Colorado Resort Communities and the 2002-2003 Drought: Impacts and Lessons Learned

By

Olga V. Wilhelmi
Environmental and Societal Impacts Group
National Center for Atmospheric Research
Boulder, CO
E-mail: olgaw@ucar.edu

Deborah S.K. Thomas
University of Colorado at Denver
Denver, CO
E-mail: Deborah.Thomas@cudenver.edu

Michael J. Hayes
National Drought Mitigation Center
University of Nebraska-Lincoln
Lincoln, NE
E-mail: mhayes2@unl.edu

2004

QUICK RESPONSE RESEARCH REPORT 174

Introduction

Drought is a frequent climatic event in the United States. Examinations of the spatial patterns of drought in the contiguous United States show that drought tends to be most persistent in the central to northern Great Plains and Rocky Mountains (Walsh et al. 1982; Karl 1983; Karl et al. 1987; Soule 1992). With annual precipitation that averages only 17 inches statewide, drought is a recurring phenomenon in Colorado and a normal part of the regional climate. State climate records show that Colorado has had a number of major drought episodes, several of those lasting from 6 to 12 years (McKee et al. 2000).

Following the development and implementation of the Colorado Drought Response Plan in 1981 (Colorado Division of Disaster Emergency Services 1981), Colorado experienced a long "wet" period from 1982 to 1999, which was free from widespread multiyear droughts. Normal or above-normal precipitation during these two decades shifted public attention away from the drought phenomenon. This wet period coincided with overall population growth across the state, rapid development of mountain resorts in Colorado, and a widespread expansion of population in resort communities (Todd et al. 2003). In the 1990s alone, the population of Summit County, Colorado, increased by 82.8 percent, thus increasing demands for water supplies. In 2000, the drought plan was revised, placing more emphasis on drought mitigation. Revision of the drought plan occurred at the right time; starting in the autumn of 1999, below-average precipitation and above-average temperatures brought the beginning of what many media sources and public figures referred to as "the worst drought in Colorado history."

When compared to other U.S. twentieth century droughts, this recent drought was as extensive as any of the major droughts of the last 40 years, but not as large as the "dust bowl" droughts of the 1930s and 1950s. Persistent dryness in the Southwest region of the United States, including Colorado, in 2002 resulted in the driest September-August in the 108-year record (NCDC 2003). This multiyear drought event affected the entire state of Colorado, resulting in significant water shortages. Although precipitation deficits were not exceptional in all areas of the state (Pielke et al. 2004), evaporation losses, above-average temperatures, and increasing water demands across the state resulted in a drought event with exceptional impacts on economic, environmental, and social sectors.

A number of studies have been conducted to address societal vulnerability to drought in the context of agriculture (e.g., Wilhelmi and Wilhite 2002) or water management (e.g., Knutson and Hayes 2002). Little has been done to look at the local level drought issues of tourism dependent communities. In this study we focused on the implications of the 2002 drought on tourism in Colorado and on the mountain resort communities in particular. Tourism brings approximately $8.5 billion into Colorado's economy each year. Skiing, the largest sector of the tourism industry, accounts for 19 percent ($1,368 million) of total tourism spending (State of Colorado 2002). Reliance of many Colorado tourism and recreational activities on water availability (e.g., rafting and skiing), in addition to increasing population migration to mountain areas, increases water demands and suggests a likely increased vulnerability of resort communities to drought.

Unique Drought Hazard or Drought Background

Compared to other natural hazards, droughts have several unique characteristics. First, drought is a slow onset hazard, often described as a "creeping phenomenon," which makes it

difficult to determine when a drought begins and ends. Second, droughts do not have a universally accepted definition, causing confusion about whether a drought exists and its severity. Third, although drought is not as physically destructive as most natural disasters, it can affect vast areas and more people than any other hazard and cause a wide range of economic, environmental, and social impacts (Wilhite and Glantz 1987, Hewitt 1997, Wilhite 2000a), both direct and indirect. A drought can be a short-term event affecting a particular economic or social sector or it can be a multiyear event with a ripple effect on multiple resources and economic sectors.

