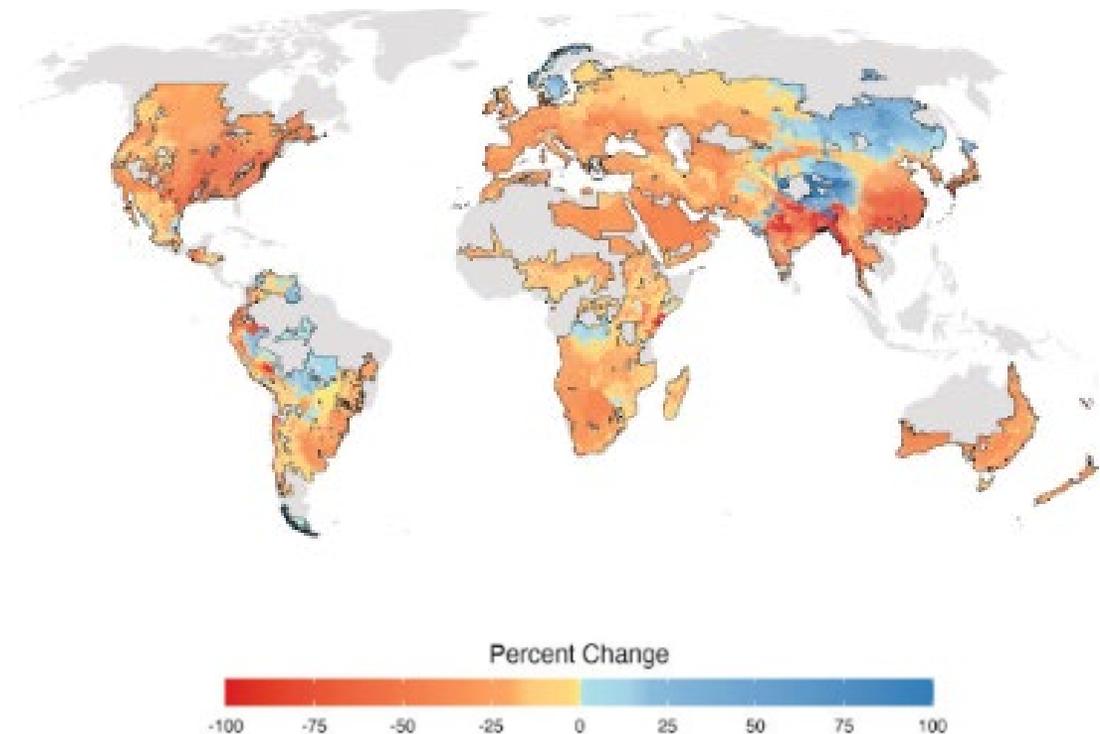
Scenario: High (RCP 8.5), undefined



DISTRIBUTION OF IMPACTS: WHEAT

Wheat: Wheat losses are notably consistent across the main wheat-growing regions, with losses of 15 to 25 percent in Eastern and Western Europe, Africa and South America. China, Russia, the United States and Canada see greater declines of 30 to 40 percent. There are notable exceptions to these global patterns: wheat-growing regions of Western China exhibit both gains and losses, whereas wheat growing regions of Northern India exhibit some of the most severe projected losses across the globe.

