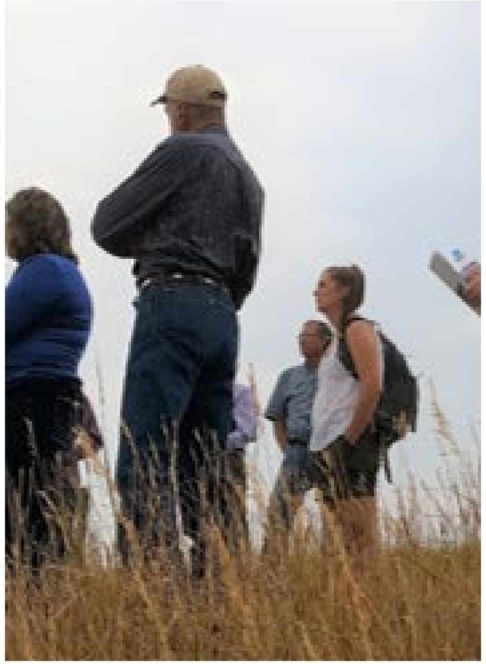




Climate Change and Agriculture in the United States – The Importance of Persistence

Dr. Emile Elias, Director, USDA Southwest Climate Hub

Dr. William Gould, Director, USDA Caribbean Climate Hub

Dr. Noah Silber Coats, USDA Southwest Climate Hub

Dr. Guillermo Alvarez, USDA Southwest Climate Hub

USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

In 2013, USDA leadership identified a major issue:

Much of the current climate science is not available in a usable form for land managers (e.g., farmers, ranchers, forest land managers)

In 2013, USDA leadership identified a major issue:

Much of the current climate science is not available in a usable form for land managers (e.g., farmers, ranchers, forest land managers)

The missing element was *place-based knowledge transfer* – aka, the “science to services spectrum”

Climate science → Climate services

USDA Climate Hubs

MISSION: Develop and deliver science-based, region-specific information and technologies so that agricultural and natural resource land managers are empowered to make climate-informed decisions.

Vision: Robust and healthy agricultural production and natural resources under increasing climate variability and climate change.

Science and data syntheses

Decision Support

Outreach convening training

USDA Climate Hubs U.S. DEPARTMENT OF AGRICULTURE

Agricultural Research Service

NRCS Natural Resources Conservation Service

APHIS

FSA FARM SERVICE AGENCY

RMA

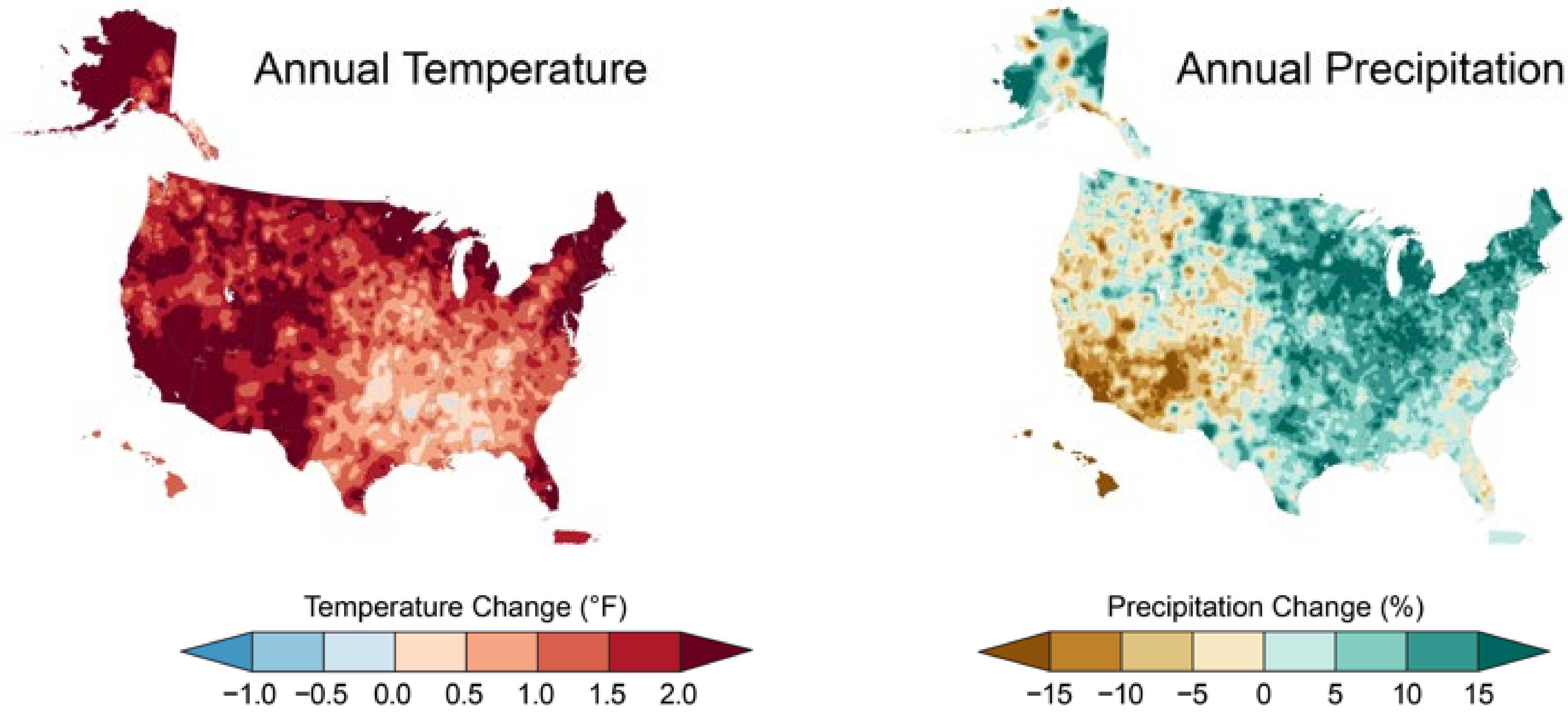
The Challenge and Approach

Science-Based Information

Climate-Informed Decision Making

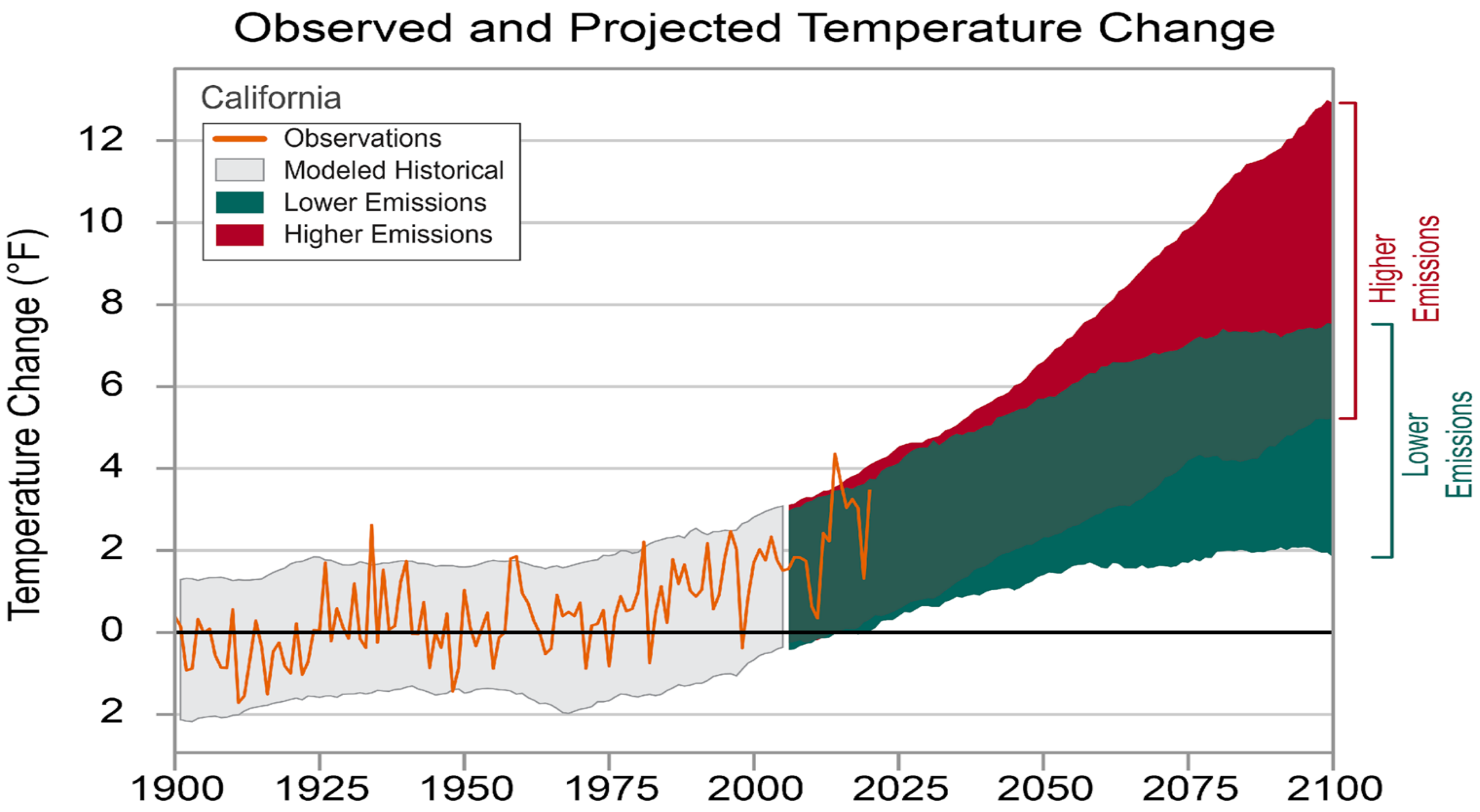
Bridging Mission of the USDA Climate Hubs

Observed Changes in Temperature and Precipitation



Source: NCA5

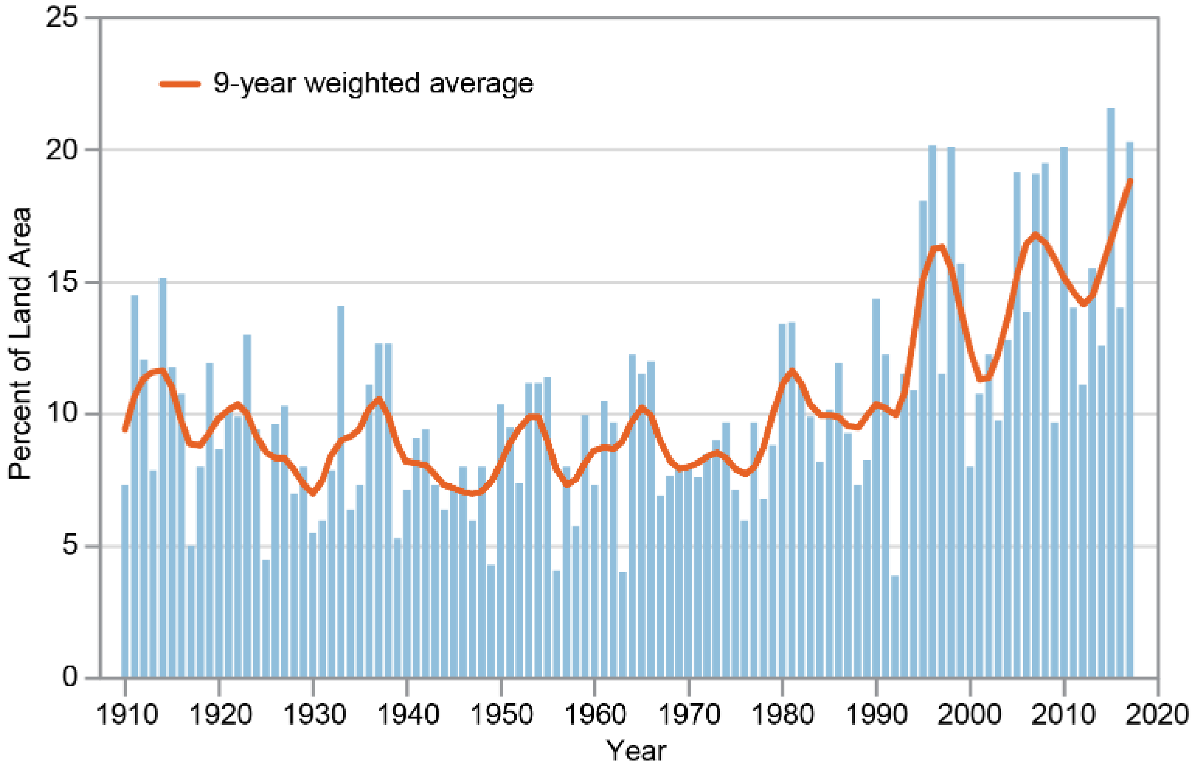
Hotter Summers and Warmer Winters



USDA Climate Hubs
U.S. DEPARTMENT OF AGRICULTURE

Source: NOAA

Extreme Precipitation Impacts are Increasing



Credit: Climate Toolbox

Source: Bloomberg News

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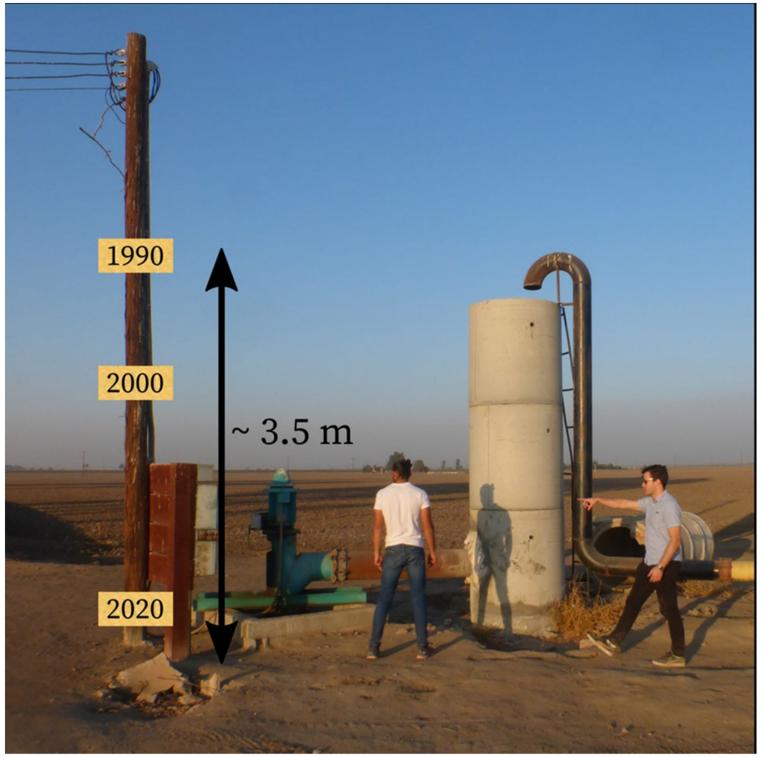
Coping with Extreme Events

