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Planning for Climate Change in the West

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Policy Focus Report Series

The policy focus report series is published by the Lincoln Institute of Land Policy to address timely public policy issues relating to land use, land markets, and property taxation. Each report is designed to bridge the gap between theory and practice by combining research findings, case studies, and contributions from scholars in a variety of academic disciplines, and from professional practitioners, local officials, and citizens in diverse communities.

About this Report

The Lincoln Institute of Land Policy and Sonoran Institute established a joint venture in 2003 to create sustainable futures for western communities. Recently named Western Lands and Communities, this partnership focuses on the Intermountain West where it emphasizes these major initiatives: state trust land management; Superstition Vistas—planning for sustainable development; smart growth tools; reshaping development patterns; western megaregions; and climate change mitigation and adaptation.

Central to the mission of Western Lands and Communities is planning for climate change. This policy focus report began as a Lincoln Institute Working Paper by Rebecca Carter (2008) titled “Land Use Planning and the Changing Climate of the West.” The paper highlights how local planners could implement land use–related practices and policies to take action against climate change impacts in their communities. Building on that research, this report offers tools and case studies, identifies barriers to local policy decisions, and provides recommendations for overcoming these obstacles to change.

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Primarily arid landscapes link the Intermountain West, which includes all or a portion of 11 states west of the Rocky Mountains—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, and parts of California, Oregon, and Washington. This seemingly boundless region has been shaped since its European settlement by dramatic fluctuations in its water and energy resources, land use patterns, economy, and a climate known for its extremes. Recent trends in all of these forces, fueled by rapid growth and change, must be altered if the Intermountain West is to achieve sustainability.

Climate change impacts, now recognized globally by scientists, are expected to wreak particular havoc on this region. Most significant are forecasts that the hydrology of the Intermountain West will become even drier. Drought, heat waves, diminished mountain snowpack, earlier snowmelt, catastrophic wildfires, and other disruptions to natural processes and wildlife habitat are projected by researchers. The rate of these disruptive effects will dictate whether communities try to reduce or mitigate the impacts by decreasing greenhouse gas (GHG) emissions, or adapt after the fact by handling climate change impacts as best they can.

This report underscores the critical role of local planners in the Intermountain West in confronting challenges posed by climate change and acting in concert with federal, regional, and state efforts to implement mitigation and adaptation policies. Federal policies most often take the form of mandates that govern state and local policy or funding support that enables local planning. Regional efforts generally have responded to the threat of climate change with cap-and-trade initiatives for controlling GHG emissions. The Intermountain West, however, has lagged behind other regions in pursuing aggressive

planning strategies to reduce GHGs—especially in its rural communities.

Of particular value for western planners are state-produced climate action plans that can guide local actions to mitigate and adapt to climate change. These state plans contain myriad policy options that not only quantify potential GHG emissions reductions, but also provide specific cost-effectiveness measures and policy language. Because the cost-effectiveness of these policy options varies widely, local communities should first consider the "low-hanging fruit"—those policies that both reduce GHG emissions and offer co-benefits to improve quality of life and sustainability at the same time.

While policies at the federal, regional, and state levels serve as important guideposts for reaching sustainability, they require local implementation to be successful. In most communities, land use and transportation policies potentially reap the greatest rewards. An array of familiar smart growth strategies for creating healthier communities now double as climate solutions: building codes and standards, compact mixed-use development, transportation alternatives, distributed and renewable energy, water resource consumption and planning, preservation of open space and agriculture, and mitigation of wildfire impacts.

Planners in all regions may face obstacles to implementing climate mitigation and adaptation policies. But these barriers may be more difficult to overcome in the Intermountain West where local planners must deal with political, demographic, economic, and geographic factors that can hinder innovative and potentially effective measures to offset climate change impacts. Such challenges may include a lack of political will, disbelief that local action can affect the big picture, perceived lack of peer communities in the region, lack of resources and options, and lack of appropriate climate science for planners.

This report encourages planners to take an active role in overcoming these obstacles by taking positive steps to integrate climate-oriented policies into their land use and development agendas as follows:

- ***Mobilize the political will.*** Focus on sustainability, economic and energy efficiency, and the co-benefits of local actions, rather than politically controversial policies and goals.
- ***Recognize local action and citizen participation.*** Coordinate state and local activities to address climate change, and use public education about climate change impacts to foster citizen participation and buy-in for local programs.
- ***Establish peer community networks on a regional scale.*** Develop peer learning networks with guidance from state climate action plans and regional initiatives to help smaller communities share ideas and learn from each other.
- ***Identify resources and a variety of options.*** Refer to state climate action plans regionwide for a variety of strategies and ideas that communities can select and apply to their own needs and circumstances.
- ***Adapt climate science to local planning needs.*** Seek out current information and tools in reports, Web sites, and other resources that can help planners translate climate science for local use, and develop a baseline level of GHGs as a first step in measuring climate strategies and results.

Local planners in the Intermountain West face both the challenge and the opportunity to ensure a sustainable future for the region, where the need to respond to potential climate change impacts is particularly urgent. This report presents a regional context and reliable data, case studies, and planner-recommended guidelines for western communities to spur local actions that can minimize those threats.

CHAPTER 1

The Climate Context of the Intermountain West

Denver, Colorado

A multitude of factors have shaped the current landscape of the Intermountain West, a vast, arid region encompassing all or a portion of 11 states west of the Rocky Mountains. The economy, population growth, land development patterns, availability and use of water and energy resources, and climate of this region are all in the throes of considerable change.

The scenic beauty, wide open spaces, abundant wildlife, mild climate, and recreational opportunities of the Intermountain West have inspired a new kind of "gold rush" fueling dramatic growth, demographic changes, and more diversified economies. Communities have seen populations boom and traditional resource extraction activities diminish. The desirable climates and growing economic engines of the desert Southwest and the Central Rockies have spawned five megaregional urban centers linked through transportation, infrastructure, and economic development. Each one is anticipated to reach nearly 10 million residents by 2050.

In the face of this rapid growth and change, achieving sustainability in the region will involve altering existing trends in development patterns, resource use, and land consumption. Planners and citizens have a key role to play in this process.

CHANGING CLIMATE PATTERNS

The climate of the Intermountain West is characterized by extremes: from the mild winters, intense summer heat, and low precipitation of the desert Southwest, to the cool

alpine tundra of the northern Rockies where glaciers are retreating as growing downstream communities rely more than ever on abundant snowpack for secure water supplies.

Climate can be defined as weather averaged over a period of time, usually 30 years or longer. This averaging tends to smooth out weather extremes and give a clearer overall picture of the temperature and precipitation patterns typical of an area. However, the terms "climate change" and "global warming" refer to long-term, far-reaching changes to the planet's average temperature, which in turn affect precipitation and wind patterns.

The scientific consensus is now clear that the climate is changing, based on long-term observations of global indicators that demonstrate increasing temperatures across the planet. An improving understanding of the processes that drive the climate system has led to the creation of global climate models, which allow scientists to separate the natural variability in the Earth's climate from changes explained by human activities, such as burning fossil fuels, that raise the level of carbon dioxide and other greenhouse gases in the air.

In preparing the Intergovernmental Panel on Climate Change Fourth Assessment report (IPCC 2007), more than 2,500 expert reviewers examined studies based on approximately 29,000 different datasets, and found that 90 percent of them indicated a trend toward global warming (Perry 2007). The IPCC, established in 1988 by the World Meteorological Organization and the United Nations Environmental Program, is recognized as the most comprehensive and authoritative source of scientific information about global climate change. Of particular interest to the Intermountain West is the IPCC's projection that the region may experience some of the most disruptive impacts from climate change in North America.

CLIMATE CHANGE IMPACTS

The 2007 IPCC report, *Climate Change 2007: Impacts, Adaptation and Vulnerability*, covered current and future impacts to and vulnerabilities of water, agriculture, forestry, health, settlements, tourism, energy, wildfire, and cities, and also projected future impacts resulting strictly from climate change. A variety of greenhouse gas emissions scenarios were evaluated, including one in which no explicit actions are taken to address global warming and the world continues on a business-as-usual path.

The IPCC findings for the Intermountain West based on a variety of models projected significant impacts for the region, ranging from drought, extreme weather events, and catastrophic wildfire to disruption of natural systems. These projections are supported by regional observations by area scientists.

Drought

The arid and semi-arid Intermountain West is expected to become warmer, and as a result even drier. Severe, sustained droughts

Hikers in the Grand Canyon enjoy a scenic view of the Colorado River. Population growth, rising water demand, and drought threaten the river's future.

will become more commonplace, and will increase in frequency as a consequence of the combination of higher temperatures, altered precipitation patterns, and earlier spring snowmelt—all of which are expected to become more prevalent under changing climate conditions.

Changes in snowpack are also likely to have a variety of negative impacts. Overall, less precipitation is anticipated to fall as snow in mountainous areas; it will fall as rain instead, reducing the amount of seasonal storage for surface water systems. This would lead to longer periods when streams are dry, with serious consequences for wildlife, natural habitats, and water supplies. The timing of peak snowmelt is also projected to occur earlier in the season, leading to more severe spring flooding events combined with reduced flows later in the year.

The forecasted changes in the hydrology of the Intermountain West would also impact municipal water supplies and cause stress to riparian ecosystems and other wildlife habitats dependent on the region's rare and precious waterways and to dry forested areas, thus playing a role in the increase of catastrophic wildfires in the region (box 1).

Extreme Weather Events

Due to a hotter, drier climate, the Intermountain West will likely see an uptick in extreme weather events. Climate models show that an increased amount of rain and snow will come in the form of severe storms exceeding current flood control systems, with more frequent and intense flood events, even while overall precipitation may decrease.

Heat waves are also likely to become more common. IPCC reports show potential surface temperature increases from climate change ranging from 35° F to 40° F. In some parts of the Intermountain West, particularly the Phoenix and Las Vegas metropolitan areas, the urban heat island effect is already pronounced, causing 10° to 11° F average nighttime temperature increases during the hottest parts of summer.

Coupling this increase with higher surface temperatures could render many areas within the region immensely uncomfortable, if not dangerous, without aggressive air-conditioning usage and consequent increases in energy consumption. As is often the case, the risks associated with higher temperatures would be borne primarily by the most disadvantaged populations, including the ill, the elderly, and low-income residents.

Catastrophic Wildfire

Wildfire in the arid western states prior to European settlement had been a natural and beneficial phenomenon for many ecosystems. Many western forest environments depend on a periodic fire regime to clear out the brushy understory, create disturbance for new growth, and facilitate reproduction of some species. However, the dominant twentieth-century management regime involved aggressive fire suppression, particularly as development pushed further into forested areas, generating public pressure for fire protection.

As a result, large fuel loads have built up in many forest ecosystems in the Intermountain West, and have been further exacerbated by the spread of nonnative, invasive grass species prone to frequent fire. Fire seasons have also been extended in duration due to warmer, earlier springs leading to increased drying periods for vegetation. This situation has already led to a dramatic increase in large-scale wildfires in the region in recent decades.

Combining these effects with climate impacts that range from more severe drought and temperature increases to the expansion of pests and pathogens, the risks of catastrophic wildfire will continue to rise. Changing climate conditions may also

increase the likelihood that invasive grasses will spread further into the region's deserts, again intensifying fire risks.

Disruption of Natural Systems

Scientists and climate experts foresee that the combined impact of altered climate conditions will cause severe disruption to ecosystem processes, wildlife, and the habitats on which they depend. These changes have tremendous implications for natural resource managers, especially in the Intermountain West where public lands make up the vast majority of land ownership. They also would

BOX 1

Climate Change Implications for the Colorado River Basin

Land use planning is deeply entwined with water availability in the Intermountain West, because the area relies on runoff from mountain watersheds to support agriculture and industry and to fuel urban growth. The Colorado River, flowing from the central Rocky Mountains through the Grand Canyon to Mexico, is managed to support major metropolitan areas, including Denver, Los Angeles, Phoenix, and Las Vegas (figure 1). It also irrigates more than 900,000 acres in both the Colorado River Basin and adjoining river basins (Colorado River Water Users Association 2009). In recent years, exploding population growth, rising water demand, and drought conditions have strained these water resources, and the river no longer reaches the Gulf of California.

A review of studies based on tree-ring chronologies dating back to the medieval era shows alternating periods of major droughts and high water flows in the Colorado River Basin (Meko et al. 2007). Results of extensive studies of historic data demonstrate that the Colorado River allocations to the basin states were made at a time of record high flows. In planning for future growth, the communities dependent on Colorado River water will need to adopt a sound and conservative management approach recognizing that drought events similar in duration and magnitude to those seen in the past could happen again.

Most climate models agree that anthropogenic climate change in the region will lead to warmer temperatures, but projections for precipitation are much more uncertain. However, it is clear that the future will not look like the past when considering water availability through the Colorado River system. A better understanding of the root causes of climatic fluctuations at regional scales is needed before models alone can be relied on for projections of future drought probabilities. Even with improved models, a random component of variability is probable, and tree-ring records serve a useful purpose in giving estimates of the range of conditions likely to be encountered.

FIGURE 1

Colorado River Basin

affect communities whose economies depend upon the scenic, recreational, and other amenity qualities of those public lands.

Competition with invasive species, particularly in areas that did not evolve to be wildfire resistant, could lead to the loss of some species of regional and cultural significance, such as the iconic saguaro cactus of the Sonoran Desert, and the Joshua tree of the Mojave Desert. This process becomes a self-reinforcing cycle, where invasive grasses are given the advantage over native species under altered fire regimes.

In alpine regions, temperature increases

BOX 2

Ecological Repercussions from the Loss of Whitebark Pines

Widespread outbreaks of mountain pine beetles (MPB) are occurring throughout the range of this native insect in the high-elevation whitebark pine forests in the Greater Yellowstone Ecosystem (GYE). Under historic climate regimes, these forests provided an inhospitable habitat for the MPB because it was usually too cold for the beetle to thrive. Climate warming has already moderated the harsh conditions that once protected these forests. As a consequence, significant tree mortality due to MPB is taking place every year, with the very real possibility of total collapse of this important ecosystem.

Recent Forest Service ground surveys have verified mortality that exceeds 90 percent of cone-bearing trees in some stands (Gibson et al. 2008). The pine's large, fleshy, highly nutritious seeds provide an important food resource for a wide array of wildlife ranging from Clark's nutcracker and red squirrels to grizzly bears, especially females with cubs. One clear prediction for the loss of cone-bearing trees is the increase in negative interactions between grizzly bears and humans.

Functional loss of whitebark pine in the short term is almost a certainty, and the cascading consequences on grizzlies may well have begun. Even in areas with substantial whitebark pine expansion, the slow growth and maturation of this tree means that its cones and other ecosystem services will take a long time to recover. Over the longer term, it is conceivable that the fragility of whitebark pine to MPB disturbance, combined with other ecological insults such as white pine blister rust, could drive GYE whitebark pines to the brink of ecological extinction.

All of the whitebark pines in this section of the Teton Wilderness in the Greater Yellowstone Ecosystem died in the summer of 2006.

Southern tip of Lake Mead, Arizona–Nevada border

leading to the spread of the mountain pine beetle into forest systems at high elevations, where the cold once kept them at bay, has exposed vast expanses of forestlands to beetle infestation and massive tree die-off (box 2). Many species have already responded to temperature increases by shifting their ranges northward or up-slope in alpine systems. For species such as the pika, a high-alpine rodent whose range already encompasses the highest elevations, a changed climate may no longer provide suitable habitat to support the species.

