

THE REPORT OF THE COLORADO LOCAL RESILIENCE PROJECT



Convened by
The Colorado Climate Network and
The Colorado Municipal League

April 2015

**Colorado
Climate
Network**
supporting local programs

CML
COLORADO MUNICIPAL LEAGUE
The Voice of Colorado's Cities and Towns

THE REPORT OF THE COLORADO LOCAL RESILIENCE PROJECT

By representatives of

El Paso County, City and County of Denver,
Jefferson County Open Space, City of Colorado Springs,
Larimer County, Boulder County, Douglas County,
Pueblo County, City of Lakewood, City of Fort Collins,
City of Arvada, City of Westminster, City of Boulder,
City of Longmont, City and County of Broomfield,
Eagle County, City of Golden, Pitkin County,
City of Durango, City of Steamboat Springs,
San Miguel County, City of Aspen, Town of Carbondale,
Town of Estes Park, Town of Vail, Town of Breckenridge,
Town of Frisco, Town of Telluride, Town of Nederland,
Town of Dillon, Boulder Valley School District,
High Country Conservation Center, Poudre Fire Authority,
Southwest Colorado Council of Governments, and
Tri-County Health Department

Convened by

The Colorado Climate Network and
The Colorado Municipal League

Edited by

Stephen Saunders and Tom Easley

April 2015



The Colorado Climate Network

The Colorado Climate Network supports efforts by local governments and allied organizations in Colorado to reduce and adapt to climate change. The Network is administered on behalf of its members by the Rocky Mountain Climate Organization.

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The Colorado Municipal League

The Colorado Municipal League is a nonprofit, nonpartisan organization providing services and resources to assist municipal officials in managing their governments and serving the cities and towns of Colorado.

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EXECUTIVE SUMMARY

This report of the Colorado Local Resilience Project expresses the consensus views of 78 of us, project participants representing 30 local governments and six other related local organizations, convened by the Colorado Climate Project and the Colorado Municipal League. Our conclusions and recommendations identify what can be done to make our state's communities more resilient to climate-change-related risks.

In Colorado, there is growing awareness of those risks. In recent years, Coloradans have personally experienced unusually hot and dry conditions, severe wildfires and floods, and widespread infestations of tree-killing beetles. A growing number of government and scientific reports link these and other developments to climate change and project even greater impacts in the future. This project was prompted by that growing awareness of our climate-related risks.

Local governments have a unique and crucial role in addressing climate-related risks, just as they do in facing any other local risks that could threaten the safety and prosperity of their communities and residents. The type of local risks posed by climate change may be new. But local government action to reduce local risks has been important for as long as we have had local government.

This report outlines a path forward in how Colorado local governments can make our communities more resilient to the climate-related risks we face. The report is a call for action, beginning with a call for more local governments to take action in their own communities to improve their local resilience. Even more, though, our conclusions and recommendations focus on what local governments can do by working together, and on the partnerships we need with the state and federal governments and others to be effective in our climate preparedness actions. Climate-related risks do not respect governmental boundaries, and coordinated actions among local governments and with other levels of government will be essential to improve the resilience of Colorado's communities.

Preparedness actions also must involve coordination among the public and private sectors, because businesses, nonprofit organizations, stakeholders, scientific experts, and individual citizens must all come together to make our state more resilient to climate-related risks.

The scope of our project is limited to actions to prepare for and address climate-related risks, not actions to reduce the emissions that are changing the climate. The report addresses the full spectrum of climate-related risks, with the primary exception being those related to water supply and use, which are already being considered by other parties in other contexts (see the text box on page 18). In fact, initiatives already underway to address Colorado's climate change/water risks offer an important model of the actions needed to address climate-related risks in other sectors. This report is designed, in part, to stimulate those comparable actions across the full spectrum of climate-related risks that Colorado communities face.

The core of our report is comprised of 42 items, including six overarching statements and 36 recommendations.

OVERARCHING STATEMENTS

We make six overarching statements—conclusions about fundamental principles that should guide local climate preparedness actions in Colorado.

- Climate change poses major risks to Colorado, and preparedness actions can reduce those risks. (Item 1 in the report)
- We emphasize the importance of reducing emissions of heat-trapping gases enough to avoid the most severe potential impacts of climate change. (Item 2)
- Local governments have essential and unique roles in preparing for and managing the risks posed by climate change, and it is important that they act to improve the resilience of local

-
- communities and resources. (Item 3)
 - Climate preparedness actions need to be targeted to reduce risks to particularly vulnerable people. (Item 4)
 - Climate preparedness actions have many co-benefits. (Item 5)
 - Local governments in Colorado need additional information, technical assistance, funding, and other resources to help them better manage the new risks posed by climate change. (Item 6)

RECOMMENDATIONS

We recommend the following 36 actions, arranged in four categories:

Assessing, Planning, and Managing for Resilience

- That Colorado local governments assess their local climate-related risks and undertake preparedness planning and management actions to improve resilience in their communities. (Item 7)
- That local governments collaborate with one another when appropriate in assessing, planning for, and managing climate-related risks. (Item 8)
- That collaborative efforts among local governments include regional collaboration among neighboring jurisdictions within particular areas of the state. These regional efforts usually will be more effective if they involve partnerships not only among local governments but also with other levels of government and other organizations. (Item 9)
- That local governments collaborate with the state and federal governments to coordinate the climate preparedness actions taken at the different levels of government. (Item 10)
- That local governments collaborate with businesses, nonprofit organizations, and other entities in developing and implementing climate preparedness actions. (Item 11)
- That local governments draw on experts to help shape local preparedness actions. (Item 12)
- That the state government establish an ongoing process to assess in detail Colorado's climate-related risks. (Item 13)
- That the Colorado state government prepare a comprehensive state-government-wide preparedness plan. (Item 14)
- That the state government consider climate-related risks in major and/or systemic decisions (including planning, policy, management, and spending decisions) that could affect or be affected by climate-related risks. (Item 15)
- That the scope of state and local emergency plans be broadened to encompass the full range of climate-related risks that could lead to future natural-hazard emergencies. (Item 16)
- That the state and local governments work to ensure food security in Colorado. (Item 17)
- That eight additional sector-specific actions be taken. (Items 18–25)

Developing and Sharing Information

- That the Colorado state government, the Colorado Climate Network, and/or another entity catalogue and distribute information to help local governments develop and implement effective

“Across the western United States, we are already experiencing the adverse impacts of climate change on our environment, infrastructure, economies, and communities. Clearly, we must implement new management strategies to build a resilient West.”

*Arnold Schwarzenegger, Governor of California, and
Bill Richardson, Governor of New Mexico*

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- preparedness actions. (Item 26)
 - That, as one method of distributing information, there be created and maintained a single, comprehensive online clearinghouse of information on climate change, climate impacts, and climate actions in Colorado, for the use of local governments and others. (Item 27)
 - That there be a statewide climate change preparedness conference to engage participants from local governments, the private sector, nonprofit organizations, and others with responsibilities for resilience actions, on what they can do to improve resilience in Colorado. (Item 28)
 - That three additional sector-specific actions be taken. (Items 29–31)

Engaging the Public and Stakeholders

- That Colorado-specific background and messaging materials on climate-related risks and preparedness be developed to be adapted and used by local governments. (Item 32)
- That local governments work with the state government and others in engaging with stakeholders, other organizations, and the public to increase awareness of climate-related risks and to help bring about community-wide preparedness actions. (Item 33)
- That one additional sector-specific action be taken. (Item 34)

Building Capacity

- That, to enable local governments to afford new climate preparedness activities, local governments work with one another and with the state and federal governments, the private sector, private foundations, and others, so that local actions are highly cost-effective; support allocations of public and private funds to help local governments meet unfunded local needs; and seek to obtain such funds to help meet unfunded local needs. (Item 35)
- That the state government and other organizations provide technical assistance and information to help local governments, related organizations, and private individuals increase their capacity to manage the risks posed by climate change. (Item 36)
- That the Colorado state government elevate the priority, funding, and staffing devoted to climate preparedness. (Item 37)
- That the state government establish mobile disaster response teams to provide recovery assistance to communities in Colorado. (Item 38)
- That five additional sector-specific actions be taken. (Items 39–43)

“Anticipating and planning for these impacts now can reduce the harm and long-term costs of climate change to communities. Decisions made today about where and how communities grow, the infrastructure they build, and the codes and standards they adopt will affect them long into the future, so decision-makers must take climate change into account as they plan.”

*State, Local, and Tribal Leaders Task Force on
Climate Preparedness and Resilience*

INTRODUCTION

This report of the Colorado Local Resilience Project expresses the consensus views of 78 of us, representing 30 local governments and six other related local organizations, convened by the Colorado Climate Network and the Colorado Municipal League. Our conclusions and recommendations identify what can be done to make Colorado communities more resilient to climate-change-related risks.

In Colorado, there is growing awareness of those risks. In recent years, Coloradans have personally experienced unusually hot and dry conditions, severe wildfires and floods, and widespread infestations of tree-killing beetles. A growing number of government and scientific reports link these and other developments to climate change and project even greater impacts in the future. (See the section on Colorado's climate-related risks, on page 4.)

This project was prompted by that growing awareness of our climate-related risks. It also builds on many recent developments:

- the work of several local governments in Colorado to assess and address their local climate-related risks (see the text box on page 11), and the interest of many additional local governments in what they, too, can do;
- work in recent years by the Colorado Water Conservation Board, the Interbasin Compact Committee, and others in the water community in considering climate-related risks to Colorado's water sector, which serves as a model for similar work in other sectors (see the text box on page 18);
- a 2011 state-government-commissioned Colorado Climate Preparedness Project report by the Western Water Assessment program at the University of Colorado Boulder, which provides a catalog of climate impacts and adaptation activities and options in five sectors: water; wildlife, ecosystems, and forests; electricity; agriculture; and outdoor recreation;¹
- legislation enacted by the Colorado General Assembly in 2013, House Bill 13-1293, which "declares that climate change presents serious, diverse, and ongoing issues for the state's people, economy, and environment," and directs the governor and others to take actions including "collaboration with other entities regarding climate change preparedness studies" and making annual reports to the General Assembly on "proposals to prepare the state for the effects of climate change;"²
- the White House's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, comprised of 26 governors, mayors, county officials, and tribal leaders who in 2014 made recommendations to the President on how the federal government can better support local climate preparedness actions (see the text boxes on the next page and on page 30);³ and
- a 2015 state government-commissioned *Colorado Climate Change Vulnerability Study* by the University of Colorado Boulder and Colorado State University, which is a compilation of existing information on climate-related risks in the state.⁴

Local governments have a unique and crucial role in addressing climate-related risks, just as they do in facing any other local risks that could threaten the safety and prosperity of their communities and residents. The type of local risks posed by climate change may be new. But local government action to reduce local risks has been important for as long as we have had local government.

This report outlines a path forward in how Colorado local governments can make our communities more resilient to the climate-related risks we face. The report is a call for action, beginning with a call for more local governments to take action in their own communities to improve their local resilience. Even more, though, our conclusions and recommendations focus on what local governments can do by working together, and on the partnerships we need with the state and federal governments and others to be effective in addressing climate-related risks, which do not respect governmental boundaries. Collaborative, coordinated actions among local governments and other levels of government will be essential to make our communities resilient.

Preparedness actions also must involve coordination between the public and private sectors, because businesses, nonprofit organizations, stakeholders, scientific experts, and individual citizens all have a stake in our future, and contributions from all are needed to help achieve a better future.

We recognize and welcome that the federal government is expressing a desire and willingness to partner with local and state governments in climate preparedness actions. One important manifestation of this is the White House's task force on climate preparedness and resilience. (Fort Collins Mayor Karen Weitkunat, a task force member, is also a participant in this Local Resilience Project.)

The federal government's interest in partnering with local and state governments on climate preparedness is especially important in Colorado, where the federal government owns 35 percent of all land—and twice as much of all forested land, where many climate-related impacts occur. Through this report, local governments in Colorado express our interest in coordinating with the federal government.

The scope of our project is limited to actions to prepare for and address climate-related risks, not actions to reduce the emissions that are changing the climate. These two types of actions have been called two sides of the same coin, and often actions have the dual benefits of both addressing climate-related risks and reducing climate change itself. For example, curtailing emissions from motor vehicles reduces the climate-related risk of increased levels of ground-level ozone, more of which forms with high temperatures—and the curtailed emissions also reduce levels of heat-trapping gases that change the climate. Similarly, better building energy efficiency reduces the climate-related risk of overloading the electricity grid during heat waves and causing blackouts—and the energy efficiency also reduces heat-trapping gases and climate change.

This is why climate preparedness and emission reductions are sometimes called two sides of a single coin. By focusing primarily on climate preparedness, we are not overlooking the need for climate protection actions. In fact, we emphasize the importance of reducing emissions to limit climate change impacts (see item 2 under Conclusions and Recommendations).

This report addresses the full spectrum of climate-related risks, with the primary exception being those related to water supply and use, which are already being considered by other parties in other contexts. In fact, initiatives already underway to address Colorado's climate change/water risks offer an important model of the actions needed to address climate-related risks in other sectors (see the text box on page 18). This report is designed, in part, to stimulate those comparable actions across the full spectrum of climate-related risks that Colorado communities face.

In preparing this report, we recognize that new funding will be needed to carry out many of the actions identified here. We recommended only those actions that we considered to be important enough to warrant seeking new funding to carry out. The last category of our recommendations identifies ways to build new capacity.

State, Local, and Tribal Leaders Task Force On Climate Preparedness and Resilience

A White House State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience recommended to the President in 2014 how the federal government can help communities deal with climate-related risks.⁵ The recommendations are based on five overarching principles:

- requiring consideration of climate-related risks as part of all federal policies, practices, investments, and regulatory and other programs;
- maximizing opportunities to take actions that have dual-benefits of increasing community resilience and reducing greenhouse gas emissions;
- strengthening coordination and partnerships among federal agencies, and across federal, state, local, and tribal jurisdictions and economic sectors;
- providing actionable data and information on climate change impacts and related tools and assistance to support decision-making; and
- consulting and cooperating with tribes and indigenous communities on all aspects of federal climate preparedness and resilience efforts, and encouraging states and local communities to do the same.

For a summary of the task force's recommendations, see the text box on page 30.

This report was prepared by five work groups, each of which focused primarily on particular subjects: cross-cutting issues, infrastructure, natural resources and outdoor recreation, public health, and wildfire preparedness and recovery. The report is a joint product of all groups, however, as each group reviewed and approved of the entirety of the report. The report reflects the opinions of project participants as individuals, and should not be construed as reflecting the views of the local governments and other organizations we represent. For more details, see the section on our process, on page 35.

A second phase of this project will focus on implementation of the recommendations in this report.

