



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

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

The Challenge and Approach

Science-Based Information

Climate-Informed Decision Making

Climate Change
DOI 10.1007/s10584-007-9367-8

Accumulated winter chill is decreasing in the fruit growing regions of California

Dennis Baldocchi · Simon Wong

Received: 2 August 2006 / Accepted: 5 October 2007
© Springer Science + Business Media B.V. 2007

Abstract We examined trends of central California and its warming is an action in Ca across the fruit and nut grow accumulated winter chill that climate datasets. The CaChI contains hourly climate data chill degree-hours. But, its National Weather Service Co many sites. But its climate temperatures. To assess long algorithms that converted into accumulated hours of winter calculations of chill hour measurements from hourly climate datasets, we found 1 degree hours is diminishing. Observed trends in winter ch applied our analytical algorithm projections of temperature for winter chill, for the period 8 By the end of the 21st century, 500 chill hours per winter. T have deleterious economic at the end of the 21st Century.

D. Baldocchi (✉) · S. Wong
Ecosystem Science Division, Dept
University of California, Berkeley,
e-mail: baldocchi@esdm.berkeley.edu

Climate Change (2011) 109 (Pages 115317-1533)
DOI 10.1007/s10584-011-0303-4

California perennial crops in a changing climate

David B. Labell · Christopher B. Field

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

1 Introduction

Agriculture is an important component of California's economy, landscape and culture, and is among the human activities most vulnerable to impending climate changes. Two particularly unique and relevant features of agriculture in California are (1) the diversity of crops grown, with California the leading U.S. producer of over 80 crops, and (2) the substantial fraction of agricultural value (roughly one-third

D. B. Labell (✉)
Department of Environmental Earth System Science and Program on Food Security and Environment,
Stanford University, Stanford, CA 94305, USA
e-mail: dlabell@stanford.edu

C. B. Field
Department of Global Ecology, Carnegie Institution, Stanford, CA 94305, USA

PLUS ONE
Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950–2009

Eike Luedeling^{1,2}, Minghui Zhang¹, Evan H. Givoni¹
¹ Department of Land, Air, and Water Resources, University of California Davis, Davis, California, United States of America; ² Department of Plant Science, University of California Davis, California, United States of America; ³ Department of Plant Science, University of California Davis, California, United States of America

Climate Change (2011) 109 (Pages 115317-1533)
DOI 10.1007/s10584-011-0303-4

Abstract Winter chill is a critical factor for the production of many tree crops. In California, winter chill is declining, which may affect the production of many tree crops. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

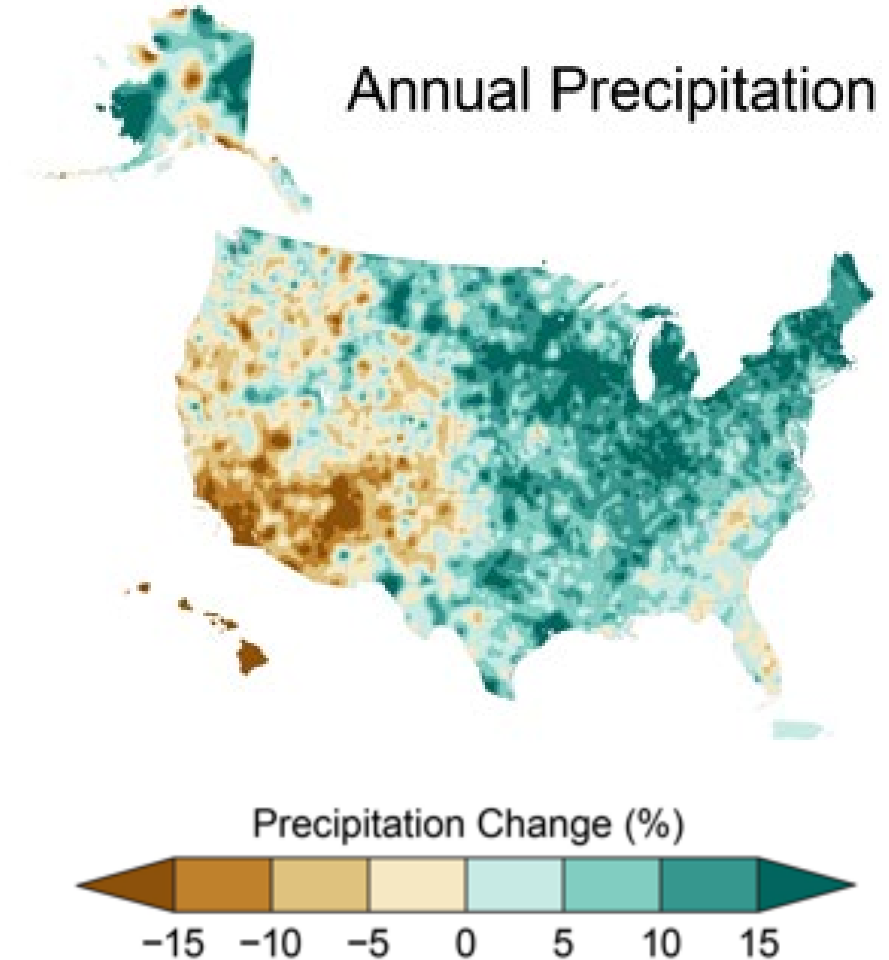
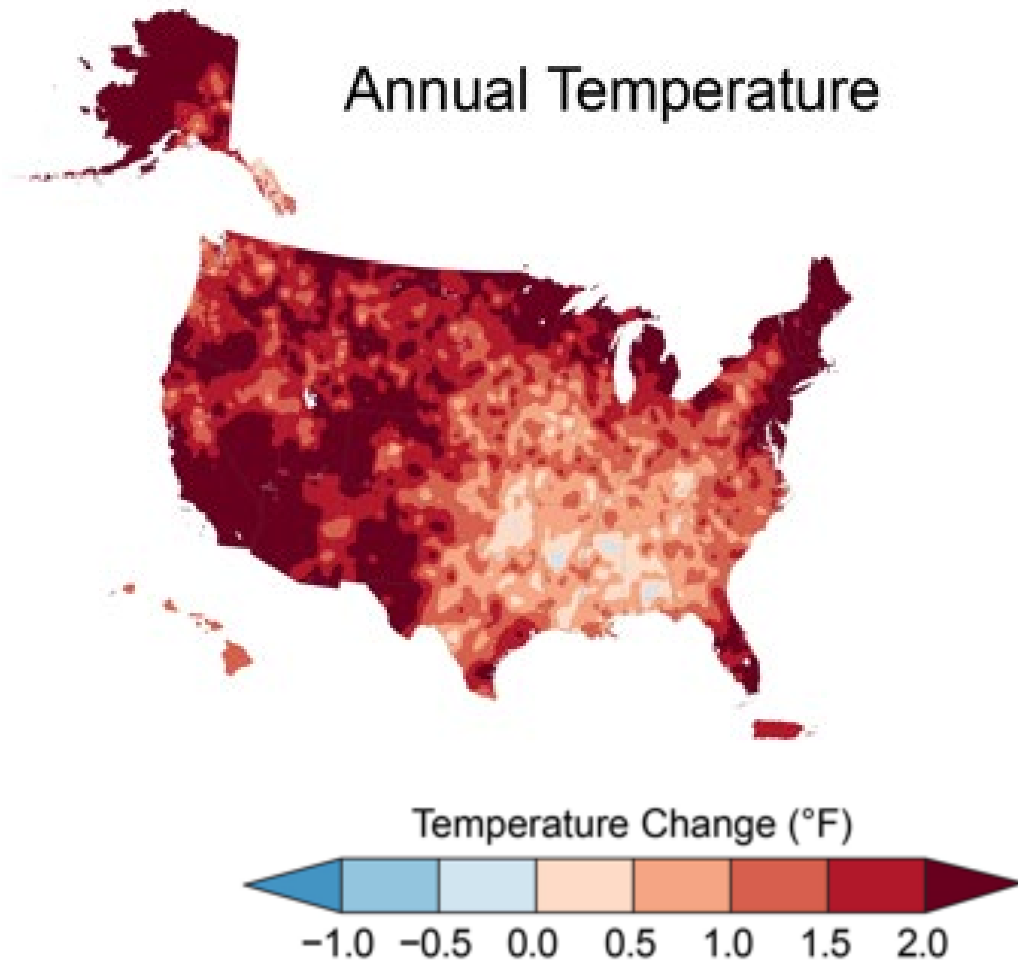
Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

Received: 9 March 2010 / Accepted: 20 September 2011 / Published online: 24 November 2011
© Springer Science+Business Media B.V. 2011

Abstract Perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the most influenced by information on future climate, since individual plants are commonly grown for more than 30 years. This study evaluated the impacts of future climate changes on the 30 most valuable perennial crops in California, using a combination of statistical crop models and downscaled climate model projections. County records on crop harvests and weather from 1980 to 2005 were used to evaluate the influence of weather on yields, with a series of cross-validation and sensitivity tests used to evaluate the robustness of projected effects. In the end, only four models appear to have a clear weather response based on historical data, with another four projecting significant but less robust relationships. Projecting impacts of climate trends to 2050 using historical relationships reveals that cherries are the only crop unambiguously threatened by warming, with no crops clearly benefiting from warming. Another robust result is that almond yields will be harmed by winter warming, although this effect may be counteracted by beneficial warming in spring and summer. Overall, the study has advanced understanding of climate impacts on California agriculture and has highlighted the importance of measuring and tracking uncertainties due to the difficulty of measuring crop-climate relationships.