The full scale of impacts to natural ecosystems in the region is not yet fully understood, but there is a growing body of scientific knowledge that indicates cause for concern. While some of these disruptive effects will be gradual, allowing for some mitigation measures to be implemented, others may be dramatic and sudden, limiting the ability of communities to adapt. In some cases, entire landscapes may be fundamentally altered by the combination of climate impacts, invasive species, and habitat loss and fragmentation from development.

SUMMARY

The impacts of climate change are expected to be severe as the Intermountain West becomes drier, subject to more extreme weather events including floods and heat waves, and vulnerable to catastrophic wildfire and disruption of ecosystems. Local governments must act sooner rather than later to reduce greenhouse gas emissions (mitigation) and deal with the impacts of unavoidable climate change (adaptation).

CHAPTER 2
Coping with Climate Change

TriMet MAX Light Rail, Portland, Oregon

For much of the past decade, the federal government was not perceived as a source of substantive action on climate change, but some state, regional, and local efforts have begun to address this issue. The Obama administration is now placing greater emphasis on climate change mitigation and adaptation, but responding to these challenges is an "all hands on deck" enterprise. Understanding policy responses from governments at all levels can be helpful in highlighting opportunities and guiding policy on climate change for local communities.

THE FEDERAL RESPONSE

Some policy strategies to address climate change are naturally most appropriate for action on the national level. Among them are vehicle fuel efficiency standards (corporate average fuel economy or CAFE standards), a carbon tax or national-level CO_2 cap-and-trade market system, research funding for development of renewable energy technologies, and incentives to reduce emissions from the transportation sector through strategic use of federal transportation authorization dollars (box 3).

Other strategies scaled to state and local policy making can benefit from national policy efforts, including renewable energy portfolio standards and building code standards. Federal policy can motivate local action in two primary ways: creation of mandates governing state and local policy, and funding that supports particular policies and activities at the local level. The federal role is currently focused on funding as a

means of enabling local planning action related to climate change.

To the extent that communities have not adopted policies to mitigate or adapt to climate change due to resource limitations or lack of expertise, the provision of federal dollars to jump-start these activities will be a strong motivator for local action. For example, the Department of Energy's Energy Efficiency and Conservation Block Grant program is making more than $2.6 billion available to communities to improve energy efficiency and reduce use of fossil fuels (U.S. Department of Energy 2009).

The challenge for local governments will be capturing these dollars to support both mitigation and adaptation activities (table 1). Most of the attention paid to climate change thus far has been focused on mitigation—actions intended to reduce future greenhouse gas emissions and lessen the long-term impacts of climate change. However, climate change is already occurring because humans have altered the composition of the atmosphere to a degree that cannot be reversed

BOX 3
CO_2 Cap-and-Trade Made Simple

Cap-and-trade is a market-based policy mechanism designed to reduce greenhouse gas emissions through influencing supply and demand forces. Through this system, a limit (cap) is set on the amount of greenhouse gas emissions allowed to be emitted by those entities covered under the policy. This cap determines the number of emissions allowances or rights to emit the regulated pollutant (in this case, CO_2). Those emissions allowances are then distributed to those entities through sale, auction, or some combination of those strategies.

Each allowance grants the release of a set amount of the pollutant, for example, one ton of carbon dioxide equivalent (CO_2e). Those firms that can reduce their emissions through implementation of low-emitting technologies or processes can then sell their emissions credits to those that cannot afford higher emissions control costs. Over time, the number of allowances available on the market can be ratcheted downward to achieve an overall carbon reduction goal. Cap-and-trade was used successfully in the Northeast to control sulphur dioxide pollution, and represents a promising strategy to achieve greenhouse gas reduction targets in a flexible, efficient, and cost-effective manner (Pew Center on Global Climate Change 2009a).

TABLE 1
Mitigation and Adaptation Strategies

	Mitigation	Adaptation
Green building technologies for municipal, industrial, commercial, and residential structures	X	X
Energy efficiency in municipal, industrial, commercial, or residential buildings	X	X
Compact building design	X	X
Reduction in vehicle miles traveled (VMT) through walkable, mixed-use, and high-density development	X	X
Increase in mass transit	X	—
Transit-oriented development	X	—
Alternative energy (distributed generation within urban areas)	X	X
Open space conservation	X	X
Urban forestry	X	X
Wildland-urban interface and fire management through building or zoning regulations	—	X
Comprehensive drought planning	—	X
Water efficiency measures	—	X
Waste management (i.e., landfill construction, methane capture and use, and composting programs)	X	—

for decades or centuries. Therefore, in addition to continuing mitigation actions, human societies must adapt to the negative effects of changes that are already taking place.

Mitigation and adaptation are two sides of the same coin, not mutually exclusive strategies. Many of the land use–related climate change mitigation policies now being established will also help states, counties, and communities adapt to climate change.

REGIONAL RESPONSES

Given the delay in federal climate policy action over the past decade, many states and regions began pursuing their own strategies to fill the void in federal leadership. Cap-and-trade systems, as one of the more politically palatable and potentially effective mechanisms for controlling greenhouse gas emissions, have been the mode of choice for these regional efforts. Two current initiatives designed to create a regional cap-and-trade market for carbon emissions are the Regional Greenhouse Gas Initiative (RGGI) and the Western Climate Initiative (WCI).

Regional Greenhouse Gas Initiative

With 10 member states in the Northeast and Mid-Atlantic region, the RGGI is the nation's first mandatory cap-and-trade system of its kind. Initiated in 2005 by the governors of Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York and Vermont, the RGGI created a cap on carbon dioxide emissions from electricity providers and a system of allowances that could be sold or traded among CO_2 emitters in the program. Massachusetts, Rhode Island, and Maryland have since joined the RGGI program, under which carbon emissions are capped at current levels in 2009 and reduced to 10 percent below current levels by 2019 (Pew Center on Global Climate Change 2009b).

Since power plants of a certain size (at least 25 megawatts and burning at least 50 percent fossil fuels in electricity generation) are the principal target of RGGI, the overall impact of the program on land use planning or transportation infrastructure decision making has been largely minimal. Plans are underway among the member states to explore ways to expand policies aimed at improving energy efficiency and increasing the portion of electric power coming from low-carbon sources, but these efforts are not expected to trickle down to the local government level.

Western Climate Initiative

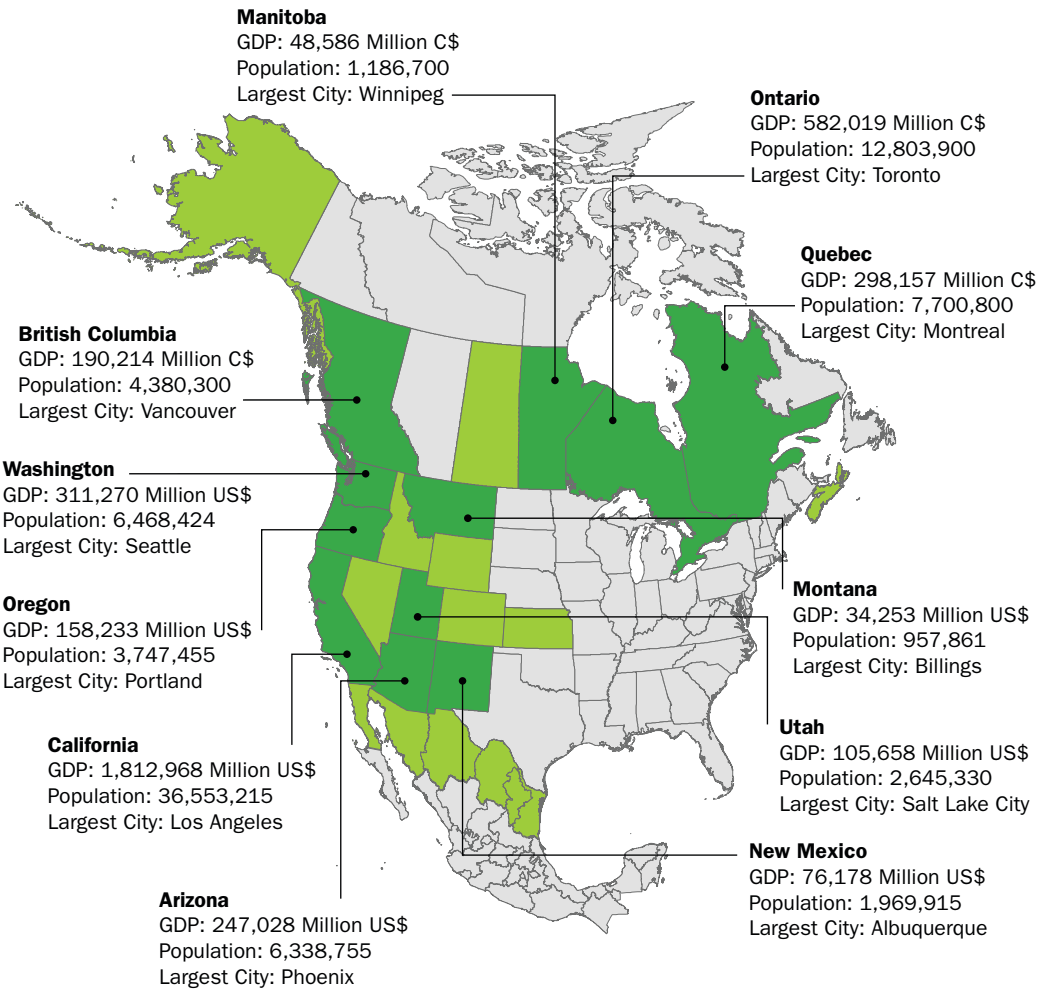
The WCI program was begun in 2007 by the governors of Arizona, California, New Mexico, Oregon, and Washington. Other western states and some Canadian provinces joined the effort later (figure 2). An additional 14 jurisdictions are participating as "observers," including several Mexican states bordering the United States (Pew Center on Global Climate Change 2009c).

WCI set its regional greenhouse gas reduction target to 15 percent below 2005 levels by 2020, and established a broad scope encompassing CO_2 and five additional greenhouse gases. It has also taken a multisector approach to emissions reductions, applying the cap to the electricity generation sector, as well as to large-scale industrial and commercial combustion processes.

In 2012 the program will expand to include transportation, residential, commercial, and industrial fuel use. According to WCI design recommendations, these sectors are included with the expectation that partner jurisdictions will accomplish reductions by implementing a variety of policies, some of which would have an impact on local land use planning, such as smart growth strategies and promotion of transit options.

This link between a regional greenhouse gas reduction goal and local planning is notable, even though how it will be implemented

FIGURE 2
Western Climate Initiative, 2009



Source: Pew Center on Global Climate Change (2009c).

remains unclear. Indeed, implementation will probably vary from state to state once the second phase of the program starts in 2012. And unlike the federal cap-and-trade system, which is likely to provide an incentive to local government by way of funding, the WCI program could create a series of mandates for local government to meet greenhouse gas reduction obligations of the participating state.

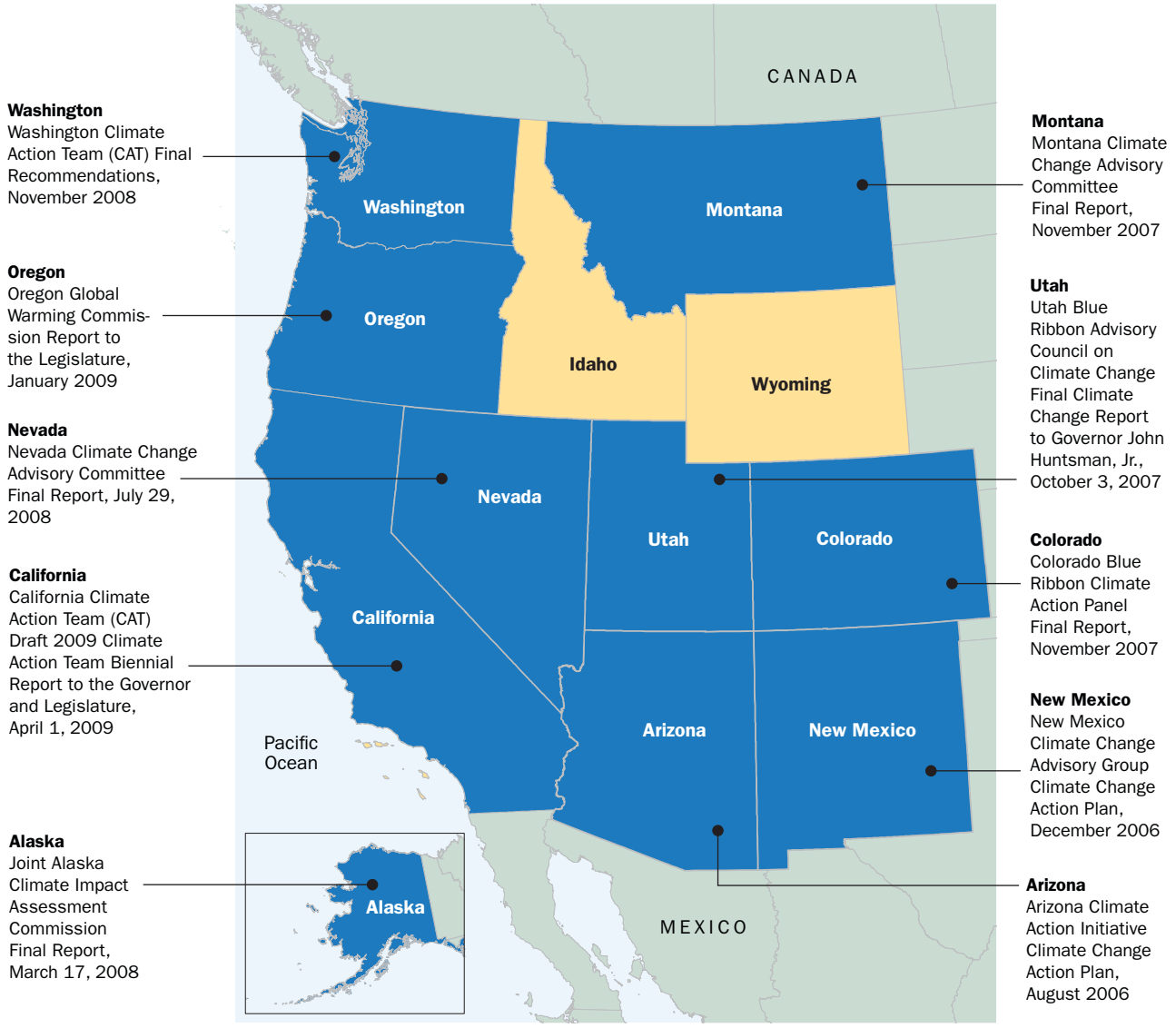
STATE-LEVEL RESPONSES

Over the past five years, some western states began to initiate their own state-specific, climate-oriented planning activities in response to growing concern about climate change, and initial impacts from those plans are beginning to be felt by some communities. According to a recent Lincoln Institute Working Paper, "Driving Climate Change Mitigation at Multiple Levels of Governance

in the West," California has moved into the forefront of integrating considerations about greenhouse gas emissions into local land use planning (Richards 2009).

The Center for Climate Strategies (CCS), based in Washington, DC, began working with western states to create action plans through facilitated stakeholder processes. The mission of CCS is to "help states, regions, and national governments tackle climate change by fostering leadership action toward solutions, enabling deliberative democracy on policy and governance choices, and providing advanced technical assistance for stakeholders and policy makers" (Center for Climate Strategies 2009). As of August 2009, 10 western states completed state-level climate action plans (figure 3), and many of them were completed with the assistance of CCS.

FIGURE 3
Completed Climate Action Plans in Ten Western States



Source: Center for Climate Strategies (2009).