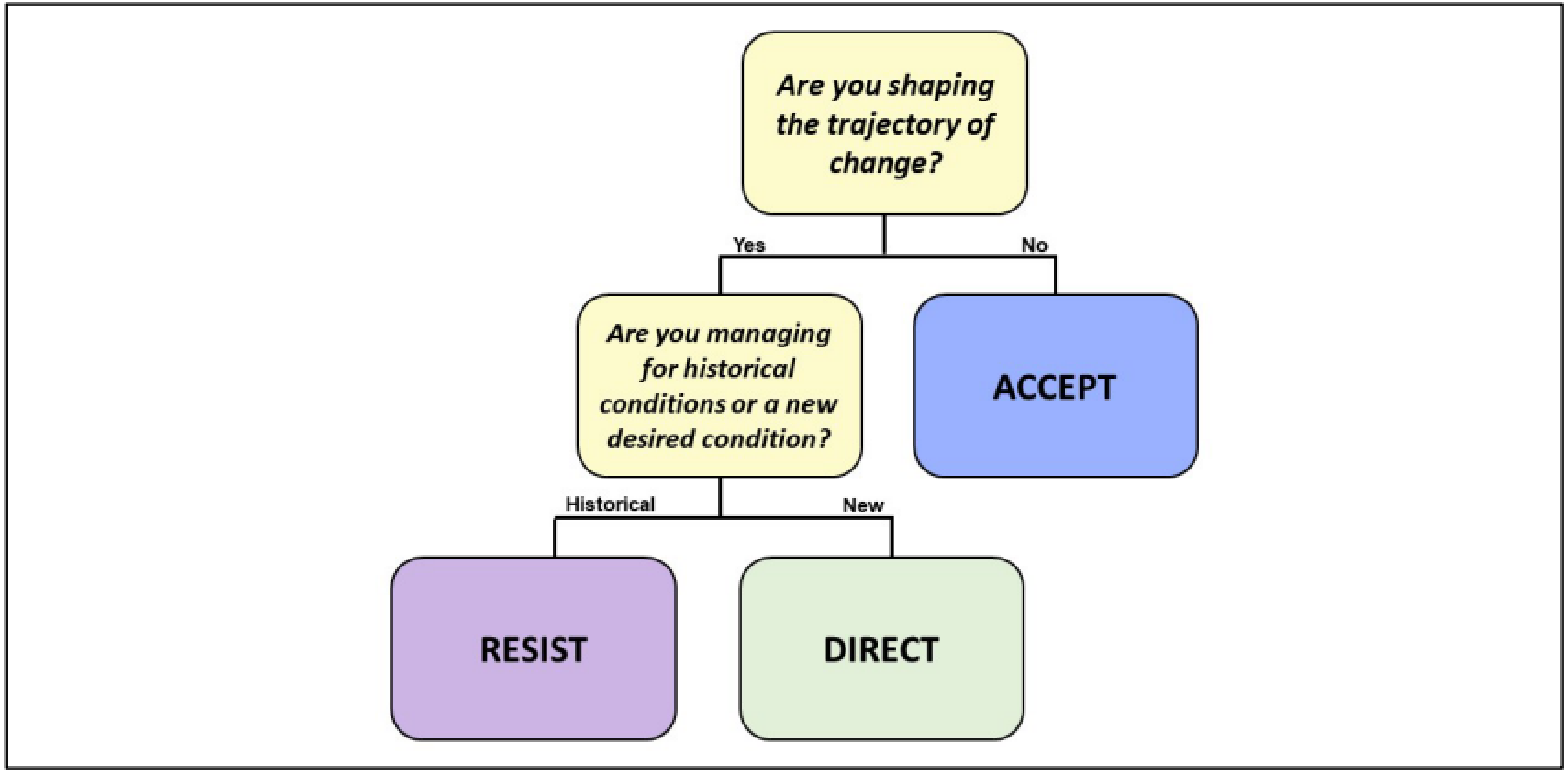
Severe Drought



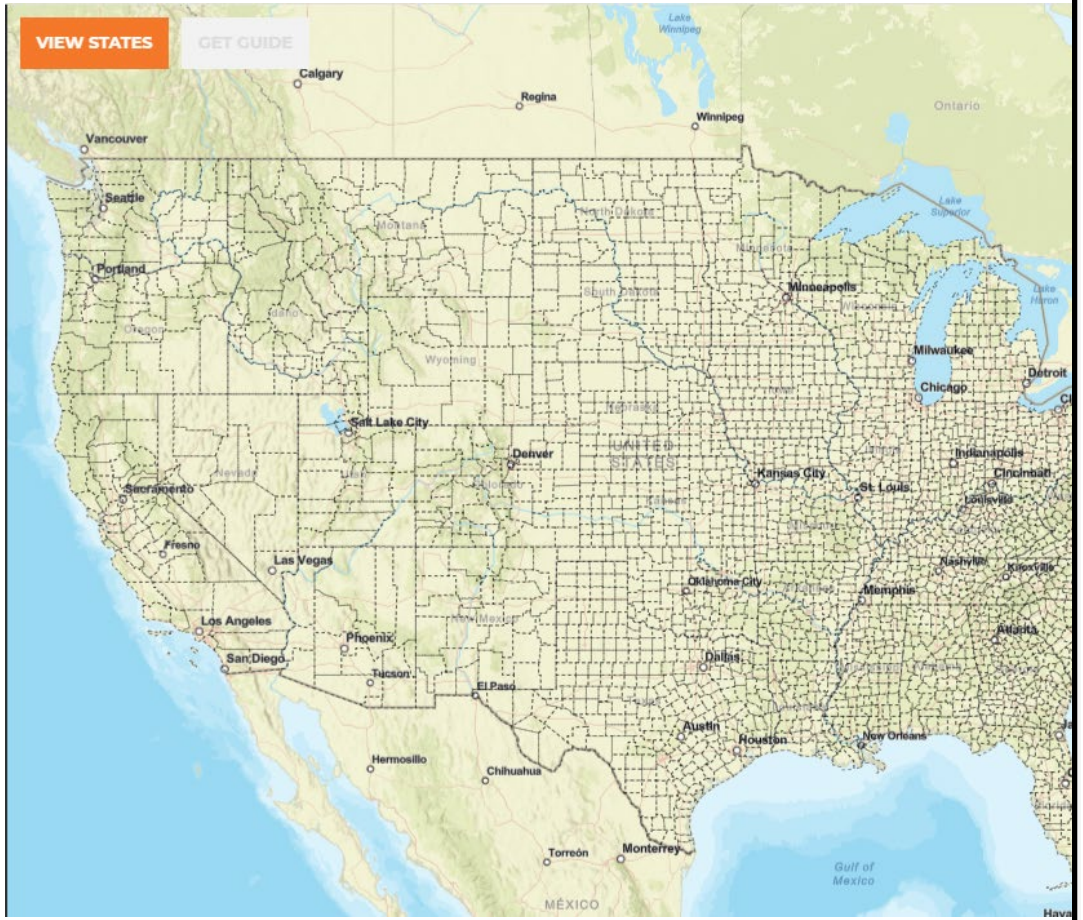
Extreme Heat

Extreme Precipitation

Management Options



Climate Quick Reference Guides



USDA Natural Resources Conservation Service | Southwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

CLIMATE QUICK REFERENCE GUIDE | Colorado

Historic Changes 1900-2020

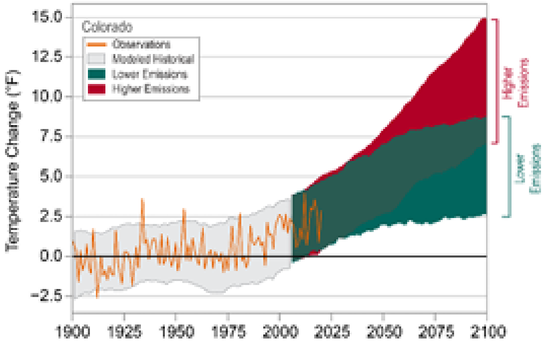
- Average temperatures have risen about 2.3°F since 1970 with warming occurring in all four seasons.
- From 1950 - 2021, average rainfall has increased 21% and the number of 2-inch extreme precipitation events in a 24-hour period has increased 117%.
- Colorado's mountains are the headwaters of 4 major rivers that supply water to 18 other states downstream. Since 2000, annual and spring precipitation totals have been generally below average.

Projected Changes 2042-2070

- Projected warming will increase the rate of soil moisture loss during dry spells, increasing the intensity of droughts and frequency of wildfires.
- While future changes in annual precipitation are uncertain, warming temperatures are projected to exacerbate the recent trend of reduced overall water availability and earlier snowmelt and runoff.

Observed and Projected Temperature Change

Observed and Projected Temperature Change



Source: statesummaries.ncics.org

La Plata County Summary

County Max Temperature (Fahrenheit)

Season	Current	2040-2070	Change
Spring	55.9	62.7	+6.75
Summer	77	83.4	+6.35
Fall	58.8	65.1	+6.32
Winter	39.1	44.6	+5.54
Annual	57.7	63.9	+6.24

County Max Precipitation (Inches)

Season	Current	2040-2070	Change
Spring	5.6	5.4	-0.2
Summer	5.7	6	+0.34
Fall	6.6	6.8	+0.16
Winter	6	6.4	+0.43
Annual	23.9	24.7	+0.74

Current data comes from PRISM Climate Group 30-year normal data for the 1971-2000 time period. Future is derived from the CMIP5 data using the mid-century time period and higher emissions scenario (RCP 8.5).
Source: swclimatehub.info/data/interactive-maps

County Top Causes of Crop Loss

Cause of Loss	Indemnity($)	Acres
Drought	474,158	18,169
Freeze	159,309	3,063
Area Plan Crops	144,528	46,300
Failure of Irr. Supply	138,415	1,392
Wildlife	124,596	1,690

Source: RMA crop loss data by county 1989-2020.
swclimatehub.info/rma/rma-data-viewer.html

"Area plan crops only" refers to damaged crops covered by a specific type of insurance policy that provides coverage based on county yields instead of policyholders' individual yields. Therefore, losses are not necessarily tied to specific weather-related cause of loss.

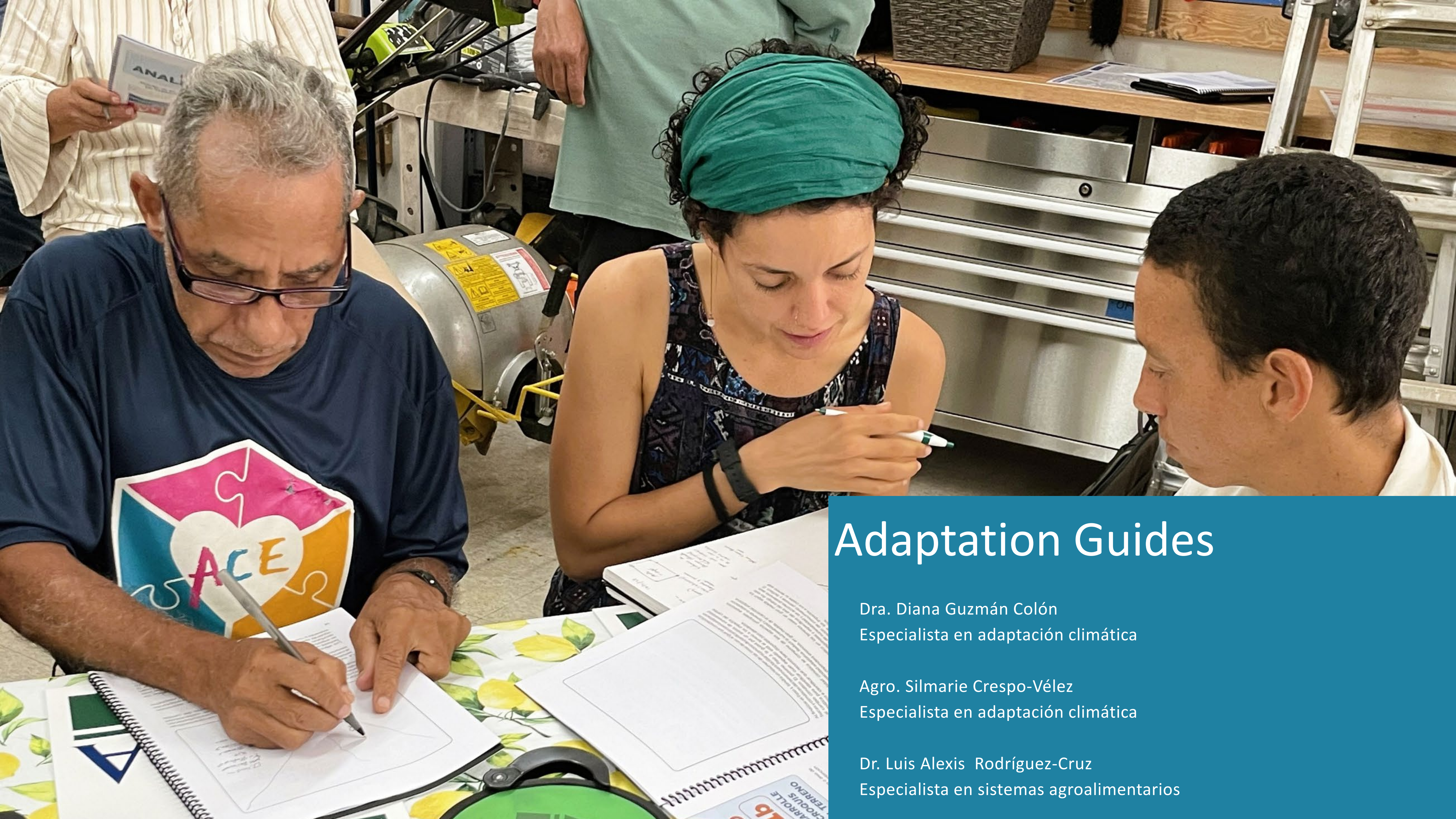
https://webapps.jornada.nmsu.edu/climate-quick-guides

Reaching people in the Caribbean

Adaptation Guide
Climate smart Caribbean

William Gould, Director, USDA Caribbean Climate Hub
USDA Forest Service, Río Piedras, Puerto Rico

Climate Change and Agriculture in the United States
The Importance of Persistence
June 25, 2024



Adaptation Guides

Dra. Diana Guzmán Colón
Especialista en adaptación climática

Agro. Silmarie Crespo-Vélez
Especialista en adaptación climática

Dr. Luis Alexis Rodríguez-Cruz
Especialista en sistemas agroalimentarios

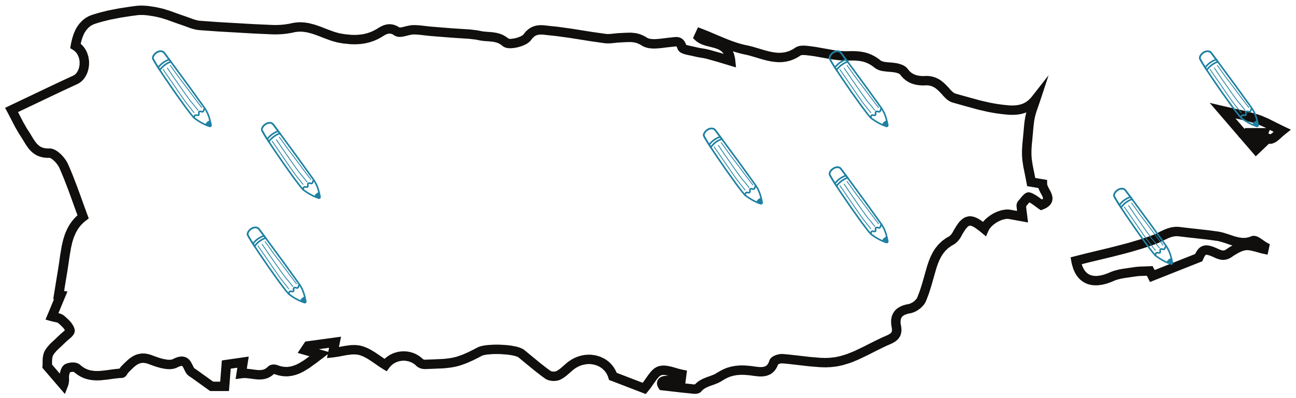
Climate Adaptation Guide for Tropical Forestry and Agriculture

Support for farm and forest planning.
Developed with feedback from farmers, ranchers, extension agents, and other stakeholders.