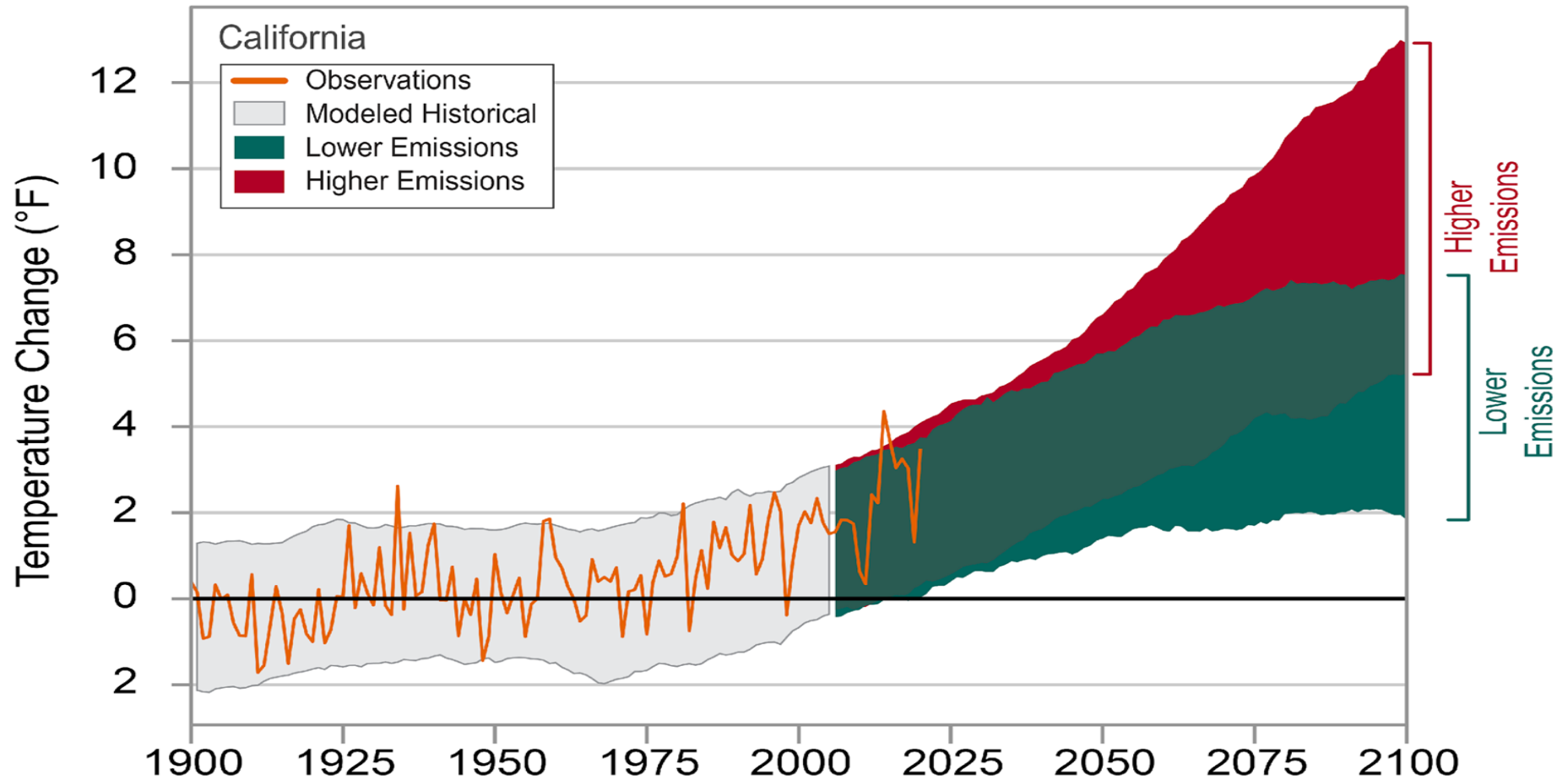


Observed Changes in Temperature and Precipitation

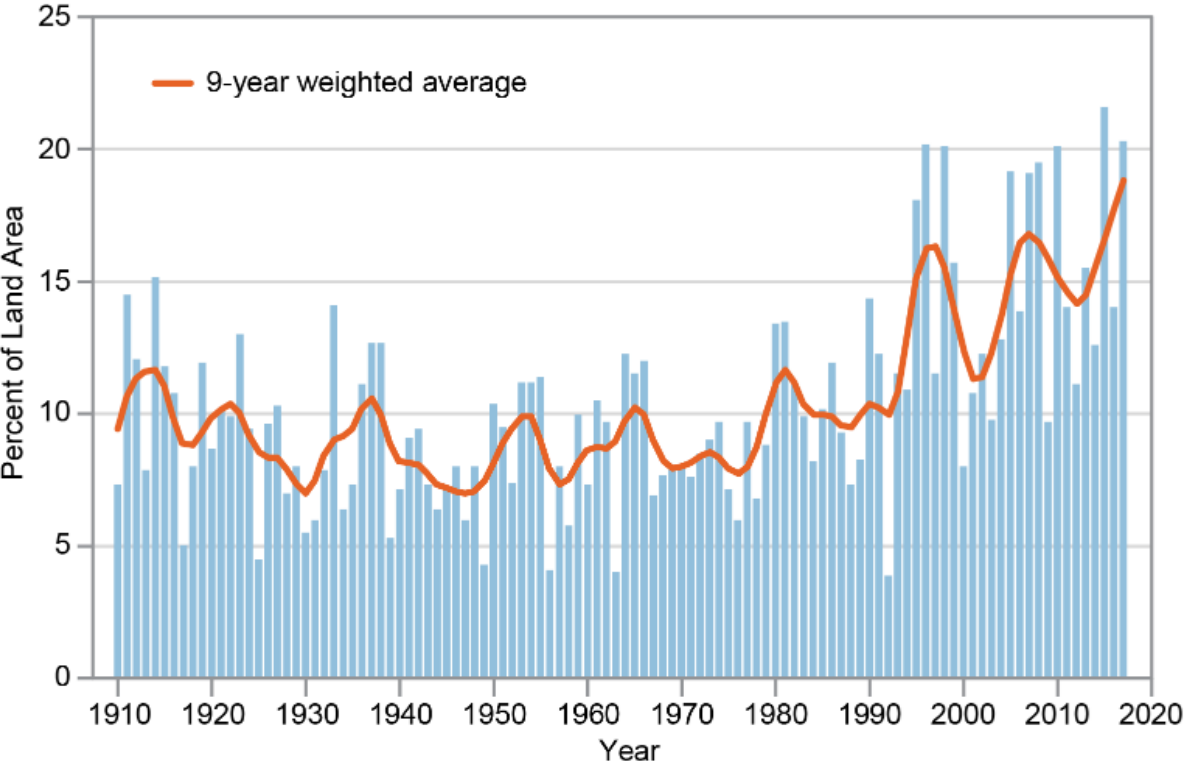


Hotter Summers and Warmer Winters

Observed and Projected Temperature Change



Extreme Precipitation Impacts are Increasing



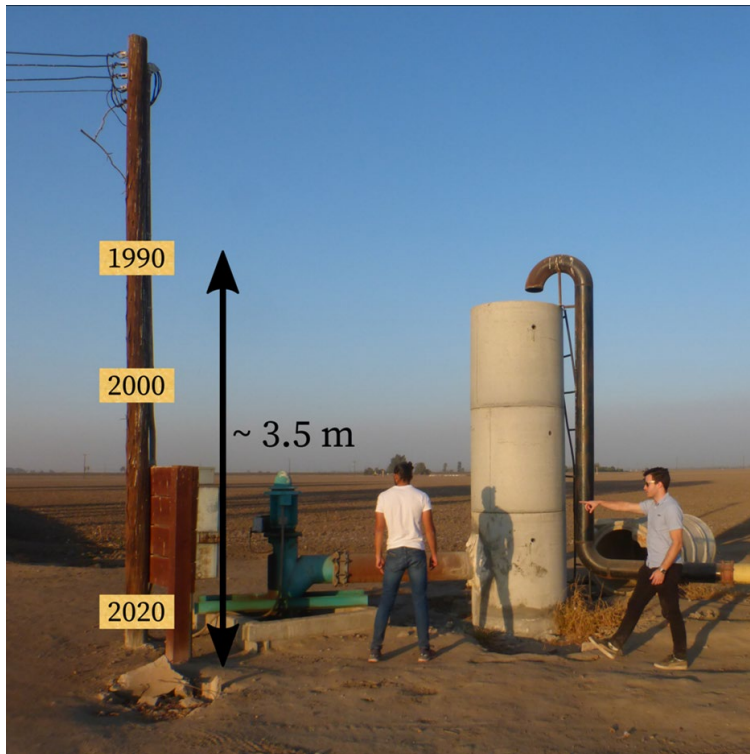
Credit: Climate Toolbox



Source: Bloomberg News

Coping with Extreme Events

Severe Drought



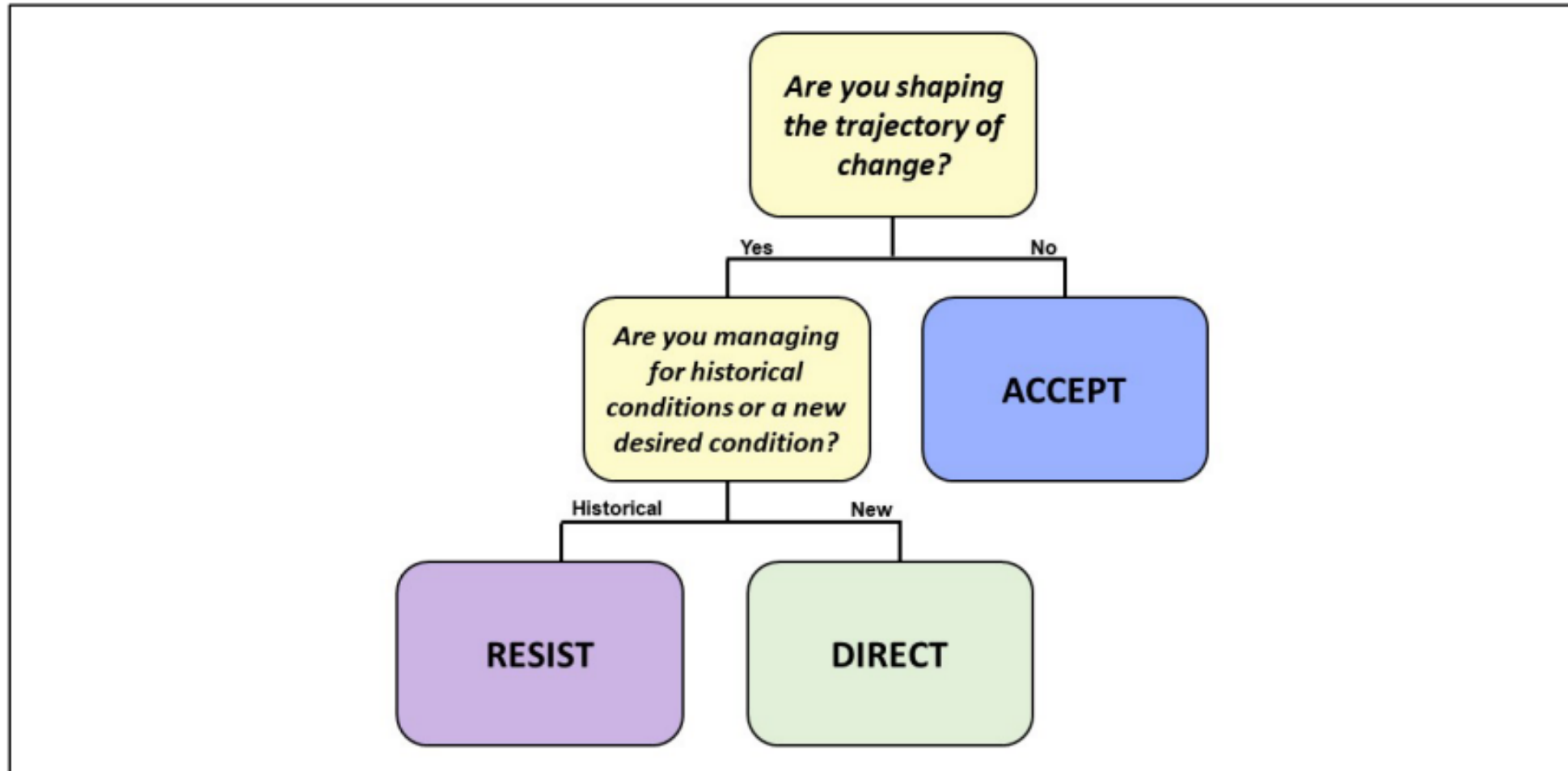
Extreme Heat



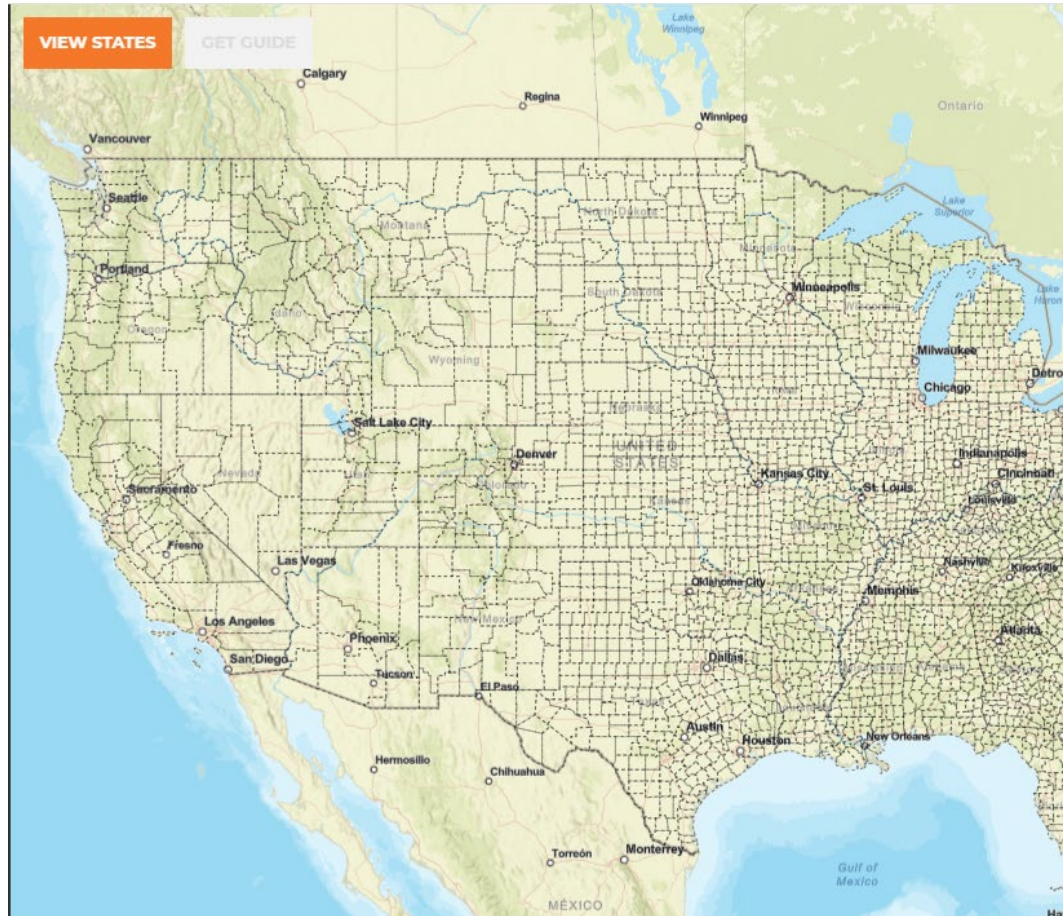
Extreme Precipitation



Management Options



Climate Quick Reference Guides



CLIMATE QUICK REFERENCE GUIDE | Colorado

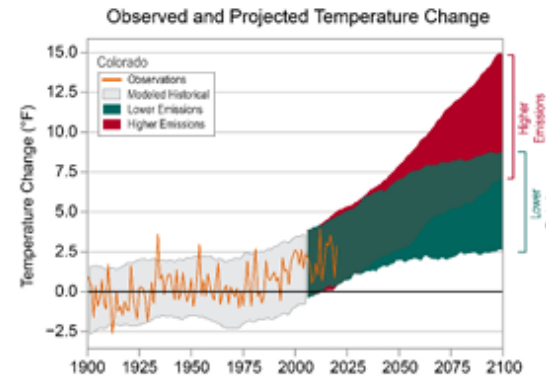
Historic Changes 1900-2020

- 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



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.

