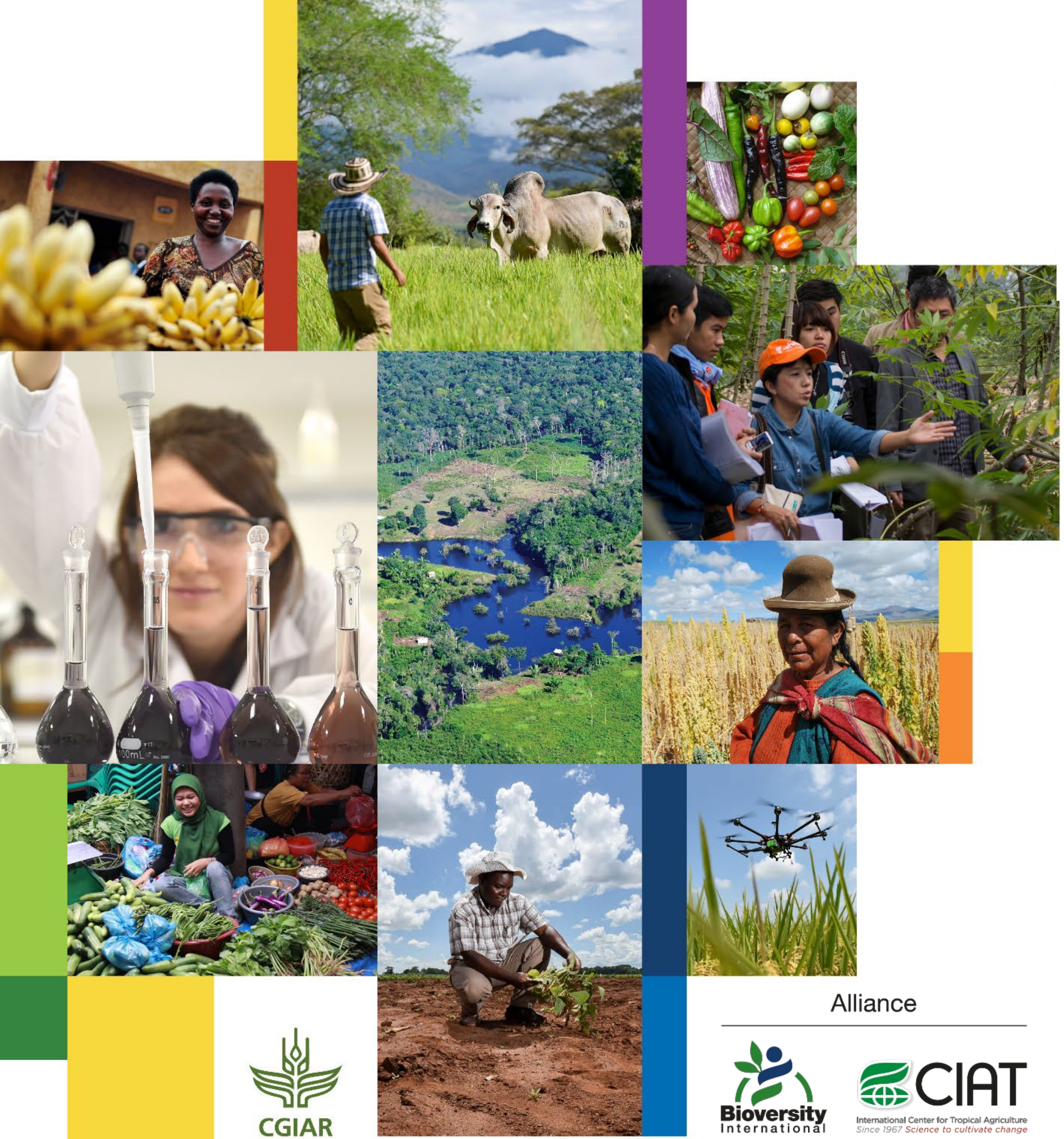


Climate Impact Tool Introduction

PRESENTED January 26, 2023

UPDATED MATERIAL ADDED February 3, 2023

CGIAR

Alliance

Bioversity International

CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change

Bioversity International and the International Center for Tropical Agriculture (CIAT) are CGIAR Research Centers.
CGIAR is a global research partnership for a food-secure future.

Agenda

01 Purpose	Accelerate adoption of climate smart agriculture
02 How	Create climate-resilient strategies using climate smart agriculture

01

Reminder of the objectives of the climate resilience work

Identify the risk

Position Adaptation as an opportunity

Quantify the risk and the opportunity and what the business needs to do

01

Identify the biggest climate change risks and opportunities which drive crop productivity

With this tool, users can:

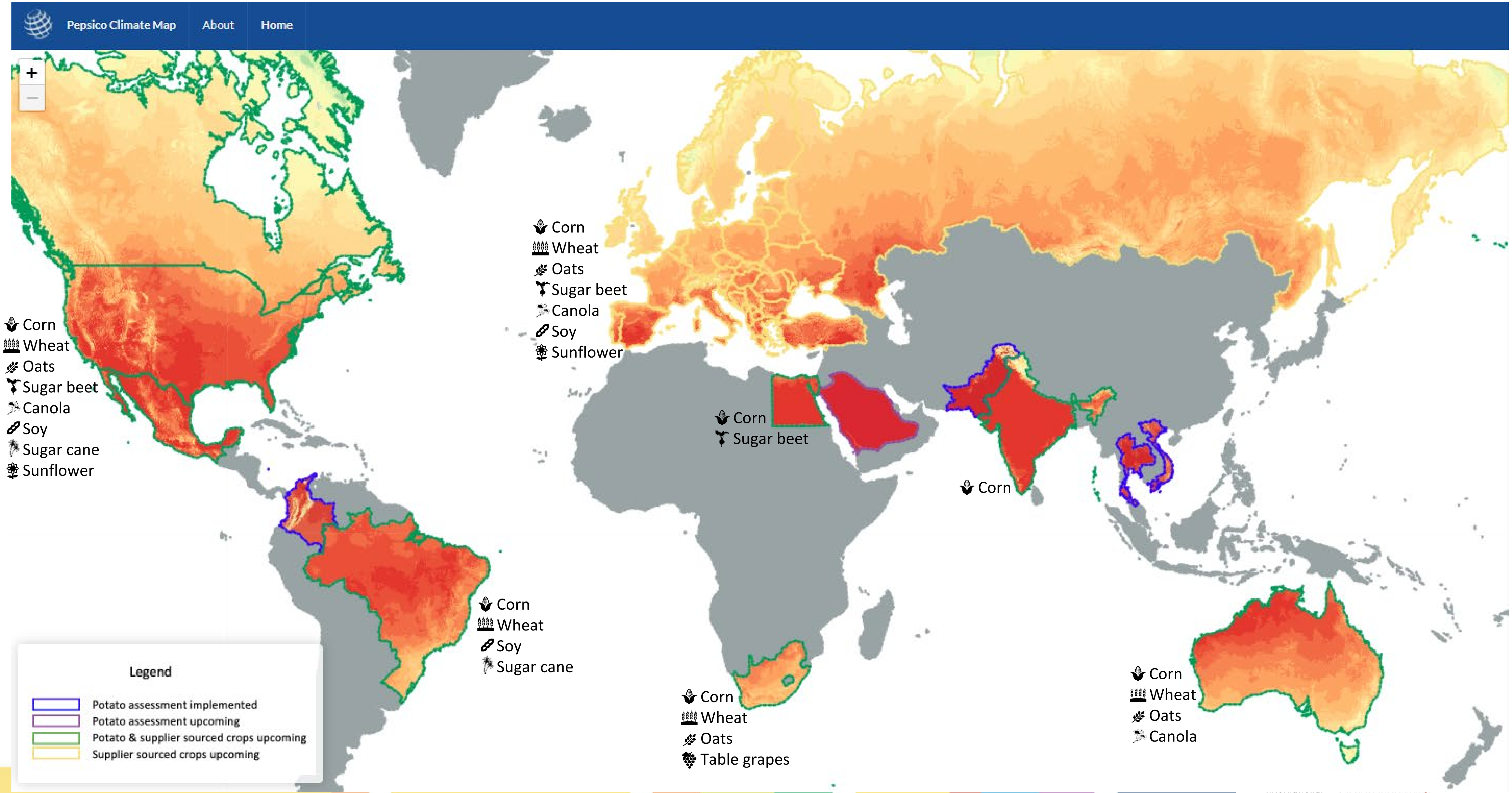
Factor the effect of climate change into planning processes

