



By Robert L. Olson and David N. Bengston

ABSTRACT: Megafires are on the rise worldwide, due not only to climate change but also to approaches to combatting fires that paradoxically increase their likelihood. A panel of futurists and two wildfire professionals convened to analyze the complex, interconnected trends in wildland fires in the context of three different scenarios for the decades ahead. They concluded that wildfire managers and the communities they serve need a new approach for managing future fire risk, one that entails more resilience and a less combative relationship with nature.



A WORLD ON FIRE

By Robert L. Olson and David N. Bengston

Wildland Fires on the Rise

WE LIVE IN A WORLD ON FIRE. In just the past few years, major wildland fires have struck at least 13 U.S. states, as well as Indonesia, Australia, China, southern Europe, Russia, Canada, Bolivia, and other parts of the world.

Wildland fires are increasing in number, size, and intensity. In particular, there has been an increase in large fire events—megafires—that account for more than 90 percent of the total area burned. These megafires can cause catastrophic damage in terms of human casualties, economic losses, and environmental destruction.

We project that the trend toward larger and more damaging fires will accelerate, driven by two main factors: climate change and fire suppression policy. Decades of suppressing fires as quickly as possible in the United States have created forests that are filled with an enormous accumulation of forest fuels that would have been cleared out by periodic low-intensity fires in the past. Climate change is creating conditions that make those fuels more likely to ignite: rising temperatures, earlier spring snow melts, longer fire seasons,

Foresight Report

*Spring/Summer
2015*



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Foresight Reports are published periodically by AAI Foresight Inc.
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Freeland, WA 98249

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and more severe droughts. As these wildfires worsen, more people and structures will be in their path due to population growth, especially in the U.S. west and southeast, along with sprawling development patterns and increasing second-home ownership. Managing wildfires will become a far more difficult challenge over the decades ahead.

To stimulate foresight for dealing with this growing threat, the Northern Research Station of the U.S. Forest Service and the Institute for Alternative Futures convened a panel of wildfire professionals and futurists [see Appendix]. This expert Foresight Panel interacted in a series of three structured online discussions, each a week long, held over a six-month period in 2013. We contained the discussion to these limited periods so it wouldn't diffuse away. Between rounds, we prepared summaries, created scenarios based on the views that the participants expressed, and developed new topics and questions for discussion. We told the panelists that, over this six-month period, we expected each of them to put in about 36 hours of total activity (including reading background materials, reflecting, putting forward their own thoughts, reacting to others in the online discussion). The results of these discussions are summarized here.

Major Uncertainties

As soon as the discussions started, the futurists warned that current planning fails to account for the high levels of uncertainty surrounding the conditions and context in which future wildfire management will need to operate. For example, a 2012 Forest Service report estimates that climate change could cause U.S. wildfires to be twice as destructive by 2050. This estimate appears to be based on the assumption that the average global temperature will increase roughly 0.5 degrees Celsius by 2050. But the latest reports from the UN Intergovernmental Panel on Climate Change warn that, if the world continues down its current carbon-emitting course, the average global temperature could rise by up to a staggering 4.8 degrees Celsius (8.6 degrees Fahrenheit) at the end of the century. This is the upper end of a range of estimates, but across much of that range the average temperature by 2050 would increase by a good deal more than 0.5 degrees Celsius.

The futurists argued that many other factors expected to shape the future of wildfire management are more uncertain than is usually assumed. For example, planners typically assume the economic system will fully recover from its recent



problems and remain fairly dynamic, that there will be abundant energy supplies (even if somewhat more expensive), and that the federal government will make laws and assure they are effectively carried out. Such planning assumes that federal, state, and local governments will have the resources to manage growing fire risks.

Some of the Foresight Panel's futurists argued that it is quite possible none of these conditions will be met, because we may be headed into a period of continued decline or even collapse. At the opposite extreme, some of the panelists envisioned dramatic progress in areas like synthetic biology, nanotechnology, artificial intelligence, and robotics, which would have revolutionary impacts and lead to new approaches to wildfire management that are not even on the radar screen today.

Given such large uncertainties and differences in outlook, panel members agreed that their conversations should not be based on any single image of the future; rather, these conversations should be organized around a set of scenarios designed to embrace the range of potential future conditions they see as plausible. The panel facilitators developed three alternative futures to serve as a framework for discussion: a decline/collapse scenario, a moderate growth scenario, and a technology transformation scenario.

