

Southwest must make choices about future climate

By Melanie Lenart

This article is the second in a two-part series considering the findings of a new climate assessment for the Southwest, scheduled for release this spring. This article explores the climate choices facing the region.

During the hottest year in U.S. history, Hurricane Sandy managed to knock out power as far inland as central Ohio while burying swaths of New Jersey and other Atlantic Coast states in several feet of water for days. The 2012 storm gained strength in part from unusually warm seas, and its severity helped thrust climate change back into the national debate.

In the Southwest, residents were facing the opposite extreme. Severe drought triggered record-breaking wildfires in Arizona in 2011 and New Mexico in 2012. In both years, the area burned in U.S. wildfires topped 8 million acres, nearly double the annual average since 1983. The 2011 drought had Texans shipping cattle to Montana, while the 2012 drought decimated Midwestern corn and other crops.

The high cost of weather extremes—with hundreds of lives lost on top of Hurricane Sandy's \$65 billion and the 2012 drought's \$35 billion price tags—is something to keep in mind during discussions about the region's climate choices.

The choice is not whether to spend money to address climate changes or not, because taking no action will have its own costly repercussions, according to the authors of "Climate Choices for a Sustainable Southwest," a chapter in the soon-to-be-published book, *The Assessment of Climate Change in the Southwest United States*.

Rather, Southwest residents and decision makers will need to choose whether to merely react to disasters such as droughts, extreme storms and heat waves or to make choices that could help head off some of the more damaging effects of climate change. The likely

effects are described in detail in other chapters of the book, a cutting-edge effort by 110 authors and 80 reviewers that is scheduled for release this spring.

The good news is that many of the steps to reduce emissions of the greenhouse gases linked to climate change can save money in the long run. What's more, some mitigation options could simultaneously make the region better able to cope with the coming changes.

Extreme Climate

Nobody blames climate change specifically for the hurricane or the drought. But there are hints that it played a role. Arctic warming may have influenced the collision of Hurricane Sandy with a winter storm, for example. And well-known laws of physics link warmer sea surface temperatures to stronger storms, while hotter air temperatures clearly dry out soils more quickly and thoroughly.

So, while scientists are still analyzing how much climate change affected these particular events, physical laws support the concept that higher temperatures can make droughts and storms more intense. As the Southwest assessment book details, a warming climate is expected to bring longer and more severe heat waves and hotter droughts that will dry soils and drain reservoirs more rapidly. The Southwest also could face more extreme rains.

Like the Atlantic, the Pacific Ocean spawns hurricanes, which can do damage far from the coast. Some of Arizona's worst floods resulted from heavy rains from remnants of hurricanes.

"Atmospheric rivers" can also strike this region (see the December 2011 Southwest Climate Outlook.) Scientists use this term to describe water-laden air traveling in long streams, often in the vicinity of the jet stream. These airstreams can carry up to 15 times more water than the Mississippi River, and they're associated with heavy flooding

when they hit mountains or otherwise come down to earth.

On December 18, 2010, an atmospheric river descended on the Phoenix area, delivering 5 inches of rain in one day to an area that typically gets only 8 inches of rain in a year.

These airstreams are expected to become about a third more saturated on average by the middle of the century, mainly because warmer air has the capacity to hoist up more water vapor, noted Gregg Garfin, an assistant professor at the University of Arizona and lead editor of the Southwest assessment book. In fact, Garfin noted that scientists have already observed an extra 4 percent of water vapor in the air since the 1970s compared to earlier years. From warmer air alone, Arizona and New Mexico can expect more of their future daily rain to come in heavier doses.

At the scale of decades, though, hot, dry spells are expected to overwhelm the punctuated rains, changing the character of the land in Arizona and New Mexico toward greater aridity. During times of drought, which are expected to be hotter and more severe, the region can also expect more agricultural losses and raging wildfires.

