SKY ISLAND ALLIANCE
Protecting our Mountain Islands and Desert Seas

Restoring Connections

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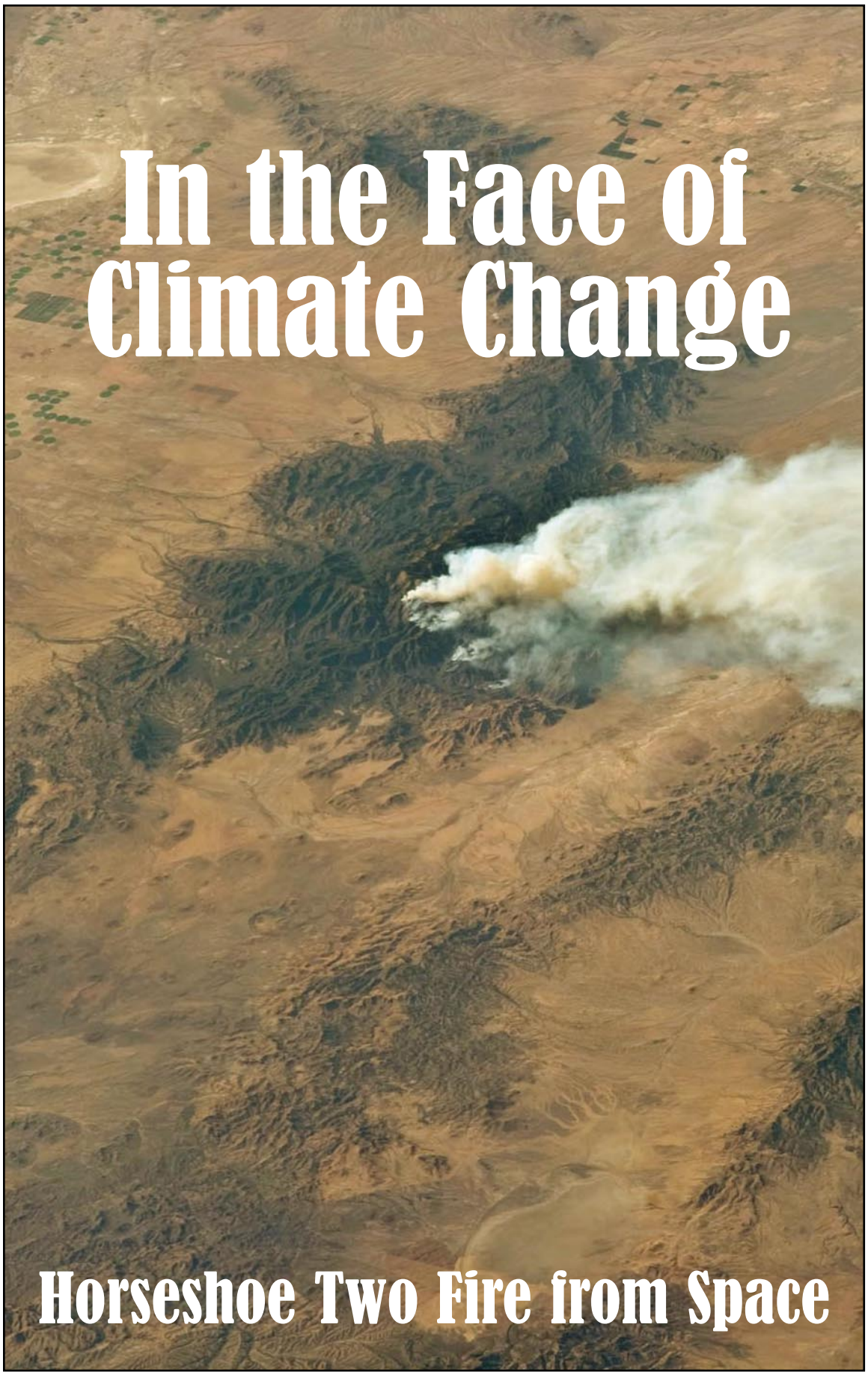

In the Face of Climate Change

Horseshoe Two Fire from Space

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This photograph, taken May 15, 2011, by an astronaut on the final mission of the Endeavour Space Shuttle, illustrates the initial scope and position of the Horseshoe Two Fire within the Chiricahua Mountains as well as an extensive smoke plume extending to the east-northeast over a distance of at least 60 kilometers.

