Confronting Climate Change in New Mexico

Action needed today to prepare the state for a hotter, drier future

HIGHLIGHTS

New Mexico's climate is getting hotter and drier, driven by regional and global warming trends. This means earlier springs, hotter summers, and less predictable winters. Precipitation patterns are also changing, with more intense droughts and a greater proportion of precipitation falling as rain rather than snow. Shrunken snowpacks and earlier snowmelts contribute to lower stream flows at critical times of the year when the reduced availability of water has greater economic and environmental consequences. To prepare for the expected impacts of these climate trends, New Mexico would benefit from sustained efforts to mitigate the potential consequences of less water, the health impacts of more excessive heat, and increased losses of lives and property from wildfires, while safeguarding the state's natural resources. Other regions of the world can look to New Mexico's growing leadership on planning for water-resource stress periods and increasing drought-resilient renewable energy sources.

Climate change is altering fundamental weather patterns—affecting temperatures, water availability, and weather extremes—that shape the lives of New Mexicans. As a result, the infrastructure and resource-management plans designed for the conditions of the past may not meet future needs of the farmers, ranchers, outdoor enthusiasts, and other residents of New Mexico.

Already, the resources and systems that New Mexicans depend upon are strained, and further changes in the climate may increase the risks to their homes, their businesses, and their lifestyles.

Developments like these are expected to continue, and likely worsen, as average temperatures rise. While the scarcity of water has long defined the Southwest, the National Climate Assessment has advised that "climate changes pose challenges for an already parched region that is expected to get hotter and, in its southern half, significantly drier" (Garfin et al. 2014).[1]

Chili peppers are just one of the crops under threat of climate change in New Mexico, as extreme heat and drought cause water supplies to dwindle.

Union of Concerned Scientists

Federal, state, and local governments can do a great deal to protect New Mexicans from current extreme heat, drought, fire, and flooding and to help them plan and prepare for future impacts. State and federal initiatives are already making financial and information resources more available, especially for assessing needs. The next step is to use such resources to design and implement on-the-ground actions that can reduce the risks and make communities more resilient to climate impacts. Strategic investments in long-term projects are also necessary, as is a refocusing of existing programs on planning and resilience. As the people of New Mexico come to understand what they face, they can prepare a prudent response.

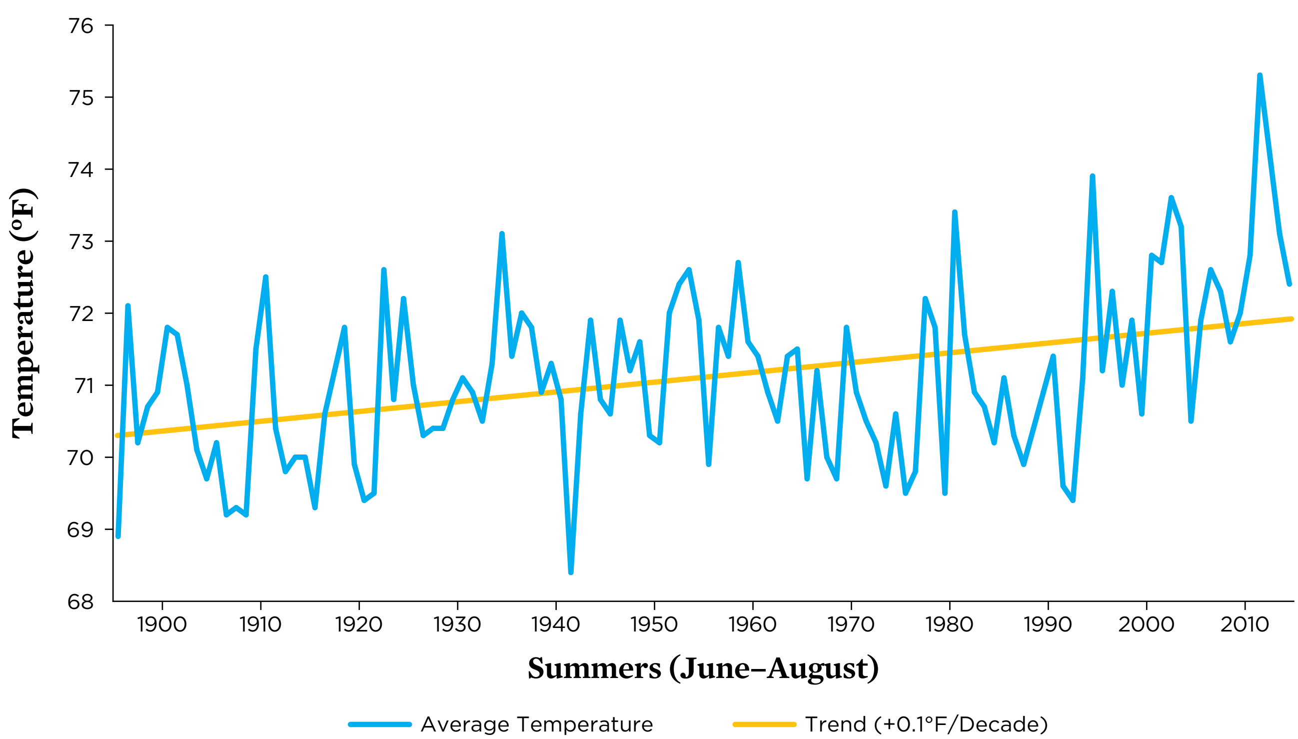
> *"Climate changes pose challenges for an already parched region that is expected to get hotter and, in its southern half, significantly drier."*
>
> — Third National Climate Assessment

