Environmental Reviews

OPEN ACCESS | Perspective

A perspective on black ash decline in eastern North America: ecological insights, cultural importance, and urgent research needs

Amy R. Wotherspoon[a], **Alexandre F. Nolin**[b], **Nathan W. Siegert**[c], **Jeffery P. Dech**[d], **Jacques C. Tardif**[e], **Anthony W. D'Amato**[f], **Jérôme Laganière**[g], **River D.R. Mathieu**[h], **Laurence Boudreault**[i,j], **John Daigle**[k], **Les Benedict**[l], **Samuel Dufour-Pelletier**[m], **Cathy Duguay**[m], **Georges-Étienne Charette**[n], **and Alexis Achim**[i]

[a]Department of Forest Resources Management, University of British Columbia, 2424 Main Mall, Vancouver, BC V6T 1Z4, Canada; [b]Laboratory of Tree Ring Research, University of Arizona, 1215 E. Lowell St., Tucson, AZ 85721, USA; [c]US Forest Service, State, Private & Tribal Forestry, Eastern Region, Forest Health Protection, 271 Mast Rd., Durham, NH 03824, USA; [d]Department of Biology, Chemistry and Geography, Nipissing University, 100 College Dr., North Bay, ON P1B 8L7, Canada; [e]Centre for Forest Interdisciplinary Research, Department of Biology, The University of Winnipeg, 515 Portage Ave., Winnipeg, MB R3B 2E9, Canada; [f]Rubenstein School of Environment and Natural Resources, University of Vermont, Aiken Center, 81 Carrigan Dr., Burlington, VT 05405, USA; [g]Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, Canadian Forest Service, 1055, du P.E.P.S., PO Box 10380 Stn. Ste-Foy, QC G1V 4C7, Canada; [h]Department of Entomology, Michigan State University, East Lansing, MI, USA; [i]Centre de recherche sur les matériaux renouvelables, Département des sciences du bois et de la forêt, Université Laval, 2425 rue de la Terrasse, QC G1V 0A6, Canada; [j]Bureau du Ndakina, W8banaki, 10175 Rue Kolipaio, Wôlinak, QC G0X 1B0, Canada; [k]Tribal member of the Penobscot Indian Nation; School of Forest Resources, University of Maine, 221 Nutting Hall, Orono, ME 04469, USA; [l]Tribal member of the Saint Regis Mohawk Tribe; Akwesasne Task Force on the Environment, Hogansburg, NY 13655, USA; [m]Bureau environnement et terre d'Odanak, Conseil des Abénakis d'Odanak, 104, rue Sibosis, Odanak, QC J0G 1H0, Canada; [n]Bureau Environnement de Wôlinak, Conseil des Abénakis de Wôlinak, 10120 Rue Kolipaïo, Wôlinak, QC G0X 1B0, Canada

Corresponding author: **Amy R. Wotherspoon** (email: amy.wotherspoon@ubc.ca)

Abstract

Black ash (*Fraxinus nigra* Marsh.) is a keystone species of wetlands and riparian ecosystems across northeastern North America. It is also culturally significant to Indigenous communities whose practices, livelihoods, and spiritual traditions are connected to the species. Today, black ash is threatened by compounding threats from climate change and the exotic emerald ash borer pest (*Agrilus planipennis Fairmaire*), which has caused extensive mortality across its range. The loss of black ash carries profound ecological and cultural consequences ranging from altered water balance of unique wetland habitats to the loss of centuries-old basket-making traditions. From this perspective, we assess the ecological role, cultural importance, and management responses associated with the decline of black ash. We synthesize evidence on its vulnerability to the emerald ash borer, explore emerging conservation strategies to support its persistence, and outline approaches to its potential restoration. Underlining these themes, we consider the importance of integrating Indigenous Knowledge systems with Western science to guide decision-making and ensure cultural continuity. Looking forward, we argue for a renewed research agenda centered on ecological monitoring, scenario planning, and collaborative governance. Advances in remote sensing, climate-envelope modeling, and genetic conservation provide promising tools to design adaptive management strategies to suit a changing environment for this species. Equally critical is the recognition of Indigenous-led initiatives, which should protect black ash for cultural use but also provide models for co-management founded in resilience and reciprocity. By highlighting these ecological, cultural, and social dimensions of black ash decline, this perspective calls for urgent, coordinated action while a critical window of opportunity remains for effective conservation of black ash.

