The Nature Conservancy
Protecting nature. Preserving life.™

Temperature Projections For the 50 US States over the Next 100 years: An Analysis Based on Data Contained in the Climate Wizard Interactive Tool

Introduction

While science irrefutably tells us that the world's climate is changing, the on-the-ground impacts of those changes are not well understood by many Americans. Even less understood by many is how those changes will directly impact their states, neighborhoods and own backyards.

Much of today's scientific data on climate change is inaccessible not only to average Americans, but also to land managers, policy makers and others who are responsible for developing and implementing plans on the local level aimed at combating climate change. There are relatively few tools that translate cutting-edge climate science and climate-model simulations into a form that people can use at local or regional scales.

To help average Americans, policy makers and other local stakeholders better understand how climate change will directly impact their states, The Nature Conservancy has analyzed the latest and most comprehensive scientific data available to calculate specific temperature projections for each of the 50 US states over the next 100 years.

The Nature Conservancy also worked with the University of Washington and the University of Southern Mississippi to develop a new on-line tool that combines the latest scientific data and climate models with geographic information systems (GIS), statistical analysis and web-based mapping services. This tool, Climate Wizard (www.climatewizard.org), represents the first time ever that the full range of climate history and future projections for specific landscapes and time frames have been brought together in a user-friendly format that is available to a mass audience.

Methodology and Results

Analyzing data from global climate models compiled for the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, The Nature Conservancy found that over the next 100 years states across the country could experience average annual temperature increases ranging from nearly 3 degrees F to more than 10 degrees F.

The Nature Conservancy with support from the University of Washington analyzed the IPCC data under three different greenhouse gas emissions scenarios: a global curbing in the rate of emissions released into the atmosphere each year over the next century (B1 scenario), a mid-21st century leveling-off of emissions (A1B scenario), and a continual increasing in the rate of emissions over the next century (A2 scenario).

All three scenarios are feasible based on past and current emission trends.

In 1990, carbon dioxide concentrations in the atmosphere were 354 parts per million (ppm) and increased at a rate of 1.3 ppm per year until reaching a level of 367 ppm in 2000. Between 2000 and today, carbon dioxide concentrations increased at a rate of 2.44 ppm per year until their current level of 389 ppm.

If emissions continue at that current rate, carbon dioxide concentrations will be 609 ppm by the end of the century. However, as demonstrated by the 1990s emission rate nearly doubling in the following decade, the rate of emissions will likely continue to increase over the next 100 years. Growing populations, industrialization and deforestation around the world also make it likely that emission rates will rapidly increase over the next century.

Scenario B1 assumes a decrease in emission rates over the next century for a total concentration of 538ppm by 2100. Scenario A1B assumes a gradual leveling off of emission rates for a total concentration of 711ppm and scenario A2 assumes an increase in emission rates for concentrations of 857ppm by 2100. [1]

The largest temperature increases were projected under the A2 scenario with some states having annual temperature increases of more than 10 degrees F. Even under the lowest B1 emission scenario, nearly every state is projected to experience temperature increases well above the 3.6 degrees F (2 degrees C) threshold many scientists say will cause irreversible impacts to the Earth's lands, waters, wildlife and human communities.

The projected annual temperature increases for each state were derived from an average of the daily mean temperatures for each month as projected by 16 of the general circulation models used in the IPCC fourth assessment report[1].

Those monthly projections can be found on Climate Wizard (www.climatewizard.org), the new web tool developed by The Nature Conservancy, the University of Washington and the University of Southern Mississippi.

---

[1] IPCC (2007) Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M et al., editors. Cambridge, United Kingdom and New York, NY, USA.: Cambridge University Press.

Climate Wizard combines the data in the IPCC climate models with maps from geographic information systems (GIS), allowing users to zero in on specific areas around the world to quickly see how temperatures and precipitation will change in the coming years under different emission scenarios. Climate Wizard also allows users to see how temperatures and precipitation have changed over the last 50 years.