Higher Temperatures, More Heat Extremes

In New Mexico, the sixth-fastest-warming state in the nation, the average annual temperature has increased about 0.6°F per decade since 1970 or about 2.7°F over 45 years (Tebaldi et al. 2012). Across the Southwest, the average annual temperature has increased by about 1.5°F, with the decade 2001–2010 being the warmest in over a century (Hoerling et al. 2013).[2] Average annual temperatures in New Mexico are projected to rise another 3.5 to 8.5°F by 2100 (Kunkel et al. 2013).[3]

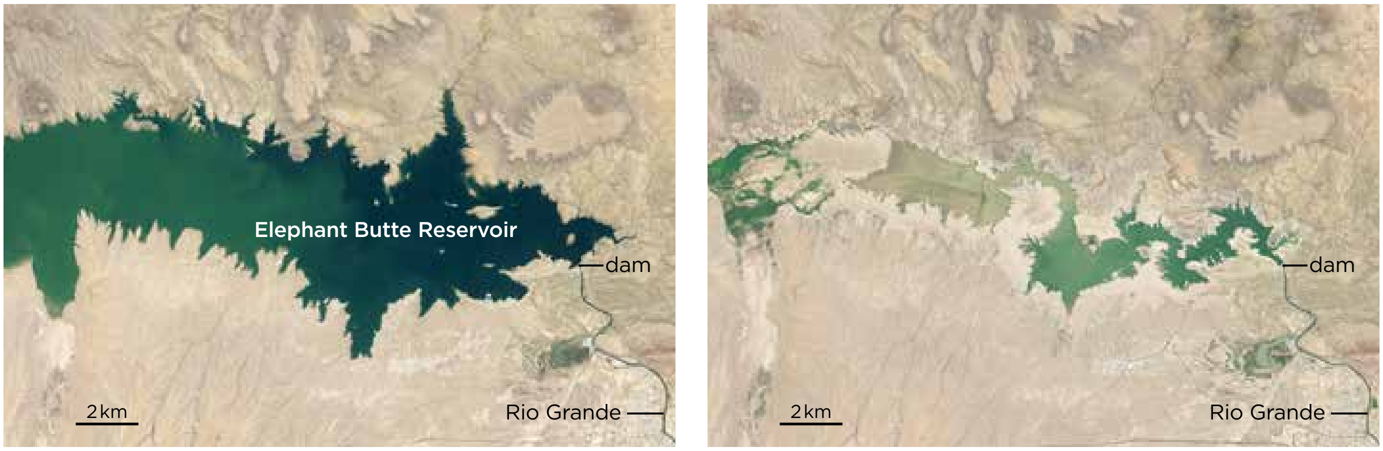
The summer of 2012 was one of the hottest in Albuquerque's history. That year, the city recorded 85 days with temperatures of 90°F or higher (U.S. Climate Data 2012). The following summer, the temperature hit even higher extremes. On June 27,

FIGURE 1. Summer Temperatures in New Mexico are Rising



Summer temperatures in New Mexico vary from year to year, but a careful analysis shows a consistent warming trend—a trend that is projected to continue into the future. Since 1970, the trend has steepened to an increase of about 0.6°F per decade.

SOURCE: NOAA 2016.



NASA

In 2013, the Elephant Butte Reservoir reached its lowest level in 40 years (right)—just 3 percent of its storage capacity, compared with a nearly full reservoir in 1994 (left). As a result, farmers received less than 10 percent of their typical irrigation water, forcing them to turn to groundwater and other sources.

2013, the city's main airport, Albuquerque International Sunport, recorded a temperature of 105°F, tied for the second-highest on record (Tassy 2013). Sixty miles away and 1,000 feet higher, the temperature at Santa Fe Municipal Airport reached 102°F, the highest ever recorded there (Oswald 2013).

INCREASING TEMPERATURES, SHRINKING WATER RESOURCES

Between 2001 and 2010, the flow in each of the Southwest's major waterways—the Sacramento-San Joaquin river system, the Colorado River, the Rio Grande, and rivers in the Great Basin—was 5 to 37 percent lower than average for the twentieth century (Hoerling et al. 2013). Late-winter and spring snowpacks are projected to decline, and this and the resulting reductions in runoff and soil moisture are expected to make the water supplies for the Southwest's cities, agriculture, and ecosystems even scarcer (Cayan et al. 2010). Droughts, a persistent risk in New Mexico, have broken historical records in recent years, disrupting the state's most vulnerable economic activities. New Mexico entered a severe six-year drought in 2009, by some measures the worst in more than a century, following closely on the heels of an intense drought in the early 2000s (Fleck 2014a). If heat-trapping gases continue to build up in the atmosphere, future droughts are projected to far outstrip those of the past 800 years (Schwalm et al. 2012).

Flow in the Rio Grande, which relates directly to the amount and timing of snowmelt in the mountains north of Albuquerque, is one of the best indicators of drought in New Mexico. For the decade ending in 2010, its flow was 23 percent lower than the twentieth-century average (Hoerling et al. 2013). Every year from 2009 to 2014 was drier than average on New Mexico's portion of the Rio Grande, and the period from 2011 to 2013 was the hottest and driest since recordkeeping began in 1895 (Cart 2013). The Rio Grande and Elephant Butte reservoirs reached historically low levels, reducing allocations of irrigation water for farmers by more than 90 percent and forcing the city of El Paso to depend entirely on groundwater (Voiland 2013). Ranchers have struggled to maintain their herds, and farmers have become increasingly dependent on groundwater resources, adding costs to save their pecan orchards, chiles, and other crops. Smaller communities worry about the viability of their water supplies, fueled by reports like those from Magdalena, the central New Mexican village that made national news when its wells ran dry and residents turned to bottled water (Walsh et al. 2014). Uncertainty in water supplies—ranging from individual wells to acequias (community-managed irrigation canals) to municipal water supplies—are facing ever-increasing demands.