Drought is often viewed primarily as an atmospheric phenomenon. However, the importance of drought is its negative impacts on society. Impacts of drought largely depend on societal vulnerability and level of preparedness at the time a drought occurs. The 2002 drought event presented an opportunity to address unique problems that resort communities experience during a drought, in particular, the complex interplay between environmental sustainability, economic vitality, and social perceptions. The 2002 drought also provided an opportunity for communities, government officials, and resort managers to assess their level of preparedness for extended periods of dryness.

In early 2002, Colorado was in its fourth consecutive year of below-normal precipitation. In January, snow pack levels were measured at 65 percent of normal. By April, the statewide snow pack totals had declined to 52 percent of normal. In addition to persistent dryness, above-normal temperatures accelerated evaporative losses and increased demand on available water supplies. In April 2002, for the first time since 1981, Colorado's governor requested activation of the Colorado Drought Mitigation and Response Plan (State of Colorado 2001) and convened the state's drought impact task forces to recommend drought response measures. The governor asked the Task Force to prepare a report of anticipated drought impacts and recommend legislative action to help offset the impacts of drought (State of Colorado 2003). Sixty-three Colorado counties received federal drought disaster designations from the U.S. Department of Agriculture. The statewide drought (Figure 1) affected agricultural production, municipal water supplies, and the tourism industry. Every sector of the tourism industry in Colorado was negatively affected by the drought. The direct damage to the recreation and tourism industries had a ripple effect and indirectly affected businesses and services that support the economies of resort communities, including restaurants, retail and grocery establishments, and others. In addition, dangerous wildfire conditions and smoke, national park and campground closures, and extensive media coverage of the Colorado wildfires had a significant impact on summer tourism.

Methodology

With the goal of understanding the impacts of and vulnerabilities to the drought hazard in Colorado resort communities, a case study was carried out between June and September 2003. The methodology for this study was based on qualitative research methods. The objective was to collect a diverse sample of interview subjects, such as representatives from state and local government, specific businesses (e.g., ski resorts), and collections of businesses (e.g., chambers of commerce). Communities from a variety of geographic locations were included in the study, each with a variable proximity to resorts, major transportation arteries, and urban centers. Even though most of those interviewed were directly associated with the tourism and recreation industry, perspectives from the environmental and agricultural sectors were obtained as well.

Interviews were conducted to investigate different types of drought impacts the communities experienced and identify the lessons learned from this drought event. Two sets of field interviews were conducted to gather information. The first set of interviews was conducted June 17-20, 2003, and concentrated on the Denver area, the Interstate 70 corridor, and Steamboat Springs. The second set of interviews was conducted September 16-20, 2003, and focused on the southwestern part of the state. Overall, twenty-two people were interviewed in 10 locations across Colorado, including Denver, Frisco, Vail, Breckenridge, Steamboat Springs, Durango, Cortez, Telluride, Montrose, and Crested Butte (Figure 2). Those interviewed included three state-level officials, one statewide ski industry representative, eight Chamber of Commerce and County Tourism Bureau representatives, five ski resort representatives, one county emergency manager, one representative from an environmental organization, and one Colorado State University extension agent. The interviews were conducted in an open-ended, conversational fashion. Although the interviews and range of questions were adjusted to interviewees' specific roles and occupations, the following questions/topics served as a guiding structure for the interviews:

- Drought perception (e.g., beginning, end) and types of impacts
- Lessons learned from the drought
- Local-resort-state relationships
- Awareness of or involvement with the Colorado drought mitigation plan; suggestions for changes to current state actions
- Next steps for preparedness for future droughts
- Role of the media in drought coverage

The interviews quickly revealed the vast complexity of the tourism industry across Colorado based on a variety of factors such as summer versus winter activities, proximity to the Denver area, regional variation in drought impacts, and the dependence of the local economies on tourism. The specific drought severity, drought impacts, and lessons learned at each location were related to the unique characteristics of that area. Several interviews included telephone or e-mail follow-ups with specific questions. All interviewees had a chance to read the report and provide their comments.

Observations

In Colorado, the tourism industry brings nearly $8.5 billion annually into the state's economy and employs more than two hundred thousand people (State of Colorado 2003), many of whom comprise the population of resort communities. Data collected during interviews allow classification of observed impacts into three general categories: direct drought impacts, secondary significant hazards related to drought, and other factors affecting resort communities. The latter category presents a cumulative effect of a group of factors affecting economies where drought was identified as one of several factors.

