



NOAA Climate.gov

A Guided Tour of Three Websites in One

David Herring, program manager

NOAA Climate Program Office

David.Herring@noaa.gov

Feb. 21, 2020

Overview

- 1. The Who and the Why**
- 2. Site information hierarchy**
- 3. News & Features**
- 4. Maps & Data**
- 5. Teaching Climate**
- 6. Success metrics**
- 7. Lessons learned and planned next steps**

Featured on Climate.gov 1 2 3 4 5



Climate & Chocolate

February 10, 2016

Filed in: News & Features

Over the next several decades, cacao-growing regions may grow warmer and drier, but with planning and adaptation, farmers can keep producing our favorite treat.

[read more](#)

Recent Topics



Introduction to CLEAN

February 5, 2020

Filed in: Teaching Climate



Toolbox for Teaching Climate & Energy

February 26, 2018

Filed in: Teaching Climate



A conversation with Danielle Claar: NOAA Postdoc, marine scientist, diver

February 4, 2020

Filed in: News & Features

Global Climate Dashboard

▼ Climate Change

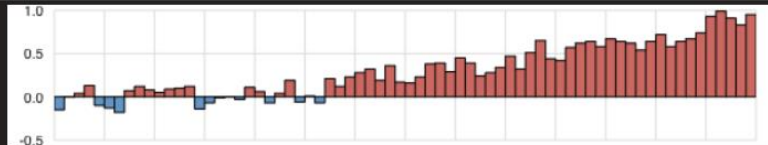
▶ Climate Variability

▶ Climate Projections

Global Average Temperature (°C)

The temperature near Earth's surface is rising: the bars show each year's average temperature compared to the 20th century average.

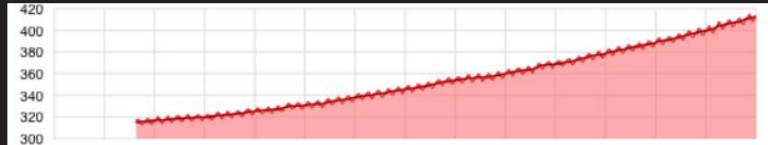
[learn more >>](#)



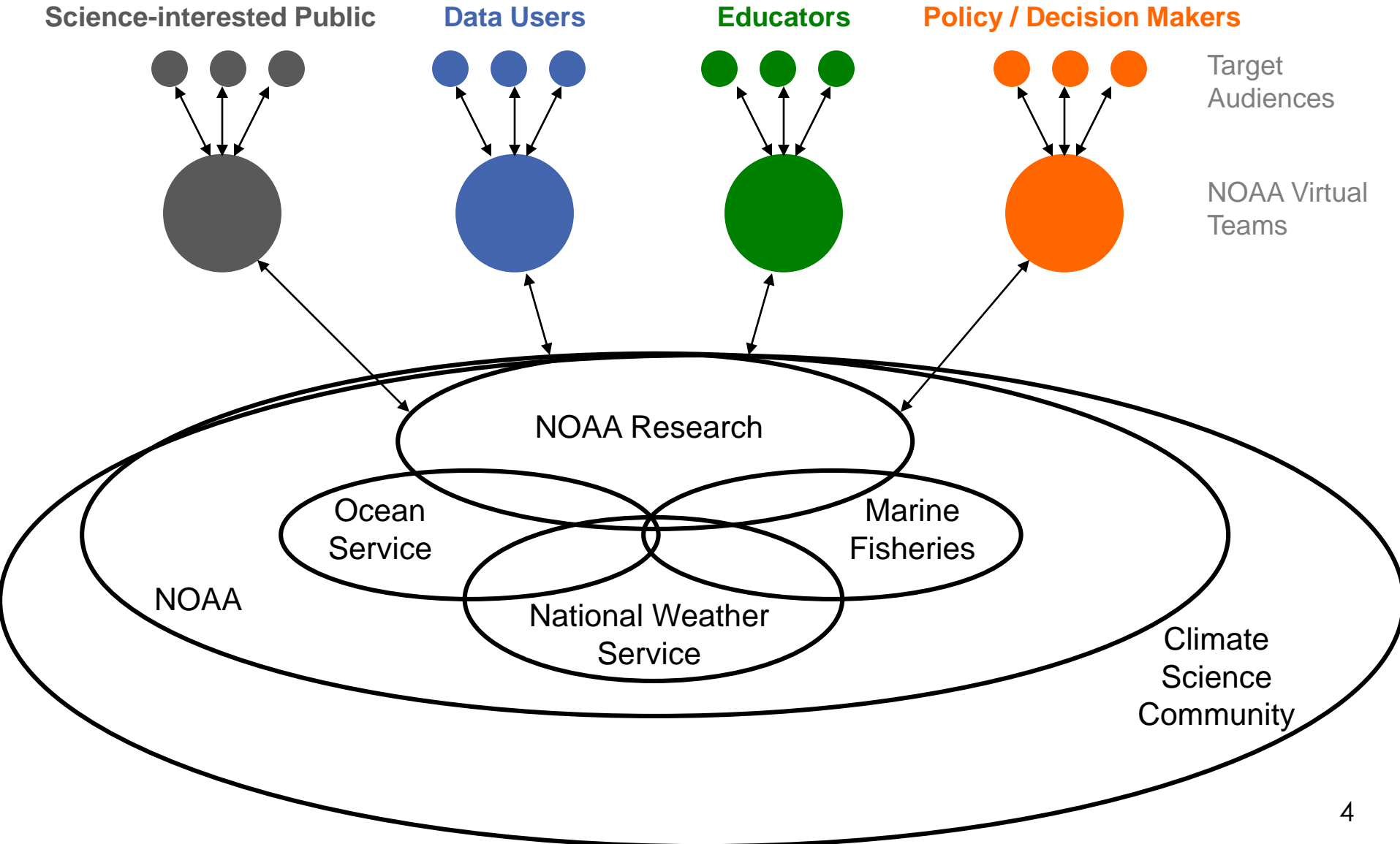
Carbon Dioxide (ppm)

The amount of carbon dioxide in the atmosphere has risen by 25% since 1958, and by about 40% since the Industrial Revolution.

[learn more >>](#)



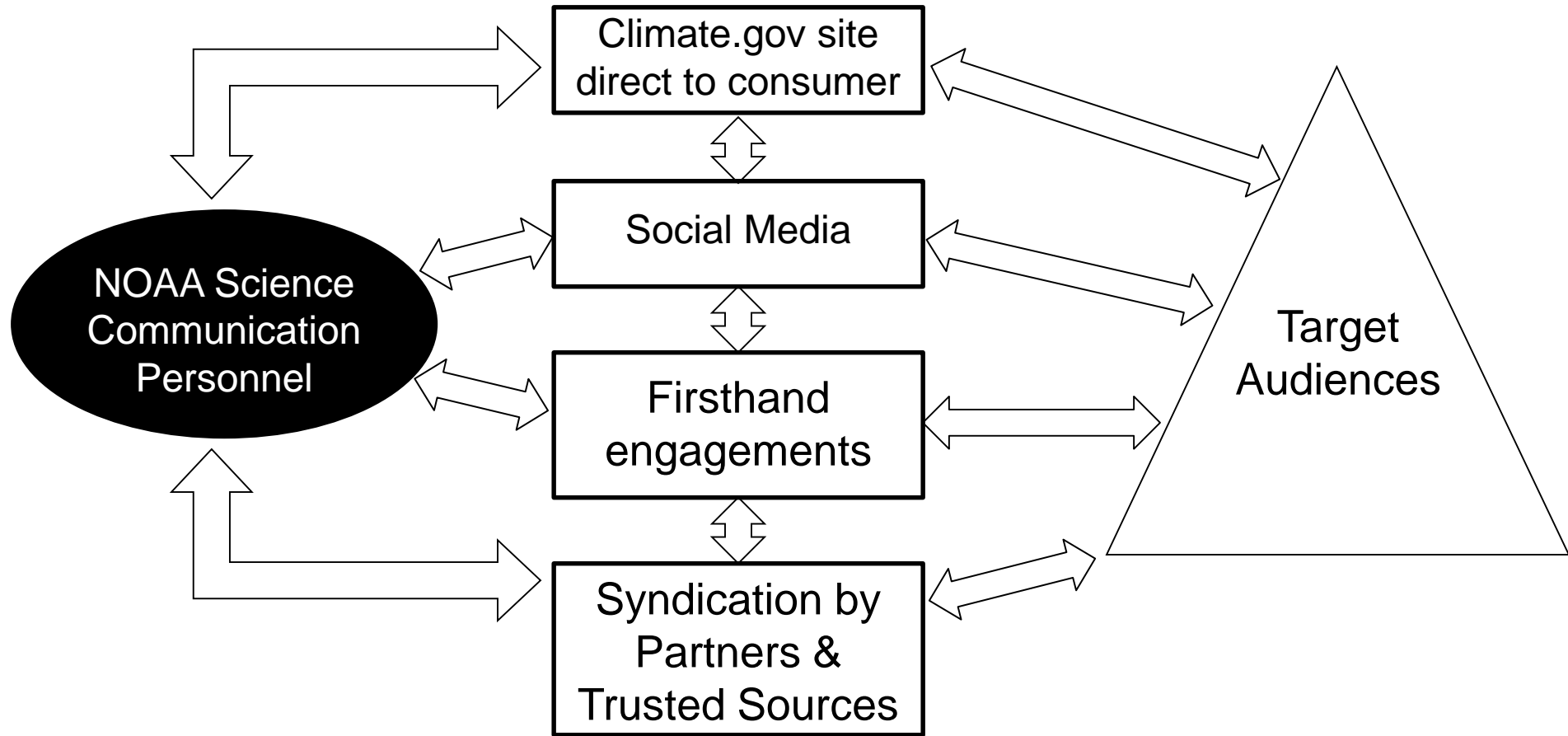
The Who: start at the audience interface and work backward into the agency