Across the Southwest, the capacity of snow to store water is crucial to managing water, and climate change risks disrupting this vital source of New Mexico's water supply. In 2015, for the fifth year in a row, New Mexico experienced a drought due to diminished snowfall in the mountains (although spring and summer rains offered some relief) (Fleck 2015). In 2014, for the first time in its 40-year history, the San Juan-Chama Drinking Water Project, designed to supplement water resources for Albuquerque, Santa Fe, and other communities in the Rio Grande watershed, was dry (Fleck 2014b).

In the coming decades, climate change will exacerbate the risk of drought in New Mexico in several ways. The National Climate Assessment projects that many parts of the state will see less precipitation overall and more consecutive dry days (Walsh et al. 2014). Even when areas receive rainfall similar to the typical amount they received historically, higher temperatures will increase the water needs for crops and livestock, while also drying out the soil more rapidly.

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Drought and wildfire decrease the soil's ability to absorb moisture. When New Mexico's heavy rain falls on this affected soil, it runs off instead of seeping down, causing disruptive and dangerous flash floods.

Most important, higher temperatures will reduce snowpack and promote earlier snowmelt in the headwaters of New Mexico's major rivers, resulting in sharply lower levels of available water at critical times of the year (Garfin et al. 2014).

EXTREME PRECIPITATION AND THE LOSS OF SCARCE WATER

New Mexicans are accustomed to extreme rainfall, with much of the state's precipitation generally falling in July and August, associated with the North American monsoon system. However, climate projections across the United States suggest that even as total annual precipitation decreases in places like the Southwest, the heaviest annual rainfall events may become more intense (Walsh et al. 2014). When heavier precipitation falls on drought-hardened or wildfire-transformed soil, which has a reduced ability to absorb moisture, more of the water runs off into streams instead of percolating into the ground (Chief et al. 2008). This can lead to flash floods, as occurred in 2014, when 90 percent of New Mexico experienced extreme or exceptional drought (Crimmins et al. 2014). The monsoon rains, which arrived late that year, dropped an average of three to six inches of rain across the state over just five days in September, with some areas receiving more than 10 inches (NWS ABQ 2015). Albuquerque received nearly half of its expected annual rainfall in a single deluge (*Albuquerque Journal* 2013). As a result, river floods and crests were exceptional in downstream areas. Such extreme events are projected to become more common, forcing communities to prepare for both extreme droughts and extreme floods.

The Impact on New Mexico's Agriculture and Forests

Higher temperatures year round and more frost-free days during winter—especially in an already hot and moisture-stressed region—are projected to increase the stress on plants, making them more vulnerable to agricultural pests and diseases (Frisvold et al. 2013). At the same time, New Mexico forests will continue to be affected by large and intense fires that occur more frequently, potentially overwhelming current and past efforts to manage forests in ways that reduce such risks (Joyce et al. 2014).

INCREASING COSTS TO AGRICULTURE

New Mexico's multibillion dollar agricultural sector already faces the effects of a warming climate. Farmers and ranchers are facing higher costs for less and lower-quality water, particularly in the southern part of the state. As drought conditions persist, farmers who historically have relied on water allocations from reservoirs and streams to irrigate their crops are pumping more and more groundwater to make up the deficit. Deeper and deeper wells are needed to accommodate the falling water table, and often the water contains higher levels of salt and other minerals that damage crops and contaminate the soil (Frisvold et al. 2013).

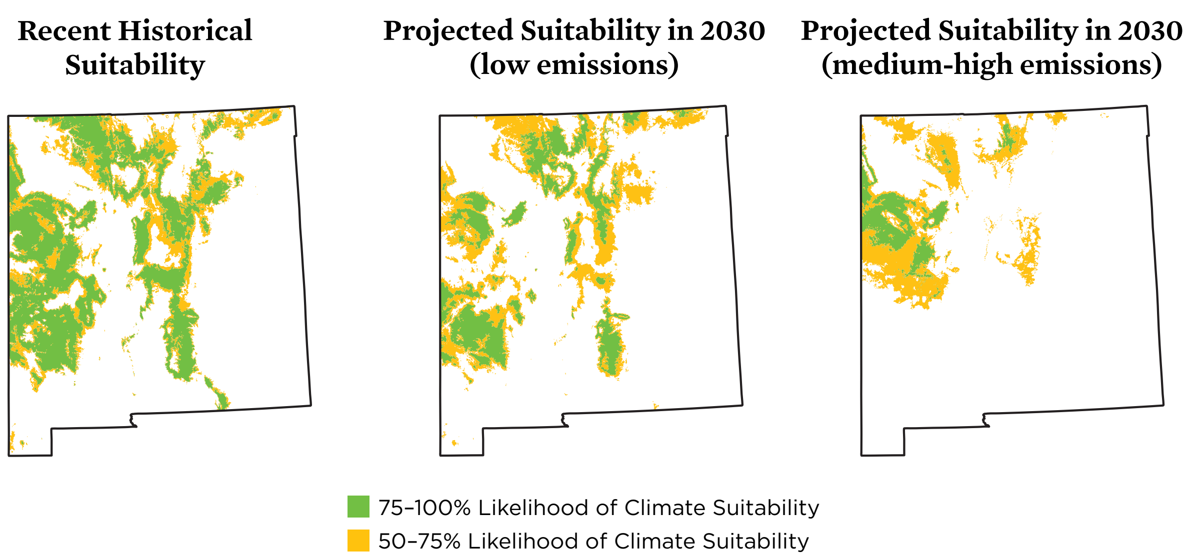
In 2013, Rio Grande farmers received allotments of only 3.5 inches of water per acre, compared with a full allotment of 36 inches in normal years (New Mexico Water Dialogue 2013). This meant they received just a tiny fraction of the 4 to 5 acre-feet needed between planting and harvest (Bosland and Walker 2004). At the same time, ranchers significantly reduced their herd sizes or sold off cattle to give grasslands a chance to recover from extreme drought (Uyttebrouck 2013).