The tourism industry in Colorado is extensive and complex. Thus, a number of elements affect drought impacts, including summer versus winter activities, proximity to the Denver metropolitan area, regional variation in drought severity, and the dependence of many resort communities on tourism. During the drought of 2002, tourism in Colorado was hit especially hard; every person interviewed identified significant direct and indirect impacts. These ranged from being expressly a result of the drought, low reservoir levels for example, to secondary

impacts resulting from the public perception of drought based on the severe wildfires that occurred in several locations around the state during the summer of 2002. In fact, in most cases, the secondary drought impacts (wildfires, grasshoppers, bark beetles) were more significant than the drought event itself.

Direct Drought Impacts

Similar to those impacts reported by the state of Colorado (2003), those interviewed mainly identified impacts on agriculture and summer tourism, especially water-related activities, such as rafting, fishing, and reservoir use. During the summer of 2002, the water recreation industry was the most affected of all tourism and recreation industries. The extremely low levels of many reservoirs and rivers throughout Colorado presented a major challenge for this sector. In addition to economic impacts, there were clear social and environmental drought impacts. Examples mentioned included depression resulting from drought-stressed natural surroundings, low stream flows, reduced water level in reservoirs, tree mortality, and poor ground water quality. As an illustration of how severely low the water levels were in 2002, Figure 3 shows the differing water levels in the Green Mountain reservoir in 2002 and 2003.

Warm temperatures and a statewide decrease in the snowpack had an impact on several of Colorado's ski resorts. Out of 25 Colorado ski resorts and ski areas, 21 make snow early in the season, from October through December. Snowmaking was implemented in Colorado as a result of droughts in 1979 and 1981 to ensure a resort's opening date and a good snow base. Snowmaking and associated acquisition of water rights for snowmaking is considered by resorts to be a major mitigation action against extreme drought events. However, in severe drought, this may increase contention over water rights with local communities. Overall, the direct winter impacts of the recent drought, especially on ski resorts in Colorado, were minor compared to the summertime impacts on other sectors of the recreation and tourism industry.

Secondary Hazards Associated with Drought

Of the secondary hazards indirectly related to drought, wildfire was the most significant. Extremely dry fuel conditions resulted in 4,612 wildfires across the state in 2002, creating poor air quality and increased potential for flash flooding. The state reported that nearly 1,000 structures were destroyed by the fires (State of Colorado 2003). For example, the Missionary Ridge Complex Fire that occurred in June and July 2002 in La Plata and Archuleta Counties, consumed 70,662 acres and 56 homes with a cost of $40.6 million (USDA 2004). The extreme dryness of fuel, unique characteristics of the topography (i.e., steep grades), and homes built in recent years in wildfire high-risk areas of the wildland/urban interface contributed to the magnitude of the impacts. In addition, debris flows resulting from flash flooding in the aftermath of the Missionary Ridge Fire caused substantial damage. Several homes that were defended during the fire were nearly destroyed by the water and debris during the flash flooding that followed.

Even though wildfires (their number and magnitude) were in part a secondary impact of drought, many communities did not identify drought as a significant hazard until the fires started. Those interviewed spoke about a complex relationship between drought and fires in or near Colorado resort communities. Fires are as natural to Colorado as drought is a normal part of its climate. A state report indicated that Colorado typically experiences about 3,000 wildfires with a

loss of 70,000 acres per year (State of Colorado 2003). The intense dryness of 2002, following several drought years, resulted in an increase in the number fires by almost 50 percent. The total area burned was nearly eight times larger than that recorded in normal years.

Everyone interviewed identified wildfire as major factor in the overall summer tourism decline. The direct impacts of the wildfires were national and state park closures, bans on campground fires, health threats due to flames and smoke, and the nationwide media coverage of the wildfires occurring in Colorado. The dramatic images of Colorado fires influenced decisions about vacationing in the Colorado mountains (Figure 4). The wildfires also often caused people to realize how severe the drought was. Wildfires played a less definite role in a winter tourism decline because once the temperatures cool, the wildfire season ends. Lower visitation during consequent winter months was only minimally a result of lagging human perception of dryness in Colorado and was more likely linked to broader skiing visitation trends.