Definitions

In this report, we have used these meanings for the following terms:

- *Climate change*, as defined in a report for the Colorado state government, refers to a persistent change, lasting decades or longer, in the average or range of climate conditions, which could be due to natural climate variability, human-induced changes, or both.⁶
- *Climate-related risks* means the impacts, risks, and vulnerabilities resulting or potentially resulting from climate change. Climate-related risks include risks that arise in part from other causes and may be magnified by climate change.
- *Local governments* means general-purpose local governments (counties, cities, and towns), local public authorities, school districts, special districts, councils of governments, and any other local governmental agencies.
- *Preparedness* means the same as climate change adaptation (an alternative term), which the federal government has defined as “adjusting to a changing climate to minimize negative effects and take advantage of new opportunities.”⁷ As used in this report, “preparedness” refers only to actions with respect to climate-related risks, although those actions may also have the co-benefits of reducing other risks.
- *Resilience* means, as defined in a federal report, “a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.”⁸

COLORADO'S CLIMATE-RELATED RISKS

Many reports document the risks that climate change poses to Colorado. Some of the most significant include:

- a 2014 U.S. government national climate assessment which comprehensively assesses the science of climate change and its impacts across the United States;⁹
- a 2013 regional assessment focused on the six southwestern states of Arizona, California, Colorado, Nevada, New Mexico, and Utah, prepared as an input to the national assessment;¹⁰
- *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation (Second Edition - August 2014)*, a report by the Western Water Assessment program at the University of Colorado Boulder for the Colorado Water Conservation Board, and online supplemental data, summarizing climate science information relevant for management and planning for Colorado's water resources (and also helpful to many others);¹¹ and
- *Colorado Climate Change Vulnerability Study*, a 2015 report by the University of Colorado Boulder and Colorado State University to the Colorado Energy Office, which provides an overview of key vulnerabilities that climate variability and change will pose for Colorado's economy and resources.¹²

These and other reports conclude that:

- Statewide average temperatures are projected to warm by +1.5°F to +4.5°F by 2050 under a scenario with low future emissions of heat-trapping gases, or by +3.5°F to +6.5°F with high future emissions. For later in the century, high emissions are projected to lead to continued further increases, to +5.5°F to +9.5°F. All these values are comparisons to 1971–2000 averages.¹³
- The highest summertime temperatures are projected to increase even more than average temperatures.¹⁴ Both extremely hot days and heat waves could increase in frequency, potentially several-fold if future emissions are high.¹⁵
- Projections for future total annual precipitation vary from decreases of a few percent to increases of a few percent.¹⁶
- Because warmer air can hold more moisture, models project that extreme precipitation events will be augmented, even in areas where total precipitation may decrease.¹⁷ In Colorado, heavy storms may increase in winter but not necessarily in summer.¹⁸
- Most published research suggests that annual streamflows in all of Colorado's river basins could be decreased. Peak streamflows are projected to come earlier in the year, by one to three weeks by mid-century, and late summer flows are projected to decrease.¹⁹
- The frequency and extent of wildfires in Colorado are projected to increase.²⁰ Projections range up to a several-fold increase in area burned annually in the state; however, projections based on statistical models may become less accurate the more that temperatures and other climatic factors change.²¹ An increase in wildfires likely would lead to more destructive flooding, as burned areas are more susceptible to flooding and runoff of sedimentation and debris.²²
- Heat-related illnesses and mortality could increase; air quality could be degraded by increases in ground-level ozone, fine particulates, and airborne allergens; and changes in outbreaks and the spread of infectious diseases could occur, but it is extremely difficult to predict these changes.²³
- Other risks include possible increases in the conditions suitable to outbreaks of tree-killing insects; potentially more frequent losses of crops from increasingly severe future droughts; increased road maintenance needs and road closures from heat-related problems; and adverse effects on skiing from less snow and on rafting, fishing, and other recreation activities from earlier and faster runoff and lower flows.²⁴

Figure 1 below, prepared by the Rocky Mountain Climate Organization, illustrates Colorado's historic statewide temperatures, taken from instrumental readings, and the projected future statewide average temperatures, from the *Climate Change in Colorado* report described on the previous page.

Historical and Projected Colorado Temperatures

Comparisons to 1971–2000 Averages

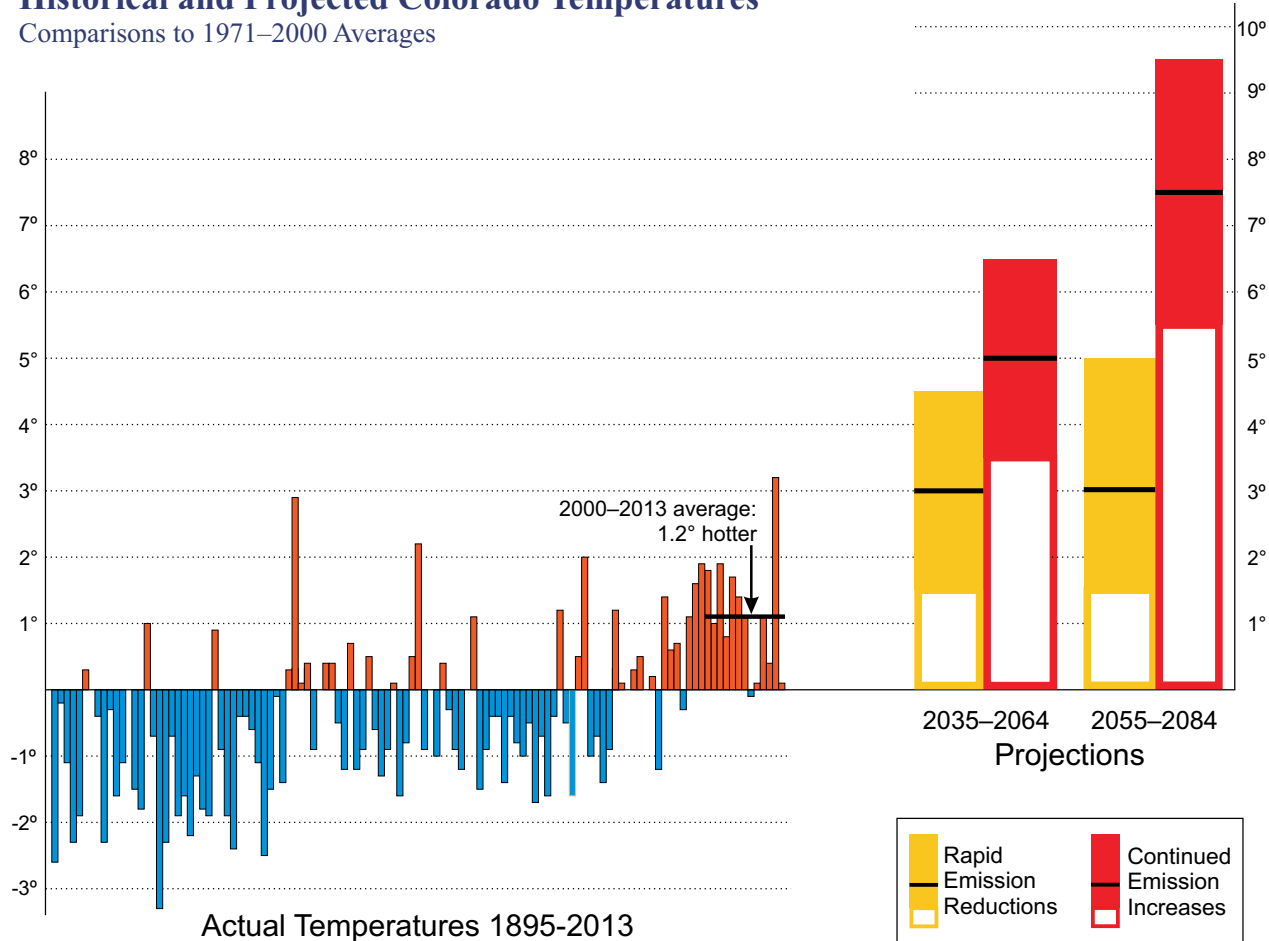


Figure 1. On the left, average statewide Colorado temperatures compared to 1971–2000, in degrees Fahrenheit. Temperatures in 2000–2013 averaged 1.2° higher. On the right, projections of statewide temperatures, again compared to 1971–2000, for two future periods, each with one scenario of rapid reductions in heat-trapping pollution (known as “representative concentration pathway,” or RCP, 2.6) and another of continued increases as in recent years (RCP 8.5). The solid colors show the 10th to the 90th percentiles of projections from 23 climate models for RCP 2.6 and 34 for RCP 8.5, and the black lines show the averages. Historical data from the National Oceanic and Atmospheric Administration, analysis by the Rocky Mountain Climate Organization (RMCO); projections from the Western Water Assessment program, University of Colorado Boulder, using latest-generation Coupled Model Intercomparison Project (CMIP5) models.²⁵ Figure by RMCO.

“The amount of warming projected beyond the next few decades is directly linked to the cumulative global emissions of heat-trapping gases and particles. By the end of this century, a roughly 3°F to 5°F rise is projected under a lower emissions scenario, which would require substantial reductions in emissions, and a 5°F to 10°F rise for a higher emissions scenario assuming continued increases in emissions, predominantly from fossil fuel combustion.”

*Climate Change Impacts in the United States*²⁶

Figure 2 below illustrates changes in extreme temperature, showing historic and projected occurrences of 95° days in Fort Collins, the one Colorado location where the frequency of historic and projected hot days has been studied so far.

Historical and Projected Extreme Heat Annual Number of 95° Days in Fort Collins

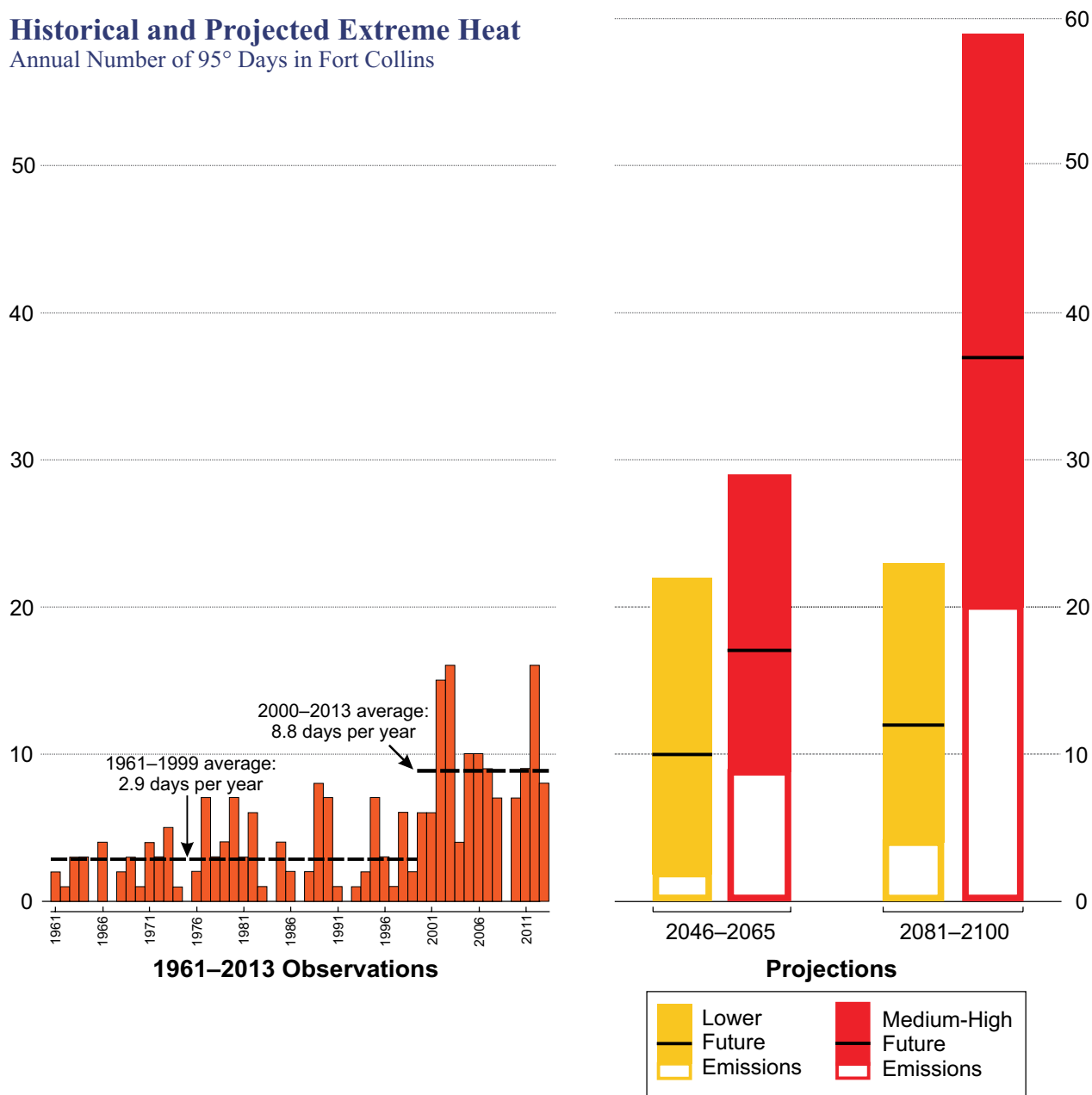


Figure 2. On the left, the number of days per year 95° or hotter in Fort Collins. The average number in 1961–1999 was 2.9 per year, and in 2000–2013 8.8 per year—nearly three times higher. On the right, projections for two future periods, each with one scenario of lower and another of medium-high future emissions. The solid colors show the 10th to the 90th percentiles of 30 projections of annual 95° days for each period/scenario combination, and the black lines the averages. Historic data from the National Oceanic and Atmospheric Administration, projections from previous-generation Coupled Model Intercomparison Project (CMIP3) models; analysis by the Rocky Mountain Climate Organization (RMCO).²⁷ Figure by RMCO.

CONCLUSIONS AND RECOMMENDATIONS

The core of our report is comprised of the following 42 items, including six overarching statements—conclusions about fundamental principles we believe should guide local climate preparedness actions in Colorado—and 36 recommendations, which identify particular actions to be taken.

Each item includes a key statement, in bold, of our overarching statement or recommendation, followed by a statement of explanations, in regular font.

OVERARCHING STATEMENTS

We conclude that:

1. Climate change poses major risks to Colorado, and preparedness actions can reduce those risks.

As documented in many reports and studies, current and projected future climate change poses new risks to the state, with potential impacts to multiple sectors, including the public health, infrastructure, water, ecosystem, outdoor recreation, tourism, agriculture, and energy sectors.

Many climate-related risks involve risks that exist independently of climate change but are magnified by climate change. For example, wildfire risks to people and property in Colorado are already increasing as the number of people living in the wildland-urban interface continues to grow; these risks are further magnified because a hotter, drier climate is projected to increase the number and extent of wildfires.

As a National Academy of Sciences report observed, actions taken now can reduce climate-related risks, while inaction can increase these risks.²⁸

2. We emphasize the importance of reducing emissions of heat-trapping gases enough to avoid the most severe potential impacts of climate change.

