

FORESTS

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Key Messages

Forestlands are a primary land cover, economic driver, and source of environmental benefits for the state of Georgia.

In addition to sequestering enough carbon to offset 23% of our state's emissions annually, forests are keeping our communities resilient to the extreme heat and weather impacts of climate change.

Climate-related stressors are pushing foresters to explore improved land management and novel revenue streams to ensure future timber product yields, clean water, and carbon storage for the state.

Overview

From working timberlands to urban forests, the forestlands of Georgia are vital to our state's economic and community health. 92% of our forests are owned and operated by private citizens and businesses who sell timber and other essential wood products to finance their operations. In addition to the urban trees and parks within our cities, the remaining 8% of Georgia's forests make up state parks, national forests, and other public lands that provide access to recreation for all Georgians. Harvesting trees, replanting seedlings, and managing the landscape allow foresters and land managers to meet the economic and environmental goals of a given forest. Georgia ranks first in the nation for acres of commercial timberland and annual volume of timber harvested. Each year, the Georgia forestry industry provides \$4 billion dollars in salaries and pensions to over 140,000 workers, contributes \$36 billion to the statewide economy, and delivers essential building supplies and energy to the region and the world [1]. In addition to their economic benefit, our forests provide critical environmental and social services to all Georgians, improving air, water, and soil quality, enhancing public health and wellbeing, providing wildlife habitat, and reducing urban heat effects [2].

Our forest ecosystems face mounting risks from “weather whiplash” as climate change increases average temperatures and the frequency of extreme weather events. Although warming temperatures may increase the growth rates of some trees in parts of the southern United States, extended droughts and harsh cold snaps threaten to increase mortality of seedlings and stress older trees, making them more susceptible to insect damage [3, 4]. Hurricane Michael demonstrated the formidable threat of increasingly frequent and intense hurricanes, flattening over \$750 million of forested land in southwest Georgia in 2018 [5,6]. These climate impacts threaten the essential functions and health of our forests and the communities that rely on them.

Preserving Georgia's forests is a critical strategy for mitigating the causes of climate change. Carbon dioxide, a greenhouse gas created by the burning of fossil fuels, is an essential element of plant photosynthesis. Trees bind this molecule in their wood, leaves, and roots as they grow. As cities expand and the demand for new housing increases across the state, population growth and development are increasing pressures on the ownership and use of timberlands. The loss of our forests to urban sprawl and alternate land uses would reduce the state's capacity to sequester carbon dioxide from the atmosphere and provide other essential ecosystem services. Drawdown Georgia, our state's climate solution roadmap, has identified forest resources as one of several necessary solutions for mitigating climate change in Georgia. Today, Georgia's forests sequester enough carbon to offset 23% of the state's annual CO₂ emissions [7, 8].

Forests also play a key role in helping communities adapt to a changing climate and reduce harmful impacts. As Georgia experiences more frequent extreme weather events, forests help to capture and abate floodwaters, reduce erosion, and provide protection from wind damage [9]. As

heat waves become longer and more frequent, urban forests cool communities and homes by 10 degrees Fahrenheit compared to treeless neighborhoods [10, 11]. Communities across the state are realizing the power of trees in addressing the complex causes and consequences of climate change, and they are integrating trees and forests as critical components of resilient urban and rural landscapes. For example, through collaboration with other non-profits and metropolitan municipalities, [Trees Atlanta](#) is well on its way to planting and conserving over 1,000,000 trees by 2030 in the greater Atlanta area [12].

Georgia's forestry industry is responding to climate change by adapting forestry management and practices. Nurseries are breeding faster growing trees to store carbon and mitigate climate impacts, and researchers are mapping the shifting growing conditions to help predict and protect the forests of the future [13, 14, 15]. In the field, foresters manage tree density to reduce competition for scarce resources and increase healthy tree growth [16]. The rebounding use of native longleaf pine, together with prescribed fire, may also provide key solutions to water scarcity, wind damage, and insect damage. Ultimately, well-managed and healthy forests reduce the risk of catastrophic wildfire that are more likely in the future [5, 17]. Forest landowners, managers, non-profits, and environmental groups are rallying behind new ways to incentivize increased tree growth (and delayed harvest) for carbon storage [2]. By rewarding landowners for carbon storage in their forests or water filtration, private marketplaces and public initiatives are helping shape private forest management for the benefit of the public.

