Ft. Grant Overlook in the Pinaleños, facing the Galiuros *courtesy Tim Van Devender.*

Climate and the Changing Landscape

by Thomas Swetnam

In the past few years, the scientific community has gone from considering how climate change impacts might play out on the landscape to documenting how it has begun. At a climate and forests workshop back in February of 2004, we wondered whether some of the drastic changes we were seeing in southwestern forests were harbingers of global warming, or only a response to past land use practices, such as a century of livestock grazing, logging, and fire suppression. Research published in the scientific journals since then has confirmed many of our concerns that climate change has played an important role.

In late 2005, my colleagues identified high temperatures as one of the likely causes of the 2002-2003 massive die-off event of southwestern piñon and ponderosa pine trees.[1] Drought and bark beetle outbreaks certainly contributed as well. But the recent dieoff was apparently more extensive (about 3.5 million acres in Arizona and New Mexico) than the one which occurred during the 1950s drought, which was at least as dry as the current drought. Higher temperatures during the recent drought seems to have been a critical factor.

A much larger bark beetle outbreak — more than 20 million acres! — in British Columbia lodgepole pine forests was strongly linked to warming temperatures, adding further evidence that climate change impacts on ecosystems is beginning in western North America.[2] On another front, my colleagues and I reported in 2006 that increasing spring and summer temperatures were correlated with increasing numbers of large forest fires in the past few decades, with the evidence indicating that earlier snowmelt acts to dry out forest fuels, triggering synchronous, large forest fires throughout the West.[3]

Even as we better understand how global warming is changing the landscape, however, we are also recognizing additional complexities in the landscape response. A variety of other factors interact with warming temperature, including annual variability in the climate system and past land management practices.

Global warming interacts with other climate patterns, such as the long-term Pacific Decadal Oscillation and Atlantic Multidecadal Oscillation and the shorter-term El Niño Southern Oscillation (commonly called El Niño). Beyond these climatic factors, there's a human component. Management practices, climate patterns and global warming all work together to affect the landscape in which we live.

To illustrate this complexity of how these various factors can interact, consider wildfire patterns in the Southwest. People have been fighting fires in western forests for more than a century, and permitting cattle and sheep to graze in forests for even longer. These management practices have changed the dynamics of fire on the landscape in some forests, as our research at the University of Arizona Laboratory of Tree-Ring Research has shown. Before Euro-American settlement, southwestern ponderosa pine forests supported frequent fires, generally of low severity. These surface fires burned along the forest floor with flame lengths of one to several feet in height, maintaining pine forests as open parks with little fuel accumulation in the understory.

Extensive livestock grazing and large-scale fire-fighting helped create conditions promoting modern-day fires that are often very severe. For example, in the Bullock and Aspen fires on Tucson's Mount Lemmon in 2002 and 2003, respectively, high severity burns completely killed even the canopy trees on roughly a third of the total burned area. Based on our knowledge of fire history reconstructed from fire-scarred trees and the ages of trees in these mountains, that proportion of high severity burn is probably anomalous over at least the past 300 years.

Along with forest management practices, climate variability influences wildfire regimes. Years of above-average rainfall, which occurs more often during El Niño events than during other years, encourage the growth of grasses. These fine fuels prime the landscape for more extensive burns during a subsequent dry year, which is more likely to occur during a La Niña event. We see the influence on forest fires of the fluctuations between these two related climate patterns at many scales, from the Southwest to western North America, and even extending to southern South America.

Yet another contributing factor in these dynamics is the recent spread of invasive grasses in many parts of the West. In the Southwest, introduced red brome and African buffle grasses are increasing exponentially in the Sonoran Desert. These highly flammable grasses resprout prolifically following wildfires, which also kill many native desert plants, such as the iconic saguaro cactus. The exotic grasses appear now to be carrying fire into the woodlands and forests up slope, creating new corridors for fire spread through sensitive habitats and at-risk human communities.

As I mentioned earlier, warming temperatures are apparently now melting the snow packs earlier and desiccating forests more quickly than in earlier decades (before about 1980). This warming has probably contributed to the enormous fires we have seen in the Southwest in the recent decades — but forest changes due to land uses and exotic species, as described above, are likely also involved. However, this pattern of warming temperatures and increasing numbers of large forest fires also shows up in many Northern Rocky Mountain forests, where fire-fighting and other management practices have had relatively little effect on forest structures.

As you can see, climate change is rarely the only impetus behind the changes we're witnessing on the landscape. Yet it can make a critical contribution to the result, much like the straw that breaks the camel's back. That's why I have found myself compelled, like so many of my fellow scientists, to issue warnings about current and predicted climate change. We're moving into dangerous and generally uncharted territory as we continue to emit greenhouse gases that unequivocally will further warm the planet, resulting in severe ecosystem disruptions.

Some skeptics compare those of us who raise this alarm to Chicken Little, warning that the sky is falling. In reality, I suspect we're playing the role of Cassandra, the tragic prophetess of Greek mythology, portrayed by Shakespeare in his play *Troilus and Cressida.* Unlike Chicken Little's, the prophecies foreseen by Cassandra came true. In the Greek myth, Cassandra's curse was that no one believed her so she was unable to prevent the gloom and doom she foresaw. Still, we must temper our Cassandra-like warnings with the humility that comes from acknowledging the significant uncertainties that persist.

continued next page

Climate and the Changing Landscape

continued

In modern times, people are now recognizing the truth that there are real dangers ahead if we don't take action to curb our greenhouse gas emissions. Therein lies the hope that we can prevent some of the worst consequences of climate change. This is also the time to think strategically and boldly about our stewardship responsibilities for the landscape and the people and wildlife that live on it.

