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END InSight

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Climate, forest management stoke Western wildfires

The fires of 2002, including the Rodeo-Chediski with its dramatic evacuations and widespread damage to communities, riveted the nation's attention on wildfire. These and other devastating wildfires in recent years have been widely attributed to severe drought conditions, but other factors, such as sequences of wet and dry climatic conditions, fire suppression, logging, overgrazing, the actions of environmentalists, and an ongoing bark beetle infestation have also been blamed for playing significant roles.

But drought is nothing new in the western United States, and forest management policies, environmental movements, and bark beetle infestations have come and gone. How did these factors combine to cause the Rodeo-Chediski fire, the largest in Arizona history? Are there ways to prevent this from happening again? This article will attempt to provide some answers to these questions.

The scope of the problem

How bad was the 2002 fire season? It depends on where you were. In Arizona, the 629,876 acres that burned were far above the 1992–2002 average of 163,407 acres, due largely to the Rodeo-Chediski fire. New Mexico's fire season was more moderate, with 119,291 acres burned, compared to a ten-year average of 226,670 acres (1). The United States as a whole came close to setting a new record for acres burned, but did not surpass the 7,383,493 acres burned in 2000 (2).

The fires of 2002 were the most expensive on record, costing federal agencies nearly $1.7 billion to fight (3). The Rodeo-Chediski cost at least $17 million to combat. It is estimated that this one fire will cost insurance companies $102 million, making it Arizona's second-costliest disaster. The 468,638-acre fire destroyed 426 structures, including more than 250 homes (4).

One reason forest fires in recent years caused more damage and were more expensive to fight and recover from is that more people are building houses closer to forested areas (the "wildland urban interface"). Many of these homeowners prefer to leave trees and brush near their homes for aesthetic reasons; however, doing so makes the homes much more vulnerable to fire.

More people are also coming in contact with wooded areas as they pursue recreational interests. It is estimated that humans caused 95 percent of all fire starts in Arizona last year (5). A signal fire lit by a lost hiker started the Chediski fire, which soon joined with the Rodeo. Sparks caused by blown car tires, carelessly discarded cigarettes, and other human-related causes can also start fires. Some researchers point out that the abundant roads necessary for logging rarely act as effective firebreaks, but do allow greater numbers of people to access wooded areas where fires may be inadvertently started (6).

The outlook for future fires, even without continued drought, is bleak. The U.S. Forest Service, researchers, and environmental groups agree that the country's Western forests are not in good shape. By some estimates, about 190 million acres of federal forests in the lower 48 states are at high fire risk (7). Some 11,376 communities appeared on the 2001 Federal Register list of communities at high risk for wildfire; many of them are located in Arizona and New Mexico.

Drought as the "tipping point"

Drought did indeed play an important role in turning the forests into tinderboxes, but it was not just the drought of 2002; the preceding three or four dry years led to long-term moisture deficits that contributed to the explosive fire season. This extended dry period was preceded by the 1997–98 El Niño, which brought increased winter rains to the Southwest. The moisture produced plentiful grass and shrubs that later dried out and provided further fuel for the fires.

Arizona precipitation from June 2001 to May 2002, on the other hand, was the lowest recorded since 1895 (8). Moisture levels in trees play an important role in determining what fire activity will be like. By early summer of last year, the wood in some forests was drier than the kiln-dried lumber sold in home improvement stores.

By examining the fire scars in tree-ring data from widespread regions across the West, researchers know that past fires often coincided with drought years (9). But drought alone cannot account for the large fires that have

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plagued the West in recent years. Over the past century, forests in the western United States have changed dramatically. In the ponderosa pine forests of Arizona and New Mexico, what were once vast areas of widely spaced, fire- and drought-tolerant trees with thick swaths of grass between them have become dense stands of smaller trees. Many ponderosa pine forests (the primary type burned in the Rodeo-Chediski fire) are estimated to be 15 times more dense than they were a century ago. As the Bush administration's Healthy Forests Initiative notes, "Where 25 to 35 trees once grew on each acre of forest, now more than 500 trees are crowded together in unhealthy conditions." (7)

Three main factors can account for these changes in the structure of Western forests: the suppression of low-intensity fires, which historically have provided a means of thinning out dense stands of smaller trees; the selective logging of larger trees, which are more fire resistant; and livestock grazing (10). Such changes make forests more fire-sensitive and susceptible to disease, and are linked to greater tree mortality, an increased buildup of fuels, more intense fires, and more widespread insect infestations. Competition from thicker stands of small trees can make it more difficult for larger trees to withstand drought. Each of these factors played a role in the big fires of 2002.