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Three Scenarios for 2030 and Beyond

Scenario 1: Decline/Collapse

- Economic growth slows, turning to a decline stretching into the foreseeable future.
- Federal government is increasingly polarized, dysfunctional, and ineffective.
- Government spending sharply declines.
- Progress in science and technology is slowed or derailed in most areas.



- Peak oil is reached, and the natural gas revolution proves shorter-lived than expected; energy prices soar, but industry has limited financial ability to invest in renewables or nuclear facilities.
- Some environmental impacts of stressed ecosystems and severe water scarcities are eased by economic decline.
- Carbon emissions stay high for a time with growing reliance on tar sands and coal, then decline as growth falters.
- Social unrest grows at first, but is eased over time by the rise of local self-sufficiency.

Scenario 2: Moderate Growth

- Economic recovery proceeds; moderate growth continues in the U.S. and global economies.
- Political polarization eases, with some improvement in government functioning.
- Economic disparities and social tensions ease slightly.
- Entitlements and other government programs receive cuts, but spending increases in highest priority areas.
- Technological advances continue, but with few major breakthroughs.
- Energy sees a continuing boom in shale gas and oil, along with significant growth in renewables.
- Pollution, environmental damage, resource depletion, and sprawl all increase.
- Climate change accelerates.
- There is a major increase in wildfires both in the U.S. and globally.

Scenario 3: Technology Transformation

- Rapid technological progress accelerates growth, but there is less emphasis on consumption, more on investment in energy and resource efficiency, renewable energy, advanced manufacturing, and sustainable agriculture.
- Government is revitalized, smaller, and more efficient; budgets are cut in some areas, but spending is heavy in highest priority areas.
- There are major breakthroughs in several areas of technology.
- Energy systems are transformed, with large investments in energy efficiency, clean energy technologies, smart grids, and energy storage.



- Despite growth, environmental impacts and resource depletion are reduced, though global impacts are still high.
- The world experiences unprecedented mobilization to deal with climate change.
- A sense of common purpose animates society, which is highly receptive to innovation; adaptive leadership works toward creating a sustainable future, shifting to clean energy, minimizing climate change, and achieving a higher quality of life.

“Business as Usual” Is Unsustainable

As the discussion turned to how to respond to the wildfire challenge, most of the initial suggestions involved various kinds of technological advances to improve firefighting. As the discussion continued, however, participants became convinced that “tech fixes” are not, by themselves, an adequate response. They would only marginally improve firefighting, which is already highly effective: In the United States, 98 percent of all fires are put out quickly. Moreover, most technology fixes would be unaffordable in a decline/collapse future. More ambitious ideas, like intelligent firefighting “big dog” robots, would only be possible in a technology transformation future. Above all, technology solutions don’t address the fundamental problem of a continuing buildup of forest fuels.

The panelists all eventually came to a sobering conclusion: The wildfire threat will worsen, with no end in sight, as long as the current approach to wildfire management continues. Climate change will increasingly stress many forests, making them more vulnerable to fires. Constant fire suppression and the buildup of fuel will increasingly create conditions for megafires that we cannot control. By always aggressively suppressing fires now, we are transferring worsening fire risks into the future.

One participant summed up the discussion with a quotation from the late economist Herbert Stein: “If something cannot go on forever, it will stop.”

A New Paradigm

After extensive discussion, Foresight Panel members concluded that this increasingly dangerous situation can only be resolved by a paradigm shift in wildfire management; this paradigm shift would involve fundamental changes in worldview, assumptions, and values. The belief that humans are somehow



above or outside of nature and can “conquer” it has contributed to the wildfire management profession’s aspiration to prevent and stop forest fires; as “firefighters,” they are engaged in a war against fire. From this standpoint, the problem today is that more fires are escaping from our control and the solution is to reassert control over nature.

But now, for all the efforts and past successes, highly damaging fires are burning larger and larger areas; if we continue with business as usual, it is virtually certain that this trend will accelerate. Panel members believe that a crisis in wildfire management will emerge at some point, not too far into the future, as the economic, social, and ecological costs of fires increase, butting against the probable limits on the resources to deal with them. The profession will require an increasingly active search for new ideas and a willingness to look at ideas

previously discarded or only weakly acted upon.