Through the CCS process, state climate action plans are developed over the course of a year by a team that works with a group of 20 to 50 stakeholders to identify, design, and analyze emissions mitigation policies. These stakeholders represent state, county, and city government officials, water and power utilities, nonprofit organizations, school districts, businesses, industries such as agriculture and mining, academic institutions, and concerned citizens.

These state plans represent a range of existing political perspectives, and embody widespread support for the data and policies contained within them. In the eight state plans examined for this report, 90 percent or more of all recommendations were approved unanimously due to the collaborative processes that provided extended opportunities for the identification and resolution of potential conflicts.

State climate action plans contain inventories of current and potential greenhouse gas emissions from various sectors and outline potential strategies for climate change mitigation. These plans also serve as a repository for information about policy solutions that could be implemented at the local government scale.

Many of the state climate action plans include estimates for the effectiveness of various greenhouse gas emissions reduction strategies, including their comparative costs. Some of these strategies and policies are fully quantified, including estimates for greenhouse gas reduction potential and cost-effectiveness. This information allows planners and other local decision makers to evaluate a range of policies and select a mix of locally appropriate, cost-effective strategies that best fit the needs and circumstances of their jurisdictions.

The majority of the first-generation state climate action plans focus on reducing greenhouse gas emissions rather than adaptation strategies to improve community resilience to anticipated temperature and climate changes given current carbon loads in the atmosphere. Colorado is an exception to this because its plan includes specific adaptation measures for agriculture, water resources, and forestry. Carbon load refers to the amount of CO_2 currently in the atmosphere. Prior to the industrial revolution, the carbon load of the atmosphere was approximately 280 parts per million (ppm), compared to current levels of around 382 ppm (US EPA 2009).

Even without articulating an explicit adaptation strategy, many actions within the state plans have value for climate change adaptation. Moreover, they provide a host of co-benefits, such as alleviating traffic congestion, preserving open space and natural habitats, and creating healthier, walkable, and more livable communities. That is not to say that communities ought to ignore the importance of adaptation strategies as they seek to manage the impacts of climate change, only that many mitigation strategies can have significant adaptive value as well.

The policy prescriptions in state climate action plans are frequently categorized by sector: energy supply, residential and commercial, transportation and land use, and agriculture and forestry. Land use–related policies do not fit neatly in a single category, but rather have considerable overlap with transportation, open space and agricultural protection, and residential development. As a result, the transportation and land use sections of many state climate action plans may contain provisions that are only tangentially related to planning, such as increases in vehicle fuel efficiency. For this analysis, research on land use strategies to address climate change was not limited to the transportation and land use sector recommendations.

State climate action plans offer several advantages to planners seeking to integrate climate change information into their work.

First, the plans are specific to a relatively limited geography, and thus reflect economic, demographic, and resource issues at a more relevant scale than regional, national, or nonspecific documents. Although not every western state has its own climate action plan, planners in states without a plan are likely to find the information in neighboring states' plans useful to their own efforts.

The state climate action plans were created through a peer review process. The plans generally contain a synthesis of climate change data and information from a variety of sources, ranging from international organizations, such as the IPCC, to the work of individual scientists and researchers familiar with the region. Although local conditions may vary from those described at the state level, it may be easier to adapt the state-level synthesis to local conditions than to start from scratch.

State-level climate action plans generally contain ambitious goals for reducing greenhouse gas emissions. If each state was successful in achieving those goals, it would represent a significant contribution to curbing emissions, mitigating future warming, and effectively adapting to climate changes that are already occurring. The key challenge remains: to implement those policies effectively and connect efforts at the state level with actions at the local level.

For example, the Colorado Carbon Fund is an innovative statewide campaign aimed at providing carbon offsets for consumers who are concerned about climate change. Consumers can choose to participate in the program and purchase carbon offsets that are high-quality and verifiable to counter their everyday activities, such as home heating and commuting. The funds are then directed to support clean energy projects, energy efficiency measures, and community-based initiatives to reduce greenhouse gas emissions.

LOCAL GOVERNMENT RESPONSES

As with policy responses at the state and regional level, many local governments began developing strategies to address climate change impacts on their own. In response to the Bush administration's rejection of the Kyoto Protocol in 2005, more than 130 mayors signed the U.S. Mayors Climate Protection Agreement, pledging to meet or exceed the greenhouse gas reduction targets outlined in that accord. By October 2009, more than 1,000 signatories had agreed to take action within their own communities to enact land use policies that encourage compact, walkable communities and preserve open space, as well as promote alternative transportation modes and increase energy efficiency through improved building code standards.

Organizations such as ICLEI–Local Governments for Sustainability have developed programs oriented to help local governments in implementing strategies to meet their climate protection goals. To provide local governments with a flexible system that can be adapted to local circumstances and capacity, and to improve success rates in implementing climate change policies, the ICLEI program centers on five milestones (box 4).

Recognition is increasing about the roles of land use planning and transportation planning at the local level in meeting the challenges of mitigation and adaptation. As illustrated in the analysis of state climate action plans and the relative cost-effectiveness of various local government planning activities to reduce greenhouse gas emissions, land use and infrastructure planning activities can account for up to 20 percent of these reduction objectives in the West.

Some energy-related strategies, such as vehicle fuel efficiency regulations, development of sustainable energy technologies,

and renewable portfolio standards, are beyond the scope of land use planners. Yet, they are important elements in the permitting process for distributed renewable energy generation, solar electric- and hot water-ready housing, and similar initiatives.

Local government action also has the advantage of being ready to implement immediately, apart from political considerations associated with its adoption. No technological advancements are needed that could delay action, and many of the tools and policies are already known and accepted in planning circles. Also, local governments can serve as learning laboratories for the implementation of strategies to respond to climate change, and can demonstrate creative mechanisms and policies that are replicable in other communities.

Several of the policy changes promoted to address climate change already fall within the suite of smart growth tools once touted not as climate solutions but as a means of creating more livable, healthier communities. These tools include compact growth, protection of open space, walkable and bikeable neighborhoods, and transportation options. The co-benefits associated with these strategies make them appealing for a variety of reasons: lowering the cost of providing services through more compact patterns of development; improving quality of life; and enhancing a community's competitive advantage and economic prosperity.

BOX 4

Five Milestones of ICLEI's Cities for Climate Protection Campaign

Milestone 1. ***Conduct a baseline emissions inventory and forecast.*** Based on energy consumption and waste generation, the city calculates greenhouse gas emissions for a base year (e.g., 2000) and for a forecast year (e.g., 2015). The inventory and forecast provide a benchmark against which the city can measure progress.

Milestone 2. ***Adopt an emissions reduction target for the forecast year.*** The city establishes an emissions reduction target. The target both fosters political will and creates a framework to guide the planning and implementation of measures.

Milestone 3. ***Develop a Local Action Plan.*** Through a multistakeholder process, the city develops a Local Action Plan that describes the policies and measures that the local government will take to reduce greenhouse gas emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct greenhouse gas reduction measures, most plans also incorporate public awareness and education efforts.

Milestone 4. ***Implement policies and measures.*** The city implements the policies and measures contained in its Local Action Plan. Typical policies and measures implemented by CCP participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

Milestone 5. ***Monitor and verify results.*** Monitoring and verifying progress on the implementation of measures to reduce or avoid greenhouse gas emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be used to improve the measures over time.

Source: ICLEI (www.iclei.org).

SUMMARY

Local government units in the Intermountain West have an essential role to play in a coordinated national, state, multistate, and substate regional effort to plan for and implement climate mitigation and adaptation policies. Even though the importance of local planning action is widely understood, the region has been slow to adopt aggressive planning policies designed to reorient development and growth into a less carbon intensive pattern, especially outside of urban centers. Local governments need to develop their own climate action plans and work with neighboring communities on relevant regional issues like transportation and water planning.

CHAPTER 3

The Role of Planning in Response to Climate Change

Roosevelt Square mixed-use development in Phoenix, Arizona

Planners in the western United States work in a wide range of capacities. In urban settings and some well-resourced amenity communities, planning professionals may be specialists on issues ranging from urban development and infill to sustainability and conservation planning. In smaller, more rural, or less wealthy communities, planners may serve as members of a limited staff, or even act as "lone rangers" responsible for all aspects of a community's planning responsibilities and management.

A broad realm of challenges confront planners in the changing Intermountain West, from high demand for building permits in rapidly growing areas to rural issues of declining populations and tax bases. The degree of concern about climate change also varies widely, from robust support for immediate action to a marked reluctance to prioritize or even acknowledge the issue.

If climate change mitigation and adaptation policies are to be successful in reducing carbon emissions and making the region more resilient to the inevitable changes in climate conditions, they must be implemented at the local level. A key question remains: What is the role of local government in creating more climate resilient communities?

The state climate action plans for western states typically contain 30 to 60 quantified policy options for reducing greenhouse gas emissions. Of these, approximately a dozen relate to land use planning and local government action, typically accounting for about one-fifth of total greenhouse gas reductions. It is clear that the participation of local government is essential to meeting climate policy goals.

Regardless of their roles or the size of their communities, planners will influence potential actions that can help mitigate and adapt to climate change. These strategies may include encouraging green building and other energy-efficient features of municipal, industrial, commercial, and residential buildings, and guiding urban form to reduce vehicle miles traveled, such as through walkable and transit-oriented community design featuring mixed-use, high-density development.

Planners also have a role in increasing the availability of public transit and alternative modes of transportation, facilitating the integration of distributed renewable energy sources into urban areas, and promoting water efficiency with respect to building design and landscaping.

Incorporating urban forestry and local food systems into planning and zoning would not be possible without the active support of community planning professionals. There is also a need in the Intermountain West for increased wildland-urban interface building and zoning regulations, particularly in areas where wildfire risk near communities is anticipated to increase.

GUIDANCE FROM STATE CLIMATE ACTION PLANS

In assessing the role of local government decision makers in addressing climate change, those efforts conducted at the local level, but within a larger regional, state, or national framework, can have a much stronger impact on overall carbon emissions. While it is true that a single municipality cannot effectively mitigate global climate change, a growing body of information is available to guide local governments on policies and actions they can take to contribute their share. Additionally, local governments have tremendous capacity to establish policies and manage growth in a manner that will safeguard their communities from the inevitable impacts of a changing climate, particularly in terms of adaptation strategies to changed climate conditions.

In terms of broader frameworks to guide local action, most western states have completed climate action plans that include activities that must be undertaken at the local level in order to succeed. These plans can serve as an important first step for coordinating local efforts.

Table 2 presents data from five of the eight western climate action plans that most thoroughly quantify potential greenhouse gas emissions reductions. It illustrates the total number of climate action policies found in the plans and the estimated greenhouse gas reduction potential if all policies were implemented. The overall figure may be different than the reduction goal stated in each plan, since the goal is often used as a target for a percentage emissions reduction over the current total, rather than by the sum of all possible reductions.

Figure 4 compares the average cost-effectiveness of CO_2 emissions reductions among land use–related policies commonly found in the climate action plans of western states. This number was created by averaging the total costs for each state's policies.

The Arizona Climate Action Plan illustrates the role that land use–related policies can play in reducing greenhouse gas emissions, as well as their relative cost-effectiveness as compared to other policy actions.

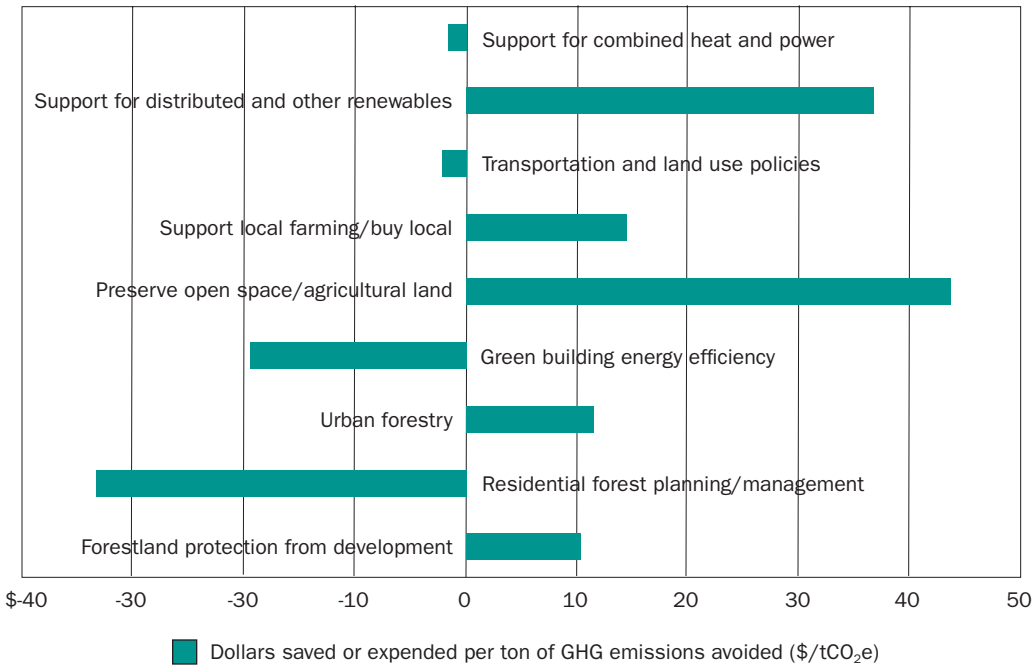
TABLE 2
Summary of Climate Action Policies in Five Western States

	Arizona	California	Montana	New Mexico	Washington
Total number of climate action policies	35	39	48	64	58
Total potential GHG emissions ($mmtCO_2e$) avoided if policies are implemented*	645	139	125	323	105
Total planning-related policies	11	8	10	19	13
Percentage of total GHG reductions possible from planning-related policies	19.9%	18.3%	10.2%	17.5%	24.7%

* $mmtCO_2e$ = million metric tons of CO_2 equivalent.

FIGURE 4

Average Cost-Effectiveness of Greenhouse Gas Emissions Reductions from Land Use–Related Policies in Western State Climate Action Plans



The Arizona plan includes a total of 49 policy recommendations, for which the greenhouse gas reduction potential of 35 policies has been quantified, totaling 645 million metric tons of CO_2 equivalent avoided if all were fully implemented (table 3).

Land use–related policies alone are not the "silver bullet" many are searching for to solve the climate crisis, but they are clearly an important component of the "silver buckshot" of solutions required to address this issue. Climate action policies for each state vary somewhat in their specifications. However, the average effectiveness of the primary land use–related policies in Arizona can be analyzed both in terms of the percentage each policy contributes to the state's total target greenhouse gas emissions reductions and the cost-effectiveness of the policy (figure 5).

LOCAL GOVERNMENT ACTIONS

Each of the following areas of local government planning are examined, along with specific policy language, estimated greenhouse gas emissions reductions, and cost-effectiveness measures drawn from state-level action plans.

Building Codes and Standards

According to some estimates, only one-third of the buildings needed in the Intermountain West to accommodate population growth projections for 2030 had been built by the year 2000 (Nelson 2004). How future structures are built will have a tremendous impact on the region, given the longevity of many buildings. This presents an important opportunity for adapting the built environment to a changing climate and creating a new, more sustainable pattern of urban form.

