News from the CLIMAS El Niño-Drought Initiative

END InSight

March 2003

The University of Arizona.

The Economic Impacts of Drought in the Southwest

Understanding the economic impacts of drought is a complicated endeavor. Drought is a complex and often long-lasting phenomenon, whose beginning and end often are only apparent in retrospect. Likewise, the economic impacts of drought may not be immediately visible but may have lasting effects on communities and policies.

Drought has both direct and indirect impacts. Direct impacts, which are usually biophysical, may include reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitats.

These direct impacts may lead to indirect economic effects, including reduced income for farmers and agribusinesses; increased prices for food and timber; diversion of government spending to disaster relief programs; and even unemployment, increased crime, and greater migration from affected areas (1).

These effects, in turn, can ripple further to affect both rural and urban areas. Rural product and service providers are influenced by farmers' and ranchers' losses, leading to a decline in their businesses. This in turn can cause a loss of tax revenue to local, state, and federal governments and economic stagnation. Such indirect effects are difficult to quantify, however, because they may be entwined with larger socioeconomic trends, such as fluctuating commodity prices, changing political priorities, and shifting job opportunities from rural to urban settings. Future urban economic development, hydroelectric power generation, and tourism and recreation-based businesses also may suffer from the economic impacts of drought.

Drought-related economic impacts on urban areas also may be severe, although they may be more difficult to see. Water providers may have to spend more to secure water supplies. For example, Phoenix-area water systems typically deliver water from the Salt River Project (SRP), but these supplies have been greatly decreased by the drought. Water providers were granted permission to substitute Colorado River water via the Central Arizona Project (CAP) canal. However, SRP charges about $10 per acre-foot of its water, while the CAP charges ten times that amount. An even more expensive option that could become necessary if the drought continues is the purchase of tribally owned water rights, which could run on the order of $1,100 per acre-foot (2). Although few cities expect immediate rate increases in the short term, if the drought continues this could become a reality for many.

Drought Impacts in Perspective

Drought impacts may seem less dramatic than those caused by other climatic events, particularly because drought does not usually lead to fatalities in the United States, where food supplies and distribution networks are sufficient to make up for regional crop failures. Although drought does not typically receive as much media attention as flooding or hurricanes, the economic losses it causes are greater. On average, drought costs the United States $6–8 billion annually. Floods, in contrast, have been calculated to cost $2.41 billion annually, whereas average hurricane costs are valued at $1.2 billion per year (3).

Droughts occur more frequently and often affect larger areas than either floods or hurricanes, although the differing nature of these events makes direct comparison difficult. Based on records of the Palmer Drought Severity Index (PDSI), some part of the United States has experienced drought in every year from 1896–1995, and in 72 of those years, droughts covered more than 10 percent of the country (Figure 1). The Lower Colorado River Basin experienced some degree of drought in 44 of the last 100 years,

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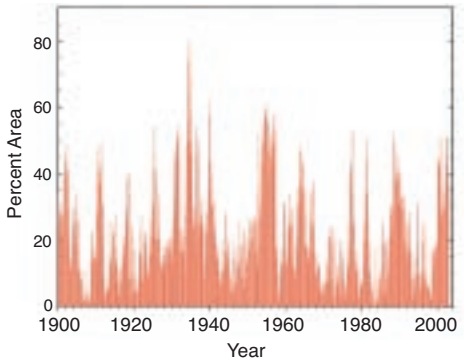

Figure 1. Percent of contiguous United States affected by moderate to extreme drought during each month of the year from January 1900 through November 2002 (the period of instrumental record). The greatest expanse of drought occurred in July 1934 when moderate to extreme drought affected 80 percent of the United States. During the summer of 2002, moderate to extreme drought affected slightly more than 50 percent of the contiguous United States. Source: National Climatic Data Center.

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while drought occurred in the Rio Grande basin in 42 of those years. During the droughts of the 1930s, which led to the Dust Bowl, an estimated 65 percent of the United States was affected (3).

The most economically damaging drought recorded in the United States between 1980–2002 was the 1988 drought, for which losses were estimated at $40 billion (4). In contrast, 1993 was the worst recent flooding year on record in terms of damages; cost estimates ranged from $15 to $27.6 billion. Hurricane Andrew, the most costly hurricane event to affect the United States, caused about $30 billion in damages.