Wheat



WHEAT: INDIA IMPACTS

High (RCP 8.5) ▼

COUNTRIES & TERRITORIES



India ▼

TIME HORIZON

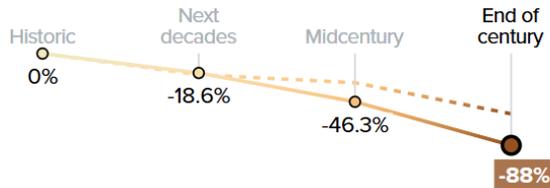
2080-2099 (end of century) ▼

Food Production Impacts

Impact Data

i Impact on Wheat Crop -88%

Percent decline



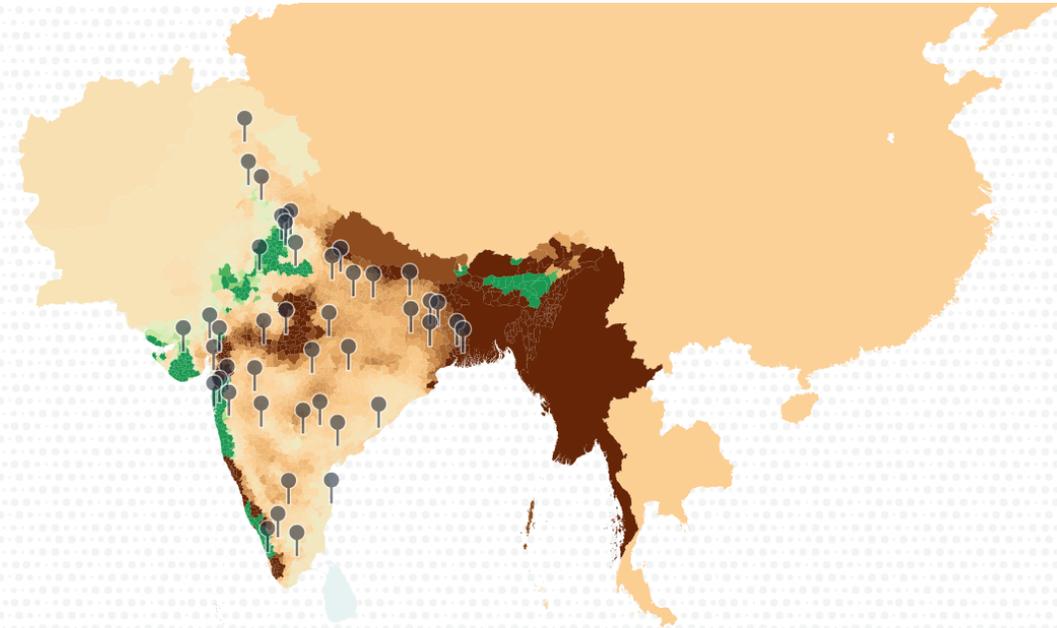
RCP EMISSION SCENARIO

High

Moderate

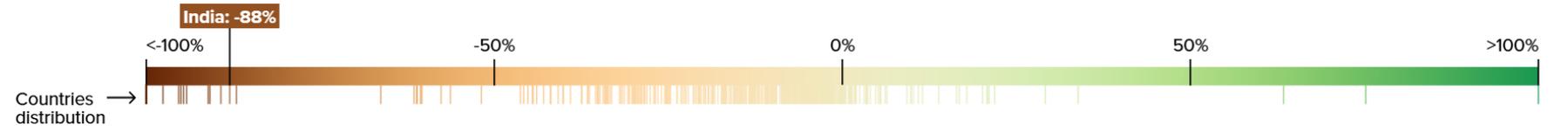
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COMPARE COUNTRIES >