Bolstering a Living System as Climate Changes

by Melanie Lenart, PhD, author of Life in the Hothouse: How a Living Planet Survives Climate Change *(www.uapress.arizona.edu)*

On this side of the Continental Divide, we have another record-breaking fire in Arizona. This year's Wallow Fire has scorched more area in northern Arizona than the record-holding Rodeo-Chediski Fire of 2002. Together, these two fires burned about 1 million acres of mostly Ponderosa pine forest in two huge patches on either side of Pinetop.

On the other side of the Continental Divide, residents in the Mississippi Basin have been dealing with deluges instead of droughts. Northeast Ohio's wettest May on record primed the pump for basement drains to become miniature geysers spewing a mixture of sewage and rainfall. Heavy rainfall caused major floods that inundated homes and low-lying land in intermittent swaths throughout the basin, from Iowa down to Louisiana.

Many factors came into play to set the stage for these opposite extremes in East and West — and climate change may well be one of them. While we can expect more of these extremes, solutions exist to dampen the problems posed by a warming climate — which include more intense droughts and floods, and bigger western wildfires.

While the potential contribution of climate change versus other factors to these specific fire and flood events has yet to be calculated, the conditions that led to them — more extreme rains, more extreme drought — fit right in line with expectations of what happens as our use of coal, gas and oil thicken the planet's atmospheric blanket of heat-trapping gases.

Here, I draw from my recent book, *Life in the Hothouse: How a Living Planet Survives Climate Change*, to put the ongoing change into the bigger picture and summarize a few things people can do to make the land and society less susceptible to fires, floods and other problems made worse by climate change.

Earth as a living system

The past 100 million years have wrought many changes on planet Earth, dubbed Gaia by James Lovelock. His Gaia theory starts from the premise that the planet is a living system that has somehow managed to survive climate swings of the past, as well as a sun that has grown slightly hotter over the eons. *Life in the Hothouse* examines the fossil record and other evidence in the context of Gaia theory to consider how Earth's responses to changing climate might have improved the living planet's ability to adapt to it.

Past climatic extremes would not work well for modern society. During past hothouses, the mostly ice-free Earth saw sea levels rise by 200 to 300 feet, burying land and bringing storm surges to new heights. During ice ages, the area now occupied by the U.S. Southwest sported large lakes and more greenery compared to what we see in today's arid climate. But much of the continent lost forest cover — and land. Glaciers and ice sheets buried the land that now hosts major cities like Chicago and New York.

Higher greenhouse gas levels during past hothouses predictably spurred on higher temperatures and melted ice sheets. The resulting rising seas covered more area, providing fodder for evaporation. And, as the laws of physics dictate, warmer air picked up more moisture.

Meanwhile, the extra carbon dioxide in the air not only warmed the planet, it also served as plant food. Plants turn carbon dioxide and water into carbohydrates, using energy from the sun to build mass out of thin air and water.

As a result, forests and wetlands tended to expand at the global scale during hothouses. The expansion of forests and wetlands, in turn, helped keep global temperatures from escalating from hellishly hot and humid to planet-roasting highs by converting carbon dioxide into wood and peat.

We've been seeing a bit of this carbon-uptake response in action in recent years. Along with the oceans, the world's remaining fragments of forest have been taking up roughly half of the carbon dioxide released by society in the burning of gas, oil and coal. In addition, forests have been taking up all of the carbon dioxide released in "land use change," a phrase that describes the transformation of forests into cities, crops and cattle ranches.

Even during big fire years, U.S. forests take up far more greenhouse gases on the whole than they release in wildfires. In a few less populated states, namely Alaska and Idaho, greenhouse-gas releases from fires can surpass society's emissions in some big-fire years. This 2007 finding by researchers Christine Wiedinmyer and Jason Neff made headlines when they reported it, using carbon-dioxide "equivalents" so they could include methane and other greenhouse gases.

Still, the nation's forests consumed 25 to 30 times more carbon-dioxide equivalent than they released in fires, based on Wiedinmyer and Neff's comparisons with five-year satellite estimates of carbon uptake by forest growth. The years they analyzed, 2002 to 2006, encompassed a large-scale drought that spurred on widespread wildfires. It included 2002, with Arizona's 468,000-acre Rodeo-Chediski Fire representing only one of several big western fires that year.

These results may be comforting at some level. Still, those of us in the Southwest would find more comfort in seeing our regional forests filled with living trees rather than charred snags.

For that to happen, we'd need to devote a reasonable budget to treating forest stands by thinning out the small trees and allowing surface fires to burn off deadwood and seedlings.

