

# Guardians and gardeners: Managing wilderness for the twenty-first century

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## Abstract

The 1964 Wilderness Act is a landmark piece of legislation, providing robust protections from development, mechanization, and resource extraction to landscapes designated by the US Congress as federal wilderness. Today, the National Wilderness Preservation System, which includes 806 wilderness areas and 111 million acres, represents the world's largest highly protected conservation network. However, a long-standing ethos of nonmanagement—exemplified by the philosophy that managers should be guardians but not gardeners—obscures long legacies of Indigenous stewardship and may not sustain essential wilderness values in a time of unprecedented ecological stressors. Many wildernesses are increasingly subject to complex and compounding unintentional (as well as intentional) human influences. In this article, we consider how a *guardians and gardeners* approach would acknowledge Indigenous influence, recognize contemporary and future environmental challenges, and provide managers the necessary rationale to respond to these complex realities. In the twenty-first century, it may be necessary to carefully, thoughtfully, and compassionately reimagine the dominant wilderness philosophy.

**Keywords:** wilderness, Indigenous stewardship, climate change, wilderness management, wilderness philosophies

In 1964, the US Congress passed the Wilderness Act (US government 1964). The product of a growing wilderness movement concerned about expanding settlement, development, and mechanization (Nash 2001), the act established the National Wilderness Preservation System and provided robust legal protections for landscapes designated by the US Congress as federal wilderness. At the time of the act's passing, nine million acres were designated as wilderness; sixty years later, nearly 112 million acres, including 806 federal wilderness areas, have received this designation (<https://wilderness.net>). Under the act, wilderness areas are protected from development, industrialization, and resource extraction; today, these wilderness landscapes are increasingly recognized as especially critical in conserving biodiversity and key-stone ecosystem processes (Dietz et al. 2015, Di Marco et al. 2019, Jones et al. 2025b).

As the primary author of the act, environmental activist Howard Zahniser played a fundamental role in codifying into law the legal definition of federal wilderness, reflecting through this definition the dominant wilderness philosophy of America's early conservation movement. Specifically, Zahniser's decision to define wilderness as an area “untrammeled by man” established an ideal of wilderness as unhindered and free from human influence. In discussing this ideal in a 1963 article, Zahniser wrote that wilderness managers should be “guardians not gardeners” of the landscapes they steward; he argued for protecting wilderness areas so that “natural forces may operate without man's manage-

ment and manipulation” (Zahniser 1963). Zahniser contrasted this *guardians not gardeners* philosophy with the changeable “fancies” and “romantic nostalgia” (Zahniser 1963) he perceived in the 1963 Leopold report, which recommended that each national park be managed to recreate “the condition that prevailed when the area was first visited by the white man” (Leopold et al. 1963). Although Zahniser admitted that wilderness preservation is itself a human concept, he held fast to the ideal that wilderness should not be managed and, therefore, obscured, intentionally or unintentionally, the relationships between Indigenous peoples and the landscapes that past and present generations have stewarded for millennia. As a result, many view this ideal of wilderness as “untrammeled by man” as troublingly linked to settler colonialism and the erasure of Indigenous cultures (Wu 2018, Fletcher et al. 2021, Köhler 2025).

Since its passage, the act has provided meaningful protections to landscapes designated as federal wilderness. Borne from a wilderness movement preoccupied by expanding development and the subsequent impacts on public lands (e.g., the potential flooding of Dinosaur National Monument by the proposed Echo Park Dam in the 1950s), the act gave federal decision-makers, acting on behalf of the public, a tool to designate and protect places that embody wilderness values (Nash 2001). This tool was then used at scale to protect landscapes—often mountainous and roadless—during a time when large landscape preservation was difficult because of population growth and for