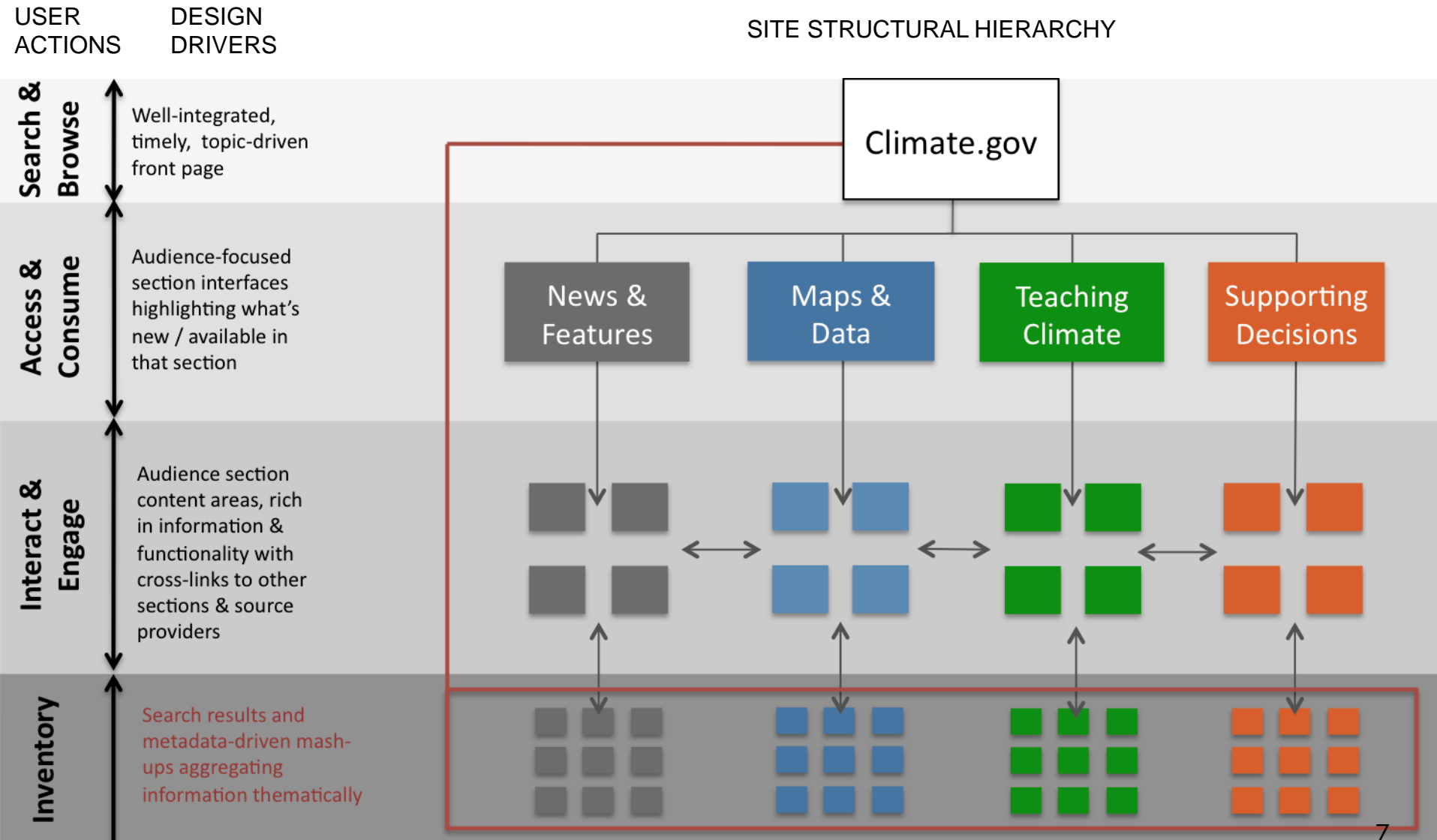
The Why: a function of audience & objective

- **News & Features** — a popular-style magazine for the science-interested public seeking “edutaining” and authoritative articles about climate science, adaptation, and mitigation.
- **Maps & Data** — an easy on-ramp for people seeking maps and datasets documenting climate-related conditions that they can use in their work. This section serves both experts and non-experts.
- **Teaching Climate** — a curated catalog of education resources for formal and informal educators who want to teach climate science in classrooms & free-choice venues.
- **Supporting Decisions** — a climate adaptation / resilience planning framework with resources for planners, policy leaders, and consultants (superseded by the “U.S. Climate Resilience Toolkit” at [toolkit.climate.gov](https://www.toolkit.climate.gov))

Our 4-pronged strategy for building relationships with target audiences



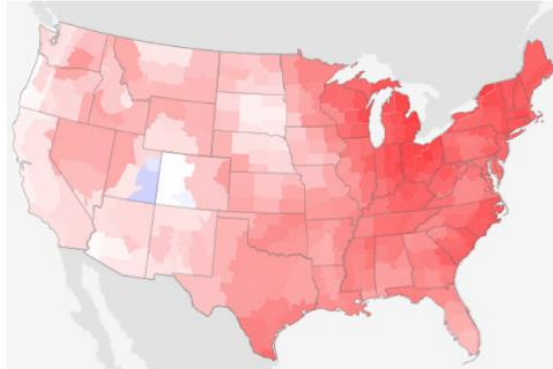
Climate.gov site structural hierarchy



Climate news, stories, images, & video
(ClimateWatch Magazine)

- [News](#)
- [How the Climate System Works](#)
- [Climate Change & Global Warming](#)
- [Natural Climate Patterns](#)
- [Climate Impacts](#)
- [Observing & Predicting](#)
- [Policy & Planning](#)
- [Extreme Events](#)

Featured Articles [1](#) [2](#) [3](#) [4](#) [5](#) [6](#)



Something the U.S. can (mostly) agree on: January 2020 was warmer than average

February 11, 2020

Although exact temperatures varied by latitude and elevation, January 2020 temperatures were above average for nearly every U.S. climate division of the Lower 48 states.

[read more](#)

Department

- [All](#)
- [News & Research Highlights](#)
- [Images & Video](#)
- [Event Tracker](#)
- [Climate Q&A](#)
- [ENSO Blog](#)
- [Beyond the Data](#)
- [Climate Case Studies](#)
- [Climate Tech](#)
- [Climate and ...](#)
- [Decision Maker's Toolbox](#)
- [Features](#)
- [Understanding Climate](#)
- [Decision Makers Take 5](#)

[See all Event Tracker »](#)

Catastrophic wildfires in southeastern Australia in 2019-20

January 3, 2020

Terrible wildfires raged through parts of southeastern Australia in the first days of 2020.

[Read more](#)



Flash drought engulfs the U.S. Southeast in September 2019

October 9, 2019

Much of the southeastern United States went from little drought to widespread severe drought in a matter of a few weeks thanks to little rain and hot and sunny days.

[Read more](#)



Europe's rogue heatwave melts Greenland

August 14, 2019

The July 2019 heatwave exited Europe



Subscribe to News & Features Updates via RSS



Featured Image

Temperature and precipitation outlooks for February 2020



Most Popular

1. [Climate Change: Global Temperature](#)
2. [Climate Change: Atmospheric Carbon Dioxide](#)
3. [What's the difference between global warming and climate change?](#)
4. [Why did Earth's surface temperature stop rising in the past decade?](#)
5. [Climate Change: Global Sea Level](#)

Climate.gov
science & information for a climate-smart nation

News & Features | Maps & Data | Teaching Climate | About | Contact | FAQs | Site Map | What's New? | El Niño & La Niña

Climate news, stories, images, & video (ClimateWatch Magazine)

News | How the Climate System Works | Climate Change & Global Warming | Natural Climate Patterns | Climate Impacts | Observing & Predicting | Policy & Planning | Extreme Events

Featured Articles 1 2 3 4 5 6

Something the U.S. can (mostly) agree on: January 2020 was warmer than average
February 11, 2020
Although exact temperatures varied by latitude and elevation, January 2020 temperatures were above average for nearly every U.S. climate division of the Lower 48 states.
[read more](#)

Department

- All
- News & Research Highlights
- Images & Video
- Event Tracker**
- Climate Q&A
- ENSO Blog
- Beyond the Data
- Climate Case Studies
- Climate Tech
- Decision Maker's Toolbox
- Features
- Understanding Climate
- Decision Makers Take 5

See all Event Tracker »

Catastrophic wildfires in southeastern Australia in 2019-20
January 3, 2020
Terrible wildfires raged through parts of southeastern Australia in the first days of 2020.
[Read more](#)

Flash drought engulfs the U.S. Southeast in September 2019
October 9, 2019
Much of the southeastern United States went from little drought to widespread severe drought in a matter of a few weeks thanks to little rain and hot and sunny days.
[Read more](#)

Europe's rogue heatwave melts Greenland
August 14, 2019
The July 2019 heatwave exited Europe

Subscribe to News & Features Updates via RSS

Featured Image
Temperature and precipitation outlooks for February 2020

Most Popular

1. Climate Change: Global Temperature
2. Climate Change: Atmospheric Carbon Dioxide
3. What's the difference between global warming and climate change?
4. Why did Earth's surface temperature stop rising in the past decade?
5. Climate Change: Global Sea Level

You are here

Browse by departments

Department content previews

Browse by topics

Rotator with new / featured content

RSS feed

Top 10 most popular articles

Climate news, stories, images, & video (ClimateWatch Magazine)

News How the Climate System Works Climate Change & Global Warming Natural Climate Patterns Climate Impacts Observing & Predicting Policy & Planning Extreme Events

Home » News & Features » Understanding Climate » Something the U.S. can (mostly) agree on: January 2020 was warmer than average

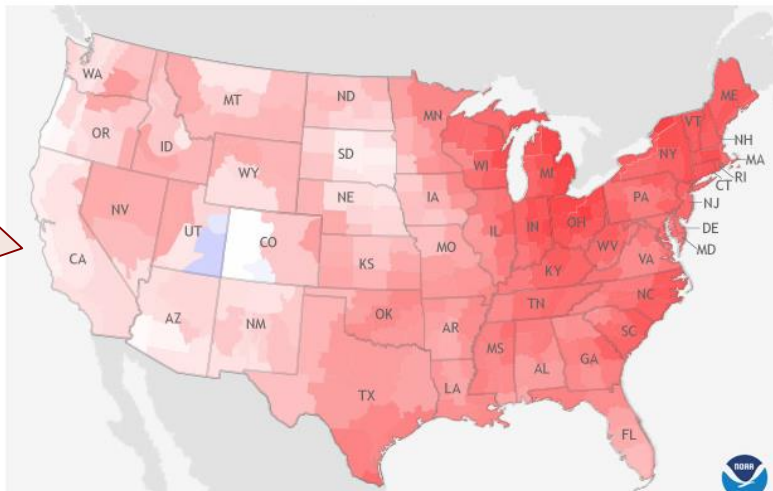
Something the U.S. can (mostly) agree on: January 2020 was warmer than average

Author: Rebecca Lindsey

February 11, 2020



According to the latest monthly climate update for the United States, January 2020 was the fifth-warmest January on record for the Lower 48 (aka "the contiguous United States," or CONUS). The warmth wasn't record-breaking, but it was widespread.



January 2020 Compared to 1981-2010 Difference from average temperature (°F) Climate.gov Data: NCEI

This map shows where January 2020 temperatures were warmer (red) or cooler (blue) than the 1981-2010 average across the contiguous United States (see Alaska). NOAA Climate.gov map, based on NCEI data.

This kind of nation-wide warmth in January isn't unique, but it's rare. In the past twenty years, it's only happened two other times, in 2006 and 2012. The only climate divisions in the CONUS that were cooler than average were in eastern Utah and southern Colorado. Alaska, meanwhile, marched to its own January drum, with colder-than-average temperatures across most of the state.

January climate trivia: farewell to our nation's lone nationally frozen month?

Highlights:

- January 2020 was the fifth warmest January on record for the contiguous United States (CONUS).
- All but a small handful of CONUS climate divisions were warmer than average.
- Alaska was also an exception, with cooler-than-average temperatures across most of the state.
- January temperatures have warmed significantly in the past 30 years.

