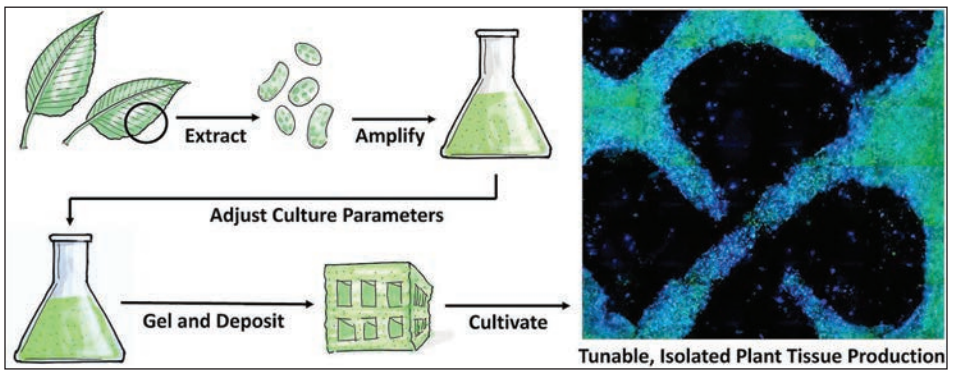
# Lab-Grown Wood: A Potential Game Changer for Forestry and Forest Products

By David N. Bengston




**From Beckwith, Ashley L., Jeffrey T. Borenstein, Luis F. Velásquez-García, 2021. "Tunable Plant-Based Materials via in Vitro Cell Culture Using a *Zinnia elegans* Model." *Journal of Cleaner Production*, vol. 288, tinyurl .com/160syskf.**

The first time I read about lab-grown meat—about seven years ago—I laughed and thought, "That's ridiculous!" The cost was astronomical: $280,000 for a single hamburger patty! How would it be scaled up from a petri dish in a lab to commercial production? And who'd want to eat this reportedly unpalatable product?

Fast forward to today, and the cost of lab-grown meat has dropped dramatically, quality and taste have improved rapidly, and it's being served in restaurants for the first time (Phys.Org 2020). Many start-ups are working to commercialize "slaughter-free" meat, which could someday radically disrupt traditional meat production. The implications for agriculture, ranching, and conservation would be profound.

Now a group of scientists at the Massachusetts Institute of Technology (MIT) have taken the first steps toward growing wood and wood products without trees, like growing meat without animals (Beckwith 2021). This startling and potentially disruptive development has been successfully demonstrated by growing wood-like structures from cells taken from Zinnia (*Zinnia elegans*) leaves. Zinnia was used for several reasons in this proof-of-concept study, including reliable and high rates of differentiation in Zinnia cultures and relatively fast-pace development, allowing for more rapid experimentation. The researchers hope to eventually translate the process to tree species.

The process begins by extracting live plant cells and placing them in a liquid growth medium, where they start reproducing. The resulting batch of cells is transferred to a three-dimensional gel matrix, where they continue to multiply. Plant hormones, including auxin and cytokinin, are added to induce the cells to produce lignin, which gives wood its rigidity. This straightforward process enabled the MIT researchers to produce wood-like structures in the shape of the gel matrix. Changing the levels of plant hormones controls how much lignin the cells produce and alters the structural characteristics of the lab-grown wood.

Although in its earliest stages, the researchers hope that one day this technology will allow wood products to be grown in any form. A dining room set could be grown directly—no need to harvest trees in a forest, transport the logs to a sawmill, process the logs into lumber, transport the lumber to a furniture factory, and so on. In addition to growing solid wood products, the researchers are interested in growing wood fibers that could replace wood pulp for paper production.

If this paradigm-shattering technology develops rapidly, like lab-grown meat, the long-term implications for forestry, forest products, and conservation are mind-boggling. For example, it could result in negative impacts on forest sector employment, with loggers and sawmill workers eventually going the way of lamplighters and switchboard operators. New jobs would be created, but they would be unlike traditional forestry and forest products jobs and would likely be located far from the forests. The economic effect on timber-dependent communities that are already struggling could be severe.

Other implications of the widespread commercialization of lab-grown wood could include more efficient biomaterials production, conservation benefits, and a new paradigm for forest ecosystem management. Many of the potential impacts are unknown and pose important research questions: How would harvesting fewer trees affect atmospheric carbon capture and climate change? How might this innovation affect wildfire in the future? What are the environmental effects of large-scale production? How would consumers respond to this unusual product? An exploration of possible implications of lab-grown wood could be carried out using futures research methods like the Futures Wheel (Bengston 2015).