WORKSHOPS

FARM VISITS

PUBLICATIONS



8 in-person workshops

1 virtual workshop: Ag Extension Agents

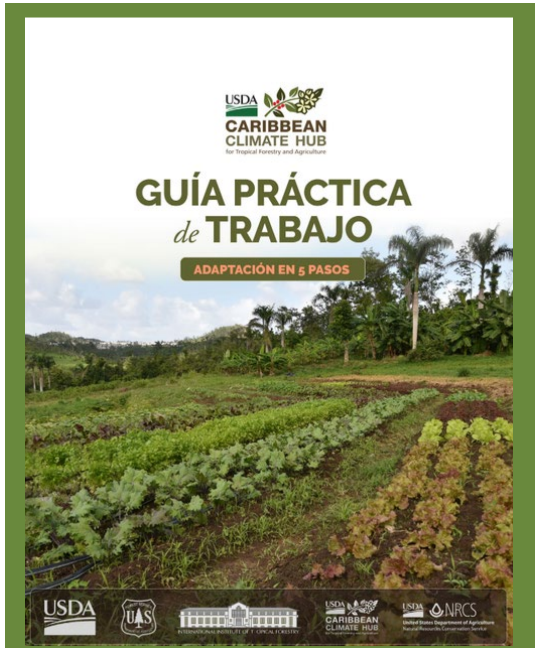
135 participants

Workshops Learning objectives:

- Increase knowledge of climate scenarios
- Identify how climate change shows up
- Develop skills to make informed decisions given the specific vulnerability of each project

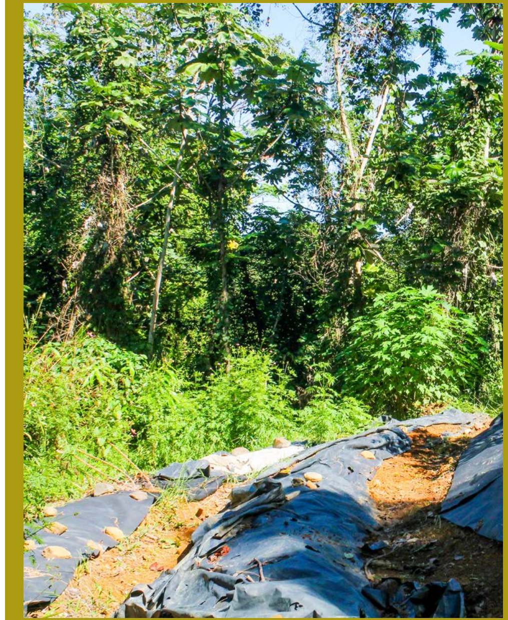
Products

GUÍA DE ADAPTACIÓN



MANUAL PRÁCTICO CORTO

10 GUÍAS PRÁCTICAS POR SECTORES

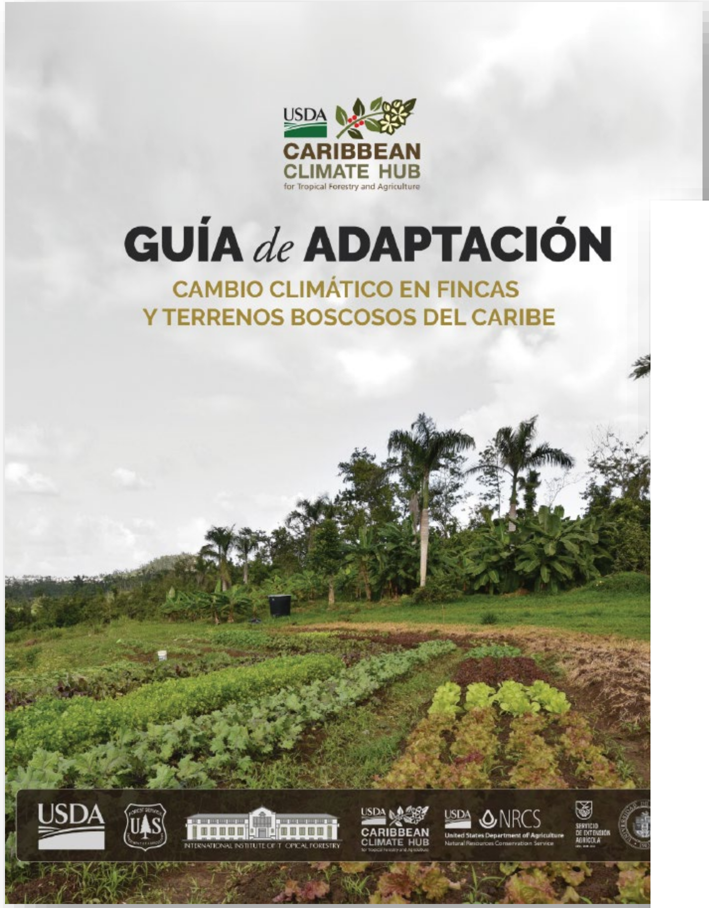


CASOS DE ESTUDIO

- Climate Change Trends, Effects and Implications for Puerto Rico
- Worksheets based on the 5 steps

Poultry, Forests, Cocoa, Coffee, Fruit trees, Livestock, Vegetables, Musaceae, Small ruminants, Root crops

Climate Adaptation Guide for Tropical Forestry and Agriculture



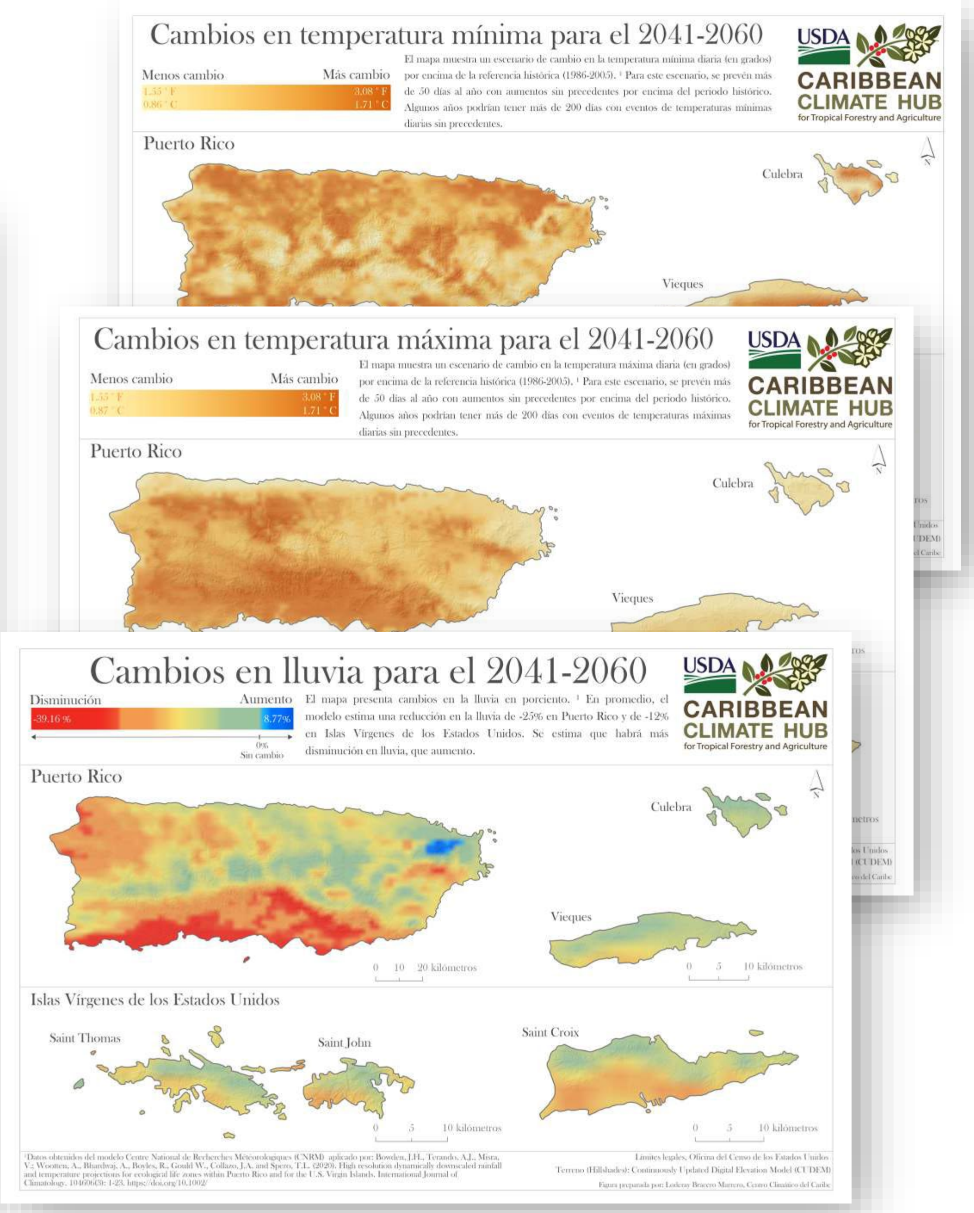
Capítulo 1

CAMBIO CLIMÁTICO

¿QUÉ ES EL CAMBIO CLIMÁTICO?

El clima se define como las condiciones del tiempo esperadas para un área geográfica a largo plazo (usualmente de 30 años o más). Estas condiciones del tiempo pueden incluir la temperatura, la precipitación, el viento, entre otros indicadores. Por ejemplo, basado en datos historicos del clima, se espera que los meses diciembre y enero sean tipicamente más frescos en el Caribe. Es posible que existan variaciones naturales dentro del año, donde se observa que las condiciones del tiempo se desvian del clima en promedio. Estas variaciones se experimentan como periodos de sequia, lluvias intensas, y olas de calor. Aunque estas variaciones pueden ser parte del ciclo natural de la tierra, muchas actividades humanas contribuyen directa o indirectamente a los cambios en el clima a través de las emisiones de gases de efecto invernadero (GEI).

Figura 1 *El efecto invernadero y su relación al calentamiento global. La energía del sol viaja hacia la Tierra, donde algunos de los rayos del sol son absorbidos por los gases de efecto invernadero en la atmósfera, mientras que otros son reflejados de vuelta al espacio. La acumulación excesiva de gases en la atmósfera provoca un aumento en calor en la Tierra.*



Climate Adaptation Guide for Tropical Forestry and Agriculture

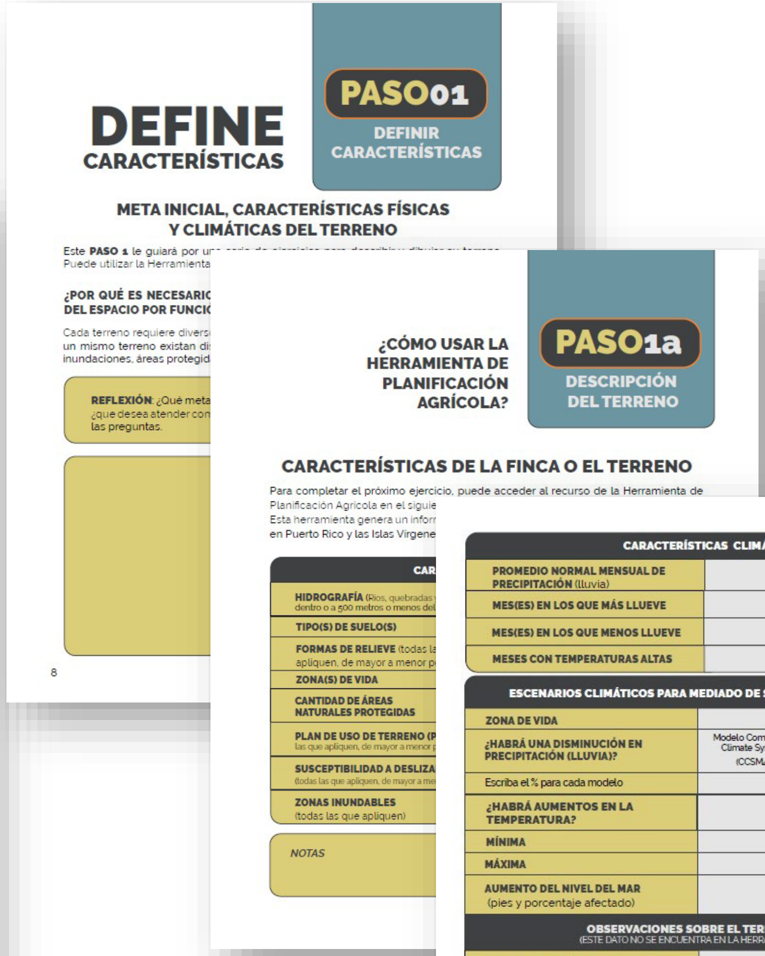
PROCESO DE ADAPTACIÓN EN 5 PASOS

Este proceso permitirá crear un espacio para la planificación basado en metas y objetivos tomando en cuenta la vulnerabilidad climática de la zona. Al completar estos pasos, se espera que tenga mayor claridad de sus necesidades e identifique cuáles prácticas le pudieran ayudar en el proceso de adaptación a corto y largo plazo.

PASOS DEL PLAN DE ADAPTACIÓN

- **01 DEFINE** META INICIAL DEL PROYECTO, CARACTERÍSTICAS FÍSICAS Y CLIMÁTICAS DEL TERRENO
- **02 ANALIZA** IMPACTOS DEL CAMBIO CLIMÁTICO Y VULNERABILIDADES ASOCIADAS
- **03 EVALÚA** LA META Y OBJETIVOS DE MANEJO PARA ATENDER LOS IMPACTOS CLIMÁTICOS
- **04 IDENTIFICA** ESTRATEGIAS Y PRÁCTICAS DE ADAPTACIÓN PARA IMPLEMENTAR
- **05 MONITOREA** EVALÚA LA EFECTIVIDAD DE LAS PRÁCTICAS IMPLEMENTADAS

Figura 2. *Aunque los pasos se presentan de manera consecutiva, no necesariamente siguen un proceso lineal. Por ejemplo, si se concluye que la efectividad de alguna práctica implementada no fue efectiva luego del monitoreo y evaluación, pudiese volver al paso 3 para reevaluar sus objetivos y continuar. Este proceso puede ser flexible y ajustarse a las necesidades particulares de la persona y el terreno.*



PASO01 DEFINIR CARACTERÍSTICAS

DEFINE CARACTERÍSTICAS

META INICIAL, CARACTERÍSTICAS FÍSICAS Y CLIMÁTICAS DEL TERRENO

PASO1a DESCRIPCIÓN DEL TERRENO

¿CÓMO USAR LA HERRAMIENTA DE PLANIFICACIÓN AGRÍCOLA?