Fire suppression policies

At the heart of the problem is a century-long Forest Service policy of suppressing forest fires as soon as possible after they start, in an effort to prevent them from spreading and possibly threatening homes and communities on the edge of forested areas. Communities may also suffer health impacts and tourism losses from smoke generated from nearby fires that are allowed to burn. Even prescribed or intentional burning is risky, because in addition to the smoke issues, such fires can get out of control, as was the case with the highly destructive May 2000 Cerro Grande fire in Los Alamos.

Researchers have argued for decades that despite such risks, fire is an important element in forest ecology and necessary to maintaining forest health. Prior to European settlement, tree densities in Western forests remained low due to grasses out-competing tree seedlings and frequent thinning by low-intensity surface fires that were carried by the abundant grasses (10). According to tree-ring records, many trees are well adapted to withstand these periodic, low-intensity fires that swept through the Southwest every four to five years before European settlement (9). Ponderosa pines in particular develop thick, heat-resistant bark as they mature and are generally able to withstand low-intensity fires once their trunk diameter reaches 5 centimeters. More intense "stand replacing" fires that might also kill larger trees are believed to have occurred much less frequently and were often linked with drought conditions (11).

Fire suppression efforts were enacted on a widespread scale in the 1950s and have proven quite effective in reducing the amount of acreage burned. For example, records from the 1930s—before such policies were enacted—show that during that decade a total of over 39 million acres burned; but in the 1970s, after fire suppression policies were fully implemented, only about a tenth as many acres burned (3).

Since the beneficial effects of fires have been curtailed, small trees are no longer thinned out. As a result, fuel loads in central Arizona are said to have increased by a factor of 9 over the last 100 years (10) and similarly in New Mexico. This leads to fires that grow more quickly and burn with greater intensity.

Logging

If overly dense stands of trees are a major component of the forest management problem, it might seem that logging would be a good way to reduce fuel loads. However, this has proven not to be the case. Logging operations tend to target only the more lucrative, but fire-resistant larger trees because there is very little commercial market for the smaller trees that actually need to be thinned (12). As a report by several environmental groups in the aftermath of the Rodeo-Chediski fire points out, the portion of the Apache-Sitgreaves National Forest that burned in that fire has been one of the most heavily logged forests over the past 50 years. Very few old growth trees or unlogged areas remain. The same report notes that dense stands of young trees actually increased between 1972 and 1997, when the forest was heavily logged (13).

Beyond removing fire-resistant large trees, logging has other effects that increase wildfire risk. Harvesting timber affects the forest structure and local microclimate in ways that can dry out the forest and leave it more susceptible to sparks (13). Logging the larger trees also opens up spaces in the forest canopy that encourage the growth of more small trees, particularly if the grasses that would ordinarily deter small trees from taking hold have been over-grazed. Dense stands of smaller trees can also act as "ladders," by which fire can climb from the forest floor into the tops of larger trees. Crown fires, as the resultant blazes are known, are among the most difficult types of fires to control and can engulf large areas in flames very quickly.

Grazing

Livestock grazing has dramatically changed vegetation in the Southwest. Livestock currently graze 91 percent of all federal lands in the 11 Western states (10). Within forested areas, grazing can play an important role in increasing wildfire susceptibility. Overgrazing is said to have stripped the grasses that once provided the fuel for more frequent, but less destructive, fires, while small trees that would have been killed in such fires have been allowed to grow into thick stands that provide concentrated fuel for intense fires. Livestock have also been

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blamed for disturbing forest ecosystems by compacting soils, which reduces water infiltration rates and increases soil erosion (10). Several Forest Service grazing allotments burned during the Rodeo-Chediski fire.