The small-scale demonstration that wood can be grown in a lab is what futurists call a "weak signal" of change—an early and provocative glimpse into a

**LAB-GROWN ■ Page 17**

# The Figured Maples Project

**The back of a guitar made with figures bigleaf maple wood. Photo: Eric Warner/Pacific Rim Tonewoods.**

Consulting forester John Keller, a long-time member of SAF and retired Washington State Department of Natural Resources forester, has worked for several years on a forest genetics project involving figured big leaf maple. Keller is assisting Pacific Rim Tonewoods (PRT), a manufacturer of acoustic guitar components in northwest Washington. PRT's goal is to develop desirable genetic lines of high-quality figured maple trees suitable for eventual harvest, manufacture, and use in musical instruments.

Bigleaf maple (*Acer macrophyllum*) is a native tree west of the Cascade and Sierra Nevada mountain ranges in British Columbia, Washington, Oregon, and California. Bigleaf maple wood typically has relatively low commercial value, except when the presence of figured wood results in a wider range of higher-value products such as tonewoods, furniture, and specialty items.

According to PRT, it is common to find figuring only near the base of trees and above or below large branches, and the value of this wood is limited. The most sought-after trees have figuring throughout the tree trunk, including beyond where branching begins. Experts broadly agree that no more than one in every 200 to 500 maples has this desirable extent of "superfiguring."

PRT and Keller seek assistance with locating superfigured maples. "If a maple log at least 24 inches in diameter (or exceptionally figured) appears to have high-quality extensive figuring, and the landowner is willing to grant access to the stump, PRT would attempt to find the stump of that log, and uniquely mark both to maintain an identity connection." For more information about the wood and the project, visit http://pacificrimtonewoods .com. FS

## Seeking GIS, Science & Tech Articles

*The Forestry Source* welcomes contributions for the GIS for Foresters and Science & Technology sections. GIS for Foresters articles cover geographic information systems, lidar and remote sensing, tips and techniques for being more productive with ArcGIS and other software, and related topics. Science & Tech focuses on recent research, technologies, and techniques for forestry and natural resources management. These articles are not peer reviewed; they may include references and links to resources. Length: 700 to 1,200 words. High-resolution photos and graphics welcome. Information: Steve Wilent, Editor, 503-622-3033, wilents@safnet.org.

**REFORESTATION** ■ From Page 9

"Maintenance will always be important. Today, in mid-February, the 2020 fire season is not yet incorporated into the data set," Sprague said. "And there will continue to be change. Climate change may continue to drive these massive fires that are making reforestation even more of a challenge for us. Updating the data and making [the information] relevant is going to be one of the key things that we'll need to do."

TNC and American Forests plan to add additional reforestation resources, Sprague said.

"The website will truly become a hub when we can integrate information about reforestation into it—we show people where reforestation can take place, but we also need to show them how to do it, what partners they need to work with, and help with making connections to take that next step toward reforestation. We hope to expand the website to encourage action, beyond just showing where reforestation can occur," he said.

"The hub is ever evolving. We are getting more information and science about the best places to prioritize reforestation, so the hub will be a dynamic place," said Cook-Patton, adding that she would like to see hubs established in other countries and regions.

"We're thinking about doing something in Canada, as well as other parts of the globe," she said. "We've found that there's a lot more value in providing these finer resolution assessments of opportunity, rather than just putting a big number out there that people can't pin to a place." FS

**LAB-GROWN** ■ From Page 10

possible and very different future. This signal is one of several thousand that have been found in the US Forest Service's "Forest Futures Horizon Scanning Project" (Hines et al. 2019), an ongoing effort to identify and explore the meaning of emerging issues and trends that could help shape the future of forestry.

Lab-grown wood products could be a game changer for forests and the forest-based sector. Although in its infancy, it is worth monitoring to avoid being blindsided by rapid, surprising, and disruptive change in the future. FS

*David Bengston is an environmental futurist with the Strategic Foresight Group, Northern Research Station, USDA Forest Service. He can be reached at david.bengston@usda.gov*

**Literature Cited**


Beckwith, Ashley L., Jeffrey T. Borenstein, Luis F. Velásquez-García, 2021. "Tunable Plant-Based Materials via in Vitro Cell Culture Using a *Zinnia elegans* Model." *Journal of Cleaner Production*, vol. 288, tinyurl.com/160syskf.

Bengston, David N. 2015. "The Futures Wheel: a Method for Exploring the Implications of Social-Ecological Change." *Society & Natural Resources*. 29(3): 374-379. fs.usda.gov/treesearch/pubs/50218.

Hines, A.; Bengston, D.N.; Dockry, M.J. (eds.). 2019. *The Forest Futures Horizon Scanning Project*. Gen. Tech. Rep. NRS-P-187. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 81 p. fs.usda.gov/treesearch/pubs/57939.

Phys.Org. 2020. "Lab-Grown Meat to Make Historic Debut at Singapore Restaurant." Dec. 16, 2020. tinyurl.com/29m359qg.