FORESTS

In recent years, drought, insects, and wildfires have ravaged New Mexico forests at a scale not seen in living memory (Funk et al. 2014). The piñon pine, New Mexico's state tree, is important both ecologically and culturally. Few other tree species can survive in the semiarid areas where they are most common, yet the effects of climate change are placing its future persistence in the state at risk (Adams et al. 2009). In the early 2000s, severe heat and drought and bark-beetle infestations caused a massive die-off of piñons. Mortality among mature piñons in the middle Rio Grande Basin exceeded 90 percent (Breshears et al. 2005). As many as 350 million piñons died across the West, with the greatest mortality in the northern New Mexico foothills of the southern Rocky Mountains (Meddens, Hicke, and Ferguson 2012). While mature pine trees live hundreds of years and have experienced severe drought before, this drought was associated with much hotter temperatures than those in the past, in large part due to a changing climate (Adams et al. 2009). The U.S. Forest Service projects that piñons could disappear from much of their current range by 2030—threatening to disrupt the entire forest ecosystem—even if the rise in heat-trapping emissions slows (Rehfeldt et al. 2012).

Hotter, drier conditions lead to more frequent and more destructive wildfires, while earlier snowmelt means that forests are drier for a longer spring season, before monsoon rains moisten the surface. The fire season in New Mexico has lengthened substantially over the past 40 years—from

FIGURE 2. Climate Change is Diminishing the Habitat of Piñon Pines



The degree of climate change will affect the amount of western land suitable for piñon pines in 2030. These maps depict areas modeled to be climatically suitable for the tree species under the recent historical (1961–1990) climate (left), conditions projected for 2030 given lower levels of heat-trapping emissions (center), and conditions projected for 2030 given medium-high levels of emissions (right). Areas in yellow have a 50–75 percent likelihood of being climatically suitable according to the models; areas in green have more than a 75 percent likelihood. These models do not address other factors that affect where species occur, such as soil types.

NOTE: The two future emissions levels are the B1 and A2 scenarios of the Intergovernmental Panel on Climate Change, respectively.

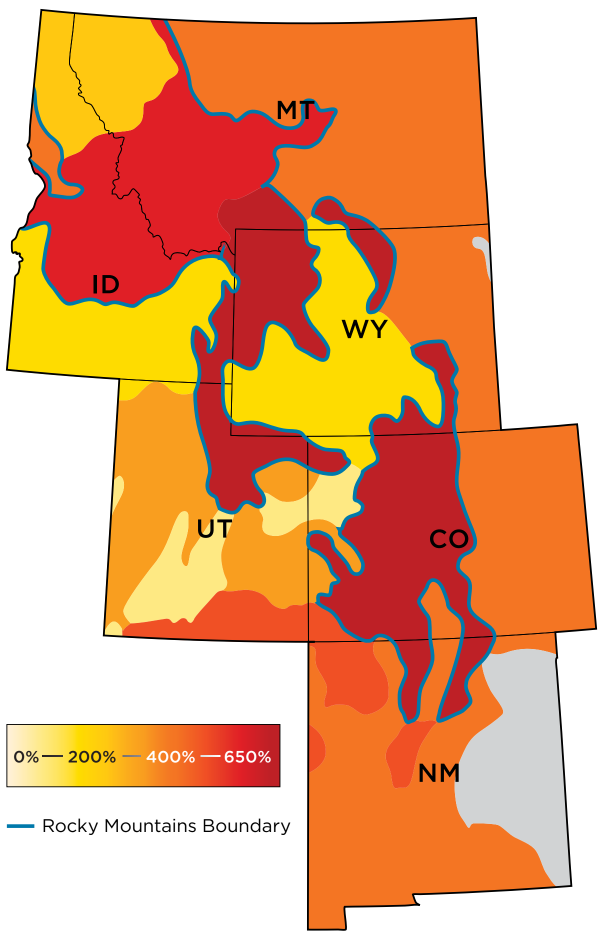
SOURCES: BASED ON USFS MOSCOW LAB 2014.

five months to seven—and fires of more than 1,000 acres occur twice as often (Climate Central 2012; Westerling et al. 2006). Wildfires themselves are a significant source of heat-trapping gases in the atmosphere.

As the Southwest continues to warm, the burn area across the region is projected to rise dramatically. The regions hit hardest are likely see a six-fold increase or more in average area burned each year (see Figure 3).

Two of the largest wildfires in New Mexico's recorded history occurred in 2011 and 2012. In 2011, more than one million acres burned as 1,875 fires raged across the state (NICC 2011). The Las Conchas Fire, then the largest in the history of New Mexico, burned over 156,000 acres (NICC 2011). Damage occurred in parts of Los Alamos National Laboratory, the Santa Clara Pueblo, and affected the water supplies for Santa Fe

FIGURE 3. Rise in Global Temperature Will Lead to Increased Wildfires in New Mexico

