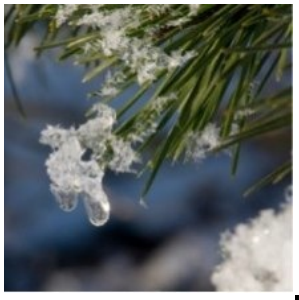

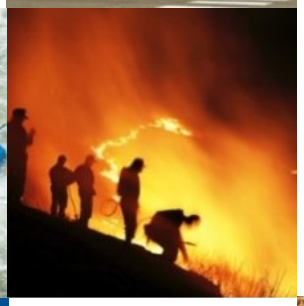

Climate Change & Aspen

An Update on Impacts to Guide Resiliency Planning & Stakeholder Engagement

EXECUTIVE SUMMARY

A report of the Aspen Global Change Institute

Prepared for the City of Aspen

ASPEN GLOBAL CHANGE INSTITUTE

Climate Change & Aspen

An Update on Impacts to Guide Resiliency Planning & Stakeholder Engagement

EXECUTIVE SUMMARY

For complete report go to: www.ourfutureaspen.com

A report by the Aspen Global Change Institute

Prepared for the City of Aspen

Prepared December 2014

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About AGCI

AGCI is an independent Colorado non-profit founded in 1989. The mission of the Aspen Global Change Institute (AGCI) is to further the scientific understanding of Earth systems and global environmental change through collaborative research projects, interdisciplinary scientific workshops, consulting, educational programs, publications, and videos. This work of regional to global significance provides new scientific understanding of critical environmental issues such as climate change, land-use change, and biodiversity loss, while improving scientific literacy and informing decision making and policy formation. AGCI collaborates with the science research community, governmental entities, stakeholders, students, and the public to accomplish its mission.

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FOREWARD

Climate change, a global issue with local consequences, poses a threat to Aspen's future. Increasing temperatures reduce our snowpack, changing water cycles diminish our rivers, and elevated risks of wildfire and landslides threaten our wilderness, property and health and safety.

Aspen's City Council, both current and former, have prepared for climate change. Though we've enacted a number of aggressive policies, two are vital: reducing our greenhouse gas emissions - a primary driver of climate change; and establishing a resiliency plan to help us address vulnerabilities in our local economy and environment. Both are aggressive, but necessary.

The following report prepared by the Aspen Global Change Institute, *Climate Change & Aspen: An Update on Impacts to Guide Resiliency Planning and Stakeholder Engagement*, is intended to help inform the resiliency planning effort. It updates the 2006 report and speaks to planning needs around critical areas that climate change affects, including: recreation and tourism, ecosystems, public health and safety, built environment and infrastructure, energy, and importantly, water.

I hope you'll find this report valuable, learn lessons from it and use the information to plan for a stronger, more resilient Aspen.

Thank you,

Steve Skadron, Mayor
December 22, 2014
Aspen, Colorado

PREFACE

Since the City of Aspen formally adopted a Climate Action Plan in May 2007, public awareness and concern about climate change has increased, yet societal actions remain nominal relative to the enormity of the challenge. This elevates the risk of near and long-term climate impacts to people and ecosystems—both in Aspen and worldwide.

Although aggressive action—globally and locally—is needed to address the root causes of climate change, local communities such as Aspen are complementing their efforts to reduce greenhouse gas emissions by also planning for the impacts arising from climate change, some portion of which are now unavoidable.

President Obama acknowledged the need to prepare for the impacts of climate change in June 2013 when he pledged his administration would "partner with communities seeking help to prepare for droughts and flood, reduce the risk of wildfires," and "make sure that cities and states assess risk under different climate scenarios so that we don't waste money."[1] It is clear from recent history and future projections that Aspen will face many of the impacts mentioned by the President, as well as additional changes, such as heat waves, altered precipitation, and dust on snow affecting mountain snowpack and the timing of runoff, all of which could alter the economic, cultural, and ecological lifeblood of the Aspen community.

Communities like Aspen can lead the way in planning for the impacts arising from climate change, some portion of which now appear unavoidable.

