

# CLIMAS Update

News from the Climate Assessment for the Southwest Project

*Integrating science, policy, and community*

THE UNIVERSITY OF ARIZONA

Volume 6,  
Number 1,  
February 2003

The 20th Pacific Climate Workshop (PACLIM) will be held April 6–9, 2003 in Pacific Grove, CA. The meeting will feature a special session on “Integrated Climate Research in Mountain Regions.” For further information see <http://meteora.ucsd.edu/paclim/>.

The 99th American Association of Geographers annual meeting will be held in New Orleans, March 5–8, 2003. For more information see <http://www.aag.org>.

The CIPEC Summer Institute on Environmental Monitoring and Assessment Applications will be held at Indiana University, Bloomington, IN, May 19–June 6, 2003. For more information see [http://www.cipec.org/training/summer\\_institute/](http://www.cipec.org/training/summer_institute/).

The Society for Applied Anthropology will hold its annual meeting March 19–23, 2003 in Portland, OR. This year’s emphasis is on “Building Bridges, Collaborating Beyond Boundaries.” See <http://www.sfaa.net/am.html> for more information.

## CLIMAS Mission

CLIMAS was established to assess the impacts of climate variability and longer-term climate change on human and natural systems in the Southwest. Our mission is to improve the ability of the region to respond sufficiently and appropriately to climatic events and climate changes.

## Climate Vulnerability Assessment for Irrigated Agriculture in Southeastern Arizona

When driving through the Sulphur Springs Valley (SSV) of southeastern Arizona, you pass by cornfields reminiscent of Iowa or Nebraska, and through pecan orchards that remind you of Georgia or Texas. Unless you look up at the Chiricahua Mountains, you have to pinch yourself to remember that you’re still in the desert!

CLIMAS researchers recently completed an assessment of climate variability impacts among ranchers and farmers in the SSV. The study had three main goals: 1) to assess the vulnerability of groundwater-dependent agriculture to climate variability; 2) to identify historical and current processes of adaptation to the vagaries of climate in the region; and 3) to assess the use of and needs for seasonal climate forecast information in agricultural decision making.

The research was conducted by a team of CLIMAS-affiliated anthropologists from the Bureau of Applied Research in Anthropology, including Timothy J. Finan, Marcela Vásquez-León, Colin T. West, Barbara Wolf, Jane Moody, and Olivia Armenta. More than 75 stakeholders were interviewed over an 18-month period, and the vulnerabilities faced by a variety of agricultural livelihoods were explored. Those interviewed included corn, chile, cotton and hay farmers, U-pick vegetable farmers, fruit and nut orchard owners, greenhouse operators, Hispanic farmers and migrant farm workers, agricultural business and service agents, agricultural extension staff, and local officials.

The team identified a complex set of public and private strategies for mitigating climate impacts in the SSV. This iterative process has led to the development of buffering strategies, which have altered farmers’ perceptions of their own vulnerability and of

the importance of climate in decision making. The cumulative impact of technological, policy-related, and managerial buffers has contributed to a perception of lowered vulnerability of irrigated agriculture to climate variability. However, farmers are not immune to weather events such as floods, freezes, and hail, nor to longer-term declines in water tables due to drought and overpumping. A cotton farmer stated that, “If you can farm here, you can farm anywhere in the world—it’s so unforgiving.”

### Geography & Groundwater

The Sulphur Springs Valley is located in southeastern corner of Arizona. Elevations range from 4,200 to 9,000 feet, permitting a wide variety of agricultural livelihoods.

Access to water has long been the principal constraint for agriculture in the region. Approximately a thousand years ago, indigenous peoples raised corn near springs and along washes within the SSV. Early Anglo-American settlers began establishing ranches around 1870, and experimented with rainfed farming and small-scale irrigation. Severe droughts from 1906–1908 wiped out many ranches; only those with adequate access to wells, springs, and ephemeral streams survived.

*continued on page 3*





## What We've Been Up To...

CLIMAS co-investigators Barbara Morehouse and Diana Liverman, along with Kathy Jacobs of the Arizona Department of Water Resources, participated in a workshop aimed at providing input into the new Climate Change/U.S. Global Change Research Program Science Plan. The workshop was held in Washington, DC on December 3–5, 2002. Liverman and Jacobs are members of a National Research Council committee that is providing guidance on revision of the plan. A draft of the plan was recently released (see <http://climatescience.org>).