Reaching people in the Caribbean

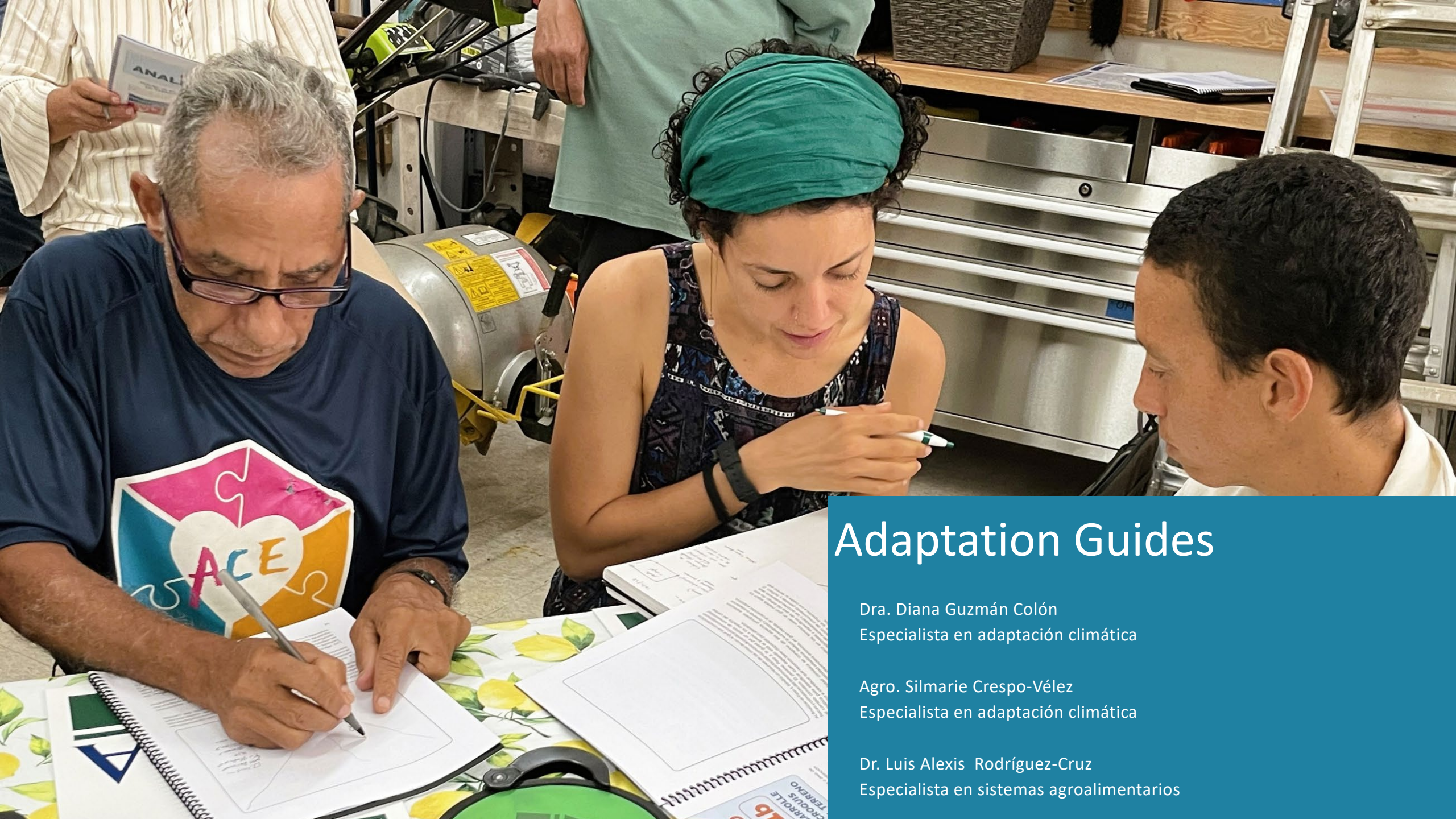
Adaptation Guide *Climate smart Caribbean*

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



U.S. DEPARTMENT OF AGRICULTURE



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

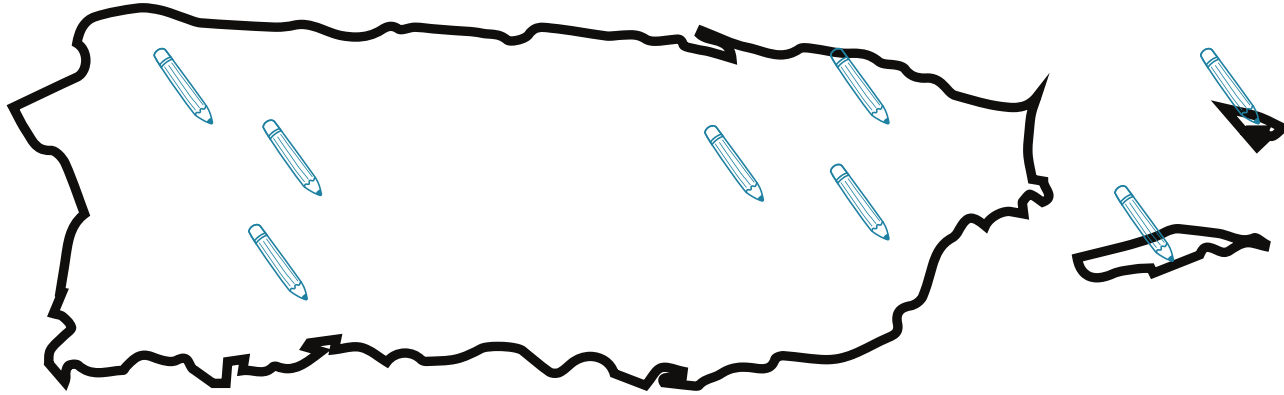


FARM VISITS



PUBLICATIONS





8 in-person workshops

1 virtual workshop: Ag Extension Agents

135 participants



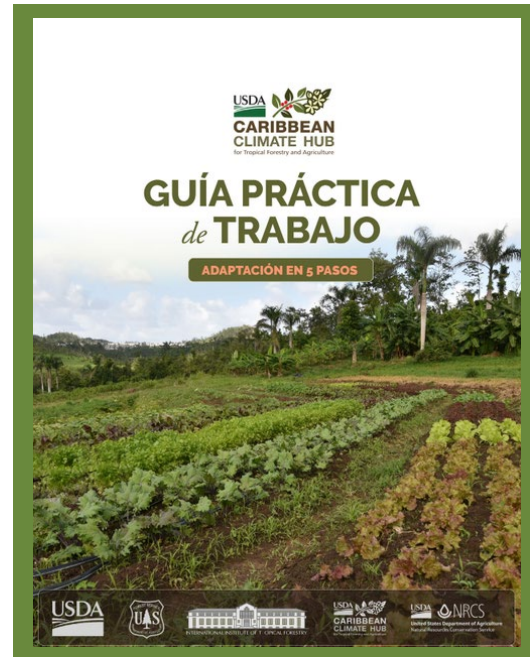
Workshops Learning objectives:

- 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



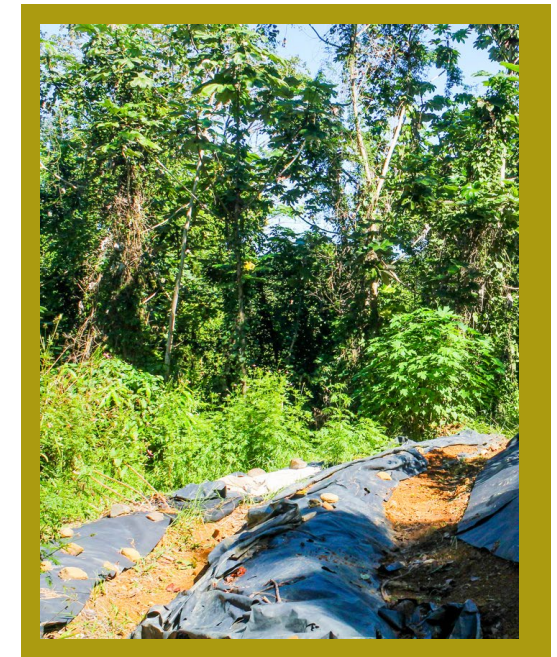
GUÍA DE ADAPTACIÓN



MANUAL PRÁCTICO CORTO



10 GUÍAS PRÁCTICAS POR SECTORES

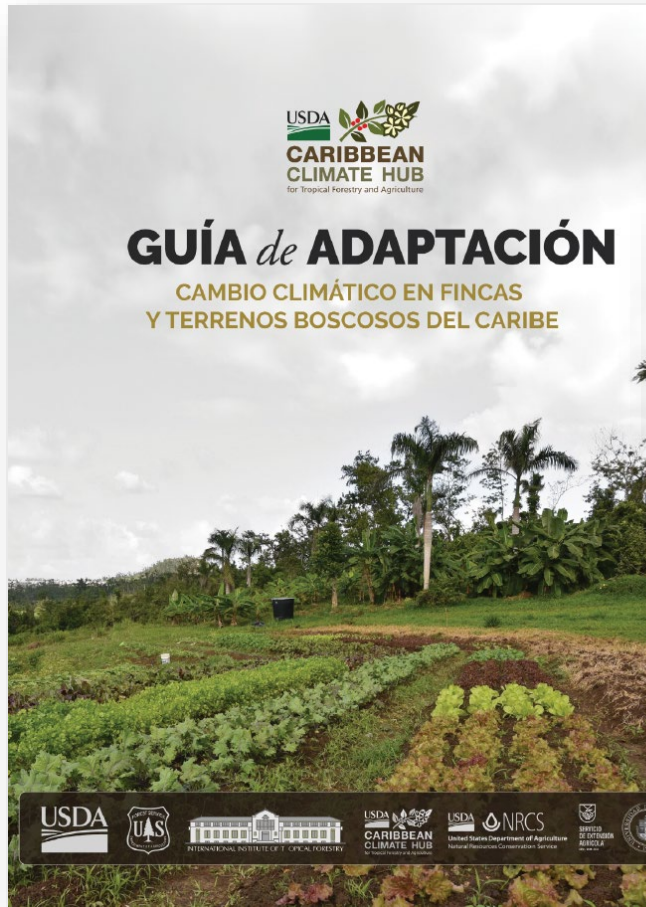


CASOS DE ESTUDIO

- 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 históricos del clima, se espera que los meses diciembre y enero sean típicamente más frescos en el Caribe. Es posible que existan variaciones naturales dentro del año, donde se observa que las condiciones del tiempo se desvían del clima en promedio. Estas variaciones se experimentan como periodos de sequía, 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).

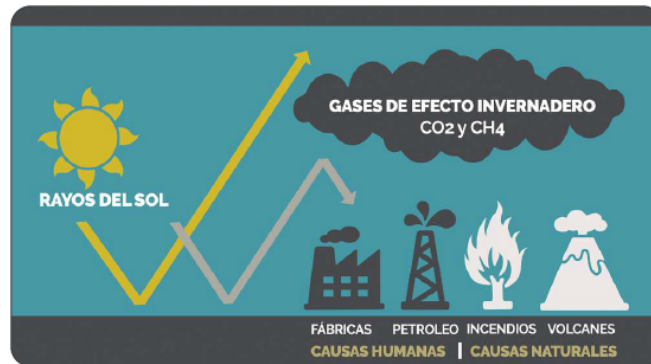


Figura 1. El efecto invernadero y su relación al calentamiento global. La energía del sol viaja hacia la Tierra, donde algunos de los rayos del sol son absorbidos por los gases de efecto invernadero en la atmósfera, mientras que otros son reflejados de vuelta al espacio. La acumulación excesiva de gases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

Cambios en temperatura mínima para el 2041-2060

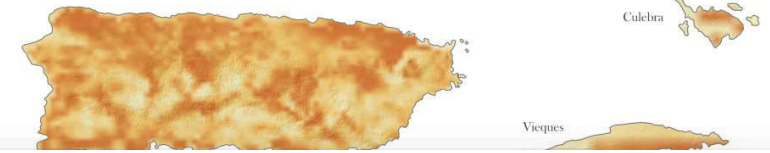
Menos cambio
1.55 °F
0.86 °C

Más cambio
3.08 °F
1.71 °C

El mapa muestra un escenario de cambio en la temperatura mínima diaria (en grados) por encima de la referencia histórica (1986-2005).¹ Para este escenario, se prevé más de 50 días al año con aumentos sin precedentes por encima del período histórico. Algunos años podrían tener más de 200 días con eventos de temperaturas mínimas diarias sin precedentes.