The City of Aspen has been a leader among cities—both large and small—in acknowledging the risks associated with climate change and pursuing aggressive and measurable actions that reduce greenhouse gas emissions. While still eager to continue visionary greenhouse gas mitigation programs, the City is now also working to prepare for climate change.

The following report serves as an update to an initial 2006 report by AGCI entitled, *Climate Change and Aspen: An Assessment of Impacts and Potential Responses*.[2] We hope the following report will be a useful complement to the earlier study and that it will make an important contribution to the City's work towards resiliency planning. Like the 2006 report, we are not intending to recommend specific actions or policies to pursue but rather offer ideas, observations, projections, and stakeholder perspectives that may be useful as a starting point in engaging the community on preparedness.

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[1] Obama, Barack. 2013. "Remarks by the President on Climate Change" (speech, Washington, DC, June 25, 2013), White House. http://www.whitehouse.gov/the-press-office/2013/06/25/remarks-president-climate-change

[2] Aspen Global Change Institute. 2006. Climate Change and Aspen: An assessment of impacts and potential responses. Available at: http://www.agci.org/dB/PDFs/Publications/2006_CCA.pdf

EXECUTIVE SUMMARY

Aspen's climate is already changing, and additional changes are anticipated throughout the 21st century and beyond. These local climate shifts will take place within the context of regional and global changes, all of which may result in conditions unprecedented in human history. The impacts of climate change are likely to affect Aspen's residents, ecosystems, and environmental amenities as well as the home communities of Aspen visitors.

For Aspen, climate change will likely include longer summertime warm periods, earlier onset of spring snowmelt, more precipitation arriving as rain rather than snow, and longer dry periods with heavier precipitation events in between. These types of changes could exacerbate already risky wildfire conditions, place extra pressure on already stretched water providers and users, provide additional challenges to ski area operators and other winter and summer recreation providers, as well as result in other impacts to every sector important to the Aspen community. Alongside the many challenges, new opportunities may also emerge, such as the possibility for expanded summertime activities.

The following report considers observations, climate modeling projections, relevant research from the literature, and stakeholder perspectives to explore climate change in Aspen as a basis for resiliency planning. Based on this effort, seven key findings emerge.

Seven key points

1. **Climate change continues to be an issue of global concern** with mounting evidence of current and future impacts to society and ecosystems. A consensus among decision-makers, citizens, and scientists is steadily growing and calls for action on emissions reduction and preparedness at international, regional, and local levels.

2. **Temperatures in Aspen during all seasons have increased since 1940,** and the summertime frost free period has lengthened by over one month. Precipitation and snowfall have declined slightly since 1980, although an overall increase has been observed since 1940.[3]

3. **Climate model results for the Aspen region project rising temperatures and alterations to precipitation over the 21st century,** and a key determinant of the magnitude of these changes will be future global greenhouse gas emission levels.

4. **Impacts from observational trends and future projections will affect critical sectors of the Aspen community,** including water, energy, recreation and tourism, public health and safety, ecosystems, and the built environment.

5. **Local stakeholders are concerned about climate change and its impacts on their environment, business, and/or personal well-being**. Many of the stakeholders interviewed for this report indicate they are already taking climate change into account for current decision-making and will likely continue to do so during future planning.

6. **Resiliency planning and implementation can help reduce vulnerability to anticipated impacts as well as exploit beneficial opportunities.** This effort is strengthened through stakeholder engagement and involvement, ongoing monitoring and evaluation, and processes that allow for flexible response strategies as both anticipated and unanticipated changes emerge.

7. **Significant reductions in greenhouse gases are a necessary part of ensuring resiliency.** Efforts to plan for the impacts of climate change will be more difficult, more expensive, and less likely to succeed if near-term strategies for emissions reductions are not enacted.

While ongoing efforts to reduce the root causes of climate change are still urgently needed, preparedness planning for future scenarios of climate-related impacts are also an essential component of society's response to climate change. By pursuing resiliency planning as a strategy for preparedness, the City of Aspen continues its legacy of leadership on climate change issues.