Rating:

★★★★★ Average: 5 (2 votes)

Share This: [Facebook] [Twitter] [Email] [Print] [6]

Topics:

Measurements and Observations

Category:

Climate Change & Global Warming Observing & Predicting

Department:

Understanding Climate

Reviewer:

Deke Arndt

Title, author, date, & print

Summary overview

User content ratings

Metadata

Breadcrumb

Body of article

Original, reusable maps & visuals

"You might also like:"

Climate.gov social media channels

facebook

NOAA Climate.Gov @NOAAClimateGov

Home Posts Videos Photos About Community

NOAA Climate.Gov January 15 · 🌐

Long-term, global-scale warming continues, with global average surface temperature just over 2 degrees F warmer than the pre-industrial average.

ADDITIONAL HIGHLIGHTS

*2019 marks the 43rd consecutive year (since 1977) with global land and ocean temperatures at least nominally above the twentieth-century average. ... See More

2019 global temperature recap

2019 WARMEST YEAR ON RECORD

2.07 F (1.15 C) ABOVE PRE-INDUSTRIAL AVERAGE (1880-1900)

Difference from average temperature (°F)

NOAA Climate.gov, NCEI

127 likes · 36 Comments

^ Facebook

Twitter >

NOAA Climate.gov @NOAAClimate

Toward a Climate-Smart Nation. Follow us for #climate news, #science, #data, resources, and more!

climate.gov Joined April 2012

303 Following 88.6K Followers

Tweets Tweets & replies Media Likes

NOAA Climate.gov @NOAAClimate · 1h

Found in the Tools section of the U.S. #Climate #Resilience Toolkit, this interactive site shows how the social and economic characteristics of the Great Lakes region are impacted changes in climate. toolkit.climate.gov/tool/great-lak...

3 replies · 8 likes

YouTube

Home Trending Subscriptions Library History Your videos Watch later Liked videos

NOAAClimate 4,59K subscribers

NOAAClimate uploaded a video

NOAA's climate outlook for winter 2019-20

NOAAClimate · 52K views · 4 months ago

NOAAClimate uploaded a video

A saildrone records rough seas while circumnavigating Antarctica

NOAAClimate · 1.9K views · 5 months ago

NOAAClimate uploaded a video

NOAA RISA's CCRUN Team: Responding to the risk of extreme heat on vulnerable populations

NOAAClimate · 1.3K views · 10 months ago

New to 1 Sign up now 1

You might like

NOAA Research @NOAAResearch Follow

NOAA NCEI Climate @NOAANCEIclimate Follow

NOAA @NOAA Follow

Trends

#LoveYourPetDay 36.9K Tweets

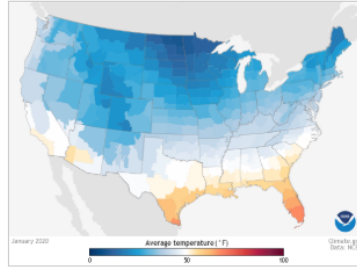
YouTube ^

(And also on Instagram)

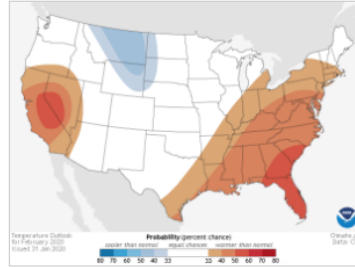
Easy access to climate data, products, and services

- [Data Snapshots](#)
- [Dataset Gallery](#)
- [Climate Data Primer](#)
- [Climate Dashboard](#)

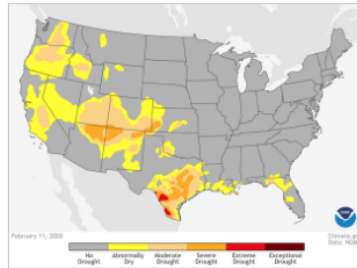
Data Snapshots: Reusable Climate Maps



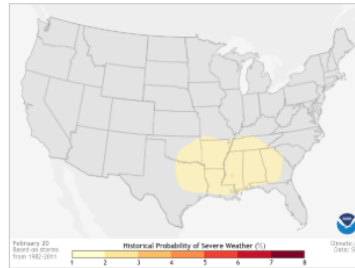
Average Monthly Temperature



Monthly Temperature Outlook



Drought Monitor



Probability of Severe Weather

Explore a range of easy-to-understand climate maps in a single interface. Featuring the work of NOAA scientists, each "snapshot" is a public-friendly version of an existing data product.

[Launch Data Snapshots](#)

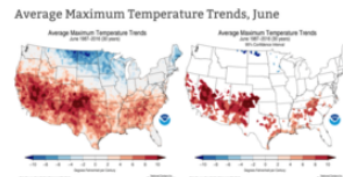
Dataset Spotlight: Past Weather by Zip Code - Data Table

US Department of Commerce
National Oceanic and Atmospheric Administration
National Centers for Environmental Prediction
National Weather Service
Climate Prediction Center
1515 L Street, NW
Washington, DC 20004
4101 Linn Co. Center Drive
Des Moines, IA 50319
515 North State Street
Chattanooga, TN 37403
5200 Auth Avenue
Norman, OK 73062
5000 Auth Avenue
Norman, OK 73062
5000 Auth Avenue
Norman, OK 73062

Zip Code	City	State	Year	Temperature (°F)	Precipitation (in)	Humidity (%)	Wind Speed (mph)	Cloud Cover (%)	Pressure (inHg)
10001	New York	NY	2019	32	0.1	65	10	80	30.1
10002	New York	NY	2019	35	0.2	70	12	75	30.2
10003	New York	NY	2019	38	0.3	75	15	70	30.3
10004	New York	NY	2019	40	0.4	80	18	65	30.4
10005	New York	NY	2019	42	0.5	85	20	60	30.5

How much rain fell over the weekend? What

View trends in temperature and precipitation



Browse the Dataset Gallery

This visual catalog with convenient filtering options can help you find the climate data you need. How-to instructions can help you navigate data access tools.

[Enter the Dataset Gallery](#)

GIS Data Locator (Advanced Users)

[Launch Map Application](#)

Climate Data Primer

Ready to learn some of the basics about climate data? Find out about measuring, modeling, and predicting climate and ways to find and use climate data.

The Primer includes information on instruments used to measure weather and climate; how weather observations relate to climate products; how climate scientists check the quality of observations, and tools you can use for exploring climate data

[Open the Primer's table of contents](#)

Recently Updated Datasets

- [Worldwide Wind Roses - Graphics and Tabular Data](#)
- [El Niño-Southern Oscillation Indicators](#)
- [Past Weather by Zip Code - Data Table](#)
- [Record-setting weather - Charts and Maps](#)

[Go to the Dataset Gallery](#)

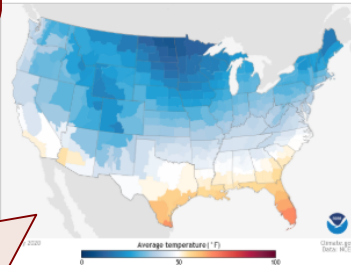
You are here

M&D's four main sections

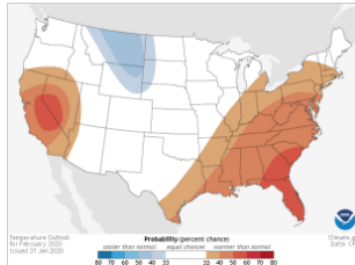
Climate-related maps for U.S. & globe

Most popular datasets

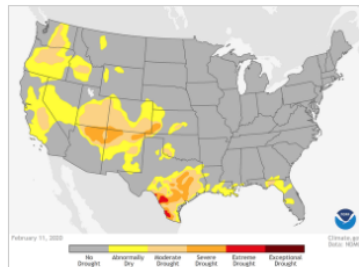
Data Snapshots: Reusable Climate Maps



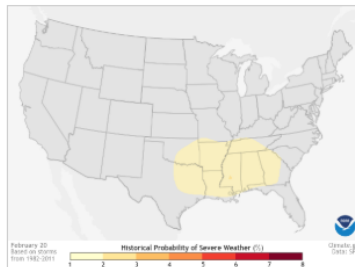
Average Monthly Temperature



Monthly Temperature Outlook



Drought Monitor



Probability of Severe Weather

Explore a range of easy-to-understand climate maps in a single interface. Featuring the work of NOAA scientists, each "snapshot" is a public-friendly version of an existing data product.

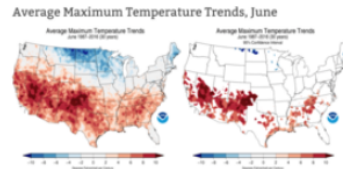
Launch Data Snapshots

Dataset Spotlight: Past Weather by Zip Code - Data Table

Year	1	2	3	4	5	6	7	8	9	10	11	12
2011	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2014	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2015	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2017	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2018	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2019	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

How much rain fell over the weekend? What

View trends in temperature and precipitation



Browse the Dataset Gallery

This visual catalog with convenient filtering options can help you find the climate data you need. How-to instructions can help you navigate data access tools.

Enter the Dataset Gallery

GIS Data Locator (Advanced Users)

Launch Map Application

Climate Data Primer

Ready to learn some of the basics about climate data? Find out about measuring, modeling, and predicting climate and ways to find and use climate data.

The Primer includes information on instruments used to measure weather and climate; how weather observations relate to climate products; how climate scientists check the quality of observations, and tools you can use for exploring climate data

Open the Primer's table of contents

Recently Updated Datasets

- Worldwide Wind Roses - Graphics and Tabular Data
- El Niño-Southern Oscillation Indicators
- Past Weather by Zip Code - Data Table
- Record-setting weather - Charts and Maps

Go to the Dataset Gallery

Full catalog of datasets

GIS data find/browse tool

Data Primer for first-timers

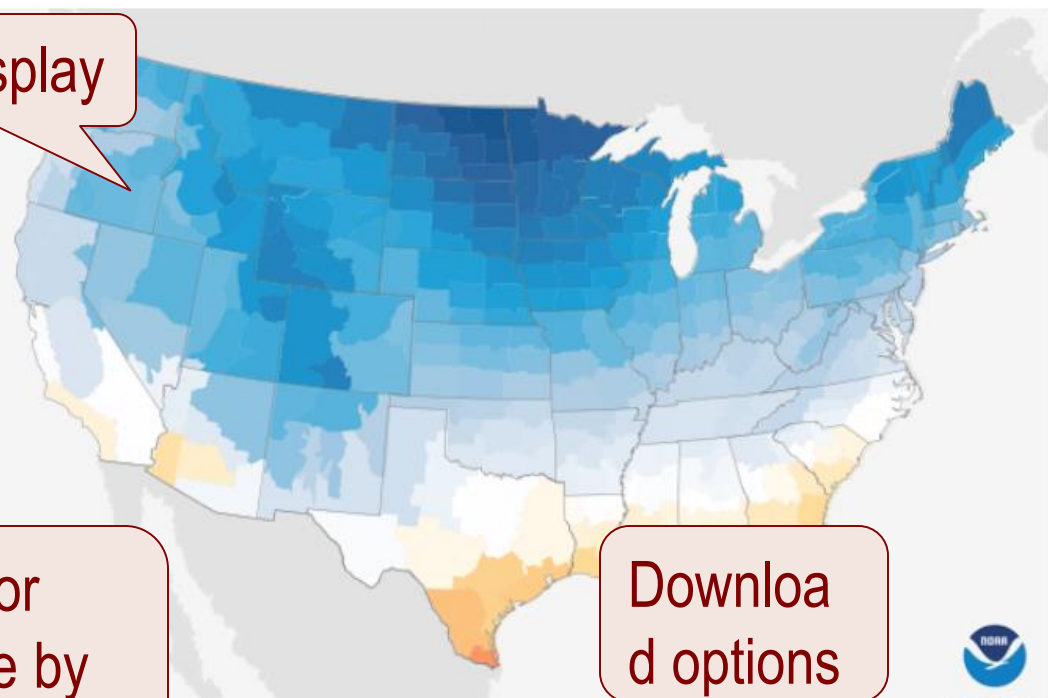
Global Climate Dashboard

View menu or detailed description

Data Snapshots

Maps | Description

Map display



Select or animate by year / month

Download options

Learn more

- Precipitation
- Temperature
 - 30-yr averages by month: Max temp
 - 30-yr averages by month: Mean temp
 - 30-yr averages by month: Min temp
 - Average Monthly Temperature
 - Difference from Average - Monthly
 - Monthly Temperature Outlook
 - Three-month Temperature Outlook
 - Difference from Average - Monthly
 - Difference from Average - Annual
- Projections
- Drought

About This Snapshot: Colors show the average monthly temperature across each of the 344 climate divisions of the contiguous United States. [read more](#)

Month: Jan | Dec
Year: 2000 | 2020

Download

Data Snapshot Details: Average Monthly Temperature

What was the average temperature?

