

Understanding and Assessing Climate Change: Preparing for Nebraska's Future

2024 Climate Change Impact Assessment Report Chapter 1 - Introduction



Chapter 1

Introduction

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Goals of this report

1. Understand Nebraska's climate variability.
2. Provide evidence-based science to support decision-making.
3. Inform policies, plans, and programs that promote action and build resilience to climate impacts.

About this report

Background

The Institute of Agriculture and Natural Resources (IANR) commissioned the first edition, **Understanding and Assessing Climate Change: Implications for Nebraska** (Bathke et al., 2014), to evaluate and summarize the existing scientific literature on our changing climate. Scientists from IANR's School of Natural Resources and the Department of Earth and Atmospheric Sciences produced a timely and seminal reference for state and local policymakers, government agency leaders, private industry, and citizens of the state of Nebraska. This report was notable in being the first state-level climate change report for Nebraska and among the first in the central United States.

The 2014 report was based on the findings of the Intergovernmental Panel on Climate Change (IPCC, 2014) and the Third National Climate Assessment (Melillo et al., 2014). Scientists interpreted findings from these reports to highlight observed and projected changes in temperature and precipitation for Nebraska. Additionally, subject-matter experts prepared commentaries to address the implications of these changes on sectors of importance to Nebraska. This report also included explanations related to understanding the causes of climate change, how scientists separate natural and human influences on climate, projecting future climate with global climate models, and achieving scientific consensus.

In 2022, the Nebraska Legislature passed LB1255 (2022), introduced by Senators Bostar and Flood, which authorized and distributed funding to UNL IANR to develop an update to the 2014 report. As specified in LB1255, UNL contracted with a third-party, science-based organization to identify and recommend specific prescriptive measures to be taken by the State of Nebraska relating to this report. Working with our state legislative contacts, the IANR and UNL liaisons, and the advisory panel report, we identified Pale Blue Dot, a firm in Maplewood, Minnesota. Pale Blue Dot has provided climate and sustainability planning and consulting services to nearly 150 communities and organizations across the United States, including the City of Omaha.

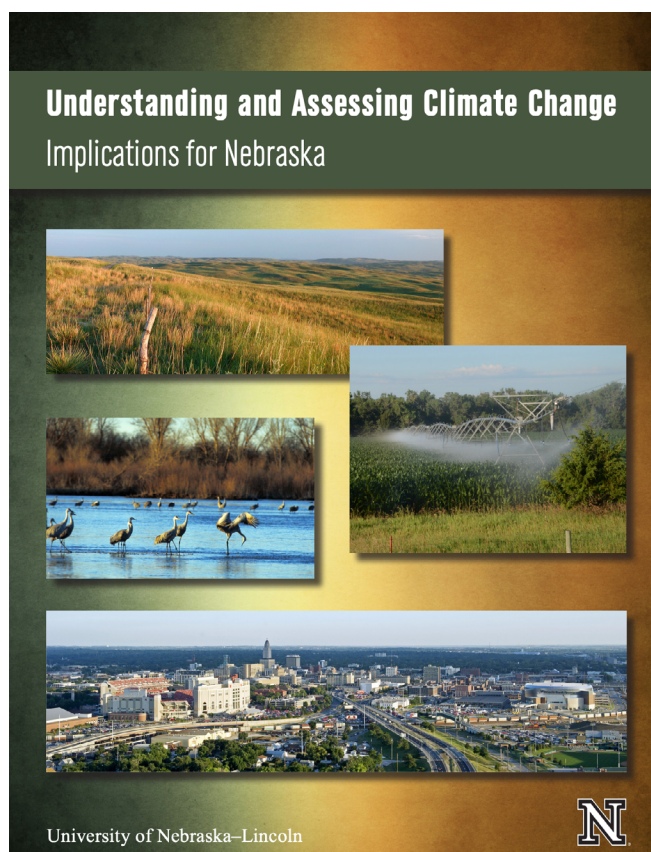


Figure 1.1. *Understanding and Assessing Climate Change: Implications for Nebraska* (Bathke et al., 2014)

Approach

Our approach for this report included a multidisciplinary team from the University of Nebraska-Lincoln, the University of Nebraska Medical Center, Creighton University, the Nebraska Indian Community College, and the USGS Nebraska Cooperative Fish and Wildlife Research Unit. This team analyzed and synthesized data, peer-reviewed literature, and other information to identify observed changes in Nebraska's climate, evaluate future climate projections, and assess the impacts of climate change on key sectors in Nebraska. An advisory panel, consisting mainly of UNL center directors, guided the activities of the writing team. University and federal government experts and our advisory panel reviewed the report.