The aim of this report is to serve as an update to a previous study conducted by the Aspen Global Change Institute in 2006. The findings presented here offer an assessment of observations, modeling, climate impacts research, and interviews intended to provide a

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[3] In 1980, the Aspen weather station underwent a change in location, moving approximately 200 feet higher in elevation.

groundwork of scientific and stakeholder input to inform and support the City's resiliency planning process. While scientific understanding has expanded and improved since the time of the 2006 study, the results of this work largely reconfirm its main conclusions.

Climate change is a global challenge requiring local and global responses

Globally, surface air temperatures have increased 1.5ºF (0.8ºC) since 1880. Projected future increases range from slight to staggering and are primarily dependent upon future emissions. As Figure 1 illustrates, average climate model projections indicate over 7ºF (3.9ºC) in additional warming under a high emissions scenario, whereas the lowest emission scenario produces less

Figure 1. Global observations and projections of average surface temperature

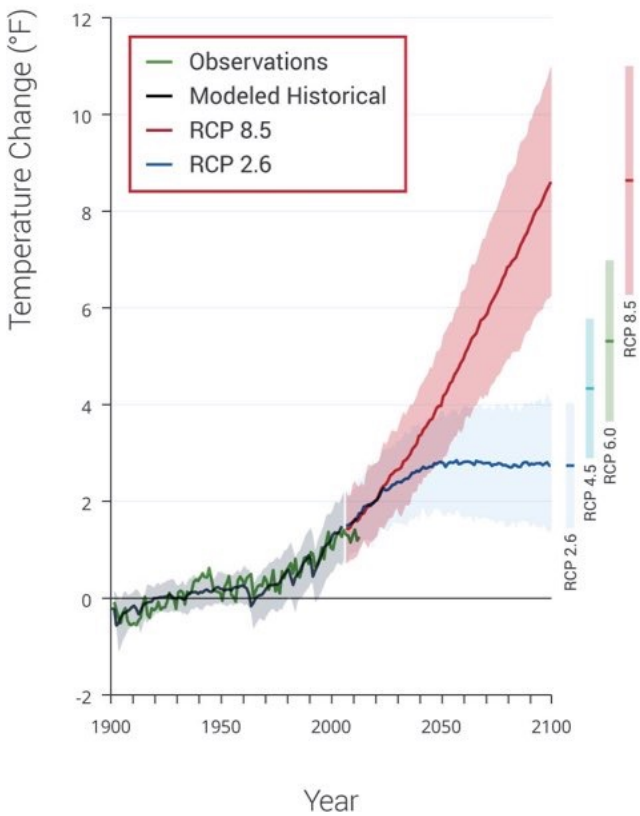


Figure 1. Observations and climate modeling results illustrate 20th and 21st century global average temperature. For historical periods, climate models largely reproduce observed conditions. For future projections, two greenhouse gas emissions scenarios are considered: a low emissions scenario, called RCP2.6 (in blue) and a high emissions scenario called RCP8.5 (in red). End-of-century temperature projections for two middle of the road scenarios, RCP4.5 and RCP6.0, are indicated to the right of graph. Under any scenario, temperatures continue to increase beyond present day levels. Additional end-of-century results for other emissions scenarios are provided to the right. Shading indicates the range of results provided by the ensemble of models. Source: Melillo et al. 2014.

than 2ºF (about 1.1ºC) in additional warming. However, it is important to note that achieving the low emissions scenario would require negative emissions later this century. While both scenarios will result in climate-related impacts, the magnitude of those impacts is likely to vary greatly depending on the trajectory of actual emissions over the coming century. As of 2014, the world continues to closely track the highest emissions scenario (RCP8.5).

Around the world, the impacts of climate change are already underway, affecting agriculture, human health, ecosystems on land and in the oceans, water supplies, and the livelihoods of more vulnerable populations. Future additional impacts along these lines are expected, and therefore, considering options for climate preparedness is now occurring at local, regional, national, and international levels.

Aspen's climate is changing

Observations of Aspen's climate since 1940 indicate rising temperatures and lengthening summers. Minimum temperatures have increased more than maximum temperatures, while average temperatures have increased approximately 2ºF (1.1ºC). One of the most striking indicators of Aspen's changing climate is the trend in frost free days, where the length of the frost free period has increased by 23 days since 1980 (see Figure 2).