Key words: *Fraxinus nigra*, emerald ash borer, Traditional Ecological Knowledge, climate change adaptation, forest restoration

Introduction

Black ash[1] (*Fraxinus nigra* Marsh.) is a foundational species in deciduous wetlands, floodplains, and riparian areas of northeastern and north-central North America (Fig. 1A). It often dominates sites uninhabitable by other tree species and contributes to the regulation of local hydrology, nutrient cycling, and other key ecological functions of wetlands (Palik et al. 2011; Slesak et al. 2014; Grinde et al. 2022). Black ash is also a culturally significant species for numerous Tribal Nations in the United States and First Nations in Canada, and is intrinsically linked to their cultural identity, spirituality, and ways of life (Benedict and David 2000; COSEWIC 2018). It is commonly used in ceremonial and medicinal contexts (Pelletier 1982; Erichsen-Brown 2013; Saint-Arnaud et al. 2024), and in centuries-old basketry traditions (Pelletier 1982; Costanza et al. 2017; Boudreault et al. 2024).

The future of black ash in North America is imperiled by the invasion of emerald ash borer (EAB; *Agrilus planipennis* Fairmaire), a phloem- and wood-boring beetle native to Asia (Siegert et al. 2014, 2023). Black ash is now considered a critically endangered species on the International Union for Conservation of Nature (IUCN) red list (Barstow et al. 2018) due to the vulnerability of North American ash species to EAB (Herms and McCullough 2014; Siegert et al. 2021; Mathieu and McCullough 2025). Together with additional pressures from habitat conversion (Catling et al. 2022), unexplained pre-EAB regional declines (Trial and Devine 1994), anticipated stressors from climate change (Iverson and Prasad 2002), and the introduced risks of known ash pathogens from Europe (i.e., *Hymenoscyphus fraxineus* that causes ash dieback (Nielsen et al. 2017)), these threats jeopardize the persistence of black ash on the landscape, as well as the ability of Indigenous communities to access and steward this culturally important species.

The loss of black ash from the landscape would leave a unique and important niche significantly altered. Black ash mortality changes evapotranspiration and water table levels (Slesak et al. 2014; Van Grinsven et al. 2017; Shannon et al. 2018), influences carbon and nitrogen cycling (Kolka et al. 2018; Davis et al. 2019), affects food webs (Youngquist et al. 2020), and reduces biodiversity and productivity across wetland ecosystems (Palik et al. 2012; Youngquist et al. 2017; Diamond et al. 2018). These losses do not account for the economic impacts nor the unmeasurable cultural harm experienced by Indigenous communities (Costanza et al. 2017; Siegert et al. 2023).

[1] Black ash carries many Indigenous names that reflect its traditional uses and cultures throughout its range. Some English and common names include black, brown, swamp, basket, hoop, water, and splinter ash. Indigenous names include Kakitéwi Maskominátik (Cree), Ehsa (Mohawk), Baapaagimaak, Aagimaak (Ojibwe), wisqoq or wisco (Mi'kmaq), wikp (Maliseet), Pse khti chan sapa (Dakota), Li frenn nwayr (Michif), Maalhakws (W8banaki), and Atshimashk[u] (Pessamiulnuat Ilnu). Other names remain preserved primarily through oral tradition and do not have standardized Latin-alphabet spellings. We acknowledge their importance and cultural relevance but have chosen to not include the full list of Indigenous names here to maintain focus of the review.

Despite this urgency, research on black ash lags compared to more commercially valued ash species, such as white ash (*Fraxinus americana* L.) and green ash (*Fraxinus pennsylvanica* Marsh.). At a broader scale, the loss of mature black ash trees from the landscape has implications for several disciplines of scientific research. This includes limiting our ability to measure, monitor, manage, and conserve this endangered species, while simultaneously limiting Indigenous access for cultural activities. Critical gaps in knowledge remain with respect to site-specific growth dynamics and natural successions, genetic diversity, and long-term viability of regeneration following EAB invasion. This is especially difficult with fewer old-growth stands and long-lived black ash trees across its range. Limited mapping and monitoring of this non-commercial species constrain our ability to track population changes. Black ash also remains underrepresented in seed banking and propagation programs (Abhainn et al. 2024). Such barriers challenge adaptive management, conservation practices, and efforts by Indigenous communities to inventory and conserve culturally significant stands in traditional harvesting areas. The collection and distribution of this information are essential in creating co-knowledge, dialogue, and connectedness between Indigenous Knowledge and Western science in the study, management, and conservation efforts of black ash across eastern North America.