Bark Beetles

An ongoing bark beetle infestation continues to contribute to a higher than average likelihood of devastating fires and is also a result of forest management practices. The higher density of smaller trees allows insect infestations to spread more easily, since meadows and other open areas do not separate trees as they once did.

Drought has also played a role in the bark beetle infestation and in increasing the likelihood of major fires. Ponderosa pines have deep taproots that allow them to survive most droughts; and they can also fight beetle infestations by pushing the invaders out with their sap. However, the drought has left the trees too dry to produce the sap required to fight the beetles. Spraying pesticides over large areas to stop beetle infestation is an option forest managers are exploring, but is prohibitively expensive and may have other unwanted ecosystem impacts (14).

Thinning or Logging?

While the ecological factors outlined in the previous section might seem fairly straightforward, a storm of political controversy has surrounded major wildfires in the West. Environmentalists have been blamed for delaying fuels reduction projects through excessive litigation, while politicians have been accused of neglecting forest health in the interest of increased profits from logging.

In many cases, the issue comes down to disputes over what constitutes true thinning for fire management purposes and what may be efforts to expedite the logging of large trees. President Bush's Healthy Forests Initiative is concerned with the ability of the Forest Service to manage forests in a timely fashion. The Initiative cites procedural delays, overly complex and restrictive regulations, and the appeals process for preventing needed thinning projects from taking place. The Initiative proposes that delays in forest management projects can be avoided by streamlining the process for gaining approval for such projects and reducing the ability of environmental groups to block them. Environmental groups, on the other hand, are concerned with the fairness of Forest Service management practices. They say that they are being unjustly blamed for what is actually poor management on the part of the Forest Service. (13)

For an objective determination of whether legal actions by environmental groups to stop fuel reduction projects are indeed excessive, the U.S. General Accounting Office in 2001 conducted a review of the appeals and litigation brought against the Forest Service. The report showed that of the 1,671 hazardous fuel reduction projects undertaken during that year, only 20 had been appealed and none had been litigated. Of those 20, only 12 involved environmental groups; recreation groups, private industry interests, and individuals were also involved. The one suit filed in Arizona by environmental groups was in the Coconino National Forest and resulted in the project being withdrawn and replaced with smaller projects (15). The Bush administration ordered its own review of appeals and litigation, and

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The Future of Fire Forecasting

Although preventing all wildfires is not possible, being better prepared for them is becoming easier thanks to the increasing sophistication of fire climate forecasts. Knowing exactly where conditions are most ripe for fires allows federal and state agencies to target their resources on those areas, so they can respond quickly, before fires expand and become more difficult to stop. CLIMAS, the program that END InSight is a part of, has taken an active role in bringing forest managers together with forecasters to develop more accurate and useful fire probability forecasts. One of our goals is to create more effective decision-support tools, to improve resource allocation decisions, and maintain better safety for firefighters and the public.

The first annual National Seasonal Assessment Workshop, which took place in Mesa, Arizona February 25–28, 2003, brought together climatologists, fuels experts, and fire behavior analysts to produce seasonal fire outlooks. The outlooks do not expect the 2003 fire season to be as severe as the 2002 season, although an above average season is expected for much of the West, including large sections of Arizona and smaller areas of New Mexico.

Forecasts for the coming fire season in the Southwest indicate that it will start in early to mid-May, which is about average over the long term. In contrast, last year's fire season started early, in March, with the Oversight fire in the Huachuca Mountains. However, forecasters predict once this year's fire season starts, it will quickly become severe.

While winter and early spring rains have helped trees to recapture some of their moisture this year, getting back to normal moisture levels would take months of steady precipitation—and this is quite unlikely to occur. The increasing bark beetle infestation is expected to make matters worse, regardless of weather conditions, since the amount of dead wood available to burn will increase. However, the worst fire-related results from the bark beetle infestation may not be visible immediately, but rather in three to five years, when the dead trees begin to fall. The fallen timber could lead to ground fires that burn hotter and are very difficult to extinguish.