Rising temperature put our local forests at risk, there's no doubt about that. Researchers including The University of Arizona's Thomas Swetnam have linked seasons when high temperature prematurely melted mountaintop snow to years of runaway wildfires. Meanwhile, other evidence indicates that the best way to protect our ponderosa pine forests from fatal flames is to thin out some of the smaller trees.

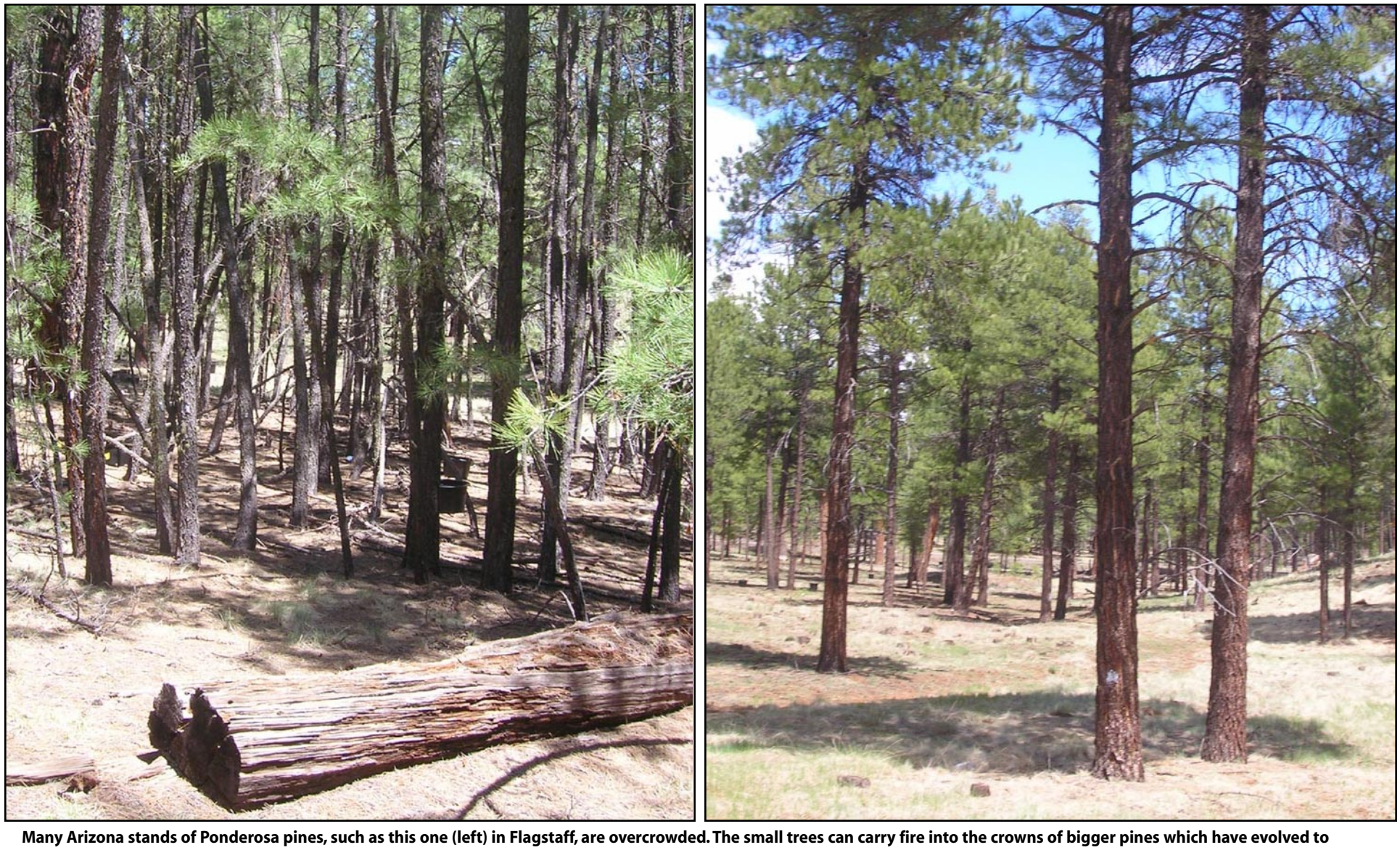
Many Arizona pine forests contain too many small trees that could torch neighboring old-growth trees — and, for that matter, homes. In many water-challenged forests, these small trees can carry fire like a candlewick up to the tops of ancient trees.