If climate change is not sufficiently slowed, the best efforts to prepare for its impacts may be overwhelmed. As the U.S. government's 2014 national climate assessment report concluded, preparedness efforts "will be more difficult, more costly, and less likely to succeed" if future emissions of heat-trapping gases are not significantly reduced.²⁹ In Colorado, the impacts from higher average temperatures and more extreme heat driven by high emissions would be far greater than from those driven by lower emissions (see figures 1 and 2 on pages 5 and 6).

Although global, not local, emissions of heat-trapping gases will determine the future extent of climate change, Colorado can play a nationally and internationally significant leadership role in demonstrating that emissions can be reduced in ways that lead to consumer savings, economic growth, and other benefits.

“Shifts in climate patterns across the state of Colorado are likely to alter the frequency, severity, and location of various disturbances such as fire, insect outbreaks, droughts, and major storms, in addition to the potential for shifting overall precipitation patterns and rising temperatures.”

*Colorado Climate Change Vulnerability Study*³⁰

3. Local governments have essential and unique roles in preparing for and managing the risks posed by climate change, and it is important that they act to improve the resilience of local communities and resources.

Preparing for and managing climate change risks will take action by all levels of government and the private sector, including businesses, nonprofit organizations, individual citizens, and others. Much of the attention on public-sector actions on climate-related risks focuses on what should be done at national and state levels, but each local community faces its own set of climate-related risks that make local actions also essential.

As the National Academy of Sciences has pointed out, climate preparedness is fundamentally a risk-management strategy.³¹ Reducing the unique local risks faced by the residents of a community is a core function of local governments, and the essential nature of that role is true for climate-related risks as well as other local risks. Among the functions of local governments that are especially important in climate preparedness are preparing for, responding to, and recovering from emergencies; land-use planning; managing traffic and transportation; designing, building, and operating transportation systems and other public infrastructure; regulating construction of buildings; managing parks, open space, and outdoor recreation; and protecting public health. Effective local government actions to address climate-related risks in carrying out these local functions is necessary to achieve resilient communities.

Preparedness Reduces Heat Wave Deaths

“Although rarely discussed in Colorado, heat is perhaps the most devastating climate-related public health impact in the country,” according to the *Colorado Climate Change Vulnerability Study*.³² In recent years in the United States, mortality from extreme heat has been greater than from hurricanes, tornadoes, flooding, and many other weather-related causes.³³ Extreme heat can also lead to cramps, heat exhaustion, heat stroke, and other health problems.³⁴ Most vulnerable are young children, older people, those with certain disabilities, the poor, the socially isolated, and the homeless.³⁵

In 1995, Chicago suffered an extreme heat wave for which the city was not prepared. As one indication of the lack of preparedness and training, in the midst of the heat wave, officials refused to believe that a public health crisis was underway and rejected pleas to activate emergency plans to get more ambulances from neighboring communities. Hospitals were so overwhelmed that 23 closed their emergency rooms to new patients. Altogether, about 700 Chicagoans ended up dying from the heat.³⁶

Following the 1995 disaster, Chicago developed new plans to warn and protect people during extreme heat. In 2012, the city experienced perhaps the most severe heat wave since 1995, but only 18 people died; the city’s preparedness actions were credited with holding down the mortality.³⁷ Other communities have also undertaken local preparedness actions to protect people from extreme heat, and studies show that these programs save lives.³⁸

Colorado has historically been considered less vulnerable to heat waves than most of the country because of our lower humidity and cooler nights. But major increases in the frequency of heat waves and hot days are projected here, especially if future emissions of heat-trapping gases are high (see Figure 2 on page 6).³⁹ Also, a recent analysis for the U.S. government’s national climate assessment shows that across the six-state Southwest (including Colorado), nighttime extreme temperatures are projected to increase more than daytime extremes.⁴⁰

And Colorado may be at more risk because we have not been seen as susceptible to heat waves and so are unprepared. This was the case in Europe in 2003, when about 35,000 people were killed by a heat wave, in large part because both residents and governments were unprepared for such an extreme event. Also, air conditioning was not ubiquitous in Europe—just as it is not in Colorado—and so people had less protection against extreme heat.⁴¹

4. Climate preparedness actions need to be targeted to reduce risks to particularly vulnerable people.

Some Coloradans are more at risk than others to climate change impacts.⁴² For example, climate-related risks to people’s health may be greater for children, the elderly, the sick, lower-income people, and the socially isolated.⁴³ As another example, residents of areas known as the wildland-urban interface are more vulnerable to the threats of wildfires to their personal safety and property than are residents of other areas.⁴⁴ Some local and state government climate preparedness actions should be focused on addressing the needs of such particularly vulnerable populations.

5. Climate preparedness actions have many co-benefits.

Measures to improve climate resilience often generate co-benefits and enhance existing programs, so resilient communities offer a higher quality of life. Preparedness actions to address climate-related risks to energy systems, for example, make energy supplies not only less vulnerable to disruption but usually also less polluting, protecting both people’s health and the climate.

6. Local governments in Colorado need additional information, technical assistance, funding, and other resources to help them better manage the new risks posed by climate change.

Climate-related risks are new, and local preparedness actions will require information, staff expertise and time, capital for investment in more resilient infrastructure, and other new resources. Improving local resilience before impacts materialize, though, can be far more cost-effective than responding to them afterwards. Recent wildfire and flooding disasters in Colorado illustrate how the federal, state, and local costs of recovering from such disasters can be staggering. The costs of recovering from the September 2013 flood along the Front Range have been estimated at \$3 billion. Through effective partnerships, local governments, the state and federal governments, and others can build the needed local capacity to prepare for and manage climate-related risks, improve the resilience of local communities, and potentially avoid greater future costs.

“A resilient community will be able to enjoy economic opportunity, parks, open spaces, recreational activities, and an environment conducive to support residents’ health and well-being.”

Climate Adaptation Plan, City and County of Denver⁴⁵



Courtesy of City and County of Denver

Denver

RECOMMENDATIONS

Our recommendations are arranged in these categories of action:

- Assessing, planning, and managing for resilience (items 7 through 25)
- Developing and sharing Information (26-31)
- Engaging the public and stakeholders (32-34)
- Building capacity (35-42)

Within each category, items are arranged according to whether they apply to all sectors or primarily to a specific, indicated sector, corresponding to the subject matter of one of our project work groups.

We recommend the following actions:

Assessing, Planning, and Managing for Resilience

All Sectors

7. That Colorado local governments assess their local climate-related risks and undertake preparedness planning and management actions to improve resilience in their communities.

The field of climate preparedness is relatively new, but already there are many reports that provide guidance on how to address climate-related risks.⁴⁶ Among the key principles are:

- Managing the risks of climate change will require understanding the ways in which the future may differ from the past. In the water community, this is sometimes expressed as an “end to stationarity,” as the past is not as useful as it used to be in indicating possible future conditions.⁴⁷ The same principle holds true for other sectors, too. For example, when building or rebuilding infrastructure, it is important that the infrastructure be designed and constructed to be resilient in a future with climate change, not merely according to previous standards and expectations.
- Comprehensive planning to address climate-related risks across all sectors can be important. A different approach, incorporating climate-related risks into all relevant planning and management actions—sometimes referred to as “mainstreaming” climate preparedness—is at least as important.
- As climate change does not respect jurisdictional boundaries, coordination among different levels of government and among neighboring jurisdictions is needed. So is collaboration within entire communities—among governments, the scientific community, businesses, nonprofit organizations, particular stakeholders, and citizens.
- There is no single climate preparedness approach that can be prescribed for all communities. The nature of specific local risks should drive local actions, and to address any particular risk a suite of actions usually is more appropriate than a single action.
- Many climate preparedness actions should incorporate adaptive management—monitoring climate change and its impacts, assessing whether preparedness actions are achieving the desired outcomes, and revising those actions as warranted.

“Anticipating and planning for these impacts now can reduce the harm and long-term costs of climate change to communities. Decisions made today about where and how communities grow, the infrastructure they build, and the codes and standards they adopt will affect them long into the future, so decision-makers must take climate change into account as they plan.”

*State, Local, and Tribal Leaders Task Force on
Climate Preparedness and Resilience⁴⁸*

Local Climate Preparedness Actions in Colorado

Several Colorado communities have already taken steps to assess and address their climate-related risks.

Local government efforts in Colorado to assess local climate-related risks include:

- the City of Fort Collins, which has commissioned a *Fort Collins Climate Change Primer* (2013) and an analysis of historic and projected incidents of hot days and heat waves, *Extreme Heat in Fort Collins* (2014) (see Figure 2 on page 6);⁴⁹
- the City of Boulder, which helped arrange a 2009 study of climate-related risks to the city's water supplies;⁵⁰ and
- the City of Aspen, which commissioned a 2006 comprehensive assessment of local climate-related risks and a 2014 update to guide local climate resilience planning.⁵¹

Local government climate preparedness planning efforts include:

- the City and County of Denver's *Climate Adaptation Plan* (2014);⁵²
- a joint effort by Boulder County and the City of Boulder, the *Boulder County Preparedness Plan* (2012);⁵³ and
- efforts now underway by the cities of Golden and Aspen to develop comprehensive local climate preparedness plans.

Denver's adaptation plan illustrates a local comprehensive preparedness plan. To prepare it, participants from across many city departments first assessed the city's vulnerabilities and identified the three most critical local climate-related risks: increase in temperature and urban heat island effects, more frequent extreme weather events, and reduced snowpack and earlier snowmelt. The plan addresses these risks through both short term (over one to two years) activities and longer term activities. Steps Denver will take include:

- **Buildings and energy:** in the short term, reducing energy use in city facilities by 2.5% per square foot over 2011 baseline; then reducing vulnerability to building energy supply disruptions, such as by increasing energy efficiency to reduce the pressure on the grid during extreme heat days;
- **Health and human services:** in the short term, defining extreme heat events and how the Department of Environmental Health will interact with other agencies when they occur; then increasing the number of shelter spaces available to at-risk populations;
- **Land use and transportation:** beginning to update guidelines for the design of city streets to address climate risks; then installing sunlight-reflecting hardscape when resurfacing roads, multi-use paths, and city parking lots;
- **Urban natural resources:** updating the right-of-way tree list to focus on trees that can thrive in future climates; then undertaking an outreach campaign to educate and encourage residents to plant those trees;
- **Water consumption:** requiring low water use plantings in the urban design standards and guidelines for Cherry Creek East, as a potential model for other neighborhoods; then collaborating with Denver Water to pilot a neighbor-to-neighbor comparison of water use on utility bills to encourage residential water conservation; and
- **Food and agriculture:** to ensure adequate local access to food in the case of extreme weather events and prolonged droughts, encouraging a broad range of food outlets and regional food hubs for processing and distributing local food.

8. That local governments collaborate with one another in assessing, planning for, and managing climate-related risks.

Collaborative efforts among local governments can enable them to expand their capability, address regional issues, and achieve greater cost-effectiveness. Collaborative efforts also can lead to consistent and reinforcing approaches to common challenges, avoid duplication among local efforts, and help local governments learn from one another and others.

New efforts, partnerships, and organizations likely will be needed to provide additional opportunities for collaboration on climate resilience. Some existing efforts and organizations already provide some such opportunities, which may need to be expanded. The Colorado Climate Network is one example. Also, five local governments in Colorado are among the 13 local government members from five southwestern states in the Western

Adaptation Alliance, a collaborative effort to enable the rapid development of best practices in the region and build resilient western communities. Although not explicitly or exclusively focused on climate change matters, many other organizations, including statewide organizations such as the Colorado Municipal League and Colorado Counties, Inc., and regional ones such as Colorado's councils of governments and the Boulder County Consortium of Cities, also can provide opportunities for networking and collaboration on climate-related risks and resilience.

9. That collaborative efforts among local governments include regional collaboration among neighboring jurisdictions within particular areas of the state. These regional efforts usually will be more effective if they involve partnerships not only among local governments but also with other levels of government and other organizations.

Collaboration in a particular region of the state among local governments in that region can be especially important and beneficial.

The state government, the Colorado Climate Network, universities, and/or other organizations can play important roles in facilitating regional intergovernmental coordination, such as by providing networking opportunities, workshops, forums and other support for local governments on a sub-state regional basis, so that local governments that share ecosystems, watersheds, transportation or other overlapping infrastructure systems or that have other common interests can work together (and potentially also with federal land management agencies, watershed councils, and others) to identify and consider climate

The Colorado Climate Network

In October 2008, representatives of several local governments decided to form a new Colorado Climate Network (CCN) to support their climate and related programs, and asked the Rocky Mountain Climate Organization, an existing nonprofit organization, to administer the network. The network is open to local governments and related organizations; the Colorado Municipal League, which with CCN convened this Local Resilience Project, is also a network member. The network is guided by a steering committee of representatives of its member organizations.

The network's principal services are the information and opportunities for interaction it offers to its members. Its activities include conferences, workshops, and the development and support of common policy positions by its members. With additional members and additional funding, the network's services and activities could expand and provide more support to more local governments and related organizations.

“Across the western United States, we are already experiencing the adverse impacts of climate change on our environment, infrastructure, economies and communities. Clearly, we must implement new management strategies to build a resilient West.”

*Arnold Schwarzenegger, Governor of California, and
Bill Richardson, Governor of New Mexico⁵⁴*

change information and regional risks, develop better pathways for collaboration to respond to and prepare for future extreme events, and collaborate in other ways.

New regional structures may sometimes be appropriate and helpful to facilitate intergovernmental coordination. One model of a new regional structure would be regional resilience roundtables of diverse stakeholders, similar to the basin roundtables formed under state law to address water resource planning.

Examples of Regional Cooperation

Two recent regional efforts illustrate how local governments and other organizations can collaborate regionally to address climate-related risks.

The *Joint Front Range Climate Change Vulnerability Study* (2012), a report on climate-related water risks, was the product of a collaborative effort among water utilities (Denver Water, Boulder Department of Public Works, City of Aurora Utilities, Colorado Springs Utilities, Fort Collins Utilities, and the Northern Colorado Water Conservation District); the Colorado Water Conservation Board; the Western Water Assessment, a federally funded program at the University of Colorado Boulder; and the Water Research Foundation, a nonprofit organization.⁵⁵ Working together, these organizations developed a process to combine climate models and hydrologic simulations, and used that process to project future streamflow trends under a representative sample of possible climate futures.

The Front Range Fuels Treatment Partnership Roundtable is an alliance of federal, state, and local governments, land management agencies, private landowners, conservation organizations, and other stakeholders collaborating to reduce wildland fire risks through fuels treatment.

These types of regional collaborative efforts will be increasingly important in the future because of the transboundary, multi-jurisdictional nature of climate-related risks.



Jeffrey Boring, Larimer County

Prescribed fire, Larimer County

10. That local governments collaborate with the state and federal governments to coordinate the climate preparedness actions taken at the different levels of government.

This improved coordination could be through interagency work groups or other mechanisms. This intergovernmental coordination could be either sector-specific or comprehensive, promoting collaboration among different governments in their overall approaches to climate-related risks and preparedness actions across all sectors.