Puerto Rico



Cambios en temperatura máxima para el 2041-2060

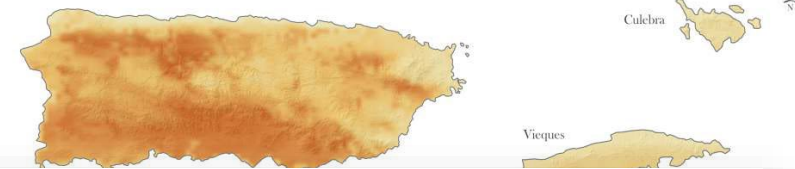
Menos cambio
1.55 °F
0.86 °C

Más cambio
3.08 °F
1.71 °C

El mapa muestra un escenario de cambio en la temperatura máxima diaria (en grados) por encima de la referencia histórica (1986-2005).¹ Para este escenario, se prevé más de 50 días al año con aumentos sin precedentes por encima del período histórico. Algunos años podrían tener más de 200 días con eventos de temperaturas máximas diarias sin precedentes.



Puerto Rico



Cambios en lluvia para el 2041-2060

Disminución
-30.16 %

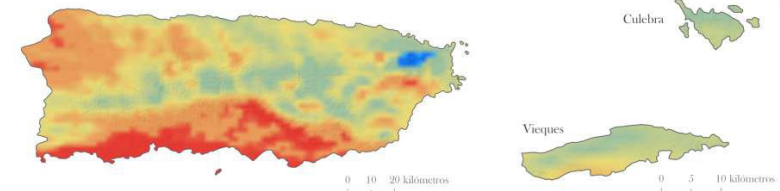
Aumento
8.77 %

Sin cambio
0%

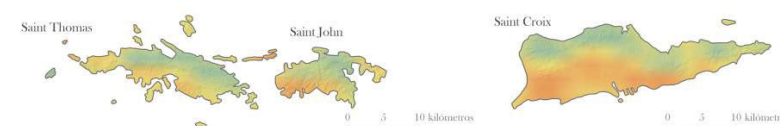
El mapa presenta cambios en la lluvia en porcentaje.¹ En promedio, el modelo estima una reducción en la lluvia de -23% en Puerto Rico y de -12% en las Islas Virgenes de los Estados Unidos. Se estima que habrá más disminución en lluvia, que aumento.



Puerto Rico



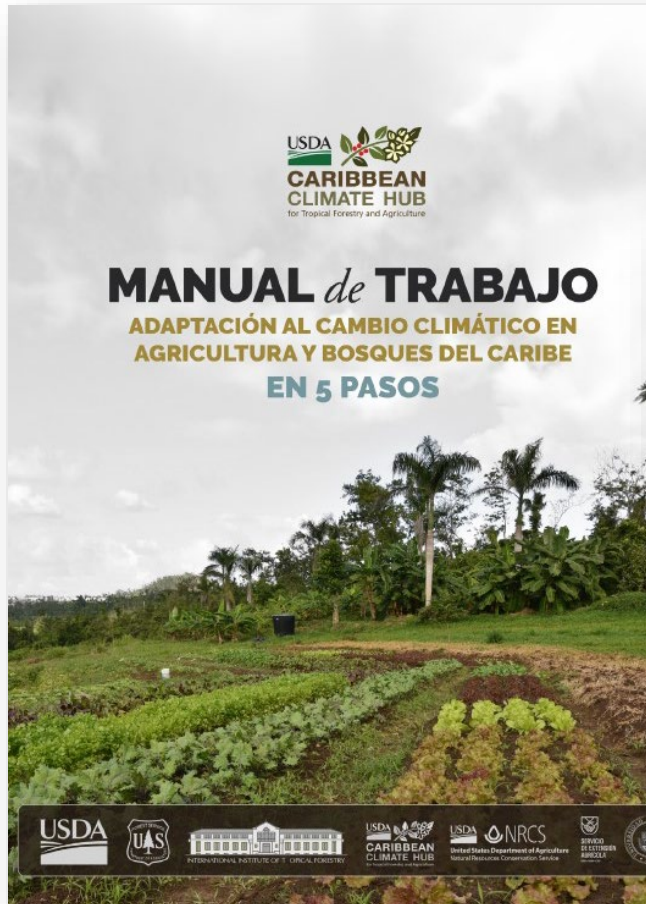
Islas Virgenes de los Estados Unidos



1 Datos obtenidos del modelo Centro Nacional de Investigaciones Meteorológicas (NCM) aplicado por Bowden, J.H., Ferrando, A.E., Mera, V., Westcott, A., Blanton, A., Boyce, S., Gault, W., Gillett, J.A., and Neely, T.L. (2019). High-resolution dynamically downscaled monthly and temperature projections for ecological life zones within Puerto Rico and for the U.S. Virgin Islands. International Journal of Climatology, 39(10):3036-3052.

Fuente: Inpdep, Oficina del Centro de los Estados Unidos y Territorio (EEUU) de la Comisión de Planificación y Desarrollo Regional (COPRED) del Caribe. Datos preparados por: Ludger Rivera-Monroy, Centro Científico del Caribe.

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.



DEFINE CARACTERÍSTICAS

PASO01
DEFINIR CARACTERÍSTICAS

META INICIAL, CARACTERÍSTICAS FÍSICAS Y CLIMÁTICAS DEL TERRENO

Este PASO 1 le guiará por un proceso de planificación. Puede utilizar la Herramienta de Planificación Agrícola en el siguiente enlace: [www.farm.caribbeanclimatehub.org](#)

¿POR QUÉ ES NECESARIO EL ESPACIO POR FUNCIONAR?
Cada terreno requiere diversos tipos de manejo. En el mismo terreno existen diferentes tipos de suelos, áreas protegidas, etc.

REFLEXIÓN: ¿Qué meta desea atender con las preguntas?

¿CÓMO USAR LA HERRAMIENTA DE PLANIFICACIÓN AGRÍCOLA?

PASO1a
DESCRIPCIÓN DEL TERRENO

CARACTERÍSTICAS DE LA FINCA O EL TERRENO

Para completar el próximo ejercicio, puede acceder al recurso de la Herramienta de Planificación Agrícola en el siguiente enlace: [www.farm.caribbeanclimatehub.org](#). Esta herramienta genera un informe en Puerto Rico y las Islas Virgenes.

CARACTERÍSTICAS DE LA FINCA O EL TERRENO
HIDROGRAFÍA (Ríos, quebradas, dentro o a 500 metros o menos del terreno)
TIPO(S) DE SUELO(S)
FORMAS DE RELIEVE (todas las que apliquen, de mayor a menor pendiente)
ZONA(S) DE VIDA NATURALES PROTEGIDAS
PLAN DE USO DE TERRENO (Plan que apliquen, de mayor a menor prioridad)
SUSCEPTIBILIDAD A DESLIZAS (todas las que apliquen, de mayor a menor prioridad)
ZONAS INUNDABLES (todas las que apliquen)
NOTAS

CARACTERÍSTICAS CLIMÁTICAS		
PROMEDIO NORMAL MENSUAL DE PRECIPITACIÓN (Lluvia)		
MESES EN LOS QUE MÁS LLUEVE		
MESES EN LOS QUE MENOS LLUEVE		
MESES CON TEMPERATURAS ALTAS		
ESCENARIOS CLIMÁTICOS PARA MEDIADO DE SIGLO (2045-2060)		
ZONA DE VIDA	Modelo Community Climate System (CCSM4)	Modelo Centre National de Recherches Meteorologiques (CNRM-CM5)
¿HABRÁ UNA DISMINUCIÓN EN PRECIPITACIÓN (LLUVIA)?		
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 (Si/No)		



Climate Adaptation Guide for Tropical Forestry and Agriculture



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








4.8

PRÁCTICAS PARA MANEJAR IMPACTOS CLIMÁTICOS PEQUEÑOS RUMIANTES

GUÍA DE ADAPTACIÓN AL
CAMBIO CLIMÁTICO EN EL CARIBE



¿CÓMO PODEMOS ADAPTARNOS?

Manejo de agua eficiente

GARANTIZAR EL ACCESO A FUENTES DE AGUA LIMPIAS

El garantizar el acceso y disponibilidad a aguas limpias es especialmente importante durante épocas de sequías. Los bebederos deben ser lo suficientemente altos para evitar que los animales los pisoteen o defequen en él. Debe haber espacio para que todos los animales tengan acceso al agua durante el día. El largo o la cantidad de bebederos dependerá de la cantidad de animales que haya en el espacio.

Es recomendable que la fuente de agua esté bajo alguna sombra o cubierta para mantener las temperaturas del agua lo más frescas posible.

NRCIS | PRÁCTICAS DE APOYO O INCENTIVO

PARA ALMACENAMIENTO

CÓDIGO 614 | FACILIDADES DE BEBEDEROS

Establecimiento de bebederos para proveer agua potable a animales de ganado o vida silvestre.



14

NRCIS | PRÁCTICAS DE APOYO O INCENTIVO

CÓDIGO 422 | FRANJAS O SETOS DE CONSERVACIÓN

Siembra lineal de plantas para propósitos de conservación y como provisión de alimentos para polinizadores.

CÓDIGO 382 | CERCADOS

Construcción de una barrera para limitar el paso de animales o personas

CÓDIGO 345 | MANEJO DE ESPECIES NO DESEADAS


Control, eliminación y manejo de especies no deseadas, invasoras, nocivas o prohibidas.

¿CÓMO PO

Mejora

INCORPORACIÓN DE LEG

Parte fundamental de la digestión que ingiera, tenga el valor nutricional efectiva.



16

ALGUNOS PASTOS RECOMENDADOS

NOMBRE COMÚN	NOMBRE CIENTÍFICO	USO
MARALFALFA	Pennisetum spp.	Ensilaje, corte y acarreo
SORGO	Sorghum bicolor	Pastoreo, heno, ensilaje, corte y acarreo
PASTO RHODES	Chloris gayana Kunth	Pastoreo, heno
VARIEDAD DE ESPECIES	Urochloa (antes llamadas Brachiaria)	Uso varían de acuerdo al hábitat
GUINEA <small>cultivares Mombasa y Tanzania</small>	Megathyrus Maximus	Ensilaje, ensilaje, corte y acarreo
YERBA ESTRELLA		
YERBA PANGOLA		
MALOJILLO		
YERBA ELEFANTE <small>cultivar más común M</small>		

ALGUNOS LEG

NOMBRE COMÚN
LEUCAENA
MATARATÓN
CALIANDRA
CRATYLIA
CLITORIA

Aunque las leguminosas pueden crecer en suelos degradados o suelos húmedos. Se utilizan para pastoreo.



AUMENTO EN INTENSIDAD DE TORRENTAS Y HURACANES

En esta sección se presentan algunas prácticas de conservación y adaptación hacia impactos relacionados al aumento en intensidad de tormentas tropicales como la pérdida o muerte de cultivos y daños operacionales.

EFECTOS O IMPLICACIONES *en rumiantes*

PÉRDIDA O MUERTE DE CULTIVOS Y ANIMALES Y DAÑOS OPERACIONALES
Los fenómenos atmosféricos como huracanes y tormentas pueden ser determinantes para la salud del ganado. Si las áreas de acceso o caminos se obstruyen, dificultan el acceso de personas para llegar al ganado, dificultando poder alimentarlos y darle los cuidados necesarios. Tormentas con vientos fuertes pueden mover objetos de sitio creando proyectiles e impactando a los animales.

¿CÓMO PODEMOS ADAPTARNOS?

Organizar productores de pequeños rumiantes

ORGANIZAR Y MEJORAR LA COMUNICACIÓN DE LOS CRIADORES DEL SECTOR DE PEQUEÑOS RUMIANTES
En momentos de fenómenos atmosféricos, la comunicación entre ganaderos de la región puede ser crucial para el apoyo de tareas de restablecimiento de operaciones. Además, sirve de beneficio para establecer innovaciones tecnológicas o mejores prácticas de adaptación, financiamiento, rentabilidad de producción, comercialización, alianzas y creación de leyes y políticas públicas.