Make the business case for investment into climate-smart agriculture practices that incorporate regenerative agriculture principles

Target climate smart agriculture practices based on specific seasonal and place-based climate risks

01

Overall scope: eight crops covering more than 50 countries



01 Crop-country combinations in scope for the RFA

	Canada	United States	Europe	Mexico	Australia	South Africa
Corn	Corn	Corn	Corn	Corn	Corn	Corn
Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Oats	Oats	Oats	Oats	Oats	Oats	Oats
Canola	Canola	Canola	Canola	Canola	Canola	
Soy	Soy	Soy	Soy	Soy		
Sugar beet	Sugar beet	Sugar beet	Sugar beet			

01

Climate hazards quantified: heat, frost, drought and flood

Index	Definition
Heat stress	Number of days with maximum temperature above a predetermined threshold in the season
Frost risk	Number of days with minimum temperature under 0°C in the season
Flood risk	Maximum precipitation in five consecutive days in the season
Drought risk	Combining temperature, precipitation, and evapotranspiration

01

Sample of climate smart agriculture practices for which simulations will be available

Adaptation options for heat stress and drought risk - Maize

Practice	Risk mitigation potential	Adaptations	Adoption level	Regen Ag score
Soil Cover	**High impact**	Cover crop, especially with legumes like clover helps improve soil health, and reduce the impacts of higher temperatures and more variable rainfall.	**Moderately used**	5
Water	**High impact**	Watershed health management is the process of implementing land use practices and water management practices to protect and improve the quality of the water and other natural resources within a watershed such as wetland restoration, grassed waterways.	**Rarely used**	2.5
Water	**High impact**	Drip irrigation improves water use efficiency and crop yields. Fertigation combined in the system helps to manage nutrients and water to obtain the maximum possible yields with the most efficient utilization of nutrients.	**Rarely used**	2
Other	**High impact**	Heat resistant variety helps shield maize producers from severe yield loss due to heat stress and help them adapt to climate change impacts.	**Moderately used**	2
Land management	**Medium impact**	Reduced tillage helps to improve soil structure, regulate soil moisture and reduce soil erosion.	**Rarely used**	5
Soil Cover	**Medium impact**	Applying mulch to the surface of soil helps to improve the soil quality and makes growing conditions more favorable. This method is recommended along with "zero to reduced tillage".	**Rarely used**	4.5
Crop Diversity	**Medium impact**	Intercropping maize with legumes provides good overall drought and flood resilience and conferred maize yield benefits even under suboptimal condition.	**Rarely used**	2.5
Other	**Medium impact**	Drought tolerant variety reduces crops' vulnerability to drought and improves food security.	**Moderately used**	2
Water	**Medium impact**	Rainwater harvesting increases soil water availability and crop yields by increasing the rainwater collected.	**Rarely used**	1
Water	**Low impact**	Soil moisture sensor allows monitoring of what is happening in the soil root zone with regard to water infiltration during and after irrigations, and to water uptake by plants between irrigations, thus enabling informed irrigation decisions on when to irrigate and how much water to apply to avoid crop water stress.	**Moderately used**	1

Agenda

01 Purpose	Accelerate adoption of climate smart agriculture
02 How	Create climate-resilient strategies using climate smart agriculture