“The belief that humans are somehow above or outside of nature and can ‘conquer’ it has contributed to the wildfire management profession’s aspiration to prevent and stop forest fires.”

We can anticipate some aspects of the new paradigm that must eventually come into place. Its worldview will be based on a deeper understanding and appreciation of the complex, self-regulating processes within natural systems, an understanding that teaches us to “go with the flow” of natural processes. This does not mean abandoning efforts to influence natural processes, but rather undertaking those efforts with more humility and respect.

The deeper understanding that has already begun developing is leading to a fuller appreciation of wildfire as a necessary natural process. Across the country and the world, many ecosystems evolved in the presence of frequent wildfire and are “fire adapted.” These landscapes require wildfire to maintain their health. Wildfire increases plant and animal diversity by releasing nutrients into the soil, causing a flush of new plant growth and providing food for forest animals. Some vegetation, like lodgepole pines, need fire to germinate their seeds and stimulate growth. Without occasional visits by fire, these landscapes become unhealthy and overly choked with trees and underbrush.



So the problem, as the panelists came to see it, is not that we need to exert stronger control over natural wildfires. Indeed, there are few areas where natural wildfire still exists in the United States, because the wildland fire community has been so successful in removing wildfire from the nation’s fire-adapted landscapes. And this is the fundamental problem. By eliminating natural wildfire, we have created a worsening situation of high-intensity *unnatural wildfire* fed by the enormous buildup of fuel that natural wildfire would have eliminated.

From this very different point of view, what we need to do is to end the war on fire, deal with the buildup of fuel, return natural wildfire to our fire-adapted landscapes, and learn to live with it. Learning to live with fire is thus part of learning to live in harmony with nature.

Contrasting Fire Management Paradigms

<i>Dominant Paradigm</i>	<i>New Paradigm</i>
“War on fire”	“Work with the flow” of natural processes
Wildfire is destructive	Wildfire is a necessary natural process
Control wildfire on the landscape	Learn to live with fire on fire-adapted landscapes
Prevent and suppress fires	Create fire resilient human and natural communities
The problem is that wildfires are escaping our control	The problem is that always suppressing natural wildfire is creating an unsustainable buildup of fuels which results in dangerous “unnatural fire”
The solution is to apply existing procedures and technologies more strongly to bring fires under control	The solution is to develop a more holistic approach to fire management where local communities, adjacent property owners, and governments work together to co-manage fire risk

Fire Resilient Communities

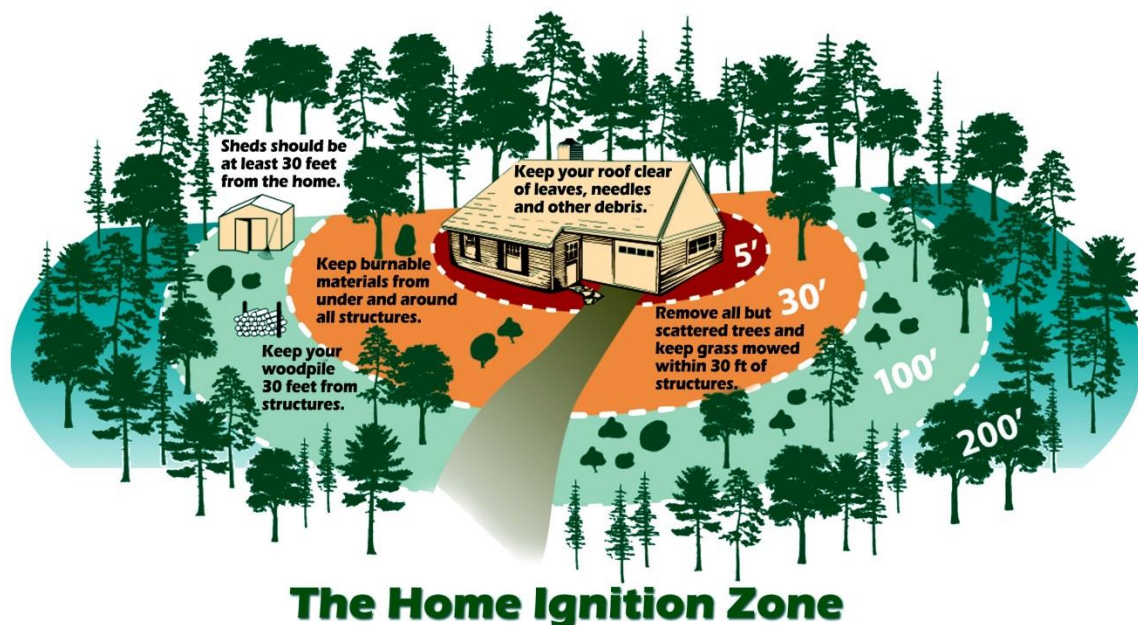
The panelists discussed different ways of implementing this new paradigm, looking for an approach that would be feasible across all three scenarios—even in the decline/collapse future where the economy is bad and the federal government is weak. The best approach, they decided, is what one participant called an “inside-out” protection strategy: Communities in wildland areas take responsibility for becoming *fire resilient*, with or without outside assistance. This



