

# Helping western forests heal

The prognosis is poor for US forest ecosystems.

## William Wallace Covington

The dry forest ecosystems of the American West, especially those once dominated by open ponderosa pine forests, are in widespread collapse. We are now witnessing sudden leaps in aberrant ecosystem behaviour long predicted by ecologists and conservation professionals (see *Nature* 407, 5; 2000). Trends over the past half-century show that the frequency, intensity and size of wildfires will increase — by orders of magnitude — the loss of biological diversity, property and human lives for many generations to come.

## Population crashes

Forest ecosystem health has declined pathologically ever since European settlement. Populations of native species have crashed while those of exotic species have irrupted. Indigenous cultural regimes and low-intensity disturbance regimes, such as surface fires, have been lost. Meanwhile, novel cultural practices — including overgrazing and fire suppression — and unprecedented disturbance regimes (such as crown fires) have become increasingly dominant.

How can we help these ecosystems recover in a way consistent with their evolutionary environment, while enhancing opportunities for continued human use? Secretary of the Interior Bruce Babbitt and Agriculture Secretary Dan Glickman recommend extensive preventive fuel treatments such as thinning and prescribed burning. In their report to President Bill Clinton in September they requested substantial budget increases over the next 10–15 years to accomplish these. Congress responded by adopting many of the recommendations and increasing funding exponentially for fiscal year 2001; the president signed the legislation for that funding in October.

This new policy attention is critically needed. But focusing on abating crown fires without focusing on the general ecological degradation of western forests is akin to treating a symptom and not the disease. The disastrous wildfire season of 2000 can be looked at in the framework my colleagues and I have developed for forest-fuel treatment. We have revised the current single-crop agriculture strategy to create an ecosystem-oriented approach that does not deviate too far from natural conditions (see Box). The debate on forests must be driven not by ideology but by all agreeing to the goal of coexistence with wildland ecosystems. The starting point must be good science. To approach the problem any other way will open the door for management decisions that may lead to short-sighted,



Old growth ponderosa pine in a restoration site (top) and post ecological restoration treatment.

uninformed ‘tree-whacking’ and forest burning that will only exacerbate the problem.

I am not so naïve as to believe that science will drive the entire debate. But, having spent 25 years trying to advance the need for ecosystem restoration, I know that debate descends to paralysis when it begins with ideology. In the little time left, it is imperative that fuels treatments should be driven by ecological restoration principles; that scientists should actively inform the debate; that scientists, managers and the public should not be afraid to use what we currently know to identify restoration treatments; that all restoration should be conducted in an explicitly formal adaptive management context; and that multiple approaches should be tested and carefully monitored.

## Restoration principles

Ecological restoration offers a practical approach for developing scientifically and ethically sound fuel-reduction treatments which not only treat wildfire symptoms, but also attack the underlying causes of ecosystem health decline. Restoration is mandated for degraded areas set aside as natural areas or wilderness, but it is also a desirable goal in the management of lands where ecosystem health and resource use are shared goals. Finally, sci-

entifically rigorous and adaptively designed restoration plans can offer a common ground to resolve preservation/use conflicts.

What is needed urgently is solid scientific evidence. Researchers, conservation professionals and other knowledgeable people concerned about western forest ecosystem health must agree and publicize an objective standard for information to counter the tendency for propaganda and ideological ‘spinning’ of research results used in developing treatments or to drive policy discussions.

Some of the stakeholders in forest management — the forestry industry, environmental groups and other resource users — use misrepresentation and pseudo-science to justify their positions and undermine the credibility of others. I have seen our restoration treatments at Flagstaff intentionally misrepresented on the one hand by some environmental activists as monolithic in approach and scientifically unsound, and on the other by some representatives of the wood- and grazing-industry as a justification for returning to old-time commodity resource production from federal lands. The reality is that ecosystem health comes first: we test multiple hypotheses operationally and vary treatments depending on site conditions. We see resource utilization as a vehicle for accomplishing restoration, not a goal.

Because I believe strongly that restoration must begin immediately I have been criticized by colleagues who argue that more information is needed first. I strongly disagree with this because the current crisis in

western forests demands action now; there is sufficient information to design and implement scientifically valid approaches that will help determine how best to proceed.

Sound knowledge about restoration is available, based on the abundant scientific research that began in the 1890s and continues today. We have solid information about forest conditions before European settlement, changes in fire regimes, deterioration of overall ecosystem health, and ecological responses to thinning and prescribed burning—the key elements of any attempt to restore ecosystem health in ponderosa pine and related ecosystems. Both early naturalists' data and contemporary research show that today's overcrowded stands of trees do not sustain the diversity of wildlife and plants that existed a century ago. Open, park-like stands that have not been severely disrupted by fire exclusion have greater plant, insect and bird diversity than stands that have become overstocked during decades of fire exclusion. These open, park-like stands also show greater old-growth tree vigour and resistance to insect attack.