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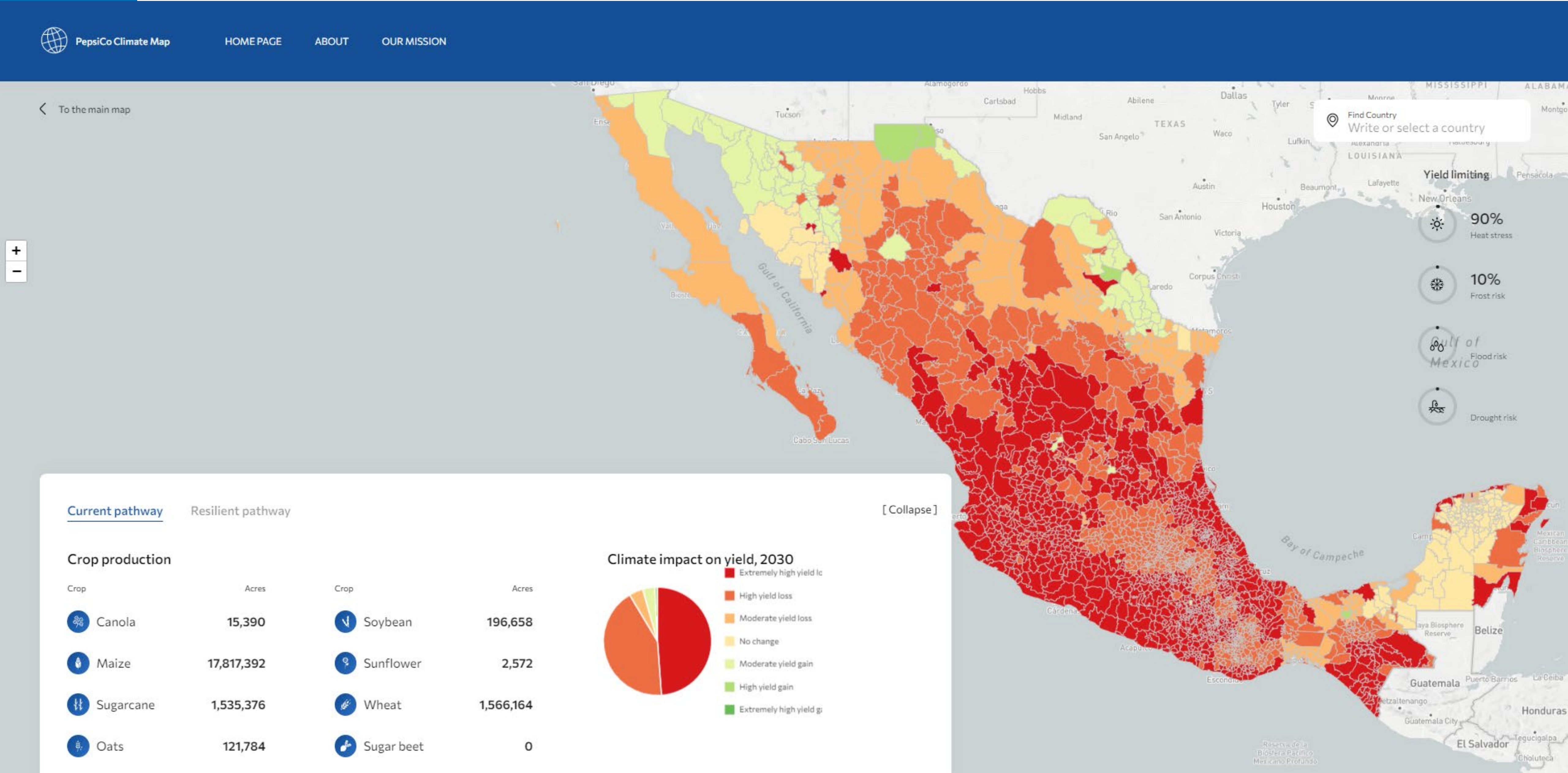
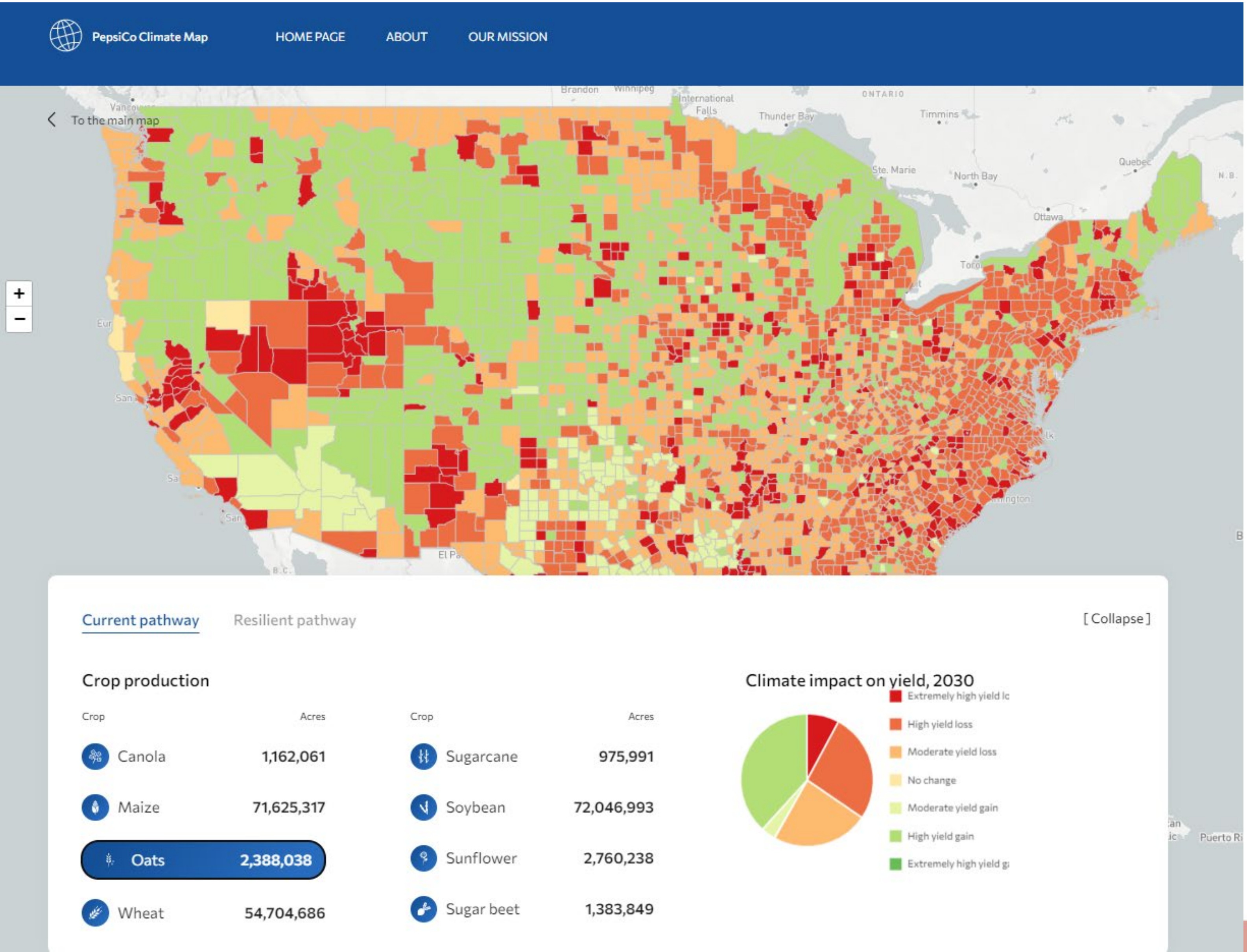
02 Example of need for survival of oats in Mexico



