

► *Climate Variability in the South*

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Climate is an important and multifaceted aspect of the physical, social, and economic character of the Southwest. The relatively warm and sunny winter weather throughout much of the region is a principal attraction for new residents, visitors, and businesses. Yet, high summer temperatures, occasional floods, and periods of drought are something to be endured or overcome.

Over the centuries, societies have developed particular adaptive strategies to cope with the region's climatic extremes. Early inhabitants relied on relatively simple techniques for cropping, irrigation, and housing. Today, residents cope with the aid of complex water-storage and flood-control structures, irrigation canals, water-supply pipelines, groundwater pumping, air conditioning, and other technologies.

These modern responses, though, have come at a cost, requiring large-scale water transfers, heavy energy use, and extensive environmental modifications. In addition, the trends and realities in the Southwest mean that we may soon be reaching - or have already reached - limits to our adaptive capabilities. And, as some suggest, we may be approaching conditions of even greater vulnerability than those early residents.

Climate Patterns in the Southwest

The Southwest's climate shows great variation from place to place, season to season, and year to year. Ranging from high-elevation plateaus to low deserts, the Southwest generally sees cooler temperatures and greater precipitation at higher elevations and warmer, drier weather patterns at lower altitudes.

Most of the region's rainfall occurs in the

summer, governed by the North American monsoon and occurring in brief, intense, localized thunderstorms. Winter precipitation falls more gently, over a longer period of time and over a larger area, and is considerably varied from one year to the next, depending on the El Niño and La Niña phenomena. Overall, the last century saw decade-to-decade shifts in precipitation patterns throughout the Southwest, with periods of wetter than average weather in the early and late part of the century and one period of extended drought in the 1950s.

Looking further into the past, climatic conditions can be detected in the measurements of tree-ring growth. These natural records reveal that precipitation patterns for the previous century have been somewhat atypical and generally wetter than usual, especially when compared to much longer-term patterns detected over the past two thousand years.

Social and Economic Factors

While it's impossible to predict the precise climatic conditions in store for the Southwest, it is important to recognize and understand the relationships between the climate and the region's social, political, economic and environmental conditions.

As one of the fastest growing regions in the United States, the Southwest is experiencing rapid population and economic expansions. But with this growth has come the conversion of land; an increased demand for water, energy, and other resources; increases in wastes and pollution; and strains on state and local government services.

Heat waves, snowstorms, floods, or extended droughts could affect crops, roadways, infrastructure, and reservoirs, but also might change energy demand,

alter retail sales, increase insurance claims, or promote hospital admissions in ways that affect the service and retail sectors. Thus, significant or prolonged climatic events can have a direct impact on key economic sectors as well as an indirect impact on related sectors. Likewise, communities dependent on a single activity can be particularly vulnerable.

Climatic Impacts on the Southwest

In urban areas, demands for water and water supplies vary seasonally. During periods of drought, some municipal water providers can augment diminished surface-water supplies with groundwater, but there are concerns across the region about the overuse of groundwater resources.

Energy is another sector sensitive to climatic variability, where both supply and demand fluctuate with temperatures and precipitation. Mining operations have a distinct vulnerability related to climate: too little water for processing or too much water in either the mine itself or in the waste settling ponds can interrupt operations.

Agricultural production in the Southwest relies heavily on irrigation, using nearly 80 percent of all water consumed. Global economic demands are shifting the types of crops grown in the region, often to crops that are more water-intensive, such as alfalfa. Because agriculture tends to be concentrated in relatively small areas in the Southwest, climatic events could be localized but would affect much of the production.

Since the viability of rangelands is dependent on precipitation, climatic extremes can also have a large impact on ranching operations. Other stresses on ranching viability in the Southwest include rural land speculation and development

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pressures, concerns over habitat protection, and changes in consumer dietary preferences.