22



Digital tools

Dra. Loderay Bracero Marrero
Gerente de información geospacial

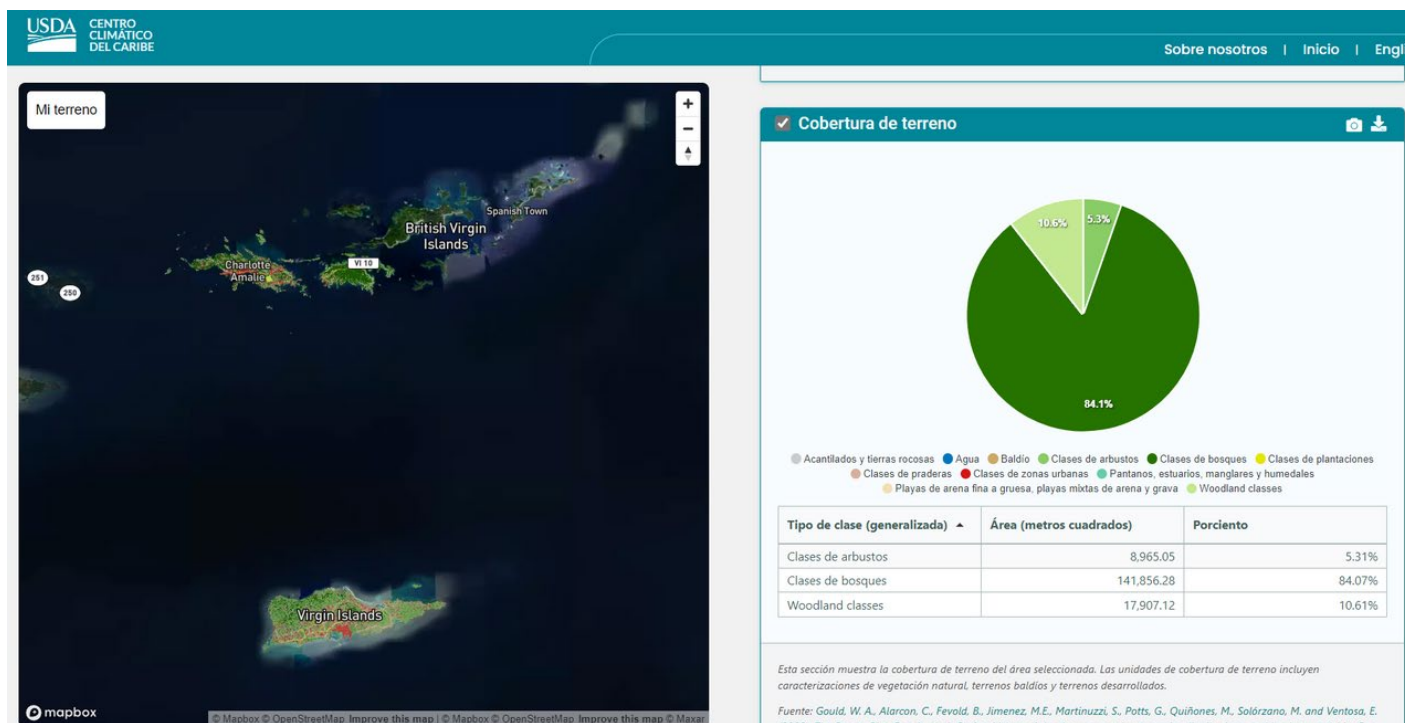
Dra. Nora Álvarez Berríos
Líder de investigación

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.



USDA CENTRO CLIMÁTICO DEL CARIBE

Sobre nosotros | Inicio | English

Mi terreno

Cobertura de terreno

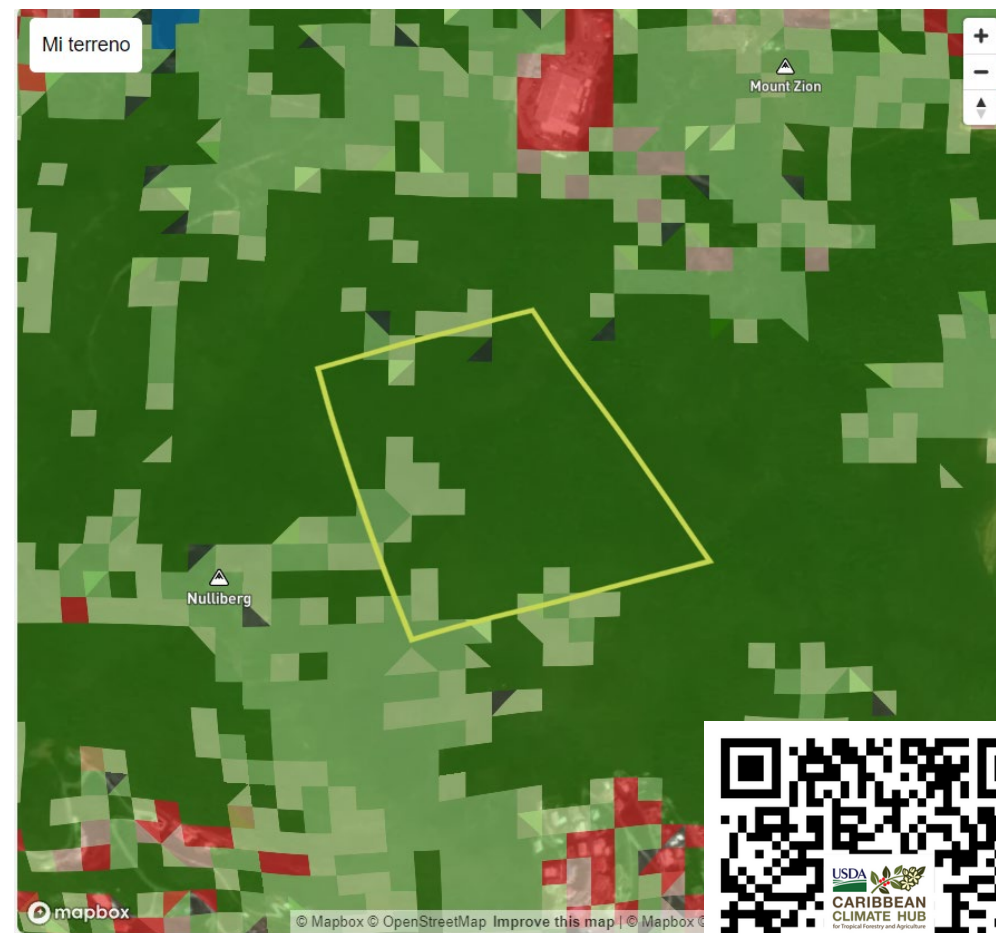
10.6% 5.3% 84.1%

- Acantilados y tierras rocas
- Agua
- Baldío
- Clases de arbustos
- Clases de bosques
- Clases de plantaciones
- Clases de praderas
- Clases de zonas urbanas
- Pantanos, estuarios, manglares y humedales
- Playas de arena fina a gruesa, playas mixtas de arena y grava
- Woodland classes

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

Esta sección muestra la cobertura de terreno del área seleccionada. Las unidades de cobertura de terreno incluyen caracterizaciones de vegetación natural, terrenos baldíos y terrenos desarrollados.

Fuente: Gould, W. A., Alarcon, C., Fevold, B., Jimenez, M.E., Martinuzzi, S., Potts, G., Quiñones, M., Solórzano, M. and Ventosa, E. (2008). The Puerto Rico Gap Analysis Project Volume 1: land cover, vertebrate species distributions, and land stewardship. Gen. Tech. Rep. ITF-39. Río Piedras, Puerto Rico: U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry.



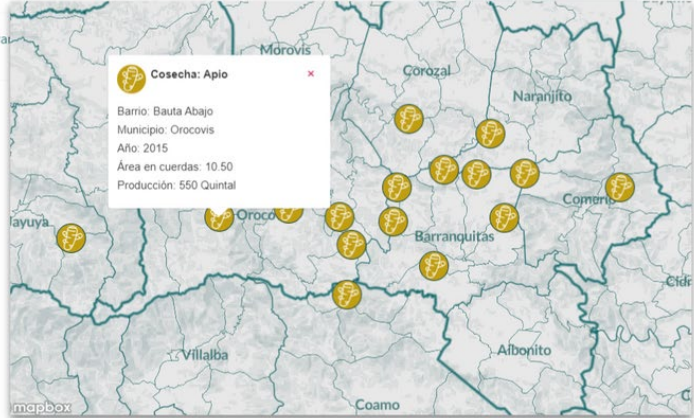
Agricultural Statistics

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



USDA CARIBBEAN CLIMATE HUB

Inicio Info Búsqueda English

Año: 2016

Cultivo:

- Berro
- Brécol
- Cacao
- Cacao - árboles en vivero
- Café - bajo sombra
- Café - sin sombra
- Café - árboles en vivero
- Calabacín
- Calabaza

Clear Filters

Descargar los datos

El mapa mostrará los primeros 500 resultados de la búsqueda. Para cambiar la cantidad de resultados, ir al formato Tabla

Mapa Tabla

mapbox

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

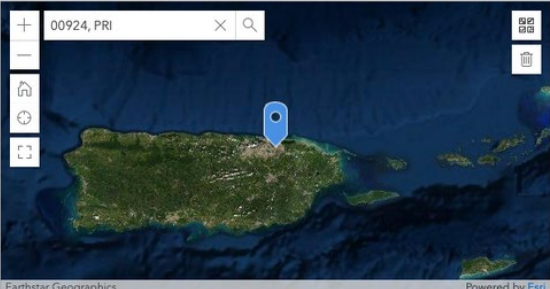
CMOR - Condition Monitoring Observer Reports on Drought

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.



Earthstar Geographics Powered by Esri



U.S. Drought Monitor
USDA Caribbean Climate Hub



¡Ayúdanos a monitorear las condiciones de sequía!

¿Qué tan seco o húmedo está?*

Severamente seco Moderadam seco Ligeradam seco Casi normal Levemente mojado Moderadam mojado Severadam mojado

Monitor de Sequía de los Estados Unidos



Saint Thomas Saint John Saint Croix





Virtual
TECH TALKS
by the Caribbean Climate Hub
ABOUT WEB TOOLS AVAILABLE FOR
DECISION MAKING IN AGRICULTURE AND FORESTRY
CLIMATE CHANGE AND EXTREME EVENTS

MAY-AUGUST
2024



REGISTER

TECH TALKS | AGENDA SCHEDULE 11:00-11:45AM AST



WEDNESDAY
MAY 29th

FARMING PLANNING TOOL



WEDNESDAY
JUNE 26th

AGRICULTURAL STATISTICS



WEDNESDAY
AUGUST 7th

DATA VIEWER
iNEW TOOL TO BE RELEASE!



WEDNESDAY
AUGUST 28th

CONDITION MONITORING AND OBSERVATION
REPORTS ON DROUGHT - CMOR

- PARTICIPANTS MAY USE THEIR CELL PHONES, TABLETS, OR COMPUTERS TO COMPLETE THE WORKSHOP EXERCISE
- ORAL TRANSLATION SERVICES FROM SPANISH TO ENGLISH & AMERICAN SIGN LANGUAGE

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).





Building Climate Literacy

Learning opportunities:

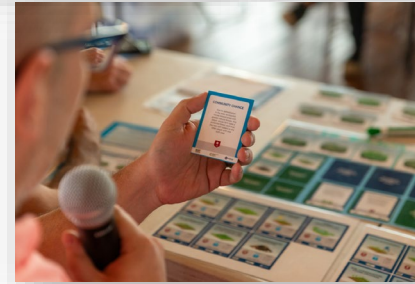
- OneUSDA workshops for farmers and forest managers.
- Climate literacy for elementary school teachers.
- Caribbean Climate Resilience Game to impart knowledge on climate change and soil health.
- Interactive multimedia module for USDA and University Extension staff.

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.

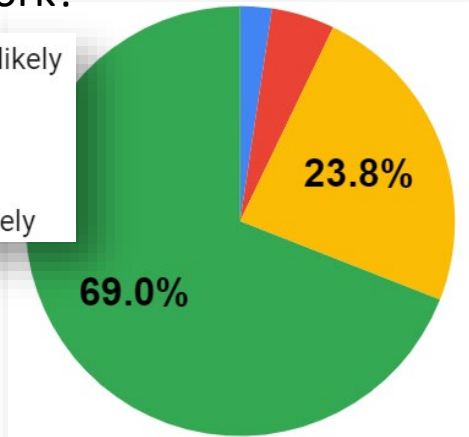
Evaluating our impact:

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



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

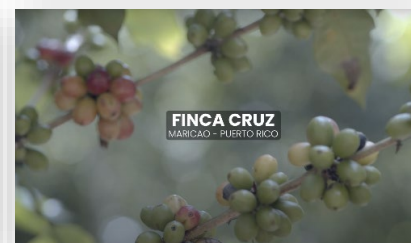
- Very Unlikely
- Neutral
- Likely
- Very Likely



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

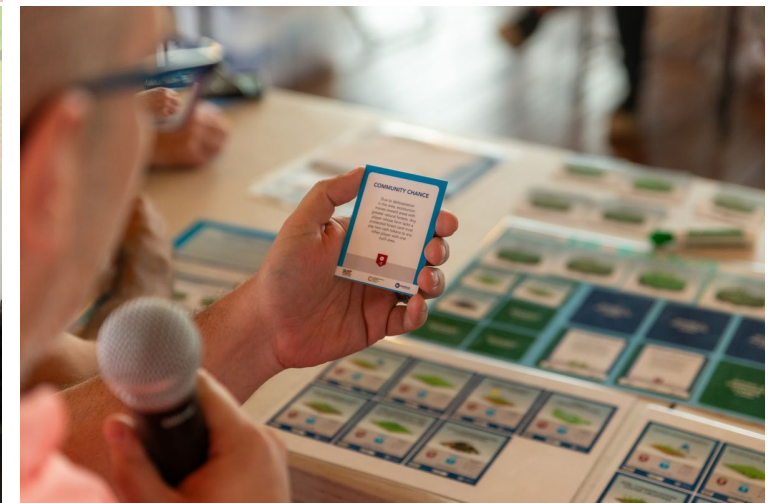
- Climate change and indicators
- Peer learning
- Informative roundtables
- Panel discussion with
 - USDA Agencies,
 - Agricultural Extension
 - Climate-Smart Commodities Partners
 - Conservation Districts





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.