Figure 2. Frost free days in Aspen

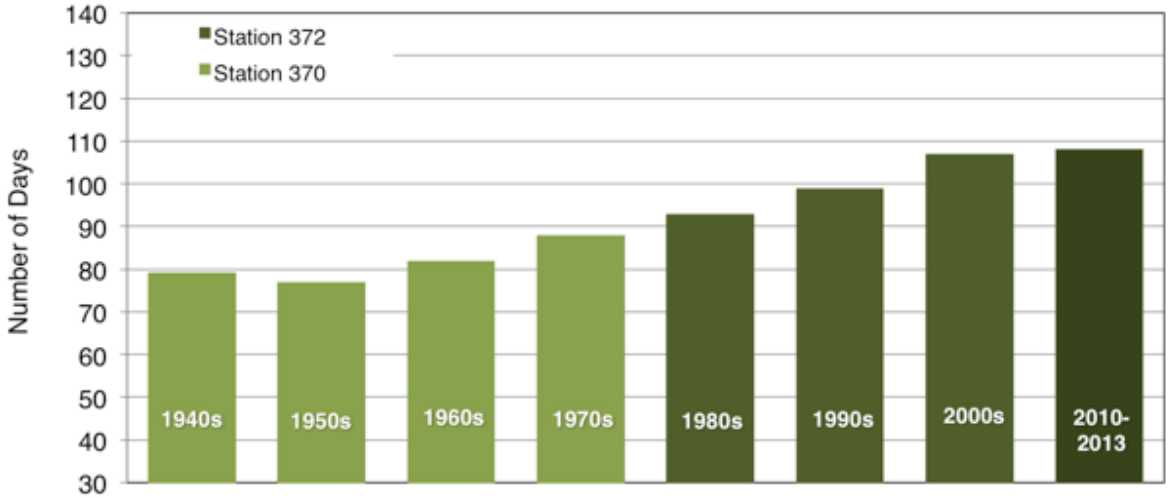


Figure 2 shows a rise in the decadal average of consecutive frost free days since the 1940s. The final darkest green bar does not represent a full decade; it represents only the decade to date: 2010-2013. The location of Aspen's weather monitoring station changed between 1979 and 1980, shifting upward in elevation ~200 feet. Data source: NOAA-NCDC Aspen Stations 370 and 372.

Trends in total precipitation as well as snowfall are mixed, both revealing an overall increase since 1940 yet a slight decrease since 1980. Analysis of local climate trends is somewhat confounded by the relocation of Aspen's primary weather station in 1980 and the high variability associated with single station records.

Table 1. Summary of climate trends observed in and around Aspen

Observation	Trend: 1940-1979	Trend: 1980-2013
Average Temperature	1.0º F increase (.6º C)	1.4º F increase (.8º C)
Frost Free Days	11 day increase	23 day increase
Total Precipitation	2.6 inch increase	0.6 inch decrease
Snow Water Equivalent *(Independence Pass)*	*Data not available*	1.2 inch decrease

Table 1. Trends for the periods 1940-1979 and 1980-2013 are displayed based on data from Aspen's weather station. As explained in further detail in Chapter 2, Aspen's weather station relocated in 1980 approximately 200 feet up in elevation, which may affect the trends observed since 1940. Sources: NOAA-NCDC stations 370 and 372; NRCS SNOTEL Independence Pass.

Additional changes are projected

Future projections of the Aspen region indicate further increases to temperature. Model projections of precipitation are more uncertain, but recent results suggest slight increases. However, due to temperature increase a greater proportion of precipitation is likely to come as rain rather than snow, with repercussions for water availability. A key uncertainty in estimating the magnitude of future changes and their impacts is the quantity of future global greenhouse gas emissions produced by the global economy.

Currently, the world continues to follow a high emissions trajectory. Under this scenario (called RCP8.5), projections prepared for this report for the Western Slope region, including much of the Colorado plateau, suggest a nearly 3ºF (1.7ºC) temperature increase by 2030 and a nearly 10ºF (5.6ºC) temperature increase by 2090, relative to observations during the historical period 1980-1999. These projections are consistent with a similar analysis for the entire state of Colorado. In comparison, a switch to a middle emissions (RCP4.5) scenario could reduce projected temperature change by the end of the century by nearly half.