In natural resource management, for example, federal, state, and local agencies can do more to share experiences and expertise and to coordinate their management of interrelated lands under different jurisdictions. Participation of federal agencies is important here, as the federal government owns more than 35 percent of Colorado’s lands and 68 percent of Colorado’s forested lands. An example of a risk for which such coordination can be important is in combating invasive species, which can be exacerbated by climate change. Another type of coordination would be identifying opportunities and priorities for connections among habitats (see item 22).

To promote federal-state-local cooperation on climate preparedness, we recommend that the state government and/or relevant organizations monitor federal policies, studies, management actions, and grant and technical assistance programs related to climate resilience, and keep local governments informed on federal actions.

We also recommend that the state government and/or relevant organizations represent Colorado interests (including those of local governments) before federal agencies on their actions related to climate resilience. Coordination among the state government, statewide organizations such as the Colorado Municipal League and Colorado Counties, Inc., and individual local governments that already monitor federal actions is important here.

11. That local governments collaborate with businesses, nonprofit organizations, and other entities in developing and implementing climate preparedness actions.

As the U.S. government’s national climate assessment points out, “a growing number of companies are beginning to actively address risks from climate change” and nonprofit organizations “have been significant actors in the national effort to prepare for climate change by providing assistance that includes planning guidance, implementation tools, contextualized climate information, best practice exchange, and help with bridging the science-policy divide to a wide array of stakeholders.”⁵⁶ Engaging these and other stakeholders which face climate-related risks and can play a role in preparedness actions will increase the likelihood of success of community preparedness actions.

The Fort Collins ClimateWise Program

More than 360 local businesses participate in the ClimateWise program of the City of Fort Collins, a free, voluntary program providing technical assistance, networking opportunities, and other services to help local businesses and other organizations reduce heat-trapping gases. The primary focus of the program is on reducing climate change, not preparedness actions, but many of the program’s accomplishments also increase local resilience to climate-related risks.

Accomplishments since 2000 include:

- 15 million trees planted
- Electric energy savings equivalent to the usage of 7,500 homes
- Natural gas savings equivalent to the usage of 2,100 homes
- Water conservation equivalent to the usage of 14,500 homes
- \$83 million in savings

The participation of so many local businesses and other organizations in this climate program suggests that there could also be extensive engagement of businesses and other stakeholders in community climate preparedness efforts.

12. That local governments draw on experts to help shape local preparedness actions.

Colorado has the advantage of having substantial in-state expertise, in both public and private institutions, across the full range of sectors and scientific fields important to climate preparedness. As stated in the Colorado Climate Preparedness Project report to the state government by the Western Water Assessment program, “Colorado can draw on a unique combination of in-state strengths in climate, energy, and natural resources research and management.”⁵⁷ This unique combination includes the many scientists and other experts in federal agency laboratories and offices (including the National Oceanic and Atmospheric Administration’s Earth System Research Laboratory in Boulder and the Department of Energy’s National Renewable Energy Laboratory in Golden); the National Center for Atmospheric Research; the state’s universities, including the Western Water Assessment program at the University of Colorado Boulder and the North Central Climate Science Center at Colorado State University, both federally funded; and other public and private organizations in Colorado. These experts can play an important role in assisting local governments (and others) in climate preparedness actions. Additional expertise is also available from out-of-state governments, universities, and organizations.

By providing a coordinating role to connect local governments with these experts, the state government, the Colorado Climate Network, and/or other organizations could promote more and better interactions between communities and experts and increase the cost-effectiveness of these interactions, both for local governments and for the experts themselves.

13. That the state government establish an ongoing process to assess in detail Colorado’s climate-related risks.

Continuing efforts by the state government to further identify and assess climate-related risks in Colorado are particularly important to local governments, which have responsibilities for taking actions to improve local resilience and need more information on those risks to guide their actions. A lead role for the state government in providing more detailed assessments is essential, as many communities in Colorado face very similar local risks and the state government can develop the information needed across the state much more comprehensively, cost-effectively, and without redundancies and waste than would be the case if local governments were to attempt to provide their own detailed assessments of climate-related risks in every community. However, opportunities for involvement in designing such a process by local governments and other stakeholders would help to ensure that it produces the information that would be most helpful to decision makers in the state.

This new, ongoing process should build on the *Colorado Climate Change Vulnerability Study* by the University of Colorado Boulder and Colorado State University for the state government (see page 4).

Statewide Vulnerability Assessments

Many other states have taken action to assess their vulnerability to climate-related risks, including:

- California, which has an ongoing statewide vulnerability assessment process, which has included three separate assessments since 2006, with the most recent derived from 30 specific studies;⁵⁸
- Washington State, which commissioned the University of Washington’s Climate Impacts Group to undertake a comprehensive statewide assessment, the *Washington Climate Change Impacts Assessment* (2009);⁵⁹ and
- Wisconsin, which has a state government-university initiative, the Wisconsin Climate Change Initiative, which includes as its centerpiece a single comprehensive, detailed vulnerability assessment, prepared with public and stakeholder input, *Wisconsin’s Changing Climate: Impacts and Adaptation* (2011).⁶⁰

The ongoing process of further assessment of state climate-related risks should:

- address specific risks, such as those facing particular sectors and particular subpopulations of Coloradans;
- include new research and analyses, including analyses of economic impacts of both action and inaction;
- assess risks on a statewide basis, on a local and sub-state basis, and as part of larger multi-state regions;
- include further commissioned work by universities and/or others;
- identify gaps in data and understanding that require further study; and
- include opportunities for stakeholder and public engagement and review.

Examples of the specific information needs that are important to address in this ongoing process of further assessment are:

- more Colorado-specific data and information on wildfire risks, including historic and projected changes in the frequency, extent, and nature of wildfires; population growth in the wildland-urban interface; and social and economic impacts of changes in wildfires;
- analyses of the economics of wildfire preparedness, mitigation, and response, including cost/benefit analyses;
- improvements in capabilities to forecast wildfire occurrence and vulnerabilities, to enable local, state, and federal agencies to better anticipate future needs;
- a centralized repository of consistent landscape-scale datasets on wildlife and ecosystems to promote data coordination and access between government and non-government agencies involved in climate adaptation planning;
- detailed assessments of public health risks from climate change, and of the specific populations that are most at risk;
- effects of changes in both average and extreme climate conditions on infrastructure; and
- effects of higher temperatures on wastewater treatment.

14. That the Colorado state government prepare a comprehensive state-government-wide preparedness plan.

A state-government-wide preparedness plan is needed not only to guide state government actions in addressing statewide climate-related risks but also to provide a conceptual and programmatic framework for consistent, coordinated actions by local governments to address local and sub-state regional risks. It therefore is important that local governments, as well as other stakeholders, have opportunities to contribute to the development of a state government preparedness plan.

House Bill 13-1293, enacted in 2013, requires annual reports to the Colorado General Assembly by the Colorado state government executive branch on the development and periodic update of a climate action plan and collaboration with other entities regarding climate change preparedness studies. State government agencies are now preparing a climate action plan, to address both reductions in heat-trapping gases and climate preparedness.⁶¹ It is not yet clear whether these two components will be combined in a single plan or if there will be a free-standing preparedness plan and a separate, parallel plan addressing emission reductions. However it is structured, the climate preparedness plan should be designed to evolve, according to the principle of adaptive management described in item 7 above.

15. That the state government consider climate-related risks in major and/or systemic decisions (including planning, policy, management, and spending decisions) that could affect or be affected by climate-related risks.

State agencies invariably consider multiple factors in making decisions. If they are not already considering climate-related risks when those risks are relevant, we recommend that they do so for major decisions that could affect or be affected by those risks. The effects of projected changes in both weather extremes and average conditions should be considered, when appropriate.

Preparedness Plans in Other States

In a 2011 Colorado Climate Preparedness Project for the Colorado state government, the Western Water Assessment (WWA) program at the University of Colorado Boulder studied examples of climate preparedness planning in Alaska, California, and Maryland, to provide guidance for the Colorado state government if it decides to initiate a similar effort.⁶² WWA found that preparedness planning in all three states:

- “began with executive or administrative orders by the governor—a strong signal from the chief executive that served to enhance cooperation among state agencies;”
- had separate work groups for different impacts or policy-relevant sectors;
- included “a stakeholder-driven vulnerability assessment;”
- “identified and focused on the highest priority climate impacts,” including those of concern to the state as a whole and to stakeholders; and
- “identified the existing roles and responsibilities of government for each affected resource as well as how to develop adaptation options that were targeted, feasible, and cost-effective.”

The Alaska plan studied by WWA is Alaska’s *Climate Change Strategy: Addressing Impacts in Alaska* (2010).⁶³ The California plan has since been updated, by *Safeguarding California: Reducing Climate Risk: An update to the 2009 California Climate Adaptation Strategy* (2014).⁶⁴ Maryland’s plan is in two parts, phase I (2008) on sea level rise and coastal storms and phase II (2011) on other issues.⁶⁵ Other state government comprehensive preparedness plans include the *Oregon Climate Change Adaptation Framework* (2010) and *Preparing for a Changing Climate: Washington State’s Integrated Climate Response Strategy* (2012).⁶⁶

The *Colorado Climate Change Vulnerability Study* includes a 10-part template that a state agency can use to develop an agency-wide climate preparedness plan, which can be an important framework to guide major and/or systemic agency decisions.⁶⁷ Also, the governor, members of the General Assembly, and other state officials should similarly consider climate-related risks in relevant major decisions.

Examples of agency plans and decisions for which consideration of climate-related risks is important include:

- The Colorado Department of Transportation should consider in its planning, design, maintenance, and other operations climate-related risks, as further explained in item 18 below.
- The Colorado Department of Public Health and Environment (CDPHE) should consider climate-related risks to public health in its studies, plans, and operations. By contrast, for example, CDPHE’s 2013 *Colorado Health and Environmental Assessment*, a broad overview of the factors influencing the health and environment of Coloradans, does not even mention climate change (see also item 25).⁶⁸

Emissions scenarios: We recommend that, in general, in developing or reviewing projections of future climate change, state agencies consider projections based on more than just one scenario of levels of future emissions of heat-trapping gases, as the future levels of such emissions are unknown, different scenarios usually produce a range of possible climate changes and risks (see figures 1 and 2 on pages 5 and 6), and local governments and others benefit from understanding the range of possible changes. Sometimes, however, the projections that are already available are based on only a single emissions scenario, or budget constraints, the time available, or the complexity of secondary analyses based on the climate projections may not allow the consideration of a range of climate projections. In those cases, consideration of only a single scenario may be the best that can be done.

State Government Consideration of Climate Risks

The Colorado Water Conservation Board (CWCB) has commissioned studies of the state's climate-related risks to its water supplies and considered those risks in its plans. These suggest the types of actions that could be undertaken in other sectors. Key CWCB studies and plans include:

- *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation (2014 update)* (see page 4);⁶⁹
- the Colorado River Water Availability Study, a multi-phase report to determine how much water from the Colorado River is available to meet Colorado's future water needs under alternate hydrologies;⁷⁰
- *The Colorado Drought Mitigation and Response Plan (2013 update)*;⁷¹ and
- *Colorado's Water Plan*, currently in draft form and to be completed by December 2015.⁷²

The CWCB also has contributed to the U.S. Bureau of Reclamation's *Colorado River Water Supply and Demand Study (2012)* and the *Joint Front Range Climate Change Vulnerability Study* (see the text box on page 13).⁷³

Colorado Parks and Wildlife, as recommended in guidance by the Association of Fish and Wildlife Agencies, is now considering climate-related risks in its preparation of a new State Wildlife Action Plan. As a foundation for this effort, the agency partnered with the Colorado Natural Heritage Program, North Central Climate Science Center, and the U.S. Geological Survey to prepare and produce a vulnerability assessment of high priority wildlife habitats in the state.⁷⁴

These actions illustrate what other state government agencies could do in other sectors.

16. That the scope of state and local emergency plans be broadened to encompass the full range of climate-related risks that could lead to future natural-hazard emergencies.

Local and state governments are required to do emergency management planning to qualify for Federal Emergency Management Agency (FEMA) hazard mitigation grants. The potential for climate change to increase the risks from extreme storms, floods, wildfires, and heat waves has so far generally been given little or no consideration in those planning processes. FEMA, however, is making changes to add the consideration of climate change as a requirement across the programs it implements. The latest change is a March 2015 update to its guidance for state natural hazard mitigation plans to require, effective in March 2016, state consideration of climate change impacts.⁷⁵ FEMA's guidance for local plans has not yet been similarly updated. Our recommendation is that both local and state emergency planning actions in Colorado incorporate climate-related risks, regardless of FEMA requirements. The Colorado Division of Homeland Security and Emergency Management could assist local governments in further considering climate-related risks, as the Division provides planning and training services to local governments, including financial and technical assistance, training, and exercise support.

Options for incorporating climate change preparedness actions and activities into local and state plans, policies, and procedures include:

- explicitly incorporating climate-related risks in natural hazard risk assessment methods;
- developing partnerships with agencies and organizations with expertise in climate-related risks and preparedness, including the private sector, academia, and such entities as the National Oceanic and Atmospheric Administration, the National Center for Atmospheric Research, and the North Central Climate Science Center at Colorado State University;
- considering how climate-related risks and preparedness can be incorporated into grant programs, with specific focus on building and infrastructure construction, and evaluation methodologies such as benefit/cost analysis; and
- promoting building standards and practices, particularly in disaster recovery efforts, that consider future climate-related risks.

17. That the state and local governments work to ensure food security in Colorado.

Globally, climate change is expected to affect food security by threatening food production and certain aspects of food quality, as well as food prices and distribution systems, according to the U.S. government’s national climate assessment.⁷⁶ Having local sources of agricultural products is important because they are inherently more resilient, as they are less vulnerable to transportation disruptions than are products from afar.

The City and County of Denver in its *Climate Adaptation Plan* has a goal to encourage local agriculture, and a specific strategy to “encourage a broad range of food outlets and regional food hubs for processing and distribution of local food.”⁷⁷ The plan recognizes that a more robust local food system makes the city more resilient to disruptions to food systems occurring in other regions and that a local system allows continuous access to food supply when climate-related disruptions occur during transportation of food over long distances. Co-benefits noted are that locally produced foods can result in fewer emissions of heat-trapping gases and other air pollutants during transportation and that making local foods readily available for sale through programs such as farmers’ markets creates jobs locally.

Infrastructure

18. That the state and local governments assess climate-related risks to all infrastructure systems and take actions to improve their resilience.

As the *Colorado Climate Change Vulnerability Study* (2015) states, no systematic analyses have yet been undertaken to identify the climate-related risks to Colorado’s transportation sector.⁷⁸ The same is true for other infrastructure systems in the state. Similarly, little consideration of climate-related risks to infrastructure systems has gone into planning and managing these systems. Yet infrastructure systems are vulnerable to many other climate-related risks beyond those arising from extreme events and



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emergencies. For example, temperature increases may exceed the tolerances of materials currently used in building roads, bridges, railroads, and other infrastructure. Hotter summers may increase the demand for air conditioning so that the overall demand for electricity exceeds available supplies, and water shortages may limit the supplies of cooling water needed to keep power plants in operation. These and many other risks need to be identified, assessed, and addressed through preparedness actions.