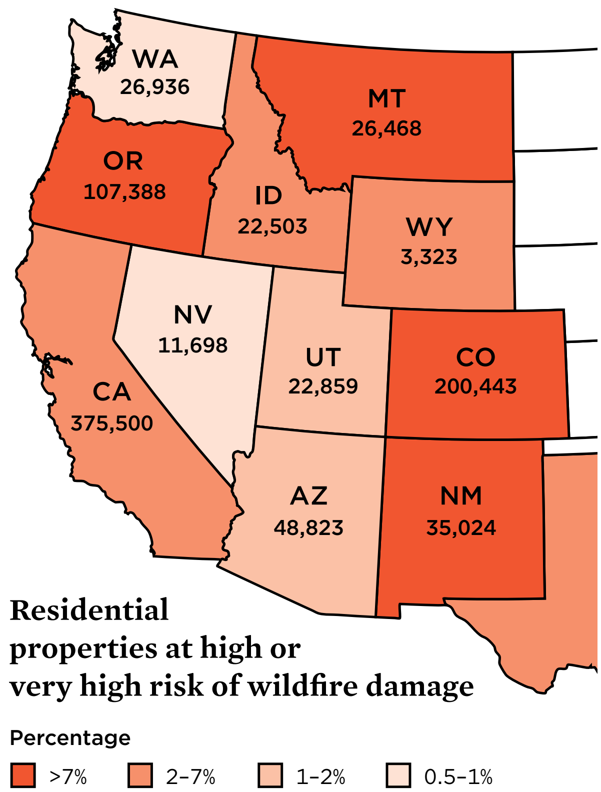


Scientists project that a temperature increase of just 1.8°F will lead to marked increases in acreage burned by wildfires in the western United States, including New Mexico. This figure shows the projected percentage increase in burned area, compared with the 1950–2003 average. Much of New Mexico is expected to see a 400% increase in burned areas, with parts of the Rocky Mountains headed towards a 650% increase.

NOTE: Grey indicates areas with insufficient data for making projections

SOURCES: ADAPTED FROM NRC 2011 AND LITTELL ET AL. 2009.

FIGURE 4. Homes at Risk from Wildfires in the Western United States



Development in or near wildfire-prone areas in the western United States is significantly raising the risks and costs of wildfires. The colors on the map show the percentage of homes in each state that are either in the very high or high wildfire risk categories. The figures in each state show the number of properties that have the highest numeric risk score, factoring in a property's proximity to very high or high wildfire-risk areas. New Mexico is one of the states with the highest percentages of homes in very high and high risk categories, based on terrain, fuel, and vegetation characteristics of the property itself.

SOURCE: BASED ON DATA BY CORELOGIC (BOTTS ET AL. 2013).

BOX 1.

Cultural Heritage: Bandelier National Monument and Los Alamos National Laboratory

Extreme precipitation, flooding, and wildfires have affected sites that are central to New Mexico's heritage. The rock carvings and cliff dwellings of Bandelier National Monument tell the story of some of the earliest inhabitants of the Americas, while their descendants live nearby in modern-day pueblos. Protecting the archaeological, ecological, and cultural features of this landscape has become more difficult as drought, large wildfires, and extreme flooding increase the risks to them and the infrastructure they depend upon. For instance, the Cerro Grande Fire raged through the area in 2000, damaging more than 70 percent of 470 archaeological sites on the adjacent property of Los Alamos National Laboratory, including ancestral pueblo structures and wooden homestead buildings (Nisengard et al. 2002). It also destroyed over 200 buildings in the nearby town of Los Alamos (GAO 2000), including several historic structures from the Manhattan Project era (Nisengard et al. 2002).

In 2011, the Las Conchas Fire, the second-largest wildfire in New Mexico history, burned much of the forest around Bandelier National Monument. Severe flooding from summer thunderstorms in 2011, 2012, and 2013 repeatedly washed out the popular Falls Trail and Frijoles Canyon Trail. Erosion from floods and extreme rainfall is now a major risk to the monument's archaeological heritage.

and Alamogordo during both the fire and related flood events after the fire. Yet the following year, 2012, the Whitewater Baldy Complex Fire surpassed the Las Conchas, burning more than 297,000 acres (Cleetus and Mulik 2014). Wildfires in 2013 to 2015 burned fewer acres annually than in the 2011 and 2012 fire seasons, but the lingering effects of catastrophic wildfires continued to impact the state (NIFC n.d.).

With over 35,000 homes in areas where the wildfire risk is "high" or "very high," New Mexico has the highest percentage of at-risk homes in the West (Figure 4) (Botts et al. 2015). Not surprisingly, the recovery costs from wildfires have soared as more fires, burning in hotter and drier conditions, have increased the risk to the state's residential and commercial properties. Beyond the costs of damage to property and recovery, fire suppression has become more costly as protecting communities and deploying prescribed fires have become more difficult (Cleetus and Mulik 2014).

Reducing Emissions, Building Resilience

New Mexico can take control of its future through a forward-looking, pragmatic response to climate change—a response that builds resilience to changes already underway and lessens emissions of heat-trapping gases.

REDUCE EMISSIONS

Efforts to reduce emissions and transition New Mexico toward low-carbon energy sources are needed in a state that ranks twelfth nationally in energy-related carbon dioxide emissions per capita (EIA 2015b). More than half of the state's nearly 54 million metric tons of CO_2 emissions in 2013 came from the electric power sector, which depended on coal-fired power plants to provide 67 percent of total in-state electricity generation (EIA 2015b; EIA 2015a).

Fortunately, smart and meaningful efforts to transition New Mexico toward a lower-carbon economy are underway. These four steps could pave the way for New Mexico to pivot toward a low-emissions economy—one that recognizes the value of key economic sectors by protecting them from the effects of a changing climate.