For this second edition, our key objective remains the same as its predecessor—describing recent trends in Nebraska's climate and interpreting the model-based

projections of future climate. We delve more deeply into the effects of climate change by summarizing the latest science on sector impacts, identifying gaps in knowledge, and highlighting management, adaptation, and policy options. While these options can have benefits, they can burden others. We include new chapters on climate justice, equity, and Indigenous communities to ensure that future actions consider the trade-offs and societal impacts. Finally, we include an assessment of survey data and information about Nebraskans' beliefs and attitudes. Like the 2014 report, many analyses in this assessment are based on published scientific literature, including the most recent NCA and IPCC reports (Box 1.1). This update also includes original data analyses, downscaled model output, and survey data to provide specific information for Nebraska. We have omitted in-depth information related to the causes of climate change. Reputable climate scientists worldwide continue to be in near unanimous agreement (greater than 99%)

that human influences have warmed the atmosphere, oceans, and land. Furthermore, the speed of the changing climate exceeds what can be attributed to natural variability (Lynas et al., 2021). The most recent IPCC (Chen et al., 2021) states the following:

Since systematic scientific assessments began in the 1970s, the influence of human activity on the warming of the climate system has evolved from theory to established fact.

Preparing for Nebraska's future must include climate change mitigation, adaptation, and resilience (Box 1.2). The future climate depends on the choices that we, as a society, make today. Without mitigation actions, the risks of intensifying extreme weather and harmful climate impacts will continue to grow and lead to more damage and economic losses to the state (USGCRP, 2023). Statewide climate planning efforts through the Nebraska Department of Environment

Box 1.1. The National Climate Assessment and the Intergovernmental Panel on Climate Change

National and international groups regularly assess the state of the science of climate change. These include the following:

The National Climate Assessment (NCA) is the federal government's report on climate change impacts, risks, and responses (USGCRP, 2023). Congressionally mandated under the U.S. Global Change Research Program, NCA reports are due to Congress and the president "not less frequently than every four years." These reports integrate scientific information from multiple sources and sectors to highlight key findings and significant knowledge gaps related to the climate's current status, observed changes, and projected future trends. NCA reports are used by national, state, and local governments, citizens, communities, and businesses to create climate resilience and sustainability plans. The most recent assessment, NCA5, released in November 2023, can be found at <https://nca2023.globalchange.gov>.

The Intergovernmental Panel on Climate Change (IPCC) is a global scientific body created by the United Nations to assess the science of climate change drivers, impacts, and future risks and how adaptation and mitigation measures can reduce those risks (IPCC, 2024). For the assessment reports, thousands of experts from 195 member nations assess and summarize the scientific papers published yearly. These reports aim to provide policymakers at all levels with the scientific information needed to develop climate policies. It does not create or enforce policy but is the key source of authoritative knowledge on the causes and effects of climate change and helps inform international climate change negotiations and agreements. The most recent IPCC reports can be found at <https://www.ipcc.ch/about>.

and Energy (NDEE) focus on implementing mitigation actions that target climate change (NDEE, 2024b). By also highlighting strategies to build resilience, reduce vulnerability through adaptation, and reflect on policy options, this report will supplement the NDEE efforts. While this report provides a scientific basis to help us understand and assess climate change in Nebraska, time and resource constraints made it impossible to include all relevant topics, sectors of the state's economy, and the assessment of specific local vulnerabilities. Other climate planning efforts address mitigation efforts, local vulnerabilities, and other sectors of Nebraska's economy (e.g., City of Lincoln, 2021; City of Omaha, 2024).

Guide to this report

Intended audience

This report synthesizes scientific information and evaluates the state of the science on climate change to inform a broad audience of decision-makers across the state of Nebraska. These decision-makers include state, local, and Tribal governments, city planners, public health officials, natural resource managers, utility providers, business owners, agricultural producers, community organizers, educators, students, the media, and concerned individuals who need to make decisions about the climate impacts they are facing. Hopefully, this report will lead to increased awareness and the initiation of actions that will enable Nebraskans to prepare for and adapt to future changes in our climate.

This assessment relies on the expert judgment of the report authors, advisory panel, and reviewers to determine what topics were included in each chapter, to describe what we know and where uncertainties remain, and to communicate the risks, responses, and opportunities associated with climate change. We view this assessment as a living document that will evolve as new knowledge becomes available. Any amendments or additions will be available on the Nebraska State Climate Office website at <https://nsco.unl.edu>.

Structure and format

Components of this report include the following:

Key messages related to this report are summarized at the beginning of each chapter and in the Executive Summary that precedes Chapter 1. Key messages, identified by chapter authors, convey the main idea or points that the author wants readers to understand and remember.