Stopping ecologically based forest restoration because of an ideological opposition to tree cutting is not saving forest ecosystems, as some would like to believe, but only contributing to their demise and causing severe losses to the wealth of species that depend on them. It also places ecosystem health practitioners in a situation similar to eliminating surgery from the options for treating human diseases.

Various ecosystem restoration options are being investigated at research sites across the American West. Most apply and test treatments developed locally by scientists, managers, environmental activists, resource users and members of the public. But it is also imperative that we accept the responsibility to apply the extensive knowledge we already have, before more forests are lost. Ecosystems have been highly fragmented and degraded by decades of overuse. Restoration is not necessarily simple, nor is success always guaranteed. But restoration-management approaches are superior to the destructive effects of unnaturally intense fires. The risks of inaction far outweigh the risks of such treatments.

I do not advocate a 'one size fits all' approach to restoring the ecological integrity of ponderosa pine forests. Management approaches should suit the place that needs restoring, its pre-European settlement reference condition and its relationship to the broader ecosystem and the communities that live within it. In this sense, ecological restoration is neither a strict recipe nor a rigid set of prescriptions, but is an adaptive process for restoring and enhancing ecosystem health and sustainable human uses of the land.

We must change our approach to fuel and forest management. The shocking fire season of 2000 and the environmental and economic damage left in its wake are tragic consequences of management and interest groups that have



Under control: a prescribed burn at Flagstaff.

failed to understand natural ecosystem structure and function. Virtually all our scientific knowledge is based on studies of degraded ecosystems—those that have been extensively altered by fire exclusion, industrial exploitation and other exotic cultural practices.

As the new US government takes shape, now is the time for land-management agencies, policy-makers and stakeholders to identify what is needed to achieve ecologically healthy forest ecosystems. The discussion should start with solid science, embrace a long-term ecological perspective and then incorporate social and ideological issues. Scientists must make this happen by actively promoting what we know and the ways this knowledge should be applied. The current crisis requires that we act immediately, using an adaptive environmental assessment approach.

Today's wildfires are so extreme in their behaviour and effects that they are in many ways worse than clearcutting. Critical habitat for threatened and endangered species is destroyed, watershed function is disrupted and human habitat value reduced for centuries to come. And such wildfires are a threat to human lives and property. To act now is to save the patient. To act now means a healthy, biologically diverse forest that is an asset, not a threat, to future generations. Is there really an alternative? ■

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♦ <http://www.for.nau.edu/ecorest>

## Ecological restoration

Ten years ago, Carl Walters and Crawford Holling memorably recommended "large-scale management experiments and learning by doing" (Walters, C. J. & Holling, C. S. *Ecology* **71**, 2060–2068; 1990). We have pursued this approach in the 'Flagstaff Plan'. In collaboration with partners in the environmental community, conservation practitioners and interested parties from government and a range of organizations, my colleagues and I at the Ecological Restoration Institute at Northern Arizona University have developed a general framework for ecologically based restoration treatments.

### Scientific framework

Ecological restoration is the restoration of natural ecosystem structures and processes. Treatments are based on reference conditions (the evolutionary environment context) and cover evolutionary and conservation biology, and ecosystem ecology principles.

### Social and political framework

In an ecosystem ecology approach, social and political concerns play a major part in defining treatments. So stakeholders must be engaged, especially community-based partnerships linked to regional and national agencies and interest groups, with policy-makers, natural resource specialists and resource managers.

### Operational framework

Financial and personnel constraints place geographical limits on treatments. So emphasis is placed on strategically located restoration fuel breaks that are anchor points for large, landscape-scale treatments. These breaks can protect key landscape ecosystem components such as human communities, critical habitat for threatened or endangered species, and core areas of greater ecosystems such as wilderness areas and national parks.

### Ecosystem management framework

Restoration and fuel reduction goals should be integrated with overall ecosystem conservation and management goals. Reference conditions serve as a starting point to the goal of scientifically based land-management objectives.

### Economic framework

Economic analyses should consider all costs and savings. Restoration-based fuel treatments save money by avoiding the costs of firefighting, rehabilitation and compensation for property damage. They are also an investment in protecting lives. They present new opportunities for rural economic development through restoration-related jobs and products. Ecological economic analysis will probably indicate that benefits greatly outweigh costs.

### Ethical framework

We have a responsibility to future generations to solve ecosystem health problems. Ecological restoration speaks to the land ethic—the humans should be good stewards and show a caring concern for nature.