Colors show the average monthly temperature across each of the 344 climate divisions of the contiguous United States. Climate divisions shown in white or very light colors had average temperatures near 50°F. Blue areas on the map were cooler than 50°F; the darker the blue, the cooler the average temperature. Orange to red areas were warmer than 50°F; the darker the shade, the warmer the monthly average temperature.

Where do these measurements come from?

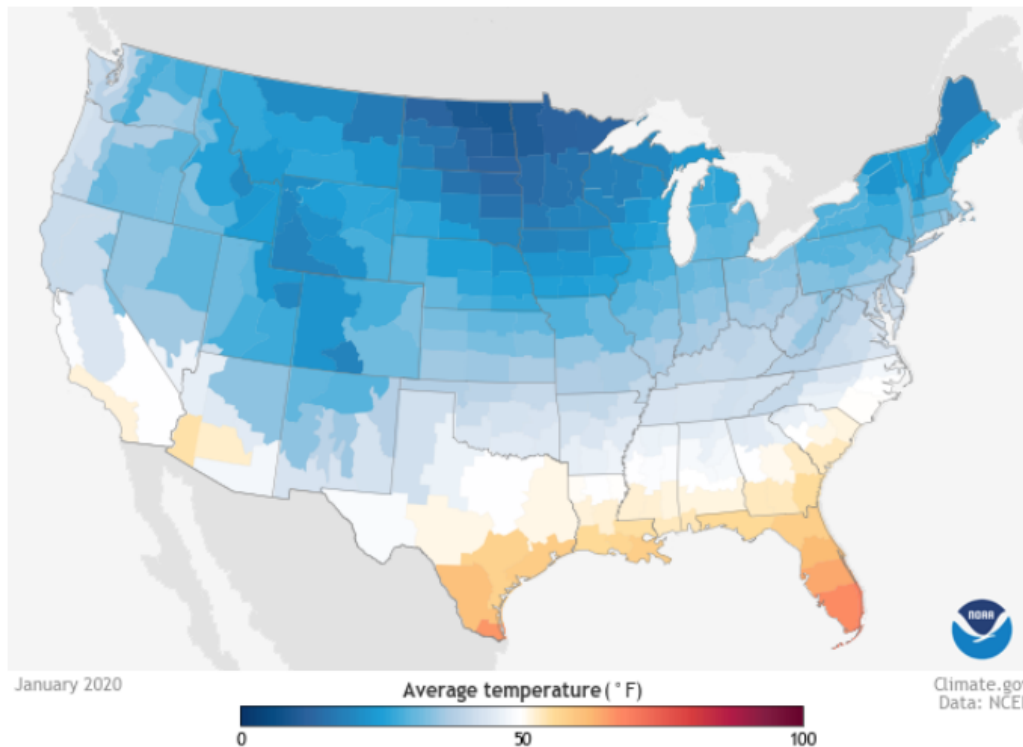
Temperature readings come from weather stations across the United States. The Global Historical Climatology Network (GHCN) scientists collect the highest and lowest temperature of the day at each station for each month. After they check data quality, they calculate the station's monthly average and create a gridded map. To fill the grid, a computer program applies a mathematical filter that accounts for the distribution of stations and the terrain. The monthly average temperature for each climate division is the average of all grid point values that fall within it.

What do the colors mean?

The map shows climate divisions that had monthly average temperatures below 50°F. The darker shade of blue, the lower the average temperature. Climate divisions shown in white and red had average temperatures above 50°F. The darker the shade of orange or red, the higher the average temperature. White or very light colors show climate divisions where the average temperature was near 50°F.

Why does this data matter?

Tracking the average temperature in each of the 344 climate divisions of the contiguous United States gives scientists a way to monitor climate at a regional scale. Energy companies use this



Plain-language details

Metadata

References & links to sources

Source Data Product:

Climate at a Glance

Data Provider:

National Centers for Environmental Information (NCEI) - Weather and Climate

Access to Source Data:

[Climate Division Data \(nClimDiv\)](#)

Reviewer:

Jake Crouch, National Centers for Environmental Information

Access to climate data, products, services

Data Snapshots

Dataset Gallery

Climate Data Primer

Climate Dashboard

Home » Maps & Data » Dataset Gallery

Refine by coverage:

- US (34)
- Global (16)
- Regional (2)

Refine by essential climate variables:

- + Atmospheric (32)
- + Terrestrial (10)
- + Oceanic (10)

Refine by data type:

- Land-based station (34)
- Marine / Ocean (10)
- Model (8)
- Satellite (8)
- Severe weather (7)
- Radar (2)
- Paleoclimate (1)

Refine by data format(s):

- txt (ascii) (20)
- csv (20)
- png (16)
- other (11)
- pdf (10)
- xml (8)
- json (6)
- shapefile (5)
- netcdf-3 (4)
- kml (3)
- netcdf-4 (3)
- geotiff (1)
- svg (1)

Dataset Gallery

To find datasets of interest, glance through the entries below, enter a search term to the left, or click terms under the filters to refine the list.

Past Weather by Zip Code - Data Table

Climate Data Online - Daily Summaries

How much rain fell over the weekend? What was the temperature over the last few weeks? Tables of daily weather observations can answer these common questions.



Average Annual and Monthly Numbers of Tornadoes by State - Maps

U.S. Tornado Climatology

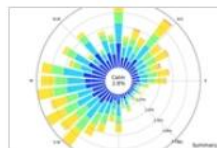
Tornadoes can occur anyplace, but they are more likely in some locations than others. Check maps that show the average number of tornadoes in each of the United States over a year or by month, based on tornado observation



Weekly Drought Map

U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a weekly map—updated each Thursday—that shows the location and intensity of areas currently experiencing abnormal dryness or drought across the United States.



Worldwide Wind Roses - Graphics and Tabular Data

Iowa Environmental Mesonet: Wind Rose Plots

The Iowa Environmental Mesonet (IEM) lets you examine long-term records of wind speed and direction for many locations around the world.



Record High & Low Daily Temperatures in the U.S. - Graphs and Tabular Data

DayRec: United States Record-Maximum/Minimum Daily Temperatures

Record high and low temperatures generate tremendous interest, largely because of the potential for impacts on human health, the environment, and built infrastructure.

Set of all datasets

Breadcrumb

Filter functions

Record High & Low Daily Temperatures in the U.S. - Graphs and Tabular Data

DayRec: United States Record-Maximum/Minimum Daily Temperatures

- General**
- How-To
- Data Access
- Related
- Documentation

Record high and low temperatures generate tremendous interest, largely because of the potential for impacts on human health, the environment, and built infrastructure. Changes in the ratio of record high and low temperatures (extremes) are also indicator of climate change.

DayRec offers three kinds of prepared charts that characterize and provide context for record temperatures*:

- Scatter plots show the years that different types of records were set for each day of the year.
- Bar charts show the decadal frequency of record-setting Tmax's and Tmin's, and
- Graphs show record Hot Tmax and Cool Tmax values for each day of the year

Where do these data come from?

DayRec displays daily maximum temperature (Tmax) and minimum temperature (Tmin) observations from a subset of stations in the [Global Historical Climatology Network \(GHCN\) - Daily](#) database. Project developers started with a subset of the 1218 stations in the U.S. [Historical Climatology Network \(USHCN\)](#). Of these, 200 stations met their stringent requirements for very low percentages of missing data—these are categorized as Class 1 stations and marked in blue in the DayRec interface. Records from an additional 224 stations met slightly less stringent requirements—these are categorized as Class 2 stations and marked in green. Learn more about DayRec's [Data](#) and [Methods](#) page.



Direct link:
[DayRec: An Interface for Exploring United States Record-Maximum/Minimum Daily Temperatures](#)

Data type: Land-based station

Time period: 1 Jan 1911 to present

Coverage: US

Source:
Carbon Dioxide Information Analysis Center (CDIAC)

Dataset title

Detailed metadata record

Site preview

Direct link to source

Climate Data Primer

What's the difference between climate and weather?

How do weather observations become climate data?

How do we observe today's climate?

In the Air...

On the Land...

In the Ocean...

How do we know about climate in the past?

How do we predict future climate?

Climate Forcing

Climate Models

Future Climate

How do scientists classify different types of climate?

How can I find or make climate maps or graphs?

How do I find the climate data I want?

Dataset Gallery

Search Strategies

What questions can I answer with climate data?

Climate Data Primer

Are you new to climate data? Ready to learn or review some of the basics?



Image Credit: noaa.gov

This site will walk you through some of the basics to help you understand and explore climate data. In the table of contents on the left, you'll find information on:

- instruments used to measure weather and climate
- how weather observations relate to climate products
- how climate scientists check the quality of observations
- tools you can use for exploring climate data

Why does climate data matter? Lots of people check climate data to find information or help them make decisions. For example:

- Folks who are planning outdoor events check **climate normals** data to help them choose a date when they can expect pleasant weather.
- Ranchers, farmers, and outdoor-recreation businesses regularly monitor **drought** conditions to see if the environment has sufficient water for plants and animals.
- Weather enthusiasts like to explore **extreme** storms and record-setting events.
- People who live near the coast consider how **sea level rise** might affect them.
- Students often consider the relationship between **global temperature** and **greenhouse** gases.
- Water companies check **precipitation** and **river** levels to monitor water supplies.

To get started, click any page title on the left.