Other secondary impacts related to drought identified by those interviewed included the infestations of bark beetles, grasshoppers, and cut worms; the spread of noxious weeds; and the decline in groundwater quality in some residential mountain communities. Many of these factors can trigger long-term ripple effects. For example, the susceptibility of the stressed trees from drought contributed to the rapid spread of the bark beetle in the forests in the southwestern part of the state. As an extension of the extended effects, the large forested areas affected by the bark beetle made perfect standing fuel for wildfires.

Additional Contributing Factors

Drought alone was not responsible for stressing the economies of Colorado resort communities. The overall decline in the U.S. economy, threats of terrorism and decline in long distance travel, political instability in the world, and general uncertainty associated with armed conflicts also contributed to fewer tourists visiting resort communities. The increase in gas prices may have also played a role in some of the decline in tourist visits. Some declines could be associated with national trends in tourism, such as the decline in visitation in the Southwest's national parks and national trends in skier visits.

Overall, impacts reported by the state and observed by local communities showed the unique and complex nature of the drought hazard in resort communities, especially when combined with other state, national, and global factors.

Lessons Learned

The interviews included a discussion about minimizing drought impacts in the future and reducing the vulnerability of mountain resort communities. Commonly, a disaster triggers proactive thinking and planning for future hazards events. There were a number of lessons learned during the 2002 drought. These lessons, identified by interviewees, can be grouped into three main categories: 1) water supply-demand conflict, 2) importance of cooperation and local-state relationships, and 3) need for a balanced message in the media (drought awareness with consideration of tourists' perceptions).

Precipitation in Colorado is highly variable in both time and space, which creates a complex water management task. During a multiyear drought, the water shortages across the state often result in competing demands for already variable and scarce water supplies. The recent drought in Colorado has highlighted the importance of water resources to economic well-

being in the resort communities and in the Western United States in general. When combined with rapidly growing mountain development and reliance on water resources for recreational activities, this drought has brought issues of competing resources to the forefront. The unique characteristic of this situation, in particular for those resorts and communities isolated from urban centers, was the desire and necessity to *cooperate* in order to get through difficult times of drought. In order to sustain local economies, it was highlighted that cooperation was important between different sectors, for example, between agriculture and tourism, between the resort itself and a resort community, and also between communities themselves.

Tourism is sensitive to public perception. Normally, when a natural disaster occurs, especially when financial assistance is required, public announcements are made about geographic locations suffering from impacts of these hazards. It was clearly stated by the interviewees that drought awareness has to be made, but with consideration of tourists' perceptions. Communities largely dependent on tourism and visitor spending recognized the importance of having disaster communication response plans in place explicitly for the tourism industry. In fact, the Colorado Office of Tourism developed a comprehensive public relations plan in the summer of 2002 as part of the Drought Task Force. The locals frequently identified the importance of the work done by the Colorado Office of Tourism. In addition to the public relations campaign at the state level, some of the local communities developed communication plans as well, recognizing that they cannot depend on the state. These disaster communication response plans were considered especially necessary at both the state and local levels because, in spite of the sporadic nature of the wildfires, the public perception was that the entire state was being affected by the fires and their smoke plumes.

One of the lessons learned was that the public message must be balanced to educate both residents and tourists about the hazard and how it affects them. The message should include both accurate information about the hazard and positive aspects of either regional variability or diversity of attractions. Change in cultural or environmental educational or marketing strategies is needed to leverage hazards. Often, hazards can present good opportunities to learn about resources and change certain practices.

Recommendations

As a result of the information collected from the interviews and the lessons learned by the resort communities across Colorado, eight recommendations have been developed for resort communities vulnerable to drought impacts.

1. Develop State and Resort Community Crisis Management Plans.

One of the most important lessons learned by the state and resort communities in Colorado was that disaster events, like the drought and fires during the summer 2002, require the establishment of crisis management plans so that the response to the events can be swift and coordinated. Therefore, it is recommended that states and local resort communities each develop their own crisis management plans to deal with these disaster events. Several communities already had crisis management plans in place that immediately helped them respond to the fires of 2002. In fact, one interviewee cited the example of their crisis management plan, which was helpful during the drought and then equally helpful in 2003 when a flood-caused sinkhole closed Interstate 70 for several days in the spring.