Physical science chapters: Chapter 2, "Climate Change Contexts," discusses global and national climate change and how those changes relate to what we see in Nebraska. Chapter 3, "Observed Changes in Nebraska's Climate," and Chapter 4, "Projections of Nebraska's Future Climate," assess how Nebraska's temperature, precipitation, and extreme events have changed in the past and are projected to change in the future.

Focused topic chapters: Chapters 5 through 14 summarize current and future risks related to climate change and discuss what options reduce those risks for selected sectors of Nebraska. This report builds on the range of topics covered in the 2014 report by adding three new chapters: Indigenous Peoples (Chapter 11), Climate Justice and Equity (Chapter 12), and Nebraskans' beliefs and attitudes toward climate change (Chapters 13 and 14).

Information boxes contain examples, expand ideas, or highlight important information from the main text.

Confidence and likelihood: As with national and international assessments (Box 1.1), chapter authors use specific terms to communicate information about scientific confidence and certainty associated with important findings, observations, and projections (Box 1.2).

Next steps include activities planned for 2025 to increase the report's accessibility and promote public engagement and outreach around climate resilience (Chapter 15).

Supplemental report: Prepared by paleBluedot and Emmons & Olivier Resources, Inc., the supplemental report includes **opportunities for mitigation, adaptation, and resilience climate risk assessments** to help individuals, communities, and the State of Nebraska increase climate resiliency. It also includes a risk assessment and a summary of the impacts of each focused topic.

Appendices: The appendices contain supplementary materials that describe the authors' qualifications

(Appendix A), technical data or survey instruments that support chapter findings (Appendix B), and a complete list of the plans and documents reviewed in the supplemental report (Appendix C).

References: A complete list of the works cited throughout this report.

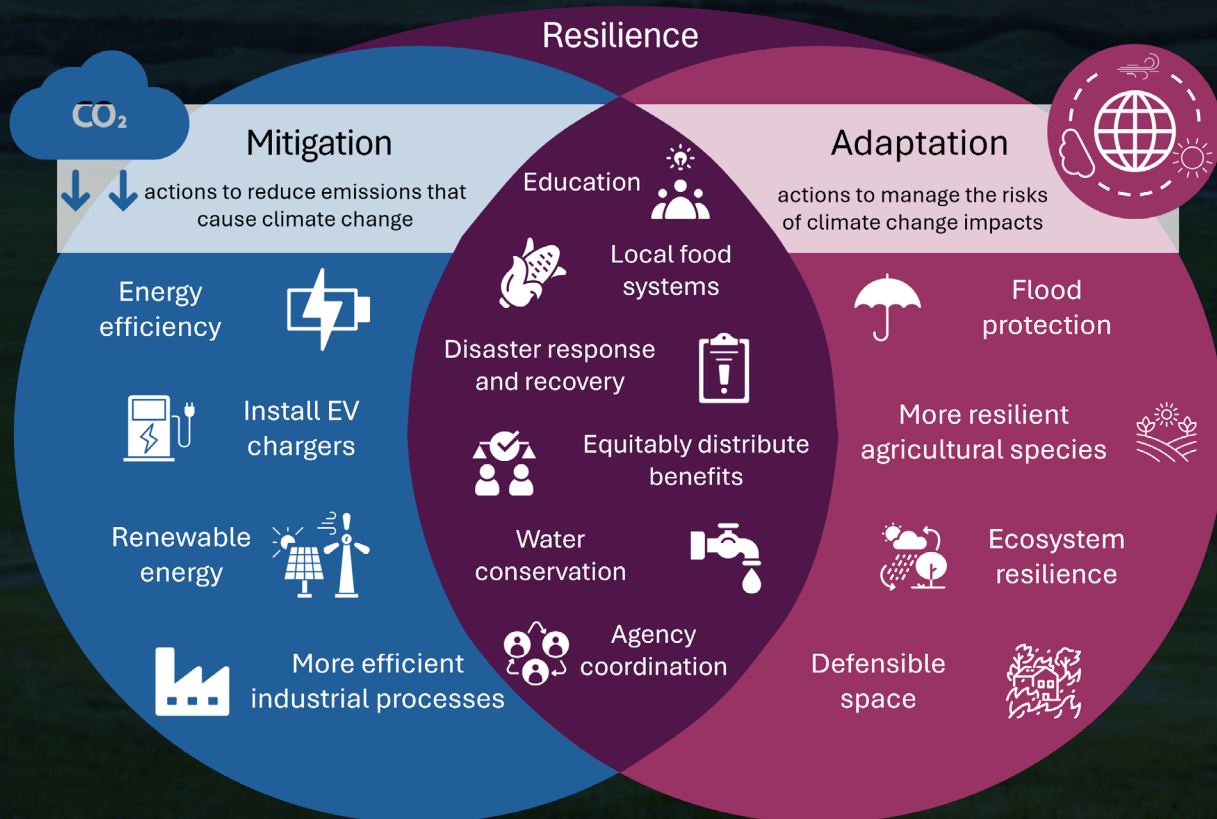
Box 1.2. Mitigation, adaptation, and resilience