CARACTERÍSTICAS DE LA FINCA O EL TERRENO

HIDROGRAFÍA
TIPO(S) DE SUELO(S)
FORMAS DE RELIEVE
ZONA(S) DE VIDA
CANTIDAD DE ÁREAS NATURALES PROTEGIDAS
PLAN DE USO DE TERRENO
SUSCEPTIBILIDAD A DESLIZA[MIENTOS]
ZONAS INUNDABLES (todas las que apliquen)

NOTAS

CARACTERÍSTICAS CLIMÁTICAS	
PROMEDIO NORMAL MENSUAL DE PRECIPITACIÓN (lluvia)	
MES(ES) EN LOS QUE MÁS LLUEVE	
MES(ES) EN LOS QUE MENOS LLUEVE	
MESES CON TEMPERATURAS ALTAS	

ESCENARIOS CLIMÁTICOS PARA MEDIADO DE SIGLO (2041-2060)		
ZONA DE VIDA		
¿HABRÁ UNA DISMINUCIÓN EN PRECIPITACIÓN (LLUVIA)?	Modelo Community Climate System (CCSM4)	Modelo Centre National de Recherches Météorologiques (CNRM)
Escriba el % para cada modelo		
¿HABRÁ AUMENTOS EN LA TEMPERATURA?		
MÍNIMA		
MÁXIMA		
AUMENTO DEL NIVEL DEL MAR (pies y porcentaje afectado)		

OBSERVACIONES SOBRE EL TERRENO (ESTE DATO NO SE ENCUENTRA EN LA HERRAMIENTA)	
RIESGO A EROSIÓN DE TERRENO (Sí/No)	

HERRAMIENTA DE PLANIFICACIÓN AGRÍCOLA www.farm.caribbeanclimatehub.org

Climate Adaptation Guide for Tropical Forestry and Agriculture

USDA CARIBBEAN CLIMATE HUB for Tropical Forestry and Agriculture

NOSOTROS | NOTICIAS Y EVENTOS | HERRAMIENTAS & APPS | PROYECTOS | RECURSOS | CONTÁCTENOS

4.1 Aves

4.2 Bosques

4.3 Cacao

4.4 Café

4.5 Hortalizas

4.6 Tuberculos

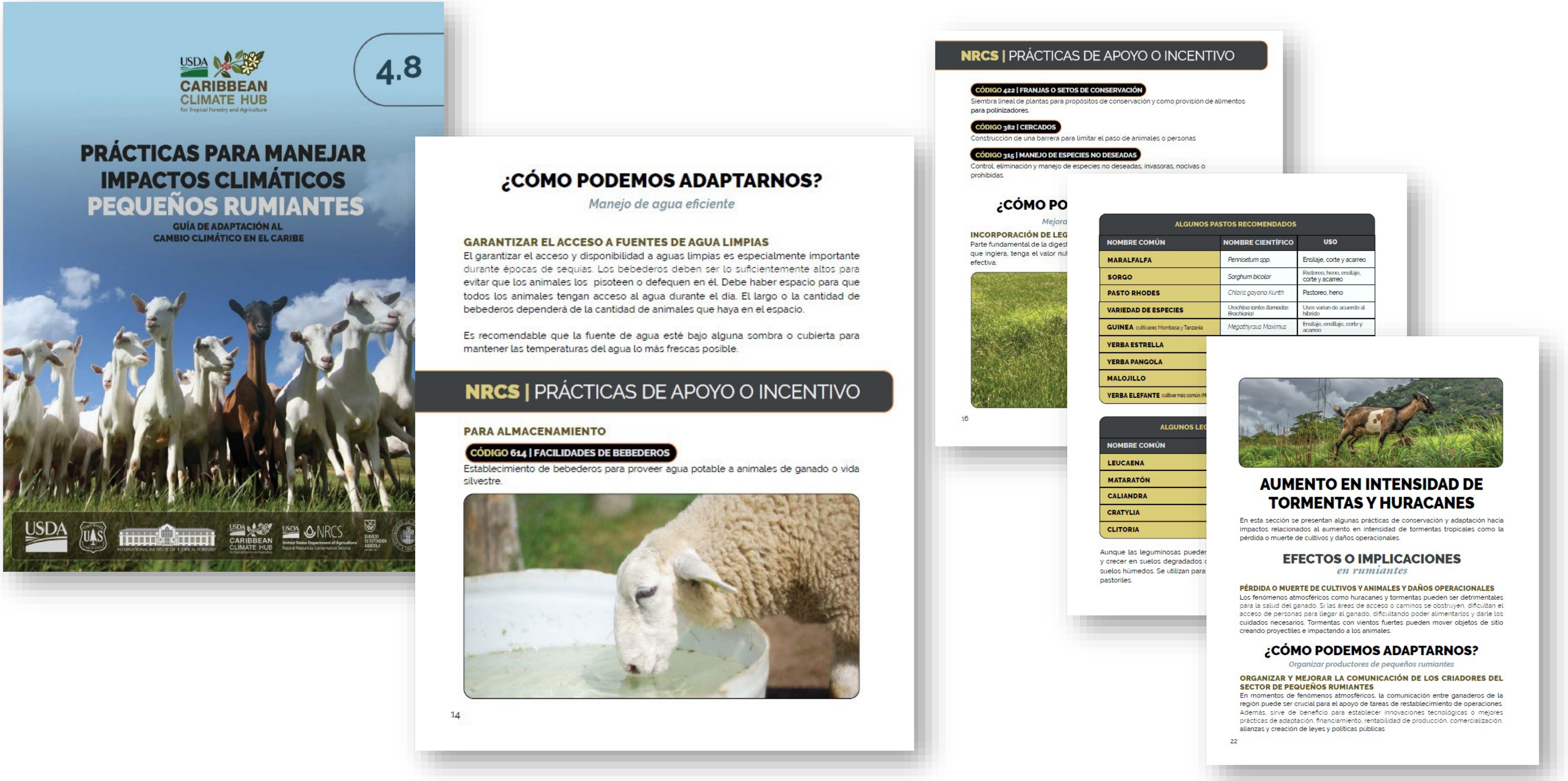
4.7 Ganaderia

4.8 Pequeños Rumiantes

4.9 Plátanos y Guineos

4.10 Árboles frutales

Climate Adaptation Guide for Tropical Forestry and Agriculture



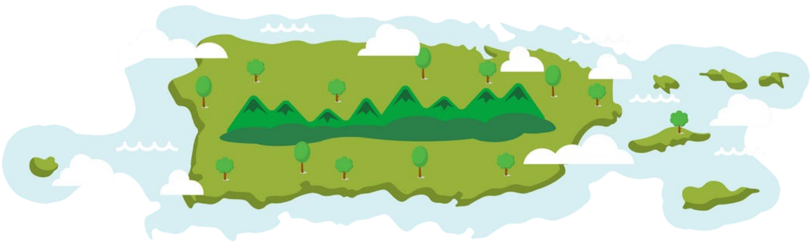
Digital tools

Dra. Loderay Bracero Marrero
Gerente de información geospacial

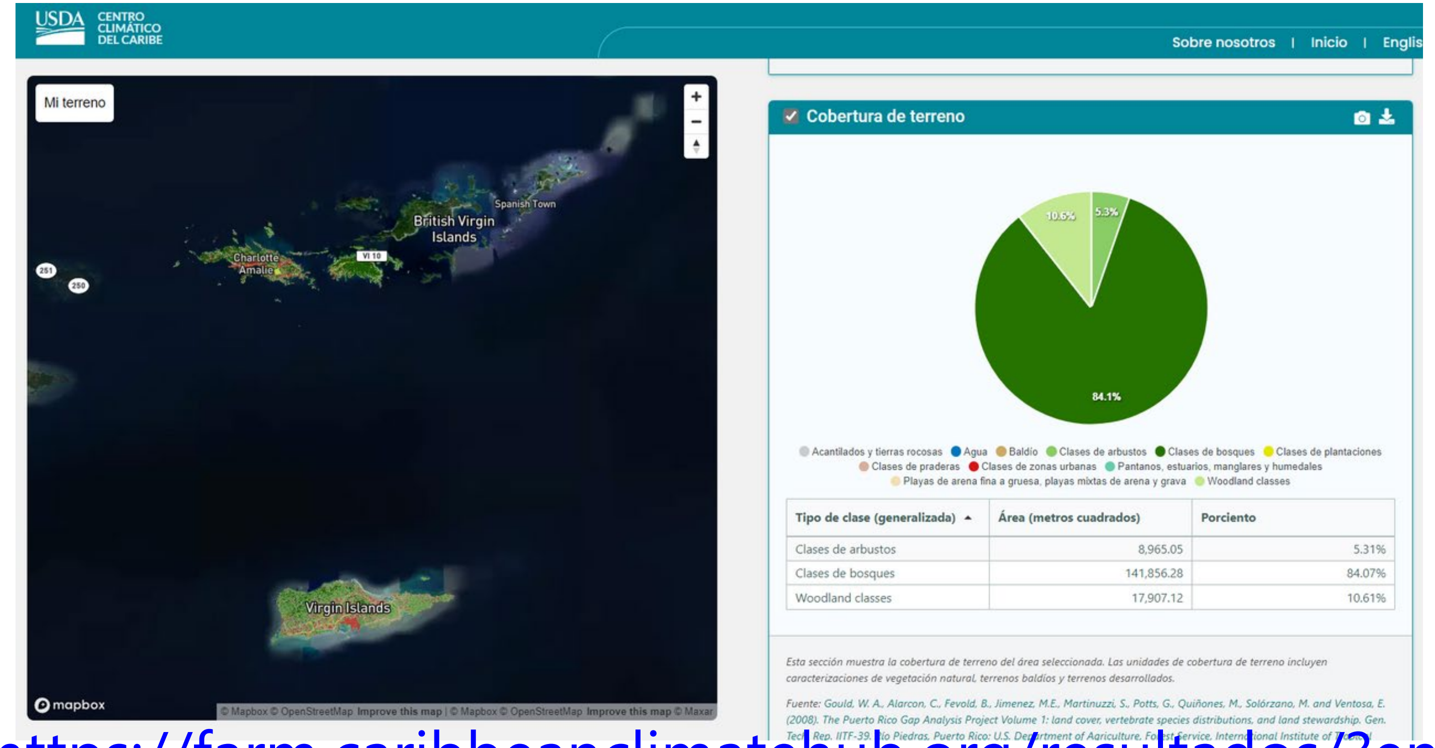
Dra. Nora Álvarez Berríos
Líder de investigación

Agro. Silmarie Crespo
Especialista en adaptación climática

Farm Planning Tool



The Farm Planning Tool provides data on the climate, hydrology, and zoning characteristics of any land in Puerto Rico and the USVI.

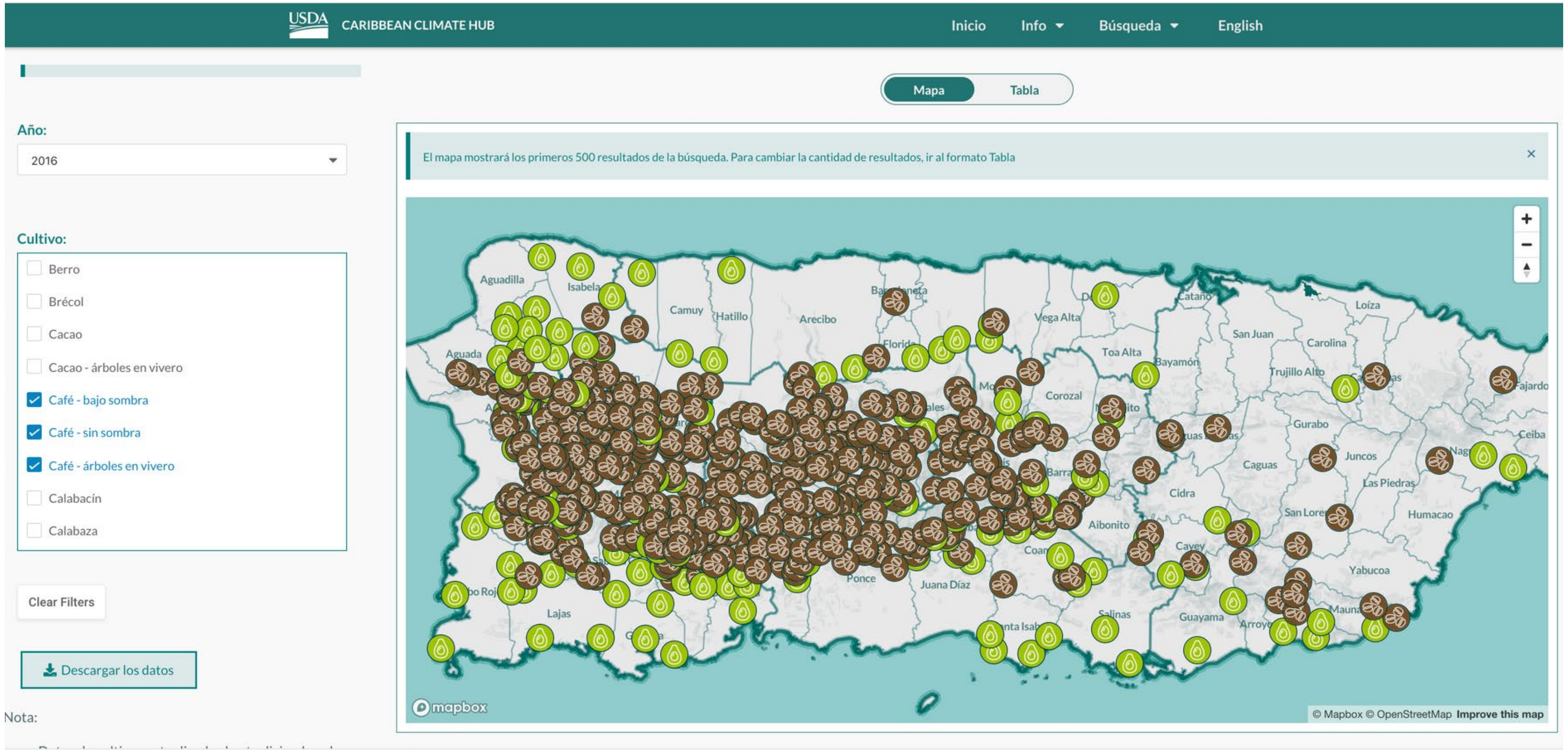


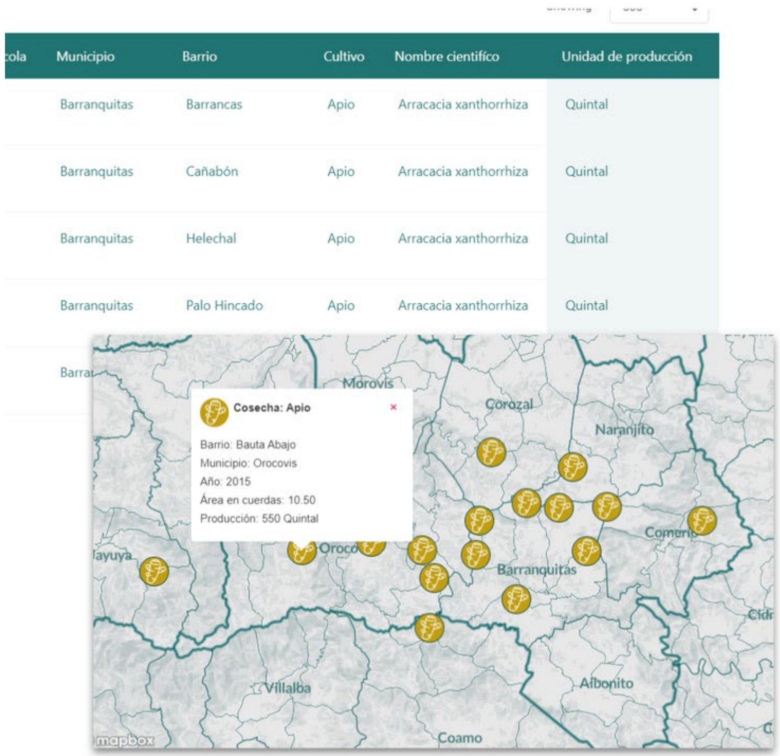
Tipo de clase (generalizada)	Área (metros cuadrados)	Porciento
Clases de arbustos	8,965.05	5.31%
Clases de bosques	141,856.28	84.07%
Woodland classes	17,907.12	10.61%

https://farm.caribbeanclimatehub.org/resultados/?entry_id=55854242

Agricultural Statistics
Online tool

Agricultural Statistics is a platform to visualize and download data on agricultural production in Puerto Rico (2013 - 2016).