At the request of the National Inter-agency Coordination Center (NICC), Gregg Garfin gave a presentation entitled "Geographic Area Coordination Center Seasonal Fire Danger Outlooks" at the NICC Predictive Services Workshop on November 6, 2002 in Redding, CA. Participants included fire weather and fire intelligence personnel from the 11 U.S. geographic areas coordinated by NICC Predictive Services.

Garfin has been working closely with NICC fire and weather specialists Tom Wordell and Rick Ochoa, and with Tim Brown from the Program for Climate, Ecosystem, and Fire Applications (CEFA) at the Desert Research Institute, to develop a standardized seasonal fire-climate forecast program for different U.S. geographic areas. Brown has recruited climate forecasters from NOAA's Climate Prediction

Center and Climate Diagnostics Center, the International Research Institute for Climate Prediction, and the Scripps Institution of Oceanography to provide a consensus forecast of fire-season climate at a joint NICC-CLIMAS-CEFA National Seasonal Assessment Workshop planned for February 25–28, 2003 in Mesa, AZ. These collaborative activities are part of a plan for CLIMAS to transfer fire forecast production from the annual CLIMAS fire-climate workshops to operational agencies, such as NICC Predictive Services.

In recent months, Dr. Martin Hoerling and Dr. Robert S. Webb of the NOAA Climate Diagnostics Center (CDC) have discussed with members of the CLIMAS team ways of improving the ability of both organizations to meet Southwest stakeholders' needs for climate information. CDC continues its work on specialized climate forecast products to help decision makers in the Southwest better understand seasonal to interannual climate variability in our region. New CDC products will be featured in future END InSight packets and at the CLIMAS Southwest Climate Outlook Web site: <http://www.ispe.arizona.edu/climas/forecasts/swoutlook.html>.

CLIMAS Graduate Research Assistant Kristen Reed will present on "Municipal Water Management Responses to Contemporary Economic, Demographic, and Environmental Change

### Subscribe to CLIMAS-News!

We have created a new listserv to provide you with the latest news from the CLIMAS project. Subscribers will receive periodic announcements about CLIMAS-sponsored events and new publications, as well as the latest drought and El Niño updates from our END InSight Initiative. If we have your email on file, we will be sending you information about the listserv. You can also visit: <http://www.ispe.arizona.edu/climas/subscribe.html> for instructions on joining the listserv.

in Flagstaff, Arizona" at the 99th Association of American Geographers Annual Meeting, March 5–8, 2003 in New Orleans. The paper is part of a session entitled "Renegotiating Urban Water and Waterfronts," in which Barbara Morehouse will be a discussant.

Morehouse recently participated in the workshop "Managing Water Resources under Conditions of High Climatic Variability in the U.S.-Mexico Border Region." The workshop, sponsored by NOAA and Centro de Investigaciones Biológicas del Noroeste, was held in La Paz, Mexico on January 14–16, 2003.

Congratulations to CLIMAS graduate student researcher David Brown for his recent scholarship awarded by the American Meteorological Society.

CLIMAS was well represented at the NOAA Climate Prediction Assessments Workshop in Alexandria, VA, October 28–30, 2002. Jonathan Overpeck presented on "The CLIMAS Project and Climate Services: Lessons Learned," while Roger Bales discussed ways that integrated assessments such as CLIMAS can contribute to reducing vulnerability to hydro-climatic variability in the Southwest. Andrew Comrie presented on "Improving Knowledge and Predictive Capabilities for Climate and Valley Fever," and Marcela Vásquez-León discussed CLIMAS efforts to assess the vulnerability of farmers in southeastern Arizona to climate risk. Nancy Schmidt, Gregg Garfin, and Rebecca Carter collaborated on a presentation introducing the END InSight Initiative.

### Submissions and Publication Information

*CLIMAS Update* is published quarterly and welcomes the submission of items of interest. The editorial staff reserves the right to select and edit copy submitted for publication. All material in the newsletter may be reproduced, provided CLIMAS is acknowledged as the source. The newsletter is provided through the support of the National Oceanic and Atmospheric Administration (NOAA).