Climate Kids Backpacks



Climate Solutions

CAMBIO CLIMÁTICO

Fundamentos básicos

¿Qué es el clima? Según la Organización Meteorológica Mundial, el clima es el estado de frecuencia de la atmósfera de un lugar. Se define en una descripción estadística de las promedios en temperatura, lluvia, y viento por un largo período de tiempo, usualmente 30 años.

Siglos: **CAMBIO CLIMÁTICO** Son cambios a largo plazo en las variables meteorológicas, como lluvia o temperatura. El calentamiento global es un aumento en la temperatura mundial promedio en consecuencia por el aumento en los niveles de gases de invernadero en la atmósfera y es una de las medidas del cambio climático.

Décadas: **CAMBIO CLIMÁTICO**

Años: **VARIABILIDAD CLIMÁTICA** Son variaciones en la frecuencia de eventos extremos (sequías, inundaciones y tormentas). Los científicos miden la variabilidad climática en un contexto de "modos" para identificar modos promedio y excepcionales como en océanos. Los cambios de estos modos que no están influenciados por la variabilidad climática del día a día de ciertos años en particular.

Temporadas: **VARIABILIDAD CLIMÁTICA**

Meses: **VARIABILIDAD CLIMÁTICA**

Semanas: **TIEMPO** Se refiere a las variaciones diarias en las condiciones atmosféricas.

Días: **TIEMPO**

Horas: **TIEMPO**

Minutos: **TIEMPO**

Los gases en la atmósfera que absorben la radiación solar se llaman gases de invernadero, como el dióxido de carbono (CO₂) y el metano (CH₄) y otros muchos más. Estos gases absorben la radiación solar proveniente del sol y ayudan al calor en la atmósfera, contribuyendo al calentamiento global.

En 2015, más de 190 países acordaron el Acuerdo de París, que establece un compromiso para limitar el aumento de la temperatura global a menos de 2°C por encima de los niveles preindustriales.

El 2015 fue el año más caluroso en la historia, superando a 1998 como el año más caluroso desde 1950.

El 2016 fue el año más caluroso desde 1950, superando a 2015 como el año más caluroso desde 1950.

Las Naciones Unidas predicen que el nivel global de aumento de la temperatura global será de 1.5°C a 2°C por encima de los niveles preindustriales en 2050.

INDICADORES DE CAMBIO CLIMÁTICO

- Glaciares y capas de hielo
- Hielo del Ártico
- Temperatura de la superficie del mar
- Contenido de calor oceánico
- Nivel del mar
- Número de días calurosos al año
- Temperatura del aire
- Cambio en los patrones de lluvia
- Intensidad y frecuencia de eventos meteorológicos extremos
- Acidificación de los océanos

Boletín Informativo del Centro Climático del Caribe del USDA



- Need for mitigation: Reduce CO₂ 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.

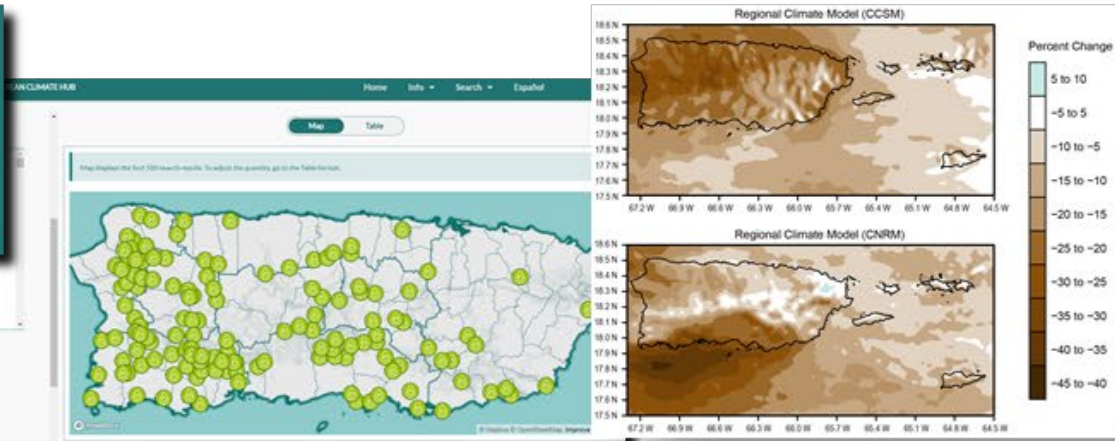
What works? Ideas and inspiration.

How to get it done? Tools and information.



ESTADÍSTICAS AGRÍCOLAS

Explora la diversidad agrícola de Puerto Rico





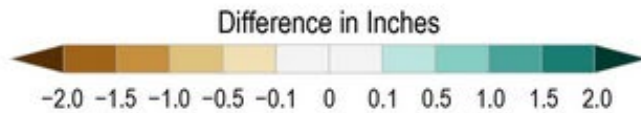
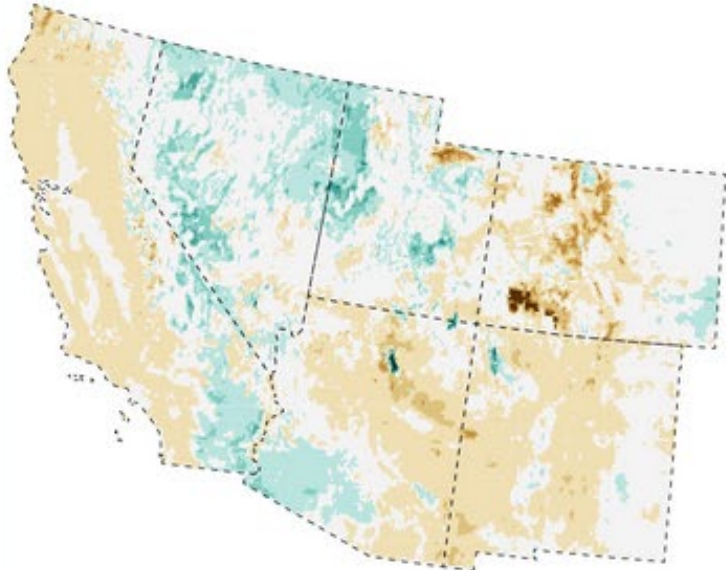
Adapting to Water Scarcity in the Southwest

Noah Silber-Coats
USDA Southwest Climate Hub
NRCS Webinar
June 25, 2024

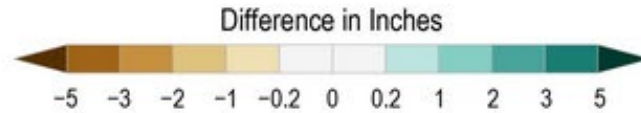


Projected Changes in Soil Moisture, Snow Water Equivalent, and Runoff

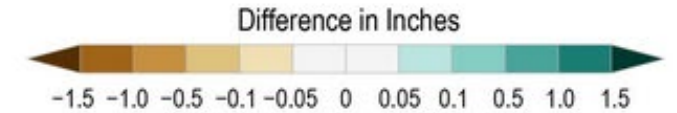
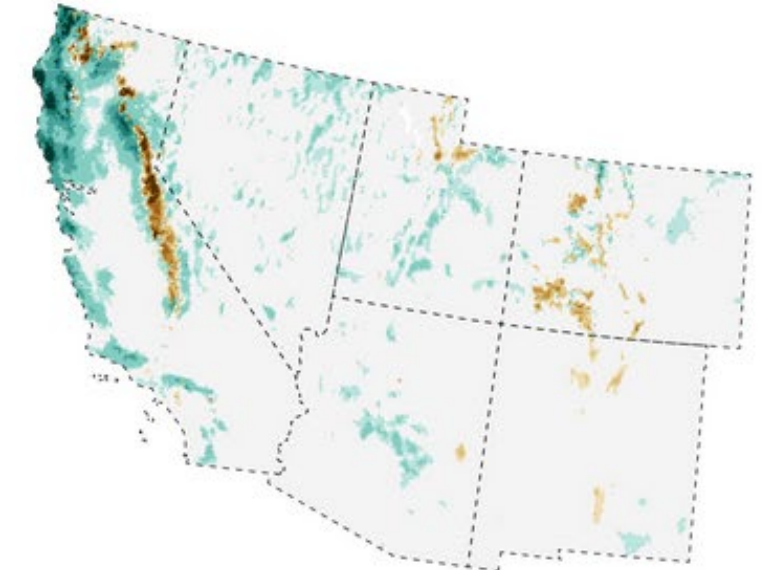
a) Projected change in average annual soil moisture (2036–2065 relative to 1991–2020)



b) Projected change in maximum annual snow water equivalent (2036–2065 relative to 1991–2020)



c) Projected change in annual runoff (2036–2065 relative to 1991–2020)



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

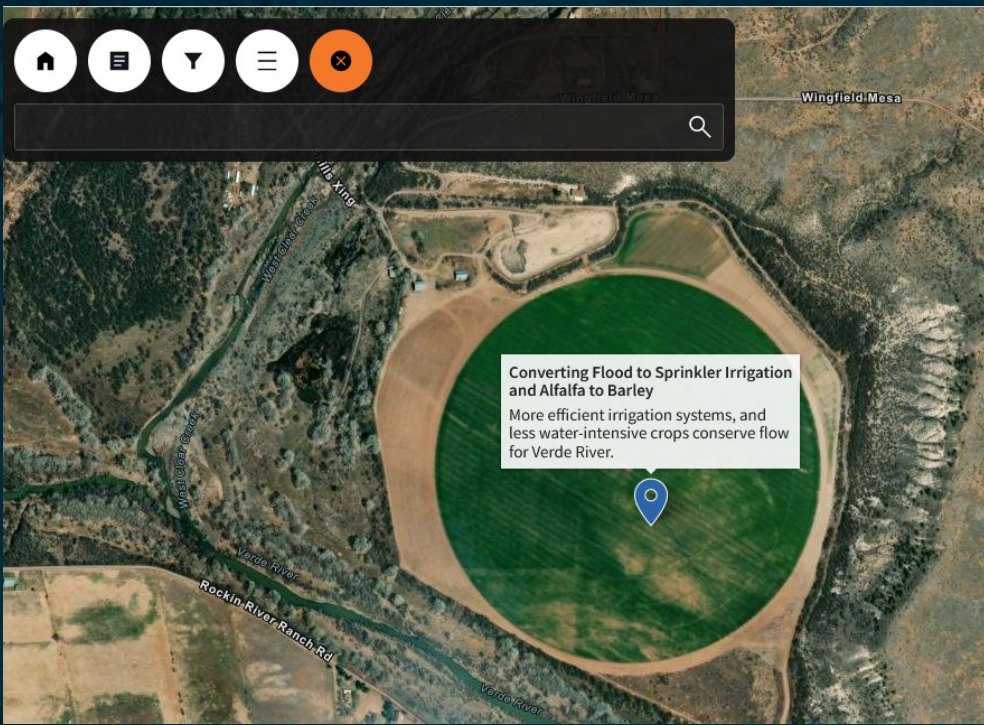


Figure 5. An experimental planting of Buffalo Gourd.
Courtesy of William P. Bemis.