Preventing fires, as well intentioned as it is and has been, allowed the growth of saplings that would not have survived a natural fire regime. The tree-ring record documents that before fire suppression efforts began roughly a century ago, fires frequently swept across the forest floor but rarely swooped up into the crowns of old-growth ponderosa pines.

The Rodeo-Chediski Fire, which killed trees in city-sized patches, generally laid down and became a much milder surface fire in areas that had been treated by thinning and/or prescribed burns, as Northern Arizona University researchers documented. What's more, these treated stands also were less likely to degrade into oak-manzanita scrub after the fire.

"Thinning" the small trees can make existing ponderosa pine forests more resilient to drought and higher temperatures as well, because fewer trees are competing for limited water supplies.

It actually costs more to harvest the small trees than a typical business can make on them. In the White



Many Arizona stands of Ponderosa pines, such as this one (left) in Flagstaff, are overcrowded. The small trees can carry fire into the crowns of bigger pines which have evolved to tolerate surface fires, but not crown fires. After "thinning" of small trees (right), preferably followed by prescribed burns, the treated stands are easier for people to walk through and more resistant to crown fires. *Photos courtesy Melanie Lenart*.

Mountains forests hosting the Wallow and Rodeo-Chediski Fires, it can cost $1,000 an acre to get these forest stands into shape with thinning projects. But these treatments clearly can make these pine stands more resistant to the big fires that are projected to increase as the climate warms. Thus, support for such projects can help keep carbon in the woods — by reducing the odds of future forest flambé.

Keeping the landscape forested has benefits that extend far beyond carbon counting and even aesthetics. Forests moderate temperatures below their canopy, keeping the local environment far cooler during summer days and somewhat warmer during winter nights. Forests and wetlands moderate floods and drought, storing excess water in times of high flow and releasing it over time to reduce the downstream impacts of drought. And they clean the water before releasing it, collecting nitrogen and other compounds so they won't spur on algal blooms in rivers, lakes and the ocean.

More forests and wetlands in the Mississippi Basin could reduce the risk from ravaging floods such as the ones we saw this year. Their cleansing skills could help constrict the oceanic Dead Zone — an area of algal growth that makes conditions unbearable for many other life forms — that forms where the Mississippi reaches the Gulf of Mexico. As it is, with nitrogen draining off corn crops as well as record rains, the Dead Zone is expected to reach record proportions this year.

Climate change poses many problems for both East and West, but these problems are made much worse by the way we treat our forests — or don't treat them. The good news is we can tackle some of these land management issues even as we wait for national and global action to reduce the greenhouse gas emissions that warm the planet.

With that in mind, I'd like to share this excerpt from *Life in the Hothouse*. It puts the role of humans into the perspective of Lovelock's theory viewing the Earth — Gaia — as a living system:

> *Wetlands have been called the planet's kidneys, given their role of purifying a dilute toxic stew of chemicals into potable water. This function only works in a healthy system, though. The ongoing destruction of wetlands leaves our planet with the equivalent of one kidney to handle the toxic load of a meth addict who subsists on French fries and whiskey. Forests have been called the planet's lungs. Again, our hacking away at these systems equates to asking an asthmatic chain smoker to run a marathon.*
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> *Are we asking Gaia to do too much with too little? How can we help, instead of hinder, efforts by our planet and its natural systems to control climate and support life? Gaia theory originator James Lovelock has compared humans to the planet's central nervous system, akin to Gaia's brain. It seems the warning signal about global warming has finally penetrated our thick skulls. Now let's hope we will feel an impulse to do something about it.*
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> *Just because a system or a planet can heal from a major assault doesn't mean it will. The wrong behavior can produce a turn for the worse. A person with a fever can recover, under the right circumstances. But if that person tries to pretend nothing's wrong, smoking and drinking the nights away, she or he could turn a mere chest cold into fatal pneumonia. A similar concept applies to the planet. Anyone who imagines that we don't have to worry about our bad habits because Gaia will take care of the mess is missing the point. We are Gaia. We're the ones who must make repairs, along with the other living systems on the planet.*
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> *"We need to begin to understand our symbiotic relationship to Earth," Justin Willie, a Diné of the Navajo Nation, reminded during a 2005 water summit held in Flagstaff, Arizona. "The problem is the solution. It's us."*

Melanie Lenart is an environmental scientist and writer based in Tucson. This excerpt is from Life in the Hothouse: How a Living Planet Survives Climate Change © 2010 Melanie Lenart. Reprinted by permission of The University of Arizona Press.