1. **Accelerate the pace of investing in renewable energy and strengthen the Renewable Electricity Standard.** New Mexico is blessed with a diverse mix of renewable energy resources, which has helped the state meet interim benchmarks toward its existing renewable electricity standard (RES), a state-established requirement that utilities supply 20 percent of their power from renewable sources by 2020 (Heeter et al. 2014). At the end of 2014, New Mexico already ranked tenth among all states for cumulative installed solar capacity, with more than 150 MW coming online from 2012 to 2014 (SEIA 2014). At that time, New Mexico had developed 812 MW of wind power that provided 7 percent of the state's electricity (AWEA n.d.). Another 330 MW of wind power capacity is under construction (AWEA n.d.).

   Nevertheless, these investments fall far short of the state's tremendous renewable energy resource potential, much of which is economically viable but remains untapped. According to the U.S. Department of Energy, New Mexico's renewable energy economic potential—led primarily by solar and wind—could produce up to an additional 3,726 terawatt-hours of electricity, which is equivalent to more than 100 times the state's current electricity generation (Brown et al. 2015). Western New Mexico's geologically active regions also hold significant geothermal potential.

State-level RES policies are among most successful and cost-effective means for driving renewable energy development in the United States (Heeter et al. 2014; UCS 2013). By extending and expanding its current RES, which is now set to level off at 20 percent in 2020, New Mexico can encourage low-carbon, efficient energy sources to play a leading role in the state. The examples of states that have committed to targets of at least 40 percent RES by 2030 suggest that New Mexico may be able to double its share of renewable electricity (Barbose 2016).

2. **Manage energy demand through investments in efficiency.** Investing in energy efficiency in homes, businesses, and industry is an effective, affordable strategy for making the transition away from carbon-intensive fossil fuels. In 2014, efficiency investments in the state lowered retail electricity sales by more than half a percent, a significant achievement for a single year (Gilleo et al. 2015). This effort was largely spurred by an important commitment New Mexico made when it adopted an energy efficiency resource standard (EERS) in 2008. Updated in 2013, the EERS requires electricity providers to implement efficiency programs that reduce electricity demand to 10 percent below 2005 levels by 2020 (Gilleo et al. 2015). Going further, a 2012 analysis found that New Mexico could cost-effectively cut electricity use at least 24 percent by 2020 (SWEEP n.d.).

   New Mexico could exercise greater control over its energy demand if its EERS were increased and extended beyond 2020. Leading states with EERS policies are demonstrating that they can reduce electricity use by 1.5 to 2 percent each year, compared with New Mexico's current target of 0.6 percent (Gilleo et al. 2015). New Mexico could ensure adherence to this policy by tightening energy efficiency building codes, helping ensure that new construction uses the most cost-effective and energy-efficient technologies and practices.

3. **Retire high-emissions coal plants.** While New Mexico relies on coal for most of its electricity generation, the economic competitiveness of its aging and inefficient coal power plants is in decline. A lack of modern pollution controls to protect public health—along with increasing competition from cleaner, lower-cost resources such as renewable energy and natural gas—is leading to the retirement of coal plants in the state (Fleischman et al. 2013). For example, three coal generators at a Four Corners facility were closed in 2013; two coal generators at the San Juan generating station are expected to close in 2017. Combined, these retirements will lower carbon emissions from New Mexico's coal power plants by as much as 37 percent (SNL Financial 2015).

4. **Craft a plan to comply with the federal Clean Power Plan.** The U.S. Environmental Protection Agency's Clean Power Plan requires New Mexico to reduce its power plant carbon emissions by 4.9 million tons by 2030, to 28 percent below 2012 levels (EPA 2015). To achieve its emissions-reduction target, New Mexico should develop and implement a strong compliance plan that places a priority on the use of renewable energy and energy efficiency, minimizes the risks of an overreliance on natural gas, and considers closing more of its economically challenged coal plants. New Mexico should also seek to collaborate with other states in its compliance strategy, as multistate efforts have proven successful in achieving cost-effective carbon reductions.

BUILDING RESILIENCE

Even if global efforts to reduce emissions succeed, the current levels of heat-trapping gases will cause the climate to continue to warm for decades, making it essential for New Mexico and its communities to build their resilience to the effects of climate change. Those impacts are costly, and while they heighten risks to the economic security of all communities, they often hit low-income and socially vulnerable communities the hardest (Task Force on Global Climate Change 2015; Melillo, Richmond, and Yohe 2014; IPCC 2014). The agricultural sector is perhaps most at risk, yet it is critical to the state's economy and generates billions of dollars in revenue each year. To survive, New Mexico agriculture depends on water—over 1.3 million acre-feet of water annually, or about 70 percent of the state's total water consumption (Bustillos and Hoel 2014).

New Mexico can prepare its economy by making good use of information resources and investing wisely in planning and response for intensifying wildfires, droughts, floods, and other extreme conditions that accompany climate change. State and community planners need to take future projections of climate change into account—including the way it might add to the effect of other stresses, such as wildfire vulnerability, increased evaporation of agricultural soils and surface reservoirs, and the risk of over-pumping groundwater.

Some New Mexicans are already showing initiative and creativity in the face of these challenges. By taking six steps, BOX 2.

Generations of Damage: Santa Clara Pueblo

Wildfires often hurt the people least equipped to respond effectively and recover quickly, including rural and tribal communities. In 2011, the Las Conchas Fire burned more than 16,000 acres belonging to the Santa Clara Pueblo community (Dasheno 2012). Wildfires leave the landscape bare and bake the soil, making it less permeable to water, thereby increasing vulnerability to runoff and flooding. Not long after the fire, disaster struck again when heavy rains in the Jemez Mountains surged through the scorched canyons. The pueblo, particularly vulnerable to flooding because of its location at the entrance to Santa Clara Canyon, was under a state of emergency after heavy rains sent tree trunks, boulders, and other debris rushing down the canyon, toppling power lines and washing out roads and bridges. Summer floods in 2012 and 2013 caused further severe damage to the area, forcing the pueblo to declare a state of emergency as fast-flowing water burst through dam structures built to protect the community.

