

# Uncertainty and Risk Building a Resilient West

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**The pine beetle infestation aggravated by rising temperature has damaged many trees in Rocky Mountains National Park.**

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Climate-related impacts vary across regions, affecting communities economically, socially, and environmentally. While all regions of the United States are expected to experience temperature increases, the eight states located between the Rocky Mountains and the Cascade and Sierra Nevada mountain ranges are in a region forecast to be hard-hit by a variety of climate impacts that may expose vulnerabilities different from those in other U.S. regions. Western communities also face an uphill battle when attempting to plan for these future challenges.

Given the significant implications associated with a changing climate in the Intermountain West, this article takes a closer look at some innovations and tools designed to help communities plan and prepare for the uncertainty and risk attributed to a changing climate, and to increase community resilience.

## **The Intermountain West**

Characterized by its scenic beauty, wide open spaces, abundant wildlife, mild climate, and count-

less recreational opportunities, the Intermountain West encompasses urban, rural, and amenity communities situated within large-scale intact open lands. The region's eight mountain states—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming—are home to 22 million people, approximately 8 percent of the total U.S. population. Western cities are generally in arid or semi-arid environments, and although the footprints of some urban centers are large, the built environment of the major cities is decidedly dense and largely concentrated in megaregions such as the Arizona Sun Corridor and Colorado Front Range.

The vast expanses of open space between metropolitan centers have intrinsic economic, cultural, and biological value. More than half the region's land is in public ownership and is managed by the Bureau of Land Management, U.S. Forest Service, National Park Service, or U.S. Fish and Wildlife Service (figure 1). In mountainous regions, some counties are 80 percent publicly owned, and in states like Arizona and Nevada the land is more than 90 percent publicly owned. Tribal lands make up a large part of the region, and state trust lands

cover approximately 46 million acres in both rural and urban areas. One of the most extensive land uses in the region is agriculture, which includes ranching and other agricultural services.

### Growth and Change

Over the past few decades, the West has experienced dramatic population growth as communities shift away from resource extractive industries such as agriculture, forestry, and mining and instead attract amenity-seeking retirees and telecommuters, as well as new professional businesses, tourism, construction, and consumer service industries (Winkler et al. 2007).

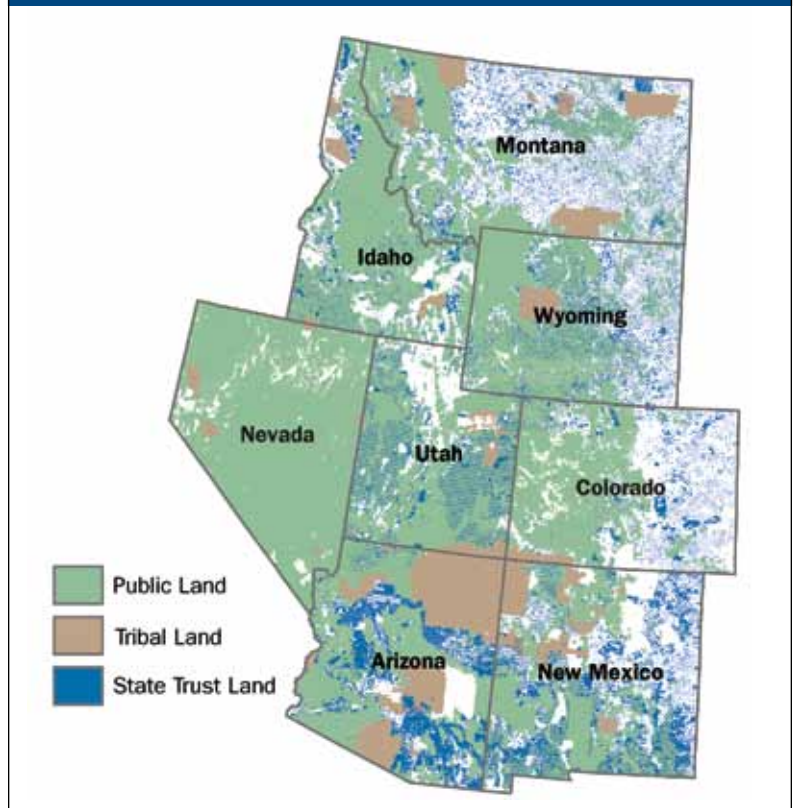
The high rate of urban growth has changed both the demographic and economic make-up of the West and also the allocation of resources. Land that was once used for grazing and agriculture has transitioned to residential and commercial uses. The proliferation of housing and industry requires the development of more energy and water resources to accommodate the growing population.