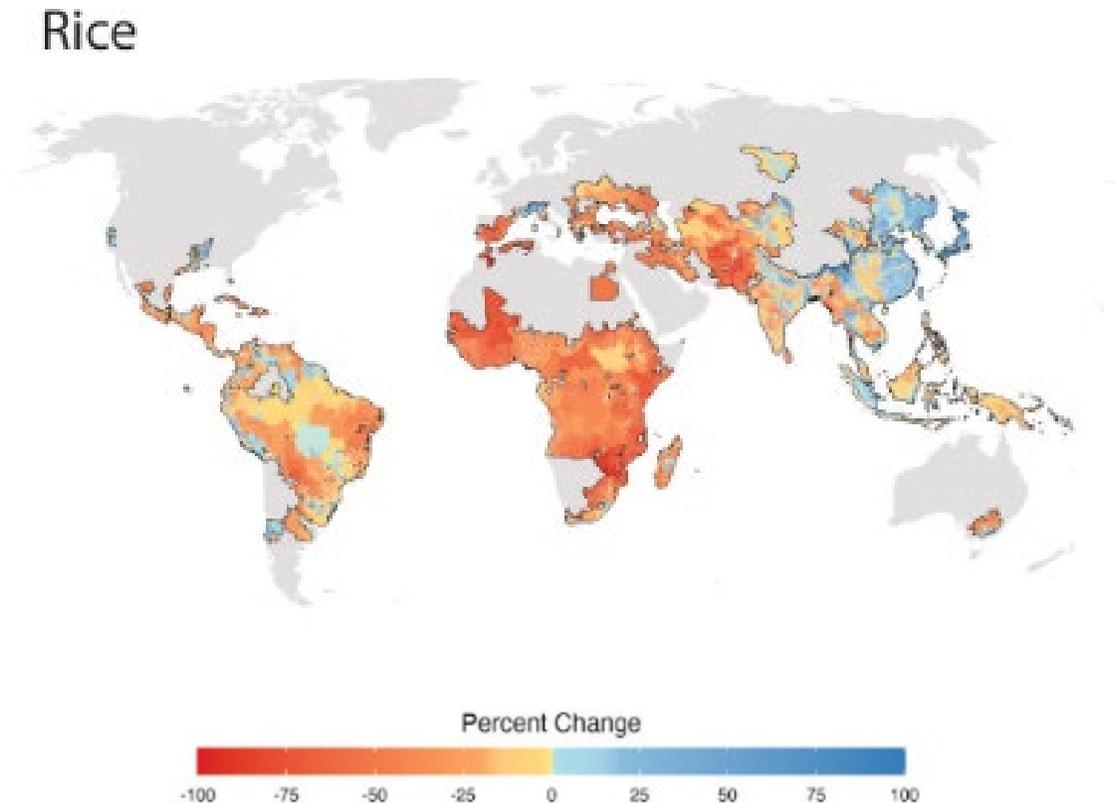
Impact on Wheat Crop

Scenario: High (RCP 8.5), undefined



DISTRIBUTION OF IMPACTS: RICE

Rice: There are net gains to rice globally, with mixed impacts on rice yields in India and Southeast Asia—where rice is primarily grown. This regional result is broadly consistent with earlier work showing rice benefits from warmer nights.