While aggressive emissions reductions may forestall possible catastrophic changes to Aspen's climate, there are still significant changes anticipated under assumptions of lower emissions. In other words, Aspen's climate is projected to change even with the more optimistic emissions scenarios. As a consequence, building resilience to the impacts of climate change (i.e.

adaptation) is now a prudent complement to existing efforts to reduce emissions (i.e. mitigation) for all likely future pathways.

Model projections of precipitation prepared for this report suggest a slight increase in total precipitation is likely for the Western Slope region during the 21st century. Conclusions drawn from a survey of other modeling results for the surrounding region published since 2006 remain mixed. Some results lean towards greater precipitation, others less, and all results contain uncertainty bounds that include the possibility for either greater or less than historical amounts of precipitation. While projections of precipitation remain uncertain in terms of the overall direction of change, there is high confidence that within the given magnitude (plus or minus) of modeled precipitation projections, rising temperatures will have a drying affect on local hydrology regardless.

Aspen's climate is projected to change under both low and high emissions scenarios. Resiliency planning is relevant for either pathway.

From a planning standpoint, resource managers will need to take into account the uncertainties associated with precipitation projections. Even within these uncertainties, planning efforts can count on the relative likelihood that future precipitation will increasingly come as rain rather than snow, increased temperatures will accelerate drying, and inter-annual variability—long a condition of the Roaring Fork Valley and the broader U.S. West—will persist.

Table 2. Summary of temperature projections for western Colorado

Projection Period	Medium Emissions (RCP 4.5) Temp. Change in Deg F (Deg C)	High Emissions (RCP 8.5) Temp. Change in Deg F (Deg C)
2030	+2.8 (1.6)	+2.9 (1.6)
2060	+4.5 (2.5)	+6.2 (3.5)
2090	+5.3 (3.0)	+9.7 (5.4)

Table 2. Projections of temperature change relative to the period 1980-1999 are provided for medium (RCP4.5) and high (RCP8.5) emissions scenarios. More results are discussed in Chapter 3, and additional discussion of methods and additional results are available in Appendix B. Source: C. Tebaldi.

Climate impacts could range from incremental to transformational

Climate change will impact a broad range of sectors vital to Aspen's economic, ecological, and cultural well-being. For this report, impacts to recreation and tourism, water, ecosystems, energy, public health and safety, and the built environment are considered.

Table 3. Summary of potential climate impacts to Aspen by sector

	Climate-related changes	Potential impacts
Recreation & Tourism	• Increasing wintertime temperatures • Shift toward more precipitation falling as rain • Increasing stream temperature • Changes to timing and quantity of runoff	• Difficulty achieving targeted ski area conditions during existing ski season schedule • Reduction in suitable fall and early winter conditions for snowmaking • Alterations to timing of ideal summer and winter recreation conditions • Degraded aesthetic quality of environment and increasing hazards posed to visitors (e.g. fire)
Water	• Increasing dry periods in the Western U.S. • Decreasing proportion of precipitation falling as snow • Changes to the timing and availability of water	• Greater pressure on existing water resources • Changes to ecological regimes • Increased fire risk • Changes to timing and volume of peak flows • Reduced hydroelectric generating potential
Ecosystems	• Increasing length of frost free period • Alterations to the timing and type of precipitation • Increasing annual and seasonal temperatures • Alterations to snowpack timing, quantity, and areal coverage	• Plant communities shift to higher elevations • Local specialist species diminish or disappear • Encroachment by invasive species • Enhanced conditions for outbreaks of insects affecting trees • Enhanced conditions for more frequent, more intense, and larger wildfires • Alterations to water quality
Public Health & Safety	• More extreme high temperatures and higher average temperatures • Higher risk of extreme events (e.g., flood, drought, fire, landslide) • Air quality impairment such as increased presence of ground level ozone	• Changing ranges of disease-carrying species • Changing climate conditions correlating to areas of food or water supply • Environmental-stress related mental illness • Loss of property or injury related to disaster events • Lengthened and growing allergy season • Increased respiratory illness
Energy	• Increasing high temperatures during summer • Warming of wintertime minimum temperatures • Alterations to snowpack and timing and quantity of runoff	• Uncertainty in future dependability of hydropower resources • Increase in cooling load and reduction in heating load of building's energy demand • Climate-related risks to national and international energy supply
Infrastructure & the Built Environment	• Shift in the magnitude of temperature and precipitation extremes • Warming of wintertime minimum temperatures; increase in summertime maximum temperatures • Alterations to timing and quantity of runoff	• Increase in hazards to structures and infrastructure from flood, fire, landslide and drought • Increase in cooling load and reduction in heating load of buildings' energy demand