is quite different from today's "outside-in" approach, where many people expect to be protected by large and expensive fire-suppression efforts from the outside.

Both research and extensive direct experience show that residential fire disasters do not have to occur, even during extreme wildfire conditions, when care has been taken to make homes and communities fire resilient. There is no reason why any homes or structures need to be lost to fire if the right protective measures are employed.

Becoming fire resilient requires communities to protect structures with protection zones. The likelihood of a home burning in a wildfire is principally determined by the nature of its *home ignition zone*—that is, its surroundings within 100–200 feet. Eliminating flammable vegetation adjacent to structures to limit ember sources and direct flame contact dramatically increases fire resistance. The other key protective strategy is to make buildings themselves more fire resistant. This requires limiting places where embers can enter and ignite structures and making use of fire-resistant building materials. At minimum, communities can strongly promote these actions, but the most effective approach is for local governments to pass building codes, protection zone requirements, standards for subdivision design, and some minimal land use restrictions to prevent building in very specific, highly dangerous locations, such as at the top of steep ridges.



Wisconsin Department of Natural Resources



As communities make themselves more fire resilient, they can work with adjacent landowners to further limit their fire risk by reducing the amount of fuel in nearby areas. Thinning can be done at any time, and with proper care, fire can be used. Fire is often used today with relatively little risk to rid areas of excessive fuel, and when communities are taking steps to become more fire resilient, the risk would be minimal. As communities and their adjacent areas become more fire resilient, surrounding public lands can be managed to whatever extent can be afforded in order to limit potential fire severity, so that fires burn in a patchy, low-intensity way. The key to this approach is local initiative and shared responsibility between communities and adjacent public or private landowners.

Once communities, adjacent land, and backcountry areas have been made fire resilient, sustainable wildland fire management would then involve maintaining this pattern over time. Loss of life and property would drop sharply, firefighter safety would increase dramatically, and the cost of wildland fire management would fall well below what it is today.

A Difficult but Inevitable Change

Building codes, protection zone requirements, fuel treatment efforts, and all the other elements of this approach are already familiar to wildfire managers. Some of these strategies have already been applied in a number of places. Programs and organizations already exist to support them, such as Community Wildfire Protection Plans that encourage thinning trees and removing understory around homes, the National Fire Protection Association's Firewise Communities program, and the Fire Adapted Communities Program. Federal fuel treatment programs have been in place for many years but have never approached the needed scale. The challenge is to expand all these efforts.

However, there are barriers at every level to the fire-resilience approach. At the national level, there has historically been strong political pressure to put fires out quickly and little understanding of the importance of fuel treatment. Within federal and state fire management agencies, preventing and fighting fires is what people have been trained to do and rewarded for, so getting outside that thinking is difficult. A federal-private "fire industrial complex" is financially and politically vested in continuing the ongoing war on wildfire. Local governments have limited incentives to support land-use planning and building codes, because the costs of suppression and recovery are now primarily handled at the



federal and state levels. Local fire departments often view firefighting as their only legitimate function.

Despite these strong barriers, the fire-resilience approach is highly likely to be adopted over the decades ahead, Foresight Panel members believe. The change will happen in different ways, depending on different future conditions, as outlined in the three scenarios.