To get an idea of what a worst-case scenario for economic impacts of drought might look like, researchers have attempted to model the impacts of previous severe, sustained droughts against possible contemporary economic losses. Researchers used tree-ring records to identify the longest and most severe drought of the last 400 years, which in the Upper and Lower Colorado River basins occurred from 1579 through 1598. Through simulations of the hydrological, environmental, and economic impacts of such a drought recurring in modern times, they projected that damages could peak at about $750 million per year (5).

Recent Drought Costs in the Southwest

The widespread drought conditions that affected a large portion of 30 states from spring to early fall 2002 caused an estimated $10 billion in damages (4). However, finding such a cut-and-dry number for the recent (and potentially on-going) drought in Arizona and New Mexico is difficult. Neither state appears to have conducted widespread, publicly available economic impact studies of the drought. Instead, data from various sectors must be considered, as the following sections on two of the most impacted sectors, ranching and forestry, illustrates.

Impacts on the Cattle Industry

One way of gauging drought impacts is to examine disaster designations by the Federal Emergency Management Association (FEMA) and the U.S. Department of Agriculture (USDA). In 2002, all 15 counties in Arizona and all 33 counties in New Mexico were designated drought disaster areas by FEMA, which permits the release of emergency funds to those affected. Most areas of both states also were designated as disaster areas by the USDA, which gives farmers access to drought relief loans and grants. However, a final tally of the costs incurred by farmers and ranchers through these programs is not yet available.

Cattle ranchers experienced much of the damage caused by the drought. One study estimated a total direct loss in cattle sales in 2002 of $400 million, with indirect effects bringing the total figure to $2.8 billion (6).

Some of the ranchers most adversely affected are those that rely heavily on public lands for grazing. Range conditions were so poor during the fall of 2002 that cattle were removed almost completely from the Tonto National Forest in Arizona. This measure was necessary to minimize further damage to rangelands, which at this point are expected to require at least two years to recover (if the drought does not continue to deepen). Alternate pastures were generally unavailable due to the widespread nature of the drought, and hay prices exceeded $100 per ton for even poor quality hay (7).

Given these circumstances, many ranchers had little choice but to liquidate their herds, often at prices lower than the cost of replacements during future, wetter times. The herds that were sold off in many cases had been genetically selected for the particular environmental conditions of specific areas. Well-established herds are familiar with the water supplies and trails of specific areas, whereas replacement cattle require time to acclimate and may not be immediately productive.

As a result of lower supplies due to ranchers thinning herds to cope with drought across the West last summer and higher feed prices, beef prices are likely to surpass the record high price of $3.45 per pound that consumers paid in April 2001 (8).

The National Public Lands Grazing Commission (NPLGC) and Tonto National Forest ranchers have proposed a program to buyout cattle grazing permits in order to provide ranchers with some cash, to prevent the sale of their private holdings, and to give them some ability to purchase replacement animals when range conditions improve (6).

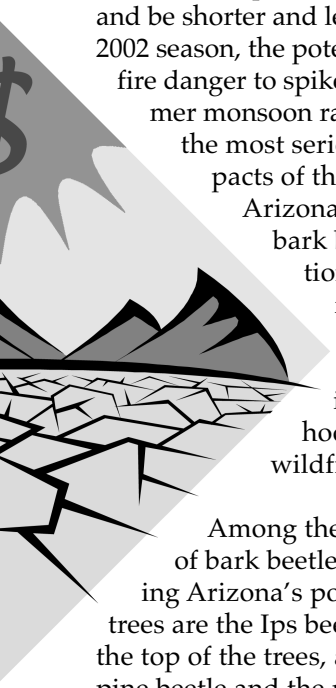
Despite this and other relief measures, ranching families are experiencing severe economic crisis that may well permanently alter the industry in the Southwest. Other trends that had been pushing ranchers off of public lands even before the current drought began, namely increasingly powerful environmental and recreational interests, continue. All of this leads to additional economic and emotional stress on ranching families and communities.

The Wildfire Element

Wildfires are another effect of drought that has important economic dimensions. For example, disaster aid to Arizona in the wake of the Rodeo-Chediski fire in the White Mountains during the summer of 2002 topped $26 million, of which $20 million is earmarked to reimburse state and local governments for the costs of fire management and suppression. The fire burned 468,000 acres and destroyed more than 450 houses (9). The White Mountains are a summer vacation destination for many Arizonans; the Rodeo-Chedeski fire negatively impacted Arizona's $30 million annual tourism revenue.