This report draws upon local observations and regional projections, as well as relevant scientific literature, to discuss the types of potential impacts that may occur in the Aspen area. However, specific responses are beyond the scope of this report and will require more detailed investigation into location-specific risks and strategies for their reduction. One example is the need to update studies on landslide risk based on projections of future hydrologic patterns — such as the rate of snowmelt and frequency and intensity of heavy rain events.

Some of the impacts identified in this study may take place gradually over decades, such as changes in energy demand patterns by people or gradual uphill shifts in plant and animal species. Other impacts, such as a severe fire or a precipitation event that causes a flooding or mudflow event could occur suddenly with dramatic and immediate consequences. Uncertainties remain in both areas, including the pace at which the global economy will decarbonize and the sensitivity of the global climate system to increasing concentrations of greenhouse gases in the atmosphere.

Vulnerability to these global changes at a local level, in turn, will depend on how local climate is affected by larger regional and global patterns. In addition, site-specific conditions, such as the exposure of structures to fire or the capacity of emergency response in event of a flood, are relevant for evaluating risk and prioritizing potential response strategies.

Ongoing consideration of all of the aforementioned components of local impacts assessment are needed as Aspen plans, implements, evaluates, and adjusts its response to both near and long-term impacts of climate change.

Stakeholders are concerned and have begun to prepare

As a preliminary source of input from the Aspen community, AGCI and the City of Aspen interviewed eleven stakeholders representing the spectrum of sectors considered in this report. Interviews were designed to elicit stakeholders perspectives on climate change, such as personal observations of changes, impacts identified, actions contemplated or taken in response, and overall level of concern about climate change relative to other issues.

All stakeholders surveyed were able to identify changes in the environment they found to be significant, although many were uncertain as to the extent the alterations were caused by climate change. Perceived changes identified by stakeholders included:

- More common drought conditions
- Less predictable seasonal weather patterns
- Earlier onset of spring
- Decreasing winter snowpack
- Reduction in extreme cold winter temperatures
- Species shifts in plant and animal communities

In general, stakeholders interviewed for this study were already involved in efforts that in some way, whether or not specifically focused on climate change, relate to reducing vulnerability or enhancing resiliency. These efforts include:

- Watershed planning and riparian health management (i.e. Roaring Fork Watershed Plan)
- Enhancing operational speed and flexibility for snowmaking
- Mitigating wildfire hazard and wildfire response capacity
- Implementing greener building codes
- Adjusting timing, size, and location of commercial rafting trips
- Expanding attractions for tourists during early winter and shoulder seasons

In addition, numerous areas of activity were identified by stakeholders for potential future actions, whether taken independently or in collaboration with other entities. These desired future actions include public education, enhanced flexibility in planning and action (e.g., development of crisis plans), reconsideration of water laws, long-term monitoring, and adjustment of building codes in relation to fire protection and energy use.

Moving forward on resiliency planning

> **Resilience:** *The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event or gradual system change in a manner timely enough to ensure the preservation, restoration, or improvement of its essential basic structures and functions.-* Adapted from IPCC 2012

To build resilience in the face of the complex nature of climate change requires an iterative, community-based process of assessment, planning, implementation, and evaluation. While elements of this cycle have occurred in the past, this phase of Aspen's engagement with resiliency planning represents the green circle in Figure 2. This type of process and its resulting outcomes are strengthened by engagement with a broad base of stakeholders, including those who may be impacted by actions taken as well as those who can inform and implement responses strategies. A diversity of criteria and types of responses can be considered in this process, and lessons from other communities may prove helpful in navigating the path forward.