Climate change is not only a threat to future generations; it is here and now. The planet is warming faster than predicted, and we are seeing the impacts of human-caused warming. Tackling current effects and preparing for future impacts requires three related strategies.

Mitigation: Efforts to reduce or prevent the flow of heat-trapping greenhouse gases into the atmosphere either by reducing sources of these gases or enhancing the “sinks” that capture and store these gases. Mitigation aims to limit the rate and magnitude of future climate change.

Adaptation: Actions that prepare for or adjust to climate change’s current or expected impacts. Adaptation goals include reducing the risks from the harmful effects of climate change and making the most of any potential benefits or opportunities.

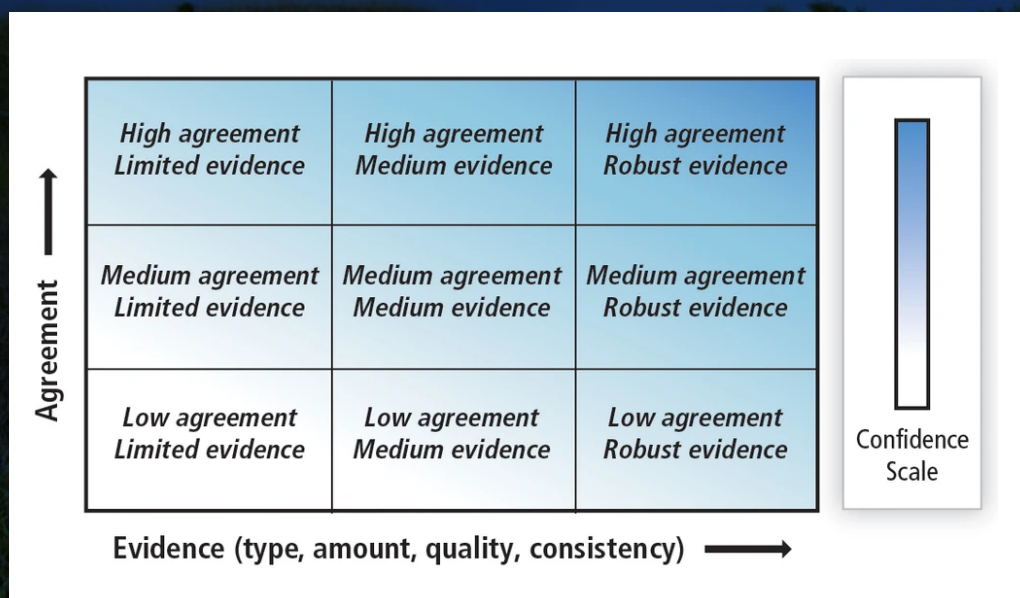
Resilience: Coping and managing the impacts of climate change while preventing them from worsening.



Venn diagram showing the relationship between climate mitigation, adaptation, and resilience. Some actions support either mitigation or adaptation goals, while a subset can address both. After Rabinowitz et al. (2023).

Box 1.3. Confidence and likelihood

Confidence refers to the degree of certainty researchers have in a result's accuracy and reliability. It is built upon factors such as the amount, quality, strength, and consistency of evidence that supports a finding, the robustness of the methods to detect, evaluate, attribute, and interpret climate trends, and the degree of agreement across scientific information sources (Figure 1.2).



A depiction of evidence and agreement statements and their relationship to confidence. Confidence increases toward the top-right corner as suggested by the increasing strength of shading. Generally, evidence is most robust when there are multiple, consistent independent lines of high-quality evidence. (Source: Mastrandrea et al., 2010)

The **likelihood** of a finding is based on a statistical analysis of observed or projected results or the authors' expert judgment based on their assessment of scientific information across varying sources (Table 1.1).

TERM	LIKELIHOOD OF OUTCOME
Virtually certain	99%–100% probability
Very likely	90%–100% probability
Likely	66%–100% probability
About as unlikely as not	33%–66% probability
Unlikely	0%–33% probability
Very unlikely	1%–10% probability

Likelihood scale
(Source: Mastrandrea et al., 2010)