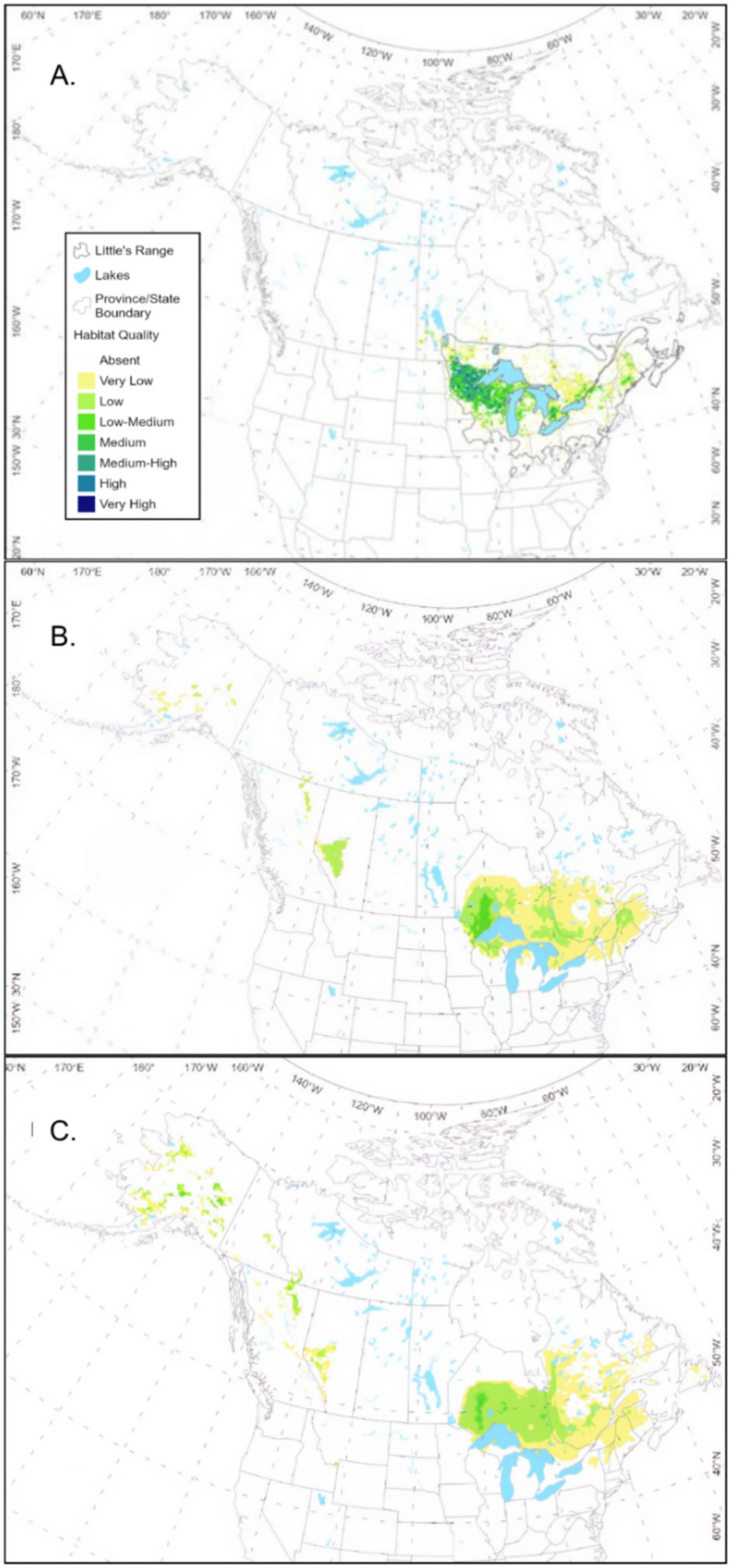
Contemporary factors threaten to functionally extirpate black ash in the next 1–2 decades (Siegert et al. 2023). Yet while mature trees persist, there remains an opportunity to consolidate and advance ecological, silvicultural, and cultural knowledge. In this perspective paper, we argue that the fate of black ash needs to be reframed, not only as a problem of pest management, but as a biocultural crisis requiring transdisciplinary, integrated responses. We critically assess how the loss of mature black ash limits both scientific and cultural knowledge, identify shortcomings in current management and conservation strategies, and call for renewed attention to future-oriented tools such as ecological monitoring, future scenario planning, and genetic conservation. Equally, we stress that Indigenous Knowledge be embedded at the core of black ash research agendas, guiding priorities and shaping collaborative frameworks for long-term resilience.

Ecological and cultural significance of black ash

Black ash is a foundational and keystone species, as well as a culturally important species for Indigenous communities. As a foundation species, its structural and functional attributes contribute to the creation of habitats that are central to its community and ecosystem (Dayton 1972; Ellison et al. 2005). In wetlands, the foundational role of black ash is highlighted by its capacity to regulate evaporation and site water balance (Slesak et al. 2014) and strongly influence primary production and food web structure (Youngquist et al. 2017, 2020). It imparts strong controls on understory species composition, hydrology, and nutrient cycling (Palik et al. 2021*b*; Grinde et al. 2022; Siegert et al. 2023), particularly on hydric

Environ. Rev. **34:** 1–11 (2026) | dx.doi.org/10.1139/er-2025-0198

Fig. 1. USNAP habitat quality model (Prasad et al. 2024) of *Fraxinus nigra* in North America using (A) Little's "Atlas of the United States Trees" range maps and the projected likelihood of colonization under both (B) moderate and (C) greenhouse gas emission by 2100. Projections do not consider future dispersal and spread of the presently expanding emerald ash borer invasion.



sites that are less favoured by other tree species. These unique conditions in lowland forests have been described as the wet niche of black ash (Slesak et al. 2014), where few other tree species are capable of regenerating on such sites (Tardif and Bergeron 1999; Looney et al. 2018; Toczydlowski et al. 2020; Springer and Dech 2021).