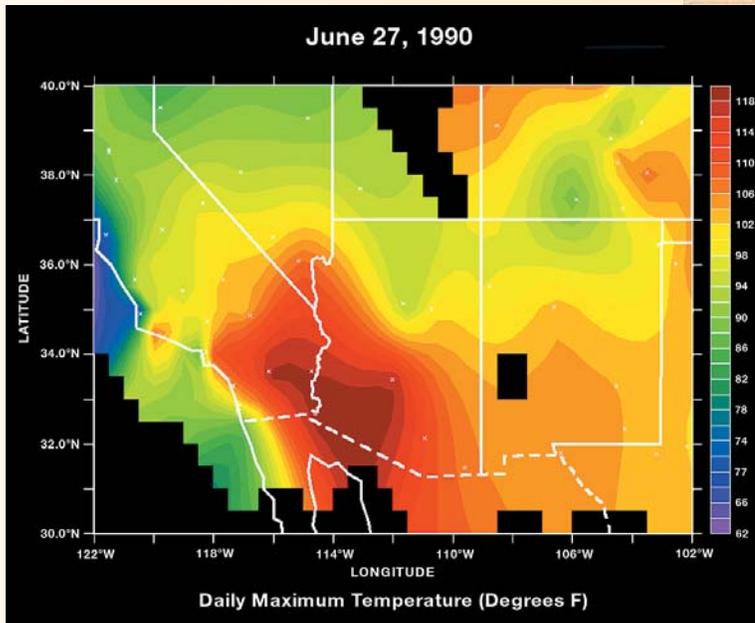
Most recently, the effects of climatic variability have been seen in forest-fire frequency. Likewise, insect infestations, mortality and growth of species, and alterations in ecosystem composition have felt the effects of

extreme climatic changes. Riparian areas and aquatic ecosystems can be affected by reduced surface-water flows, declining groundwater levels, losses of native vegetation, and changes in the timing and amount of precipitation. Climate also affects recreation and tourism: snowfall precipitation, river flows, and the vitality of forests, grasslands, riparian other natural or scenic areas attract tourists for snowing, fishing, hiking, birdwatching, and other activities.

Finally, significant effects on human health can result from extreme temperatures or weather events, causing increased air pollutions like ground-level ozone; water and air-borne diseases such as valley fever; and vector-borne diseases such as hanta virus, dengue, and malaria.

Responses with Additional Benefits

While the Southwest's climate has varied a great deal over time, and there is every reason to expect it to continue to vary in



Daily maximum temperature, June 27, 1990, when a major heat wave crossed the Southwest. From CLIMVIS, the climate visualization system from the National Climate Data Center; at lwf.ncdc.gov/oa/ferret/fsodlas/contour.html.

the future, the rate and magnitude of these changes remains uncertain - especially given the influence of an overall global warming trend. Given that our present society and economy in the region developed during a relatively wet period, just a return to more typical, drier conditions recorded in tree-ring records would present major challenges and far-reaching consequences throughout the region.

In most instances, appropriate responses to climatic variability and change, such as water conservation, renewable energy production, urban growth management, open-space and ecosystem protection often have many more general benefits and can promote longer-term economic and environmental sustainability in the region.

Excerpted from "A Primer on Climatic Variability and Change in the Southwest" by Robert Merideth, published by the Udall Center for Studies in Public Policy and the Institute for the Study of Planet Earth (ISPE) at The University of Arizona. For a free copy, contact ISPE at (520) 792-8712 or the Udall Center at (520) 884-4373, www.udallcenter.arizona.edu.

Some Climate Lessons

Global connections.

When it comes to climate, no region is in isolation from any other. Climatic patterns and cycles may have their origins in one area but have widespread effects throughout the planet. Agricultural losses from natural hazards in the Midwest, livestock selloffs due to drought in Texas and Mexico, and increased energy demands due to heat waves in California or the Great Plains, all have an effect on the Southwest.

Information is key.

Information about climatic variability and change - whether it be in the form of six-month outlooks for precipitation, month-by-month forecasts of spring snowmelt and streamflow, weekly weather reports, or even short-term flash flood warnings - is key to being able to adapt, or respond to the impacts.

Coordinated planning and management.

There is a need for coordinated communication and interaction among the various individuals, agencies, and institutions involved in decision making, including those in drought management, flood response, energy provision, fire control, health care and disease prevention, and land and ecosystem management.