Deadline for next issue: April 1, 2003  
Send to: Rebecca Carter at [rhcarter@email.arizona.edu](mailto:rhcarter@email.arizona.edu)  
Newsletters are archived at: <http://www.ispe.arizona.edu/climas/pubs.html>

Please direct change-of-address requests to:  
CLIMAS, Institute for the Study of Planet Earth,  
The University of Arizona, PO Box 210156, Tucson, AZ 85721  
or visit <http://www.ispe.arizona.edu/climas/pubs/update/subscribe.html>



Printed on Recycled Paper

## Vulnerability (continued from page 1)

The lack of reliable surface water precluded the establishment of permanent, large-scale, intensive agriculture until the 1940s, when the Sulphur Springs Valley Electrical Cooperative became established. Electricity allowed farmers to pump adequate amounts of groundwater. Farming and ranching prospered until the mid-1970s, when a combination of factors, including drought, a sharp increase in the cost of energy, and groundwater depletion led to widespread bankruptcy. Around 60 percent of the farmers went out of business, and over 80,000 irrigated acres were taken out of production (see Figure 1).

### Recent Adaptations

Since the 1980s, agriculture in the valley has undergone profound transformations to deal with water scarcity and reduce water use. Farmers have adopted more water-efficient irrigation technologies, switching from flood furrow irrigation to sprinklers and drip irrigation systems. This technology has become more accessible with loans from the U.S. Department of Agriculture and cost-sharing programs with the Natural Resources Conservation Service.

Because high water costs do not allow farmers in the SSV to compete in regular commodity markets, they are moving towards niche markets and value-added agricultural production. Farmers also have become more diversified, switching from traditional row crops such as cotton and sorghum, to more profitable and water-efficient fruit and nut orchards and vegetable crops. Newcomers have expanded organic fruit production, shifted toward U-Pick farms to cater to the area's growing tourism industry, and established greenhouses in the SSV.

Public policies also provide a buffer against market- and climate-related difficulties. Farmers may take advantage of federal crop subsidies, as well as disaster relief and crop insurance programs, which buffer them against drought, hail, and floods.

The use of climate and weather information has become more widespread. Behind most operations are computer networks that track market prices and weather conditions in other parts of the nation or world, helping agricultural producers to make more informed decisions. Fruit growers in particular have invested in computerized temperature warning systems, wind machines, and propane burners to guard against frost, and have formed an association to share frost forecast information and maximize the effectiveness of frost protection devices. Weather reports are monitored on a daily basis during the summer, and many farmers subscribe to the Data Transmission Network (DTN) service to obtain forecasts ranging from 24 hours to 90 days in advance.

Despite these measures, farmers continue to be vulnerable to climate variability. Excessive rain can make fields inaccessible for harvesting, while prolonged drought can make irrigation costs exorbitant. Rains influence decisions about when to plant and harvest and climate patterns in other parts of the United States can affect the profitability of local agriculture. Some farming livelihoods are more vulnerable than others, since each crop is susceptible to particular climate and weather-related events throughout its life cycle. Frosts and warm winters are a problem for orchard owners, whereas low summer precipitation is a major concern for corn farmers. Vegetable growers prefer aridity to rain so that they can control pests, molds, and disease; greenhouses are mostly concerned about solar radiation. Labor requirements also vary significantly depending on the crop, available technology, and the timing of specific climate-related events.

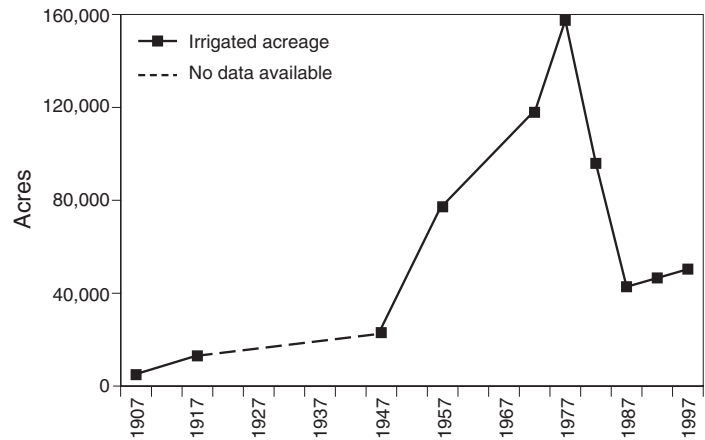


Figure 1. Irrigated acreage change in Cochise County, Arizona, 1909 to 1997.

