

Northern Research Station

Rooted in Research

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Looking Ahead to the Future of Forestry

Long-term planning is crucial in forestry, where decisions often need to be made decades in advance. However, anticipating the future is difficult because changes are happening faster and becoming more complex. In addition, many changes that could affect forestry—for example, social trends, technological advances, and economic disruptions—come from fields outside of forestry.

Horizon scanning is about looking for clues that hint at possible futures in a particular sector or industry, even though we can't predict the long-term future with certainty. These signals can come from publications describing emerging issues; technological innovations; and trends in social, economic, environmental, and other domains. Horizon scanning can be a valuable tool for generating foresight in a time of rapid and often surprising changes.

To help natural resource managers and decision makers think about the future, David Bengston, research economist with the U.S. Department of Agriculture, Forest Service, Northern Research Station, established the Forest Futures Horizon Scanning Project, which aims to spot early signs of change (called “scan hits”) that forestry professionals might not notice. The Forest Horizons database has collected more than 4000 scan hits to date.

In a [recent article](#), Bengston and colleagues present signals of change collected in the database. Considering these changes in long-term planning can help decision makers in forestry and natural resource management prepare for the coming decades. As Bengston explains, “Futures research has been a missing piece in the puzzle of understanding the human dimensions of forest management. The goal is to identify and explore emerging signals of change that could affect forestry in the future but may not be on the radar screens of decision makers today.”

Imminent Changes

Growing Indigenous Empowerment: A growing trend in natural resource management, Indigenous empowerment includes the return of Indigenous lands to Tribes, co-management of Federal lands with Tribes, and the rising influence of Indigenous knowledge in environmental science



A piece of glass that was made from wood. USDA Forest Service photo.

KEY FINDINGS

- Horizon scanning can enhance foresight in forestry by identifying emerging signals of change, exploring possible implications, and bringing these signals to the attention of planners and policymakers.
- A recent study identified emerging signals of change—mostly coming from outside of forestry—that could shape the future of forestry.
- The study grouped the emerging signals into those likely to affect forestry in the short term, medium term, and long term.

and natural resource management. This trend could lead to more biodiversity, better carbon storage, and other ecosystem benefits.

Accelerating Climate Migration: Climate change effects like wildfires, heat waves, droughts, floods, and rising sea levels are prompting people to move to safer areas, a trend that researchers expect will speed up in the coming decades. This population shift could affect forest-based communities, leading to values clashes between new and long-time residents but also potentially revitalizing rural areas that have experienced population loss in the past.

Passenger Drones for Tourism and Work: Passenger drones are battery-powered aircraft that take off and land like helicopters but are much cheaper and easier to fly. In forestry, passenger drones could provide recreational access to remote public lands, assist in search and rescue operations, and carry firefighters to hard-to-reach areas.

Possible Medium-Term Changes

Urban Vertical Forests: The first "vertical forest" in Milan, Italy, in 2014, spurred other cities to build tall buildings covered in greenery. Vertical forests have the potential to change urban forestry and arboriculture. In addition, they can offer health benefits, reduce heat, absorb CO₂, lower energy use, support diverse plants and animals, and revitalize cities.

Forests and Health Care: Many studies show that spending time in nature benefits physical and mental health. Forest-based medical interventions have been shown to help humans' cardiovascular and immune systems and reduce depression, anxiety, stress, and negative emotions. Integrating forest management with health care is likely to increase in the future.

Remote Physical Jobs in Forestry: Autonomous robots are now being supervised remotely, with workers controlling them from miles away. This technology, called telerobotics, is expanding from space and military uses to many fields. In forestry, remote workers could someday monitor robots performing tasks such as inventorying forests, planting, pruning, timber harvesting, and firefighting.

Possible Long-Term Future Changes

Lab-grown Wood: Scientists at MIT are growing wood products without using trees, similar to how lab-grown meat is produced without animals. This technology could allow wood products to be grown directly in any shape, eliminating the need to harvest trees, transport logs, and process them in sawmills. Widespread use of lab-grown wood could significantly disrupt traditional forestry and wood product industries.

Abrupt Climate Change: Climate change has been gradual so far, but crossing certain tipping points could cause rapid changes. Potential tipping points include Arctic heatwaves that melt permafrost and release large amounts of greenhouse gases, a significant slowdown of the Atlantic Ocean current, and the collapse of major ice sheets in Greenland and Antarctica. These abrupt changes could happen faster than we can adapt to them.

Implications

These emerging signals of change are diverse. They come from areas outside forestry—architecture, human health, climate, demographic shifts, and technological innovation, to name a few—which highlights the importance of detecting changes that could affect forestry. "A better understanding of the broad

future context for forest management can improve decision making today," explains Bengston, "by helping build resilience to emerging challenges and taking advantage of positive changes that may be on the horizon."



Technological advances, such as the use of passenger drones, could improve recreational access to remote public lands and carry firefighters to hard-to-reach areas. 3D rendering image of a passenger drone. Licensed image by chesky/AdobeStock.

FURTHER READING

Bengston, David N; Westphal, Lynne M; Adelson, Paul; Crabtree, Jason; Dockry, Michael J; Hines, Andy; Kubik, George H; Romero, Maria; Van Stanley, Zach; Zimmerman, Nicole L. 2023. [Emerging signals of change that could shape the future of forestry: a horizon scan](https://doi.org/10.1093/jofore/fvad046). *Journal of Forestry*. 122(2): 152–158. <https://doi.org/10.1093/jofore/fvad046>.

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PROJECT LEAD

[David Bengston](#) is a research economist with the Northern Research Station. His futures research looks at how emerging issues and developments may affect natural resource management in the coming decades, with the goal of improving policy, planning, and decision making.

[Cherie Fisher](#) is the author of this Rooted in Research science brief.

[Forest Service Research and Development](#) works with partners to deliver the knowledge and tools that land managers need to sustain the health, diversity, and productivity of our Nation's forests and grasslands for present and future generations. The Northern Research Station (NRS), one of seven FS R&D units, is rooted in the geography of the Northeast and Midwest. NRS science supports a sustainable future.

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