Plain language explanations & questions to guide beginners

Filter function

Climate data at a glance

Select category

Global Climate Dashboard

Climate Change

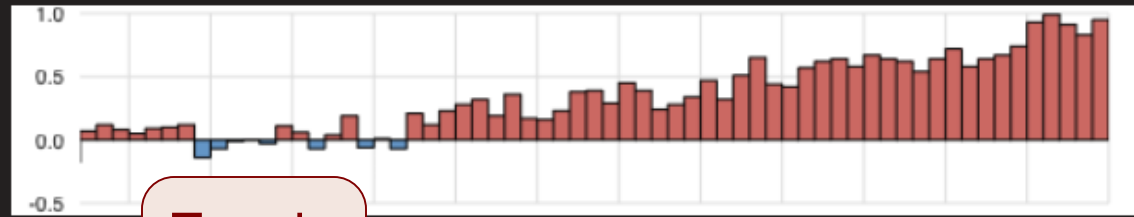
Climate Variability

Climate Projections

Global Average Temperature (°C)

The temperature near Earth's surface is rising: the bars show each year's average temperature compared to the 20th century average.

[learn more >>](#)

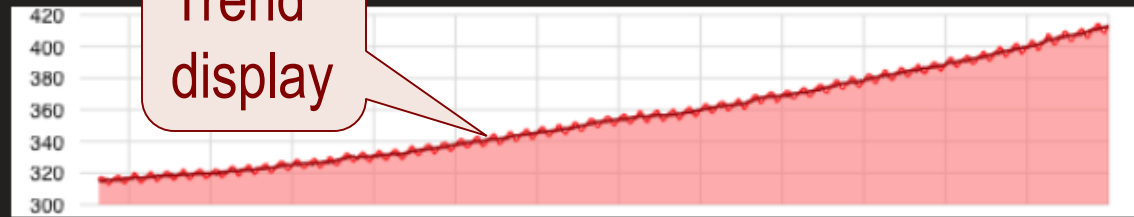


Trend display

Carbon Dioxide (ppm)

The amount of carbon dioxide in the atmosphere has risen by 25% since 1958, and by about 40% since the Industrial Revolution.

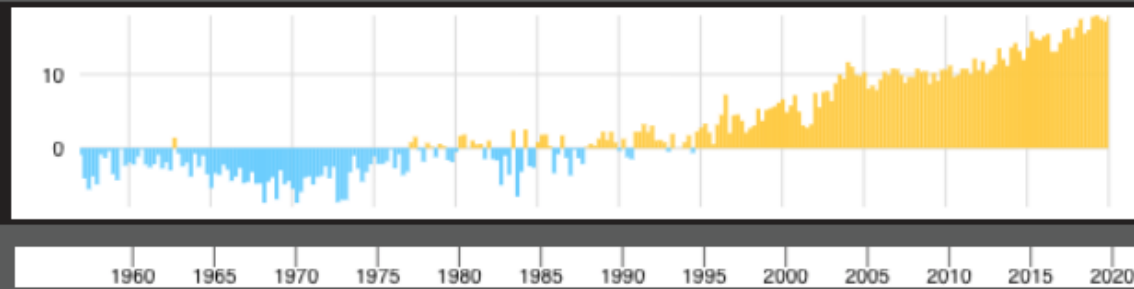
[learn more >>](#)



Ocean Heat (10²² Joules)

Each bar shows heat energy in the top half-mile of the ocean compared to the average from 1955-2006.

[learn more >>](#)



Captions & links to more

← Earlier | Later →

▲ Temperature

▲ Carbon Dioxide

▶ Snow

▶ Sea Level

▶ Arctic Sea Ice

▲ Ocean Heat

▶ Sun's Energy

Glaciers

▶ Heat-Trapping Gases

Select variable

Select time

Landing page title, author, & date

Plain-language narrative with embedded visuals.

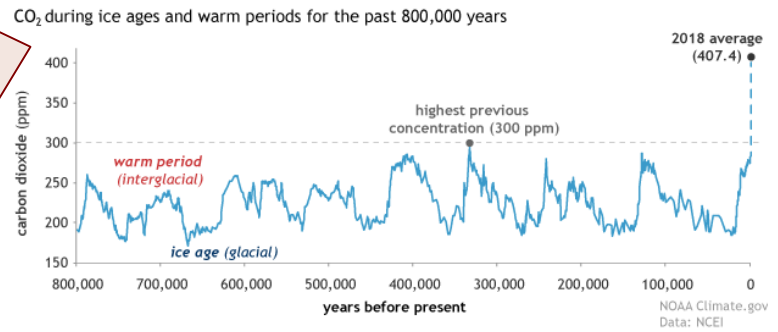
Bottom of page: links to sources and related datasets

Climate Change: Atmospheric Carbon Dioxide

Author: [Rebecca Lindsey](#)
February 20, 2020



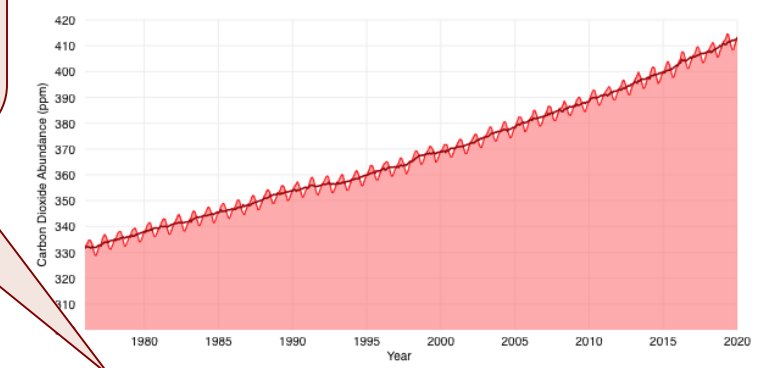
The global average atmospheric carbon dioxide in 2018 was 407.4 parts per million (ppm for short), with a range of uncertainty of plus or minus 0.1 ppm. Carbon dioxide levels today are higher than at any point in at least the past 800,000 years.



Atmospheric carbon dioxide concentrations in parts per million (ppm) for the past 800,000 years, based on EPICA (ice core) data. The peaks and valleys in carbon dioxide levels track the coming and going of ice ages (low carbon dioxide) and warmer interglacials (higher levels). Throughout these cycles, atmospheric carbon dioxide was never higher than 300 ppm; in 2018, it reached 407.4 ppm (black dot). NOAA Climate.gov, based on EPICA Dome C [data](#) (Lüthi, D., et al., 2008) provided by NOAA NCEI Paleoclimatology Program.

In fact, the last time the atmospheric CO2 amounts were this high was more than 3 million years ago, when temperature was 2°–3°C (3.6°–5.4°F) higher than during the pre-industrial era, and sea level was 15–25 meters (50–80 feet) higher than today.

Carbon dioxide concentrations are rising mostly because of the fossil fuels that people are burning for energy. Fossil fuels like coal and oil contain carbon that plants pulled out of the atmosphere through photosynthesis over the span of many millions of years; we are returning that carbon to the atmosphere in just a few hundred years.



Summary of key points

Highlights:

- Human activities have increased the natural concentration of carbon dioxide in our atmosphere, amplifying Earth's natural greenhouse effect.
- The global average amount of carbon dioxide hit a new record high in 2018: 407.4 parts per million.
- The annual rate of increase in atmospheric carbon dioxide over the past 60 years is about 100 times faster than previous natural increases, such as those that occurred at the end of the last ice age 11,000-17,000 years ago.
- The ocean has absorbed enough carbon dioxide to lower its pH by 0.1 units, a 30% increase in acidity.

Rating:

★★★★★
Average: 3.9 (295 votes)

Share This: [f](#) [t](#) [e](#) [m](#) [+](#) 312

Tags:

[carbon dioxide](#) [emissions](#)

Topics:

- [Global Energy Balance](#)
- [Atmospheric Composition](#)
- [Greenhouse Effect](#)
- [Greenhouse Gas Emissions](#)
- [Land Use Changes](#)

Category:

- [How the Climate System Works](#)
- [Climate Change & Global Warming](#)
- [Observing & Predicting](#)

Department:

[Understanding Climate](#)

Reviewer:

Ed Dlugokencky

Metadata

Teaching Climate

The screenshot shows the Climate.gov website's 'Teaching Climate' section. At the top, the Climate.gov logo is visible with the tagline 'science & information for a climate-smart nation'. The navigation bar includes 'News & Features', 'Maps & Data', 'Teaching Climate' (highlighted), 'About', 'Contact', 'FAQs', 'Site Map', 'What's New?', and 'El Niño & La Niña'. Below the navigation bar, there are tabs for 'Climate Systems', 'Causes of Climate Change', 'Measuring & Modeling Climate', 'Climate Impacts', 'Human Responses to Climate', and 'Nature of Climate Science'. The main content area features a 'Featured Resources' section with a large image of Earth and a '#TEACH4CLIMATE' graphic. The featured resource is 'Introduction to CLEAN', a webinar series from the Climate Literacy and Energy Awareness Network (CLEAN) dated February 6, 2020. Below this, there are sections for 'Teaching Climate Literacy', 'Professional Development', and 'Search'. The 'Teaching Climate Literacy' section includes a resource titled 'Climate and energy are complex topics...' with a 'Read more' link. The 'Professional Development' section features 'The UC Berkeley Understanding Global Change Project and CLEAN' webinar series, dated March 4, with a 'View event' link. The 'Search' section has a search bar, a 'Grade Level' dropdown menu set to '- Any -', and a 'Find Resources' button. Below the search section, there are sections for 'National Climate Assessment Teaching Resources', 'Climate Youth Engagement', and 'Blog'. The 'National Climate Assessment Teaching Resources' section includes a resource titled 'Explore a series of guides for educators...' with a 'Read more' link. The 'Climate Youth Engagement' section has sub-sections for 'Case Studies', 'Events', and 'Blog'. The 'Case Studies' section includes 'Unique and diverse youth programming models...' with a 'See case studies >>' link. The 'Events' section includes '2018 Native Youth Community Adaptation and Leadership Congress' and 'Our Time to Lead: Youth Engagement on Climate Change' with a 'View event map >>' link. The 'Blog' section includes 'Get Involved: Climate Choices Issue Guide' dated April 18, 2016, with a 'Read more >>' link. At the bottom, there is an 'Educational Resources' section with tabs for 'Visuals', 'Videos', 'Demos & Experiments', and 'Interactive Tools'. The 'Visuals' tab is active, showing two resources: 'Earth's Changing Climates' and 'Why fly south? How climate change alters the phenology of plants and animals'. The 'Earth's Changing Climates' resource includes a thumbnail image and a description: 'In this activity, students are guided through graphs of surface air temperature anomaly data and Vostok ice core data to illustrate how scientists use these data to develop the basis for modeling how climate is likely to change in the future.' The 'Why fly south?' resource includes a description: 'This activity introduces students to plotting and analyzing phenology data. Students use 30 years of data that shows the date of the first lilac bloom and the number of days of ice cover...