Alternative Arid-Adapted Crops



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



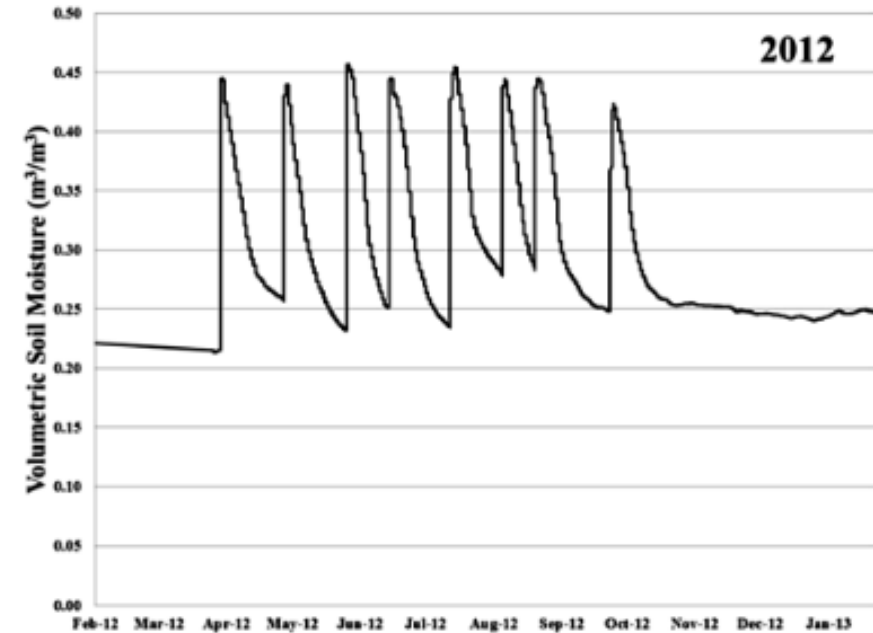
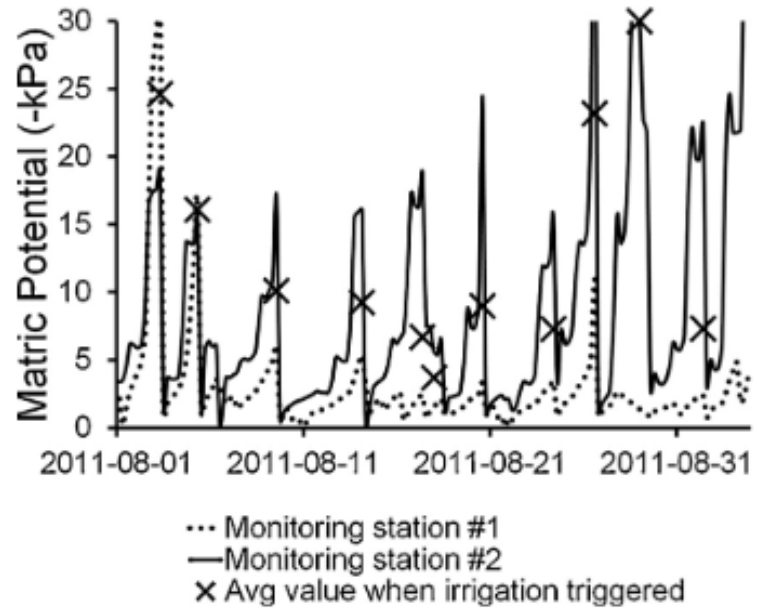
Irrigation Technologies:

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)

Manage your farms with
Water Irrigation Soil Environment
(WISE) decisions

DesertAgWISE combines a century of research expertise on desert crops, science-based intelligence, and the latest technology, to provide a desert-specific WISE (Water Irrigation Soil Environment) tool to optimize production efficiencies.

[Sign Up](#) [Learn More](#)



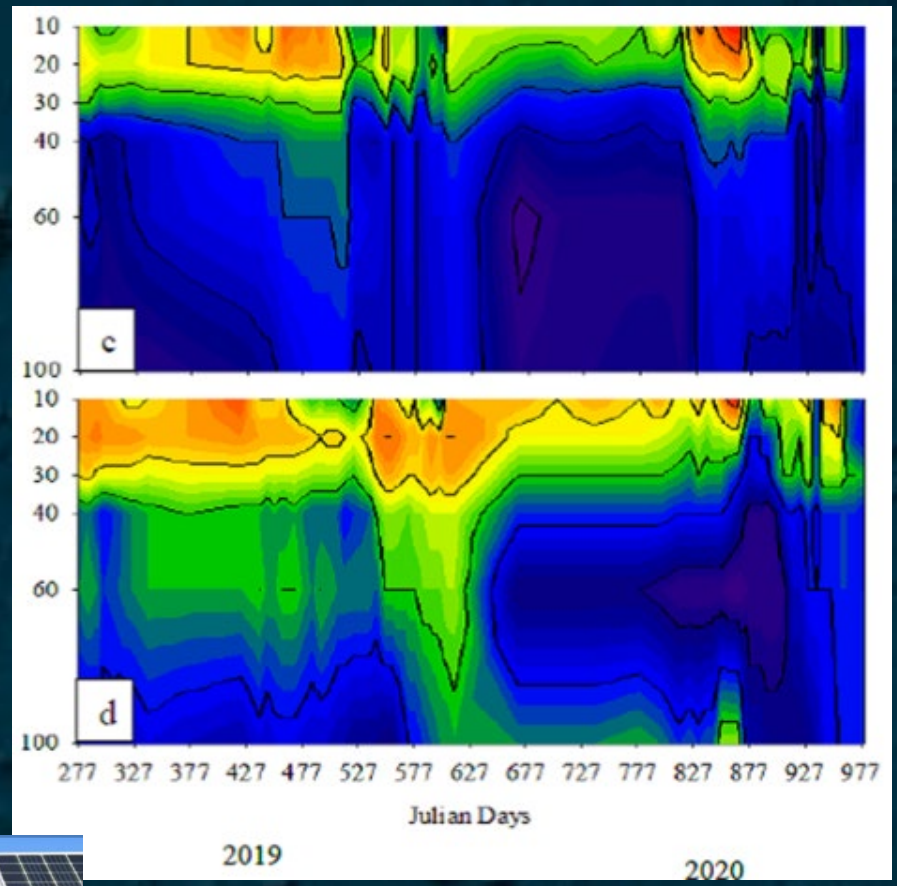
Deficit Irrigation:

- 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:

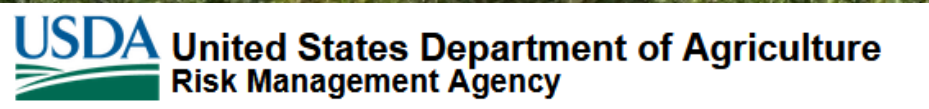
- Right, winter cover crop vs. fallow – cover crop depletes water in spring, saves water in summer.
- Below: strip-till balances water conservation and yield. Irrigations reduced, cost-saving to producers.
- Below right: Agrivoltaics can reduce heat stress and reduce water loss.





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

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





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)



euellar 155113496 / Getty Images



United States Department of Agriculture
Southwest Climate Hub

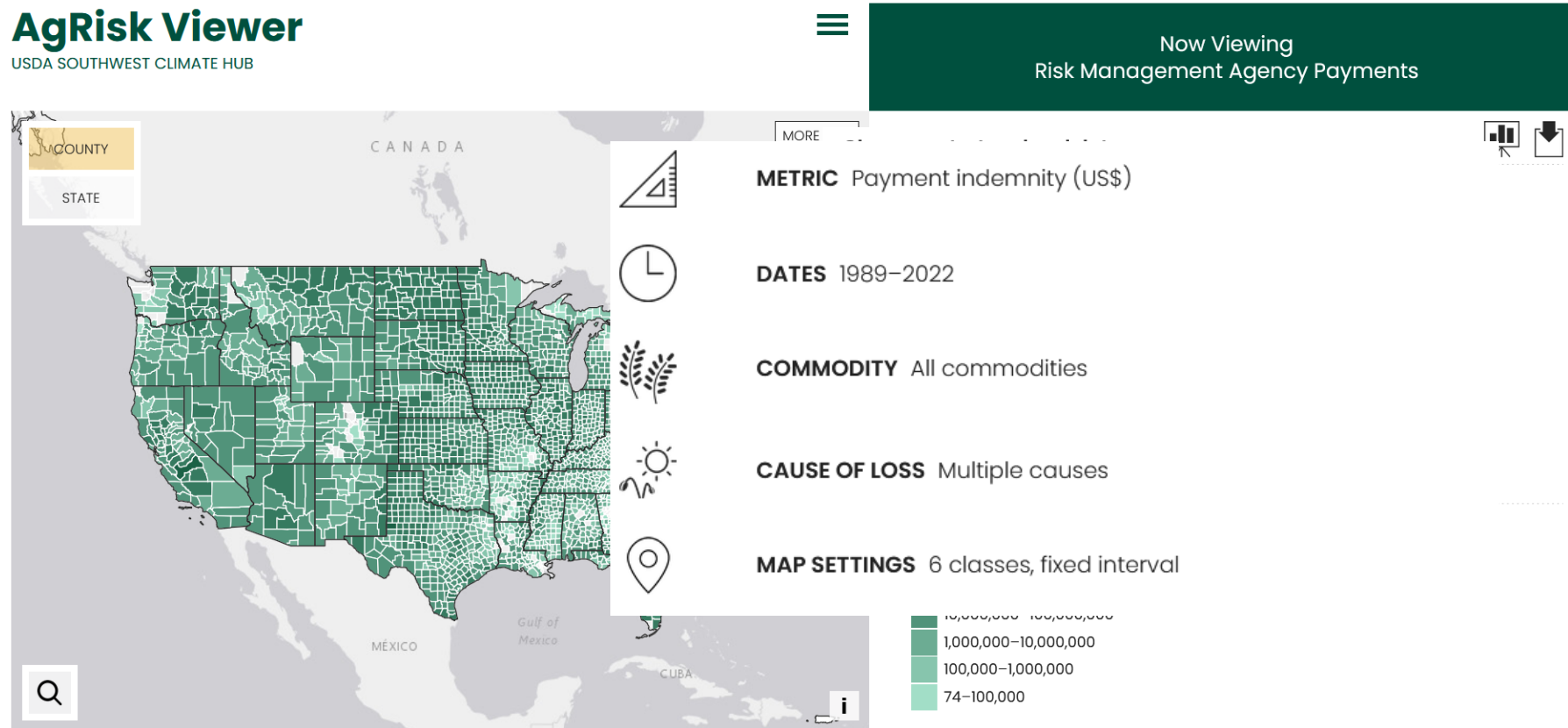
@USDAClimateHubs
#AdaptationInAction



1. Easy to use platform

AgRisk Viewer

USDA SOUTHWEST CLIMATE HUB



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



United States Department of Agriculture
Southwest Climate Hub

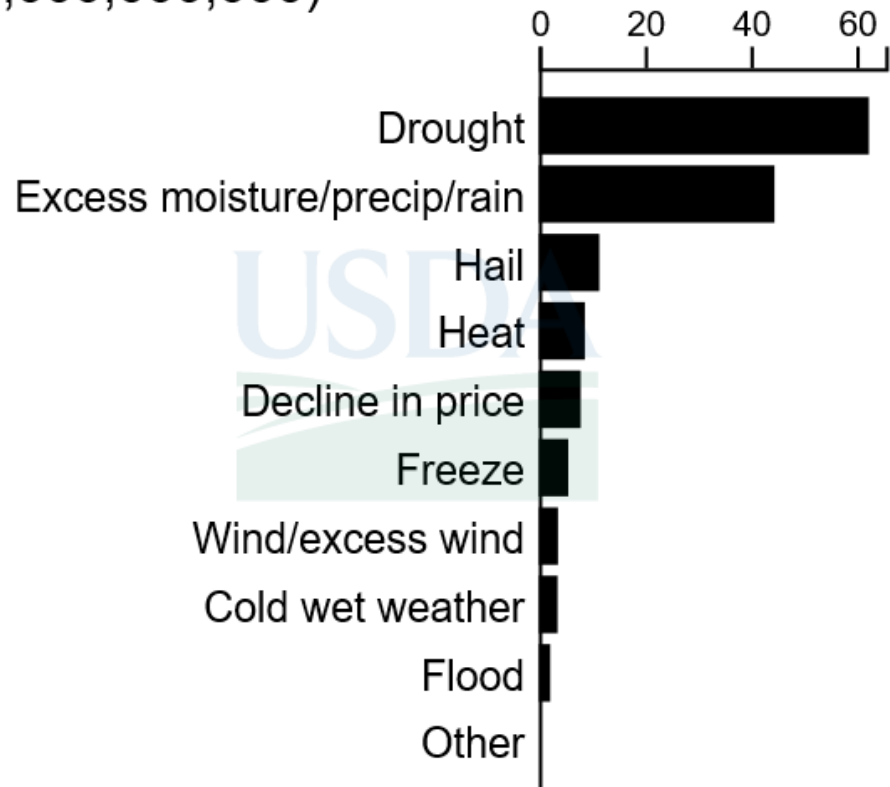


United States Department of Agriculture
Risk Management Agency



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

1989–2022 totals by cause of loss
(x 1,000,000,000)