The resort communities shared that a successful crisis management plan requires the involvement of all local businesses and the local media. It is important that community officials, businesses, the media, and the public are all sharing the same information and providing a consistent message to each other as well as state and national officials and media. In some cases, the World Wide Web proved to be effective for providing the coordination and communication needed by the crisis management plans. Press releases were made available over the Web, and Web pages and webcams were effective in providing information to potential tourists and visitors.

The most important aspect of a community crisis management plan is elimination of "panic" that frequently results because of disaster events. The communities with plans did say that these plans reduced or eliminated "panic" in their communities during the summer of 2002. However, the communities without plans mentioned that there was "panic" in how they responded that same summer. Noting this contrast in the reflections of the communities is critical.

2. Improve Coordination and Communication.

Colorado resort communities were unanimous in suggesting that improved coordination and communication is critical for dealing with drought events. One community expressed it as "communication is the key!" This recommendation applies to improved coordination and communication between officials at the local level as well as between the local officials and state or federal officials. Improved coordination and communication is an important component of a community crisis management plan as well. In the case of Colorado, increased coordination and communication between the resort communities and the ski resorts did take place during 2002. Some communities also discussed how important it was for the state to communicate with the communities as part of its Drought Task Force activities. The Colorado Office of Tourism had representation on the Drought Task Force and also worked hard during the drought to make sure that the various resort communities and individual ski resorts were informed. The office and several of the resort communities relied heavily on e-mails and the Web to make sure information was communicated between various officials, agencies, and the public. Improving the vertical connection between state and local officials is a critical component of this recommendation.

Some additional tools are available to improve coordination and communication. For example, in one case, the Colorado State University Cooperative Extension was involved in assisting with the coordination and communication. The extension services of land grant universities across the country are in a unique position to provide valuable interactions between officials as well as technological transfer between the universities and rural regions of each state. Improved communication and coordination includes the media as well. All participants in the study expressed the value of the media and the importance of close coordination and communication with the local, state, and national media. An element of this recommendation is workshops held by resort communities to explain to the media the importance of tourism and recreation for the local economies and to develop better collaboration between officials and the media during natural hazard events.

3. Market the Positive During a Drought Event.

Marketing and public perceptions are very important in determining tourists' visits across the state. The rule of thumb that "all publicity is good publicity" did not apply to the Colorado tourism and recreation industry in 2002. As a result, one recommendation would be that the state, and the resort communities located within the state, be prepared to go on the offensive and identify ways to shift their marketing strategies and focus on the positive aspects about the local tourism and recreation that still exist in spite of the drought.

There were several great examples of how the resort communities across Colorado tried to accomplish this recommendation during 2002 and the other years of drought across the state. In each case, it required that the communities become innovative in identifying new ideas. One community used the grasshopper outbreak as an opportunity to market some good- natured grasshopper-related products, thereby poking fun at the natural situation they were experiencing in a positive, rather than negative, way. Another approach was a "Got Water?" campaign, while several communities shifted their marketing focuses toward more water-related themes and highlighted water more in their promotional materials. As mentioned in the previous two recommendations, the Web played an important role in positive marketing as well. One community highlighted a "mystery in the desert" Web site targeted toward Asian audiences.

4. Diversify Local Economies in Resort Communities.

Colorado resort communities are highly vulnerable to disaster events because their economies are linked so tightly to tourism and recreation. For example, the central counties within Colorado rely on tourism and recreation for 51 percent of their employment and 76 percent of their income generation. Several communities saw the importance of diversifying the economies as well as diversifying their businesses. One of the examples given was that rafting companies should probably not just focus on rafting, but have additional sources of income to rely on during the years when rafting is not as available. In other years, however, it might be the rafting that helps the company to sustain itself through another difficult period. A couple of communities mentioned that developing stronger interrelationships between the resort communities and the surrounding agricultural areas was an important opportunity to improve their diversity and reduce their vulnerability to disaster events. Another goal that communities mentioned was trying to bring their summer/winter tourism and recreation income closer to a 50/50 ratio in order to provide some additional diversity in dealing with hazard events.

5. Develop Coordinated Water, Wildfire, and Drought Educational Materials.

Many of the officials interviewed for this study discussed the importance of developing coordinated water, wildfire, and drought educational materials. Providing this information to schools around the state for curriculum inclusion is an opportunity to increase the understanding of the importance of tourism, recreation, and natural resources to the state and the interrelationship of hazards to these sectors. As seen with other topics, such as pollution and environmental issues, educating the youth has a "trickle up" impact on the adult society. Educational materials, however, are also needed for the public in general and for the visitors coming into the state from elsewhere.