Transportation: As one essential example of the state government consideration of climate-related risks called for in item 15 above, we recommend that the Colorado Department of Transportation (CDOT) consider in its planning, design, and operation of state transportation systems relevant climate-related risks, including the effects on transportation infrastructure of consistently higher average temperatures; of floods, extreme heat; and of more frequent fluctuations between freezes and thaws, which affect snow and ice removal, avalanches, rockfalls, landslides, and sinkholes. The Federal Highway Administration’s Climate Change and Extreme Weather Vulnerability Assessment Framework could be used.⁷⁹ The *Colorado Climate Change Vulnerability Study* also identifies a variety of ways that climate-related risks could be incorporated into transportation decision making, based on actions in other states.⁸⁰ Local governments and other stakeholders should have opportunities to provide input to the CDOT consideration of these risks.

Energy: The *Colorado Climate Change Vulnerability Study* points out a number of ways in which climate changes, especially higher temperatures but also more extreme weather and wildfires, can affect the capacity and reliability of electricity generation and other energy systems.⁸¹ Examples of actions to promote the resilience of energy systems to climate-related risks include:

- the Colorado Energy Office (CEO) and Public Utilities Commission working with utilities to implement automated demand response to decrease electricity load during peak usage;
- the state government and local governments continuing to incentivize adoption of renewable energy generation;
- the Colorado Municipal League, Colorado Counties, Inc., the Colorado Climate Network, or another entity maintaining a repository and clearinghouse of local efforts to reduce barriers to renewable energy generation; and
- the CEO exploring and expanding mechanisms by which they can facilitate the energy performance contracts and energy audit programs for more local governments, and also expanding energy performance and audits to private entities.



Larimer County Engineering Department

Larimer County

Climate-Related Risks to Infrastructure in Other States

Two examples of how other state governments have considered climate-related risks on infrastructure are:

- the Oregon Department of Transportation's *Climate Change Adaptation Strategy Report* (2012) and the department's climate change website;⁸² and
- the California Department of Transportation's *Caltrans Activities to Address Climate Change Reducing Greenhouse Gas Emissions and Adapting to Impacts* (2013), which summarizes what that agency has done and will do to reduce heat-trapping gases and adapt the state's transportation system to prepare for the impacts of climate change.⁸³

19. That local governments collaborate with state and federal agencies to improve assessments of flooding risks and management of land use within floodplains.

The destructive September 2013 flooding in Colorado led to new awareness in the state that greater preparation may be required to mitigate potential damages from future flood events. Specific actions which are foundational for improving future resiliency include:

- Local governments, with technical assistance provided by the state, should participate in the Federal Emergency Management Agency (FEMA)'s National Flood Insurance Program (NFIP) Community Rating System, a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements, reducing local flood risks and resulting in discounted flood insurance premium rates.
- Local governments, the state, and the federal government should collaborate with FEMA in an effort to facilitate the construction of a more resilient structure when an existing structure is lost or damaged in an event. The existing insurance environment that provides for "like" replacement needs to be embellished to include the concept of more resilient replacement.
- Local governments, with assistance from the state and federal governments, should endeavor to clarify the interaction and overlap of local land use codes and floodplain regulations. It is essential to the efficient and effective jurisdiction of floodplains that federal, state, and local regulations be understood in terms of where they intersect, complement, and contradict. All communities should be active in floodplain management, with stated goals to reduce flood hazards, regulate floodplain activities, adopt floodplain policies, map floodplains, and educate the public about floods, floodplains, and risk. For example, the implementation of flood control mechanisms such as retaining ponds and culvert requirements are areas where local jurisdictions may need to be more stringent than state or federal requirements.
- Local governments, the state, and the federal government should collaborate with FEMA in an effort to update the definition of 100-year floodplain in order to take into account climate-related risks, including changes in precipitation and temperature that influence runoff and snowmelt. These changes need to be reflected in updated risk profiles and map revisions for floodplain management.
- Local governments and the state government should promote an understanding of riverine flooding and how it differs fundamentally from coastal flooding. This understanding should include discussions of mud and debris flows so that every community has knowledge of the potential natural threats in their areas.
- Local governments and the state government should prepare for the implementation of the new Federal Flood Risk Management Standard and the forthcoming federal agency regulations to meet the standard (see the draft implementing guidelines proposed by FEMA in January 2015), which will set new requirements for federal actions in or affecting floodplains, including federal funding of road construction.⁸⁴

- Communities are also encouraged to participate in the Colorado Association of Stormwater and Floodplain Managers. Participation in this organization will help them to stay up to speed on changes in approaches and ideas for improving resilience.

20. That all local governments develop all-hazard emergency operation plans and continuity of operation plans.

Local governments need to have emergency operation plans and continuity of operation plans to be eligible for federal disaster assistance funding from the Federal Emergency Management Agency (FEMA). Most local governments in Colorado have these plans, but some, especially those in smaller communities, do not yet.

Every local government should have these plans in place, to prepare for potential disasters and also to avoid potential delays in getting assistance from FEMA in case of a federally declared disaster.

Also, local emergency planning efforts should be active so that local coordination of emergency planning can be accomplished, professional networks can stay tight, and citizens can remain up to date as situations change within their community.

Natural Resources and Outdoor Recreation

21. That a comprehensive, detailed, and quantified assessment of climate-related risks to natural resources and recreation in Colorado be prepared.

The primary objectives for this natural resources and outdoor recreation vulnerability assessment are to help management agencies (at state, regional, and local levels) to set priorities and develop strategies to address the greatest climate-related risks. The assessment should help those agencies:

- determine which systems are likely to be most affected by climate-related transformations to help set priorities for planning and develop management responses (e.g., early detection and rapid response); and
- determine why these systems are likely to be vulnerable to climate change, including the interaction with other existing stressors, to help shape short- and long-term adaptation strategies.

“The scale, scope and pace of change occurring in ecological systems today—and forecast for the future—are by all accounts unprecedented. These changes will have significant impacts on ecosystems in Colorado and their value for the state’s residents.”

*Colorado Climate Change Vulnerability Study*⁸⁵



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Bark beetle-killed trees, Flat Tops Wilderness

This assessment should be a collaborative effort, best led by the state government, but involving experts and managers from federal agencies, local governments, universities, nonprofit organizations, and others.

This assessment should consider the interplay of climate change, other stressors on natural resources, and changes in populations; synthesize key existing research and literature; and address impacts on such topics as:

- natural resources, including consideration of all ecosystem types, habitat loss and fragmentation, species population shifts, invasive species and diseases, phenology (the timing of natural events), and ecosystem services;
- outdoor nature-based recreation, including hiking, camping, wildlife watching, skiing and snowboarding, snowmobiling, rafting and kayaking, and more, including the economic costs and opportunities from impacts to those activities;
- ecosystem disturbances that may be affected by climate change, including wildfire and insect infestations (including projections of possible increases in the frequency and extent of wildfires).

22. That local, state, and federal agencies and others collaborate in identifying needs, opportunities, and priorities for: (1) connections among habitats, such as buffers, wildlife corridors, and a connected network of conservation areas, to increase the ability of plant and animal species to migrate and adapt to changes in climate and ecosystems; and (2) connections among communities, such as greenways and trails.

The Western Governors Association in June 2008 approved a *Wildlife Corridors Initiative* report, recognizing that wildlife movement corridors and crucial wildlife habitats within these landscapes are critical to maintaining large, intact and functioning ecosystems, healthy fish and wildlife populations, and public access to natural landscapes.⁸⁶ The risks posed by climate change, including projected greater extremes and increases in drought, in addition to unprecedented population growth, energy development, and new transportation infrastructure, are resulting in notable landscape impacts—including habitat loss and habitat fragmentation—ultimately threatening the West’s quality of life and economic well-being.

Greenways and trails within and connecting communities provide many widely recognized benefits, but greenways and trails are vulnerable to climate-related risks, as demonstrated by how they have been disrupted by floods and wildfires in recent years in Colorado. As local governments and others identify needs, opportunities, and priorities for greenways, trails, and other connections among communities, including in rebuilding those that have recently been disrupted and in considering new ones, it is important that they consider climate-related risks.

Public Health

23. That the Colorado Department of Public Health and Environment (CDPHE) take the lead in a collaborative effort, including local public health officials and others, to determine how CDPHE can best factor climate-related risks into state public health programs and regulatory decisions.

Information on how climate change may affect public health risks is relevant to many regulatory and other decisions made by the Colorado Department of Public Health and Environment. The consideration of those climate-related risks, however, has been uneven and inconsistent. A single comprehensive effort to consider how to best factor climate-related risks into those state processes would lead to better analysis, decision-making, and protection of public health.

Although CDPHE is the appropriate entity to take the lead in the state-level assessment, there should be opportunities for engagement in this process by local public health agencies, university and other experts, and others.

24. That local governments and local public health agencies work together in a coordinated way to similarly assess the best ways to factor climate-related risks into local public health programs and upcoming decisions under those programs that address climate-related risks to public health.

This recommendation is similar to that in item 23, but applies to local, not state, public health decisions in which consideration of climate change is relevant. These decisions should include consideration of spread of diseases, adverse effects on indoor and outdoor air and water quality, impacts from extreme weather events, updated projections of extreme heat and cold using projections to inform emergency response, and analysis of regional variations in impacts within the state.

A statewide, coordinated effort by local governments and local public health agencies on the consideration of public-health related risks in local health decisions could perhaps be centrally organized by the Colorado Climate Network, Colorado Municipal League, Colorado Counties, Inc., and/or the Colorado Department of Public Health and Environment.

25. That the Colorado Department of Public Health and Environment add consideration of climate change to the minimum standards for core services required for local public health agencies.

The Colorado Public Health Act of 2008 is designed to assure that core public health services are available to every person in Colorado with a consistent standard of quality.⁸⁷ Rules promulgated by the Colorado State Board of Health prescribe core public health services representing the minimum level of public health services that local public health agencies must provide. Every five years, each local health department must conduct a community health assessment and develop its own corresponding plan, and the Colorado Department of Public Health and Environment (CDPHE) similarly prepares a statewide assessment and a comprehensive, statewide public health improvement plan. Currently, the state rules do not explicitly require consideration of climate-related risks to public health, CDPHE's 2013 *Colorado Health and Environmental Assessment* does not mention climate change, and local community health assessments typically do not consider climate-related risks, either.⁸⁸

For climate-related risks to be explicitly considered in the next round of assessments and plans (not due until 2018), either the Board of Health should revise its rules to explicitly require that consideration, or the CDPHE Office of Planning and Partnerships and local public health agencies should, without being required to do so, incorporate consideration of climate change in their assessments and plans. Current core services in which consideration of climate-related risks would be appropriate include:

- assessment and planning methodologies to identify, evaluate and understand community health problems, priority populations, and potential threats to the public's health, and use this knowledge to determine what strategies are needed to engage partners and improve health;
- development, implementation, and evaluation of policies and programs to enhance and promote healthy living, quality of life and well-being while reducing preventable (chronic and communicable) diseases, injuries, disabilities, and other poor health outcomes across the life-span;
- preparation and response to emergencies with a public health or environmental health implication in coordination with local, state and federal agencies and public and private sector partners; and
- protection and improvement of air, water, land, and food quality by identifying, investigating, and responding to community environmental health concerns, reducing current and emerging environmental health risks, preventing communicable diseases, and sustaining the environment.

Developing and Sharing Information

All Sectors

26. That the Colorado state government, the Colorado Climate Network, and/or another entity catalogue and distribute information to help local governments develop and implement effective preparedness actions.

This information could include such materials as preparedness planning and management guides, templates or models for actions to be adapted and adopted by local governments, compilations of best practices that have been successfully undertaken by local governments, and case studies.

Public health: As one example with respect to public health risks, we recommend that the Colorado Department of Public Health and Environment (CDPHE) develop a toolkit to help local health agencies plan for climate-related risks to public health, and should compile and distribute information on best local practices. The toolkit should include evidence-based strategies and best management practices and should be web-based to facilitate sharing the information. The toolkit should be supported with data from CDPHE and elsewhere (for example, the Rocky Mountain Climate Organization extreme heat analysis for the City of Fort Collins) to assist local governments in identifying significant impacts and appropriate strategies to address them.⁸⁹ The toolkit also should be designed to provide guidance for the health status and capacity assessment functions required for Public Health Improvement Plans under Colorado's Public Health Act of 2008.⁹⁰ Examples of relevant climate-related risks that the toolkit should address include heat waves, respiratory illnesses, cardiovascular illnesses, infectious diseases, and mental health.

Wildfire: As another example, with respect to wildfire risks, we recommend that the state government develop a model building code and best management practices for consideration by local governments and provide other technical assistance to help local governments take action to protect buildings in the wildland/urban interface (WUI) from the risks of wildfires. We concur with the need for a state-wide, model ordinance for private property in the WUI, as was recommended in the 2013 report of the Wildfire Insurance and Forest Health Task Force appointed by Governor John Hickenlooper.⁹¹

Examples of Guidance Documents from Elsewhere

Examples from California of information developed by the state government, local governments, and others to help local governments develop and implement effective preparedness actions include:

- the *California Adaptation Planning Guide*, developed by state agencies and others to provide guidance for local and sub-state regional climate change preparedness planning;⁹²
- the California Cal-Adapt website, a web-based climate adaptation planning tool which allows users to identify potential climate change risks in specific geographic areas throughout the state;⁹³
- a California Department of Transportation-commissioned publication, *Addressing Climate Change Adaptation in Regional Transportation Plans: A Guide for California MPOs and RTPAs* (2013), to help metropolitan planning organizations and regional transportation planning agencies in incorporating the risks of climate change impacts into their existing decision-making;⁹⁴ and
- the California Department of Health's *Climate Action for Health: Integrating Public Health into Climate Action Planning* (2014).⁹⁵

27. That, as one method of distributing information (see item #26), there be created and maintained a single, comprehensive online clearinghouse of information on climate change, climate impacts, and climate actions in Colorado, for the use of local governments and others.

Such a clearinghouse should include:

- information on possible impacts on statewide, regional, and, to the extent possible, local levels;
- statewide, sub-state regional, and local actions that are underway in Colorado to address climate change;
- links to guidance documents, toolkits, and information on best practices and case studies (of both successes and failures) for local governments and related organizations and others on how they can address climate change;
- materials to support public communications on climate risks and climate actions; and
- similar information.

The clearinghouse could be created and maintained by the Colorado state government, the Colorado Climate Network, or some other entity. Having one single clearinghouse of information would help to produce consistency in public messaging by local governments, which would make their communications with the public more effective. If there is not a single Colorado clearinghouse maintained by a single organization, all organizations providing clearinghouses should coordinate their efforts to make their clearinghouses as seamlessly useful as possible.

28. That there be a statewide climate change resilience and preparedness conference to engage participants from local governments, the private sector, nonprofit organizations, and others who have responsibilities for resilience actions, on what they can do to improve resilience to climate-related risks in Colorado.