Two years before that, the Cerro Grande fire ravaged the forest near Los Alamos, New Mexico. The fire consumed 48,000 acres of forest and destroyed 235 structures. Firefighting costs exceeded $15 million and the total cost is expected to approach $1 billion (10). The Cerro Grande fire illustrates the link between climate and wildfires—the strong El Niño in 1998 brought heavy rains, which in turn increased the growth of small trees and grasses on the forest floor. La Niña-related droughts over the next two years dried this material out, providing a vast amount of fuel for the wildfires that raged out of control in 2000.

Although the 2003 fire season in the Southwest is predicted to start later and be shorter and less severe than the 2002 season, the potential remains for fire danger to spike before the summer monsoon rains arrive. One of the most serious long-term impacts of the drought for Arizona's timberlands is bark beetle infestations, which have affected well over 600,000 forested acres and increase the likelihood of destructive wildfires (11).



Among the different types of bark beetles that are infesting Arizona's ponderosa pine trees are the Ips beetle, which attacks the top of the trees, and the western pine beetle and the round-head beetle, which both burrow into the mid-section of the tree. Healthy trees respond to beetle infestation by producing enough sap to "pitch" the bark beetles out of the trees. However, Arizona's ponderosa pines are water-stressed due to the ongoing drought, and as a result 2 to 20 trees are dying per acre in the Coconino National Forest (12). In the hard-hit Jemez Mountains near Los Alamos, New Mexico up to 90 percent of the piñon pine trees are dead from beetle outbreaks and foresters expect up to

Product of the Month – Southwest Area Wildland Fire Operations

As temperatures warm and forests become drier, this month we'd like to point you toward the Southwest Area Wildland Fire Operations website, found at http://www.fs.fed.us/r3/fire/. The site includes a wealth of fire-related information, some of which is geared toward fire management professionals, and other features that are of interest to a broader audience.

The latest updates on current fire-related events may be found in the Fire Information section, which includes maps of large fire areas. Prescribed fire reports and current information on fire restrictions and closures is also available. For a longer-term perspective, the site includes a section with historical information, statistics and maps pertaining to large fires in Arizona, New Mexico, and western Texas.

The Predictive Services section of this site is divided into Fire Intelligence, Fire Weather and Outlook Products. Fire Intelligence offers various types of news and reports on fire conditions, and also indicates Preparedness Levels for both the Southwest region and nation. Fire Weather reports are available in a variety of formats, and are updated daily during the fire season.

The Outlook Products area includes daily fire behavior reports and maps of fire behavior and weather. The site is a source of daily, weekly, monthly and seasonal fire weather and fire danger forecasts (the daily and weekly reports will become available as the fire season progresses).

The Fire Management part of the website contains information targeted toward fire managers, but also offers insight into how the National Fire Plan is being implemented by various agencies in the Southwest.

The site also offers an excellent set of links to other fire management agencies.

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60 percent of the ponderosa pines to die in the next few years (13). The presence of so many dead trees significantly increases the risk of major forest fires in the Southwest this coming fire season.

Winners and Losers

Although the economic impacts of drought often are viewed as purely negative, individual responses and experiences cannot be so neatly categorized, because drought impacts are not evenly distributed among sectors or across the landscape. The lack of precipitation actually may benefit agriculturalists that rely on groundwater for irrigation, for example, because it removes the risk involved in receiving too much precipitation at the wrong time in their production cycle. While ranchers in the Southwest may have to reduce their herds due to drought, ranchers in other regions benefit. Economists such as CLIMAS researchers Dan Osgood and Bonnie Colby will continue their efforts to better account for the economic impacts of drought in the Southwest.

In the meantime, the waiting game continues. Just as it is not yet clear whether February's above-average precipitation will continue and pull the Southwest out of the current drought or if spring conditions will again be as dry as the previous four years, no one yet knows for certain how much the drought ultimately will cost the economy of the Southwest.

–Rebecca Carter, CLIMAS

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About END InSight

END InSight is a year-long project to provide stakeholders in the Southwest with information about current drought and El Niño conditions. As part of the Climate Assessment for the Southwest (CLIMAS) project at the University of Arizona, END InSight is gathering feedback from stakeholders to improve the creation and use of climate information.

The *END InSight Newsletter* is published monthly and includes background and topical climate information. All material in the newsletter may be reproduced, provided CLIMAS is acknowledged as the source. The newsletter is produced with support from the National Oceanic and Atmospheric Administration (NOAA).

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