TABLE 3
All Arizona Greenhouse Gas Reduction Policies

#		2007–2020 Cumulative GHG Reduction ($mmtCO_2e$)	Ranked by Percent of Total Reduction	Dollars Saved or Expended per ton of GHG Emissions Avoided ($/tCO_2e$)
1	Environmental portfolio standard/renewable energy standard and tariff	116.00	17.98	$6.00
2	Demand-side efficiency goals, funds, incentives, and programs	103.00	15.96	-$36.00
3	Carbon intensity targets	70.40	10.91	$44.00
4	Solid waste management	36.00	5.58	n/a
5	State clean car program	32.50	5.04	-$90.00
6	Integrated resource planning	28.00	4.34	-$2.00
7	Ethanol production and use	28.00	4.34	$0.00
8	Smart growth bundle of options*	26.70	4.14	$0.00
9	"Beyond code" building design incentives and programs for smart growth**	18.00	2.79	-$17.00
10	Electricity pricing strategies	16.00	2.48	-$63.00
11	Pricing strategies	16.00	2.48	-$63.00
12	Distributed generation/combined heat and power	16.00	2.48	-$25.00
13	Reducing barriers to renewables and clean distributed generation	16.00	2.48	-$25.00
14	Building standards/codes for smart growth	14.00	2.17	-$18.00
15	Pay-as-you-drive insurance	12.30	1.91	$0.00
16	Reduction of vehicle idling	11.80	1.83	-$22.00
17	Distributed generation/renewable energy applications	10.00	1.55	$31.00
18	Direct renewable energy support (including tax credits and incentives, R&D, and siting/zoning)	10.00	1.55	$31.00
19	Appliance standards	7.00	1.08	-$66.00
20	Demand-side fuel switching	7.00	1.08	n/a
21	Forest ecosystem management—residential lands	6.40	0.99	-$21.00
22	Biodiesel implementation	6.20	0.96	$0.00
23	Water use and wastewater management	6.00	0.93	n/a
24	60 mph speed limit for commercial trucks	5.20	0.81	$35.00
25	Low rolling resistance tires and tire inflation	4.80	0.74	n/a
26	Biomass feedstocks for electricity or steam production	4.54	0.70	-$8.00
27	Manure management—manure digesters	3.82	0.59	$7.00
28	Forestland protection from developed uses	3.73	0.58	$17.00
29	State leadership programs	3.00	0.46	-$4.00
30	Forest ecosystem management—other lands	2.90	0.45	-$21.00
31	Reduce conversion of farm and rangelands to developed uses	1.59	0.25	$65.00
32	Accelerated replacement/retirement of high-emitting diesel fleet	1.20	0.19	n/a
33	Reforestation/restoration of forestland	0.65	0.10	$44.00
34	State lead-by-example (via procurement and SmartWay)	0.40	0.06	$0.00
35	Programs to support local farming/buy local	0.15	0.02	$6.00
	Totals	**645.28**	**100.00**	

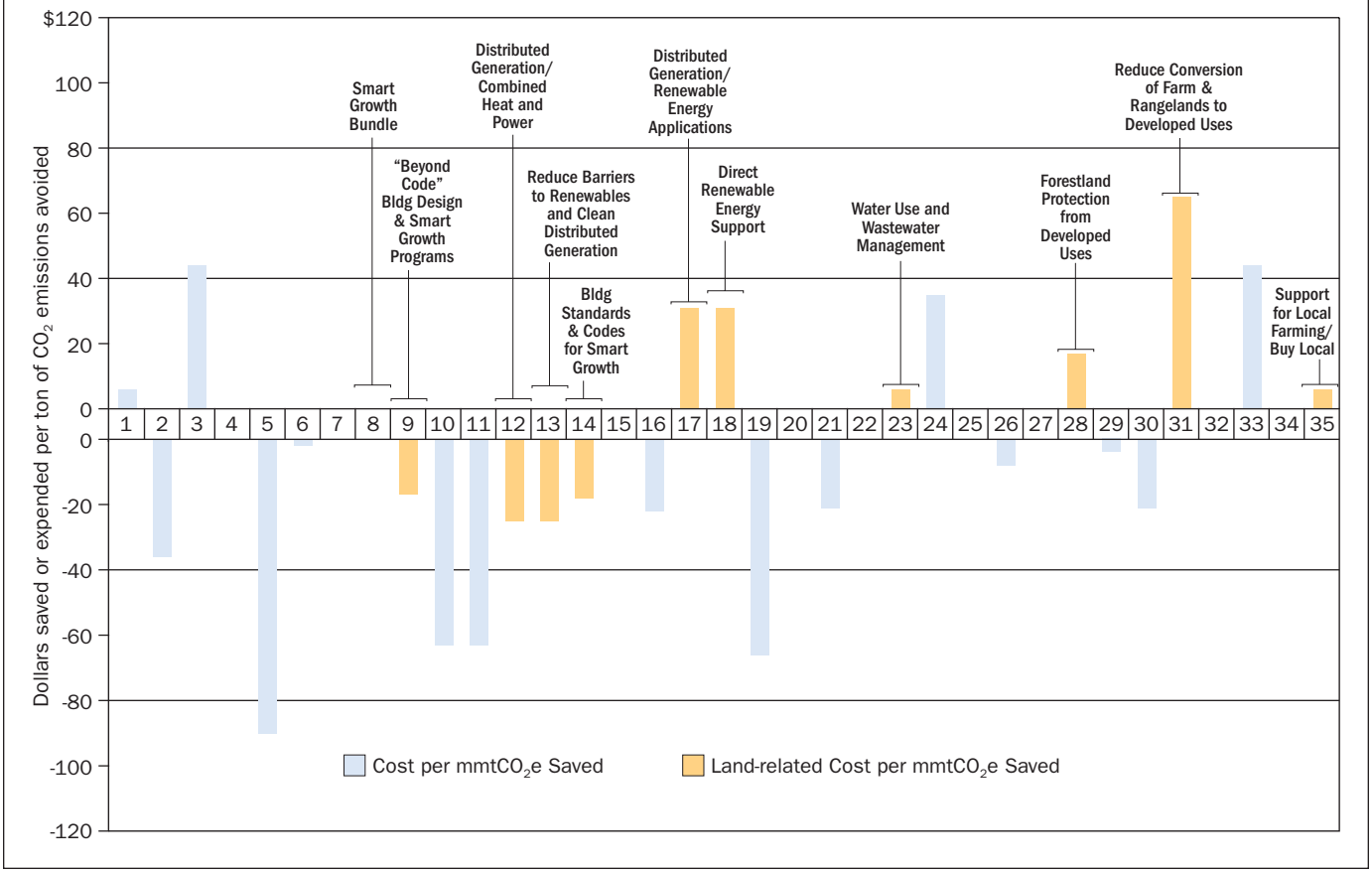
Notes: Rows marked in yellow indicate greenhouse gas reduction policies linked to local land use planning decisions. A negative figure reflects an overall cost savings generated by the policy action in reducing greenhouse gas emissions.

* The smart growth bundle of options refers to a set of strategies to reduce carbon emissions through improved urban form through implementation of policies to promote infill, transit-oriented development, and mixed-use development.

** "Beyond code" building design incentives refer to implementation of energy performance standards for new and existing buildings that achieve high levels of energy efficiency that might not be achieved through application of standard code requirements.

Source: Arizona Climate Action Plan (*www.azclimatechange.gov*).

FIGURE 5
Effectiveness of Arizona Climate Action Policies



Note: Numbers 1–35 refer to policies listed in Table 3.

Residential and commercial buildings account for nearly half of all energy used in the United States. Commercial buildings account for the largest portion of peak energy demand in most regions, with their energy intensity (energy use per square foot) increasing by 12 percent from 1990 to 1999. Residential energy use across the nation is predicted to increase 27 percent by the year 2025; that figure may be even higher for the Intermountain West if its pattern of rapid development continues (Precourt Institute for Energy Efficiency 2009).

The technology and expertise needed to create higher-performance buildings already exist. Using these innovative practices along with better systems integration could achieve cost-effective energy savings as high as 50 percent compared with new structures meeting the bare minimum standards in current building codes. In addition, retrofit technologies and practices on existing buildings could provide supplementary energy savings in the range of 5 to 20 percent (Precourt Institute for Energy Efficiency 2009).

Green building codes refer to policies that affect the physical structure of buildings or the efficiency of major systems such as electrical consumption and water use. Examples of green building practices include external shading, increased insulation and air tightness, energy efficient cooling, natural ventilation, and greater thermal mass (i.e., thicker exterior walls that aid in regulation of temperature), all of which reduce energy use. Green building policies also promote the integration of solar, micro-wind, combined heat and power, and other renewable, distributed, and/or efficient energy systems into the building design.

Location and site layout are a part of green building as well, and may have implications for broader land use planning and management in communities. These practices involve reducing summer heat gain and winter heat loss through appropriate building orientation, profile, and window placement. Green building practices include locating and designing buildings to reduce vulnerability to natural events such as flooding and wildfires. Since these phenomena are projected to increase in frequency and intensity with climate change, green building becomes an attractive adaptation policy.

Building materials are another component in meeting green building standards. "Cool roofs" that use light-colored coatings and materials to increase heat reflection and reduce absorption are encouraged, as are green roofs, porous paving materials, and "cool pavement," which employs light-colored sidewalks, parking lots, and roads.

Green building policies appear in seven of the eight western state climate action plans studied (Appendix, Table A1). They range from standard building codes already in place to those specifically designated as related to smart growth or "beyond" or "reach" codes. Depending on the state, they may apply to state buildings only, or to a broader range of structures that can include businesses and residences (box 5). Several state policies also include provisions for solar hot water and electrical generation.

Such policies are popular because they can make significant contributions to reducing greenhouse gas emissions, while also saving money for residents and local governments. The California Solar Initiative, which seeks to put solar cells on one million residential rooftops in the state, is the only green building policy among those in the seven states studied that has not proven cost-effective. The program, as implemented by the California Public Utilities Commission, has been estimated to cost $3 billion per year for consumer rebates over its 10-year lifespan. At this cost, each kilowatt-hour of

The East Valley Bus Operations and Maintenance Facility in Tempe, Arizona was awarded Leadership in Energy and Environmental Design (LEED) gold certification by the U.S. Green Building Council. Owned and operated by Valley Metro and the cities of Tempe and Scottsdale, the bus maintenance and transit facility opened in the summer of 2007, costing $46.8 million to build.

BOX 5

Linking State Policy to Green Building in Montana

The Montana Climate Action Plan contains the following provisions under its Building Energy Codes policy:

- Increase standards so that the minimum performance of new and substantially renovated buildings, both commercial and residential, is at least 15 percent higher by 2010 than required by today's building codes (as of 2003), and 30 percent higher by 2020;
- Encourage and work toward achieving the goal of "carbon-neutral" status for new buildings;
- Encourage the use of recycled and local building materials;
- Express energy-efficiency standards on a per-unit-floor-space basis for commercial buildings and on a per-dwelling-unit basis for residential buildings;
- Periodically and regularly review building codes, including energy-efficiency requirements of building codes, to ensure that they stay up-to-date;
- Offer or require education to equip building code officials, builders, designers, and others to effectively implement building energy code improvements; and
- Explore new mechanisms, such as working with financial institutions and the use of spot checks, to improve code implementation in rural areas.

electricity produced by solar photovoltaics costs 20 cents, compared to 12 to 15 cents per kilowatt-hour of grid electricity. However, there is a significant upside in promoting solar energy, and costs are expected to drop as technologies improve and as more industries and consumers participate in the solar market (Resources for the Future 2008).

Green building also has an important role to play in helping western communities successfully adapt to a changing climate. By substituting natural daylight for electrical lighting, employing better insulation to replace large heating and cooling systems, and implementing other energy-saving measures, the draw from residential electrical use on the energy grid is greatly reduced.

If, as climate projections indicate, heat waves become longer and more intense, higher air conditioning use at peak times may strain power supplies, and more severe storms forecast by climate scientists may worsen power delivery disruptions. Green buildings may provide greater comfort for their inhabitants compared to conventional buildings in the event of power outages, and would contribute to the resiliency of a community enduring extreme weather events.

Land Use and Transportation

Moving up in scale from building and site design, land use planning affects building locations, development patterns, and urban form, impacting the carbon footprint of an entire community and region (box 6). Households built in compact areas use 20 percent less primary energy for space heating and cooling than equivalent ones built in sprawling areas, due primarily to less exterior wall area in attached and multifamily housing and less floor area consumed at higher densities (Ewing et al. 2008).

Compact development patterns have the potential to reduce driving between 20 and 40 percent compared to the current mode of isolated subdivisions on the suburban edge, far from workplaces and other destinations. Shifting 60 percent of the new growth to more compact developments would save an estimated 85 million metric tons of CO_2 annually at the national level by 2030 (Ewing et al. 2008).

Denser urban form would also help preserve farmland and open space, protect water quality by decreasing impervious surface area, and improve health by creating walkable, bikeable neighborhoods that provide opportunities for more physical activity. Lastly, it would save taxpayers money by reducing the cost of roads, water and sewer lines, and other infrastructure (box 7).

BOX 6

Climate Change and Regional Scenario Modeling

Western Lands and Communities, a joint venture of the Lincoln Institute of Land Policy and the Sonoran Institute, is involved with a project to create alternative development scenarios for Superstition Vistas, a 275-square-mile parcel of Arizona state trust land. It represents one of the largest single-ownership planning efforts in the western United States. The goal of the project is to develop sustainable planning practices that could serve as a national model for energy- and water-efficient development with a low carbon footprint.

Fregonese Associates of Portland, Oregon is part of the team selected to develop a scenario modeling process that used prototype buildings, which were then aggregated into development types representing different urban forms—from downtown centers to mixed-use main streets. These development types were then "painted" on the landscape using the Envision Tomorrow Scenario Builder (Condon, Cavens, and Miller 2009). This process yielded four scenarios representing a variety of regional growth patterns and the following five lessons for improving sustainability.

1. The combination of multimodal land use and transportation design and building improvements can have a huge impact on carbon emissions. Preliminary indications from the Superstition Vistas work show that reductions of 50 to 60 percent in carbon emissions are possible with current technology.

2. Building in a "greener" fashion is a key strategy. The impact of developing buildings to a greater level of energy efficiency can significantly reduce greenhouse gas emissions and energy consumption.

3. The costs of improving energy efficiency vary widely among different kinds of buildings. Some building types may have considerably higher costs than others to achieve comparable improvements, such as use of carbon-neutral energy rather than energy conservation.

4. Developing a more compact form can reduce the carbon impact from buildings while accommodating the same population forecast. In the case of Superstition Vistas, the more compact scenarios reduced carbon emissions by 20 to 25 percent, before adding energy efficiency measures to the building prototypes.

5. Achieving a better jobs/housing balance is a key to reducing transportation-related carbon emissions. A low carbon footprint from transportation sources is difficult to achieve without a successful economic development program.

View of Superstition Mountains from the Superstition Vistas state trust land parcel in Arizona

The Utah Transit Authority's FrontRunner Provo to Salt Lake City high-capacity commuter rail line will be completed by 2015.

The transportation sector typically makes up 25 to 35 percent of the greenhouse gas emissions of western states (US EPA 2006). Some transportation issues are outside the scope of land use planning, such as vehicle fuel efficiency standards, reduction of vehicle idling, pay-as-you-drive insurance, fuel standards, and speed limits. However, planners can influence the implementation of transportation and land use policies such as those that seek to reduce vehicle miles traveled by promoting more compact, mixed-use communities better served by public transportation and other alternative transportation options.

Urban form also has a direct bearing on the number of vehicle miles residents must travel in the course of their day-to-day lives. Transportation now accounts for a full one-third of CO_2 emissions in the United States, and that share continues to grow as other sectors decline in overall emissions (Ewing et al. 2008). Despite advances in vehicle fuel economy, the amount of CO_2 attributable to driving is expected to increase 59 percent between 2005 and 2030 if current trends continue, despite only a 23 percent increase in population (Energy Information Administration 2006).