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political and economic reasons. As a result, many lands and ecosystems designated as wilderness look and function in ways different from how they might have without the legal protections of this legislation. Today, the National Wilderness Preservation System represents the largest highly protected conservation network in the world (Dietz et al. 2015). Wilderness landscapes provide important habitat for wildlife (Lehikoinen et al. 2019), serve as places where visitors can have a diversity of experiences in the natural world (Cole et al. 2012), contribute to critical scientific research (Kreider et al. 2023), and create cascading economic benefits to surrounding communities that often exceed the potential commercial value from resource extraction (Holmes et al. 2016). As the large landscapes of the United States have changed over the last decades, these wilderness landscapes increasingly contrast with other managed and developed lands. For example, some have suggested that wilderness landscapes are better positioned to meet the challenges posed by global warming than are unprotected landscapes (Jones et al. 2025b) and serve as buffers against extinction risk (Di Marco et al. 2019).

However, a hands-off approach to wilderness has posed a significant management dilemma for decades (Heinselman 1965, Kilgore 1987, Sydorak et al. 2000). The act, in addition to defining wilderness as untrammeled, charges managers with preserving wilderness areas in their natural condition—a directive that has at times necessitated some degree of human management, such as limiting invasions by nonnative species and restoring rare biota (Lieberman et al. 2018). Furthermore, critics point out that the *guardians not gardeners* philosophy of wilderness advances an explicitly Western worldview that ignores the presence and influence of Indigenous peoples on the landscapes of North America (Cronon 1996), ancestral homelands that were often extensively stewarded before Euro-American colonization (Boyd 1999, Kimmerer and Lake 2001, Anderson 2013).

In this article, we examine the limitations of a hands-off approach to stewarding wilderness. First, we discuss several fundamental misunderstandings perpetuated by the *guardians not gardeners* philosophy regarding Indigenous people and traditional stewardship practices. Next, we consider the effects of three intensifying ecological stressors on wilderness and the potential benefits of certain management actions to ameliorate these stressors and promote ecosystem resilience. We then suggest that a *guardians and gardeners* approach maintains the core values and protections of the act, recognizes the long-standing relationships between Indigenous people and many wilderness landscapes, and provides increased acceptability for targeted, temporary, and restrained management actions aligned with the act's core ideals. To conclude, we discuss the practical considerations wilderness managers may face in realizing a *guardians and gardeners* stewardship approach.

In an era of significant ecological stressors including climate change, climate-mediated disturbances (e.g., bark beetle outbreaks that kill trees), altered fire regimes, and invasive species, the *guardians not gardeners* philosophy may not sustain essential wilderness values into the foreseeable future. In addition, as social values evolve in recognition of the historical dispossession of Indigenous people from lands they had cared for from time immemorial, the *guardians not gardeners* philosophy may not recognize the many vital types of human relationships that shape these places. As managers work to ensure the enduring resource of wilderness for generations to come, a philosophy that includes a more nuanced understanding of stewardship as it relates to