**PREDICTIONS** ■ From Page 12

*of Forest2Market, a global provider of timber pricing, cost benchmarks, and in-depth analytics for participants in the wood raw materials supply chain. Stewart earned a bachelor's degree in forestry from Texas A&M University and a master's degree in forest economics from the University of Georgia. This article, first published on the company's blog (blog.forest2market.com), appears here with Stewart's permission.*

*This article was originally published on Forest2Market's blog (tinyurl.com/vah-13si3) and included predictions for the global chemicals industry in 2021 by Charles Fryer, senior adviser and founder of Tecnon OrbiChem.*

**COMMENTARY** ■ From Page 14

There is also a strong aversion to change. Many assume that the forest conditions they see around them today are the same as existed in the past, and that prior to European settlement, US forests and grasslands were free of human management or influences. This is not true. Even in the face of a changing climate, if western forests were more like they were in the 1850s, the risk of catastrophic wildfire would be substantially reduced. They would also be more ecologically diverse, resilient, and aesthetically attractive than what we have today.

Solutions to this dilemma are not simple or cheap, but the cost of inaction will be far higher, both to human communities and to heathy forest and grassland ecosystems. We must somehow develop the collective will to act. FS

*Doug MacCleery worked in northern California early in his Forest Service career. He was deputy assistant secretary for natural resources and environment in the US Department of Agriculture from 1981 through 1987, then transferred to the Forest Service's Washington, DC, office, where he worked in forest management policy and legislation until he retired in 2010.*

*This essay was first published in Dovetail Partners' monthly newsletter,* The Outlook*, in November 2020 (tinyurl.com/nq79u7gw). It appears here with Dovetail's kind permission. The author thanks Ashley McFarland and others at Dovetail who assisted with producing this essay.*

*This essay also appeared in* Evergreen Magazine *on January 27, 2021 (tinyurl.com/4ketf2su).*

## SAF NEWS

# Libby Chapter Holds South Flower Creek Tour

**By Russ Gautreaux**

**DNRC forester, Dave Marsh (center) describes the ongoing timber sale work being conducted on Montana Department of State Lands in the South Flower Creek area.**

The South Flower Creek watershed, which provides water to Libby, Montana, was severely affected by strong wind events in early February and on March 3, 2020. Soils were very wet at the time, and the resulting blowdown affected at least 1,000 acres, most of which had been previously entered for improvement harvests.

The Libby chapter of the Montana SAF hosted an informational field trip to the area on September 2. The lands in the watershed are a mix of federal, state, and city ownerships. Libby chapter members and key community collaborators provided brief overviews of the various land management and recreational projects being done on US Forest Service, Montana Department of Natural Resources and Conservation (DNRC), and City of Libby properties that were affected by the wind events.

Libby chapter chair Ed Levert described the recently completed salvage of about 20 mbf of blowdown timber on five acres of city property and provided background on previously completed Firewise fuels reduction work. DNRC forester Dave Marsh spoke of the recently completed logging on adjacent state lands and the DNRC's ongoing blowdown salvage of about 425 mbf on 945 acres. Tour organizer April Rainey, a US Forest Service timber sale administrator, described the status of work completed on eight acres on a nearby agency project. She also offered information on local timber and pulp markets and discussed the challenges operators face in marketing logs. Rainey said that the Forest Service project area was minimally impacted by wind, in part because buffer zones protected the areas previously logged.

Eric Johnson, a US Forest Service fuels technician, emphasized the importance of integrating the agency fuels projects with other collaborating land owners who want to reduce fire risk to the watershed and the adjacent town. He described the results of a 78-acre fuels project in which 21 acres where treated with mechanical mastication and 57 acres had lop and scatter treatments. Johnson also provided an overview of the weather and winds that the Flower Creek area receives.

Ben Scott, president of the Kootenai Nordic Club, described the work completed on the ski trail and biathlon course. Scott, a well-travelled outdoor recreation advocate, noted that the success of such projects in other communities has diversified their logging-based economies. The cross-country ski trails have been in place for some time and are well-known by local skiers. The biathlon course, a recent addition, will be marketed primarily to outside visitors. Because of the importance of Flower Creek to Libby's water supply, Kristi Klein, a source water protection specialist with the Montana Department of Environmental Quality, attended the field trip as an observer.

The Libby area chapter of SAF continues its effort to inform our members, stay relevant to our community, and be a visible and effective volunteer organization. The Libby chapter hosted another field trip on October 20, during which representatives of Libby County, the US Forest Service, and the US Natural Resources Conservation Service provided an overview of the Greater Libby Interface Stewardship Project, which encompasses 263,000 acres of public, industrial private, and nonindustrial private forestland surrounding Libby. The project goal is to expand the continuity of past and planned future fuels treatments. FS

*Russ Gautreaux, an SAF Fellow, is the Libby chapter's secretary-treasurer.*