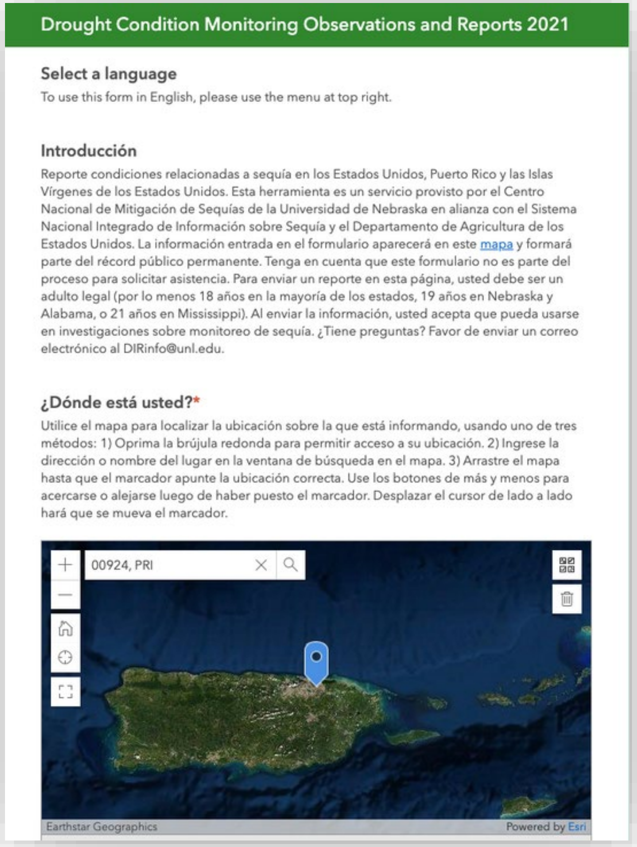
Municipio	Barrio	Cultivo	Nombre científico	Unidad de producción
Barranquitas	Barrancas	Apio	Arracacia xanthorrhiza	Quintal
Barranquitas	Cañabón	Apio	Arracacia xanthorrhiza	Quintal
Barranquitas	Helechal	Apio	Arracacia xanthorrhiza	Quintal
Barranquitas	Palo Hincado	Apio	Arracacia xanthorrhiza	Quintal

Por primera vez, se puede observar la producción agrícola en Puerto Rico en un mapa

https://ea.caribbeanclimatehub.org/

Citizen science tools for monitoring drought

CMOR - Condition Monitoring Observer Reports on Drought



Drought Condition Monitoring Observations and Reports 2021

Select a language

To use this form in English, please use the menu at top right.

Introducción

Reporte condiciones relacionadas a sequía en los Estados Unidos, Puerto Rico y las Islas Vírgenes de los Estados Unidos. Esta herramienta es un servicio provisto por el Centro Nacional de Mitigación de Sequías de la Universidad de Nebraska en alianza con el Sistema Nacional Integrado de Información sobre Sequía y el Departamento de Agricultura de los Estados Unidos. La información entrada en el formulario aparecerá en este mapa y formará parte del récord público permanente. Tenga en cuenta que este formulario no es parte del proceso para solicitar asistencia. Para enviar un reporte en esta página, usted debe ser un adulto legal (por lo menos 18 años en la mayoría de los estados, 19 años en Nebraska y Alabama, o 21 años en Mississippi). Al enviar la información, usted acepta que pueda usarse en investigaciones sobre monitoreo de sequía. ¿Tiene preguntas? Favor de enviar un correo electrónico al DIRinfo@unl.edu.

¿Dónde está usted?*

Utilice el mapa para localizar la ubicación sobre la que está informando, usando uno de tres métodos: 1) Oprima la brújula redonda para permitir acceso a su ubicación. 2) Ingrese la dirección o nombre del lugar en la ventana de búsqueda en el mapa. 3) Arrastre el mapa hasta que el marcador apunte la ubicación correcta. Use los botones de más y menos para acercarse o alejarse luego de haber puesto el marcador. Desplazar el cursor de lado a lado hará que se mueva el marcador.

00924, PRI

Earthstar Geographics

Powered by Esri

https://droughtimpacts.unl.edu/tools/conditionmonitoringobservations.aspx




Para más información


Tech Talks

Dr. Loderay Bracero Marrero

Technical talks on the web tools available for decision making in agriculture and forestry.

Our tools aim to provide practical strategies to the agricultural and forestry sectors to adapt to climate change and extreme events (droughts, floods, or hurricanes).

Climate-Smart Caribbean

Collaborative Partnership

Supported by the National Institute of Food and Agriculture

Building Climate Literacy

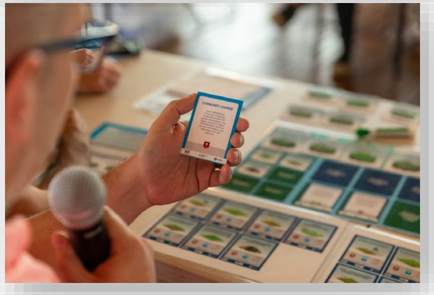
Learning opportunities:

- OneUSDA workshops for farmers and forest managers.
- Climate literacy for elementary school teachers.
- Caribbean Climate Resilience Game to impart knowledge on climate change and soil health.
- Interactive multimedia module for USDA and University Extension staff.



Supporting action:

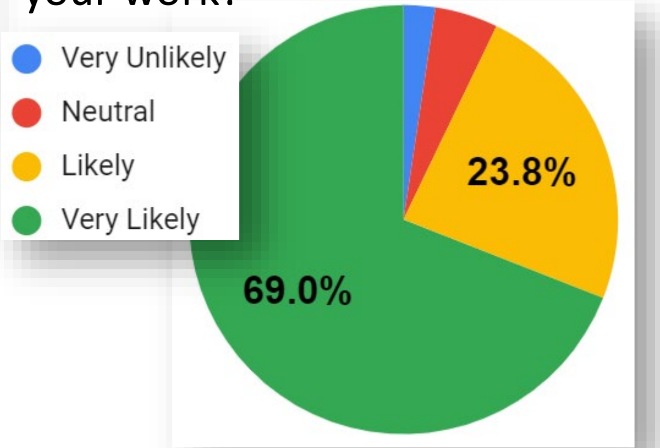
- Climate-smart Dairy educational module and workshop series for dairy producers.
- Soil Health Learning Network peer to peer learning.
- Climate-Smart reforestation workshop series.
- Climate adaptation and preparedness for farmers and forest managers.




Evaluating our impact:

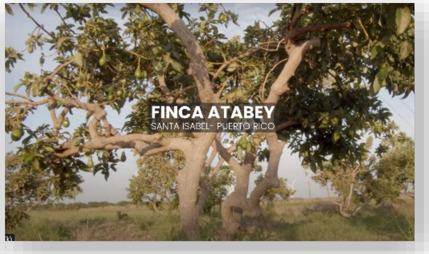
- How effective is our climate literacy training and knowledge sharing?

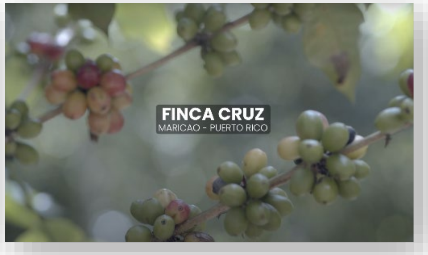
"How likely are you to apply what you discussed today in your work?"

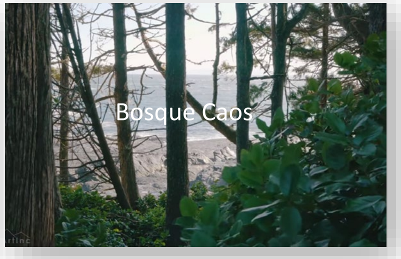


Adapta video series: Sharing local adaptation success stories https://www.youtube.com/@CaribbeanClimateHub

Five new videos in Spanish and English. 2000+ views in the last month.







One USDA

Conversations for farmers and landowners

- Climate change and indicators
- Peer learning
- Informative roundtables
- Panel discussion with
  - USDA Agencies,
  - Agricultural Extension
  - Climate-Smart Commodities Partners
  - Conservation Districts

Caribbean Climate Resilience Game

Interactive learning tool that facilitates players to understand how their farm management decisions affect the profitability of their farming operations, their climate resilience and long-term soil health.

WINROCK INTERNATIONAL

Climate Kids Backpacks

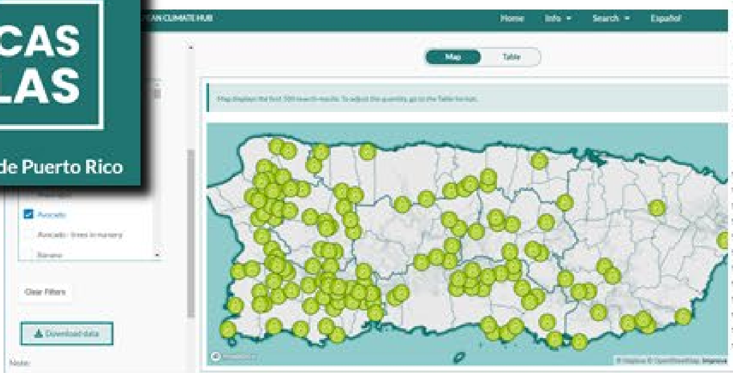
Climate Solutions

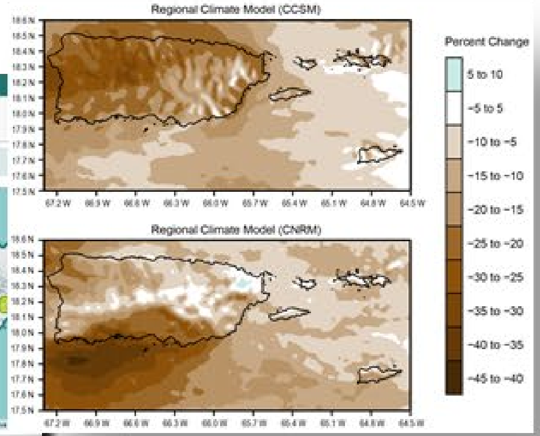
- Need for mitigation: Reduce CO_2 emissions and increase carbon sequestration.
- Need for adaptation: Manage water, support resilient crops, practices, products and markets.
- Need for learning:
  - What works to reduce vulnerability?
  - How to share and incentivize?

What to expect? Climate projections.

What works? Ideas and inspiration.

How to get it done? Tools and information.