If the future evolves along the lines of the decline/collapse scenario, the war on fire would end by force of necessity. With government unable to shoulder much of the fire-protection burden, communities would be forced to assume the primary role themselves through co-management of risk by citizens and adjacent landowners. Communities that fail to accept this role would burn if fire passes

through them. But if communities are proactive and create fire-resilient structures and landscapes, they will survive any fires that occur. If they facilitate creation of fire-resilient landscapes adjacent to their communities, the lands they depend on for their quality of life will survive fire without much harm. Without federal firefighting support, fire will roam on the larger landscape in the way it did pre-settlement, causing damage but eliminating built-up fuel and eventually creating landscape-scale fire resilience.

“If communities are proactive and create fire-resilient structures and landscapes, they will survive any fires that occur.”

If conditions evolve to be more like those in the technology transformation future, panel members believed communities would readily adopt the fire-resilience approach. This approach fits the culture of the scenario, which is open to innovation; supports adaptive leadership; and promotes commitment to moving toward a sustainable future. In a future like this, with ample resources and effective government, the U.S. Forest Service and other government agencies could play a large role in facilitating the shift. The scenario’s high-tech capabilities would provide better tools for fuel treatment, ecological restoration, and communicating and organizing for change. But the scenario’s “cultural fit” with the new paradigm is more important than its technical advances.



In conditions similar to the moderate growth scenario, panelists expect that all the resistances to the fire-resilience approach would stay strong for a long time. Government is not ineffective, as in the decline/collapse future, but neither is it innovative and adaptive. The scenario has enough resources to keep escalating what we are already doing—for a time. Fire risk is growing rapidly in the scenario, and dealing with immediate fire dangers would tend to use up the time and attention needed for reconsidering the whole approach to the problem.

Panelists saw two ways that the shift to a fire-resilience approach might happen in the moderate growth scenario. The preferable way hinges on the influence of a science-based approach to managing risk. Panelists believe, for example, that continuing research may be able to demonstrate that spending a given amount of money on fuel treatment across the western National Forests and other public lands will reduce expected suppression costs by even more. If this proves possible, then the pressure to adopt a new approach might become strong enough to overcome the barriers.

The undesirable way that the shift could occur is with current practices continuing for another generation or two. Landscapes would experience more and more catastrophic fire events, many more firefighters would lose their lives, and fire suppression costs would continue to escalate, until finally the failure of the fire suppression approach could no longer be denied.

The bottom line of the panelists' thinking is that, as conditions change over time, the existing fire suppression approach will fail across the whole range of plausible future conditions, whereas the emerging fire resilience approach works in all those conditions.

Facilitating the Shift Toward Fire Resilience

The Foresight Panel members used the scenarios as a framework for brainstorming measures for facilitating the shift toward fire resilience. Then they focused attention on the most robust ideas—those likely to be workable across a broad range of future conditions. This put the focus on low-cost, easy to manage measures that might be possible even in the conditions of a decline/collapse future.



Many of these actions are already being done on a small scale and only need to be continued and strengthened. Efforts recommended by the Foresight Panel include:

- Do trainings that cultivate an adaptive leadership stance, in which the leader does not have all the answers. A central leadership task is to span organizational boundaries and to facilitate people learning together, experimenting, and cooperating to solve problems.
- Use awards, certifications, and competitions to encourage innovation. For example, create a LEED-type certification program for fire-resistant homes and organize fire resilience design competitions sponsored with architecture schools, landscape architecture programs, and materials science programs at engineering schools.
- Create an ongoing and innovative public relations effort highlighting the fire resilience approach. Shift Smokey Bear's message from "Only you can prevent forest fires" to something like "Only you can make your home and community fire resilient."
- Connect wildfire management to larger global concerns for sustainability and security; low-cost steps could include encouraging organizations like the Worldwatch Institute and the World Resources Institute to conduct studies of sustainable approaches to wildfire management.
- Conduct additional social science research to more fully understand the human dimensions of a fire resilience approach.
- Provide additional "how to do it" information on becoming fire resilient in many forms and through many different channels.
- Utilize "serious games" and playable simulations to train first responders and to engage communities, homeowners, and children.
- Help educate the political community about the true nature of wildland fire problems.
- Support the development of a new fire economics that incorporates long-term thinking and the value of life-supporting ecosystem services.

If more resources are available, many of these actions could be strengthened and many additional actions could be possible, such as rapid expansion of fuel treatment programs or a program to finance fire-resistant home improvements modeled after existing weatherization programs.