The concept of a "Drought Awareness Week" was generally seen as a bad idea to those in tourism and recreation because it would focus too much on the hazard rather than opportunities, thus producing a negative perception. However, incorporating drought into water and wildfire awareness campaigns was generally thought to be important. Finally, educating the statewide and local media on the interconnectedness of these issues was seen as very critical so that balanced stories about the events can be followed by positive stories focusing on the recovery processes.

6. Promote Research on the Drought Impacts, Responses, and Predictions for Resort Communities.

It became clear during the study that very little is known about the complete extent of drought impacts and responses on the tourism and recreation industries and how they affect resort communities. For example, understanding both local and statewide economic losses resulting from Colorado's summer of 2002 is probably not possible because of the interconnectedness of the tourism sector and nonhazard-related trends. In addition, long-term predictions are improving and the opportunity to identify the potential for drought events on resort communities is increasing. Understanding how the accuracy (and uncertainty) of these predictions affects action (or inaction) by decision makers at the state and resort community level becomes increasingly important.

7. Increase State Tourism Budgets.

Because marketing and public perception play such an important role for resort communities and for states that rely heavily on the tourism and recreation industry, it is vitally important for states to have money set aside to help the communities and the state respond during disaster events, such as the drought and wildfires across Colorado during the summer of 2002. Most communities surveyed responded positively and generally enthusiastically about the efforts made by the Colorado Office of Tourism in 2002, but universally agreed that the office was under-staffed and had too little money to adequately cope with the situation. It is obvious that budget options are very limited in Colorado and other states, but given the importance of tourism and recreation statewide, and the impacts that disaster events have on specific resort communities and the businesses within these communities, having some contingencies built into state budgets seems necessary.

8. Create a National Office of Tourism.

At times during the study, frustration was expressed at the lack of national representation and attention to the unique and specific needs of recreation and tourism, particularly during hazard events. Therefore, it is recommended that a national office of tourism (or tourism and recreation) be created at some level. Disaster events, like the current drought, have a devastating local impact on communities dependent on recreation and tourism. Thus, there is a great need for a mechanism to provide assistance to these communities and the businesses within these communities, which would be very similar to the mechanism currently available to agricultural producers experiencing drought. Currently, there are several national drought-related initiatives being discussed, and it is recommended that the tourism and recreation industries be major components in each of these national initiatives.

Summary

The appeal of Colorado tourism is in the diversity of outdoor recreational activities throughout all four seasons. A majority of tourist activities and resort communities rely on the availability of water. Recent drought in Colorado brought the issue of limited water resources in the American West to the forefront. In many situations, this drought was a wake up call prompting water managers to assess their preparedness for extended periods of dryness and investigate regional cooperation in order to avoid conflicts. This is particularly important because of rapid mountain development as well as population growth in the Front Range that has occurred in the past twenty years and the consequent increase in water demands. Significant impacts, with respect to the actual precipitation deficit, showed that Colorado's society is now more vulnerable to short-term droughts than in the past (Pielke et al. 2004). Thinking about and participating in water conservation and practicing it in the marginal lands is critical for long-term sustainability.

Acknowledgements

Support for this research came from the Quick Response Program, funded by the National Science Foundation though the Natural Hazards Research and Applications Information Center in Boulder, Colorado. The authors wish to thank all of those who participated in the drought study and who shared their experiences with us.

References

Colorado Division of Disaster Emergency Services. *The Colorado drought response plan*. 1981.

Hewitt, K. 1997. *Regions at risk: A geographical introduction to disasters*. England: Addison Wesley Longman Limited.

Karl, T.R. 1983. Some spatial characteristics of drought duration in the United States. *Journal of Climate and Applied Meteorology* 22:1356-66.

Karl, T.R., F. Quilan, and D.D. Ezell. 1987. Drought termination and amelioration: Its climatological probability. *Journal of Climate and Applied Meteorology* 26:1198-1209.