The screenshot shows the Climate.gov website with the following elements:

- Header:** NOAA Climate.gov logo with the tagline "science & information for a climate-smart nation". Navigation tabs include "News & Features", "Maps & Data", "Teaching Climate" (highlighted), "About", "Contact", "FAQs", "Site Map", and "What's New?". A search bar is located in the top right.
- Secondary Navigation:** A row of topic-based links: "Reviewed resources for teaching about climate and energy", "Climate Systems", "Causes of Climate Change", "Measuring & Modeling Climate", "Climate Impacts", "Human Responses to Climate", and "Nature of Climate Science".
- Featured Resources:** A section titled "Featured Resources" with a grid of 4 items. The first item is "Introduction to CLEAN", a webinar series from February 6, 2020, featuring a globe and "#TEACH4CLIMATE" logo. Other items include "Climate Literacy Guide", "The UC Berkeley Understanding Global Change Project and CLEAN", and "National Climate Assessment Teaching Resources".
- Teaching Climate Literacy:** A section with a "Climate Literacy Guide" resource, described as a complex topic with various approaches.
- Professional Development:** A section featuring "The UC Berkeley Understanding Global Change Project and CLEAN" webinar series.
- Search:** A search bar with a "Grade Level" dropdown menu (set to "- Any -") and a "Find Resources" button. Below it, it says "Reviewed learning activities from cleanet.org".
- National Climate Assessment Teaching Resources:** A section with a "National Climate Assessment Teaching Resources" resource, described as a series of guides for educators.
- Climate Youth Engagement:** A section with "Case Studies" (describing youth programming models) and "Events" (including "2018 Native Youth Community Adaptation and Leadership Congress" and "Our Time to Lead: Youth Engagement on Climate Change").
- Educational Resources:** A section with tabs for "Visuals", "Videos", "Demos & Experiments", and "Interactive Tools". It features two resources: "Earth's Changing Climates" (a graph-based activity) and "Why fly south? How climate change alters the phenology of plants and animals" (a phenology data activity).

Menu of topics

Timely / featured content

Climate Literacy Guide

Search CLEAN catalog

Teaching climate based on NCA

Youth engagement projects

Related education resources

Reviewed resources for teaching about climate and energy

[Climate Systems](#)

[Causes of Climate Change](#)

[Measuring & Modeling Climate](#)

[Climate Impacts](#)

[Human Responses to Climate](#)

[Nature of Climate Science](#)

Home » Teaching Climate » Resources and Tools

Educational Resources: Search the CLEAN Collection

Find and download scientifically and pedagogically reviewed digital resources for teaching about climate's influence on you and society and your influence on climate.

72 Results for

Apply



Why is Carbon an Important Element?

Students explore the carbon cycle and the relationship between atmospheric carbon dioxide concentrations and temperature. Students create and compare graphs of carbon dioxide and temperature data from one local (Mauna Loa, Hawaii) meteorological station and one NASA global data set. These graphs, as well as a global vegetation map and an atmospheric wind circulation patterns diagram, are used as evidence to support the scientific claims they develop through their analysis and interpretation.



Scales and Processes of the Global Carbon Cycle

This static visualization shows that the global carbon cycle is determined by the interactions of climate, the environment, and Earth's living systems at many levels, from molecular to global.



Using the Carbon Cycle Interactive Game in the Classroom

In this activity, students learn how carbon cycles through the Earth system by playing an online game.



Capturing Carbon

This PBS video shows how Klaus Lackner, a geophysicist at Columbia University, is trying to tackle the problem of rising atmospheric CO₂ levels by using an idea inspired by his daughter's 8th-grade science fair project. The video examines the idea of pulling CO₂ out of the atmosphere via a passive chemical process.

Filter your results [Clear all](#) [X](#)

Educational Resource Type

- Multimedia (40)
- Learning Activities (26)
- Demos & Experiments (11)
- Interactive Tools (5)

Climate Topics

- Climate System (64)
- Causes of Climate Change (22)
- Measuring and Modeling Climate (20)
- Climate Impacts (11)
- Energy Use (6)
- Human Responses to Climate (3)
- Nature of Climate Science (3)

Grade Level

- Intermediate (3-5) (6)
- Middle (6-8) (54)
- High School (9-12) (66)
- College Lower (13-14) (39)
- College Upper (15-16) (15)
- Informal (6)

Climate Literacy Principles

- Climate change has consequences (12)
- Climate is complex (65)
- Climate is variable (18)
- Humans affect climate (16)
- Humans can take action (8)
- Life affects climate; climate affects life (22)
- Our understanding of climate (19)
- Sun is primary energy (6)

Search term

Result set

Filter by metadata categories

Using the Carbon Cycle Interactive Game in the Classroom

Website preview

In this activity, students learn how carbon cycles through the Earth system by playing an online game.

Go To:

http://www.windows.ucar.edu/tour/link=/teacher_resources/teach_carbongame.html

Lisa Gardiner
Julia Genyuk
Windows to the Universe

Credits

Direct link



Notes From Our Reviewers

The CLEAN collection is hand-picked and rigorously reviewed for scientific effectiveness. Read what our review team had to say about this resource by [how CLEAN reviews teaching materials](#)

Information to guide educators

Teaching Tips

About the Science

About the Pedagogy

Technical Details

Very simplified description of the carbon cycle, with concepts possibly being oversimplified. Numbers listed in the interactive should be checked by an expert, especially as the increase of CO2 is likely higher now.

Comment from expert scientist: The game provides a very nice and fun approach to understand all compartments of Earth where carbon is stored and cycled and how these parts interact with each other. The provided links give age-appropriate information to understand additional concepts.

Topics:

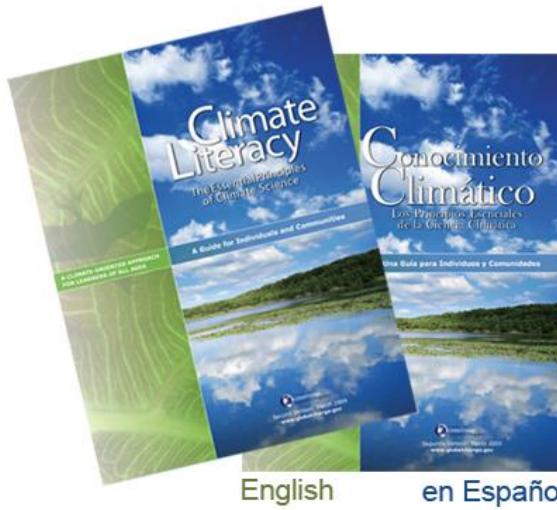
Sources and Sinks
Carbon Cycle

Grade Level:

Middle (6-8)
High School (9-12)
Intermediate (3-5)

Contextual metadata

Home » Teaching Climate » The Essential Principles of Climate Literacy



English en Español

Teaching Climate Literacy

- The Essential Principles of Climate Literacy
- What is Climate Science Literacy?
- GP. Humans can take action
- 1. Sun is primary energy
- 2. Climate is complex
- 3. Life affects climate; climate affects life
- 4. Climate is variable
- 5. Our understanding of climate
- 6. Humans affect climate
- 7. Climate change has consequences
- Partnership with CLEAN collection
- Climate Youth Engagement

Share This 109

A guidebook defining climate literacy for educators, in PDF format in English & Spanish

(see also the Energy Literacy Guide)

The Essential Principles of Climate Literacy

Climate Literacy: The Essential Principles of Climate Science presents information that is deemed important for individuals and communities to know and understand about Earth's climate, impacts of climate change, and approaches to adaptation or mitigation. Principles in the guide can serve as discussion starters or launching points for scientific inquiry. The guide aims to promote greater *climate science literacy* by providing this educational framework of principles and concepts. The guide can also serve educators who teach climate science as a way to meet content standards in their science curricula.

Teaching Climate

Climate science and energy are complex topics, with rapidly developing science and technology and the potential for controversy. How can educators effectively bring these important subjects into their classrooms? There are many ways to approach climate and energy depending on the grade level, course topics and instructional method. Yet no matter the pedagogic setting, using a literacy-based approach can provide a sound foundation to build learners' understanding of these topics.

The Teaching Climate section will support the [Next Generation Science Standards](#) (NGSS) implementation through an integrated Earth system science approach in K-12 education.

Landing pages summarizing the essential principles & fundamental concepts of climate literacy

Home » Teaching Climate » Climate Youth Engagement



Climate Youth Engagement

Society needs citizens who understand the climate system and know how to apply that knowledge in their careers and in their engagement as active members of their communities. (USGCRP Climate Literacy, 2009)

As part of the White House Climate Education and Literacy Initiative (CELI), launched in December 2014 to connect students and citizens with the best-available, science-based information about climate change new collaborations were formed focused on youth engagement on climate change.

Youth and educators are asked to join the conversation at #Youth4Climate from November 12th to December 12th, 2015 as part of the COP21 conference in Paris. All major events can be found [here](#).

Teaching Climate Literacy

The Essential Principles of Climate Literacy

What is Climate Science Literacy?

GP. Humans can take action

1. Sun is primary energy
2. Climate is complex
3. Life affects climate; climate affects life
4. Climate is variable
5. Our understanding of climate
6. Humans affect climate
7. Climate change has consequences

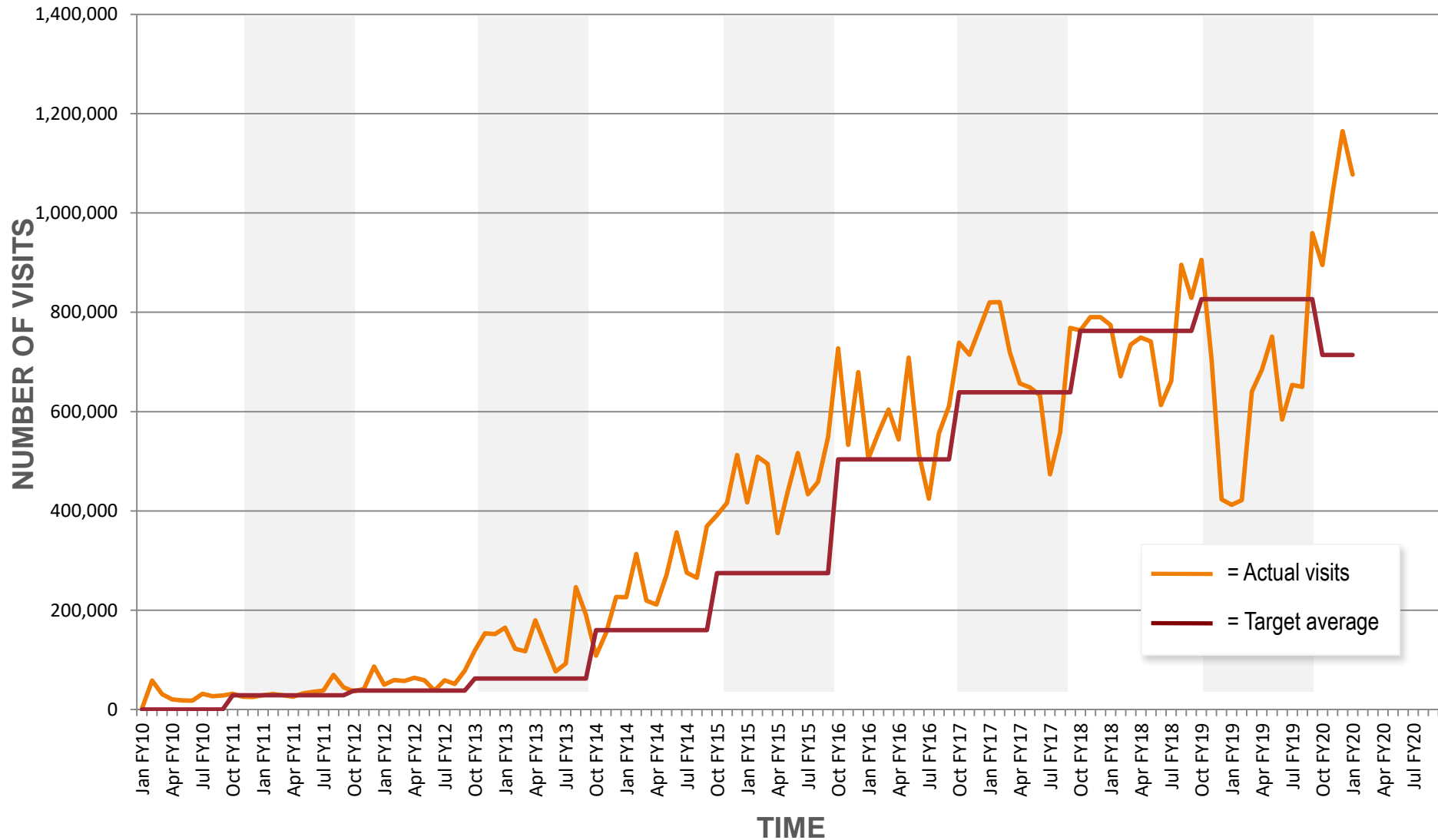
Partnership with CLEAN collection

Climate Youth Engagement

Share This [f](#) [t](#) [v](#) [e](#) [+](#) 4

Success Metrics

Climate.gov growth in **visits** compared to **target**



Measuring 'Quality of Relationship' (QoR)

Awareness:

Do our target audiences know that NOAA Climate.gov exists and what climate science data, information, and services we provide?