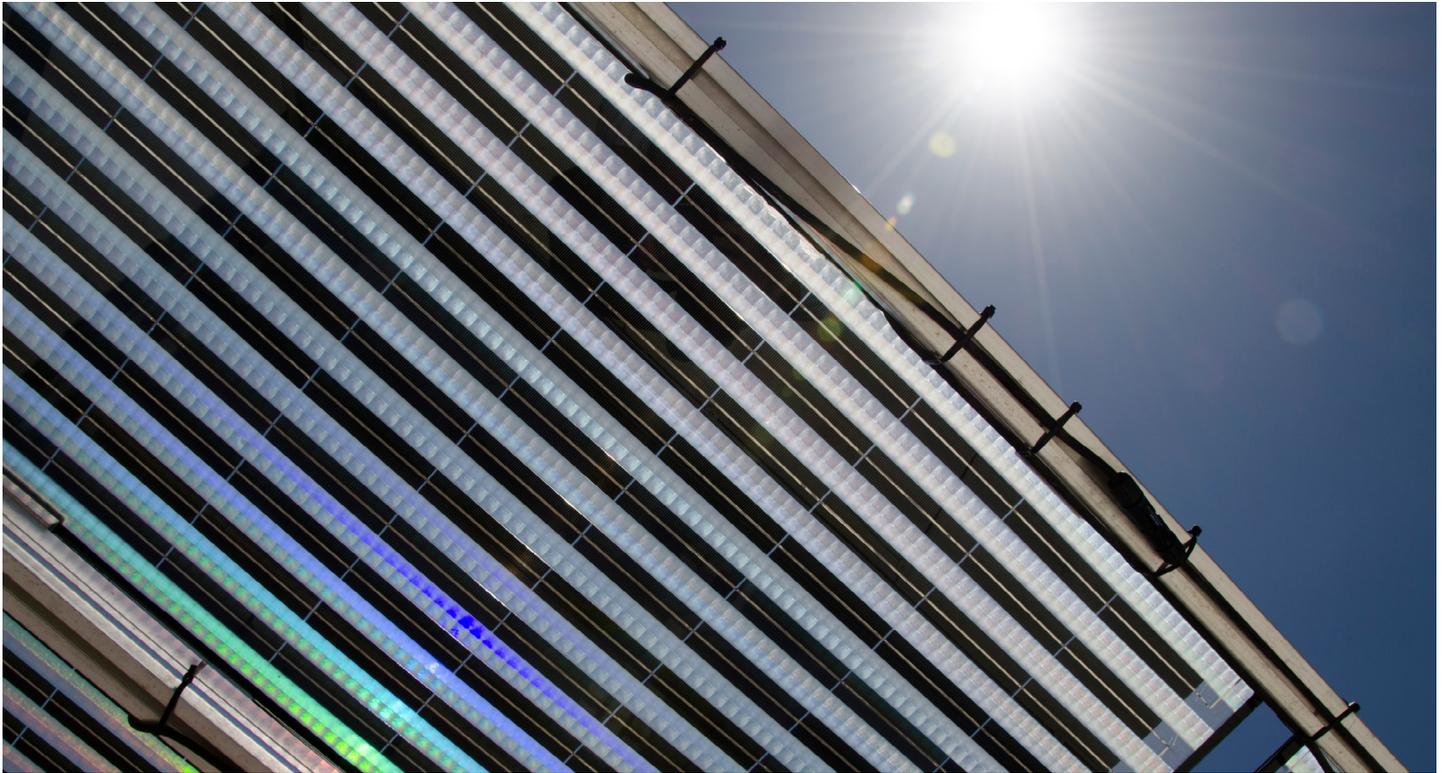
Climate Choices

Just how hot temperatures get depends on many factors, most notably the amount of greenhouse gases wafting in the atmosphere. These gases trap heat, warming the air and causing the climate system to respond in its effort to dissipate that heat. By 2012, airborne levels of the greenhouse gas carbon dioxide had reached 394 ppm, about 40 percent higher than before the Industrial Revolution took hold in the 19th century.