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reports that between January 2001 and July 2002, 48 percent of all Forest Service mechanical thinning projects were appealed. The Arizona environmental groups claim that the two reports sought to compare very different types of factors, and thus are not comparable (13). It is also worth noting that the Rodeo-Chediski fire burned primarily on the White Mountain Apache reservation, where the actions of environmental groups would have no influence (6)

How can the problem be solved?
There is widespread agreement that improving forest health and protecting communities from wildfires are key priorities. Restoring forests to conditions closer to their natural conditions is one step being pursued. Allowing fires to burn in areas that do not threaten urban areas is one option; mechanically thinning forests in areas where burning is not safe is another. More emphasis is also being placed on working with communities to take action to safeguard houses, such as using fire-resistant building materials and keeping brush-free perimeters around structures. Better forecasting of fire conditions will also allow fire managers to better target suppression efforts toward areas where the fire danger is highest (see sidebar, page 3) and their restoration efforts toward areas where prescribed burns and thinning can be done safely.

As fire historian Stephen Pyne of Arizona State University notes, "There are three strategies for dealing with the fire-prone West: convert the land to something less combustible, do the burning ourselves, or rely on suppression. The United States needs to use all three options—and in innovative mixes" (16). Projects by CLIMAS, other agencies, and researchers in the Southwest seek innovative ways to bring together fire managers, communities, and scientists to find the common ground that will allow for timely, effective and scientifically sound forest management.

–Rebecca Carter, CLIMAS

References

(1) Southwest Area Wildland Fire Operations. 2002. YTD & Historical Totals: Fire and Acres (By Agency and State). Accessed at http://www.fs.fed.us/r3/fire/ on April 4, 2003.

(2) National Interagency Coordination Center. 2002. 2002 statistics and summary. Accessed at http://www.nifc.gov/news/2002_StatsSumm/intro_summary.pdf on April 10, 2003.

(3) National Interagency Fire Center. 2002. Wildland fire statistics: suppression costs for federal agencies. Accessed at http://www.nifc.gov/stats/wildlandfirestats.html on April 10, 2003.

(4) Wichner, D. 2002. Rodeo-Chediski costs rank 2nd. *Arizona Daily Star,* July 16, 2002.

(5) Pitzl, M. J. 2003. Arizona braces for tough fire season. *The Arizona Republic,* March 9, 2003.

(6) Pacific Biodiversity Institute. 2002. Analysis of land ownership and prior land management activities within the Rodeo & Chediski Fires, Arizona. Accessed at http://www.pacificbio.org/RodeoChediskiFires8July2002lowres.pdf on April 9, 2003.

(7) The White House: President George W. Bush. 2002. Healthy forests: an initiative for wildfire prevention and stronger communities. Accessed at http://www.whitehouse.gov/infocus/healthyforests/sect5.html on April 3, 2003.

(8) Ingley, K. 2002. The real monster is drought. *The Arizona Republic,* June 30, 2002.

(9) Swetnam, T. W. 2002. Fire and climate history in the Western Americas from tree rings. *PAGES News,* 10(1):6–8.

(10) Belsky, A. J., and D. M. Blumenthal. 1997. Effects of livestock grazing on stand dynamics and soils of upland forests of the Interior West. *Conservation Biology,* 11:315–327.

(12) Babbitt, C. J. 2002. Drought created this nightmare; it will end with patience, wisdom. *The Arizona Republic,* June 30, 2002.

(13) B. Segee, and M. Taylor. 2002. Prelude to catastrophe: recent and historic land management within the Rodeo-Chediski fire area. Center for Biological Diversity. Accessed at http://www.biologicaldiversity.org/swcbd/Programs/fire/r-c_report.pdf on April 4, 2003.

(14) Marizco, M. 2002. Beetles sap strength of pine trees. *Arizona Daily Sun,* August 8, 2002.

(15) U.S. General Accounting Office. 2001. Forest service: appeals and litigations of fuel reduction projects. GAO-01-1114R, Accessed at http://www.gao.gov/ on April 4, 2003.

(16) Pyne, S. 2002. Meeting fire on its terms. *New York Times,* June 25, 2002.

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.

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