Trust:

Our audiences' perceptions of the site's accuracy, credibility, and authority.

Satisfaction:

Our audiences' perceptions of the site's relevance, reliability, & completeness.

Usability & Use:

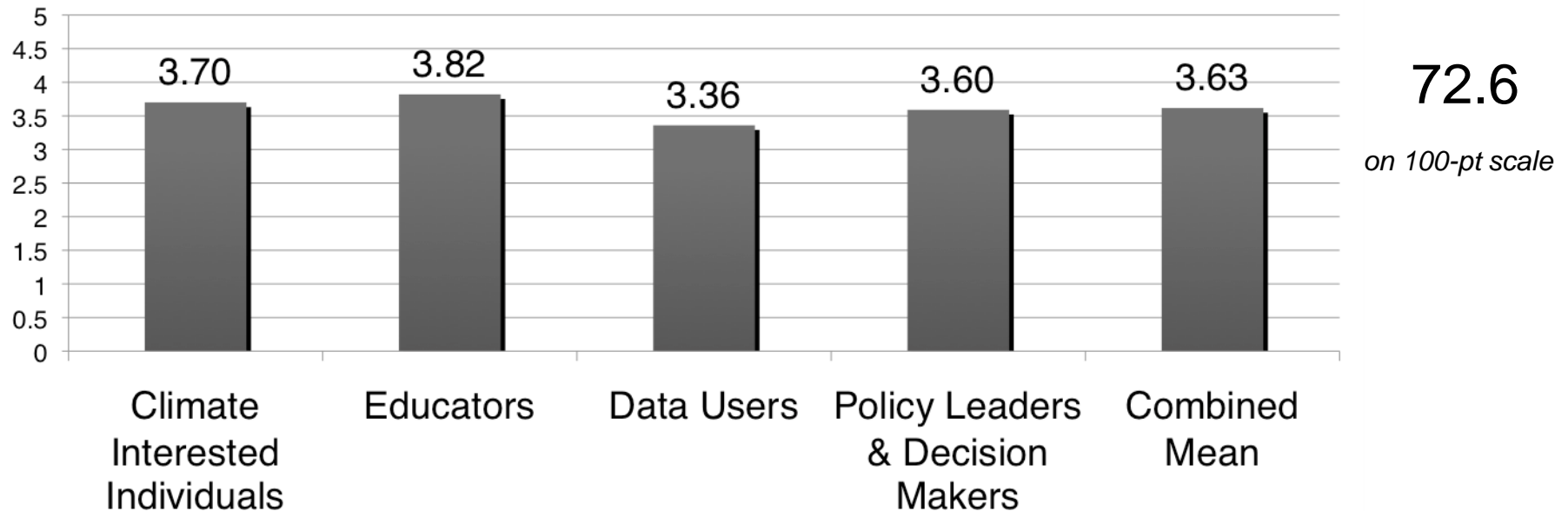
How easy is it to use Climate.gov? How useful are our resources? Are our resources being used? If not, why not? And, if so, how often / how widely?

Control Mutuality:

Do users perceive they can ask questions, offer criticisms, &/or recommendations and get a timely response? Do they perceive opportunities for 2-way interactions? Do they feel they can influence us as much as we influence them?

Our first QoR Score in 2011: 3.63* (72.6)

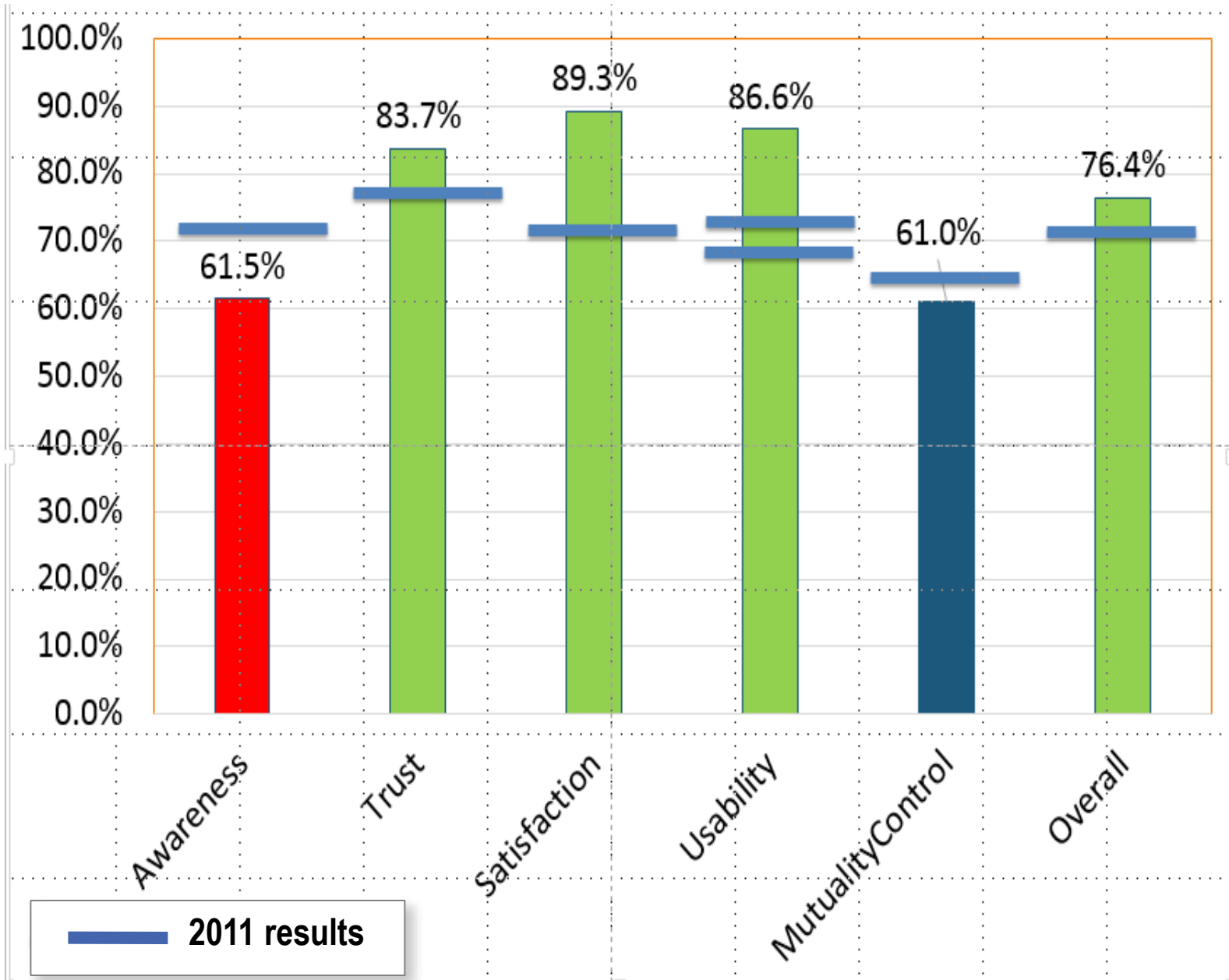
**Survey Score by Target Audience
and Combined Mean**



*Scale of 1 to 5, n=525, based on five core questions common to all target audiences that measure functionality *and* quality of relationship. (71% survey completion rate)

Survey conducted and published by Margaret Mooney & Jean Phillips, U. of Wisconsin-Madison, in 2011.

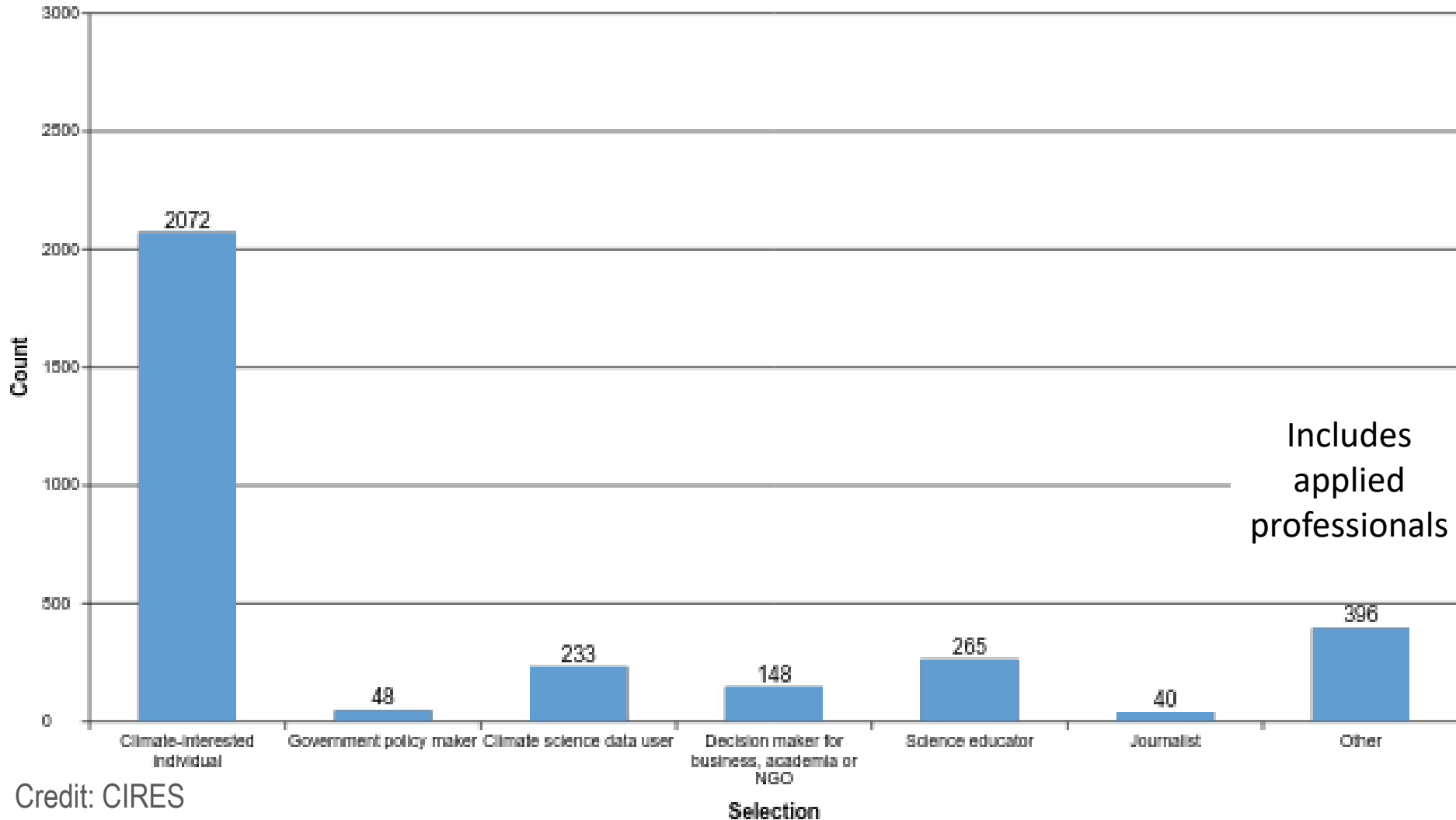
Our first QoR Score in 2015: 3.82 (76.4)