As a keystone species in wetland environments, black ash has a greater impact on the community than expected for its given abundance. This involves mediating interactions among species and ultimately influencing diversity (Paine 1969; Power et al. 1996). Experimental removals of black ash populations have reduced transpiration and evaporation, delayed water table drawdown, and eventually increased water table depth (Slesak et al. 2014; Van Grinsven et al. 2017; Shannon et al. 2018). Studies have also found that without high-nitrogen black ash litter, there are corresponding changes in nitrogen and carbon cycling, productivity, and decomposition (Kolka et al. 2018; Davis et al. 2019), which, in turn, affects food web structure (Youngquist et al. 2020). Black ash removal from sites where it currently predominates would likely cause a shift in dominance from woody to herbaceous vegetation (Diamond et al. 2018) and open-canopy meadows (Palik et al. 2012; Youngquist et al. 2017), as no other co-occurring tree species can survive long-term in these wet hydrologic conditions (Palik et al. 2012, 2021*a*, 2021*b*; Bolton et al. 2018). Loss of black ash would not only increase fluxes of N_2O and CH_4 from soils (Toczydlowski et al. 2020) but would also result in the loss of distinct habitats for vertebrates (Grinde et al. 2022) and various specialists of ash trees (Gandhi and Herms 2010). Loss of black ash would also alter habitat structure and forage resources for a wide variety of organisms, including birds, small mammals, moose (*Alces alces* L.), and white-tailed deer (*Odocoileus virginianus* Zimmermann), much of whose associated biodiversity remains poorly documented. Black ash habitats are also known to host fragile and critically endangered species, such as flooded jelly skin (*Leptogium rivulare* (Ach.) Mont.), a lichen that is listed as a species of special concern in Canada given the expected habitat loss associated with rapid EAB-related black ash mortality (COSEWIC 2015). Yet, many of these organisms are cryptic, inconspicuous species (e.g., bryophytes (Caners 2020); arthropods (Gandhi and Herms 2010)) that are often overlooked in research and conservation efforts.

Black ash holds cultural significance in Indigenous creation stories and as an identity symbol for Indigenous communities across eastern North America. Garibaldi and Turner (2004) introduced the concept of a cultural keystone species as a culturally important species that shapes the identity of a group of people through its relevance to diet, material use, medicine, or spirituality. For First Nations in Canada and Tribal Nations in the United States, black ash is deeply embedded in their cultural traditions (Diamond and Emery 2011; Frey et al. 2019; Boudreault et al. 2024). This includes its use in Indigenous medicine and basketry, of which knowledge and practices are passed down through generations and are sources of heritage connection (Costanza et al. 2017; Saint-Arnaud et al. 2024). Beyond its symbolic role, basketry has long provided an important means of livelihood, linking cultural expression with economic autonomy while also integrating ecological knowledge. Basket makers and basket-tree harvesters, for example, carefully select “basket-quality” trees to pound logs to separate tree rings into splits (Boudreault et al. 2024), illustrating how ecological knowledge is embodied in skilled craftmanship and passed on through generations.

Indigenous practices have motivated much of the recent ecological research of black ash forests in the eastern United States and Canada. Task forces formed by Indigenous communities and researchers have been established to address the potential loss of black ash trees from the landscape and to guide cultural management and conservation practices (i.e., D’Amato et al. 2023*a*). While many individual Nations have developed management and best practice guides, there remains limited communication across international borders, and uptake of traditional ecological knowledge (TEK) (Menzies and Butler 2006; Asselin 2015) into broader management practices has been slow.