Knutson C. and M.J. Hayes. 2001. *Analyzing effectiveness of state drought plans*. Quick Response Report 136. Boulder, CO: Natural Hazards Research and Applications Information Center, University of Colorado. http://www.colorado.edu/hazards/qr/qr136/qr136.html.

McKee, T. B., N.J. Doesken, J. Kleist, C. J. Shrier, and W.P. Stanton. 2000. *A history of drought in Colorado: Lessons learned and what lies ahead*. 2nd ed. Colorado Water Resource Institute 9. Ft. Collins, CO: Colorado Water Resources Research Institute, Colorado State University. http://cwrri.colostate.edu/.

National Climatic Data Center (NCDC). 2003. *Climate of 2002: Annual review, U.S. drought*. http://lwf.ncdc.noaa.gov/oa/climate/research/2002/ann/drought-summary.html.

Pielke Sr., R.A., N. Doesken, O. Bliss, T. Green, C. Chaffin, J. Salas, C. Woodhouse, J. Lukas, and K. Walter. 2004. Drought 2002 in Colorado–An unprecedented drought or a routine drought? Ft. Collins, CO: Colorado Climate Center, Colorado State University. http://ulysses .atmos.colostate.edu/pdfs/PAGEOPH_2002DroughtArticle.pdf.

Scott, D. 2003. Climate change and tourism in the mountain regions of North America. In *Proceedings of the 1st international conference on climate change and tourism*, *Djerba, Tunisia, April 9-11, 2003*. Madrid: World Tourism Organization.

Soule, P.T. 1992. Spatial patterns of drought frequency and duration in the contiguous USA based on multiple drought event definitions. *International Journal of Climatology* 12:11-24.

State of Colorado. 2001. *The Colorado drought response and mitigation plan*. http://www .dola.state.co.us/oem/Publications/droughtplan.pdf.

State of Colorado. Office of State Planning and Budgeting. 2002. *Economic impact task force report on the impact of drought*. http://cwcb.state.co.us/owc/Drought_Planning/Economy_ITF _report.pdf.

State of Colorado. Colorado Water Availability Task Force and Impact Task Forces. 2003. *2003 drought impact and mitigation report*. http://cwcb.state.co.us/owc/Drought_Planning/2003_Drought_Impact_and_Mitigation_Report_Final.pdf.

Thomas, D., O. Wilhelmi, and M. Hayes. 2004. Disaster reduction, drought, and the resort community. In *Mountain resort planning and development in an era of globalization*, ed. T. Clark, A. Gill, and R. Hartmann. In review.

Todd, A., D. McKnight, and L. Wyatt. 2003. Abandoned mines, mountain sports, and climate variability: Implications for the Colorado tourism economy. *Eos* 84 (38): 377, 386.

U.S. Department of Agriculture (USDA). Forest Service. 2004. Missionary Ridge Fire Archives. http://www.fs.fed.us/r2/sanjuan/fire/missridge/index.shtml.

Walsh, J.E., M.B. Richman, and D.W. Allen. 1982. Spatial coherence of monthly precipitation in the United States. *Monthly Weather Review* 110: 272-86.

Wilhelmi, O.V., and D.A. Wilhite. 2002. Assessing vulnerability to agricultural drought: A Nebraska case study. *Natural Hazards* 25:37-58.

Wilhite, D.A. 2000. Drought as a natural hazard: Concepts and definitions. In *Drought: A global assessment*, ed. D.A. Wilhite, 1-18. New York: Routledge.

Wilhite, D.A., and M.H. Glantz. 1987. Understanding the drought phenomena: The role of definitions. In *Planning for drought: towards a reduction of societal vulnerability*, ed. D.A. Wilhite and W.E. Easterling, 11-27. Boulder, CO: Westview Press.