Many western communities are dependent on the Colorado River, which serves the water supply needs of 30 million people in seven U.S. states and Mexico. More than 70 percent of this water is used to irrigate 3.5 million acres of cropland. In addition to natural resource changes, the increase in growth has caused an expansion of housing in and near forests, an area known as the wildland urban interface, to take advantage of the West's natural amenities.

However, the changes in the region are not only attributable to growth; the climate is also changing. Since the 1880s, scientists have been measuring the Earth's surface temperature at thousands of locations, taking into account instrument deviations and local temperature factors such as urban heat islands. The analysis of this data shows that the Earth's average temperature has increased by more than 1.4° over the past 100 years, with much of this increase experienced over the past 35 years, and it is evident that the temperature is continuing to rise.

Although the temperature changes appear to be marginal, they have significant impacts on local climate. For example, winters are now shorter and milder, snow and ice cover are decreasing, heat waves are becoming more frequent, and many plant and animal species are moving to cooler or higher altitudes to escape the warmer weather.

**FIGURE 1**  
**Public, Tribal, and State Trust Lands in the Intermountain West**



Source: Courtesy of the Sonoran Institute.

Although climate change is a highly complex issue that varies from region to region, the following impacts have been identified as overarching changes that will occur because of rising temperatures in the West:

- higher frequency of prolonged heat waves and drought;
- increased number and severity of forest fires;
- biodiversity changes, including the severity of disease outbreaks and other disturbances;
- prolonged and wider impacts of vector-borne disease; and
- damage to infrastructure due to unexpected and extreme weather events.

Changes are already in progress. There have been widespread temperature-related reductions in snowpack over the last 50 years, leading to changes in the seasonal timing of river runoff. Feng and Hu (2007) have demonstrated that the dates of peak snow accumulation and peak snowmelt runoff are occurring 10 to 40 days earlier than in previous years. The Colorado River is especially

vulnerable, often receiving a large portion of its water from a hydrological system dependent on snowmelt precipitation from three basin states: Colorado, Utah, and Wyoming.

Precipitation patterns also are changing and becoming more variable. Drought is becoming more prolonged along with the frequency and intensity of heavy downpours. Large wildfires are more frequent, and the fire season is getting longer (figure 2). Wildfires burn twice as much land area each year as they did 40 years ago with a burn season two and half months longer than 40 years ago (Climate Central 2012).

As the climate becomes increasingly variable and shifts further and further from the relative stability experienced by humankind to date, the resulting changes will make communities more vulnerable and may put their health and livelihood at risk. Even one season of drought can have dramatic repercussions, notably higher basic food prices that put considerable strain on vulnerable populations including the elderly and financially disadvantaged. Increasing temperatures, prolonged drought, and incidences of wildfire and biodiversity changes due to migration of invasive species play a significant role in the accelerating transformation of the landscape. With so many effects felt

at the community scale, local governments have an important role to play in planning for intensifying climate changes.

**Planning for Change**

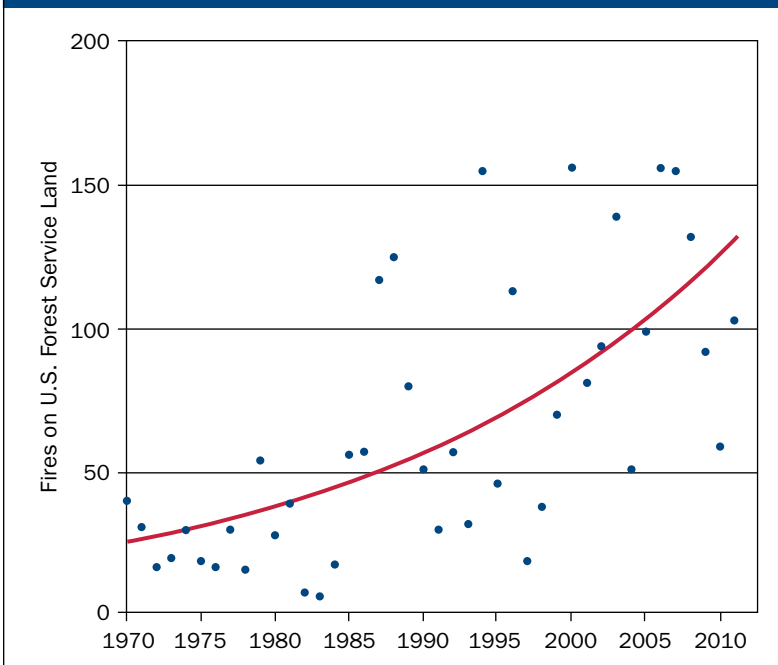
Climate action occurs at multiple levels of governance and in a variety of different capacities. The federal government plays a significant role in responding to large-scale disasters that affect multiple states, such as the recent Hurricane Sandy. Regulatory federal actions that coincide with climate change, such as vehicle fuel efficiency standards or proposals for a national carbon tax, apply to the entire population. At the same time, state governments and regional groups are implementing regional strategies such as cap-and-trade systems and multijurisdictional transportation planning projects.