Distribution and ongoing decline

Across its north-central and northeastern North America range, black ash occurs as a dominant species on sites with poor drainage and high nutrient availability where seasonal waterlogging limits competition with other species. In its northernmost range, such as the Great Lakes–St. Lawrence Forest (Springer and Dech 2021) or the clay belt of Ontario–Quebec Boreal Forest (Tardif et al. 1994; Tardif and Bergeron 1997) regions, black ash often forms near-pure stands in lowland floodplains. Elsewhere, it is often found in wetland forests as a key species to the black ash–American elm–red maple forest cover type in the United States and Canada (Rudolf 1980; Ehrenfeld et al. 2012), but can also occur as a component of a wide spectrum of mixed broadleaf-conifer forests. Within Canada, black ash is estimated to cover only 0.01% of Canada’s relative area, the equivalent to approximately 34 500 ha (Hermosilla et al. 2022). By comparison, it is estimated to cover over 1000 000 ha across wetlands of Michigan, Wisconsin, and Minnesota of the United States (Kolka et al. 2018; Fig. 1).

Decline of black ash stands has been observed on relatively drier site types since the 1980s with crown dieback and reduced wood quality reported prior to EAB arrival and establishment in North America (Trial and Devine 1994; Siegert et al. 2014). As a shallow-rooted species, black ash is susceptible to water table fluctuation and freeze–thaw injury. For this reason, some decline has been attributed to spring drought, excessive soil moisture, advanced age and senescence, or proximity to roads in relation to hydrological flow or toxicity from de-icing salt (Livingston and White 1997; Palik et al. 2011). However, the detection of the EAB in North America in the early 2000s has been responsible for near-complete mortality in affected black ash stands with more than 95% basal area losses consistently observed in post-invasion forests (Siegert et al. 2021; N.W. Siegert, unpublished data). These levels of mortality are expected across the species range through 2050 based on recent modeling efforts utilizing observed EAB spread rates and impacts on black ash inventory (Siegert et al. 2023). Unfortunately, due to perceived low economic importance and location within relatively small spatial units, more detailed information and mapping of black ash distribution remains limited (Wilson et al. 2012).

Black ash decline due to the EAB is expected to reduce its percent land area coverage across the eastern United States by up to 70% depending on climate change scenarios (Iverson and Prasad 2002). However, warming temperatures at northern latitudes (Wotherspoon et al. 2024) also suggest increased suitable habitat for black ash northward from its current range limit at 40–50°N towards 50–60°N (Morin et al. 2008) (Fig. 1B and 1C). Nevertheless, current projections suggest that EAB will functionally remove black ash from across its range by 2045, including for 98% of Indigenous communities in the United States by 2035 (Siegert et al. 2023). When considering the interactions between EAB and climate change, estimating future growth projections for black ash remains challenging. This is, in part, because recent research has been focusing on potential replacement species of black ash to mitigate biomass loss and changes to ecological functions due to its decline (Palik et al. 2011; Iverson et al. 2016; Bolton et al. 2018). Rather than accepting the extirpation of black ash from the landscape, monitoring should remain ongoing to track its abundance and distribution to accurately model future loss. These data would also be essential in highlighting regions of conservation or preservation, particularly if they are occurring on lands with Indigenous access.

The need for coordinated data collection, distribution mapping, modeling, and scenario planning

Ongoing efforts to monitor, manage, and promote awareness of the significance of black ash forests have advanced over the past two decades but remain limited in scope, are geographically fragmented, and are insufficiently integrated with Indigenous Knowledge and priorities. The scarcity of data on the distribution of black ash presents a significant challenge for informed conservation and management decisions. Notably, it impedes efforts to continue examining the silvics of black ash, assess population size trends and climate–soil-growth relationships for habitat distribution assessments. It remains difficult to identify priority conservation areas, particularly in regions most affected by EAB infestation and in northernmost areas critical for facilitating the species' range expansion under climate change. This further limits Indigenous access, particularly in regions where private land ownership prevents traditional gathering and access.

Monitoring efforts for black ash remain limited with few long-term datasets tracking regeneration success, stand dynamics, or treatment outcomes. Remote sensing technologies and national forest inventories may help overcome these limitations by mapping canopy decline, hydrological shifts, and post-EAB successional trajectories. These inventories are beginning to be used to identify distribution and land cover changes to major leading species across North America, although some are currently limited in detecting black ash (Wilson et al. 2012; Beaudoin et al. 2014; Host et al. 2020; Hermosilla et al. 2022). Promising local-scale approaches have been proposed, including those calibrated with environmental variables (Isaacson et al. 2012; Engelstad et al. 2019), approaches leveraging black ash phenology (Wolter 1995), and techniques utilizing hyperspectral signatures (Furniss et al. 2022). While these methods are currently limited to a regional scope, larger scale monitoring and mapping would aid in informing projected distribution and dispersal patterns across the entire range of black ash. These new range maps, coupled with information on the potential influence of climate change, could be used to better predict black ash response to novel conditions affecting these important wetland forests, such as greater evaporative demand, long-term endemic EAB infestation, and changes to site hydrology due to loss of the black ash overstory.