RICE: PAKISTAN IMPACTS

High (RCP 8.5) ▼

COUNTRIES & TERRITORIES

Pakistan ▼

TIME HORIZON

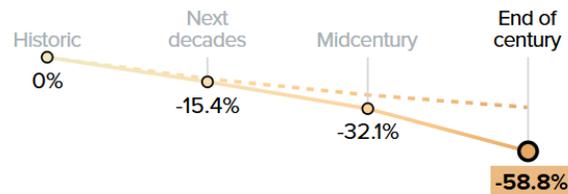
2080-2099 (end of century) ▼

Food Production Impacts

Impact Data

Impact on Rice Crop -58.8%

Percent decline



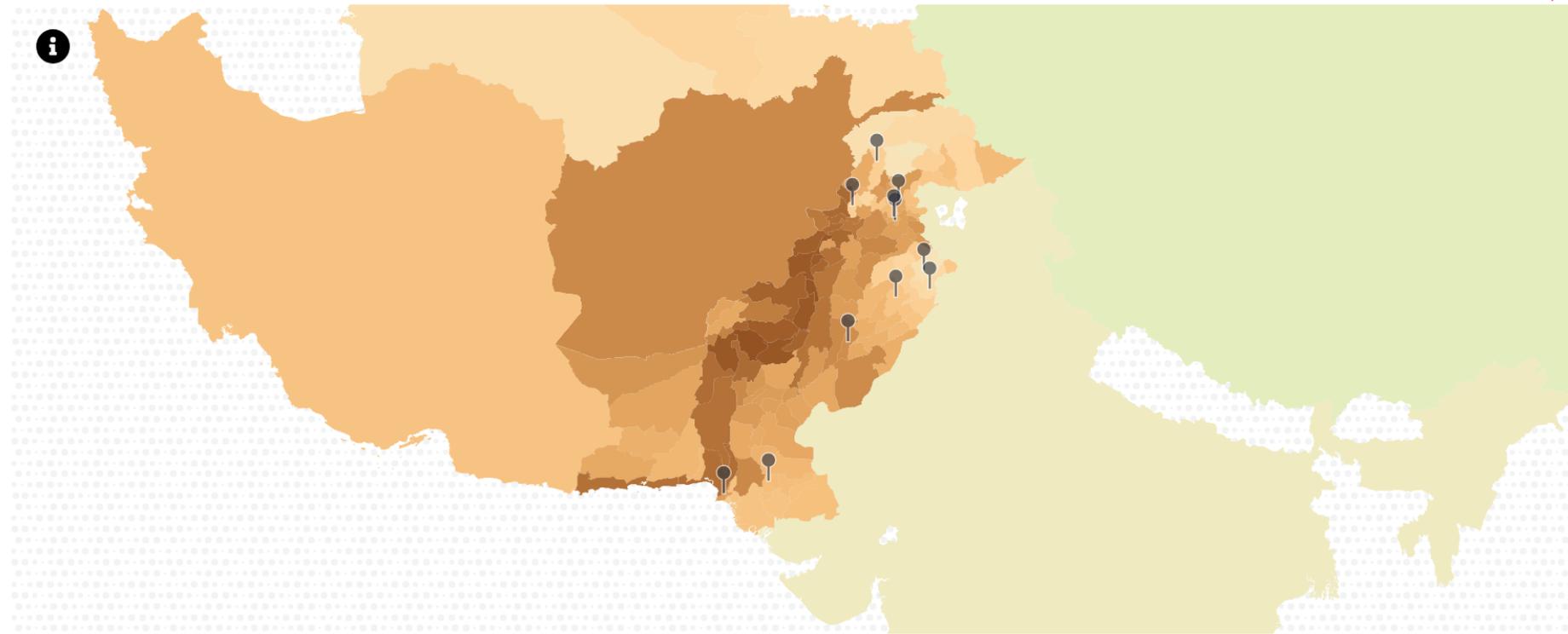
RCP EMISSION SCENARIO

High

Moderate

Show borders i

COMPARE COUNTRIES >



Impact on Rice Crop

Pakistan: -58.8%

Scenario: High (RCP 8.5), undefined



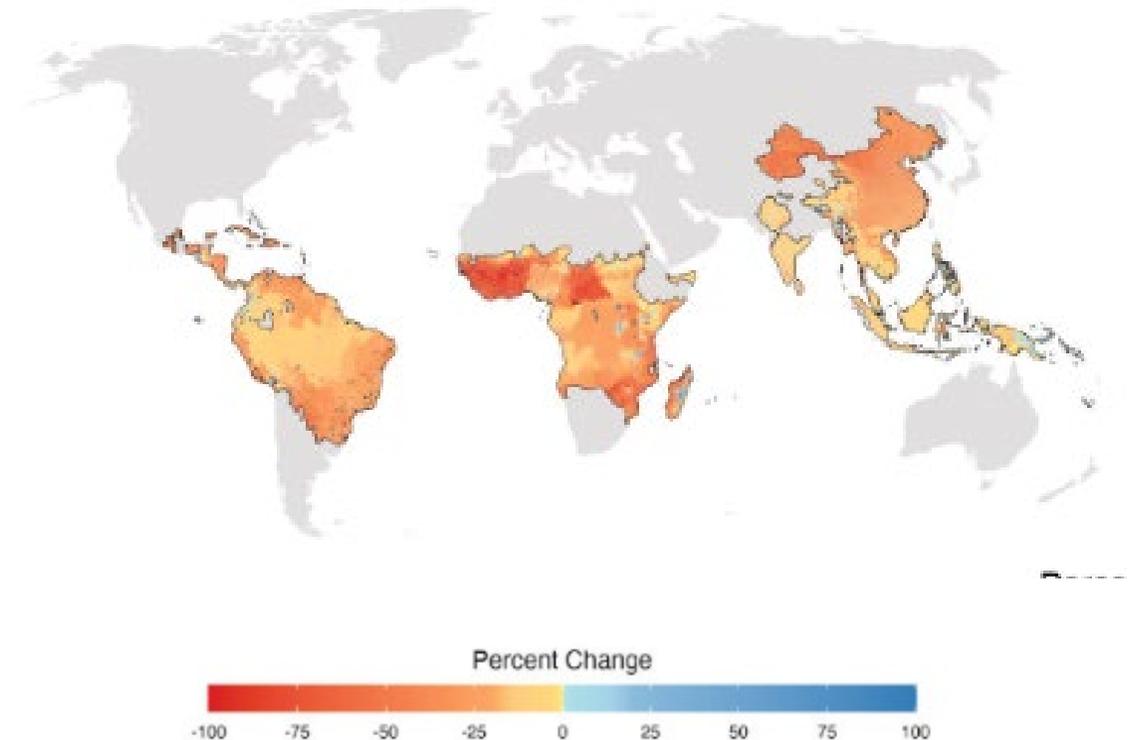
DISTRIBUTION OF IMPACTS: CASSAVA

Cassava: Climate change is projected to uniformly hurt cassava crops across nearly all regions in which it is currently grown.

The largest losses, 40 percent, are in Sub-Saharan Africa.

Although cassava does not make up a large portion of global agricultural revenues, it is an important subsistence crop in low-income and middle-income countries. Thus, climate change may pose a substantial future threat to the nutritional intake of the global poor.