Climate Wizard provides policy makers, land managers and the general public simple analyses and graphical depictions of how climate has, and is projected, to change within specific geographic locations throughout the world.

Climate Wizard will be continually updated to reflect the latest scientific research and data, including projections of future impacts to hydrology, soil moisture, wildfire, vegetation, marine conditions, disease, and agricultural productivity.

The Nature Conservancy worked with some of the country's leading research institutes to compile the historic climate data and future projection models contained in Climate Wizard and used to develop the state temperature projections.

The PRISM Group of Oregon State University provided data on historic temperature and precipitation changes for the United States over the past 50 years. Historical data for international countries was provided by the Climatic Research Unit and the Tyndall Centre.

Future climate projections for the United States were derived from Lawrence Livermore National Laboratory (LLNL), Reclamation, and Santa Clara University downscaled climate projections derived from the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) Coupled Model Intercomparison Project phase 3 (CMIP3) multi-model dataset. The international climate projections were downscaled by the US Forest Service at the Forestry Sciences Laboratory, Corvallis, Oregon using climate data also from the CMIP3 dataset.

Increase in average annual temperature, in degrees Fahrenheit, by 2100. Ranked from highest to lowest change under the high A2 Emission Scenario

	State Name	A2 Emission Scenario	A1B Emission Scenario	B1 Emission Scenario
1	Kansas	10.4	9.1	6.7
2	Nebraska	10.3	9.4	6.9
3	Iowa	10.2	9.4	7.0
4	South Dakota	10.0	9.3	6.9
5	Oklahoma	9.9	8.7	6.4
6	Missouri	9.9	9.2	6.8
7	Illinois	9.6	9.1	6.6
8	Nevada	9.4	8.6	6.5
9	Utah	9.4	8.3	6.5
10	Colorado	9.3	8.0	6.3
11	North Dakota	9.3	9.0	6.7
12	Minnesota	9.3	8.7	6.4
13	Wyoming	9.2	8.4	6.3
14	Arkansas	9.2	8.7	6.4
15	Texas	9.2	7.9	5.9
16	Indiana	9.2	8.9	6.1
17	Wisconsin	9.1	8.5	6.3
18	Idaho	9.0	8.5	6.3
19	Ohio	9.0	8.9	6.0
20	Vermont	8.9	9.1	6.5
21	Montana	8.9	8.7	6.4
22	New Hampshire	8.8	9.0	6.5
23	Kentucky	8.8	8.6	5.9
24	New York	8.8	9.0	6.6
25	Pennsylvania	8.7	8.9	6.1
26	Maine	8.7	8.7	6.2
27	Mississippi	8.6	8.1	5.3
28	New Mexico	8.6	7.3	6.0
29	West Virginia	8.6	8.3	5.7
30	Tennessee	8.6	8.3	5.9
31	Arizona	8.5	7.4	6.0
32	California	8.5	7.8	5.9
33	Louisiana	8.4	7.6	4.9
34	Oregon	8.4	7.9	6.0
35	Michigan	8.4	8.3	6.2
36	Alabama	8.4	7.7	5.0
37	Alaska	8.3	7.7	5.2
38	Massachusetts	8.2	8.4	6.2
39	New Jersey	8.2	8.4	5.8
40	Georgia	8.1	7.6	4.9
41	Virginia	8.1	7.9	5.3
42	Connecticut	8.0	8.2	6.1
43	Maryland	7.9	8.1	5.5
44	Washington	7.8	7.8	5.7
45	Rhode Island	7.7	7.9	5.9
46	North Carolina	7.7	7.4	4.9
47	South Carolina	7.6	7.4	4.9
48	Delaware	7.6	7.9	5.4
49	Florida	6.7	6.5	4.2
50	Hawaii	4.9	4.0	2.8

Average Annual Temperature Increase in º F by 2100