Climate envelopes and species distribution modeling under climate change scenarios represent a promising avenue for future landscape-scale planning and restoration efforts. With the improvement of models that can be used to accurately map the climate niche of black ash, future projections of habitat suitability can be similarly mapped under changing scenarios (Iverson and Prasad 2002; Morin et al. 2008; Gustafson et al. 2025). When combined with species dispersal dynamics and the potential spread of EAB, such tools would allow for scenario-based planning that could identify future refugia, range contraction zones, and regions where restoration and management interventions would be the most critical and the most effective. These projections could then be considered with proximity to Indigenous communities or locations of basket-quality stands to help prioritize monitoring, management, seed collection, or assisted migration. These integrations could also support conservation policies that proactively account for both ecological change and cultural continuity.

Restoration and silviculture in the presence and absence of emerald ash borer

Preventative silvicultural treatments prior to, and during, invasions of EAB have historically aimed to emphasize stand resilience against stressors. Given the high range of soil moisture in which black ash is found, different systems have been proposed for different site types. Group and single-tree selection systems have been suggested on wet organic sites to maintain canopy closure, support black ash replacement species regeneration, maintain water table levels, and to achieve wildlife habitat goals (Slesak et al. 2014; Looney et al. 2015; Palik et al. 2021*b*; Springer and Dech 2021). Even-aged methods such as shelterwood systems have been recommended on poorly drained mineral soils owing to the low frequency of seed crops. In either method, some regeneration from black ash stump sprouts is also reliable (Erdmann et al. 1987). Timing of silvicultural treatments relative to EAB invasion is likely to be a critical factor in successful black ash persistence through regeneration from stump sprouts, given that stump sprouts from EAB-killed black ash have low vigor and little to no long-term survivorship (Siegert et al. 2021; N.W. Siegert, unpublished data).

In recent years, restoration research has largely focused on mitigating ecosystem collapse following EAB-induced mortality, particularly in the Great Lakes region. Experimental planting of alternative species such as red maple and swamp white oak has been tested to maintain canopy cover, hydrology, and carbon cycling (Bolton et al. 2018; Palik et al. 2021*b*). These species, and others, are often already components of some black ash habitats (Engelken et al. 2020; Siegert et al. 2021; N.W. Siegert, unpublished data). Such trials suggest that mixed-species approaches may help sustain ecosystem services, yet restoration efforts are challenging due to the variability of site hydrology, particularly in post-EAB infestation conditions, and because of the lack of long-term data on black ash survival in restored conditions.

Evaluation of integrated pest management treatments is underway, including application of systemic insecticides and release of parasitoid, and other biological control agents aimed at suppressing EAB infestations while promoting recruitment and regeneration in black ash stands. While the impact of parasitoid release is still unknown (Herms and McCullough 2014), systemic insecticide injections have been highly successful in forest settings on individual trees (D'Amato et al. 2023*b*), and some (e.g., emamectin benzoate) have demonstrated effectiveness for up to 3 years (Herms and McCullough 2014; Herms et al. 2019). Furthermore, the Odanak and W8linak First Nations of Quebec found success using azadirachtin to protect trees in communities and through a partnership with forestry companies to provide basket-quality black ash. While promising, these insecticide treatments have traditionally been limited to use in residential and urban arboriculture, leaving remaining questions about their scalability in forested landscapes. Recent work, however, has demonstrated the potential for these treatments across broad landscapes to control EAB outbreaks (Castrillo et al. 2010; Srei et al. 2020), preserve basket-quality trees, protect seed-producing overstory trees, and sustain ash genetic diversity (D'Amato et al. 2023*a*).

Significant challenges still remain to the restoration and silviculture of black ash. In many cases, black ash remains the dominant source of regeneration in stands after EAB-induced mortality of overstory trees or pre-EAB silvicultural treatments (e.g., Engelken et al. 2020; Siegert et al. 2021) making successful regeneration of black ash the key for its conservation. For this reason, avoiding the regeneration of non-ash species, invasive species or altering site conditions during regeneration harvests is critical. However, endemic EAB populations will continue to threaten unprotected black ash regeneration as it grows into larger diameter classes, and other non-ash tree species may require artificial regeneration plus woody and herbaceous vegetation control for adequate establishment (Looney et al. 2017). Artificial regeneration of alternative species, combined with vegetation control, may be required to ensure long-term canopy cover. However, these treatments are labor-intensive and costly.

Conservation and preservation of black ash genetic materials

The decimating effect of the EAB invasion has shifted some focus of black ash management from yield-based management strategies towards the protection of existing black ash stands and the safeguarding of genetic resources for both commercial and cultural purposes; efforts of which vary in intensity depending on black ash density and distribution, landowner objectives, resources, and phase of EAB infestation (D'Amato et al. 2023*b*). More data are needed when it comes to black ash reproductive biology, genetic diversity, and the feasibility of potential in situ and ex situ strategies. Genetic resources for the conservation and preservation of black ash are insufficient, particularly compared to other ash species (Abhainn et al. 2024). The exception is work done by Lee and Pijut (2017, 2018) who have explored the potential of in vitro propagation in controlled environments for ash species to improve resistance to EAB. However, this research is ongoing and has yet to be implemented in the field.