Cassava



CASSAVA: CHINA IMPACTS

EMISSION SCENARIO ⓘ

High (RCP 8.5) ▾

COUNTRIES & TERRITORIES

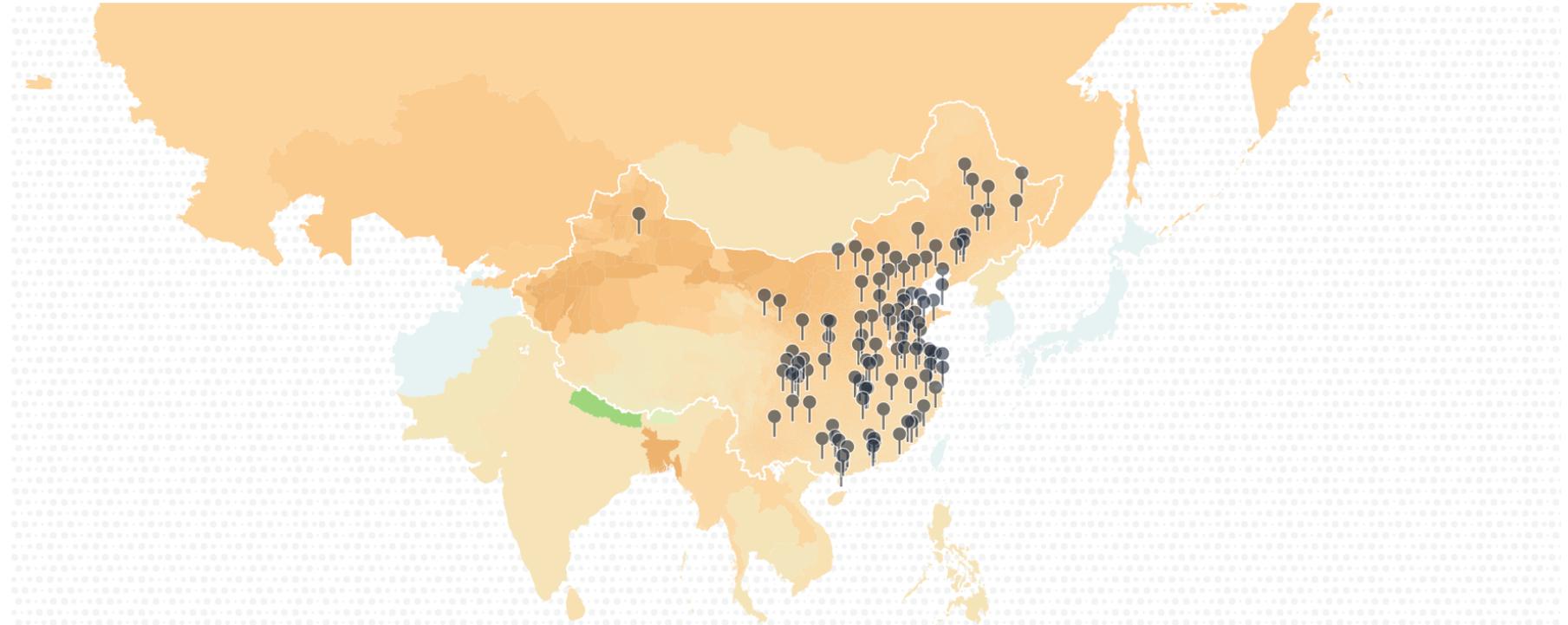
China ▾

TIME HORIZON

2080-2099 (end of century) ▾

Show borders ⓘ

COMPARE COUNTRIES >

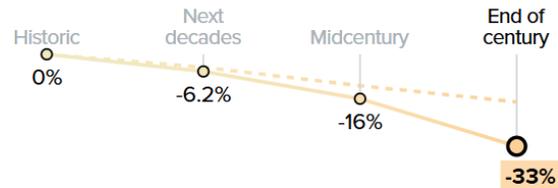


Food Production Impacts

Impact Data

Impact on Cassava Crop **-33%**

Percent decline



RCP EMISSION SCENARIO

High

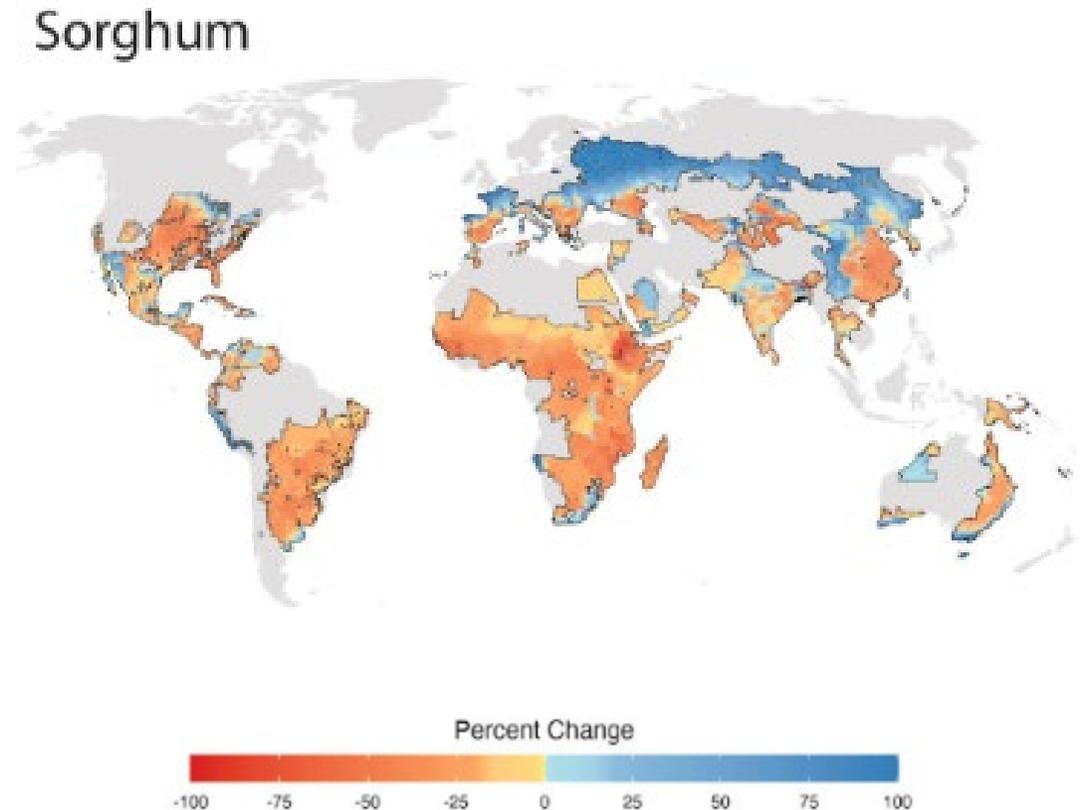
Moderate

Impact on Cassava Crop



DISTRIBUTION OF IMPACTS: SORGHUM

Sorghum: Climate change is also projected to hurt sorghum crops in almost all of the main regions where it's currently grown: 40 percent decline in North America (-40%), 10 percent decline in South Asia, and a 25 percent decline in Sub-Saharan Africa. Western Europe sees its sorghum yields improve by 28 percent, and in Northern China by 3 percent.