Credits: Susan Sullivan et al., CIRCES
Cooperative Institute for Research in the environmental Sciences

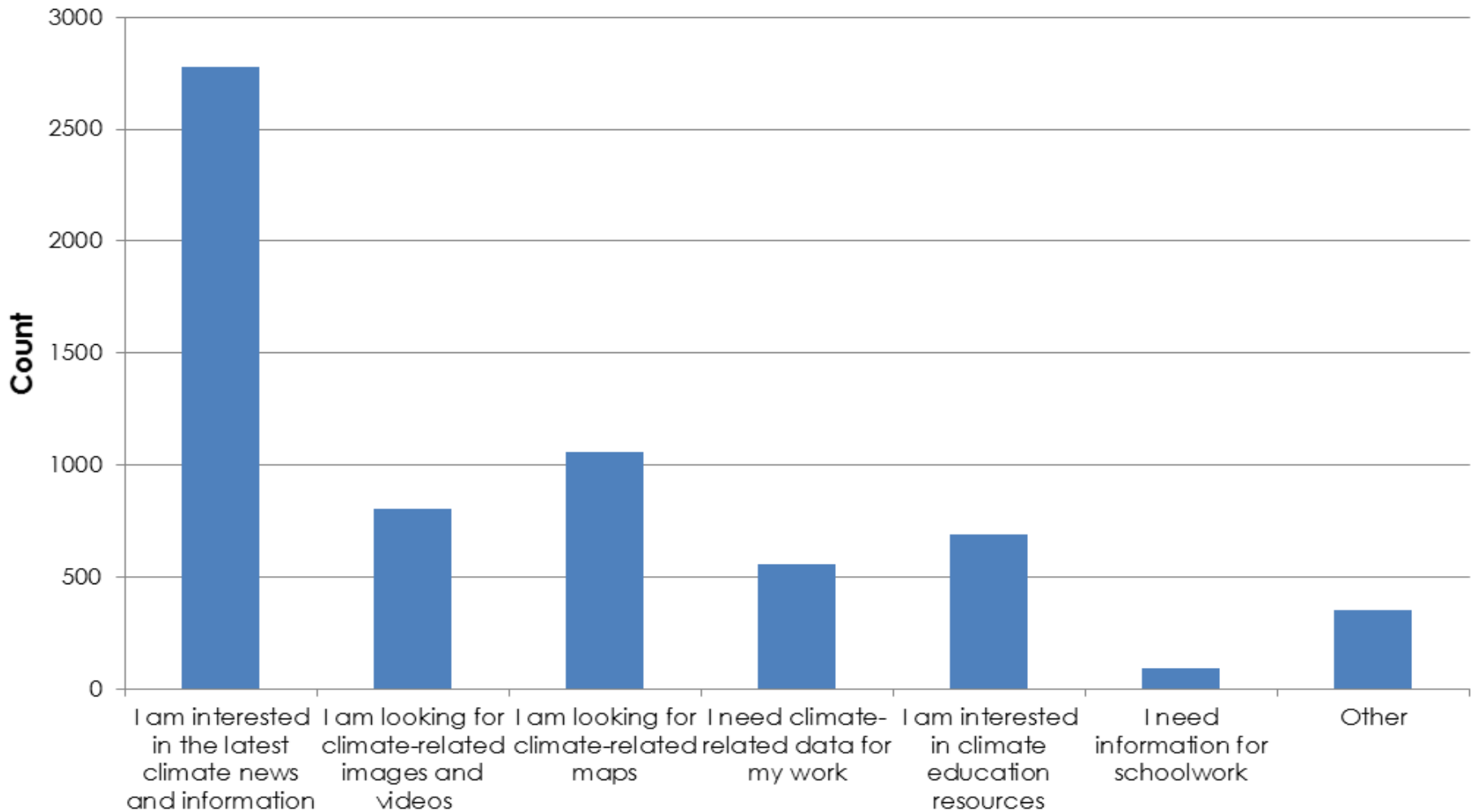
The majority of visitors (64%) identify themselves as “climate-interested public”

Which of the following best describes you? n=3227



The majority of visitors seek News & Features

What are your reasons for visiting Climate.gov? (select all that apply)



Credit: CIRES

Selection

Lessons Learned & Next Steps

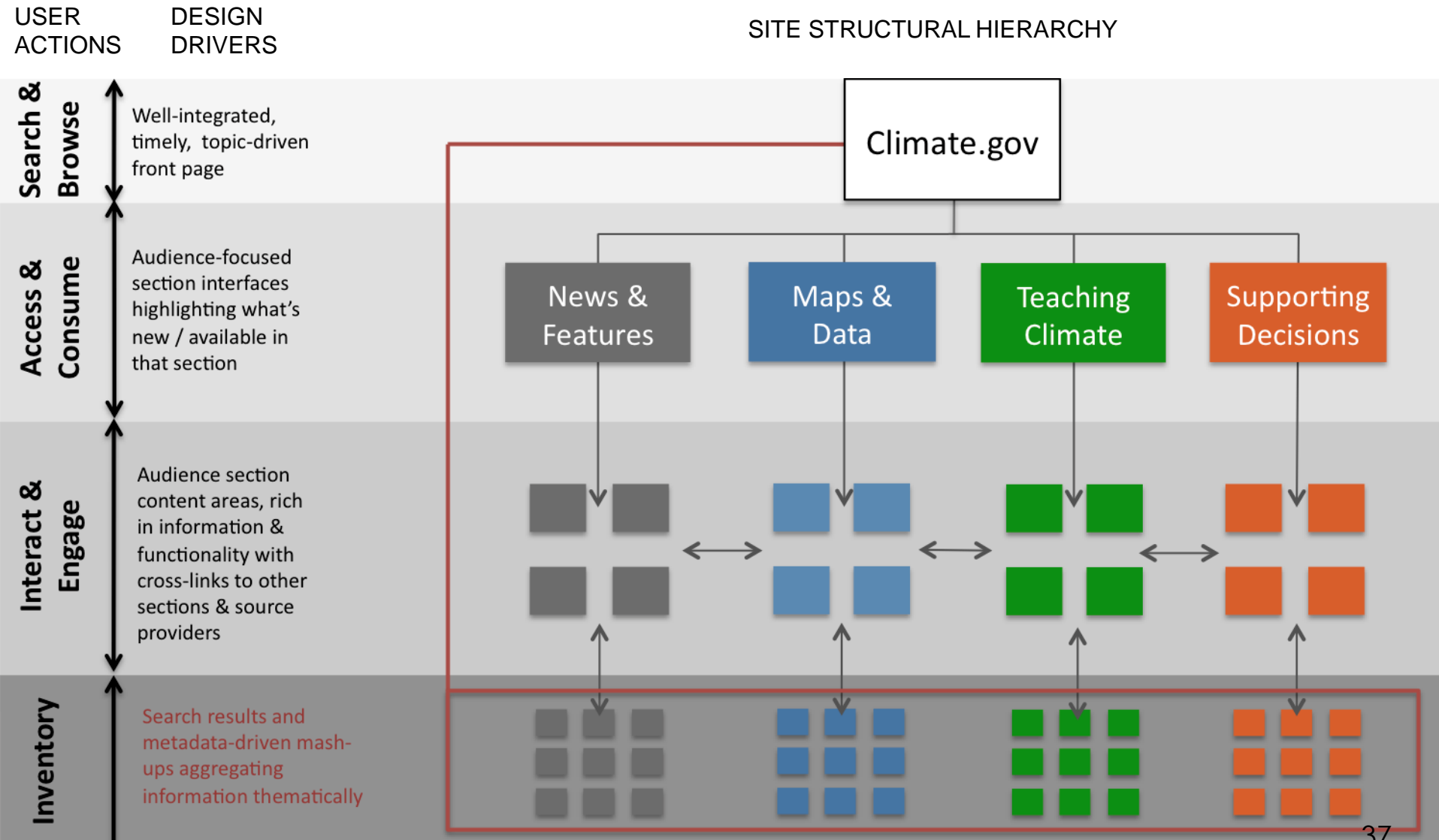
Eight key lessons learned

1. **We must focus & streamline due to limited resources** — prioritize and align content and design better with our audiences' interests & motivations.
2. **Our current audience-focused design isn't optimal** — our current section bins and navigation pathways don't match well with most users' mental models, thus a design change is needed.
3. **The 'why' trumps the 'who'** — people are motivated seekers of information, focused more on why they came to the site than they are on their profession or identity. Similarly, other evidence suggests 'where' trumps 'what'.
4. **Most people come *initially* seeking timely & topical info** — a majority of our visitors are “climate-interested public” and so timely & topical content should be made most prominent.

Eight key lessons learned

- 5. Our audience-focused hypothesis wasn't entirely wrong** — people can be further characterized by particular facets of interest (where, what, who, & how), but it takes purposeful relationship building to increase dwell time and motivate deeper dives.
- 6. Context and effective cross-linking are key** — people expect content to be grouped within the context of whatever topic page they're on, thus we need better cross-linking & integration.
- 7. We must become mobile-device friendly** — Most web users today are on a mobile device; plus we lose status in popular search engines if we don't make this change.
- 8. Site (re)design & development must become quick & nimble** — Massive, year-long projects are unwieldy & overwhelming. Expand our design and dev capacity so we can do small-scale draft-to-deployment sprints in 2- to 4-week “sprints”.

Phase 2 Climate.gov site structural hierarchy



Phase 3 site structure & navigational hierarchy

DESCRIPTIVE INFO

SITE STRUCTURAL HIERARCHY

News & Features:
timely & topical info for
climate-interested public

Audience-focused
sections highlighting
unique contents &
functionality

Section content areas, rich
in information &
functionality with cross-
links & out-links

Users can move thru the
site to upstream info &
data providers