Land use and transportation policies are specified in all eight western state-level climate action plans described in this report (Appendix, Table A2). In the state plans of Arizona, Colorado, and New Mexico (box 8), transportation policies are combined with land use and economic development provisions, making it difficult to evaluate specific aspects of the smart growth "bundle of tools." However, in all states that quantify the likely costs of CO_2 reduction through implementation of smart growth strategies, the policies either incur no additional costs or provide cost savings. It should be noted, however, that infrastructure costs associated

BOX 7

Four Planning Strategies to Reduce Energy Consumption

Land use planning affects the ability of people to make good choices in order to reduce their carbon footprint. Well-designed places can be part of the solution to climate change by allowing green living to be the easy choice.

1. **Minimize the need for travel.** If people have to travel shorter distances between their homes and work, shopping, services, and recreation, then less fossil fuel will be burned in the process.

2. **Maximize transportation alternatives to the single-occupant, conventionally fueled vehicle.** If people can travel by foot, bike, or public transit, the amount of greenhouse gas emissions from conventional automobiles will be minimized. Land use planning can have a significant influence on whether people travel by alternate modes of transportation by making it easy to use them.

3. **Minimize energy needs for heating, cooling, electricity, water, wastewater, food production, and disposal of trash and food waste.** Energy is used to power a wide variety of systems that people depend upon. The first step is to minimize energy consumption in these systems through energy efficiency measures.

4. **Maximize alternatives to conventional (carbon-based) energy sources.** Solar, wind, geothermal, and other renewable sources of energy can displace the need for conventional energy sources. Land use planning can be a barrier to the effective use of these resources but can also be adapted to encourage more effective use of renewable sources.

with some transit strategies are not included in the assessment. These policies are also expected to be effective in reducing greenhouse gas emissions over the long term by reducing overall vehicle miles traveled.

It is difficult to separate the comparative effectiveness of potential greenhouse gas reductions from the cost-effectiveness of smart growth, transit and multimodal transportation infrastructure, and walkable-bikeable design, since many state climate action plans combine land use and transportation policies that affect these outcomes. Many of these policies include a mix of actions, both within and outside the purview of land use planners. However, given the significance of the transportation sector in contributing to greenhouse gas emissions in the Intermountain West, strategies to lower time spent in single-person, fossil-fuel-burning transportation modes will be key to successfully lowering the carbon footprint of communities.

Energy Sources

Energy use is at the heart of climate change mitigation efforts, and therefore, the majority of climate change policies addressed in the state climate action plans deal with this sector (Appendix, Table A3). Only a few strategies connected to energy policy are directly relevant to planning, but implementation of such policies may require changes in zoning and building codes that would fall within the scope of local planning authorities.

Planners have significant influence over policies that encourage the integration of distributed alternative energy generation into urban settings. Planning actions can help enable greater use of combined heat and power (CHP) technologies that have the potential to take all distributed generation technologies one step further in pollution prevention by utilizing the waste heat from the generation of electricity for producing steam, heating water, or creating cooling energy. CHP could also encompass district-level energy strategies through placement of highly efficient energy generators near buildings where the produced heat and power is needed, rather than requiring power transmission over long distances.

Combined heat and power has great potential to reduce greenhouse gas emissions and results in overall cost savings to communities and residents. However, only part of the implementation of this policy is within the purview of land use planners. Utilities also will play an essential role in implementing this strategy.

BOX 8

New Mexico's Transportation Policies to Reduce VMT

The New Mexico Climate Action Plan provides a good example of the range of transportation and land use policies.

- Infill and brownfield redevelopment
- Transit-oriented development
- Smart growth planning and modeling tools
- Multimodal transportation bundle
- Promotion of LEED for neighborhood development

Traditional low-density development exacerbates dependence on automobile travel and contributes to GHG emissions.

Promotion of distributed generation policies offers adaptation benefits as well. Climate change will increase peak demands on power grids as cities cope with more frequent, intense, and longer heat events, which can overwhelm energy infrastructure and lead to widespread outages. Such incidents are less likely to occur with distributed generation systems since local supplies and demand have greater flexibility to adjust to local conditions and could provide a more stable network. Support for distributed and other renewable energy strategies offers high potential greenhouse gas reductions, but these policies are generally more expensive to implement.

Water Resources

Water is a resource that will be dramatically affected by climate change, which in turn will increase water demand while decreasing its availability in the Intermountain West. A report from the National Research Council regarding the long-term adequacy of Colorado River water supplies suggests that temperatures across the region will continue to rise in the foreseeable future (National Academy of Sciences 2007). Higher temperatures will result in less Upper Basin precipitation falling and being stored as snow, increased evaporative losses, and earlier peak spring snowmelt.

Cumulatively, these changes are likely to reduce future Colorado River streamflow and water supplies, contributing to the increasing severity, frequency, and duration of future droughts. Since the Colorado River serves a significant portion of western communities and urban areas, these projections could have sobering consequences for the stability of water supplies in the Intermountain West.

A substantial portion of the region's electricity comes from hydroelectric supplies, which is an advantage in mitigating future climate change as hydroelectric sources emit little to no greenhouse gases. However, as climate change reduces streamflows across the area, the availability and reliability of hydropower will decrease. A 10 percent decrease in runoff in the Colorado River is estimated to reduce hydropower production by 36 percent (Northern Arizona University 2005). With less hydropower available, utilities may be forced to turn to fossil fuel energy sources, thereby increasing the region's contribution to climate change. Further, because hydropower is used for peak load, its loss is particularly problematic.

In addition to mounting water supply demands, the IPCC Fourth Assessment Report also notes with high confidence that climate change is likely to make it more difficult to achieve existing water quality goals (IPCC 2007). While many aspects of water supply, demand, and use are beyond the sphere of influence of planners, they will have to deal with the consequences of such decisions.

Policies aimed at improving water resources planning rarely appear in state-level climate action plans, and even less frequently involve local government planning officials. In fact, Arizona, California, and Colorado are the only states that mention water resource planning at all. This may be because state plans are largely designed to mitigate future climate change, rather than guide adaptation to current and inevitable changes. However, the cost-effectiveness of these policies is difficult to calculate with currently available data (Appendix, Table A4).

Planning that promotes greater water efficiency will lead to lower overall water use, and consequently, less energy needed to move and treat water supplies. The actions of land use planners will affect water consumption levels in a changed climate, and impact the amount of water available and required to irrigate parks, medians, and land-

scapes around businesses and, to some extent, residences. Land use patterns will also affect the level of risk and additional expense that counties and municipalities will bear in times of more extreme flood events alternating with drought conditions.

Local land use planning can improve water management practices in order to adequately prepare communities for changed climate conditions, which may be significantly drier than during the past century when most western communities developed (box 9). Local governments will need to acknowledge newly vulnerable areas and be prepared to adjust zoning and floodplain maps and management of low-lying lands near rivers and coasts to accommodate more severe flooding. Floods once expected to occur every 100 years based on long-term historical data may occur much more frequently.

Storm water design standards also may need revision in order to accommodate higher water flows through larger and more durable culverts, larger water retention and drainage basins, improved drainage systems, and protection of pipes from disruption by floodwaters.

BOX 9

Leadership in Water Conservation: City of Tucson, Arizona

Rainwater harvesting is a simple and effective way for community members, schools, and government agencies to engage in regional water conservation efforts while benefiting native wildlife and outdoor spaces. Water harvesting decreases erosion and improves water infiltration, recharging groundwater tables.

The Sonoran Institute has a decade of experience in promoting water harvesting techniques in rural areas. In 2008, the Institute began working with a local organization, Watershed Management Group, to implement a series of water harvesting demonstration projects in the urban areas of Tucson and Santa Cruz County, Arizona. The Institute also helped craft two innovative water harvesting ordinances that were adopted by the City of Tucson in the fall of 2008.

Tucson's Commercial Rainwater Harvesting Ordinance is the first of its kind in the country, taking effect June 1, 2010. Facilities subject to the ordinance must meet 50 percent of their landscape demand using harvested rainwater, prepare a site water harvesting plan and water budget, meter outdoor water use, and use irrigation controls that respond to soil moisture conditions at the site. Facilities have three years to establish plants before the 50 percent requirement must be met. The requirement is waived during periods of drought.

Tucson's City Council also approved a measure requiring a plumbing hookup in new homes so wastewater from washing machines, sinks, and showers may be sent to separate drain lines connected to irrigation systems at the homeowner's expense. More recently, the Sonoran Institute and Watershed Management Group joined forces with Tucson Water, a department of the City of Tucson, the University of Arizona, and Tucson Audubon Society to develop and pilot a water banking program that will provide a direct link between water conservation and local river restoration.

Sonoran Institute volunteers install water harvesting features in Tucson.

Columbia City Farmers Market, Seattle, Washington

Periodic water shortages resulting in lower system pressure may make delivering water to outlying areas more difficult, particularly in older, gravity-fed systems. Communities may need to develop adaptation strategies that are tailored for their unique circumstances to shore up aged infrastructure that may not prove adequate under changed water supply conditions. Generally drier conditions may leave less water for landscaping in parks and along roadways. Shifting landscaping emphasis to native, drought-tolerant species would maintain the quality of life and ambiance of public spaces while creating significant water savings.

Local governments could employ a range of other strategies to keep water supplies secure under long-term drought conditions. They may require water harvesting systems to be included on new buildings, and work to change public perception and behavior through practices that reduce waste. Additionally, they may allow water recycling in the form of graywater systems, greater use of effluent, and improved infiltration of storm water into aquifers.

Open Space and Agricultural Preservation

Planners play an essential role in encouraging more compact urban form, which allows for the preservation of open space for various uses, as well as working landscapes for agriculture and ranching. For example, preservation of natural open spaces, particularly forestlands, is important to maintaining carbon sinks (Wayburn 2009). Enhancement of natural landscapes can even increase the level of carbon sequestration, offsetting some of the inevitable greenhouse gas emissions associated with the built environment.

Some climate action policies also encourage local production and consumption of food and fiber as both a means to reduce transport costs and to provide residents with healthy, fresh food. Implementation of these open space and agriculture-related policies may require adjustments to zoning in and around urban areas (Appendix, Table A5).

Programs that support local production and consumption of food and fiber are not expected to have large impacts on greenhouse gas emissions, but they are inexpensive to implement and provide additional benefits to the community. These range from more farmers markets offering fresh, healthy food to better economic health of local agricultural businesses and reduced shipping costs. Local food production has the potential to preserve or even increase quality of life and sense of place.

Both of these types of agriculture-related policies have adaptation value. At the global level, the agricultural sector is expected to be one of the most severely impacted by climate change, with reduced productivity and

crop yields forecast for many areas. Reduced supplies will make food more expensive and, combined with higher prices and likely higher future transportation costs, will add to its price volatility. Locally produced crops are more likely to be heirloom varieties being reintroduced and other regionally adapted varieties. These local crop species may prove more resilient to changing climatic conditions than the limited number of hybridized varieties generally produced by large agribusinesses.

Forestry

The forests of the Intermountain West are already feeling the impacts of climate change. Although the economic importance of the forestry industry has decreased in recent decades, many communities in the region continue to rely on forests as important to their identity, sense of place, and quality of life, as well as for jobs and income.

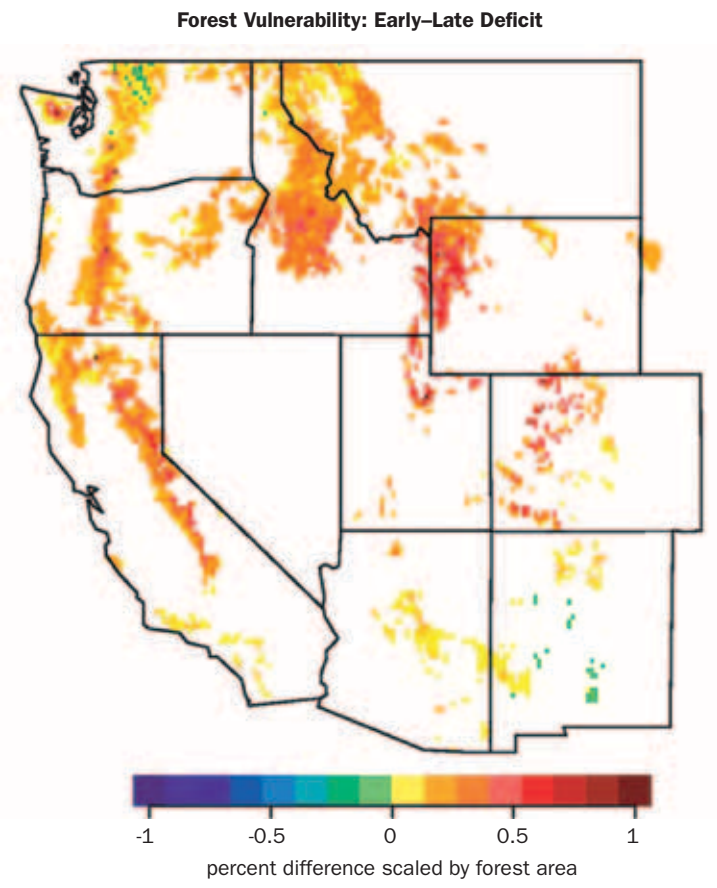
The amenity value of western forests is significant. Much of the draw for new residents in the region is the scenic beauty associated with the rugged mountains, forests, and abundant wildlife. Often, the highest value properties are those located adjacent to or within these natural landscapes. The preference for a home within or near forests has increased development of these areas which, like riparian flood plains, may be subject to increased environmental hazards.

Since 1986, the Intermountain West has experienced a fourfold increase in the number of major wildfires and a sixfold increase in the area of forests burned, compared to the 1970–1986 period (Westerling et al. 2006). Four primary factors, all linked to climate change, are blamed: earlier snowmelt, higher summer temperatures, a longer fire season, and an expanded area of vulnerable high-elevation forests that previously were protected much of the year by snowpack (figure 6).

Studies of wildfire and climate change in Canada point to a 74 to 118 percent increase in the next century. Similar increases seem likely for the western states and carry with them increased risks for communities near forestlands (Flannigan et al. 2005; Running 2006).

The fundamental changes being seen in these forestlands, combined with the preference of westerners to locate in and near forested wildlands, set the region on a collision course between development and wildfire. Current estimates indicate that only 14 percent of the available wildland-urban interface (WUI) in the Intermountain West is now developed. Much of the remaining

FIGURE 6
Large Wildfires Occur in Areas of Reduced Average Moisture



Source: Westerling et al. (2006).

Fire damage in Yellowstone National Park

86 percent is available as potential sites for a portion of the estimated 16.1 million new homes that will be built in the region by 2030 (Gude, Rasker, and van den Noort 2007; Nelson 2004).

Annual damages in the Intermountain West from wildfires have exceeded $1 billion in 6 of the past 15 years (NOAA 2006). Given current trends in firefighting costs, development of only half of the WUI could lead to annual firefighting costs of up to $4.3 billion. However, these costs do not account for the probability of further increases in the frequency of wildfires linked to climate change.

Planners have an important role to play in ensuring their communities are well-adapted to changed forestry and wildfire issues. Even before enacting climate action plans, many western states had established policies to reduce wildfire damage to residential areas. For example, Arizona, New Mexico, Idaho, and Colorado have recommended building standards and local programs to reduce wildfire damages. Additionally, Oregon, California, Utah, and Montana have set laws allowing county governments to deny approval to subdivisions that do not mitigate the impacts to public health and safety from wildland fires.

Oregon, California, and Utah also have taken further steps. California state law requires homeowners in the WUI to clear brush and vegetation within specific distances around structures. Utah sets minimum standards for ordinance requirements based on the 2003 International Urban Wildland Interface Code, and Oregon sets standards for defensible space, fuel breaks, building materials, ingress and egress, and open burning on the property (Gude, Rasker, and Van den Noort 2007). All of these actions can reduce risk to residents and communities near forested lands.