SORGHUM: USA IMPACTS

COUNTRIES & TERRITORIES



United States



TIME HORIZON

2080-2099 (end of century)

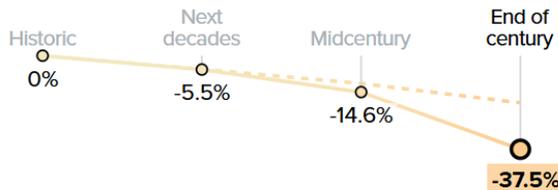


Food Production Impacts

Impact Data

i Impact on Wheat Crop **-37.5%**

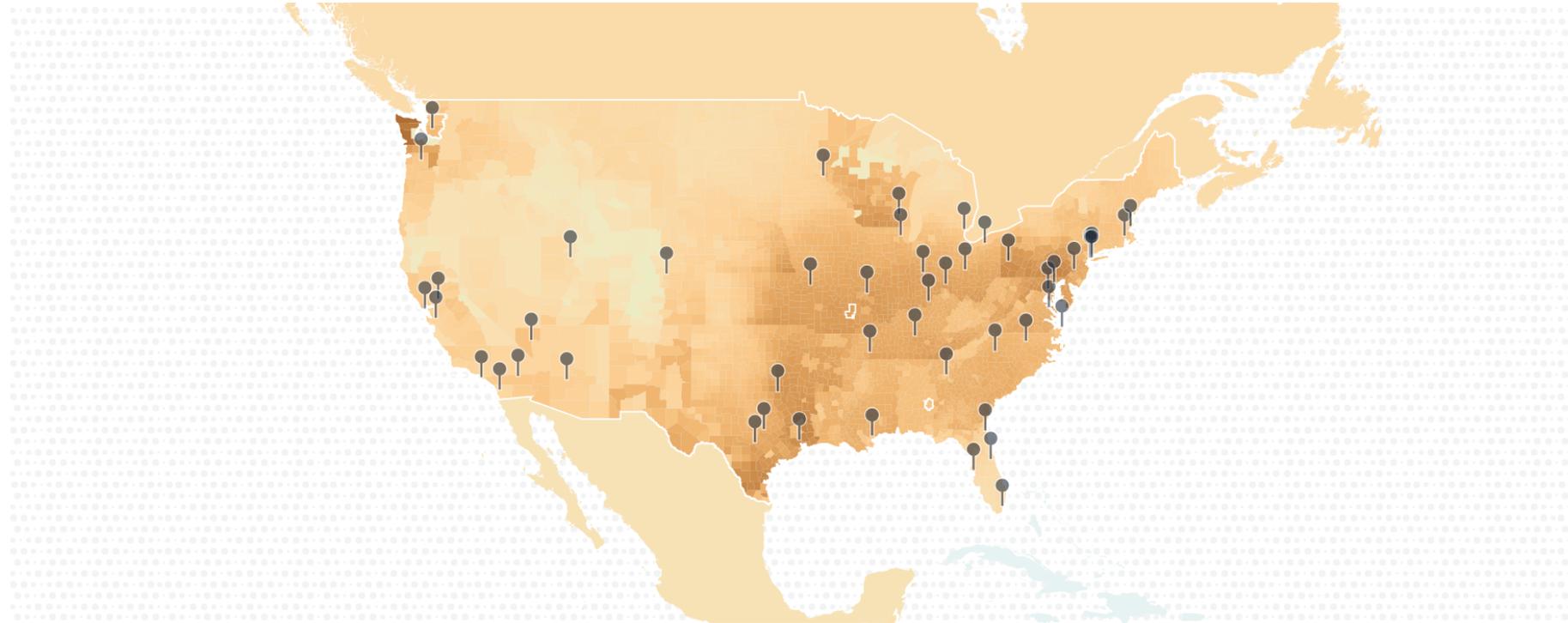
Percent decline



RCP EMISSION SCENARIO

High

Moderate



Impact on Wheat Crop

Scenario: High (RCP 8.5), undefined



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THANK YOU!

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