This conference would be a cost-effective opportunity to acquaint many local government staff members (and others, including programs staff members of state government agencies, businesses, nonprofit organizations, and others) with information on climate preparedness actions. The conference could focus on implementing the actions recommended in this report, and perhaps also on other climate preparedness actions. The Colorado Climate Network and the Colorado Municipal League have indicated an interest in sponsoring such a conference, and other organizations may also be interested.

A well-attended and well-received conference of this type from another state is the California Adaptation Forum, jointly organized by the California Local Government Commission and the California state government and held in August 2014.

Infrastructure

29. That utilities and local governments work together so that local governments are provided with detailed energy use data they need for local government assessments and use.

To inform local policy-making, local governments need energy use data aggregated at the neighborhood or similarly fine scale, without identifying individual customers. We support the efforts made to date by the Public Utilities Commission (PUC) and interveners to find ways to provide this access to this data, and we urge that Colorado utilities consider approaches adopted in other states to allow sharing of this data while protecting customer privacy.

Local governments often seek to benchmark and measure energy efficiency improvements and inventories of heat-trapping gas emissions by using aggregated energy use data that can be provided only by utilities. A group of Colorado local governments and advocacy groups, supported by the Colorado Energy Office, has been urging the PUC to give local governments access to this data while protecting customer privacy. Similar groups should extend the effort to the rural electric cooperatives that generally operate outside the jurisdiction of the PUC.

Natural Resources and Outdoor Recreation

30. That the Colorado Department of Natural Resources or some other appropriate organization take the lead in convening an annual workshop involving state and local government officials and staff, university experts, and others to review the latest information on climate-change-driven natural resource risks and implications for action in Colorado.

Such an annual workshop would be a cost-effective way for staff members of local governments to become and stay knowledgeable about the new climate-related risks to natural resources and opportunities for outdoor recreation and about actions that can be taken to address them.

Public Health

31. That the Colorado Department of Public Health and Environment take the lead in convening an annual workshop involving state officials and staff, local health departments, university experts, and others to review the latest information on climate-change-driven public health risks and implications for action in Colorado.

As with such an annual workshop on climate-related risks to natural resources and outdoor recreation (see item 30), this would be a cost-effective way for staff members of local health departments to become and stay knowledgeable about the new climate-related risks to public health and actions that can be taken to address them.

Engaging the Public and Stakeholders

All Sectors

32. That Colorado-specific background and messaging materials on climate-related risks and preparedness be developed to be adapted and used by local governments.

Local governments need materials explaining Colorado climate-related risks and preparedness actions that can be taken locally, which the local governments can adapt for local use in engaging with stakeholders and the general public in their communities to increase awareness of those risks, encourage private actions to address them, and build support for actions taken by the local governments. These foundational materials could be developed by the state government, the Colorado Climate Network (CCN), and/or another organization.

Local governments also need information and assistance in how to most effectively communicate with and engage stakeholders and citizens on climate-related risks and preparedness actions. Again, the state government, CCN, and/or other organizations could provide such information and assistance to help local governments more effectively engage with stakeholders and the public.

Among the principles that are important in shaping the needed materials and assistance that are needed, and the use that local governments can make of them, are:

- Messaging materials and efforts should focus on engaging the public about climate-related risks as not just disasters driven in part by climate change (such as wildfires and floods) but also as “slow moving” climate disruptions operating over longer time frames (such as forest disruptions by bark beetles, water supply changes, etc.).
- Consistent messaging by different local governments and others on climate-related risks and opportunities and on climate preparedness makes that messaging more effective.
- Although communication with the public in a community is largely a local government function, it can be effective to engage businesses and non-profit organizations.
- Part of the messaging should be about positive economic consequences of climate preparedness actions.

- The messaging should be designed in part to encourage the engagement of stakeholders and citizens in the development and implementation of state and local government efforts to address climate change risks.
- The state government should maintain communication materials on climate literacy that would be made available to local communities and other interested parties to be used as a public resource and incorporated into school curricula.
- Local governments and others would benefit from additional academic research involving longitudinal studies—involving studying the same participants over time—on the relative effectiveness of different types of outreach campaigns in leading to citizen awareness and action. An example of such a study is one underway involving the effectiveness of calls for evacuation during recent wildfires in El Paso County; more such studies would be helpful to local governments.

One area where the development of background and messaging materials is especially important is about the health effects of heat waves and actions that can be taken to protect people during heat waves—a subject which has received little attention in Colorado but could be much more important in the future as the climate changes (see the text box on page 8).

33. That local governments work with the state government and others in engaging with stakeholders, other organizations, and the public to increase awareness of climate-related risks and to help bring about community-wide preparedness actions.

It is widely recognized that local resilience to climate-related risks depends on community-wide actions, not just those of government. One of the key reasons why local governments have such an important role in climate resilience and preparedness is that local governments, more than other levels of government, have unique abilities to engage with stakeholders, other organizations, and the public in their communities.

There also are important opportunities and needs for local governments to work together with the state government in stakeholder and public engagement efforts. For example, the Colorado Division of Homeland Security and Emergency Management, the Colorado Division of Parks and Wildlife, and other state agencies should incorporate information about climate-related risks in their public outreach and communication efforts. It also is important that local governments work with federal land management agencies in their areas, including the U.S. Forest Service, National Park Service, and Bureau of Land Management, which together manage much of Colorado land. All of these federal agencies provide information to visitors to their lands, all face climate-related risks to the resources and values they protect, and increasingly they can provide some of the best information about how natural and cultural resources and visitor experiences may be affected by climate-related risks. Organizations such as Colorado State University’s Extension and other college and university offices and programs, businesses including ski resorts, rafting companies, and other outdoor recreation businesses, and tourism promotion offices are all important potential allies in stakeholder and public outreach and communications.

Community awareness programs and public involvement campaigns can be important in bringing about awareness and action, and we recommend that climate-related risks be incorporated in such programs and campaigns. We recommend that:

- the Colorado state government highlight climate-related risks as part of its participation each spring and fall in the Federal Emergency Management Agency’s America’s PreparAthon! (a national community-based campaign for emergency preparedness and resilience actions), with particular emphasis on preparedness for extreme weather and wildfires during the spring campaign; and

Iowa Climate Statement 2014

An example from another state of effective engagement with the public about climate-related risks is a joint public statement by 180 science faculty members and researchers from 38 Iowa colleges and universities about how climate change may affect the health of residents of that state.⁹⁶

- the Colorado state government continue and expand the Colorado United Day of Service (originally held in 2014 on the first anniversary of the September 2013 flooding), making it a weeks-long summer program to encourage community involvement in preparedness, mitigation, and response to disasters.

Wildfire

34. That local governments work with stakeholders and other organizations to engage with homeowners and landowners in the wildland-urban interface regarding the importance and effectiveness of wildfire mitigation and provide them with assistance.

The wildland-urban interface (WUI), where wildfire risks to people and their property are greatest, comprises about 10 percent of Colorado lands but also contains residences for about 38 percent of the state's population.⁹⁷ The Wildfire Insurance and Forest Health Task Force appointed by Governor Hickenlooper cited in its report a Colorado State University study (using an earlier set of WUI estimates) projecting that development in the WUI will increase by 300 percent by 2030, compared to 2000.⁹⁸ Any such increase would markedly increase the number of residents and landowners vulnerable to wildfire risks, as would the projected increases in the frequency and extent of wildfires as a result of climate change.

Wildfire mitigation in the WUI—reducing or eliminating the risk of wildfire to humans and their environment, before wildfire breaks out—is widely recognized as key to protecting lives and property, and as more cost-effective than fire suppression once a wildfire is underway. The Wildfire Insurance and Forest Health Task Force recommended that stakeholders and community partners work together to help educate homeowners and landowners in the WUI about the importance of wildfire mitigation on their property and to inform them about the resources (including both mitigation expertise and also potential avenues of public assistance, such as grants and federal initiatives) available to them.



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Waldo Canyon fire, Colorado Springs, 2012

Examples of such resources are the Firewise Communities Program administered jointly by the National Fire Protection Association and the U.S. Forest Service, and the Fire Adapted Communities program sponsored by a coalition of organizations, which encourage local solutions for safety by involving homeowners and communities in taking responsibility for preparing their homes, businesses, parks, utilities, and other community assets from the risk of wildfire.⁹⁹

Local governments in jurisdictions containing WUI areas can and should play leading roles in engaging within their communities to bring about these important wildfire mitigation actions by homeowners and landowners and to provide them with information on the assistance that can be obtained in support of their efforts.

Building Capacity

All Sectors

35. That, to enable local governments to afford new climate preparation activities, local governments work with one another and with the state and federal governments, the private sector, private foundations, and others, so that local actions are highly cost-effective; support allocations of public and private funds to help local governments meet unfunded local needs; and seek to obtain such funds to help meet unfunded local needs.

Assessing and addressing climate-related risks can make long-term economic sense for Colorado communities, as the costs of inaction can outweigh the costs of preparedness actions. Still, preparedness actions can impose new costs and create new budgetary pressures for local governments, and holding down those costs and seeking funding to cover them will be important.

One way that local governments can hold down the costs of preparedness actions is by working together with other local governments, as coordinated actions sometimes can be more cost-effective than having individual local governments each undertake similar actions on their own. This may be especially true for conducting state, regional, and local vulnerability assessments and resilience planning, as many local governments face similar needs and challenges. Cooperative, coordinated actions are especially important for smaller local governments with especially limited staff and budgets, which may not be able, for example, to develop their own, separate climate preparedness plans.

The same principle can be true for cooperative actions among, for example, both the state government and local governments—that more can be done, at a lower cost, by working together than separately.

State government funding for local government comprehensive climate preparedness plans would help build capacity for local governments to undertake those plans, and could serve as an incentive for local planning. This could be, for example, if eligibility for state funding were dependent on local planning.

Consideration could be given to using existing sources of state funding of local activities, such as Great Outdoor Colorado funds and energy impact assistance funds, for local resilience actions. When laws and

Recommendations of State, Local, and Tribal Leaders Task Force

The recommendations of the White House's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience identify ways that the federal government can help states, communities, and tribes improve their resilience to climate-related risks.¹⁰⁰ The task force identified literally hundreds of federal actions that would help state and local governments and tribes:

- Build resilient communities
- Improve resilience in the nation's infrastructure
- Ensure resilience of natural resources
- Preserve human health and support resilient populations
- Support climate-smart hazard mitigation and disaster preparedness and recovery
- Understand and act on the economics of resilience
- Build capacity for resilience

rules are already broad enough to allow it, we believe that state agencies should consider climate-related risks and preparedness needs as part of their current decision-making process. To the extent that existing laws and rules are not now that broad, the state government should consider whether to revise the laws and/or rules to allow that consideration.

Cooperative efforts among local governments before the Colorado General Assembly could increase the chances of both state government funding of both local planning assistance and the many new climate preparedness actions by state agencies called for in this report.

Recently, the federal government has in various ways expressed strong interest in working with and supporting state and local climate preparedness actions. One manifestation of this is the White House State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (see the text boxes on pages 2 and 30). An effective partnership between the Colorado state government and local governments in identifying needs for and seeking federal funding for cooperative federal-state-local or state-local climate preparedness actions could increase the chances of obtaining that funding and making possible more climate preparedness actions here. As part of such a state-local partnership, the state government and local governments should work together to advocate in Congress, and in particular with the state's congressional delegation, for increased preparedness funding for federal agency climate preparedness actions.

One particular area for which we recommend increased federal funding is for wildfire mitigation efforts on federal lands. Funds that otherwise could be available for that purpose often are directly or indirectly used instead to cover the high costs of federal fire suppression efforts. Yet mitigation efforts to reduce wildfire risks can be more cost-effective than suppressing fires after they start, and mitigation efforts on nearby lands can be undercut if there are not effective mitigation efforts on federal lands. This is especially important because the federal government owns 68 percent of forested lands in the state.

36. That the state government and other organizations provide technical assistance and information to help local governments, related organizations, and private individuals increase their capacity to manage the risks posed by climate change.

This technical assistance and information could be provided by the state government, the Colorado Climate Network, and/or one or more other organizations, and could include resource guides, compilations of best practices, case studies (including examples of both successes and failures), and toolkits for the use of local governments.

In particular:

- Climate resilience academies could be held to inform and train local government officials and staff and provide networking opportunities for them, similar to those convened by the Western Adaptation Alliance.
- The Colorado Division of Homeland Security and Emergency Management should address preparedness for climate-related events in its outreach to local communities.
- The technical assistance to local governments should include the formation of one or more technical assistance teams to travel to and assist communities that are undertaking preparedness planning.
- The Colorado Department of Agriculture should provide assistance in setting up local or regional distributions centers to facilitate cost-effective market access for small growers.
- The Colorado Energy Office (CEO) should continue to work with the Colorado Energy Code Compliance Collaborative to conduct training sessions for local government building departments on the content of and adoption of international Energy Conservation Code updates.
- CEO and the Department of Local Affairs (DOLA) and other sustainability organizations should provide resources, grants, and technical assistance on energy efficiency and renewable energy for local governments, and businesses.
- The Colorado Climate Network or another entity should develop and distribute a set of best practices for land use planning that encourages community design to minimize vehicle miles traveled by people by use of walking, bicycling, and public transit.

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- CEO and DOLA and other sustainability organizations should provide resources, grants, and technical assistance on energy efficiency and renewable energy for local governments, and businesses.

The state technical assistance should be proactive. Responsibility would best be divided among the state agencies with jurisdiction, including CEO, Colorado Department of Public Health and Environment, and Department of Natural Resources agencies. Additional state government employees may be needed to provide the technical assistance. It also may be appropriate for groups such as the Colorado Climate Network to work in partnership with the state government.

37. That the Colorado state government elevate the priority, funding, and staffing devoted to climate preparedness.

Several options exist to achieve these ends. One way to do this, in part, would be for the state government to provide specific funding for the climate change position and responsibilities detailed in House Bill 13-1293 (2013) (see page 1), and elevate the importance of that position. Another way to do this, in part, would be for the governor to appoint a state climate preparedness advisor, assigned to the governor's Office of Policy, Research and Legislative Affairs, who, in collaboration with the governor's cabinet, could coordinate the state government preparedness actions and improve interagency coordination. An additional way would be for state government agencies that have not done so to ensure that appropriate staff members have climate preparedness explicitly included within their responsibilities. Other actions, too, may be needed to build the capacity of state government agencies and offices to further address climate-related risks.

House Bill 13-1293 required the governor to designate a state employee to assess climate change issues in the state; the duties of that position include: (a) development and periodic update of a climate action plan or similar document that sets forth a strategy, including specific policy recommendations, that the state could use to address climate change and reduce its greenhouse gas emissions; and (b) collaboration with other entities regarding climate change preparedness studies. However, no particular funding was provided for this position or for these duties.¹⁰¹

A 2011 Western Water Assessment report to the Colorado state government, the *Colorado Climate Preparedness Project* final report, recommended that, "The governor should weigh the pros and cons of appointing a separate climate change adaptation coordinator."¹⁰²

38. That the state government establish mobile disaster response teams to provide recovery assistance to communities in Colorado.