While in the United States oats has opportunity to expand



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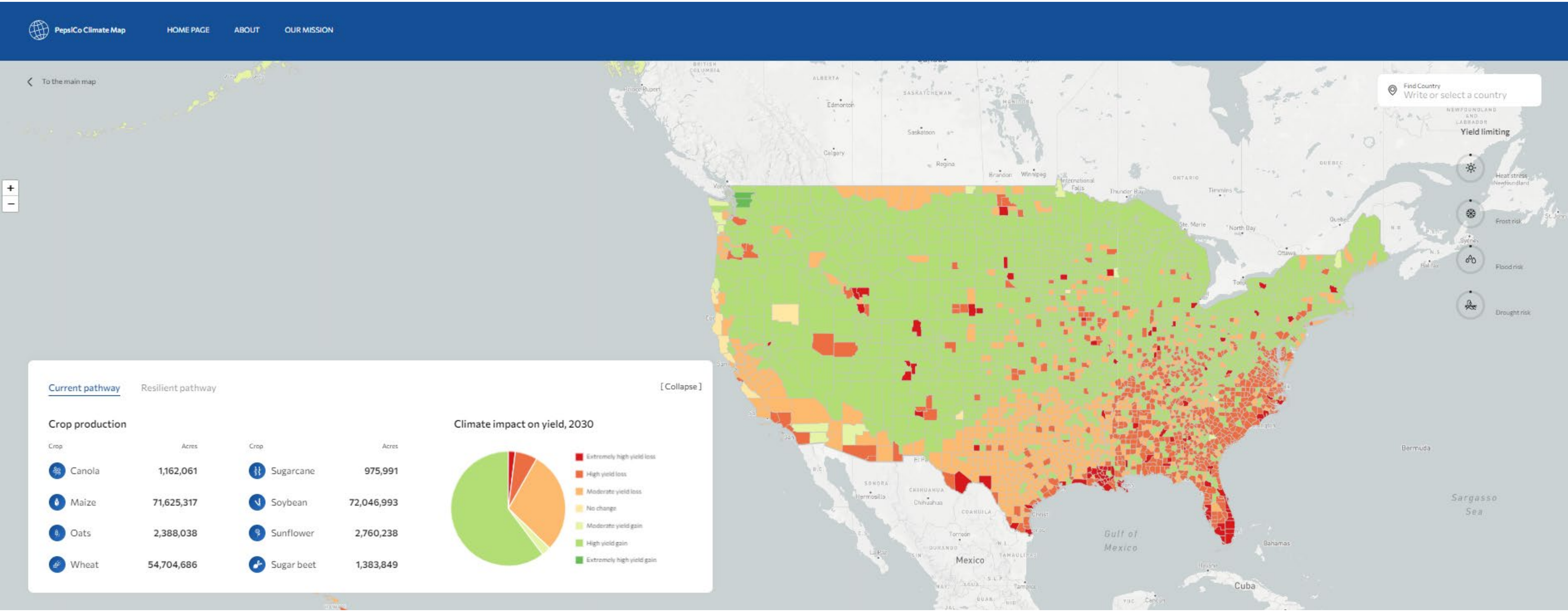
02 Canola in the United States



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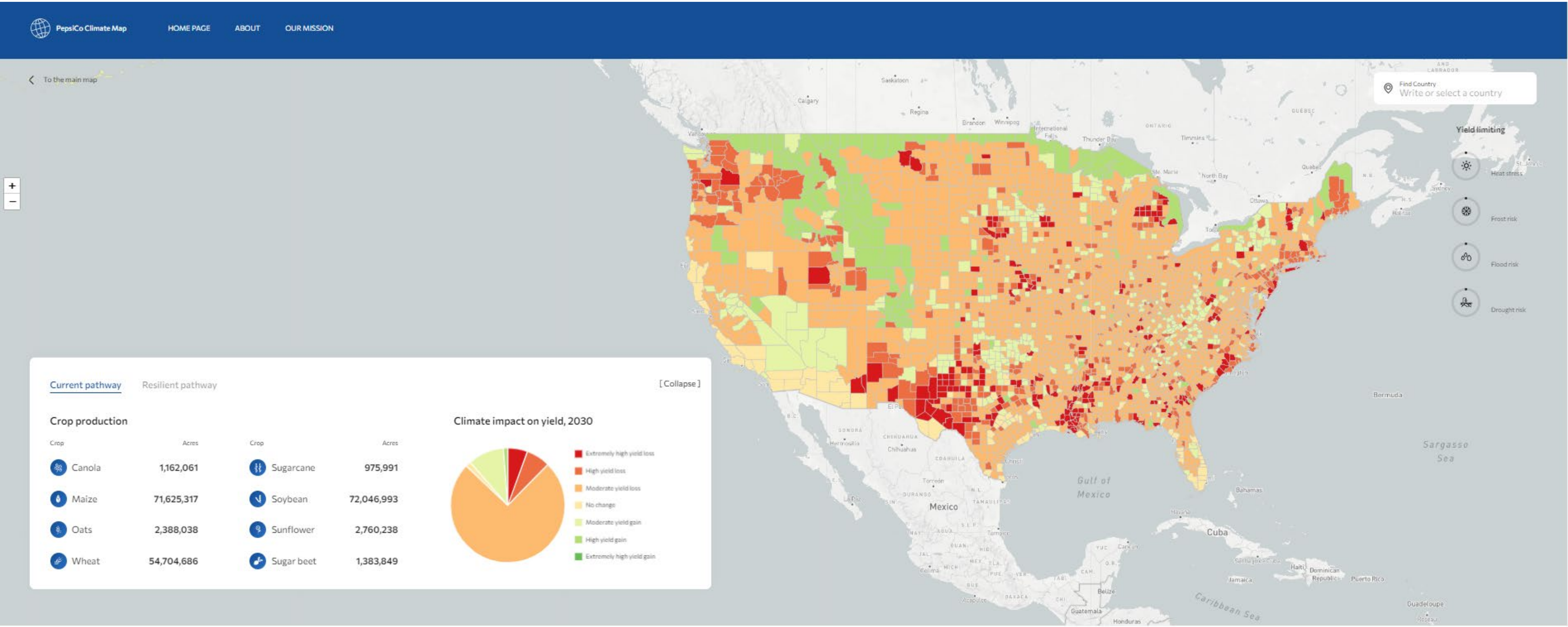
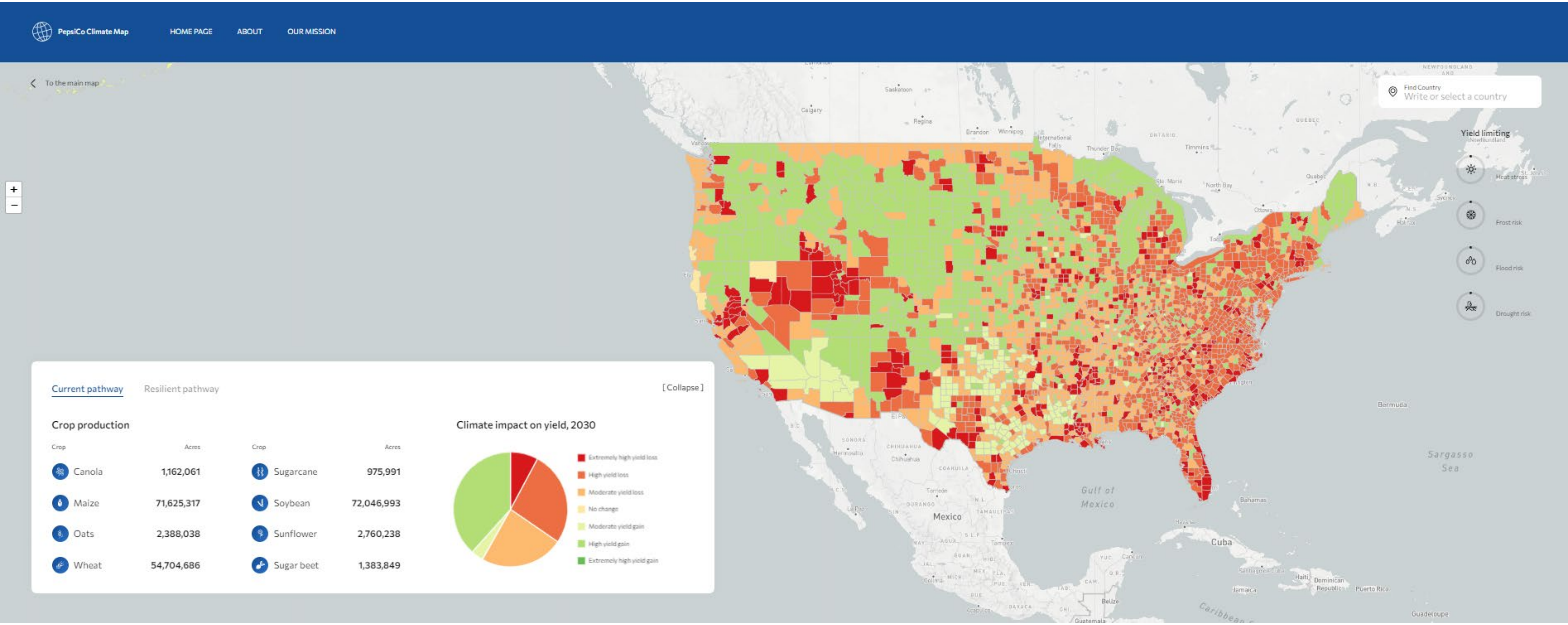
02 Corn in the United States