Several types of forestry-related policies are outlined in state climate action plans (Appendix, Table A6). Those relevant to land use planning include policies to promote improved forest health or ecosystem management in residential areas in an attempt to reduce wildfire risks. Land use policies that protect forestlands from developed uses, particularly in the WUI areas subject to high fire risk, are beneficial as well. Their cost-effectiveness ranges from considerable cost savings for programs that promote forest health, restoration, and ecosystem management, to higher costs to protect forestlands from developed uses.

Policies to preserve agricultural land, forests, and natural open space are often among the most expensive to implement, according to the state climate action plan analysis, and generally fall in the mid-range in greenhouse gas reduction effectiveness. If the primary goal of implementing a policy is to reduce greenhouse gas emissions for the lowest cost possible, direct conservation may not be the most cost-effective. However, such strategies often have a host of co-benefits that improve quality of life and sustainability. Such policies also indirectly support the goal of more compact urban form that reduces vehicle miles traveled.

Healthy forest ecosystems also promote watershed health by absorbing greater amounts of runoff from storms, preventing erosion, and allowing more efficient recharge of aquifers. Trees can provide shade to streams, helping to keep water temperatures cool, a condition essential to the survival of iconic western species like trout and salmon. Healthy forests can also serve as important carbon sinks, and could have increasing potential in terms of sequestering CO_2 from the atmosphere, as well as decreasing large amounts of carbon released through the burning of catastrophic wildfires.

Furthermore, natural open space and forests preserve biodiversity by protecting and enhancing the habitat of western animal and plant species. These strategies have significant co-benefits for communities by improving the quality of life and connection to nature for residents, preserving valuable ecosystem services, increasing recreational opportunities, and keeping the community climate resilient.

SUMMARY

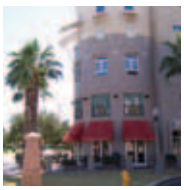
There is ample evidence in the climate action plans of the western states that cost-effectiveness varies widely across different policy options, with many offering positive cost savings and/or potential co-benefits. Local governments should seek out the "low-hanging fruit"—measures that are both effective at reducing GHG emissions and have a positive payoff—while considering the co-benefits offered by many policy options. Table 4 summarizes the average findings across eight western states on five of these policy types (see Appendix for the complete analysis).

TABLE 4
Average GHG Reductions and Cost-Effectiveness of Land Use–Related Policies

Policy Type		GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/$tCO_2e$)
Green Building and Building Energy Efficiency Policies	Average for all policies of this type (7 of the 8 states)	5.12	1.51	$35.94
	Average for all policies of this type minus California Solar Initiative (7 of the 8 states)	5.05	1.47	-$25.53
Land Use and Transportation Policies	Full suite of land use and transportation policies (4 of the 8 states)	13.81	4.59	n/a
Energy Supply Policies	Support for distributed and other renewables (5 of the 8 states)	6.14	1.14	$36.80
	Support for combined heat and power (5 of the 8 states)	9.03	2.78	-$1.67
Agriculture and Open Space Policies	Preserve open space/agricultural land (5 of the 8 states)	3.44	0.79	$43.76
	Support local farming/buy local (4 of the 8 states)	2.04	0.65	$3.73
Forestry and Wildfire Policies	Forestland protection from development (6 of the 8 states)	1.55	2.35	$10.50
	Forest planning/management for residential lands (4 of the 8 states)	4.45	0.88	-$33.50
	Urban forestry (4 of the 8 states)	0.31	0.33	$11.50

Notes: Data on water policies were not extensive enough to be averaged across states. A negative figure reflects an overall cost savings generated by the policy action in reducing greenhouse gas emissions.

Source: Adapted from individual state climate action plans.



CHAPTER 4

Barriers to Implementing Local Climate Change Policies

Winter wetlands near Mt. Blanca, Alamosa County, Colorado

Western states have pioneered some of the more innovative and potentially effective policies to address climate change on a state and regional basis. However, the region appears to be lagging when it comes to implementation of climate action at the local level. Although most western states and many cities and towns are developing their own climate plans, there is a widespread lack of coordination between states and localities.

While planners in all regions may encounter obstacles to implementing climate mitigation and adaptation policies, some barriers may be more prevalent and difficult to overcome in the Intermountain West given the region's political, demographic, economic, and geographic context. Plans that have gained the requisite political and financial support to be implemented in other regions may require significant retooling to be applicable in these states.

The barriers and challenges faced by planners regarding climate change policy in the Intermountain West were articulated in several sources for this report. These included roundtable discussions with a group of land use planning experts convened by Western Lands and Communities, as well as direct feedback obtained at various land use planning and climate change conferences and forums.

Additional challenges were examined in greater detail through an opinion research survey conducted for Western Lands and Communities by Fairbank, Maslin, Maullin, Metz & Associates (Metz and Below 2009).

Through a pair of focus groups and several dozen telephone interviews, the researchers spoke to a variety of local government officials—elected officials, city and county managers, and planning staff—in seven western states (Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming).

Conversations focused on (1) identifying the primary obstacles to addressing climate change in land use planning, and how they can be overcome; (2) determining which information local government officials need to craft effective policies to address climate change; and (3) evaluating the best ways to convey that information to local officials.

Few respondents named climate change as one of the most pressing planning challenges facing their communities. This was the case even when talking to officials from the handful of local governments that have formal climate action plans. However, many of the issues they mentioned do have connections to climate change, such as water supplies, energy use, and increased strain on local infrastructure and services.

LACK OF POLITICAL SUPPORT

Climate change is still perceived as politically controversial in many communities. In all but the largest and most environmentally concerned communities, survey participants reported a hesitance within government to take on an issue that they perceive as potentially divisive. Some local residents do not realize it is a problem, and others oppose aggressive action to address it.

With views on the need for national climate action basically split along party lines, garnering political support for local efforts can be difficult in the largely conservative and traditionally Republican states. Most communities that have made a visible commitment to working on climate change mitigation are either large urban areas or resort communities, where politics often lean to the more liberal politics espoused by the Democratic party.

Furthermore, economic conditions in many traditional, resource extraction–based rural western towns have grown worse in recent years, due to declines in industries such as agriculture, mining, and forestry. These areas are more likely to resist the conclusion that anthropogenic, or human-caused, climate change is a reality upheld by broad scientific consensus.

Economically distressed communities also may be among the least able to plan for climate changes, given tight budgets and lack of resources to support planning personnel and expertise. Many officials in the survey reported that their communities would be unlikely to take steps to address climate change that might place financial responsibility on local residents, unless they were provided with clear evidence that the economic benefits of the policies would outweigh their costs.

It is important to recognize that there is an inherent challenge in reaping the economic benefits of climate-related policies. While local communities may bear the brunt of the costs for policies and actions to address climate change, the benefits created can often extend beyond their communities, which can also contribute to slow adoption of mitigation and adaptation strategies.

The culture of the Intermountain West and its attachment to the concepts of rugged individualism and frontier spirit can sometimes present challenges to implementing not only climate-related land use policies, but any zoning regulations or other government policies concerning growth and development that may affect private interests while seeking to serve the public good. The concept of private property rights is a core value in much of the region, particularly in rural areas, although (or because) federal

and state government agencies own large tracts of land in these states. New, progressive land use planning policies, including those that could yield climate mitigation or adaptation benefits, are often viewed with suspicion or disinterest.

This combination of factors makes securing sufficient support to integrate climate change into meaningful planning efforts nearly impossible in some areas. Ironically, many of the communities that rely on abundant natural resources for their livelihoods are the most vulnerable to climate change, and would benefit greatly from forward-thinking policies to improve climate resiliency.

DISCOUNTING THE IMPACT OF LOCAL ACTION

Another dimension limiting local action on climate change is a belief that small-scale adaptations and mitigation will not affect the larger picture. Climate change is a complex global issue, and the media often portray far-ranging impacts such as melting glaciers, shrinking ice sheets, and threats to iconic species like polar bears.

The challenge may appear so daunting that the actions of a single community may seem unlikely to have an impact. Local officials may assume this problem is being solved by higher levels of government through major policy efforts, such as alternative energy technology, the closure of coal-fired electricity plants, or the raising of vehicle fuel-efficiency standards. Even the process of generating state climate action plans, which includes a number of necessary local policy actions, can cause local leaders to believe the problem is out of their hands.

Elected officials everywhere are sensitive to the attitudes, opinions, and priorities of their constituents. Several respondents to the research survey placed the blame for lack of action on climate change mitigation squarely on the shoulders of the public. Political party affiliation, the immensity of the challenge, and a lack of effective education on the issue were cited as causes for apathy about the need for climate action, as were the public's continuing preferences for energy consumptive lifestyles.

PERCEIVED LACK OF PEER COMMUNITIES IN THE REGION

Another hindrance to effective climate change action at the local level is a perceived lack of peer communities engaged in the issue. In some areas of the nation, especially the coastal regions of California, Oregon, and Washington, and the northeastern states, planning for climate change mitigation is quickly becoming standard practice.

This is not yet true in other regions, especially for smaller, nonresort communities in the Intermountain West. Those that do not fit the big city or resort community type may have a difficult time finding communities similar to their own in circumstance, political leanings, and capacity to use as a model for their climate change efforts.

LACK OF RESOURCES AND OPTIONS

Even in the best of economic times, it can be difficult for local governments to add new initiatives. And even though strategies such as energy efficiency improvements in government operations may save money in the long run, up-front funding can be hard to find. Add in the recent stress on typical local government funding sources like sales and property taxes and the picture can look rather daunting. Yet local governments are finding that energy efficiency improvements for buildings can significantly lower operating and maintenance costs. Using local bonding authority or stretching out routine maintenance to build cash reserves to fund improvements are ways to gain those long-term benefits.

Antelope Flats, Jackson Hole, Wyoming

Several survey respondents said that larger cities and resort towns have been more active in dealing with climate change because they are more likely to be able to dedicate funding to this issue. However, few understood that many policies identified in state climate action plans could actually result in savings to the municipalities that choose to implement them.

Even in communities with the political will to act, many officials indicated that limited resources, such as the lack of dedicated staff people able to explore the complexities of potential policy alternatives, prevent them from implementing some policies to address climate change. A related issue is the time lag between when resources would need to be dedicated to enact climate change policies, and when those policies would pay off in climate benefits or co-benefits. For many communities, the long-term benefits were understood, but the initial costs associated with immediate implementation of those policies were discouraging.

These challenges are exacerbated in the Intermountain West by its historic rapid rate of growth. Many communities are grappling simultaneously with spikes in population, water scarcity, loss of open space, and fiscal pressures to provide critical infrastructure such as roads, power lines, sewers, and schools. It may be difficult to justify higher spending on more resilient systems whose payback may be several years or even decades away.

All planners deal with the same basic types of infrastructure (e.g., roads, buildings, water and wastewater systems, energy systems). But they may have very different philosophies on urban planning, shaped by their training and their physical, socioeconomic, and political environments. Their level of management sophistication and ability to incorporate complex information about climate change are not uniform.

Planners may also have different degrees of influence on local decision making depending on the administrative structure

and political atmosphere of the community in which they work. Translating climate change information and policies for land use planners into a "one size fits all" format is not likely to work.

LACK OF APPROPRIATE CLIMATE SCIENCE FOR PLANNERS

A significant barrier to incorporating climate science into local land use planning is the lack of information prepared in a format that can be easily digested and integrated into decision-making processes. The main source of climate change information currently is peer-reviewed scientific literature, which can be narrowly focused and difficult to translate into practical applications.

The paucity of information specifically adapted for planners and citizens can also present a challenge. Finding and sufficiently distilling accurate projections of changes in temperature, precipitation, and other factors, and how these may affect a particular community, can be a difficult task. Climate variability information often resides in sources unfamiliar to planners, such as scientific journal articles or reports. Such material is frequently written for fellow experts in climate science, rather than decision makers or the general public, making it difficult for planners to decipher.

The complex topography, hydrology, and weather patterns of the Intermountain West may present further challenges. Some parts of the region have highly variable climates, making projections at a finer scale more important than in more homogenous areas. Current climate change projections based on global models are relatively large-scale and may not reflect local conditions with the degree of specificity that urban planners would prefer.

Inappropriate temporal scales may also be an issue. Forecasts are often too short-term to be useful, projecting a few seasons out at most, or too long-term, looking 50 to 100 years into the future. Neither is appropriate for the 10- to 30-year planning horizon in which most planners operate.

This barrier is compounded by the fact that at present most long-term climate change predictions are probabilistic. This makes it difficult for planners to assess how to apply available information, how much confidence to have in it, how to scale it to their area of concern, or how much to invest in options that incorporate climate change but might be more expensive or complex. Planners accustomed to conducting precise analyses to guide their actions may be uncomfortable with this degree of uncertainty. Tools do not yet exist to allow them the same degree of precision in planning for climate change impacts as they have for current hazard risks, transportation infrastructure, and housing needs.

Even when planners and other local decision makers can access and understand climate science, it can be difficult to know which land use–related policies are the most effective and strategic. Implementing such policies requires knowledge about which of them has the greatest potential to significantly reduce greenhouse gas emissions, at what cost, and in what time frame.

To date most state, county, and municipal climate action planning has focused on reducing greenhouse gases—and rightfully so, given the urgency in preventing greater damages later. However, the Intermountain West is likely to suffer severe climate change impacts, and western communities would benefit from starting to plan for additional adaptation measures as soon as possible.

SUMMARY OF BARRIERS

The barriers to implementing climate change policies at the local level may seem overwhelming, but they can be understood

as categories of challenges, each of which can be addressed separately with appropriate recommendations for action.

Lack of political will

- Climate change is still perceived as politically controversial.
- Local planners have different philosophies, levels of management sophistication, and degrees of influence on decision making, which affect their effectiveness in providing leadership on local climate action.
- The rugged individualist culture of the West questions any type of regulation or government policy seen as challenging private property rights.

Discounting the impact of local action

- Many people do not believe their small-scale adaptations will affect the big picture.
- Local officials may assume the problems of climate change are being solved by higher levels of government.
- Public apathy and consumer preferences show a lack of concern for taking action.

Perceived lack of peer communities in the region

- Large cities and resort communities have different concerns and resources available to take action on climate change.
- Small, rural, nonresort communities have difficulty finding others in similar circumstances.

Lack of resources and options

- Many communities do not have the financial resources to implement new policies and actions.
- They may not have enough staff to take on additional projects.

Glenwood Springs, Colorado

- There is a perceived time lag between when resources are needed and when the benefits would pay off.
- The rapid growth occurring in many communities makes it difficult to keep up with changes on the ground.

Lack of appropriate climate science for planners

- Scientific research is not prepared for general use by planners, citizens, and public officials.
- The variable climatic zones of the Intermountain West make it difficult to link technical climate change projections with local conditions.
- Local planners are sometimes unable to assess the most effective and strategic policies to address specific climate-related problems.

CHAPTER 5

Recommendations for Local Planners and Communities

Participants share views at the Sonoran Institute's 2006 Western Community Stewardship Forum in Grand Junction, Colorado.

The climate change challenge is forcing the entire world to take notice, and the Intermountain West is considered especially vulnerable. The region's response must be two-pronged, focused both on mitigating greenhouse gas emission levels and enacting measures to adapt to the changes that are now deemed inevitable. Local planners and policy makers have important roles to play in these efforts as they affect land use and development.

The existing range of policy options can be implemented more effectively, and sooner, if planners play an active role. Key aspects of many of these policies, including their potential success in mitigating greenhouse gas emissions and their cost-effectiveness, can be found in state-level climate action plans. These plans form the basis for more widespread action in the Intermountain West, and can help overcome some of the primary barriers to such action. They are created through an iterative, inclusive process that ensures widespread support, and thus are useful in overcoming the lack of political will that may hamper local efforts. They also summarize key types of information, such as projected climate changes, in more user-friendly language.