Figure 3. Adaptation planning cycle

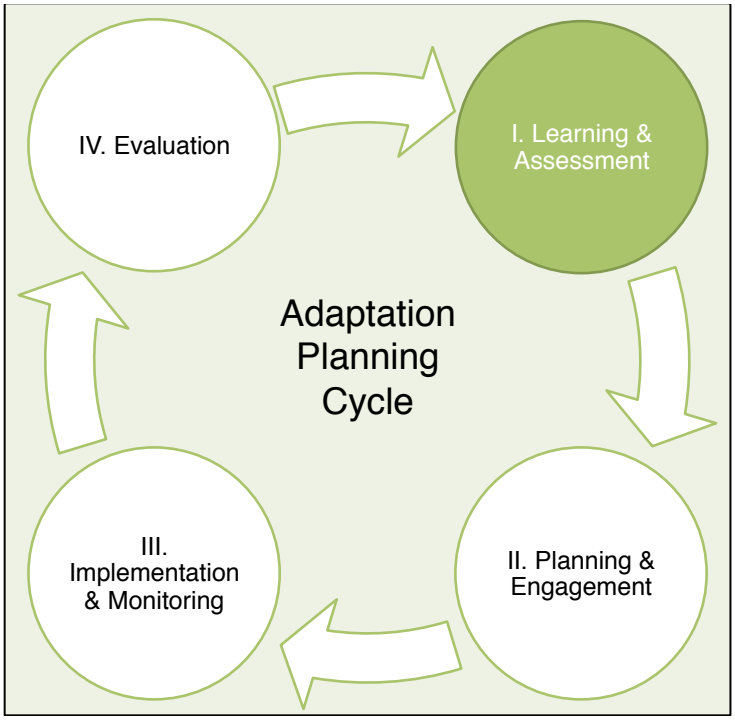


Figure 3. Planning in the context of change is often best supported by an adaptive planning process that is cyclical rather than linear and allows for learning and adjustment along the way. Initial learning and assessment (I) informs planning and initial engagement with the community (II). Plans are then implemented and long-term monitoring based on goals and objectives (III) enable evaluation. As learning takes place within the sectors of our community — what worked, what didn't, and why — the adaptive management cycle begins anew, building from refined goals of and approaches to resiliency and sustainability.

Figure 3 presents an idealized version of the adaptive planning process as four phases. Though in practice resiliency planning may not occur as neatly as illustrated here, the notion of planning as a cyclical process instead of as a linear route with beginning and end points is a central theme of effective resiliency planning in the context of climate change.

As a resiliency planning process begins to contemplate actions and the goals that impel them, a range of types of response can be considered along with multiple criteria for gauging success. For example, responses to the impact of increasing wildfires could include reducing exposure of assets in fire prone areas, reducing the vulnerability of structures through best practices in wildfire mitigation, enhancing emergency response and recovery capacity, or a combination of all these approaches as well as others. Response strategies under the category of *transformation* may include a number of resiliency enhancing actions coordinated with efforts such as greenhouse gas reduction goals that, in combination, increase the overall sustainability of a community.

Criteria for success can be considered throughout resiliency planning and can cover a broad range of factors, including the avoidance of economic losses and preservation of basic municipal services. Criteria can also extend to capture important, if harder to measure, factors such as maintaining ecological health, preserving procedural integrity, and maintaining or even enhancing community character and culture (see Table 4).

Table 4. Categories of response and criteria for success

Example Categories of Response	Example Criteria for Success
• **Reduce exposure:**(e.g., relocate assets from high risk areas) • **Enhance response and recovery preparedness** (e.g., increase emergency response capacity) • I**ncrease resilience to changing risks** (e.g., planning for multiple future scenarios) • **Reduce vulnerability** (e.g., hardening infrastructure and services to extreme events) • **Transfer and share risks** (e.g., collaborative planning and action with stakeholders and neighboring governments) • **Transformation** (e.g., pursing an integrated approach to mitigate underlying causes of risk while also enhancing resiliency and overall sustainability)	• **Economic:** Minimizing or avoiding financial losses and/or capitalizing on opportunities and benefits • **Institutional**: Preserving the ability of institutions, policies, and resource management to meet obligations to constituents as well as ecosystems • **Ecological:** preserving the resilience capacity, diversity and services made possible by healthy ecosystems • **Social:** Reducing vulnerabilities and/or inequities within marginalized populations while strengthening communities • **Procedural:** Supporting transparent and inclusive processes • **Cultural:** Preserving and/or enhancing vital aspects of community character and civic culture
Adapted from IPCC 2012	*Adapted from Moser and Boykoff 2013*