Crop	Acres	Crop	Acres
Canola	1,162,061	Sugarcane	975,991
Maize	71,625,317	Soybean	72,046,993
Oats	2,388,038	Sunflower	2,760,238
Wheat	54,704,686	Sugar beet	1,383,849

02

Oats in the United States



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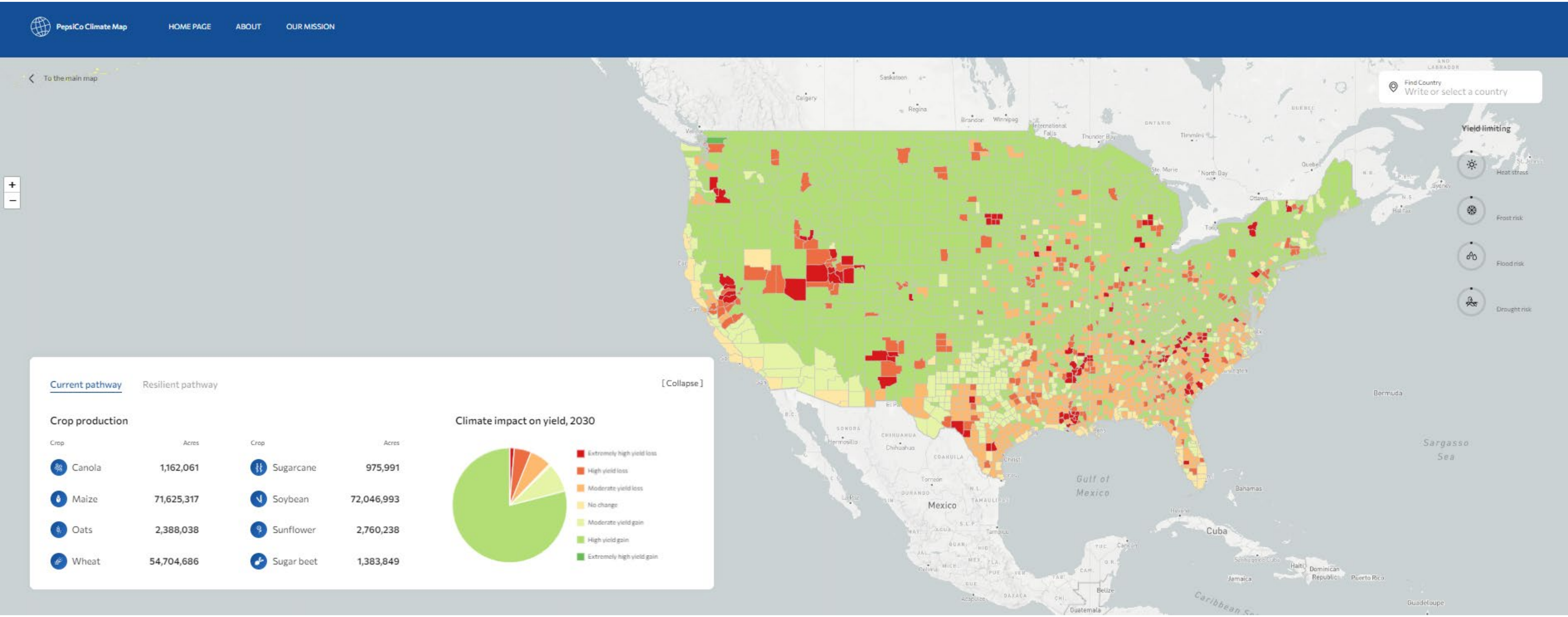
Wheat in the United States



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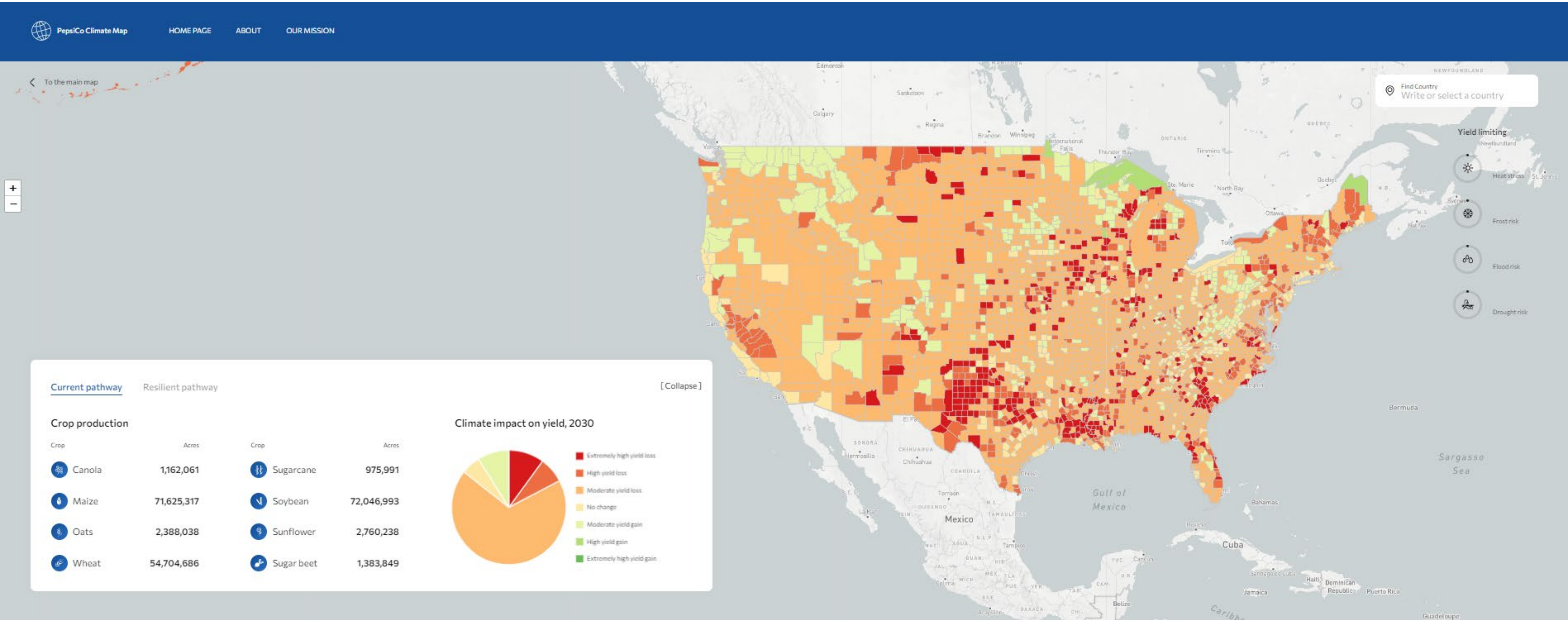
02