In terms of effective action on the ground, local governments are most suited to tackle local impacts and planning efforts relating to the issue of climate change. They are in a prime position to create comprehensive strategies that directly alter city functions to support mitigation and adaptation efforts. Local action plays an extensive role as city governments have direct authority over essential functions such as waste management, public transportation, public works, and facility management, as well as land use and zoning. For example, Boulder County recently adopted its Climate Change Preparedness Plan to help local residents and communities prepare for changing environmental conditions. This plan identifies local impacts, explores how these impacts will affect resource management, and outlines opportunities for adaptation planning.

**The Context for Climate Planning in the West**

Western Lands and Communities, a joint venture of the Lincoln Institute of Land Policy and the Sonoran Institute, has developed a large body of resources and reports to gain a better understanding of the needs and challenges facing western communities (Carter 2008; Richards 2009; Bark 2009; Metz and Below 2009). The seminal report, *Planning for Climate Change in the West*, identifies key barriers to implementing local climate action policies (Carter and Culp 2010). A review of these reports, along with interviews with western sustainability directors, revealed three key challenges associated with climate action:

**FIGURE 2**  
Large Fires Are Becoming More Common in the West



Source: Courtesy of Climate Central (2012).

- political context;
- communication of multiple values and beliefs; and
- lack of funding and resources.

Climate change can be a politically polarizing topic in the West. The clash of multiple viewpoints creates barriers in terms of building political support and conducting effective educational outreach, thus reducing the potential for civic engagement and limiting capacity for collective action in pursuit of common interests. Long-held cultural beliefs about limiting the role of government and protecting private property and citizens' rights contribute to the resistance to zoning and other policies that would change land use patterns or regulate growth.

Without the backing of significant decision makers, such as the mayor or city manager, or strong support from the municipal council, moving climate action forward can be a difficult proposition. There are also internal communication obstacles in bringing different city departments together to discuss local climate change impacts and the best approach to work collaboratively to ensure that the programs and policies address the adverse impacts effectively.

With local governments scrambling to accommodate shortfalls related to the recent recession, cities lack the financial resources needed to invest in current climate action in order to avoid the high cost of future climate impacts. Often, communities discount future impacts, which place the burden and expense of climate planning (or inaction) onto future generations. Dealing with rapid population growth and fiscal pressures to provide infrastructure makes it increasingly difficult to obtain funding to underwrite climate planning. Even communities that adopt climate plans may encounter obstacles in implementing those plans. Some communities may be overwhelmed by the task of deciphering climate science, and many are unfamiliar with policies and actions necessary to mitigate and adapt to climate change.

### **Unlocking Climate Action in the West**

While some local governments in the Intermountain West, such as Salt Lake City, Flagstaff, Tucson, Denver, Las Vegas and Boulder County, are making concerted and laudatory efforts to address climate

change, they represent a small sampling of the region. Overall, the West is behind the curve on implementation efforts to adapt to climate change and create communities that are more resilient.

However, the West is feeling the heat, literally and figuratively. After a summer of record temperatures, raging wildfires, and crippling drought, a large and growing majority of Americans believe that global warming is affecting weather patterns. They understand that droughts and heat waves are becoming more common and the weather is becoming increasingly volatile (Leiserowitz 2012). One of the main challenges facing communities is how to integrate new information about the risks of climate change into existing planning frameworks in order to plan effectively for an uncertain future.

### **Tools for Change**

To help address the challenges associated with climate action, there are many tools that western communities can use to guide community resilience. Organizations such as ICLEI—Local Governments for Sustainability, the Institute for Sustainable Communities (ISC), and the Urban Sustainability Directors Network (USDN) provide information and trainings that offer sample policies and plans, peer networking opportunities, technical tools, and resources on vulnerability and risk. However, many of these organizations have a broad geographical focus and a target audience in large cities. It is important to address the needs of smaller communities that have political, fiscal, and resource constraints. In addition, there is a large need to better integrate climate adaptation policies into existing city departments and plans.

The Lincoln Institute and the Sonoran Institute are developing tools and resources that support efforts to plan and prepare for the ever-changing landscape of the West, including: information exchange and training; value setting planning tools; and anticipatory governance methods and tools. These tools offer promise for working in a variety of community types, including the underserved rural and amenity regions, and supplying the support and training that local planners need to integrate climate resilience planning holistically into current planning processes and encourage collaboration among multiple departments.