"It will take generations for our community and lands to recover from the devastation of the fire," said Walter Dasheno, governor of Santa Clara Pueblo at the time of the floods. "And because of climate change it is not clear what the future will look like" (Dasheno 2012).

Larry1732/Creative Commons (Wikimedia Commons)

Climate change is increasing the frequency of wildfires, and making it more difficult to recover from their destruction. In 2011, the Santa Clara Pueblo community lost more than 16,000 acres of forested land to wildfire, which cleared the way for heavy flooding the new two summers.

state and federal policies should enable and build on such efforts to safeguard communities.

1. **Support and learn from communities taking systematic steps to reduce risks from wildfire.** In New Mexico, five communities—Elk Ridge, the Greater Eastern Jemez Wildland, Hidden Lake, the Village of Ruidoso, and Taos Pines Ranch—were cited as success stories when they received competitive "FireWise" grants from the National Fire Plan, aimed at reducing wildfire risk and potential home and property losses. Under that program, local fire districts provide communities and their residents with wildfire risk assessments, prescribe mitigation measures, and recommend options for enhancing the long-term health of forests.[4] Such valuable services could be expanded throughout the state, protecting lives and property, while reducing New Mexico's reliance on federal fire suppression efforts.

2. **Learn and share lessons from water innovators within the state who are working through difficult choices.** For example, water users in the Lower Rio Grande Basin in southern New Mexico have faced severe and sustained drought on top of an increasingly arid climate, yet the current priority system by which rights to use water are appropriated has led to more demand for water than can be sustainably supplied. In 2015, Elephant Butte Irrigation District implemented its Depletion Reduction Offset Program (DROP), which gives municipal and industrial water users access to combined groundwater and surface water rights through the leasing and fallowing of irrigated land to reduce depletions from agricultural use.

"It will take generations for our community and lands to recover from the devastation of the fire, and because of climate change it is not clear what the future will look like."

— Walter Dasheno, governor of Santa Clara Pueblo

The reduced demand for agricultural water has offset depletions caused by meeting municipal and industrial demand, allowing the system to remain in balance.

Another, longer-term example is the Rio Grande Water Fund, a public-private partnership that seeks to protect vital watersheds in northern New Mexico through large-scale restoration of forests and watersheds. The fund invests in thinning overgrown forests, restoring streams, and rehabilitating areas that have flooded after wildfires.[5] Although this fund was not designed to address climate resilience, it is well-suited to forward-looking action.

3. **Make better use of monitoring systems to provide early warning of drought, flooding, or other extreme conditions.** For instance, the New Mexico Climate Center housed at New Mexico State University operates a network of weather stations across the state and analyzes the climate data from them.[6] Farmers and ranchers, among others, can use this real-time climate data to help them anticipate and understand climate-driven weather events, inform irrigation schedules, and take proactive steps to protect their investments.

   Another source of information is the New Mexico Office of the State Engineer, which coordinates the Interstate Stream Commission responsible for monitoring the impact of climate change on New Mexico's water supply and the state's ability to manage water resources.[7] The office informs communities about water supply challenges and coordinates their responses. This role should be supported and enhanced.

4. **Ensure that state regulatory regimes recognize the impacts of climate change on resources and take those impacts into account when managing them.** Impacts the state is already experiencing include extreme variability in the supply of surface and groundwater, changes in the quantities and types of water-supply demand, and increases in forest fires and flooding. As the state considers options for planning and managing its water and other resources, it must actively assess current and future climate impacts and incorporate them into regional and state water plans in an iterative and ongoing way. Analyses based on more extreme projections, rather than median projections, provide a "stress-test" approach to considering how future climate extremes may affect water resources and water projects. They could be a helpful approach to managing the state's water resources and designing water infrastructure.

5. **Provide sufficient funding for regional and statewide water planning, administration, and infrastructure designed for the future, not the past.** Additional resources are needed to adequately understand, plan, and address water resource management needs across the state. Given growing demands for water resources to keep the state's economy thriving, investing in water resources pays multiple dividends, and in many ways that are not traditionally measured. For example, better infrastructure would give water managers more precise control over water allocation, helping farmers protect their economic stability, as well as strengthening the communities built upon the acequia irrigation system. In 2013, New Mexico Governor Susana Martinez took a significant step in this regard when she announced the allocation of $112 million from the state's capital investment fund to water infrastructure improvements, saying "Unprecedented drought, wildfires, and floods have put further stress on New Mexico's aging water infrastructure in communities large and small across the state" (Western States Water Council 2013). These funds are a critical step toward addressing unmet needs, which are expected to worsen with climate change.

DOE

One of New Mexico's largest commercial solar PV installations can be found at the Indian Pueblo Cultural Center. This project is a successful example of how New Mexico could increase its renewable energy resources to reduce emissions and build resilience.

6. **Adopt a groundwater measurement and accounting method that is well understood, broadly accepted, and properly integrated across the spectrum of water dealings.** Because groundwater cannot be plainly seen, a variety of metrics are used to assess groundwater levels and storage, including measuring extraction or employing modeling. Metrics and monitoring efforts can be tailored to fit state and local needs. For example, in North Texas, one Groundwater Conservation District measures groundwater extraction by installing a meter or device

to measure water flow that is accurate to within a few percent. In California, the Sacramento Central Groundwater Authority monitors its wells twice a year (SCGA 2012). If needed, scientists have demonstrated that groundwater usage can be effectively modeled in near-real-time with the support of satellite data (Zaitchik, Rodell, and Reichle 2008; Allen, Masahiro, and Trezza 2007). Metering electricity usage by groundwater wells to estimate groundwater pumped from individual wells is key to ensuring groundwater sustainability.