Soybean in the United States



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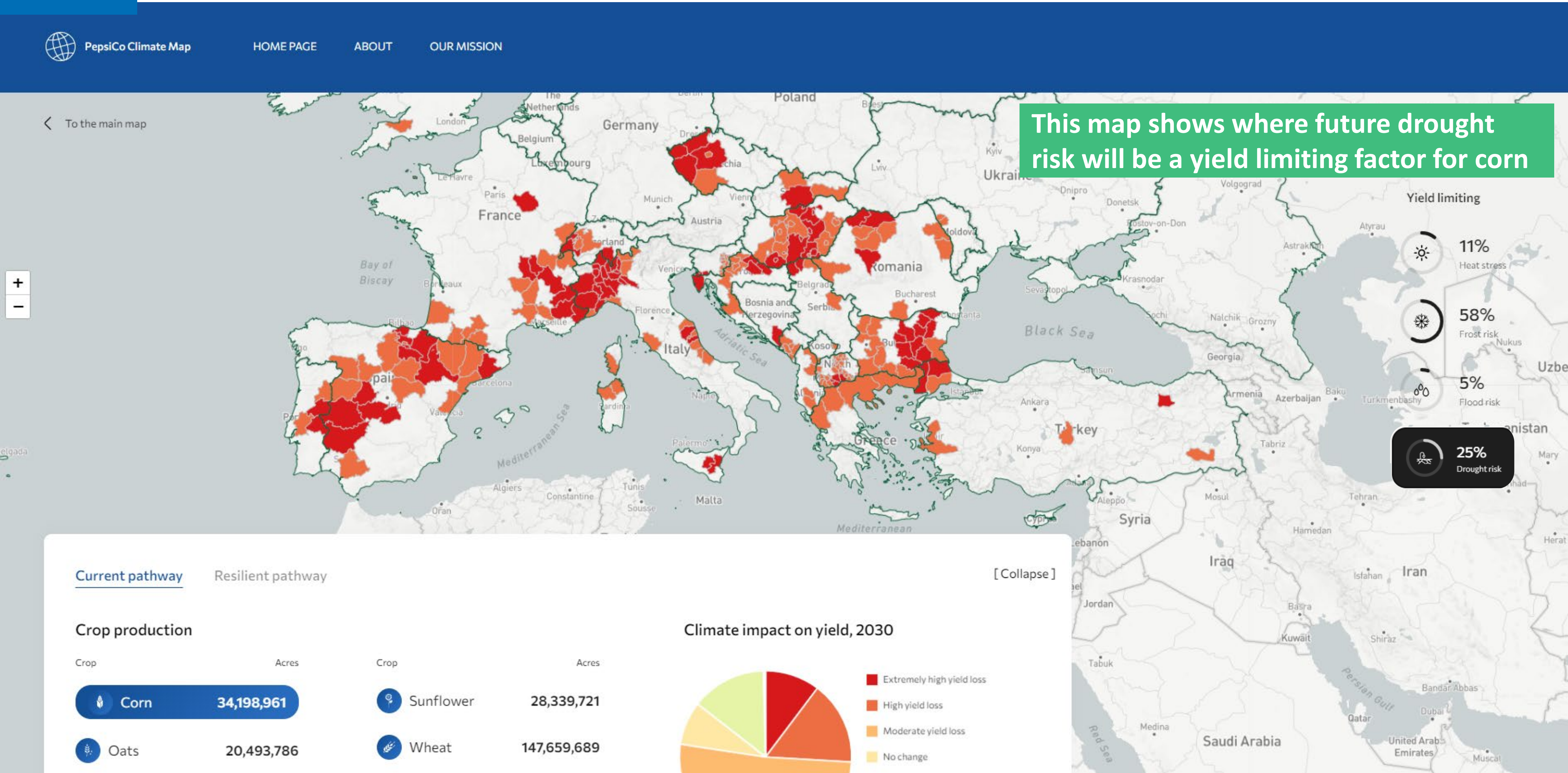
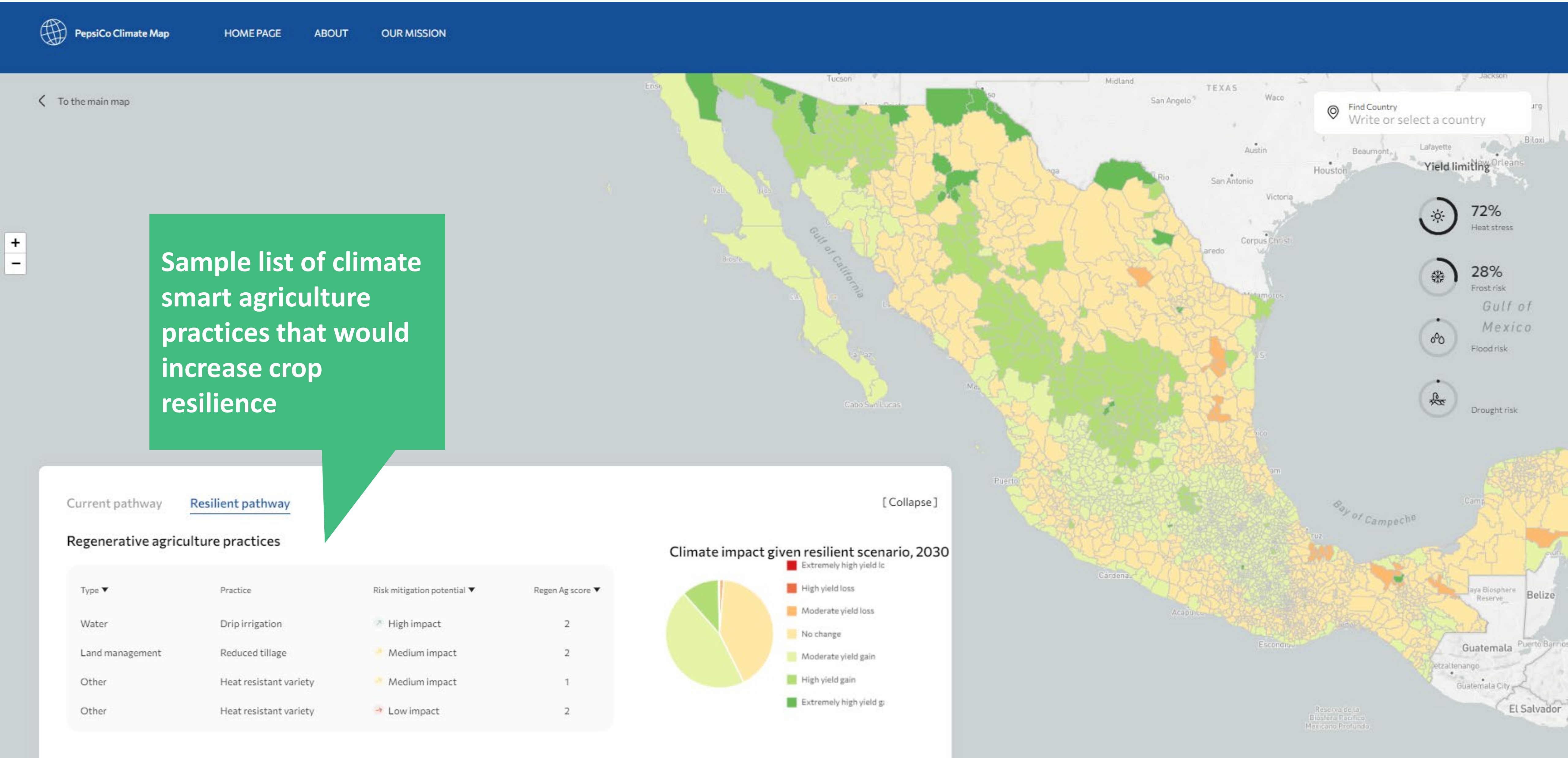
02 Visualize the areas affected by the selected yield limiting factor