It is still possible to mitigate coming impacts in some areas. In forests, we need to undertake judicious forest treatments, which will include landscape-scale forest thinning and prescribed burning in order to reduce the risk of severe, large-scale wildfires. In other ecosystems, we need to make similar efforts to increase native ecosystems' ability to adapt to global warming and the changes that come with it.

We have much work ahead, but it is essential work if we want to make the landscape we live in more resilient to climate change. My hope is that the information here and elsewhere will help people understand why it's important to undertake these important steps to reduce some of the risk to our landscape that is posed by rising temperatures. Recognizing the danger ahead can be a blessing if we have the foresight to take action to mitigate it.

References Cited

[1] Breshears, D.D., Cobb, N.S., Rich, P.M., Price, K.P., Allen, C.D., Balice, R.G., Romme, W.H., Kastens, J.H., Floyd M.L., Belnap J., Anderson J.J., Myres O.B., and Meyer C.W., 2005. Regional vegetation die-off in response to global-change-type drought. *Proceedings of the National Academy of Sciences* 102:15144-15148

[2] Gillett, N.P, Weaver, A.J., Zwiers, F.W., and Flannigan, M.D., 2004. Detecting the effect of climate change on Canadian forest fires. *Geophysical Research Letters* 31: L18211, 1-4.

[3] Westerling, A.L., Hidalgo, H.G., Cayan D.R., and Swetnam T.W. 2006. Warming and earlier spring increase western U.S. forest wildfire activity. *Science* 313:940-943.

Thomas W. Swetnam is professor of dendrochronology and watershed management and Director of the University of Arizona's Laboratory of Tree-Ring Research. Melanie Lenart also contributed to this perspective piece, which is a slightly edited version of a foreword that ran in Global Warming in the Southwest: Projections, Observations and Impacts*, a University of Arizona publication available at:* **geo.ispe.arizona.edu/climas/publications/pdfs/GWSouthwest.pdf**

Recent Developments Leave Forest Planning in Flux

by David Hodges, SIA Policy Director

At the end of March, the 2005 Forest Planning Rule was vacated by a US District Court in California, with the presiding judge, Phyllis Hamilton finding that the Bush's administrations rule for land and resource management planning violated the basic laws ensuring that forest ecosystems have environmental safeguards.

Tim Preso, a lawyer who represented the environmental group Earthjustice, said, "basically, the importance of this decision is that the Bush administration had been trying to take all mandatory environmental protections out of forest planning process and this decision puts them back in."

This has had the effect of (at least temporarily) bringing Forest Plan revision, to a halt.

After considering several options, it first appeared the Forest Service had decided on utilizing the "2004 Interpretive Rule." This Rule was developed to give individual forests the latitude to move ahead with planning efforts, without waiting on the lengthy process that was playing out in developing a new (2005) planning rule.

The 2004 Interpretive Rule allows each forest to use either the 1982 Rule (which the existing Coronado Plan was done under) or the 2000 Planning Rule, which was finalized at the end of the Clinton Administration.

At this point, the Coronado NF made a decision to proceed under the 1982 planning rule, which means the final plan would have an Environmental Impact Statement, Standard and Guidelines, Management Indicator Species, and would retain current emphasis on retaining scenic values.

The Coronado has been working to remove all references to the 2005 rule from the document formerly known as the Comprehensive Evaluation Review (CER), and will be transforming the information into a Comprehensive Assessment. They hope to have a draft document out for public review by the end of August and still hope to have public meetings in the fall, to validate the needs for change and then focusing on desired conditions, and possibly objectives to achieve desired conditions. The desired conditions and objectives will be the backbone of the proposed revised plan.

According to the Coronado's revision team leader Jennifer Ruyle, "there are some very good examples of forests that have accomplished a lot in periods of transition, and we will follow those examples. At this point we can continue to focus on analyses and interim products that add value to the final product. There is a lot of work that can be done that fits under any of the rules that have ever been promulgated, and that is what we intend to do."

I wish that I could say that it all ended there and we are moving forward with completing long overdue forest plan revisions. Unfortunately, the Forest Service nationally has decided on an attempt at resurrecting the 2005 Planning Rule. They are preparing a draft Environmental Impact Statement, which in theory would satisfy a major concern of the courts, and would open the door to returning to the 2005 rule. It is anyone's guess at this point, as to what happen next, beyond delay.

Here at SIA, and with the Coronado Planning Partnership, we have continued to develop organizing and campaign tools for when forest plan revision is reinitiated. The good news is we have a strategy in place we believe will work regardless of what planning process, plan revision is done under.

On that front we have continued to create reports for each of the 12 Ecosystem Management Areas on the Coronado National Forest, all of which will contain threats, assets, conservation targets, and management recommendations, as well as an analysis of both wilderness suitability and areas to be managed for roadless and semi-primitive recreation, and special management area proposals (and of course, maps).

Soon, we will be make drafts of these reports available to the public for review and suggestions.

We have continued developing the Sky Island Action Center website, which you can view at **www.skyislandaction.org/ActionCenter.html**

In addition to forest planning, we have been heavily involved in the Travel Management planning process that the Coronado is undergoing. We have completed our recommendations for the Santa Catalina and Nogales Ranger Districts and these are available for review at the above website. Thanks to all of you who have helped with that. We are now beginning to work on transportation recommendations for the Safford Ranger District.

If you have questions about any of this, or would like to get involved, please contact me at **dhodges@skyislandalliance.org** or 520.624.7080 ext. 13.