The Federal Emergency Management Agency provides disaster response teams to support local efforts with respect to federally designated disasters, but those teams are not available to help in other disasters. The state government could provide similar teams to help in other disasters, and as needed to supplement federal teams in federal disasters. Colorado-formed and -trained disaster recovery teams could have more expertise in recovering from local disasters than might be the case with federal teams.

Concepts that could guide these new state disaster response teams include:

- A team could be comprised of members experienced in recovery from a particular type of disaster, and could include employees of contractors, nonprofits, or local governments (from anywhere in the state, not from the disaster area itself).
- As one illustration of how the teams might be organized, the teams could be drawn from the staff of local governments, organized and trained by the state government, and potentially paid for at least in part through federal reimbursements.
- The need for disaster response teams, however, may be greater than what may be reimbursed by the federal government. To the extent that federal reimbursements would not cover all costs, the state and/or local governments would need to cover the costs.
- Ideally, a team would be engaged in a disaster-affected area long enough to meet local needs, which might mean a minimum of 18 months of support to the community to enable recovery to take hold.

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- Assistance provided by a disaster recovery team could include informing local staff and others of the best practices that are known to help in recovery from a particular type of disaster, technical assistance in grant applications and accounting for federal or state funds spent, and more.

Public Health

39. That the Colorado state government lead a collaborative process, with input from local health departments, universities, and others, to (1) assess the existing capacity of state and local health departments and other relevant organizations to reduce climate-related risks to public health and (2) develop proposals for increasing that capacity as necessary.

Climate-related risks to public health are both new and have not been explicitly and comprehensively assessed in Colorado through state and local public health assessments (see item 24) or otherwise, and so it is not clear the extent to which the state government, local public health agencies, healthcare providers, and perhaps also others have the capacity they need to address those risks. We recommend an assessment of their capacity and the development of plans to increase that capacity (if and as needed), to include the following:

- analyses of how climate-related risks to public health are being currently addressed;
- assessment of what is needed to address future needs;
- analyses of gaps in addressing future needs; and
- an implementation plan, including state roles.

There is an existing process to assess statewide and local health needs and to develop plans to meet those needs, but the next round of revisions of those assessments and plans will not be undertaken for a few years (see item 25). The process called for here can be undertaken independently of and prior to the next round of those assessments and plans.

Also, to help increase the capacities of the Colorado Department of Public Health and Environment (CDPHE) and local public health agencies to address climate-related risks to public health, we recommend that CDPHE and/or local agencies should seek to participate in the Climate-Ready States and Cities Initiative of the federal Centers for Disease Control and Prevention (CDC), in which CDC is using its prevention expertise to help state and city health departments investigate, prepare for, and respond to climate-related risks to public health.¹⁰³ If direct participation in that initiative is not now possible, CDPHE and/or local governments and local public health agencies should seek to obtain and apply any useful information from CDC and/or from state and local participants in the initiative.

Wildfire

40. That the state government provide increased funding for wildfire mitigation activities, through continued and increased funding of the Colorado Forest Restoration Grant Program and the Wildfire Risk Reduction Grant Program and by replacing the current tax subtraction for mitigation expenditures with a tax credit.

Wildfire mitigation is more cost-effective than firefighting. But current state government funding and incentives do not bring about wildfire mitigation on the scale that is currently needed, let alone on the scale that could be necessary to prepare for climate-driven increases in wildfires. We recommend that the governor propose increases in funding and incentives for wildfire mitigation and the General Assembly enact them.

Current state funding programs for wildfire mitigation include the Forest Restoration Program and the Wildfire Risk Reduction Grant Program. The Colorado General Assembly in 2014 considered but did not pass a new wildfire mitigation tax credit, to provide taxpayers with a credit for 50 percent of the costs they incur in performing wildfire mitigation measures, not to exceed \$2,500. This would be a much larger incentive than under current law, which provides for a subtraction of half of a taxpayer's mitigation expenditures from federal adjusted gross income.

41. That the state government consider levying a fee on properties located in the wildland-urban interface, with the revenue to be dedicated to wildfire mitigation efforts.

The Wildfire Insurance and Forest Health Task Force appointed by Governor Hickenlooper recommended in its September 2013 report that a fee be assessed on those who live in the wildland-urban interface (WUI).¹⁰⁴ The task force cited a guiding principle that “homeowners in the WUI should share in the risk of living in wildfire-prone areas and should therefore shoulder much of the associated costs.” As recommended by the task force the fee would be collected at the state level and the revenue distributed to local governments to help offset the costs of mitigation for properties in the WUI.

As the state task force pointed out, California recently enacted legislation that requires rural residents to pay an annual \$150 fire-fighting fee. The funds are used for prevention and protection services. Idaho, Montana, Oregon, and Washington also have fee requirements in place.

Because in some neighborhoods extensive mitigation efforts have already been performed, it might be appropriate to allow exemptions from the fee, under precise criteria that could be developed.

42. That fire protection agency staffs be trained in wildfire preparedness and prevention practices.

Currently, the staffs of fire protection districts, particularly smaller ones, often focus primarily on fire response, and have limited experience or training in wildfire preparedness planning and public outreach regarding wildfire prevention. To provide more training in the latter, local fire protection agencies can avail themselves of a number of existing training resources, including:

- the National Fire Academy administered by the U.S. Fire Administration, an entity of the Federal Emergency Management Agency, which develops and delivers fire prevention and safety education programs in partnership with other federal agencies, the fire and emergency response community, and others;
- the Firewise Communities Program administered jointly by the National Fire Protection Association and the U.S. Forest Service, which offers workshops and training for firefighters and others on how to protect neighborhoods before wildfires happen; and
- the National Wildfire Coordinating Group, made up of federal agencies and state agencies through the National Association of State Foresters, which provides training and education on wildfire prevention.

Wildfire Mitigation in Douglas County

Douglas County completed hazardous-fuels and forest-stand improvement projects in the Keene Ranch, Dawson Butte Ranch, and Sage Port/Antlers open spaces. In total, over 140 acres were treated on county-owned properties in and around wildland-urban interface communities. Projects were funded in part through a grant from the Colorado Department of Natural Resources’ Wildfire Risk Reduction Grant Program. These projects were collaborative projects supported by community residents, the county government, fire protection districts, the Colorado State Forest Service, and the land conservancy easement holder. Improved forest health and reduced fuel loads have increased the resilience of the forest resource and protected the financial investments that have been made in the land acquisitions.

PROJECT PROCESS

This initial phase of the Colorado Local Resilience Project was convened by the Colorado Climate Network and the Colorado Municipal League, which jointly worked to identify and invite potential project participants.

The 78 individuals participating in the project include elected officials and program staff from 30 local governments, listed below by the population size of their communities. The local governments represented in the project include seven of the 10 largest counties and seven of the 11 largest cities in Colorado.

El Paso County	Eagle County
City and County of Denver	City of Golden
Jefferson County Open Space	Pitkin County
City of Colorado Springs	City of Durango
Larimer County	City of Steamboat Springs
Boulder County	San Miguel County
Douglas County	City of Aspen
Pueblo County	Town of Carbondale
City of Lakewood	Town of Estes Park
City of Fort Collins	Town of Vail
City of Arvada	Town of Breckenridge
City of Westminster	Town of Frisco
City of Boulder	Town of Telluride
City of Longmont	Town of Nederland
City and County of Broomfield	Town of Dillon

Other organizations represented in the project are those listed below, each of which has responsibility for some local climate resilience and preparedness functions.

Boulder Valley School District	Denver Health
High Country Conservation Center (a nonprofit organization which works in partnership with local governments in Summit County)	Poudre Fire Authority
	Southwest Colorado Council of Governments
	Tri-County Health Department

During the project participant recruitment phase, Denver Mayor Michael Hancock, Fort Collins Mayor Karen Weitkunat, and Summit County Commissioner Dan Gibbs invited certain elected officials to participate in the project. The work group participants include 14 local elected officials—four county commissioners, three mayors, and seven city council members. Also, two top local government managers—one town manager and one town administrator—are among the participants.

Project participants served as members of five work groups, each of which focused primarily on particular sectors: cross-cutting issues, infrastructure, natural resources and outdoor recreation, public health, and wildfire preparedness and recovery. Each group, however, reviewed and approved of the entirety of the report, and so it is a joint effort of all project participants.

Each work group met four or five times, from September 2014 through February 2015.

Decision making in all work groups was by consensus, with no need for separate work group votes on individual items included in the report. All project participants listed on pages iv-vi generally approved of the content of the report, but that does not signify approval by any or the local governments or other organizations which they represent.

A subsequent phase of this project will focus on implementation of the recommendations identified in this first phase.

SELECTED REFERENCES

The following references are of general usefulness for officials and staff of local governments and others engaged in climate resilience and preparedness.

Arnott, James, Elise Osenga, and John Katzenberger, *Climate Change and Aspen: An Update on Impacts to Guide Resiliency Planning and Stakeholder Engagement*, report by the Aspen Global Change Institute to the City of Aspen (Aspen, CO: Aspen Global Change Institute, 2014), [http://www.agci.org/docs/Climate%20Change%20&%20Aspen%202014%20\(December\).pdf](http://www.agci.org/docs/Climate%20Change%20&%20Aspen%202014%20(December).pdf).

Aspen Global Change Institute and others, *Climate Change and Aspen: An Assessment of Impacts and Potential Responses*, report to the City of Aspen (Aspen, CO: Aspen Global Change Institute, 2006), http://www.agci.org/dB/PDFs/Publications/2006_CCA.pdf.

Averyt, Kristen, and others, *Colorado Climate Preparedness Project: Final Report*, report by Western Water Assessment, University of Colorado Boulder, to the Colorado state government (Boulder, CO: University of Colorado Boulder, 2011), http://www.colorado.edu/publications/reports/WWA_ColoClimatePreparednessProject_Report_2011.pdf.

California Emergency Management Agency and California Natural Resources Agency, *California Adaptation Planning Guide* (Sacramento: State of California, 2012). Three component documents are available at http://resources.ca.gov/climate/safeguarding/adaptation_policy_guide/.

Center for Climate Strategies, *Center for Climate Strategies Adaptation Guidebook: Comprehensive Climate Action* (Washington, DC: Center for Climate Strategies, 2011), <http://www.climatestrategies.us/library/library/view/908>.

City and County of Denver, *City and County of Denver Climate Adaptation Plan* (Denver: City and County of Denver, 2014), <http://www.denvergov.org/LinkClick.aspx?fileticket=URN0Yf2lgAl%3d&tabid=444803&mid=514160>.

Decker, Karin, and Michelle Fink, *Colorado Wildlife Action Plan Enhancement: Climate Change Vulnerability Assessment*, report by the Colorado Natural Heritage Program, Colorado State University, to Colorado Parks and Wildlife (Fort Collins, CO: Colorado State University, 2014), http://www.cnhp.colostate.edu/download/documents/2014/CO_SWAP_Enhancement_CCVA.pdf.

Funk, Jason, and others, *Rocky Mountain Forests at Risk: Confronting Climate-Driven Impacts from Insects, Wildfires, Heat, and Drought*, report by the Union of Concerned Scientists and the Rocky Mountain Climate Organization (Cambridge, MA: Union of Concerned Scientists, 2014), <http://www.rockymountainclimate.org/images/RockyMountainForestsAtRisk.pdf>.

Garfin, Greg, and others, editors, *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment* (Washington, DC: Island Press, 2013), <http://swccar.org/sites/all/themes/files/SW-NCAcolor-FINALweb.pdf>.

Geos Institute, *Climate Change Primer for Fort Collins, Colorado*, (2013), <http://www.fcgov.com/climateprotection/pdf/fortcollinsclimatechangeprimer2013.pdf>.

Gordon, Eric, and Dennis Ojima, editors, *Colorado Climate Change Vulnerability Study*, report by the University of Colorado Boulder and Colorado State University to the Colorado Energy Office (Boulder, CO: University of Colorado Boulder, 2015), http://www.colorado.edu/climate/co2015vulnerability/co_vulnerability_report_2015_final.pdf.

-
- Institute for Sustainable Communities, *Climate Adaptation and Resilience: A Resource Guide for Local Leaders* (Eugene, OR: Institute for Sustainable Communities, 2012), http://sustainablecommunitiesleadershipacademy.org/resource_files/documents/AR_3.0_RG_NO_BIOS_10_1.pdf.
- Lukas, Jeff, and others, *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation (Second Edition - August 2014)*, report by Western Water Assessment, University of Colorado Boulder, to the Colorado Water Conservation Board (Boulder, CO: University of Colorado Boulder, 2014), http://www.colorado.edu/climate/co2014report/Climate_Change_CO_Report_2014_FINAL.pdf. Supplemental information on a full range of climate projections is available at <http://www.colorado.edu/climate/co2014report/>.
- Panel on Adapting to the Impacts of Climate Change, National Research Council of the National Academies, *Adapting to the Impacts of Climate Change* (Washington, DC: National Academies Press, 2010), http://www.nap.edu/download.php?record_id=12783#.
- President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, *Recommendations to the President* (Washington, DC: U.S. Council on Environmental Quality, 2014), http://www.whitehouse.gov/sites/default/files/docs/task_force_report_0.pdf.
- Ritter, Jr., Governor Bill, *Colorado Climate Action Plan: A Strategy to Address Global Warming* (Denver: Office of the Governor of Colorado, 2007), http://www.colorado.gov/governor/images/nee/CO_Climate_Action_Plan.pdf.
- Rocky Mountain Climate Organization, *Extreme Heat in Fort Collins*, report by the Rocky Mountain Climate Organization to the City of Fort Collins (Louisville, CO: Rocky Mountain Climate Organization, 2014), <http://www.rockymountainclimate.org/images/FortCollinsExtremeHeat-revised.pdf>.
- Snover, A. K., and others, *Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments*, report by the Climate Impacts Group, University of Washington, and King County, Washington, in association with ICLEI—Local Governments for Sustainability (Oakland, CA: ICLEI—Local Governments for Sustainability, 2007), <http://cses.washington.edu/db/pdf/snoveretalgb574.pdf>.
- U.S. Climate Toolkit (no date), <http://toolkit.climate.gov/>.
- U.S. Global Change Research Program, *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, editors (Washington, DC: U.S. Global Change Research Program, 2014), <http://nca2014.globalchange.gov/downloads>.
- Vogel, Jason, and others, *Boulder County Climate Change Preparedness Plan*, report by Stratus Consulting, Inc., to the Boulder County Commissioners' Sustainability Office (Boulder, CO: 2012), <http://www.bouldercounty.org/doc/sustainability/ccpp.pdf>.
- Wildfire Insurance and Forest Health Task Force, *Report to the Governor of Colorado, the Speaker of the House of Representatives and the President of the Senate* (Denver: Colorado Department of Regulatory Agencies, 2013), <http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Wildfire+Task+Force+Report.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251892100983&ssbinary=true>.