This map shows where future drought risk will be a yield limiting factor for corn

02 Match risks to practices that can reduce risk and improve productivity

Sample list of climate smart agriculture practices that would increase crop resilience

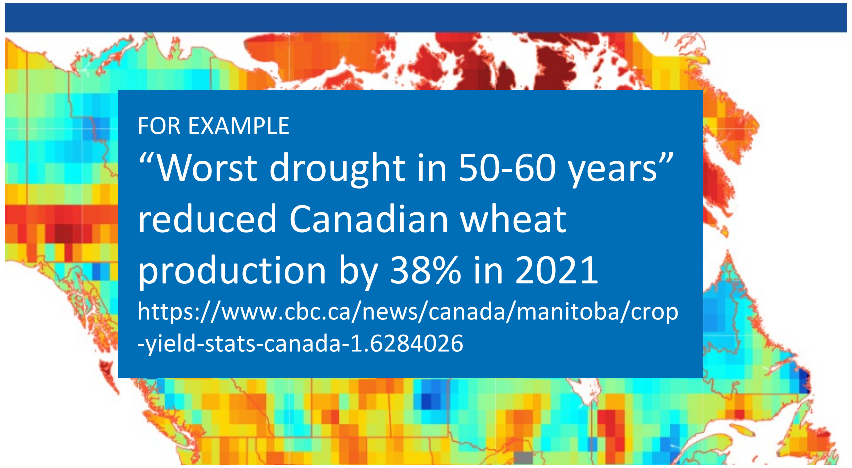


Climate methodology

Climate risk and opportunity assessment methodology (1 of 2)

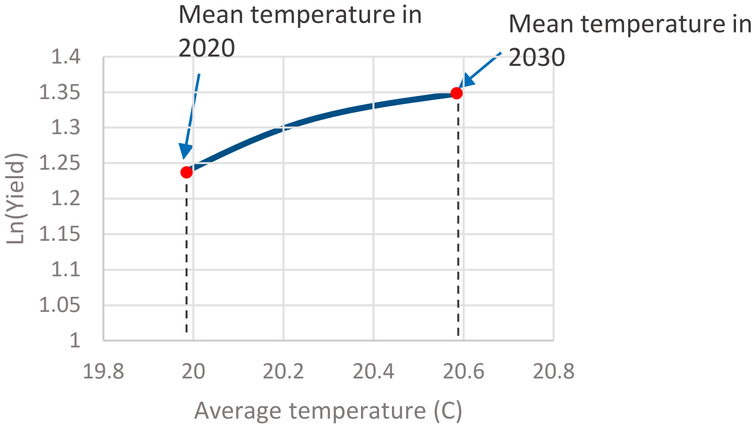
1 Understand climate impacts on crop yields

Compile existing available literature to understand the extent of positive and negative impacts on climate factors on crop yields



2 Identify climate models that best represent different countries' baseline and future climate

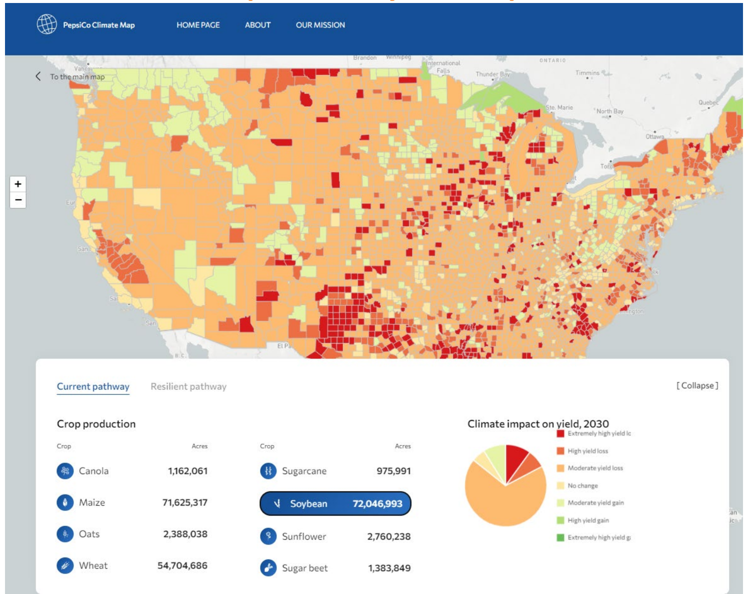
Scientific literature review demonstrates climate models that best represent each countries and region's temperature, rainfall and extreme events

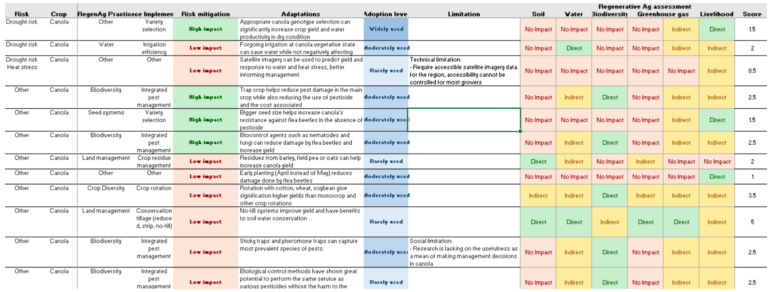


Crop	Heat	Frost	Flood	Drought
Crop 1				
Crop 2				
Crop 3				
Crop 4				
Crop 5				
Crop 6				
Crop 7				
Crop 8				
Crop 9				
Crop 10				