**Information Exchange and Training**

Communities often look to their peers that are similar in size, capacity, and geography to get a better understanding of planning efforts that will be successful in their own region. Local governments, institutions, and planning firms are encouraged to publicize their experiences so other communities can learn from their successes and missteps, and then modify and adapt their own plans as needed.

The Successful Communities Online Toolkit information exchange, also known as SCOTie, is an example of a tool that caters to western communities by encouraging the exchange of vital information in the form of best practice case studies and resources (figure 3). The case studies in SCOTie are organized by state, community type, and planning issue. To build and disseminate the toolkit’s case studies and resources, SCOTie partners with state chapters of the American Planning Association and nonprofit organizations working to build stronger, more resilient communities. Educational

webinars like the *Planning in the West* adaptation series offer a way for communities to learn about climate-related planning and interact directly with representatives from model communities.

**Value Setting Planning Tools**

To move past political debates over climate science, tools are needed to facilitate collaborative planning efforts that include stakeholders with varying values and beliefs. Facilitating a process that focuses on engaging the public and finding common ground in moving forward with action to mitigate climate variability can neutralize the polarizing debates that are often stuck on the causes of climate change and scientific uncertainty.

Value setting is a particularly useful resource for informing management decisions where communities have to make tough decisions when resources are stressed by demand and climate variability. For example, in January 2012 the Sonoran Institute, the Morrison Institute, and the University of Arizona hosted the *Watering the Sun Corridor* pre-conference workshop where 100 participants saw presentations from experts, engaged in interactive discussions in small groups, and interacted collectively using live polling. Participants explored value tradeoffs between competing uses of water for urban development, agricultural production, and the environment in a water system stressed by drought induced by climate change. This collaborative, interactive format brought together stakeholders with many different viewpoints to gain a better understanding of collective values regarding the distribution of water in Arizona.

**Anticipatory Governance Methods and Tools**

As the future becomes less certain and more risky, traditional planning approaches that involve making educated predictions and developing plans and tools to reach that desired result will likely prove to be inadequate. Cities need tools to “anticipate and adapt” to change rather than “predict and plan” in order to better incorporate the uncertainties and complexities of future conditions (Quay 2010). Scenario planning is a technique that cities can use to think about climate impacts and develop ways to adapt to them. The use of scenarios can enable planners to grapple with complex issues, think about how trends and changes will play out across multiple scenarios, and plan for policy options that are robust under many future scenarios.

**FIGURE 3**  
Screenshot of the Successful Communities Online Toolkit information exchange (SCOTie) Website




Source: Courtesy of the Sonoran Institute.

Western Lands and Communities is collaborating with partners including the Consensus Building Institute to develop coherent methodologies, identify driving forces of change, and develop educational tools to support community adaptation using scenario planning tools and techniques. Computer-based planning tools are valued because they help communities gain a better understanding of how particular planning ideas and strategies will shape their future. Building better plans that adapt to challenges like climate change will require communities to make decisions in the face of competing economic interests, different cultural values, and divergent views about property rights and the role of government.

Over the years, planning tools have evolved to help professional and citizen planners analyze and develop options and scenarios. Some tools are available commercially and others are free to the public, with varied user and output complexity. Although these tools are gaining traction, the current use of interactive planning tools is limited and faces a number of challenges. For example, the complex tasks of selecting a tool, collecting data, calibrating the tool, developing scenarios, and using the tool to assess various scenarios present significant barriers to many potential users. Western Lands and Communities is collaborating with tool developers to address the near and long-term challenges and expanding the use of scenario planning tools (Holway et al. 2012).

## Conclusion

The Intermountain West is a complex region with changing demographics, rapid population growth, and increased economic and cultural diversity. Western Lands and Communities is working to develop and disseminate educational tools and methodologies that will help western communities plan holistically for climate change, build capacity for understanding risk and managing uncertainty in an inclusive manner, and engage communities of disparate stakeholders. To accomplish these ambitious goals, planners need effective tools to shape the future of their communities. We will continue to explore new approaches and methods for assisting planners in the effort to anticipate and adapt to change, engage communities in the effort to develop and adopt adaptation policies, and ultimately create more resilient communities that are prepared for the impacts of a changing climate. 

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## WEB LINKS

Western Lands and Communities:  
<http://www.sonoraninstitute.org/where-we-work/westwide-research-tools/lincoln-sonoran-joint-venture.html>

Successful Communities Online Toolkit information exchange (SCOTie):  
<http://scotie.sonoraninstitute.org>

Planning in the West webinars:  
<http://www.sonoraninstitute.org/where-we-work/westwide-training-leadership/planning-in-the-west-webinars.html>

Scenario Planning Tools:  
<http://scenarioplanningtools.org>