Now Viewing
Risk Management Agency Payments

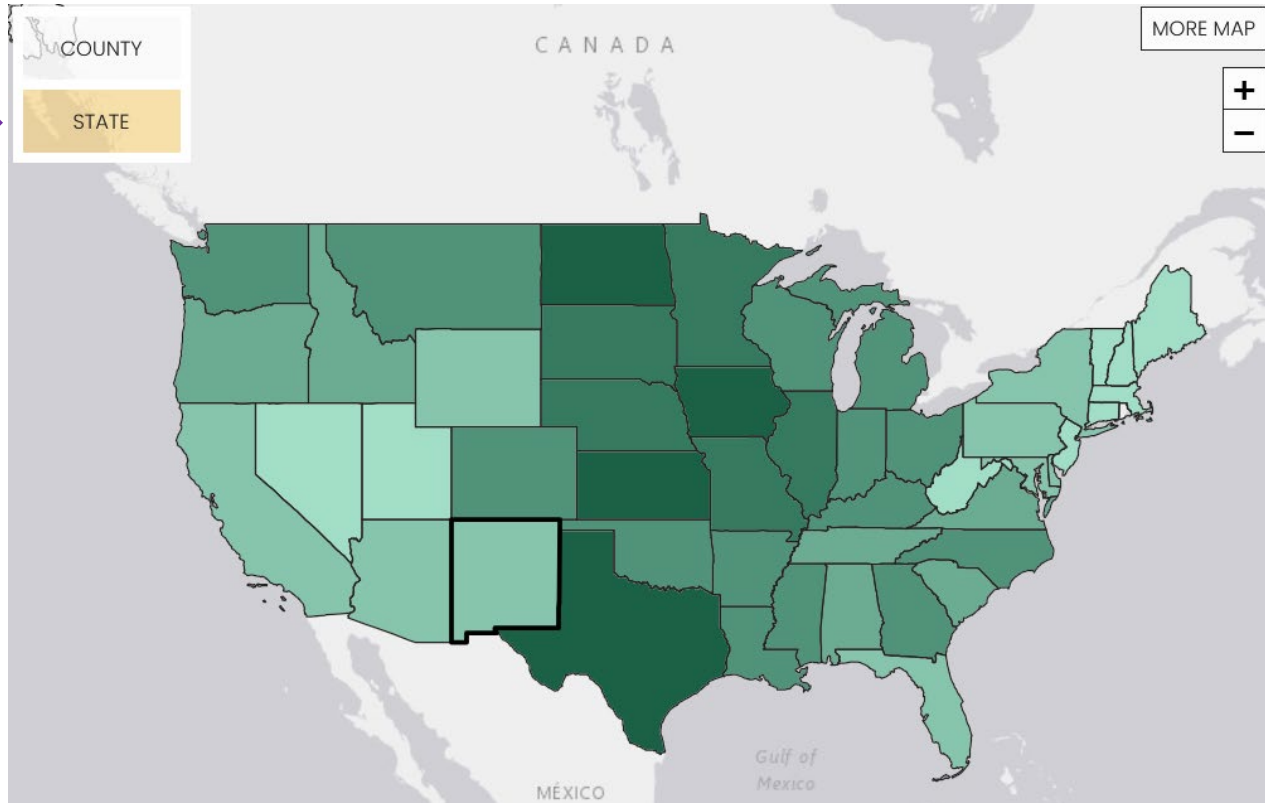


cuellar 155113496 / Getty Images

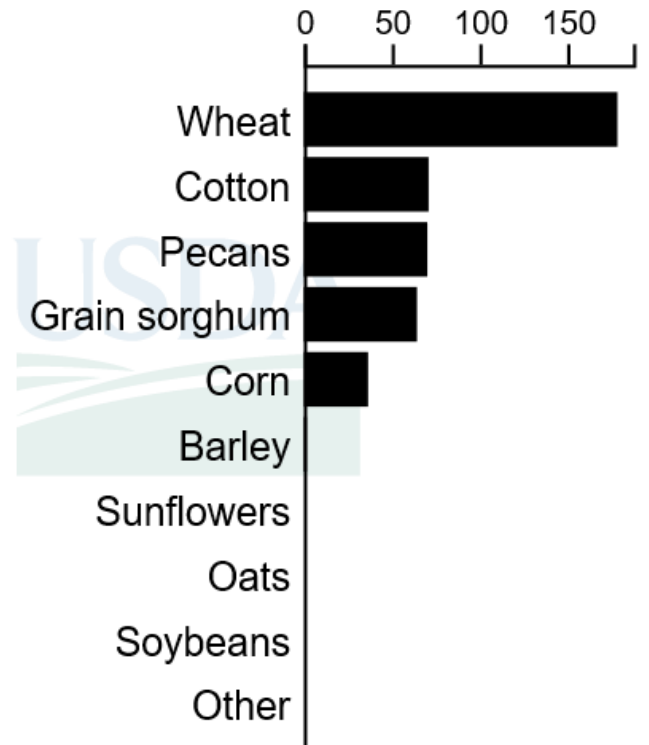




2. Analyze crop insurance trends over time and space by cause of loss and commodity



1989–2022 totals by commodity
(x 1,000,000)



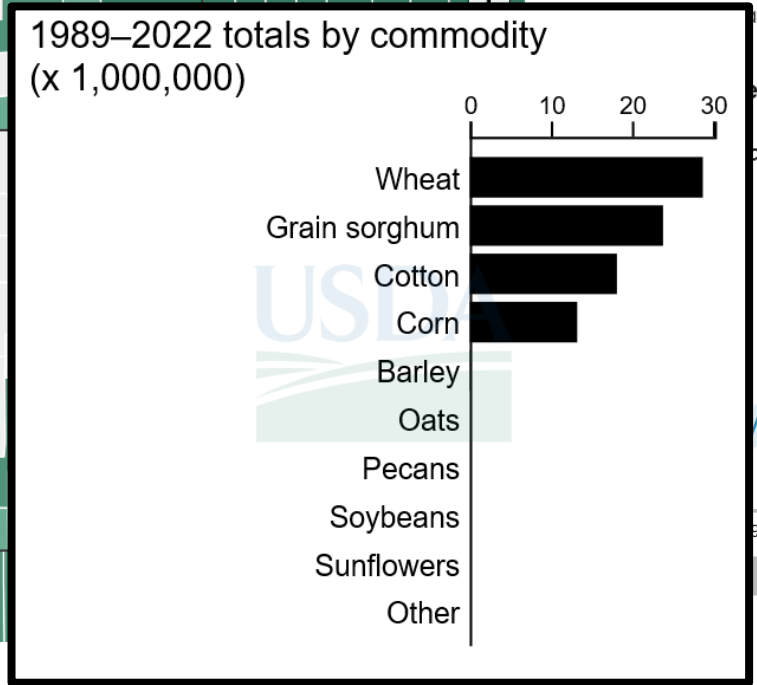
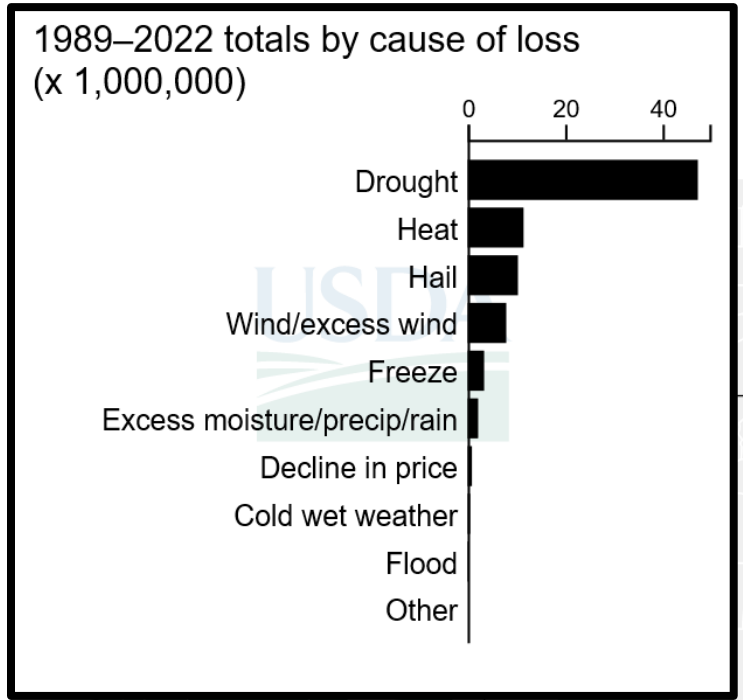
@USDAClimateHubs
#AdaptationInAction



United States Department of Agriculture
Southwest Climate Hub



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



Now Viewing
Risk Management Agency Payments

Roosevelt County, NM: 84,063,822.89

1989-2022 totals by commodity (x 1,000,000)

Commodity	Total (x 1,000,000)
Wheat	28
Grain sorghum	25
Cotton	18
Corn	12
Barley	5
Oats	3
Pecans	2
Soybeans	1
Sunflowers	1
Other	1

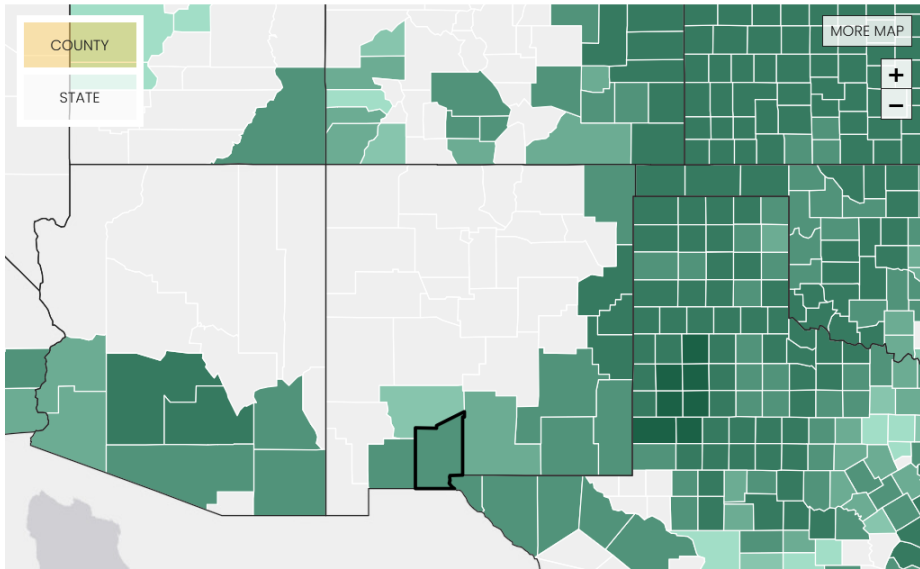
- Compound extremes (Lesk et al. 2022)
- Effects on yields of wheat and specific mitigation strategies (Ortiz et al. 2008)
- Impact on yield and water consumption of cotton (Jans et al. 2021)



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

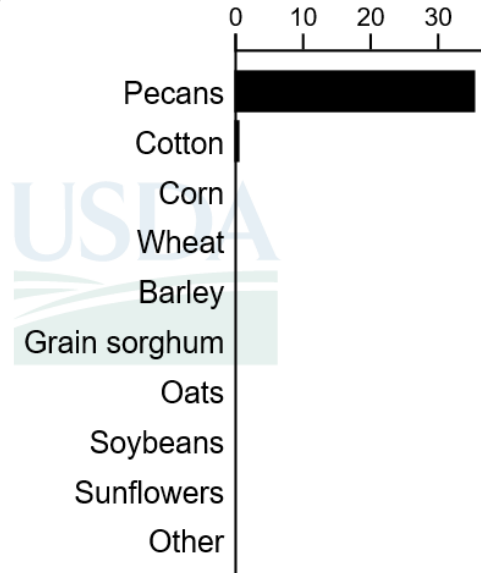
AgRisk Viewer

USDA SOUTHWEST CLIMATE HUB



Doña Ana County, NM

1989–2022 totals by commodity
(x 1,000,000)



- 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)



United States Department of Agriculture
Southwest Climate Hub

@USDAClimateHubs
#AdaptationInAction



Thank you!

Questions:
Guillermo Alvarez Ph.D.
guillermo.alvarez1@montana.edu

Agricultural Risk in a Changing
Environment (AgRisk Viewer):

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



cuellar 155113496 / Getty Images

Thank you!

Questions?

Emile Elias

Director, USDA Southwest Climate Hub
emile.elias@usda.gov

William Gould

Director, USDA Caribbean Climate Hub
william.a.gould@usda.gov

Guillermo Alvarez

USDA Southwest Climate Hub
guillermo.alvarez1@montana.edu

Noah Silber-Coats

USDA Southwest Climate Hub
noahsc@nmsu.edu

USDA is an equal opportunity provider, employer, and lender.