### Ethnic Differences in Buffering

The team also found that ethnicity plays a significant role in explaining how and why some farmers have been more successful than others in buffering against the vagaries of climate. Hispanic farmers tend to be more vulnerable, due to variables such as social class, language/literacy, migration, and age. The Hispanic farmers interviewed were mostly low technology, resource-scarce producers, with less access to land, government aid, and other forms of institutional support.

Farm workers were identified as an even more vulnerable group. Climate extremes generally limit their mobility. Forecasting information, most of which is produced by the dominant culture, may be inaccessible or inappropriate to their needs. Vulnerabilities may be magnified by a lack of secure housing, inadequate sanitation, and inconsistent access to medical services.

### Buffering Impacts the Environment

Since there are no perennial sources of surface water to support irrigated farming in the SSV, urban and rural livelihoods depend completely on groundwater from two basin aquifers. Although the future of agricultural production is contingent upon adequate replenishment of the regional aquifers, groundwater withdrawal rates continue to exceed recharge. Little is known about how much water is available and how long it will last at the present rate of extraction.

continued on page 4







## Vulnerability (continued from page 3)

Groundwater irrigation is a double-edged sword: on the one hand, it allows farmers to prosper in a semiarid region where rainfall is erratic and, as one cotton farmer stated, "drought is the norm." On the other hand, farmers have overexploited this resource for decades, forcing them to spend increasing amounts of capital on technology and electricity to reach falling water tables. This issue, coupled with anxiety about frequent drought conditions, was a primary concern of nearly all stakeholders interviewed.

Farmers point to advances in irrigation efficiency as a critical component of the future of agriculture in the SSV. But while technology has reduced short-term vulnerability to drought, it also may be increasing vulnerability to multiyear droughts, which lower the water table and substantially increase pumping costs. At the same time, government assistance programs have led to a perception of decreased risk. The viability of such adaptations and their long-term impact on the natural environment is questionable. Are these programs, in fact, buffering farmers to the point where they discourage adaptations to changing environmental conditions at the farm level?

### The Future of Agriculture in the SSV

Although access to groundwater is key to successful farming in the SSV,

the study demonstrates that this alone is not enough for farmers to succeed in the semiarid Southwest. Technological and institutional resources that enable more efficient water use, or that permit farmers to diversify, must accompany groundwater access. Existing information on regional aquifers is insufficient to determine whether or not there is a real divergence between stakeholder-perceived vulnerability and actual vulnerability; thus a better understanding of the relationship between hydrology and climate is required.

Nearly all of the interviewees expressed a sense of humility about the constraints that the environment forces on their agricultural livelihoods. A woman who had ranched, farmed and grown orchards in the SSV for more than 50 years summarized this sentiment by saying, "Mother Nature always gets the last word."

Find out more in a newly released research report, available at <http://www.ispe.arizona.edu/climas/pubs/> or contact [mvasquez@u.arizona.edu](mailto:mvasquez@u.arizona.edu).

## CLIMAS Hosts WestMap Workshop

CLIMAS hosted a planning workshop in early January 2003 to begin developing the Western Climate Mapping Initiative (WestMap). WestMap aims to provide an easily accessible, comprehensive package of fine-scale, high temporal resolution climate data, associated tools, and educational resources to the diverse communities of climate data users in the United States.

The early focus of WestMap will be on covering the complex climate of the western United States. Myriad climate mapping challenges are present within this region, including fine scale topographic variations, extensive high elevation mountain ranges, deserts, coastal boundary regions, interior valleys, rain shadows, limited data availability, and poor station distribution.

A suite of fine-scale gridded time series data at fixed scales, which can then be aggregated to user-specified domains, is envisioned. Strong demand for this kind of climate data by stakeholders has been noted by the western Regional Integrated Sciences and Assessments (RISA) program (which includes CLIMAS).

The WestMap project is being put together by a consortium that includes the CLIMAS, the PRISM climate-mapping group at Oregon State University, the Western Regional Climate Center/Desert Research Institute, California Applications Program RISA/Scripps Institution of Oceanography, NOAA Climate Diagnostics Center Western Water Assessment RISA, and the Natural Resources Conservation Service.