Although state climate action plans provide a basis from which to propagate local climate action, further effort will be required to ensure widespread implementation of effective policies. For example, communities may need assistance in assessing the costs and benefits of various types of policies at

the local level, and in selecting policies that are appropriate for their specific circumstances. Assistance also is needed in translating available science to address particular situations, what types of changes to expect, and how best to plan for them.

More rigorous, qualitative research into the barriers to local climate action would help communities devise strategies to overcome them. Finally, increased outreach and capacity building will be required to ensure that planners have the information they need to spur local action as soon as possible. The need is particularly urgent in the Intermountain West, where a large portion of the housing, commercial, and service buildings, transportation infrastructure, water and energy systems, and indeed entire communities have yet to be built to meet growing population demands.

Planners in these states have a unique opportunity to determine the region's future by taking positive steps to integrate climate-oriented policies into their land use and development agendas. These recommendations are based on the research survey by Fairbank, Maslin, Maullin, Metz & Associates (Metz and Below 2009).

MOBILIZE THE POLITICAL WILL

Given the general skepticism present in many western communities, officials in the research survey indicated that they often shift discussion of climate change in their public planning meetings to describe sustainability or economic efficiency, noting that invoking climate change per se can sometimes result in opposition to any proposal.

Most officials also recommended highlighting the co-benefits of policies that address climate change: less pollution, lower energy use, more green spaces, more housing and transportation choices, greater local independence, and, most important, cost savings that can result from cost-benefit analyses. These benefits, rather than greenhouse gas reduction, were seen as more likely to generate public support for local climate change policies.

Basalt, Colorado

Some rural areas of the Intermountain West are beginning to recognize the connection between quality of life, economic prosperity, and land use policies that can make their communities more resilient to climate change, and they are embracing measures that can contribute to mitigation. Regardless of conflicting local opinions about climate change, some communities are eager to contribute to the nation's energy independence.

Local governments willing to search actively for new energy generation options, for example, often find that those policies play an important role in reviving declining rural economies. Emphasizing the energy efficiency and independence aspects of such strategies, rather than climate change itself, may strengthen community support for the measures. Focusing on the cost savings of land use–related actions, such as those provided by energy efficient building practices, rather than on their climate change mitigation and adaptation value, may also be an effective strategy to overcoming political barriers in some areas.

Drawing upon state-level climate action plans may be another effective local strategy.

Stakeholders discuss fragile desert lands near Phoenix, Arizona.

The collaborative process through which these policies are created engenders widespread political support from diverse sectors within the state. Highlighting the participation of respected officials already involved in the state climate action planning process and recruiting them as messengers about the benefits of policies to address climate change can be a convincing strategy for local communities as well.

RECOGNIZE LOCAL ACTION AND CITIZEN PARTICIPATION

Given that many state climate action plan policies require local implementation, yielding nearly 20 percent of the emissions reductions in some states, it is essential to better coordinate and integrate state and local activities on climate change. If the current disconnect continues, many western states will be unable to meet their statewide goals.

For example, the state plans might point to employing smart growth strategies in their menus of policy options. But the extent to which smart growth practices will need to be employed within each local jurisdiction is not well understood or communicated.

In part this reflects the lack of direct control employed by most western states in local land use planning. The states do not prescribe the amount, kind, or quality of development. But this is also partly due to the lack of analytic tools that would allow either state or local decision makers to better understand how different patterns of growth or development types affect greenhouse gas emissions. A recent Lincoln Institute of Land Policy report, *Urban Planning Tools for Climate Change Mitigation*, documents the current state of knowledge and calls for improvements in this important piece of the puzzle (Condon, Cavens, and Miller 2009).

As the details of state climate action plans demonstrate, many climate change mitigation strategies are most effectively implemented at the local level. Counties, cities, and towns are also the most appropriate level of government to tackle the adaptation actions that must take place to climate-proof communities. The process of many communities taking action to reduce their carbon footprint would undoubtedly lead to cumulative reductions in greenhouse gas emissions and mitigation on a larger scale.

Improved public education and information about the local impacts of climate change are critical to foster better citizen participation in local action planning. But the planning community is not always the best messenger of a public education campaign designed to raise awareness about anthropogenic climate change. Instead, planners may be better positioned to emphasize the many co-benefits that respond to climate impacts, such as cost savings, efficiency features, and improved quality of life resulting from actions taken to lower a community's carbon footprint.

The Sonoran Institute has many years of experience in working successfully with local communities in the Intermountain West. Through that work, five critical

elements called Hallmarks of Successful Communities have been identified in communities that have coped effectively with challenges from growth and change. These elements are important for gaining broad public support for policies that not only enable a community to cope with growth and change, but make the community more climate-resilient:

1. *Develop a broadly shared vision of the future* through an inclusive process that engages diverse stakeholders in the community and encourages constructive, informed dialogue.
2. *Understand the local economy* within the context of regional, national, and global economies, and develop policy changes that will honor a community's traditions while preparing it for future economic prosperity.
3. *Understand natural and cultural assets* and their influence on population growth and development in the community in terms of economic contribution and quality of life enhancements.
4. *Effectively manage growth and change* by using a wide variety of regulatory and nonregulatory strategies and tools to protect or enhance local assets and by promoting more sustainable patterns of growth.
5. *Value leadership and cultivate local leaders* who have the political courage and commitment to a community vision that extends beyond a typical two- to six-year election cycle. These leaders can be a tremendous asset in enabling communities to prepare for the impacts of a changing environment.

As demonstrated by reviewing the various strategies in state climate action plans that pertain to local governments, there are a host of co-benefits associated with gaining buy-in from the majority. By engaging diverse community stakeholders in the

Aspen, Colorado

development of a plan to address the impacts of climate change, public and political support for those policy changes can be obtained on the front end, removing one of the more significant barriers to local action.

ESTABLISH PEER COMMUNITY NETWORKS ON A REGIONAL SCALE

Communities need a road map, with tools and best practices from peer communities, to assist them in taking concrete steps to implement climate policies. Considering that most western states have drafted climate action plans that will need to be implemented at the local level, it is likely that a broader range of western communities will soon be in a position to share their best practices and lessons learned. The establishment of peer learning networks could change the perception that few municipalities are addressing climate change issues and make best practices more widely available across the Intermountain West.

When asked what kind of information might help them develop policies to address climate change, officials interviewed in the survey most often mentioned case studies. They sought studies that would demonstrate the economic benefits of adopting climate change policies, highlight clear and actionable steps, and indicate what metrics could be used to measure the effectiveness of the policies. Officials emphasized that these studies should come from communities comparable to their own in size, climate, economy, and political culture. They wanted the information to be concise, and whenever possible they would prefer to exchange information in person at local conferences or through direct presentations.

Many local-level actions necessary to address climate change have a significant regional component that requires interactions across jurisdictions. This is particularly true in the transportation sector, as most planning and infrastructure development for roads, highways, and transit are most appropriately handled at a regional scale. Conservation planning, water management, and energy planning are also best done at a regional scale.

Communities will need guidance to identify activities and strategies that are best accomplished at the regional rather than local level and to develop approaches to improve coordination among neighboring jurisdictions. The Lincoln Institute of Land Policy, as part of its joint venture work with the University of Montana's Center for Natural Resources and Environmental Policy, has developed a set of core principles for regional collaboration (McKinney and Johnson 2009).

Many regional initiatives emerge in response to a growing threat that cannot be addressed solely by local jurisdictions. Climate change certainly fits this description and creates an opportunity to develop a deliberative and thoughtful regional response that involves multiple jurisdictions.

IDENTIFY RESOURCES AND A VARIETY OF OPTIONS

The good news is that many of the actions planners can implement to mitigate and adapt to climate change will actually result in significant short-term savings to their communities, as well as additional long-term benefits. In places where costs are a major stumbling block, it may prove more effective to start with policies that result in significant cost savings, and plan for a longer time frame for adoption of other more expensive measures.

Providing a menu of flexible options rather than a rigid recipe of only one way to integrate climate change information into planning could be the best option. Such an approach would allow planners to choose the policies most likely to have the greatest

impact in their communities in terms of both reducing emissions and promoting adaptation. Moreover, they could garner the necessary support and resources for implementation of such policies and provide the additional benefits most desired by the community (box 10).

In determining the highest value actions, in terms of cost-effectiveness and greenhouse gas reduction potential, the state climate action plans give local governments a tremendous leg up. Local officials can then select the highest value strategies from the state's list of options.

Given the obstacles facing local governments in terms of costs, capacity, and political salability for climate change policies, it will be important to tailor the approach to an individual community's unique circumstances. In some cases, this may require expressing the policies in terms of economic development and hazard resilience, rather than as climate change policies per se. Public participation in developing a vision or action plan for making the community more resilient can also help in overcoming barriers.

Even if a community is unable to develop a holistic action plan for climate change, local governments can still pluck the "low-hanging fruit" among the strategies outlined in state climate action plans. For example, energy efficiency programs provide significant cost savings to communities while also lowering their carbon footprint.

Another common first step is to use public buildings, parking areas, and roadways as models for more sustainable and carbon-neutral behavior. Local government leaders can demonstrate innovation through iconic public buildings and other structures, and use them as models in promoting or incentivizing similar efforts in the private sector.

BOX 10
Denver's Greenprint Program

The Greenprint Denver initiative started in 2006, shortly after the mayor joined the U.S. Conference of Mayors' Climate Protection Agreement. This program charts an action agenda for the city over a five-year period to meet goals for sustainability, energy efficiency, greenhouse gas emissions reductions, land use and transportation, natural resource protection, and more (Richards 2009). Among its goals for the year 2011 are:

Multimodal Transportation

- Continue implementation of FasTracks and Denver Union Station projects, to transport up to half a million people every day.
- Complete additional transportation connections that support multimodal transportation options for more of Denver's citizens. By 2030, 41 percent of Denver's job growth (70,000 jobs) and 30 percent of Denver's population growth (22,000 households) will be located in Denver's new transit zones.

Healthy Communities

- Ensure 100 percent of Denver Public Schools have bike and walk-to-school programs.

Workplace Commuting

- Achieve and retain recognition in U.S. EPA's "Best Workplaces for Commuters" awards program.

Source: Greenprint Denver (www.greenprintdenver.org/about/climate-action-plan-reports/).

ADAPT CLIMATE SCIENCE TO LOCAL PLANNING NEEDS

Several sources of climate change information exist to fill this gap. Most state climate action plans contain a summary of climate change effects and impacts, based on the scientific information available at the state level. Using such information at the local level requires some degree of downscaling, however. University-based Regional Integrated Science Assessments (RISAs) also produce summaries of the changing climate efforts of their regions.

The IPCC reports, particularly the Summaries for Policy Makers, translate climate science to some degree, but this information

may still be considered complex. It also may be at spatial or time scales that are inappropriate for local planning purposes. Some of the most innovative policies for mitigating further climate change can be found in the growing number of municipal climate action plans. However, they take many different forms, and many of the climate change and sustainability policies in municipal plans also appear in state action plans.

Rather than waiting for new information and tools to be developed or the science to be perfected, it may be more productive for planners to focus on available information, even if it is uncertain and imperfect for their purposes. For example, many cities may already be taking actions that are likely to promote climate change mitigation and adaptation as part of other efforts, such as sustainability, transportation, urban design, and other types of planning.

Other efforts might include educating planners and other local decision makers to understand that the scientific assessment of "very likely" is a high enough probability under which to implement some if not most policies, even if exact numbers cannot yet be determined. Some degree of uncertainty is inherent in planning to mitigate or adapt to climate change, just as it is in planning for population growth or economic trends.

One way to increase the comfort level of planners is to examine climate science from a planning perspective to discern the level of certainty planners actually need in order to react with policy measures. For example, some decisions, such as how large storm water culverts must be or how far floodplain restrictions should extend, require precise figures to maximize cost-effectiveness. Others, such as green building and smart growth policies, may not require such firm information, particularly if it can be made clear that these "win-win" actions are likely to provide additional benefits regardless of the eventual magnitude of climate change or the extent of its impacts (Bark 2009).

A critical first step for any jurisdiction in seeking to address the impacts of climate change is to establish a baseline level of greenhouse gas emissions. Then it will be possible to set a realistic target and measure local progress toward meeting emissions reduction goals or the impact of planning decisions on the community's carbon footprint. Ongoing monitoring and measurement of land use–related climate strategies such as the performance of buildings, urban form patterns, and transportation systems are equally important to ensure that these measures are meeting their objectives.

A greenhouse gas emissions inventory and forecast provide an important benchmark for the community in measuring progress, as well as identifying those areas where the local government has been successful in lowering emissions. With this information, a local government can effectively pinpoint other strategies and sectors for increased mitigation or adaptation efforts, and build upon their success in developing policies to address climate change.

SUMMARY OF RECOMMENDATIONS

Planners need to work closely with local citizens and public officials to evaluate ways to implement changes that can both mitigate greenhouse gas emissions and adapt to future impacts of the changing climate of their region. This summary of recommendations is designed to guide locally appropriate climate action planning.

Mobilize the political will

- Communities can focus on sustainability, economic and energy efficiency, and the co-benefits of local actions, rather than politically controversial policies and goals.

- Local governments in resource-rich areas can contribute to the nation's energy independence through new energy generation options.
- Successful local programs focus on cost savings, energy-efficient building practices, and other land use planning actions.
- State climate action plans and the participation of respected state and local officials can provide support for local action.

Recognize local action and citizen participation

- Coordination of state and local activities to address climate change is critical to implement successful and long-term results.
- Local communities can reduce their carbon footprint in many small ways that lead to cumulative reductions on a larger scale.
- Improved public education and information about the impacts of climate change will foster citizen participation and buy-in for local programs.

Establish peer community networks on a regional scale

- Peer learning networks developed with guidance from state climate actions plans can help smaller communities share ideas and learn from each other.
- Case studies are a valuable vehicle for demonstrating the economic benefits of local climate change policies.
- Many resources already exist to help communities work across jurisdictional boundaries to collaborate on regional land use plans to address anticipated climate changes.
- A growing number of cities are developing action plans that can serve as models for other communities.

Residents review plans at the Sonoran Institute's 2009 Community Design Academy in Pinal County, Arizona.

Identify resources and a variety of options

- State climate action plans offer a variety of strategies from which communities can choose those most appropriate for their circumstances.
- Many climate action policies and practices have shown significant short-term savings as well as long-term benefits for communities.

Adapt climate science to local planning needs

- An increasing number of reports, Web sites, and other resources are available to translate climate science into information that is accessible and useful for local planners and communities.
- Resources exist to help communities develop a baseline level of greenhouse gas emissions as a first step in ongoing monitoring of climate strategies and results.