Just as the broader threats of climate change are expected to affect people of color, low-income communities, and indigenous communities in Georgia disproportionately, the benefits of forest land ownership and harms of the forestry industry are not equally distributed across the state's population. While female forest land ownership has increased in recent years, historical racial inequities in land ownership remain stark. While more than 30% of the state's population is Black, less than 5% of the state's forest landowners are Black [18]. Polluting industrial sites that process forest products are more likely to be located adjacent to low-income, minority communities [19]. Even prescribed fire, a central ecological land management tool, may disproportionately affect rural Black communities and other populations with lower socioeconomic status in the southeastern United States [20, 21]. Although prescribed fire protects important natural communities and helps prevent more harmful, catastrophic wildfires, fine particulate matter is released during burns that can contribute to asthma, chronic obstructive pulmonary disease, bronchitis, and pneumonia in people who are exposed at high levels [22]. Land managers who use this practice take special training, follow weather guidelines, and are working with researchers to develop best practices to mitigate these health concerns [23]. Substantial economic and environmental justice issues are ongoing topics of concern among landowners, resource managers, policymakers, and community members to ensure healthy forests are enjoyed by all.

Resources

[Drawdown Georgia: Land Sinks](#)

Land and forests can act as a carbon sink, storing carbon by returning it to natural vegetation (i.e., storing carbon in the bark or fiber of a tree). Drawdown GA has compiled a list of actions, including the protection and expansion of land sinks, that could help Georgia reduce its greenhouse gas emissions. The Land Sinks page includes information on temperate forest stewardship, afforestation & silvopasture, and coastal wetlands.

[Georgia Forestry Commission](#)

The Georgia Forestry Commission's Carbon Sequestration page details how the Georgia Carbon Sequestration Registry works, answers common questions about carbon sequestration, and provides a list of helpful resources (both internal and external). The Georgia Forestry Commission's website also includes sections on other forest management and conservation topics, fire prevention and suppression, the forest industry, and urban and community forestry.

[Adaptive Silviculture for Climate Change](#)

Silviculture refers to the sustainable management of all aspects of a forest considering the needs of landowners and society, and its practices include planting, pruning, and regeneration harvest. The Adaptive Silviculture for Climate Change project was designed to study how to best integrate adaptation measures into silviculture practices while still meeting management goals. The project is testing different approaches at diverse trial sites across the country, including one site in southwest Georgia.

[Forests & Water Connection Initiative](#)

The health and management of forests have implications for water resources that flow through or depend on the forests. Well-managed forests can reduce soil erosion and moderate water flow and, in turn, reduce the need for water treatment down the line. Water providers and users save energy and money when benefiting from these processes which are sometimes referred to as ecosystem services. The Forests & Water Connection Initiative seeks to establish a market for ecosystem services in Georgia.

[Georgia Forestry Foundation](#)

The Georgia Forestry Foundation acknowledges the power of forests to reduce atmospheric carbon and supports efforts to sustain working forests across the state. The foundation's work focuses on opportunities for forest landowners to engage in carbon reduction projects through forest carbon markets and on supporting the development and use of sustainable building practices.

[Georgia Prescribed Fire Council](#)

Despite the potential side effects described above, prescribed fires are a longstanding and essential component of forest management. The Georgia Prescribed Fire Council is a group of

state, federal, and private partners who share information and expertise about the proper application of prescribed fire. The council's website includes educational information, event updates, and links to related resources.