Hybridization represents an emerging approach to ash conservation, whereby hybrid crosses between North American and Asian ash species (*F. nigra x F. mandshurica*) have shown similar physiological and growth responses to environmental conditions compared to their parent species (Haavik and Herms 2019). While the hybrid approach shows potential, consideration needs to be paid to the foundational roles of native ash in terms of supporting native specialist biodiversity (Perry et al. 2022) and potential impacts on wood quality for traditional use such as basket-making (Boudreault et al. 2024) and medicine, which are integral to Indigenous knowledge systems and practices.

Outside of known EAB-infested areas, preservation of black ash seeds began in 2004 in Canada (Natural Resources Canada 2021) and in 2005 in the US (USDA/National Center for Genetic Resources Preservation), along with many Indigenous communities that have also initiated their own black ash stand inventories and seed collections. Still, conservation efforts face difficulties due to limited-scale monitoring programs, lack of data coordination between research groups across jurisdictions, states, and provinces, as well as funding constraints. Preservation efforts are challenged by accessing viable seed sources in differing geographic regions with high EAB mortality (i.e., northern Quebec and Ontario compared to eastern United States), as well as the unknown genetic diversity of these seedlings. In the case of individual ash trees that remain on the landscape showing delayed mortality or apparent tolerance to EAB (known as "lingering" ash), these individuals may hold adaptive traits that could play a role in genetic conservation and selective breeding strategies (McKinney et al. 2014; Pike et al. 2021). Targeting these trees for conservation and restoration both ex situ and in situ, particularly in culturally or ecologically significant areas, should remain a priority as well as better coordination between Western and Indigenous-led initiatives to ensure that culturally significant genotypes are not overlooked.

The need for integrated perspectives

Black ash conservation is also a governance and policy challenge, shaped by governance structures, land tenure, and institutional frameworks that determine, among others, access to forest resources. Social-science approaches, including policy analysis, co-management research (Pinkerton 2019), and participatory governance studies (Dietz and Stern 2008), can help identify how current systems enable or constrain Indigenous stewardship (Hewlett 2002). There are many partners (Indigenous and non-Indigenous foresters, landowners, researchers, etc.) involved in ensuring the future of black ash, all of whom play important and complementary roles in mobilizing TEK and Western science-based knowledge. However, to foster more effective partnerships between Indigenous and non-Indigenous collaborators, research and management initiatives should be structured using co-development and co-governance frameworks (Menzies and Butler 2006; Fa et al. 2020), including early and equitable involvement of Indigenous communities in defining research objectives, methods, and data ownership. Joint stewardship agreements, data-sharing protocols, and reciprocal training opportunities can help operationalize these collaborations in both the context of forest management and cultural conservation (Frey et al. 2019; Francis 2024) and ensure future action and policy surrounding black ash remains in line with the needs of Indigenous communities. This includes not only provincial and state organizations but also national and international groups that can continue to monitor black ash health, regeneration, and the livelihoods associated with this species within and across Canada and the US.

In Canada, federal and provincial governments have the constitutional obligation to consult First Nations regarding projects across their ancestral territory, which has become a frontline of ash protection. Avoiding, mitigating, and compensating for the loss of black ash is a recurrent demand for promoters and governments who wish to develop projects with impacts on forested wetlands. For many community members and actors on these projects, the protection of black ash is more than a motivator, it is also a tool for stewarding the land and its resources, as well as restoring the bond between land and Indigenous communities. As the EAB infestation stretches north, further into the range of black ash, First Nations in Canada (such as the Odanak and W8linak) are actively working to align their actions with those of their partner Tribal Nations in the US. This includes combined efforts to collect seed, conduct black ash stand inventories, and organize community events to promote the transmission of cultural practices and knowledge (representatives of Odanak and W8linak, pers. comm.). These efforts and conversations intersect with sovereignty; some Canadian First Nations have challenged aspects of the federal Species at Risk Act when proposed measures were perceived to infringe on ancestral rights to harvest and sell black ash products. Such examples highlight that black ash represents not only an ecological and cultural keystone, but also a living marker of Indigenous rights and governance.