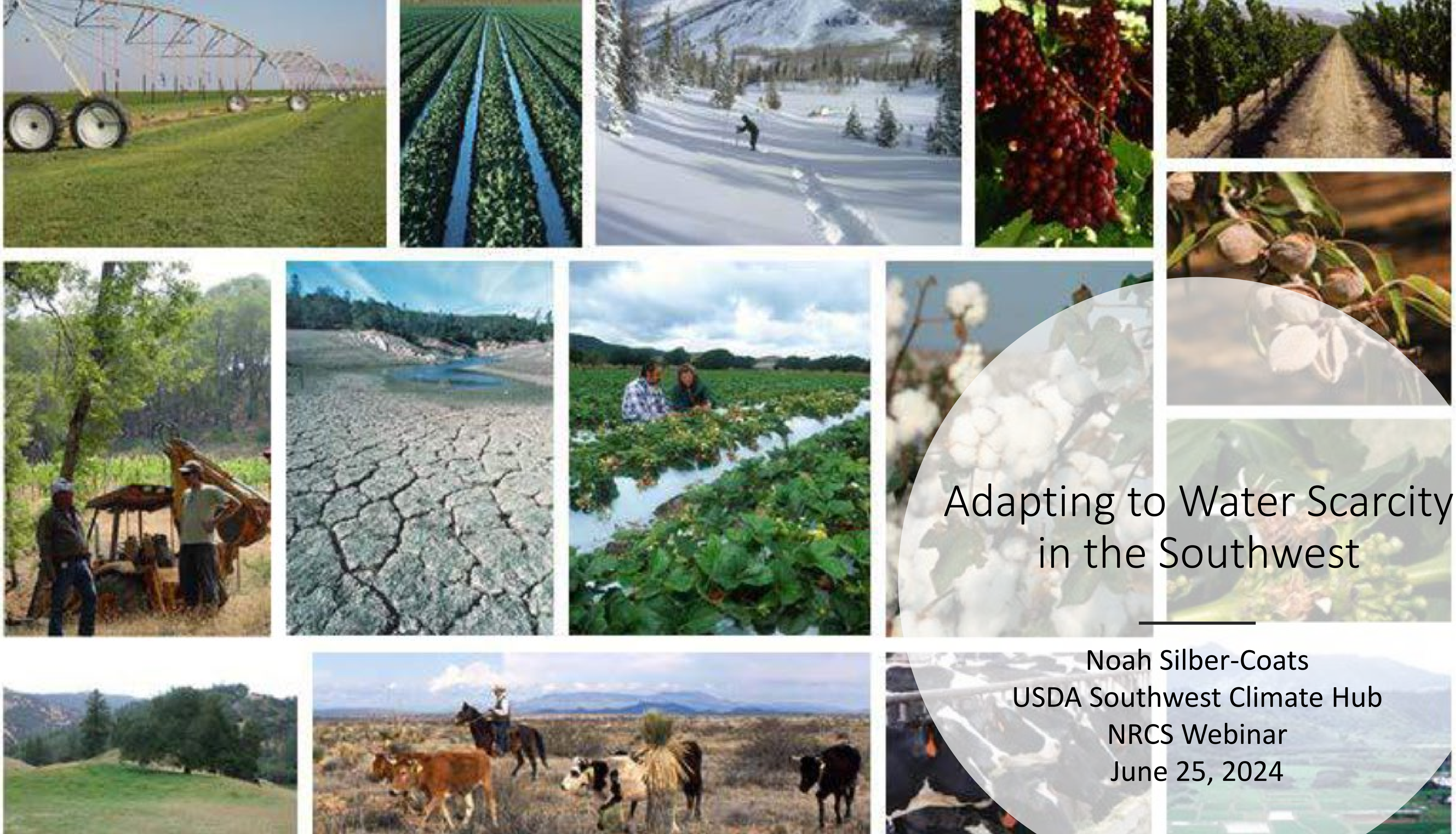




USDA Climate Hubs U.S. DEPARTMENT OF AGRICULTURE

INTERNATIONAL INSTITUTE OF TROPICAL FORESTRY

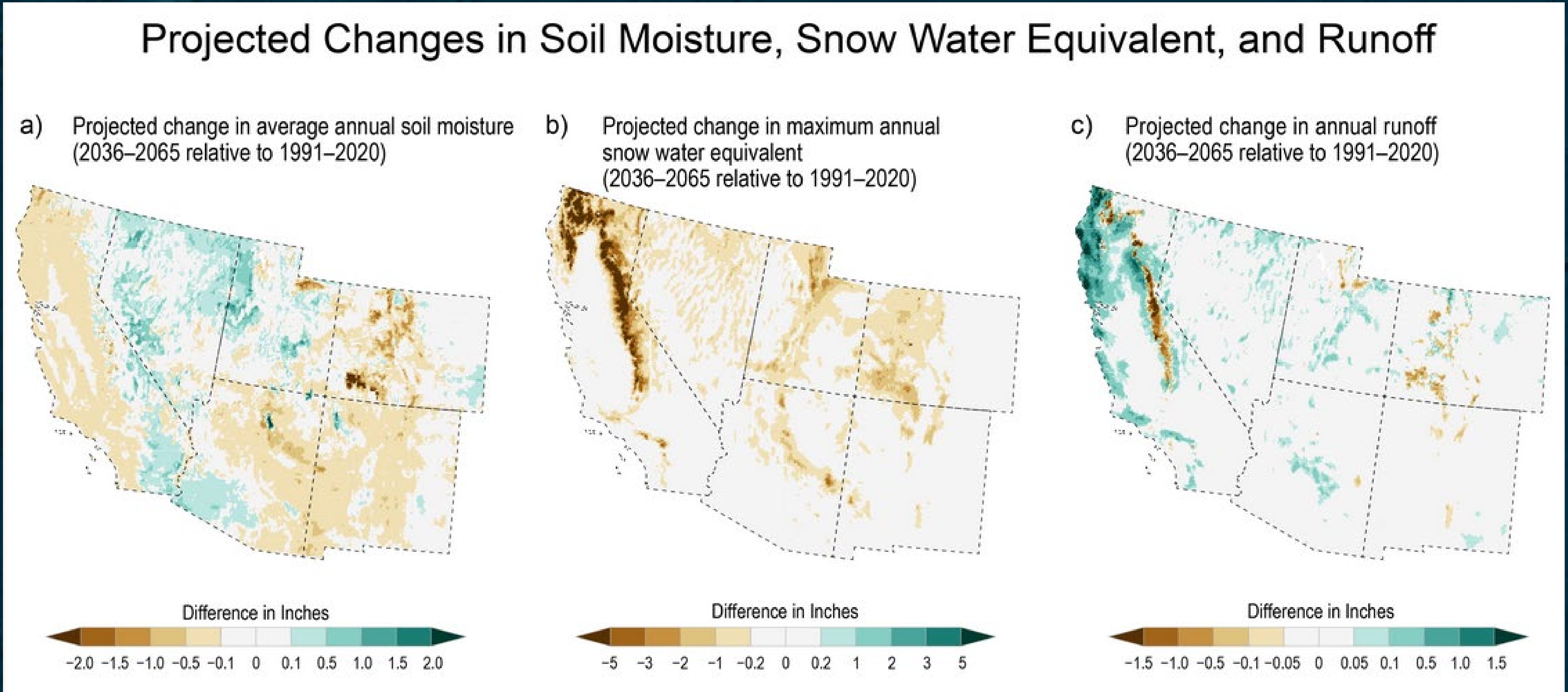
USDA CARIBBEAN CLIMATE HUB for Tropical Forestry and Agriculture



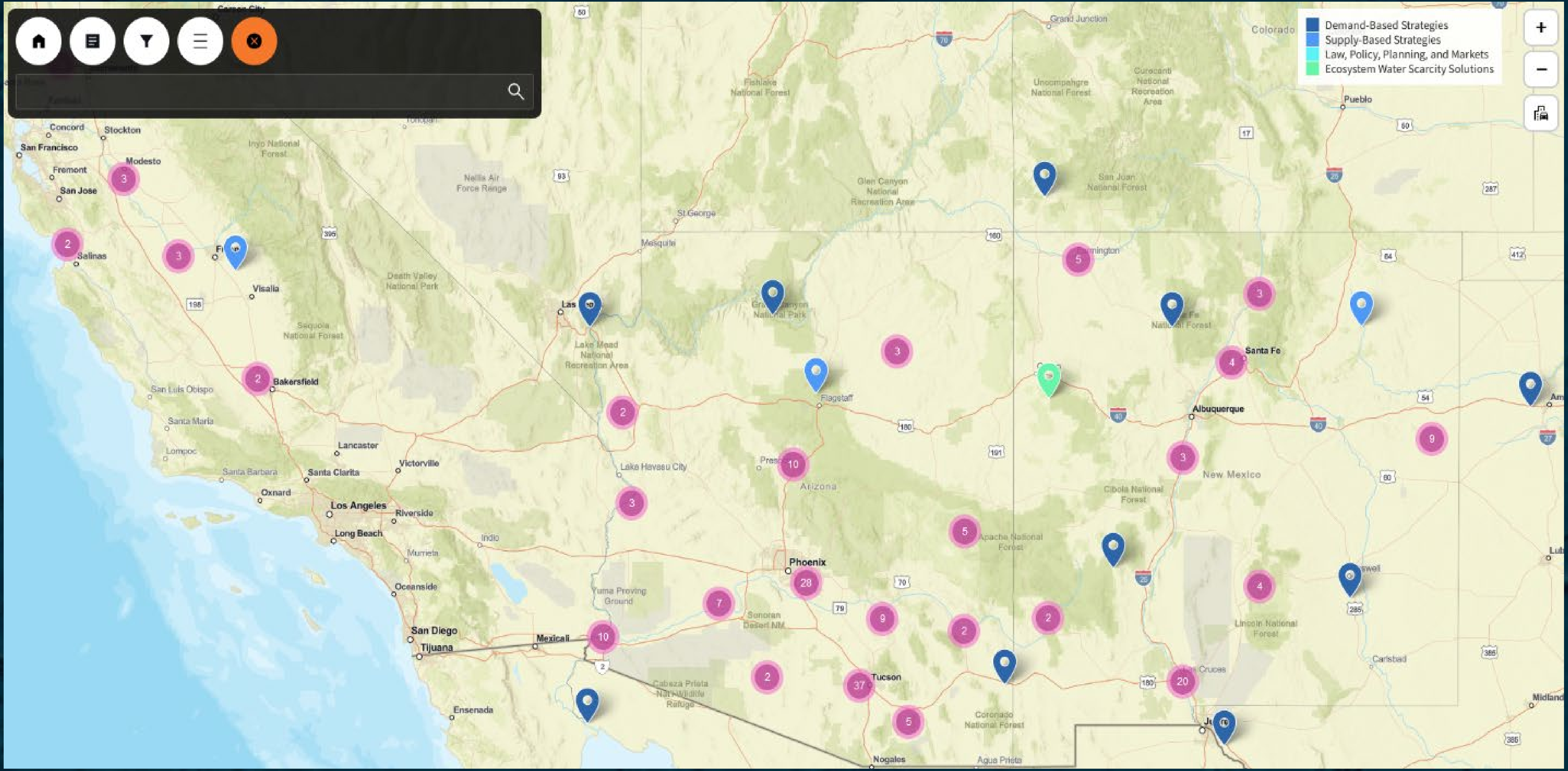
Adapting to Water Scarcity in the Southwest

Noah Silber-Coats
USDA Southwest Climate Hub

NRCS Webinar
June 25, 2024



- Southwest becoming hotter and drier (Image: 5th National Climate Assessment)

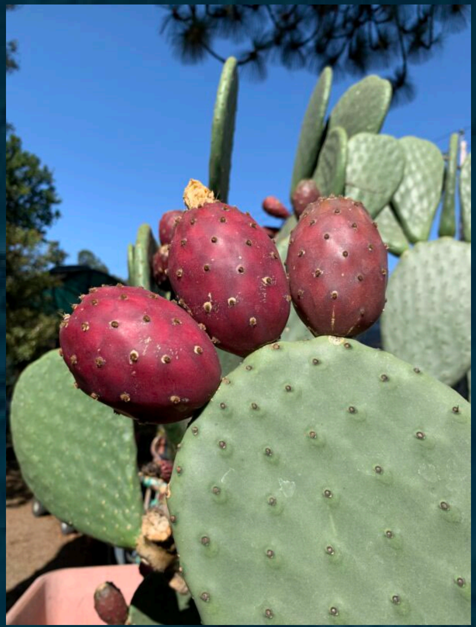


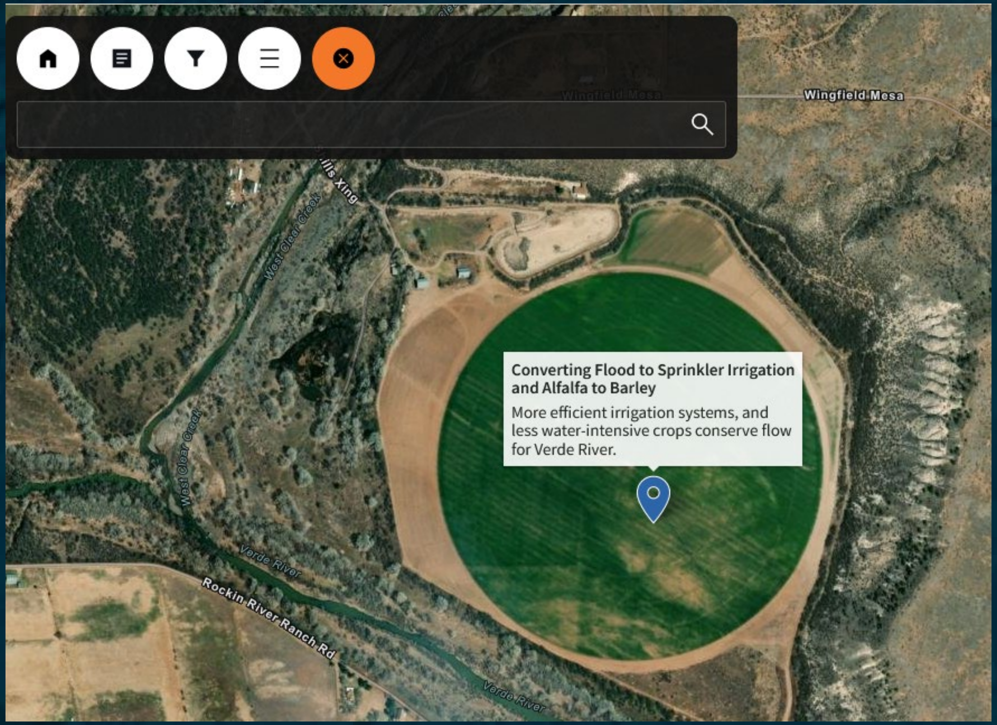
https://webapps.jornada.nmsu.edu/wata

Figure 5. *An experimental planting of Buffalo Gourd. Courtesy of William P. Bemis.*

Figure 3. *A view of Agave americana three-year-old transplants at Page Ranch, Arizona.*

Alternative Arid-Adapted Crops



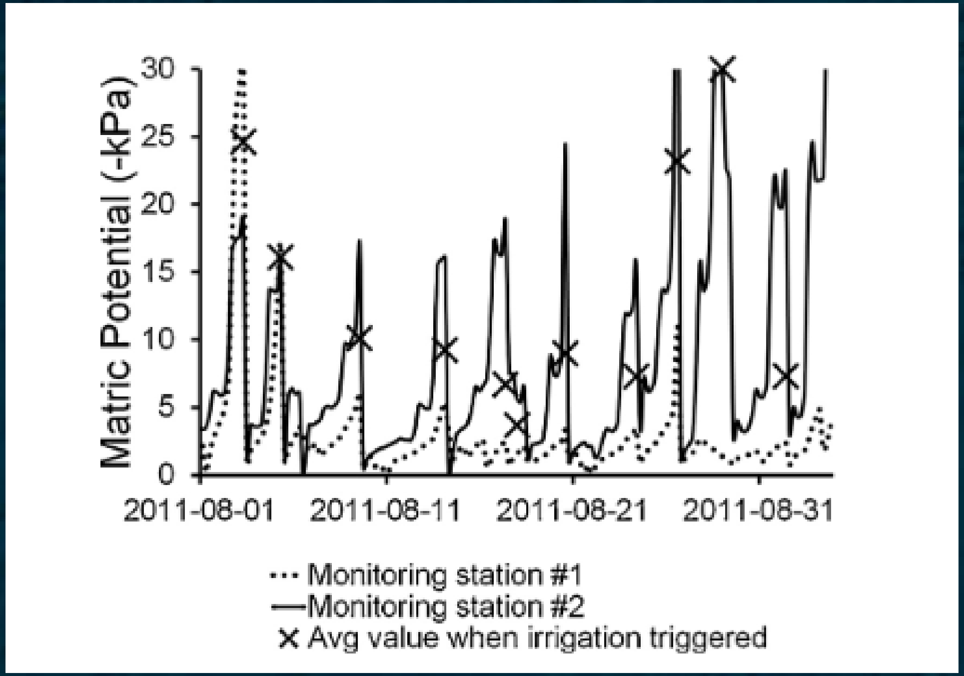


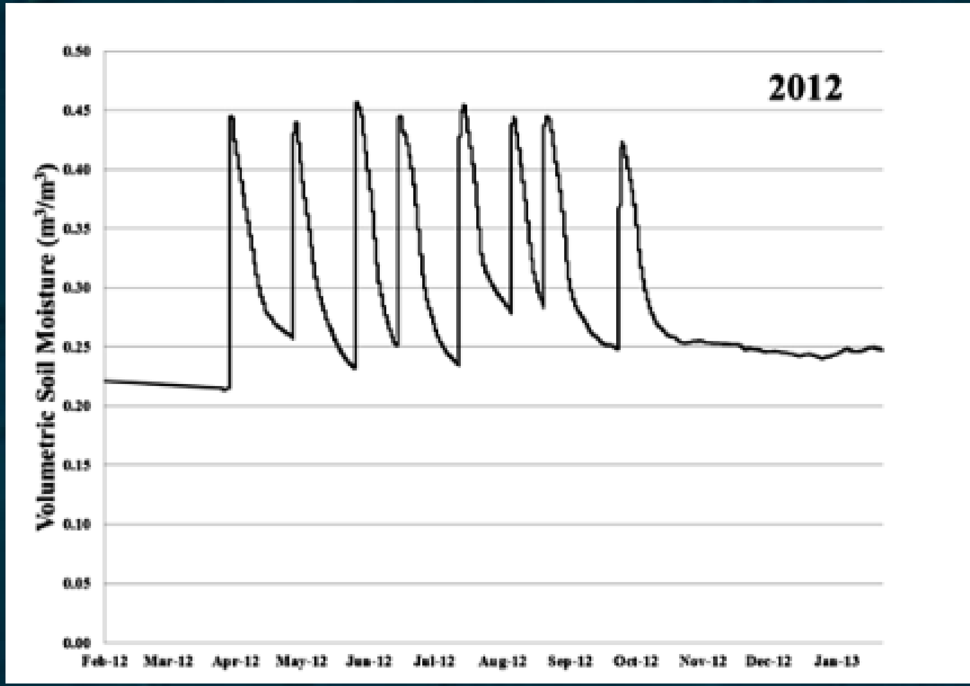
Irrigation Technologies:

Above – conversion from flood to sprinkler irrigation with support from The Nature Conservancy

Right – Low Elevation Precision Application (LEPA) and Mobile Drip Irrigation (MDI) further increase efficiency.

https://extension.usu.edu/crops/research/irrigation-pivots-laterals

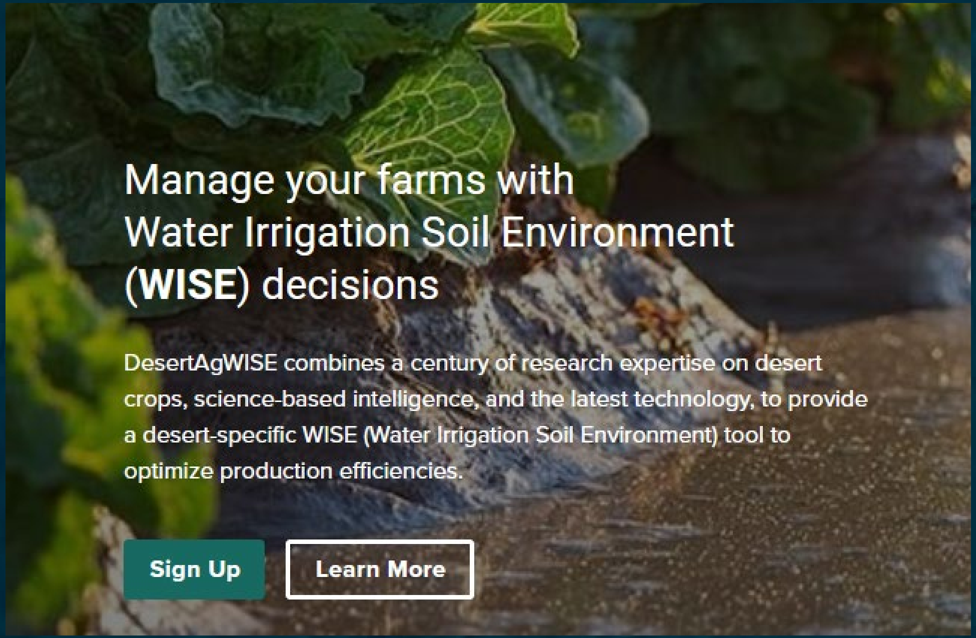




Irrigation Timing Tools:

- Top – soil-moisture sensor-based timing (left, strawberries in CA, right pecans in TX)

- Desert AgWISE app (www.desertagwise.org)

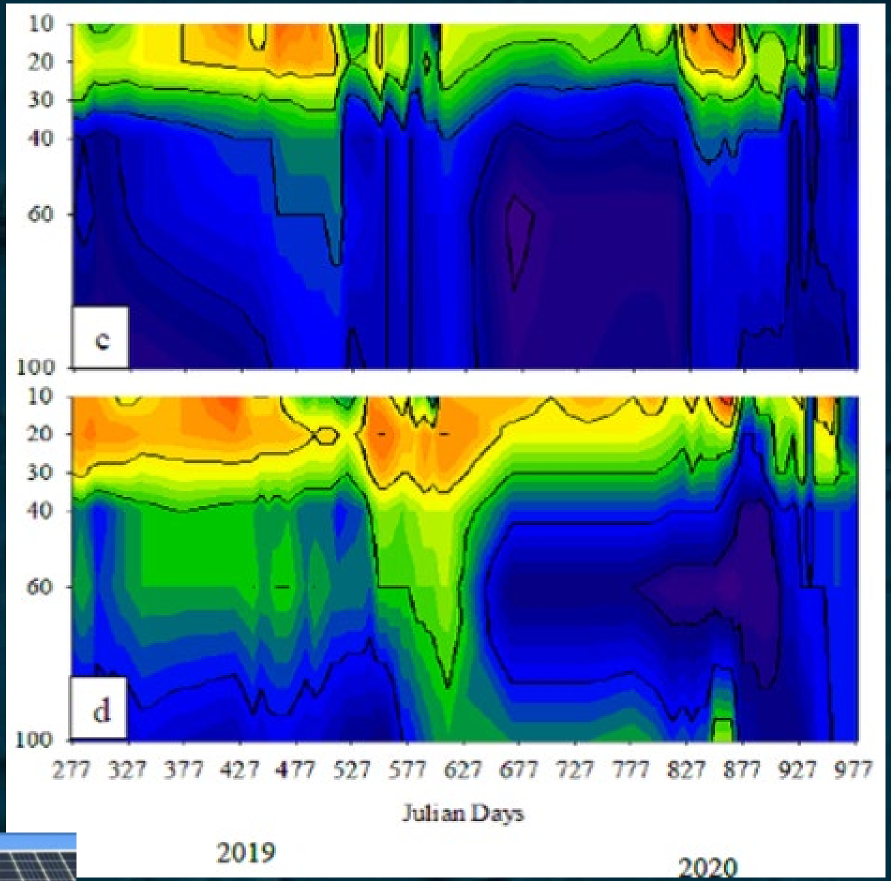


Deficit Irrigation:

- When to reduce water, by how much?
- Canola (above) tolerates stress during vegetative growth
- Safflower (top right) tolerates stress after flowering
- Alfalfa – California experiment under drip irrigation got 90% yield with 75% of water

Soil Moisture Conservation and Reducing Evapotranspiration:

- Right, winter cover crop vs. fallow – cover crop depletes water in spring, saves water in summer.
- Below: strip-till balances water conservation and yield. Irrigations reduced, cost-saving to producers.
- Below right: Agrivoltaics can reduce head stress and reduce water loss.



10 YEARS OF CLIMATE HUBS

Agricultural risk and climate adaptation in the Southwest region of the United States

Guillermo Alvarez Ph.D.
NRCS Webinar June 25, 2024

USDA United States Department of Agriculture
Risk Management Agency

USDA United States Department of Agriculture
Southwest Climate Hub

MONTANA STATE UNIVERSITY

Climate adaptation in the Southwest region of the United States

- Human activities, through emissions of greenhouse gases, have caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020 (IPCC 2023)
- Greenhouse gas emissions have continued to increase due to unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions (IPCC 2023)
- More frequent, intense, and accelerated drought (Mukherjee et al. 2018; Strzepek et al. 2010)
- Compound extremes (Lesk et al. 2022)

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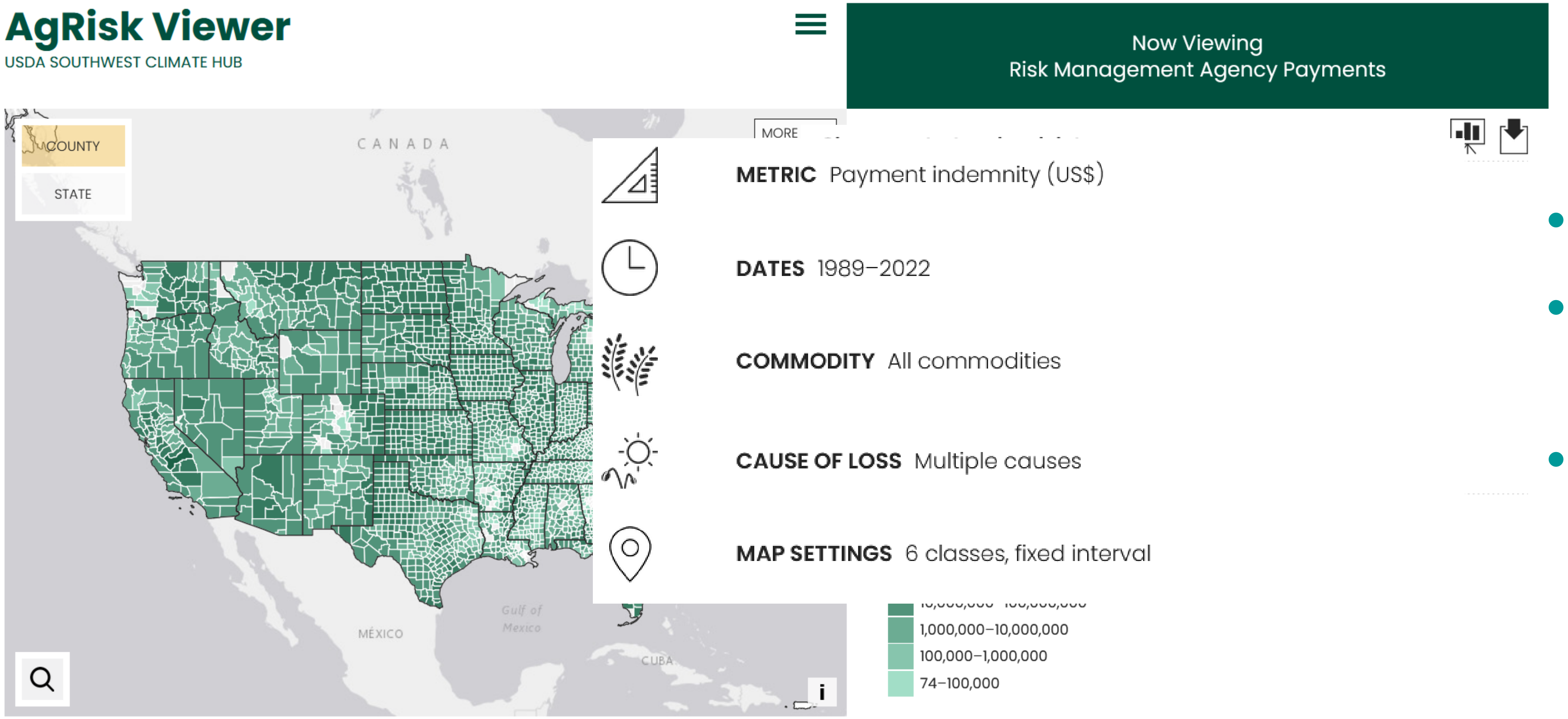
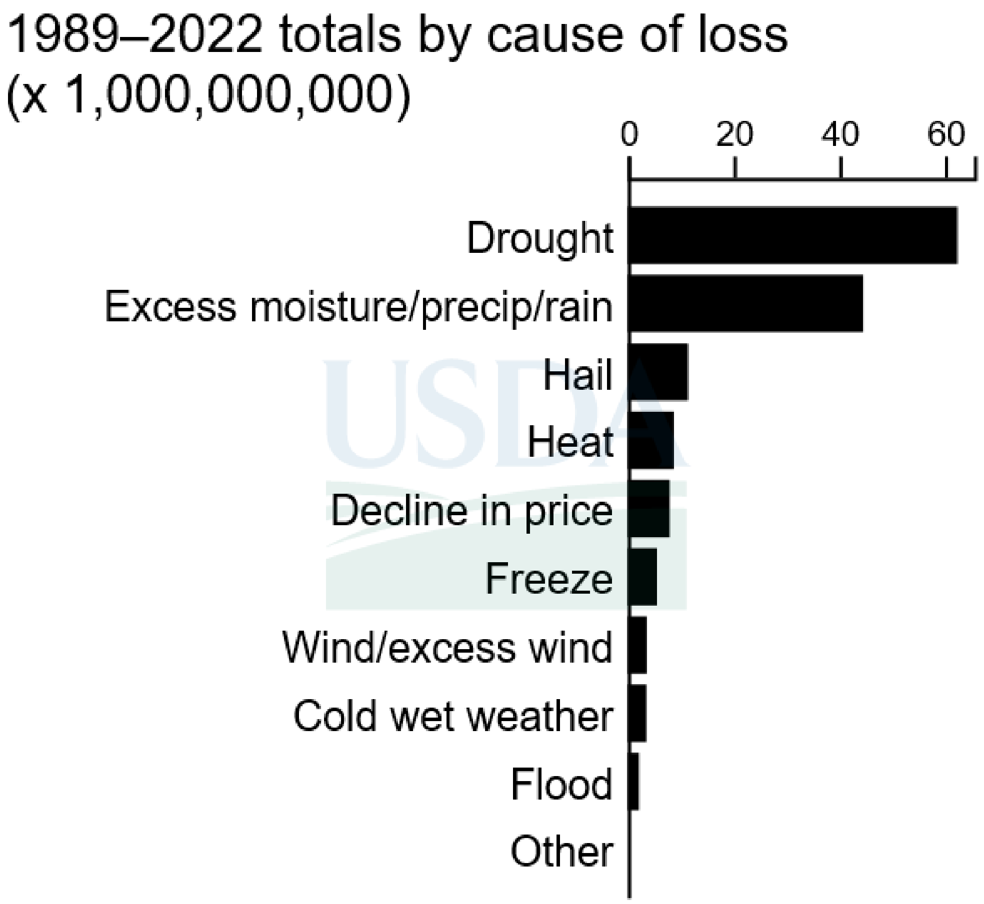
#AdaptationInAction

1. Easy to use platform



- climatehubs.usda.gov
- RMA historical cause of loss dataset
- Summary of business reports

2. Analyze crop insurance trends over time and space by cause of loss and commodity



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United States Department of Agriculture
Southwest Climate Hub

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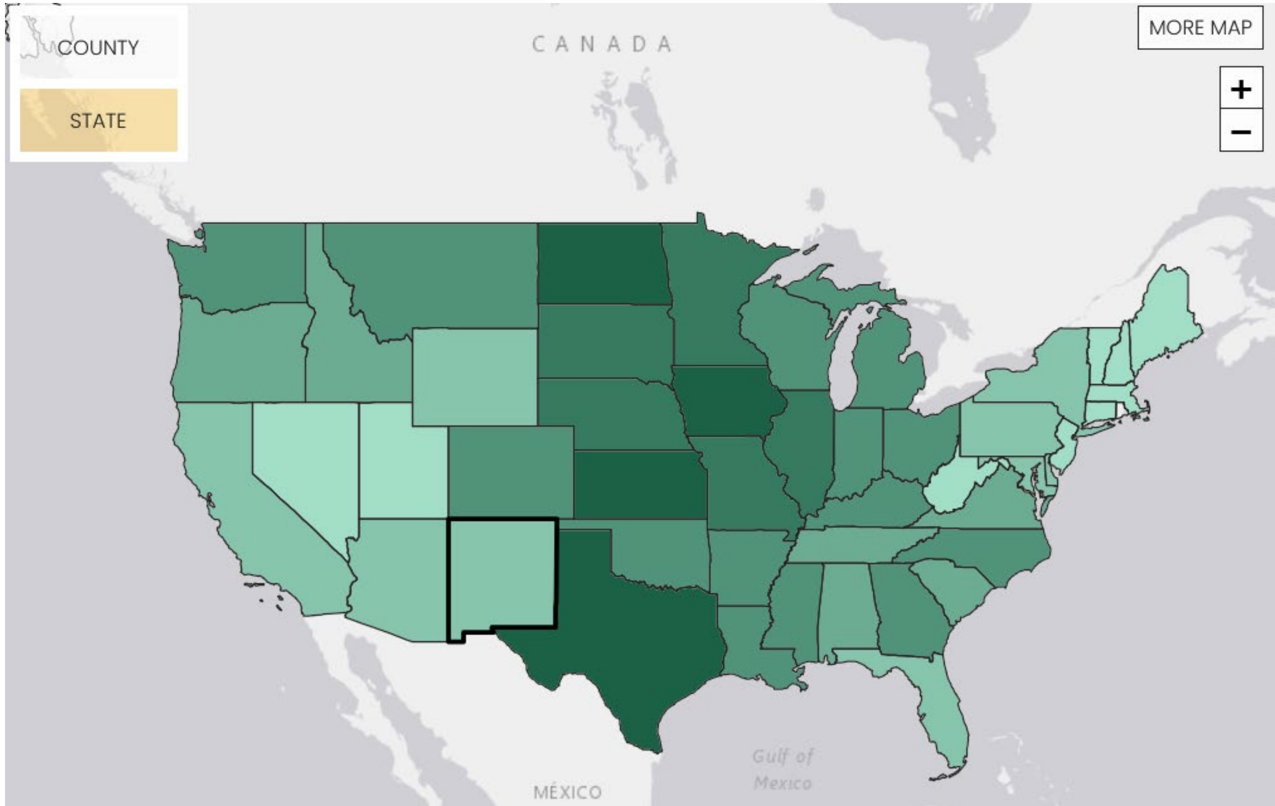