Appendix

TABLE A1
Green Building and Building Energy Efficiency Policies

State	Green Building and Building Energy Efficiency Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Western States Averages	Average for all policies of this type (7 of the 8 states)	5.12	1.51	$35.94
	Average for all policies of this type minus California Solar Initiative (7 of the 8 states)	5.05	1.47	-$25.53
Arizona	"Beyond code" building design incentives and programs for smart growth	18.00	2.79	-$17.00
	Building standards/codes for smart growth	14.00	2.17	-$18.00
California	Building energy efficiency standards in place	2.14	1.55	-$190.31
	Green Building Initiative	1.80	1.30	-$2.03
	California Solar Initiative	0.92	0.66	$614.78
Colorado	Energy efficiency audits and upgrades for existing state buildings	Not quantified		
	High-performance state buildings: State buildings and buildings constructed with state funds must meet a high-performance building standard equal to or exceeding LEED standards	Not quantified		
Montana	Building energy codes	1.60	1.28	-$10.00
	"Beyond Code" building design incentives and mandatory programs	3.40	2.71	-$5.00
New Mexico	Improved building codes	16.60	5.14	-$12.00
	Solar hot-water-ready and solar PV-ready codes for new buildings	Not quantified		
	Solar hot water systems as an element of building codes for new buildings	Not quantified		
	Building energy performance requirements for state-funded and other government buildings ("reach codes")	0.20	0.06	$1.00
	Building energy performance promotion and incentives for energy performance enhancements (attaining "reach codes") in nongovernment buildings (including existing buildings)	7.40	2.29	-$2.00
Oregon	None			
Utah	Incentives for improved design and construction (Energy Star, LEED, green buildings)	Not quantified		
	Improved building codes			
	Solar hot water and photovoltaic codes for new buildings			
Washington	State green buildings–electricity savings	0.70	0.16	Not quantified
	State green buildings–gas savings	0.60	0.13	
	Building codes–electricity savings	2.30	0.51	
	Building codes–gas savings	2.00	0.45	

Source: Adapted from individual state climate action plans.

TABLE A2
Land Use and Transportation Policies

State	Land Use and Transportation Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Western States Averages	Full suite of land use and transportation policies	13.81	4.59	n/a
Arizona	Smart growth bundle of options	26.70	4.14	$0.00
California	Measures to improve transportation energy efficiency and smart land use and intelligent transportation	18.67	13.48	$0.00
	Transportation policy implementation	Not quantified		
Colorado	Recognize community excellence in land use and transportation in the Governor's Annual Awards of Excellence in Sustainability	Not quantified		
Montana	Growth and development bundle (smart growth policies)	0.77	0.61	<$0
	Transportation system management	Not quantified		
New Mexico	Transportation and land use incentive/disincentive options bundle	Not quantified		
	Infill, brownfield redevelopment	13.40	4.15	Zero net costs or positive cost savings
	Transit-oriented development			
	Smart growth planning, modeling, tools			
	Multimodal transportation bundle			
	Promote LEED for neighborhood development			
Oregon	Integrate land use and transportation decisions with greenhouse gas consequences	0.40	Not quantified	Cost-effective
	Incorporate greenhouse gas emission impacts into transportation planning decisions	n/a		Cost-effective
	Set and meet goals for freight (truck/rail) transportation efficiency; achieve this through equipment, coordination and land use	n/a		Unknown if cost-effective
	Improve mass transit and inter-city transit links	n/a		n/a
Utah	Develop and implement aggressive mass transit strategy	Estimates based on average GHG emissions reduction cost estimates from other states.	Not quantified	Estimates based on average GHG emissions reduction cost estimates from other states.
	Quality (smart) growth programs (i.e., 13% of new development in walkable, mixed-use districts)			
	Explore funding options for suite of transportation and land use options			
Washington	Promote compact and transit-oriented development	14.85	3.31	Not quantified
	State, regional, and local VMT reduction goals and standards	36.70	8.19	
	Local transportation financing tools and bicycle and pedestrian infrastructure improvements	1.30	0.29	
	Promotion and incentives for improved community planning and improved design and construction (third-party sustainability, green, and energy efficiency building certification programs) in the private and nonstate public sectors	11.50	2.57	-$17.00

Source: Adapted from individual state climate action plans.

TABLE A3

Land Use–Related Energy Policies

State	Land Use–Related Energy Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Western States Averages	Support for distributed and other renewables (5 of the 8 states)	6.14	1.14	$36.80
	Support for combined heat and power (5 of the 8 states)	9.03	2.78	-$1.67
Arizona	Distributed generation/combined heat and power	16.00	2.48	-$25.00
	Reduce barriers to renewables and clean distributed generation	16.00	2.48	-$25.00
	Distributed generation/renewable energy applications	10.00	1.55	$31.00
California	None			
Colorado	None			
Montana	Distributed renewables	0.80	0.64	$21.00
	Combined heat and power	5.00	3.98	$16.00
New Mexico	Incentives and promotion for renewable energy and clean combined heat and power	Not quantified		n/a
	Regulatory/legislative grid, pricing, and other policies to support distributed generation	Not quantified		n/a
	Incentives and barrier reductions for combined heat and power (CHP)	6.10	1.89	$4.00
	Financial incentives for distributed renewables	1.60	0.50	$105.00
Oregon	None			
Utah	Promote combined heat and power distributed generation using incentives and removing institutional and other barriers	Estimates based on average GHG emissions reduction cost estimates from other states.	Not quantified	Estimates based on average GHG emissions reduction cost estimates from other states.
	Distributed generation with combined heat and power systems			
	Distributed generation with renewable energy applications			
Washington	Distributed renewable energy incentives and/or barrier removal	2.30	0.51	$52.00

Source: Adapted from individual state climate action plans.

TABLE A4
Land Use–Related Water Policies

State	Land Use–Related Water Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Arizona	Water use and wastewater management	6.00	0.93	n/a
California	Water use efficiency	0.51	0.37	-$528.09
Colorado	Plan for severe drought, flooding, and other risks of climate change	Not quantified		

Source: Adapted from individual state climate action plans.

TABLE A5
Agriculture and Open Space Policies

State	Agriculture and Open Space Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Western States Averages	Preserve open space/agricultural land (5 of the 8 states)	3.44	0.79	$43.76
	Support local farming/buy local (4 of the 8 states)	2.04	0.65	$ 3.73
Arizona	Reduce conversion of farm and rangelands to developed uses	1.60	0.25	$65.00
	Programs to support local farming/buy local	0.10	0.02	$6.00
California	None			
Colorado	None			
Montana	Preserve open space and working lands—agriculture	0.12	0.10	$32.00
	Programs to promote local food and fiber	0.12	0.10	$5.00
New Mexico	Reduce permanent conversion of agricultural land and rangeland to developed uses	1.60	0.50	$62.00
	Programs to support local farming/buy local	5.90	1.83	$0.20
Oregon	None			
Utah	Preserve open space/agricultural land	Not quantified		
Washington	Preserve open space/agricultural land	10.42	2.33	$16.05
	Support for an integrated regional food system	Not quantified		

Source: Adapted from individual state climate action plans.

TABLE A6
Forestry and Wildfire Policies

State	Forestry and Wildfire Policies	GHG Reductions ($mmtCO_2e$) Total	Percent of Total Potential Reductions	Cost-effectiveness ($/tCO_2e$)
Western States Averages	Forestland protection from development (6 of the 8 states)	1.55	2.35	$10.50
	Forest planning/management for residential lands (4 of the 8 states)	4.45	0.88	-$33.50
	Urban forestry (4 of the 8 states)	0.31	0.33	$11.50
	Fire management and risk reduction (2 of the 8 states)	not quantified		
Arizona	Forest ecosystem management—residential lands	6.40	0.99	-$21.00
	Forestland protection from developed uses	3.70	0.57	$17.00
California	Forest conservation	0.40	0.29	$0.00
	Urban forestry	0.88	0.64	$37.50
Colorado	Reduce risk of wildfires through improved forest planning and greater use of forest biomass	Not quantified		
Montana	Preserve open space and working lands—forests	0.90	0.72	$3.00
	Afforestation/reforestation programs—urban trees	0.04	0.03	-$3.00
New Mexico	Forestland protection from developed uses	1.20	0.37	$22.00
	Forest health & restoration—residential lands	2.50	0.77	-$46.00
Oregon	None			
Utah	Protect forestland by reduced conversion to nonforest land	Not quantified		
	Increase fire management and risk reduction programs			
	Promoting urban and community trees			
Washington	Reduced conversion to nonforest cover	26.80	5.98	$22.00
	Urban and community forests	1.40	0.31	-$122.00

Source: Adapted from individual state climate action plans.

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* These working papers were commissioned by Western Lands and Communities as part of the analysis for this policy focus report.

RESOURCES

NATIONAL OCEANIC & ATMOSPHERIC ASSOCIATION (NOAA), CLIMATE PROGRAM OFFICE, REGIONAL INTEGRATED SCIENCES AND ASSESSMENTS (RISAS)

"The Regional Integrated Sciences and Assessments (RISA) program supports research that addresses complex climate sensitive issues of concern to decision-makers and policy planners at a regional level. The RISA research team members are primarily based at universities though some of the team members are based at government research facilities, non-profit organizations or private sector entities. Traditionally the research has focused on the fisheries, water, wildfire, and agriculture sectors. The program also supports research into climate sensitive public health issues. Recently, coastal restoration has also become an important research focus for some of the teams." (*www.climate.noaa.gov/cpo_pa/risa/*)

RISAs in the Western United States

RISA Name	States Covered	Research Focus	Land Use Planning Information/Projects
California Applications Program (CAP)	California Nevada	Water Resource Management, Forest Fires, Snow Pack, Human Health	Water resources and wildfire planning
Climate Assessment for the Southwest (CLIMAS)	Arizona New Mexico	Forestry, Water Resource Management, Forest Fires, Agriculture, Snow Pack, Human Health	Community vulnerability, economics and sectoral assessments, urban water studies
Climate Impacts Group (CIG)	Idaho Oregon Washington	Fisheries, Water Resource Management, Forestry, Snow Pack	Emphasis on intersection of climate change and public policy; coauthored ICLEI adaptation guide
Western Water Assessment (WWA)	Colorado Utah Wyoming	Agriculture, Water Resource Management, Snow Pack	Water resources and policy

National Oceanic & Atmospheric Association (NOAA)
Climate Program Office
Silver Spring Metro Center
Bldg 3, Room 11627
1315 East-West Highway
Silver Spring, MD 20910
Phone: (301) 301-734-1200
www.climate.noaa.gov/cpo_pa/risa

California Applications Program (CAP)
Scripps Institution of Oceanography
University of California - San Diego
9500 Gilman Drive
La Jolla, CA 92093-0224
Phone: (858) 534-4507
http://meteora.ucsd.edu/cap

Climate Assessment for the Southwest (CLIMAS)
Institute for the Study of Planet Earth
University of Arizona
PO Box 210156
Tucson, AZ 85721
Phone: (520) 792-8712
www.climas.arizona.edu

Climate Impacts Group (CIG)
Center for Science in the Earth System
Joint Institute for the Study of the Atmosphere and Ocean (JISAO)
University of Washington
Box 355672
Seattle, WA 98195-5672
Phone: (206) 616-5350
http://cses.washington.edu/cig

Western Water Assessment (WWA)
NOAA Earth System Research Laboratory
R/PSD 325 Broadway
Boulder, CO 80305
Phone: (303) 497-4573
http://wwa.colorado.edu/index.html

OTHER ORGANIZATIONS

Center for Clean Air Policy
750 First Street, NE
Suite 940
Washington, DC 20002
Phone: (202) 408-9260
www.ccap.org
Key Publication: *Ask the Climate Question: Adapting to Climate Change Impacts in Urban Regions*

Center for Climate Strategies
1899 L Street, NW
Suite 900
Washington, DC 20036
Phone: (703) 691-3064
www.climatestrategies.us

Clean Air Partnership
75 Elizabeth Street
Toronto, ON M5G 1P4
Phone: (416) 392-6672
www.cleanairpartnership.org
Key Publication: *Cities Preparing for Climate Change*

The H. John Heinz III Center for Science, Economics and the Environment
900 17th Street, NW
Suite 700
Washington, DC 20006
Phone: (202) 737-6307
www.heinzctr.org
Key Publication: *A Survey of Climate Change Adaptation Planning*

ICLEI–Local Governments for Sustainability USA
436 14th Street
Suite 1520
Oakland, CA 94612
Phone: (510) 844-0699
www.icleiusa.org/
Key Publication: *Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments*

WESTERN STATE CLIMATE ACTION PLANS

Alaska
www.climatechange.alaska.gov/doc-links.htm

Arizona
www.azclimatechange.gov/docs.html

California
www.climatechange.ca.gov/publications/index.html

Colorado
www.coloradoclimate.org

Montana
www.mtclimatechange.us

Nevada
http://gov.state.nv.us/climate

New Mexico
www.nmclimatechange.us

Oregon
www.oregon.gov/ENERGY/GBLWRM/GWC/index.shtml

Utah
www.deq.utah.gov/BRAC_Climate/

Washington
www.ecy.wa.gov/climatechange/2008cat_overview.htm

OTHER CLIMATE ACTION RESOURCES

American Planning Association
Green Communities Research Center
http://planning.org/nationalcenters/green/index.htm

American Planning Association and Environmental and Energy Study Institute–Planners Energy and Climate Database
www.planning.org/research/energy/database/index.htm

Boulder County ClimateSmart Loan Program
www.bouldercounty.org/bocc/cslp

California Governor's Office of Planning and Research
http://opr.ca.gov/index.php?a=ceqa/index.html

City of Aspen Canary Initiative
http://aspenglobalwarming.com/

Colorado Governor's Energy Office and University of Colorado Center for Energy and Environmental Security
Colorado Energy Profile
www.energyincolorado.org/

Greenprint Denver
www.greenprintdenver.org/

Institute for Local Government
CAPCOA Model Policies for Greenhouse Gases in General Plans
www.ca-ilg.org/node/1348

State and Municipal Climate Change Plans: The First Generation, by Stephen M. Wheeler, University of California, Davis, in *Journal of the American Planning Association*, September 2008.
http://lda.ucdavis.edu/people/websites/wheeler/

Western Climate Initiative
www.westernclimateinitiative.org

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* *The views expressed in this report are those of the author herself and do not necessarily reflect the views of the U.S. Agency for International Development or the U.S. government.*

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Western Lands and Communities is a partnership of the Lincoln Institute and the Sonoran Institute that takes a long-term strategic perspective on shaping growth, sustaining cities, protecting resources, and empowering communities in the Intermountain West.

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Planning for Climate Change in the West

The primarily arid landscapes of the Intermountain West include all or a portion of 11 states west of the Rocky Mountains. This seemingly boundless region has been shaped since its European settlement by dramatic fluctuations in its water and energy resources, land use patterns, economy, and a climate known for its extremes. Recent trends in all of these forces fueled by rapid growth and change must be altered if the region is to achieve sustainability.

This report underscores the critical role of local planners in confronting the challenges posed by climate change and acting in concert with federal, regional, and state efforts to implement mitigation and adaptation policies. Of particular value for western planners are state-produced climate action plans that can guide local actions to mitigate and adapt to climate change. These state plans contain myriad policy options that not only quantify potential greenhouse gas emissions reductions, but also provide specific policy language and cost-effectiveness measures.

In most communities, land use and transportation policies potentially reap the greatest rewards. An array of familiar smart growth strategies for creating healthier communities now double as climate solutions: building codes and standards, compact mixed-use development, transportation alternatives, distributed and renewable energy, water resource consumption and planning, preservation of open space and agriculture, and mitigation of wildfire impacts.

This report encourages planners to take an active role in overcoming barriers to local action by taking positive steps to integrate climate-oriented policies into their land use and development agendas as follows:

- ***Mobilize the political will.*** Focus on sustainability, economic and energy efficiency, and the co-benefits of local actions, rather than politically controversial policies and goals.
- ***Recognize local action and citizen participation.*** Coordinate state and local activities to address climate change, and use public education about climate change impacts to foster citizen participation and buy-in for local programs.
- ***Establish peer community networks on a regional scale.*** Develop peer learning networks with guidance from state climate action plans and regional initiatives to help smaller communities share ideas and learn from each other.
- ***Identify resources and a variety of options.*** Refer to state climate action plans region-wide for a variety of strategies and ideas that communities can select and apply to their own needs and circumstances.
- ***Adapt climate science to local planning needs.*** Seek out current information and tools in reports, Web sites, and other resources that can help planners translate available climate science for local use, and develop a baseline level of GHGs as a first step in measuring climate strategies and results.

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