3 Project the impact of climate and adaptation practices on yield to an interactive dashboard

Tailor per country and crop





Detailed version

Climate risk assessment methodology

1 Understand climate impacts on crop yields

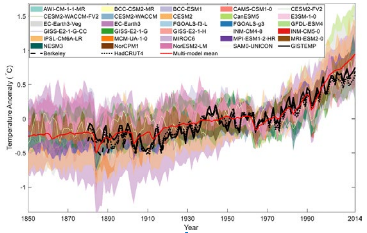
Baseline and future climate data (CMIP6)

Key crops and growing calendars

Quantify greatest limiting factors from literature

2 Identify climate models that best represent different countries' baseline and future climate

Select most robust model ensemble for each country



Develop climate hazard indices

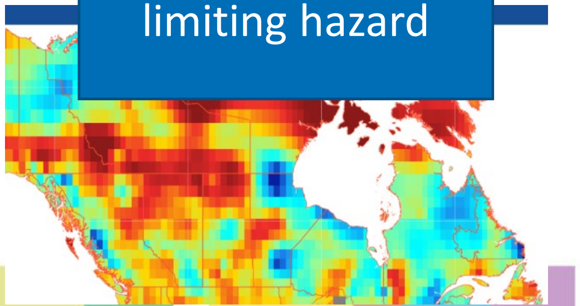
- Heat stress
- Frost risk
- Flood risk
- Drought risk

Assign thresholds for each hazard and crop

Crop/hazard sensitivity + Impact on yield → Thresholds

Crop	Heat	Frost	Flood	Drought
Crop 1				
Crop 2				
Crop 3				
Crop 4				
Crop n				

Map greatest limiting hazard



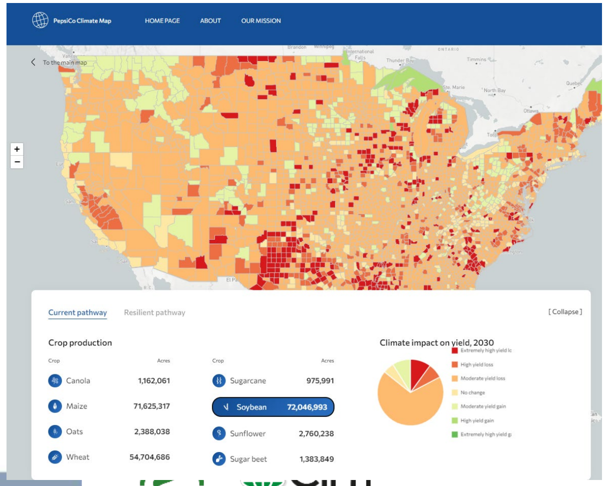
3 Project the impact of climate and adaptation practices on yield to an interactive dashboard

Adaptation practices

Production areas

Practice	Risk mitigation potential	Adoptation level	Regen Ag score
	High impact		
	Medium impact		
	Low impact		

Project the impact of climate and adaptation practices on interactive dashboard



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Annex

Annex	List of literature
A	Crop calendars and data sources
B	Climate data (CMIP6)
C	Climate impacts on yields
D	Selection of climate models
E	Adaptation practices
F	Production areas

Annex A - Crop calendars and data sources

<table>
<tr><th>Country</th><th>Growing period</th><th>Crop</th><th>Data sources</th></tr>
<tr><td>South Africa</td><td>November- May</td><td>Maize</td><td rowspan="29">https://ipad.fas.usda.gov/ogamaps/cropcalendar.aspx

https://www.fao.org/giews/countrybrief/

https://www.nda.agric.za/docs/Brochures/Oats.pdf

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<tr><td>South Africa</td><td>May- December</td><td>Oats</td></tr>
<tr><td>South Africa</td><td>May- November</td><td>Wheat</td></tr>
<tr><td>Europe and Russia</td><td>April- October</td><td>Maize and Oats and Sugar beet and Soy and Sunflower</td></tr>
<tr><td>Europe and Russia</td><td>Jan-December</td><td>Wheat and Canola</td></tr>
<tr><td>Egypt</td><td>May- November</td><td>Maize</td></tr>
<tr><td>Egypt</td><td>September- April</td><td>Sugar beet</td></tr>
<tr><td>Brazil</td><td>October-August</td><td>Maize</td></tr>
<tr><td>Brazil</td><td>April- December</td><td>Wheat</td></tr>
<tr><td>Brazil</td><td>October- May</td><td>Soybean</td></tr>
<tr><td>Brazil</td><td>Jan-December</td><td>Sugarcane</td></tr>
<tr><td>India (Kharif)</td><td>March- December</td><td>Maize</td></tr>
<tr><td>Australia</td><td>October-June</td><td>Maize</td></tr>
<tr><td>Australia</td><td>April- December</td><td>Canola and Oats</td></tr>
<tr><td>Australia</td><td>April- January</td><td>Wheat</td></tr>
<tr><td>US</td><td>April-November</td><td>Maize</td></tr>
<tr><td>US</td><td>Jan-December</td><td>Oats and Wheat and Sugarcane</td></tr>
<tr><td>US</td><td>September- June</td><td>Canola</td></tr>
<tr><td>US</td><td>April-October</td><td>Sunflower and Sugar beet</td></tr>
<tr><td>US</td><td>May-October</td><td>Soybean</td></tr>
<tr><td>Canada</td><td>May- November</td><td>Maize and Soybean</td></tr>
<tr><td>Canada</td><td>May- October</td><td>Oats and Canola and Sunflower</td></tr>
<tr><td>Canada</td><td>Jan- December</td><td>Wheat and Sugarcane</td></tr>
<tr><td>Canada</td><td>April- September</td><td>Sugar beet</td></tr>
<tr><td>Mexico</td><td>Jan-December</td><td>Maize and Sugarcane and Oats</td></tr>
<tr><td>Mexico</td><td>September- July</td><td>Wheat</td></tr>
<tr><td>Mexico</td><td>April-September</td><td>Sugar beet</td></tr>
<tr><td>Mexico</td><td>November- June</td><td>Canola</td></tr>
<tr><td>Mexico</td><td>April- December</td><td>Soybean and Sunflower</td></tr>
</table>

Annex B – Climate data

CMIP6

Eyring, V. *et al.* (2016) 'Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization', *Geoscientific Model Development*, 9(5), pp. 1937–1958. Available at: https://doi.org/10.5194/gmd-9-1937-2016.

Annex C – Climate impact on yield

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Annex C – Climate impact on yield

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