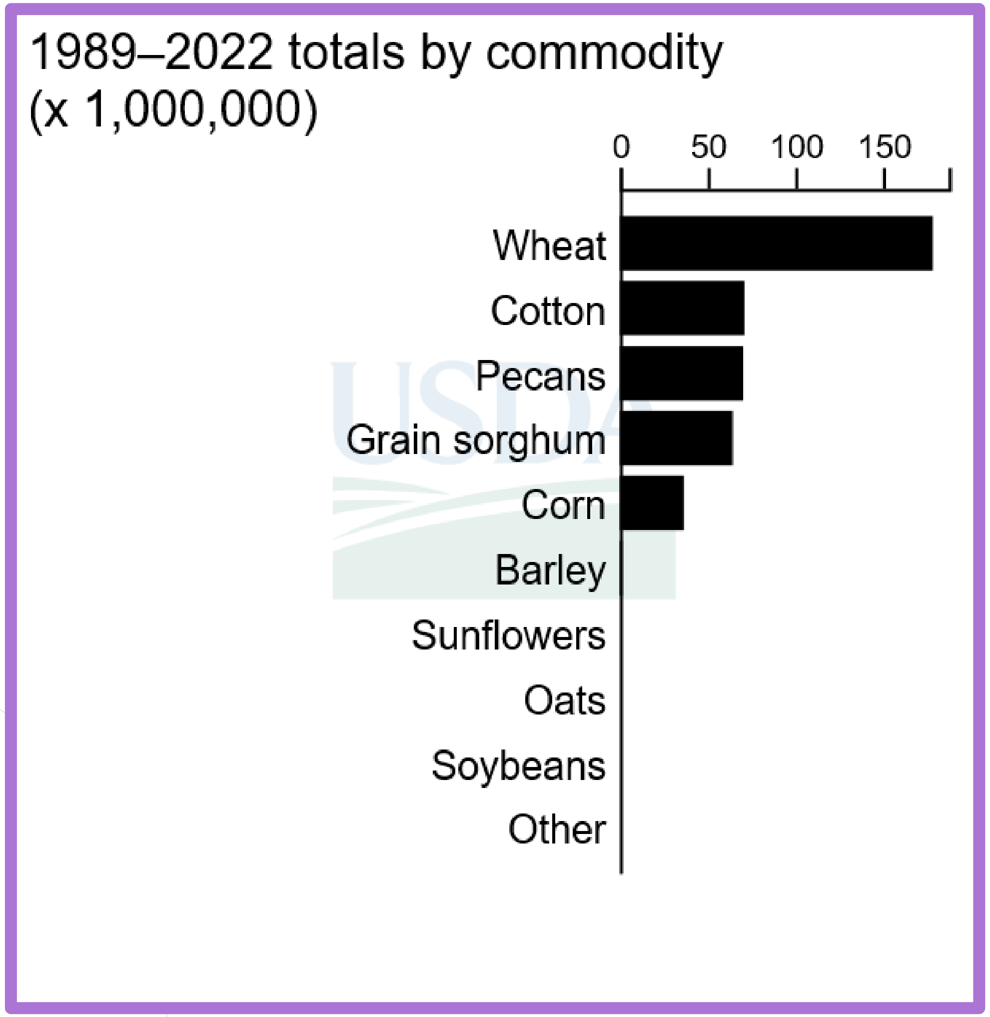

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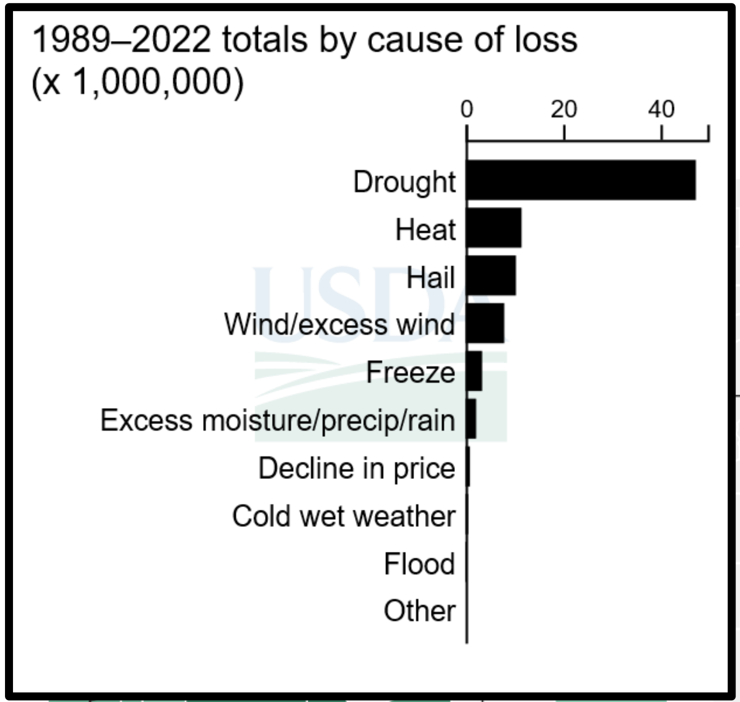
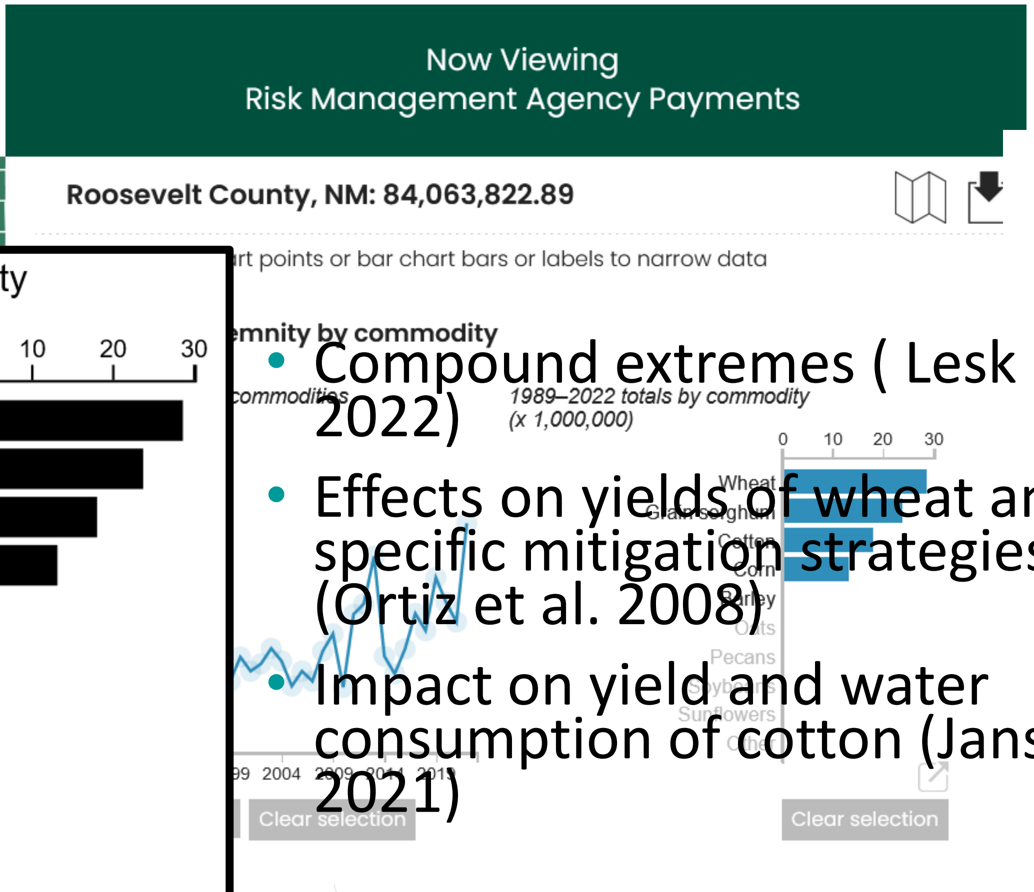
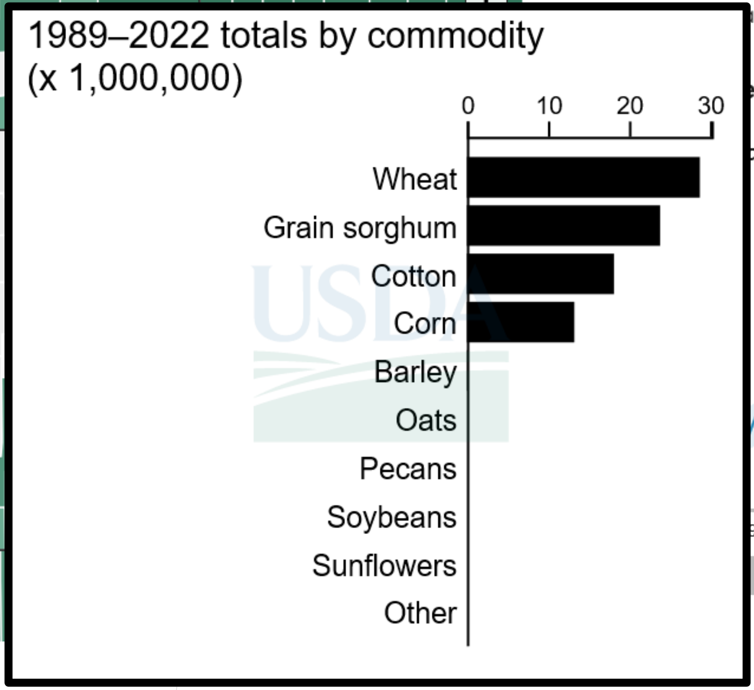
3. Better understand the role of long-term climate trends in crop insurance data to support sustainable agricultural production and community resilience

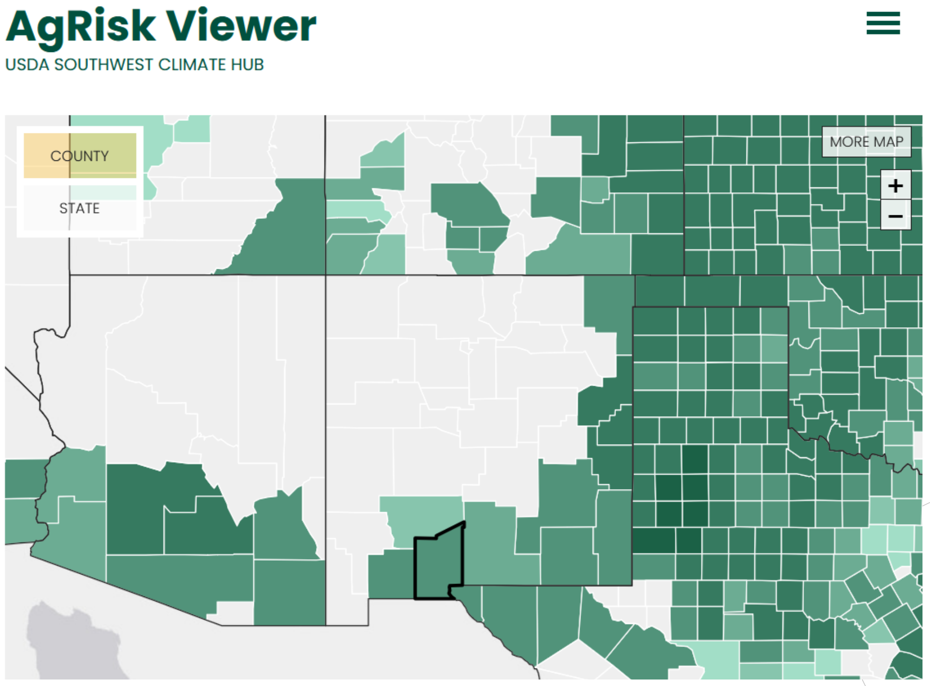




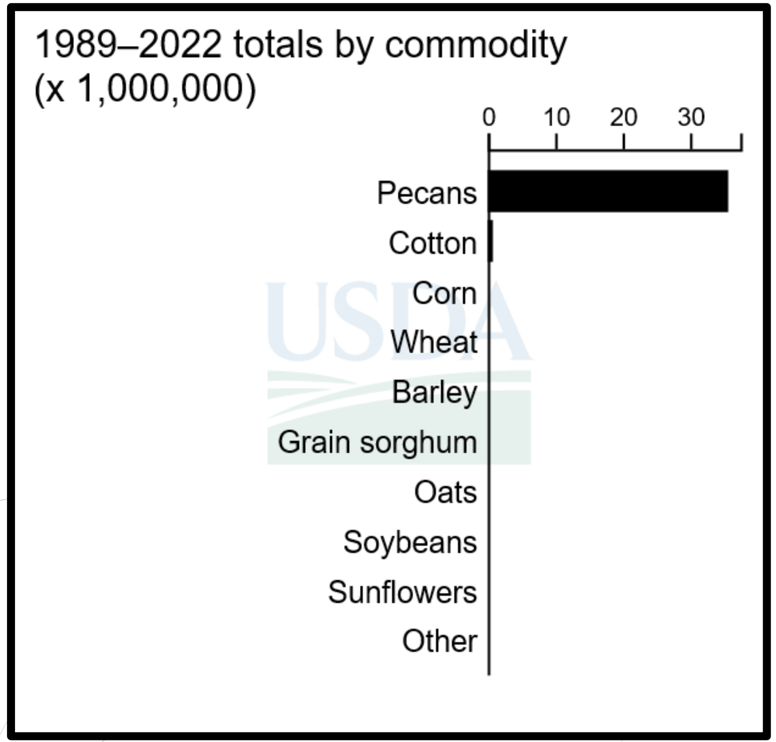


- Compound extremes (Lesk et al. 2022)
- Effects on yields of wheat and specific mitigation strategies (Ortiz et al. 2008)
- Impact on yield and water consumption of cotton (Jans et al. 2021)

3. Better understand the role of long-term climate trends in crop insurance data to support sustainable agricultural production and community resilience



Doña Ana County, NM



- Direct effect of temperature and drought on the development of pecans (Mokari et al. 2021)
- Sustainable water management strategies and pecans (Mokari et al. 2019; Samani et al. 2011)

Thank you!

Questions:

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Agricultural Risk in a Changing Environment (AgRisk Viewer):

https://www.climatehubs.usda.gov/hubs/southwest/tools/agrisk-viewer

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United States Department of Agriculture
Southwest Climate Hub

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Risk Management Agency

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Thank you!
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