Communities large and small have begun considering and implementing actions to enhance resiliency. Examples range from Keene, New Hampshire to King County, Washington — from New York City to Moab, Utah. In many instances, exemplary plans include inclusive processes for community input, a scientific basis for considering future impacts, specific action items that delineate responsibilities, timelines, and measurable outcomes, as well as opportunities for reflection and flexibility as future conditions unfold over time.

Additionally, regional and national networks and organizations have formed to provide resources to support communities in their efforts. Chapter 6 of the report offers more details and descriptions of these resources. Leadership as well as partnerships plays an important role in developing and implementing resiliency strategies. Aspen is in a position to demonstrate leadership in adaptation strategies for mountain resort communities.

Roadmap

The full report examines the key points and statements made throughout this summary in greater depth. Chapter 1 outlines the rationale for the update to the 2006 report and provides a conceptual overview of assessing climate-related risk at a local scale. Definitions pertinent to thinking and communicating about preparedness for climate change are provided.

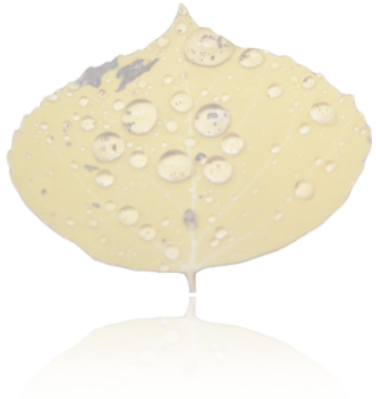
Chapter 2 presents observational data on recent historical patterns of climate change for the world, the southwestern region, and for Aspen. A specific analysis of available Aspen weather data since 1940 is reported in addition to a brief discussion of historical hydrologic data on the Roaring Fork River. As a complement to historical observations, Chapter 3 looks forward by using several lines of climate modeling results to portray possible future climate conditions in the Aspen region based on various greenhouse gas emissions scenarios. One approach taken employs a similar methodology to those utilized in the 2006 Study. Another approach characterizes the results of modeling studies for regions surrounding or near to Aspen and compares these new results to the results of the 2006 Study.

Chapter 4 explores the potential impacts to six sectors identified as important to the City of Aspen while setting of the scope of this study. They include: recreation and tourism, water, ecosystems, public health and safety, energy, and infrastructure and the built environment. The impacts presented in this section are based on a survey of scientific literature addressing climate-related impacts in areas comparable or related to Aspen. It is anticipated that this overview will be a launching pad for more in-depth consideration of how anticipated trends and changes will play out locally.

Chapter 5 summarizes the input received from a set of eleven stakeholder interviews conducted in early 2014 by AGCI and the City of Aspen. Stakeholders were selected to represent the range of sectors examined in Chapter 4, and the interviews were intended as a preliminary round of

engagement with the community on climate change impacts and resiliency planning. Summaries of changes and impacts identified by stakeholders as well as actions taken or in planning are documented and discussed.

Chapter 6 offers some preliminary guidance for the anticipated City and community effort on building resiliency. A conceptual model for adaptive management, categories of response that build resiliency, criteria to consider when defining goals and objectives, and a small set of helpful examples are provided. Finally, a concluding section points the way forward and identifies areas of future research that could support a resiliency planning process.

Many of the climate impacts and vulnerabilities discussed in the 2006 report related to climate change impacts on the physical, socioeconomic, and ecosystems of the Aspen area have been validated in the literature on Upper Colorado River basin and mountain resort communities in general. This new study, however, shifts its focus towards resiliency and how to frame it in a changing climate as a critical complement to ongoing mitigation efforts. It serves as an introduction to areas the City and the community as a whole may consider in developing a comprehensive resiliency plan — a living document updated as conditions change and new information becomes available.

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