In the United States, much of the knowledge on reforestation strategies for black ash in the Northeast originates from Tribal partners and councils (Benedict and David 2000) and has been critical to informing broader seed collection efforts. Emery et al. (2014) can serve as a guiding example of the collaboration between the Great Lakes Indian Fish and Wildlife Commission and the USDA Forest Service in defining characteristics of paper birch for traditional uses that was then translated into a field guide for targeted inventories to inform silvicultural practices. The Ash Protection Collaboration Across Waponankik (APCAW) is an Indigenous-led program that includes Indigenous Tribal Nations, federal, state, private landowners, and non-profit organizations that work together to address needs prioritized by Tribal communities (McDonald 2025).

Black ash is rapidly approaching a threshold where ecological decline and cultural loss may irreversibly converge. Historical cases of catastrophic decline of eastern North American tree species have shown how rapidly exotic pests can remove species from the landscape and reshape forest ecosystems. Examples include the near extinction of American chestnut (*Castanea dentata* (Marsh.) Borkh.) due to chestnut blight (*Cryphonectria parasitica* (Murrill) Barr) (Hepting 1974), American elm (*Ulmus americana* L.) due to Dutch elm disease (*Ophiostoma novi-ulmi* and *Ophiostoma ulmi*) (Hubbles 1999), and the white walnut (*Juglans cinerea* L.) due to the butternut canker (*Ophiognomonia clavigignenti-juglandacearum* (Nair, Kostichka, & Kuntz)) (Broders et al. 2015). These examples come from only the last century (1990–2000) and highlight the importance of proactive conservation strategies, early detection, and active management (Schlarbaum et al. 1998) to mitigate similar risks facing black ash.

While recent progress has been made in understanding its ecology, silvics, and management, critical research and conservation gaps remain. A renewed agenda is needed to consolidate essential ecological, cultural, and genetic knowledge of black ash while mature stands still exist on the landscape. Such an agenda must include both Western science and TEK, prioritize long-term resilience over short-term mitigation, and embrace interdisciplinary frameworks that prepare for unprecedented challenges in the face of climate change and pest management.

The renewed agenda for black ash research and conservation that we are proposing centers on resilience, inclusivity, and proactive planning, and focuses on four urgencies. In particular, these include: (1) consolidating ecological knowledge, particularly on edaphic drivers, regeneration ecology, and long-term responses to climate and disturbance; (2) scaling up monitoring and modeling through integration of remote sensing, climate envelop tools, habitat modeling, and TEK-based biocultural conservation; (3) expanding genetic conservation through coordinated seed banking, propagation trials, lingering ash trees, and protection of remaining ash unaffected by EAB; and lastly (4) institutionalizing Indigenous leadership, whereby TEK and Indigenous governance are a cohesive integration of research design, policy development, and conservation action. This agenda not only recognizes that black ash is a critically endangered tree species, but a biocultural keystone whose fate embodies broader questions of ecological resilience, cultural continuity, and adaptive management.

Positionality Statement

This perspective was co-written by 15 forest ecologists, entomologists, dendrochronologists, climate, wood, and soil scientists and researchers from academic institutions and federal agencies in Canada and the United States. The team includes Indigenous collaborations and Indigenous community members who are actively engaged in research, stewardship, and management of black ash. This diverse group brings together a wide range of disciplines, experiential knowledge, and cultural perspectives to inform this work on the urgent ecological and cultural conservation needs of black ash across North America. Together, these perspectives contribute to an integrated approach that aligns Western scientific knowledge with Indigenous Knowledge systems, while ensuring that the ecological and cultural interests associated with black ash are represented respectfully and accurately.

Acknowledgements

The co-authors of this publication respectfully acknowledge that the research and writing for this project took place across many institutions that are situated on traditional, ancestral, and unceded territory of First Nations in Canada and Tribal Nations in the United States. We honour the relationships that these Indigenous communities have sustained to the lands, forests, and ecosystems, particularly in which black ash is found. We remain committed to fostering respectful and meaningful relationships and acts of reconciliation, particularly in the protection and sovereignty of black ash to all Indigenous communities that are connected to it.

Article information

History dates

Received: 11 September 2025
Accepted: 27 November 2025
Version of record online: 19 February 2026

Data availability

This manuscript does not report any data.

Author information

Author ORCIDs

Amy R. Wotherspoon https://orcid.org/0000-0001-6480-2318

Author contributions

Conceptualization: ARW, AFN, NWS, JPD, JCT, JL, RDRM, LB
Funding acquisition: AA
Project administration: ARW
Supervision: ARW
Writing – original draft: ARW, AFN, NWS, JPD, JCT, AWD, JL, RDRM, LB, JD, LB, SD, CD, GC
Writing – review & editing: ARW, AFN, NWS, JPD, JCT, AWD, JL, RDRM, LB, JD, LB, SD, CD, GC, AA

Funding information

This research was funded by Silva21, an NSERC Alliance research program (NSERC ALLRP 556265-20) led by Alexis Achim (Université Laval, Québec).

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