References

1. Enterprise Innovation Institute at Georgia Tech. *Economic Benefits of the Forest Industry in Georgia: 2019*. (Georgia Forestry Commission, 2019).
2. Forest and Water Connection Initiative. <https://www.forestsandwater.org/> Accessed 11/15/21.
3. Thomas, R. Q., Jersild, A. L., Brooks, E. B., Thomas, V. A. & Wynne, R. H. A mid-century ecological forecast with partitioned uncertainty predicts increases in loblolly pine forest productivity. *Ecological Applications* 28, 1503–1519 (2018).
4. Woodbury, P. B., Smith, J. E., Weinstein, D. A. & Laurence, J. A. Assessing potential climate change effects on loblolly pine growth: A probabilistic regional modeling approach. *Forest Ecology and Management* **107**, 99–116 (1998).
5. Rutledge, B. T., Cannon, J. B., McIntyre, R. K., Holland, A. M. & Jack, S. B. Tree, stand, and landscape factors contributing to hurricane damage in a coastal plain forest: post-hurricane assessment in a longleaf pine landscape. *Forest Ecology and Management* **481**, 118724 (2021).
6. Palmer, W., Sisson, D.C., Hiers, K., 2019. Hurricane Michael Damages Forest Lands. Tall Timbers. URL <https://talltimbers.org/hurricane-michael-damages-forest-lands/> (accessed 2.8.22).
7. Dwivedi, P. & Mohan, J. Land Sinks Solutions Sector | Drawdown Georgia. *Drawdown Georgia* <https://www.drawdownga.org/solutions/land-sinks/>. Accessed 11/15/21.
8. Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Nichols, Michael C.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2021. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2019. Resource Update FS-307. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. [plus 2appendixes]. <https://doi.org/10.2737/FS-RU-307>.
9. Moore, R., Williams, T., Rodriguez, E. & Hepinstall-Cymmerman, J. Quantifying the value of non-timber ecosystem services from Georgia's private forests. 51. January 2011.

10. US Environmental Protection Agency. Reducing urban heat islands: Compendium of strategies. (2008).
11. Arbor Day Foundation. *The Urban Heat-Island Effect*. <https://www.arborday.org/trees/climatechange/heatland.cfm>. Accessed 1/11/22.
12. Trees Atlanta. *History*. <https://www.treesatlanta.org/who-we-are/history/> Accessed 1/11/22.
13. Matallana-Ramirez, L. P., Whetten, R. W., Sanchez, G. M. & Payn, K. G. Breeding for Climate Change Resilience: A Case Study of Loblolly Pine (*Pinus taeda* L.) in North America. *Frontiers in Plant Science* **12**, 790 (2021).
14. Samuelson, L. J., Stokes, T. A. & Johnsen, K. H. Ecophysiological comparison of 50-year-old longleaf pine, slash pine and loblolly pine. *Forest Ecology and Management* **274**, 108–115 (2012).
15. Adaptive Silviculture and Climate Change. *Silviculture & Climate Adaptation*. <https://www.adaptivesilviculture.org/silviculture-climate-adaptation> Accessed 1/11/22.
16. Boyle, M. F., Hedden, R. L. & Waldrop, T. A. Impact of prescribed fire and thinning on host resistance to the southern pine beetle: preliminary results of the national fire and fire surrogate study. Gen. Tech. Rep. SRS-71. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 5. (2004).
17. Kirkman, L. K. *Ecological Restoration and Management of Longleaf Pine Forests*. (CRC Press: Taylor & Francis Group, 2017).
18. Goyke, N. & Dwivedi, P. Ascertaining differences between farmer and non-farmer African American forest landowners in Georgia, United States. *Trees, Forests and People* **5**, 100118 (2021).
19. Koester, S. & Davis, S. Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States. *Environmental Justice* **11**, 64–70 (2018).
20. Afrin, S. & Garcia-Menendez, F. Potential impacts of prescribed fire smoke on public health and socially vulnerable populations in a Southeastern U.S. state. *Science of The Total Environment* **794**, 148712 (2021).

21. Johnson Gaither, C., Afrin, S., Garcia-Menendez, F., Odman, M.T., Huang, R., Goodrick, S., Ricardo da Silva, A., 2019. African American Exposure to Prescribed Fire Smoke in Georgia, USA. *International Journal of Environmental Research and Public Health* 16, 3079. <https://doi.org/10.3390/ijerph16173079>
22. Cascio, Wayne E. "Wildland fire smoke and human health." *Science of the Total Environment* 624 (2018): 586-595.
23. Campbell, J.H., Fawcett, J.E., Godwin, D.R. & L.A. Boby, 2020. Smoke Management Guidebook for Prescribed Burning in the Southern Region. University of Georgia Warnell School of Forestry and Natural Resources. Outreach Publication WSFNR-20-91A (Nov 2020).