> *"Unprecedented drought, wildfires, and floods have put further stress on New Mexico's aging water infrastructure in communities large and small across the state."*
>
> — Governor Susana Martinez

BOX 3.

Federal Initiatives

- The multiagency National Drought Resilience Partnership, established in 2013, helps states and communities measure and analyze data on water supplies, snowpack, and soil moisture; develop watershed-wide drought plans; and develop resources to help farmers and other water users measure and conserve water and enhance soil health.[8]
- The National Water and Climate Center, a project of the National Resources Conservation Service, conducts the New Mexico Snow Survey Program, providing mountain snowpack data and streamflow forecasts for the state.[9]
- The Southwest Climate Science Center, located in Tucson, Arizona, is a collaboration of scientists and resource managers to better plan for and adapt to climate change in the region.[10]
- The Southwest Climate Regional Hub, located at New Mexico State University in Las Cruces, is one of seven U.S. Department of Agriculture hubs established across the country to help farmers and ranchers adapt their operations to a changing climate.[11]

While many existing federal programs can alleviate some costs, Congress should increase national investments in a number of programs, including the following:

- The New Mexico Drought Preparedness Act of 2015, introduced by U.S. senators Tom Udall and Martin Heinrich, would provide drought relief and address long-term drought challenges by improving the efficiency and effectiveness of water management in the state. If enacted, this act would address drought conditions by targeting critical water-management challenges in the Rio Grande River Basin, which is the state's largest and most economically important watershed. The act would provide for technical assistance to foster a federal acquisition and local water trading program, studies aimed at optimizing basin infrastructure management, maintenance of flow management for ecosystem benefits, and additional funding for drought mitigation and relief.
- The Pre-Disaster Mitigation Grant program is designed to reduce risks to people and property and to diminish reliance on federal funding when disasters occur. The program helps fund hazard-mitigation planning and projects that reduce New Mexico's vulnerability to floods, wildfires, and other extreme weather events.[12]
- The Western Watershed Enhancement Partnership helps reduce wildfire risks to water supplies by partnering with local businesses to clear flammable forest debris and manage forests in ways that strengthen resilience.[13]

Federal investments in climate preparedness and resilience can help protect communities in New Mexico. Larger appropriations and strategic grants for these and similar programs would help New Mexico prepare for droughts, wildfires, and other impacts of climate change, as well as assist communities in times of need and speed recovery when those impacts are felt.

The federal government must make the latest science and data easily accessible to states and communities, delivering them before critical decision moments and leading to better-informed planning decisions. Agencies at all levels of government need to reevaluate existing programs, hold steady or increase disaster-response efforts, and place a high priority on preparedness for climate-change-fueled natural disasters, which are expected to become more harmful and costly. Without smart investments now, the costs will strain the ability of even the most resilient and resourceful communities to cope and recover, draining the budgets of state and local governments.

New Mexico's Path to a Strong, Resilient Future

New Mexico has a long history of facing a challenging climate, and New Mexicans have learned to be resourceful and resilient. The state has invested in meeting the needs of its people, while using approaches and policies aimed at keeping its economy within the limits of its available resources.

The future climate will alter these circumstances, changing the availability of vital resources, making past investments obsolete, and testing the resourcefulness of New Mexico's people. New Mexico can survive and even thrive in this new world, but only if it takes wise steps today. As the future unfolds, New Mexicans deserve the commitment of state and federal policy makers to doing the utmost to limit risks and helping the state become more resilient to the unavoidable challenges.

New resources and investments are only part of the solution. When the state empowers its people to makes better choices for themselves—backed up by forward-looking investments—the people of New Mexico can forge a new path to a resilient future, as they have done many times before. The challenge today is for New Mexico to take the steps necessary to effectively manage and reduce the impacts of climate change and ensure the future security of the state and its residents.

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ENDNOTES

1. *The latest National Climate Assessment, the third, was developed by a team of more than 300 experts, guided by a 60-member Federal Advisory Committee. The report was extensively reviewed by the public, a panel of the National Academy of Sciences, and other experts, including from federal agencies. For more information, see:* http://nca2014.globalchange.gov.
2. *These figures are in comparison with a 1901–1960 reference period.*
3. *These figures are in comparison with a 1971–1999 reference period.*
4. *For more information about the FireWise success stories, see:* www.firewise.org/wildfire-preparedness/be-firewise/success-stories/new-mexico.aspx?sso=0.
5. *For more information about the Rio Grande Water Fund, see:* www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newmexico/new-mexico-rio-grande-water-fund.xml.
6. *For more information about the New Mexico Climate Center, see:* http://weather.nmsu.edu.
7. *For more information about the New Mexico Office of the State Engineer and the Interstate Stream Commission, see:* www.ose.state.nm.us/index.php.
8. *For more information about the National Drought Resilience Partnership, see:* www.drought.gov/drought/content/ndrp.
9. *For more information about the New Mexico Snow Survey Program, see:* www.nrcs.usda.gov/wps/portal/nrcs/main/nm/snow.
10. *For more information about the Southwest Climate Science Center, see:* www.doi.gov//csc/southwest/index.cfm.
11. *For more information about the Southwest Climate Regional Hub, see:* http://swclimatehub.info.
12. *For more information about the Pre-Disaster Mitigation Grant program, see:* https://fema.gov/pre-disaster-mitigation-grant-program.
13. *For more information about the Western Watershed Enhancement Partnership, see:* www.usda.gov/wps/portal/usda/usdahome?contentid=2013/07/0147.xml.

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