Curtailing concentrations of greenhouse gases is often the goal of climate mitigation efforts. Mitigation can take many

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Solar energy systems have the potential to supply a large fraction of the Southwest's energy. Traditional photovoltaic arrays and new ones under research and development, like this photo holographic planar concentrator at Tucson Electric Power's test yard, are one of many options available to mitigate and adapt to climate changes. Credit: Thomas McDonald.

forms, from expanding the region's portfolio of renewable energy to strategically planting more shade trees to using more energy-efficient appliances. Whatever form it takes, Southwest assessment authors note, it's essential to do it. It's also crucial to take steps to adapt, or plan ways to make society and natural systems less vulnerable to impacts and more resilient to the coming changes.

"If we don't mitigate, we let the problem become so big that adaptation becomes impossibly hard," said Susanne Moser, a Stanford University researcher and one of the Climate Choices chapter's lead authors. "We just don't have the luxury of not doing both."

Generating electricity on a commercial scale using solar panels is not as cheap as using coal, but the authors suggest tapping the region's abundant solar resources would help keep the climate

change more manageable while creating business opportunities.

"If it were easy enough to bring energy from the Southwest to the rest of the nation, we could supply everyone. It is of that magnitude," Moser said of solar energy.

Individual rooftop solar panels offer the advantage of keeping the residences below humming even during power outages. But Diana Liverman, another of the chapter's lead authors and co-director of the University of Arizona's Institute of the Environment, emphasized that large-scale commercial arrays are key to reducing greenhouse gases to a degree that might help keep global climate from warming beyond the 2°C (or 3.6°F) that experts suggest would be particularly dangerous.

To do its share to keep temperature from rising above 2°C, the United

States would need to reduce greenhouse gas emissions to 50 to 80 percent below 1990 levels by 2050, the assessment notes, citing the U.S. National Academy of Sciences.

One way for the Southwest to meet this target would be for the region to retire all of its electricity plants powered by coal, Garfin suggested. Electricity plants are designed to last for many decades, so choices made today will continue to affect the region in 2050.

"A whole separate way of thinking about climate that people are now starting to focus on is 'It's about the infrastructure,'" Liverman said, noting this includes structures for electricity generation, coastal defenses, water treatment plants or large buildings. "Whether it's adaptation or mitigation, what really matters is the investments that we're making in infrastructure that will be with us for a while."

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Other Values of Mitigation

Reducing the use of coal for electricity generation could also help the region avoid an unsustainable increase in water demand—something seen as essential to help the Southwest remain attractive to investors and residents. Dry-cooled solar-powered electricity plants use far less water than coal plants, leaving more available to support crops, trees, wildlife and people.

Some mitigation options even save money, Liverman noted. Improving energy efficiency tops the list of cost-saving measures. Insulating homes better, adjusting thermostats and switching to lower-energy lighting, for instance, quickly translate into savings on energy costs.

Other forms of mitigation may cost money but provide benefits that go beyond economic. For instance, treatments to thin some of the smaller trees out of regional forests can make them less flammable, thus helping to keep the carbon they have siphoned from the air locked up in wood and soil instead of going up in smoke as greenhouse gases.

At the same time, these treatments would help save people and communities from the many costs associated with wildfires, including loss of lives as well as structures, money spent on suppression efforts, and health problems from polluted air.

Planting urban trees similarly offers a way to help the region adapt to higher temperatures and its impacts while mitigating climate change. Trees soak up carbon dioxide while cooling the urban environment, which, in turn, helps reduce the need for air conditioning.

Harvesting rainfall and reusing water can help Southwest residents grow trees. Liverman used her own home as an example, noting that she recycles water from her washing machine and shower to support trees that cool her home, saving her money and energy by reducing

the need for air conditioning. Also, rainwater harvesting, which includes diverting stormwater off streets toward vegetation, can help reduce the severity of floods.

The climate choices facing the region may seem daunting, but the people of the Southwest have a record of taking on large-scale challenges that transform the environment, Liverman noted. She cited two examples to illustrate this: the protection of public land, and the large-scale construction of dams and canals to move water into drier regions.

“When Americans choose to act,” she added, “we can really make a difference.”

The Southwest assessment Summary for Decision Makers is available at: www.swcarr.arizona.edu

Links to fact sheets summarizing each chapter, a PDF version of the book, and an order form for a hard copy version will also be posted on the website in coming weeks.