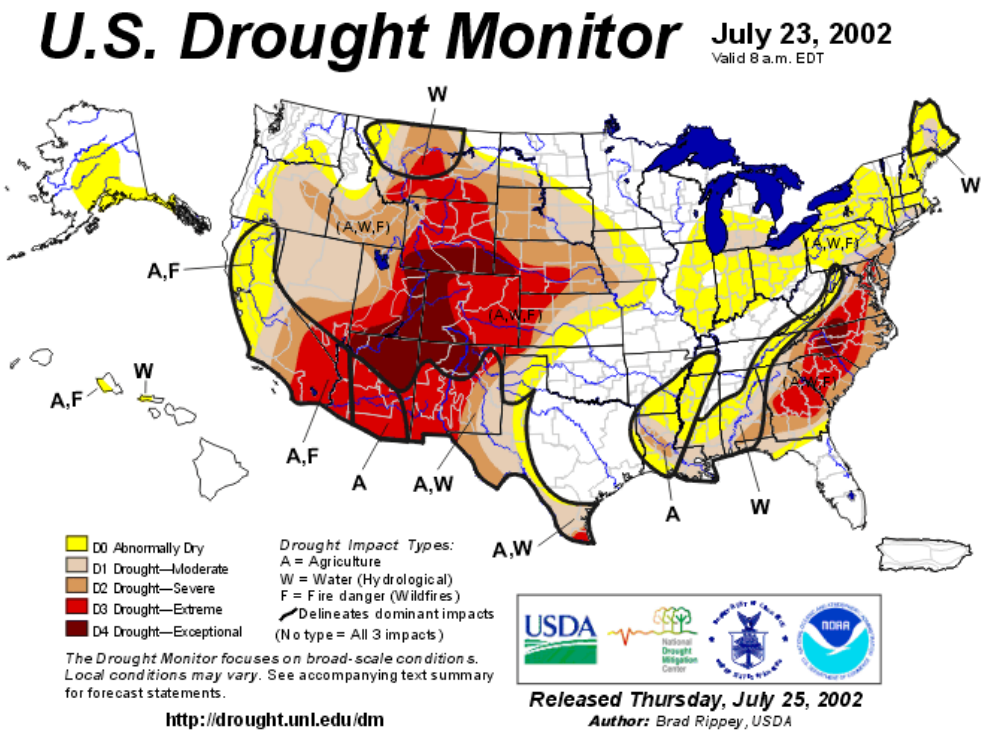

Figure 1: The U.S. Drought Monitor for July 23, 2002, shows the state of Colorado in extreme and exceptional drought categories.

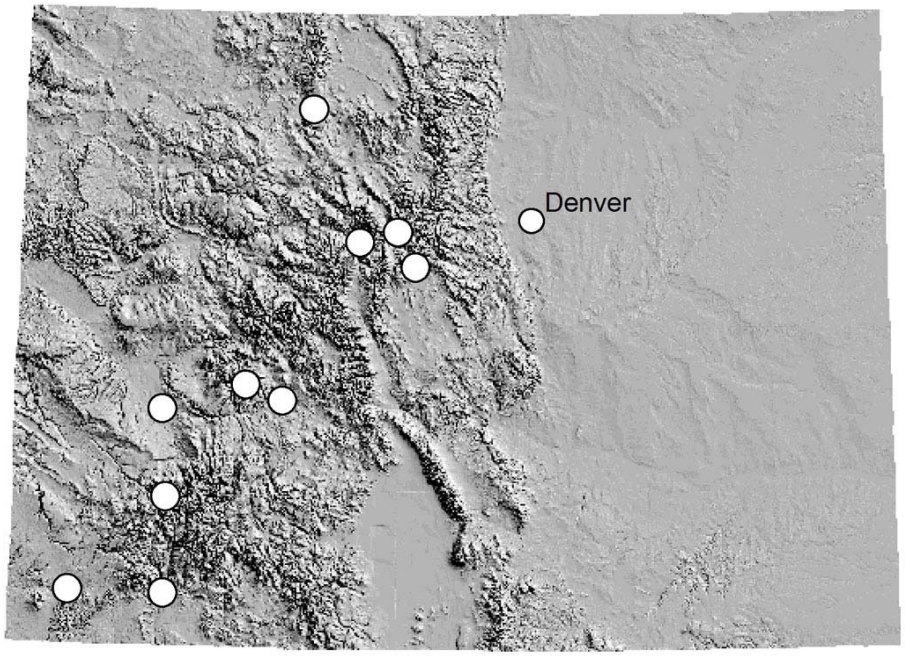

Figure 2. Interview locations throughout Colorado (Thomas et al. 2004).

(a) (b)

Figure 3. Changes in the Green Mountain reservoir water level due to drought: (a) water level in 2002, (b) water level in 2003.

Figure 4. Images of western wildfires shown on the Weather Channel in June 2002.