If conditions evolve so that strong federal leadership is possible, the federal government could pursue a comprehensive approach to wildland fire



management. This would entail creating a new system of firesheds across the country, each with a fireshed council responsible for all aspects of wildland fire: fuels treatment, preparedness planning, suppression response, fire rehabilitation and recovery, and promotion of fire-resilient land-use building codes and zoning. The federal government could also provide incentives to these local councils, prioritizing investment based on risk ranking and community performance.

Institutionalizing Foresight in Wildfire Management

The Foresight Panel members argued that, to have a lasting effect, foresight efforts need to be ongoing and institutionalized into routine planning and policy making. They identified two main strategies for institutionalizing foresight: An in-house strategy would involve creating an interagency fire futures unit that would be staffed with several trained futurists, with enough budget and personnel to do high quality and continuing foresight. This unit would be responsible for regular horizon scanning and high-priority projects using a range of foresight methods.

An alternative strategy is to have one or more high-level persons assigned specifically to contract with futures research organizations and think tanks, purchasing scans and focused studies on a regular basis, and working closely with fire planners, managers, and policy makers to incorporate the findings into decision making and strategies.

The Foresight Panel produced a comprehensive rethinking of potential wildfire futures with new images of the preferred future and bleak forecasts of what the future could be like if business as usual continues. Their work reinforces the views of a growing number of people in the wildland management community who believe that a new approach to wildfire needs to be developed. It will be fascinating to watch how these ideas play out over the years and decades ahead.

Appendix: Foresight Panel Participants

Futurists:

- **Peter C. Bishop:** retired associate professor of strategic foresight and director of the graduate program in futures studies at the University of Houston; founding board member of the Association of Professional



- Futurists; president of Strategic Foresight and Development. He now directs the Teach the Future program, teachthefuture.org, whose mission is to bring futures thinking to secondary, collegiate, and professional schools.
- **Jamais Cascio:** professional futurist at OpentheFuture.com; distinguished fellow at the Institute for the Future; senior fellow at the Institute for Ethics and Emerging Technologies; co-founder of WorldChanging.com.
 - **James A. Dator:** professor and director of the Hawaii Research Center for Futures Studies, Department of Political Science; former president of the World Futures Studies Federation; co-founder of the Institute for Alternative Futures.
 - **Elizabeth Hand:** Nebula Award winning science fiction author and visionary scenario writer; author of 15 novels and four collections of short stories; faculty member at the Stonecoast MFA Program in Creative Writing at the University of Southern Maine.
 - **Michael Marien:** former editor of *Future Survey*, a scanning service published monthly by the World Future Society (1979–2008); director of GlobalForesightBooks.org; author of numerous articles in leading futures research publications and other scholarly journals.
 - **Jonathan Peck:** president and senior futurist at the Institute for Alternative Futures, whose futures work spans scientific, economic, political, and social changes that can be addressed with an understanding of complex systems dynamics.
 - **David Rejeski:** director of the Science and Technology Innovation Program at the Woodrow Wilson International Center for Scholars; former head of the Future Studies Unit at the U.S. Environmental Protection Agency.

Wildland fire professionals:

- **Sarah McCaffrey:** social scientist with the U.S. Forest Service, Northern Research Station's People and Their Environments research unit; internationally recognized expert on the social dynamics of fire management.



- **John Phipps:** director of the U.S. Forest Service, Rocky Mountain Research Station; former senior adviser in the Deputy Chief's Office, State & Private Forestry, U.S. Forest Service, responsible for developing policy analysis and options for national fire issues.

Organizers and facilitators:

- **Robert L. Olson:** senior fellow and founding board member, Institute for Alternative Futures, and former project director and consultant to the director, Congressional Office of Technology Assessment.
- **David N. Bengston:** environmental futurist, U.S. Forest Service, Northern Research Station, Strategic Foresight and Rapid Response Group.
- **Leif DeVaney** (research assistant): PhD candidate in Conservation Biology at the University of Minnesota.
- **Trevor Thompson** (research assistant): graduate student in the School of Forestry and Environmental Studies, Yale University, and former junior futurist at the Institute for Alternative Futures.

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Cover photo: U.S. Forest Service photo by Mike McMillan.