NOTES

1. Averyt and others (see Selected References [hereafter “References”]).
2. *An Act concerning the creation of a position by the governor for climate change matters*, House Bill 13-1293, http://www.leg.state.co.us/clics/clics2013a/csl.nsf/fsbillcont/FD5B92C7D67F90F787257AEE0058A740?Open&file=1293_enr.pdf.
3. President’s State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (see References).
4. Gordon and Ojima (see References).
5. President’s State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (see References).
6. Lukas and others (see References).
7. Fedcenter.gov, *Climate change adaptation* (no date), <https://www.fedcenter.gov/programs/climate/>.
8. Rosina Bierbaum and others, “Adaptation,” chapter 28 in U.S. Global Change Research Program (see References).
9. U.S. Global Change Research Program (see References).
10. Garfin and others (see References).
11. Lukas and others (see References).
12. Gordon and Ojima (see References).
13. Lukas and others (see References).
14. Lukas and others (see References).
15. Lukas and others; Alexander Gershunov and others, “Future climate: Projected extremes,” chapter 7 in Garfin and others; Rocky Mountain Climate Organization (see References for all).
16. Lukas and others (see References).
17. Gershunov and others (see Note 15).
18. Lukas and others (see References); Gershunov and others (see Note 15).
19. Lukas and others (see References).
20. Erica Fleishman and others, “Natural ecosystems,” chapter 8 in Garfin and others (see References).
21. Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations, National Research Council, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia* (Washington, DC: National Academies Press, 2011); Erica Fleishman and others, “Natural ecosystems,” chapter 8 in Garfin and others (see References).
22. Kevin Moriarty and Tony Cheng, “Hayman fire research summary, 2003–2012: Prepared for the Hayman Fire Science Symposium, June 21–22, 2012” (2012), http://coloradoforestrestoration.org/wp-content/uploads/2014/11/2012_HaymanFireResearchSummary.pdf.
23. Rebecca McKeown, “Public health sector,” chapter 10 in Gordon and Ojima (see References).
24. Gordon and Ojima, Garfin and others (see References for both).
25. National Climatic Data Center, National Oceanic and Atmospheric Administration, Colorado statewide average temperatures from climate division dataset, obtained from the Western Regional Climate Center, “Plot time history of single/multi-month precipitation/temperature,” http://www.wrcc.dri.edu/cgi-bin/divplot1_form.pl?0500.
26. “Overview and report findings,” chapter 1 in U.S. Global Change Research Program (see References).

-
27. Figure adapted from Rocky Mountain Climate Organization (see References); see that report for details on sources and methodology.
 28. Panel on Adapting to the Impacts of Climate Change (see References).
 29. Bierbaum and others (see Note 8).
 30. Theresa Jedd, "Ecosystems sector," chapter 4 in Gordon and Ojima (see References).
 31. Panel on Adapting to the Impacts of Climate Change (see References).
 32. McKeown (see Note 23).
 33. Centers for Disease Control and Prevention, *Climate Change and Extreme Heat Events* (no date), <http://www.cdc.gov/climateandhealth/pubs/ClimateChangeandExtremeHeatEvents.pdf>; National Weather Service, *Natural Hazard Statistics* (no date), <http://www.nws.noaa.gov/om/hazstats.shtml>.
 34. Centers for Disease Control and Prevention (see previous note).
 35. Centers for Disease Control and Prevention (see Note 33).
 36. Eric Klineberg, *Heat Wave: A Social Autopsy of Disaster in Chicago* (Chicago: University of Chicago Press, 2002); University of Chicago Press, *Dying alone: An interview with Eric Klinenberg* (2002), <http://press.uchicago.edu/Misc/Chicago/443213in.html>.
 37. Bryce T. O'Neill, "Chicago heat waves: A climatological comparison," presentation to American Meteorological Society, 20th Conference on Applied Climatology, Jan. 8, 2013" (2013), <https://ams.confex.com/ams/93Annual/webprogram/Paper221616.html>; Lolly Bowean, "Lessons from '95 disaster help city bear latest heat wave," *Chicago Tribune*, July 08, 2012, http://articles.chicagotribune.com/2012-07-08/news/ct-met-heat-wave-qa-0708-20120708_1_heat-wave-eric-klinenberg-air-conditioning-today.
 38. Centers for Disease Control and Prevention (see Note 33).
 39. McKeown (see Note 23); Rocky Mountain Climate Organization (see References).
 40. Gershunov and others (see note 15).
 41. McKeown (see Note 23); Ulisses Confalonieri and others, "Human health," chapter 8 in Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Impacts, Adaptation, and Vulnerability*, Working Group II contribution to the Fourth Assessment Report of the IPCC (Cambridge, UK: Cambridge University Press, 2007), <https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter8.pdf>.
 42. Eric Gordon and Roberta Klein, "Demography, land use, and economics," chapter 3 in Gordon and Ojima (see References).
 43. George Luber and others, "Human health," chapter 9 in U.S. Global Change Research Program (see References).
 44. Gordon and Klein (see Note 42).
 45. City and County of Denver (see References).
 46. Averyt and others; Center for Climate Strategies; Climate Impacts Group and King County, Washington; and Panel on Adapting to the Impacts of Climate Change (2010) (see References for all).
 47. Colorado Water Institute, *Workshop on Nonstationarity, Hydrologic Frequency Analysis, and Water Management*, J. Olsen and others, editors (2010), <http://www.cwi.colostate.edu/publications/is/109.pdf>.
 48. President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (see References).
 49. Geos Institute; Rocky Mountain Climate Organization (see References for both).
 50. Joel B. Smith and others, *The Potential Consequences of Climate Change for Boulder Colorado's Water Supplies*, a report to the National Oceanic and Atmospheric Administration (2009).
 51. Aspen Global Change Institute and others; Arnott, Osenga, and Katzenberger (see References for both).

-
52. City and County of Denver (see References).
53. Vogel and others (see References).
54. Western Governors' Association, *Climate Adaptation Priorities for the Western States: Scoping Report* (Denver: Western Governors' Association, 2010).
55. Mark Woodbury and others, *Joint Front Range Climate Change Vulnerability Study* (Denver: Water Research Foundation, 2012), <http://cwcbweblink.state.co.us/WebLink/ElectronicFile.aspx?docid=157704&searchid=4575fc8b-6a7b-4a33-bbf8-35266b2c6742&dbid=0>.
56. Bierbaum and others (see Note 8).
57. Averyt and others (see References).
58. State of California, *California Climate Change Portal: California Climate Change Assessments* (no date), http://www.climatechange.ca.gov/climate_action_team/reports/climate_assessments.html.
59. Climate Impacts Group, University of Washington, *The Washington Climate Change Impacts Assessment* (Seattle: University of Washington, 2009), <http://cses.washington.edu/cig/res/ia/waccia.shtml>.
60. Wisconsin Initiative on Climate Change Impacts, *Wisconsin's Changing Climate: Impacts and Adaptation* (Madison, WI: Nelson Institute for Environmental Studies, University of Wisconsin, and Wisconsin Department of Natural Resources, 2011), available at <http://www.wicci.wisc.edu/publications.php>.
61. House Bill 13-1293 (see Note 2).
62. Averyt and others (see References).
63. Adaptation Advisory Group, *Alaska's Climate Change Strategy: Addressing Impacts in Alaska*, report to the Alaska Climate Change Sub-Cabinet (2010), http://www.climatechange.alaska.gov/aag/docs/aag_all_rpt_27jan10.pdf.
64. California Natural Resources Agency, *Safeguarding California: Reducing Climate Risk* (Sacramento: California Natural Resources Agency, 2014), http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf.
65. Adaptation and Response Working Group, Maryland Commission on Climate Change, "Comprehensive strategy for reducing Maryland's vulnerability to climate change," chapter 5 in Maryland Commission on Climate Change, *Climate Action Plan* (Annapolis: Maryland Department of the Environment, 2008), <http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/legislation/index.aspx>; Adaptation and Response and Scientific and Technical working groups, Maryland Commission on Climate Change, *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change: Phase II* (Annapolis: Maryland Department of the Environment, 2011), http://www.dnr.state.md.us/climatechange/climatechange_phase2_adaptation_strategy.pdf.
66. Oregon Climate Change Research Institute, *The Oregon Climate Change Adaptation Framework* (Eugene: Oregon Department of Energy, 2010), http://www.oregon.gov/ENERGY/GBLWRM/docs/Framework_Final_DLCD.pdf; Washington Department of Ecology, *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy* (Olympia: Washington Department of Ecology, 2012), <https://fortress.wa.gov/ecy/publications/publications/1201004.pdf>.
67. Eric Gordon and Roberta Klein, "Moving toward preparedness," chapter 11 in Gordon and Ojima (see References).
68. Colorado Department of Public Health and Environment, *Colorado Health and Environmental Assessment 2013* (Denver: Colorado Department of Public Health and Environment, 2013), https://www.colorado.gov/pacific/sites/default/files/OPP_2013-Colorado-Health-and-Environmental-Assessment_0.pdf.
69. Lukas and others (see References).
70. See Colorado Water Conservation Board, *Colorado River Water Availability Study* (no date), <http://cwcb.state.co.us/technical-resources/colorado-river-water-availability-study/Pages/main.aspx>.
71. Colorado Water Conservation Board, *Colorado Drought Mitigation and Response Plan* (Denver: Colorado Water Conservation Board, 2013), <http://cwcb.state.co.us/water-management/drought/Documents/StateDroughtMitPlan2013/ColoradoDroughtMitigationResponsePlan2013.pdf>.

-
72. Colorado Water Conservation Board, *Colorado's Water Plan*, draft, report for Colorado Governor John W. Hickenlooper (Denver: Colorado Water Conservation Board: 2014), <https://www.colorado.gov/pacific/sites/default/files/2014-Draft-Colorado%27sWaterPlan%28FULL%29.pdf>.
73. U.S. Bureau of Reclamation, *Colorado River Basin Water Supply and Demand Study* (2012), available at <http://www.usbr.gov/lc/region/programs/crbstudy.html>; Woodbury and others (see note 55).
74. Decker and Fink (see References).
75. Federal Emergency Management Agency, *State Mitigation Plan Review Guide* (2015), http://www.fema.gov/media-library-data/1425915308555-aba3a873bc5f1140f7320d1ebeb18c6/State_Mitigation_Plan_Review_Guide_2015.pdf.
76. George Luber and others, "Human health," chapter 9 in U.S. Global Change Research Program (see References.)
77. City and County of Denver (see References).
78. Roberta Klein, "Transportation sector," chapter 8 in Gordon and Ojima (see References).
79. Federal Highway Administration, *The Federal Highway Administration's Climate Change and Extreme Weather Vulnerability Assessment Framework* (Washington, DC: Federal Highway Administration, 2012), http://www.fhwa.dot.gov/environment/climate_change/adaptation/publications_and_tools/vulnerability_assessment_framework/fhwahep13005.pdf.
80. Klein (see Note 78).
81. Eric Gordon, "Energy sector," chapter 7 in Gordon and Ojima (see References).
82. Liz Hormann, *2012 ODOT Climate Change Adaptation Strategy Report* (Eugene: Oregon Department of Transportation, 2012), http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/docs/odot_adaptation_strategy_final.pdf; Oregon Department of Transportation, *ODOT Climate Change*, <http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/pages/index.aspx>.
83. ICF International, *Caltrans Activities to Address Climate Change: Reducing Greenhouse Gas Emissions and Adapting to Impacts*, report to the California Department of Transportation (Sacramento: California Department of Transportation, 2013), http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf.
84. Federal Emergency Management Agency, *Revised Guidelines for Implementing Executive Order 1988, Floodplain Management: Draft for public comment* (2015), <http://www.fema.gov/media-library-data/1422653213069-9af488f43e1cf4a0a76ae870b2dcede9/DRAFT-FFRMS-Implementing-Guidelines-1-29-2015r2.pdf>.
85. Jedd (see note 30).
86. Western Governors' Association, *Wildlife Corridors Initiative* (2008), available at <http://www.nature.nps.gov/biology/migratoryspecies/documents/WGAWildlifeCorridorsInitiative.pdf>.
87. *An Act concerning public health, and making an appropriation in connection therewith*, Senate Bill 08-194, [http://www.leg.state.co.us/clics/clics2008a/csl.nsf/billcontainers/DB568B03CEEE1BA787257368007918D3/\\$FILE/194_enr.pdf](http://www.leg.state.co.us/clics/clics2008a/csl.nsf/billcontainers/DB568B03CEEE1BA787257368007918D3/$FILE/194_enr.pdf).
88. Colorado Department of Public Health and Environment (see note 68).
89. Rocky Mountain Climate Organization (see References).
90. Senate Bill 08-194 (see Note 87).
91. Wildfire Insurance and Forest Health Task Force (see References).
92. California Emergency Management Agency and California Natural Resources Agency (see References).
93. Cal-Adapt, *cal-adapt* (no date), <http://cal-adapt.org/>.
94. Cambridge Systematics, Inc., *Addressing Climate Change Adaptation in Regional Transportation Plans: A Guide for California MPOs and RTPAs*, report to the California Department of Transportation (Sacramento: California Department of Transportation, 2013), http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/FR3_CA_Climate_Change_Adaptation_Guide_2013-02-26_.pdf.

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95. California Department of Public Health, *Climate Action for Health: Integrating Public Health into Climate Action Planning* (Sacramento: California Department of Public Health, 2012), http://www.cdph.ca.gov/programs/CCDPHP/Documents/CAPS_and_Health_Published3-22-12.pdf.
96. *Iowa Climate Statement 2014: Impacts on the Health of Iowans*, 2014, http://cgrer.uiowa.edu/files/cgrer.uiowa.edu/files/pdf_files/Iowa%20Climate%20Statement%202014-Impacts%20on%20the%20Health%20of%20Iowans_with%20signatures.pdf.
97. Colorado State Forest Service, *Colorado Wildfire Risk Assessment Report* (Fort Collins: Colorado State Forest Service, 2013), <http://csfs.colostate.edu/pdfs/Colorado-WRA-Final-Report.pdf>.
98. Wildfire Insurance and Forest Health Task Force (see References).
99. National Fire Protection Association, *FireWise Communities* (no date), <http://www.firewise.org/?sso=0>; Fire Adapted Communities Coalition, *Fire Adapted Communities* (no date), <http://www.fireadapted.org/>.
100. President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (see References).
101. House Bill 13-1293 (see Note 2).
102. Averyt and others (see References).
103. Centers for Disease Control and Prevention, *CDC's Climate-Ready States and Cities Initiative* (no date), http://www.cdc.gov/climateandhealth/climate_ready.htm.
104. Wildfire Insurance and Forest Health Task Force (see References).



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The Colorado Climate Network supports efforts by local governments and allied organizations in Colorado to reduce and adapt to climate change. The Network is administered on behalf of its members by the Rocky Mountain Climate Organization.

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The Colorado Municipal League is a nonprofit, nonpartisan organization providing services and resources to assist municipal officials in managing their governments and serving the cities and towns of Colorado.

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