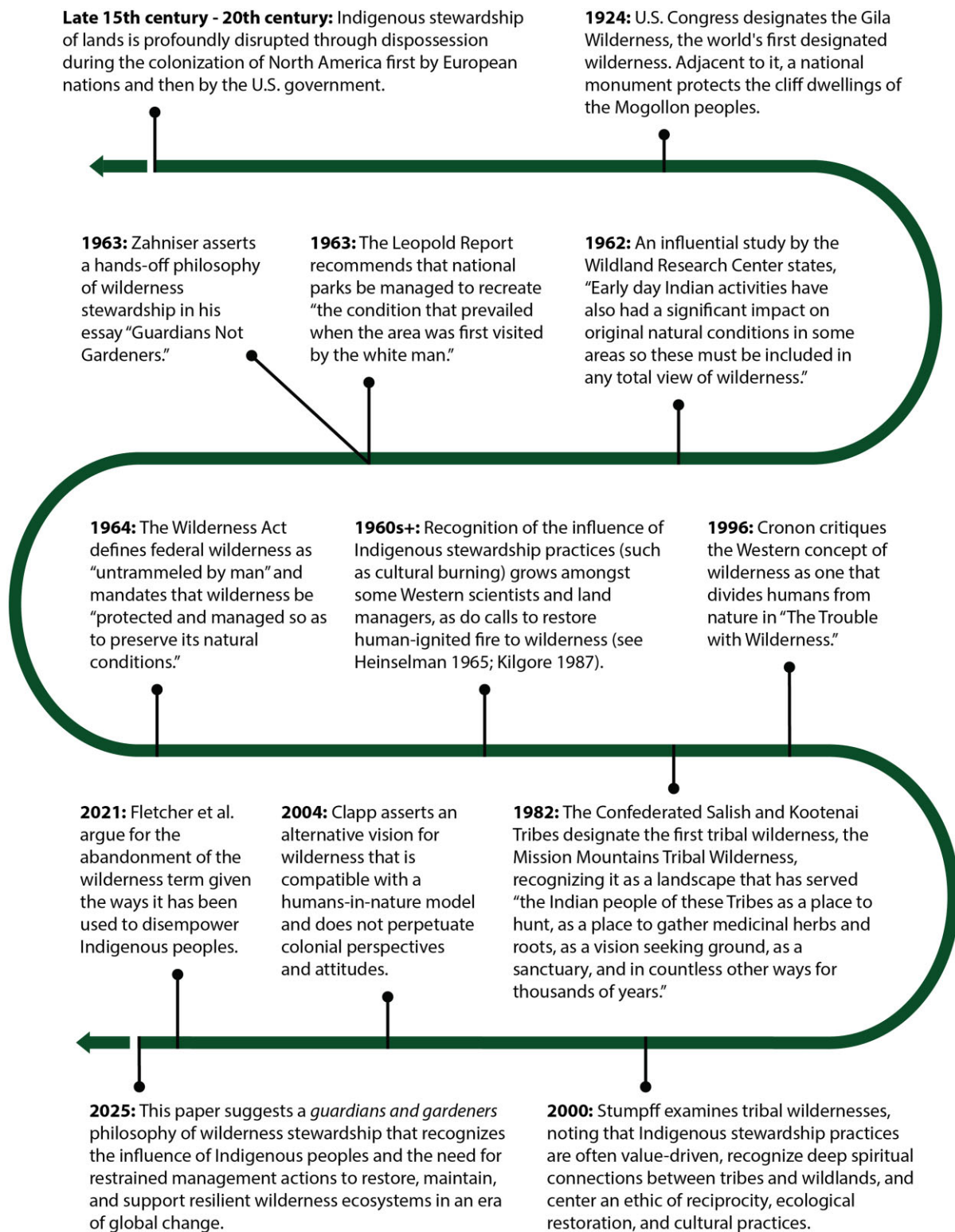
human-led actions in wilderness may better address the realities and complexities of the twenty-first century.

## Fundamental issues with the *guardians not gardeners* concept of wilderness

To consider the future of land management in wilderness areas, one might consider its roots in European colonialism and mischaracterizations of ecological history. On one hand, language in the Wilderness Act discounts the influence of humans; on the other hand, language from contemporary interagency sources acknowledges the historical influence of Indigenous peoples but ignores their interests in the present (Landres et al. 2015). Each view discounts Indigenous people. Moreover, language that discounts human influence within wilderness interfaces with colonial concepts such as *terra nullius* ("land belonging to no one"), historically used to justify the land dispossession and genocide of Indigenous peoples (Zukas 2005). Federal Indian removal, relocation, termination, and assimilation policies coincided with the establishment of national parks and forest reserves as "the early conception of the wilderness as the place where Indians lived (or should live) gave way to the idealization of uninhabited wilderness" (Spence 1999). The view that stresses the absence or invisibility of humans over large areas is at odds with historical ecology where, outside ice-dominated regions, nearly all terrestrial landscapes show long and significant histories of human activity (Ellis et al. 2021).

Another common strain of thought rejects human influence as hubris and considers wilderness as a control for human manipulation (Zahniser 2014). This view was reflected in a statement in Lucas (1973) that "the object is to let nature 'roll the dice' and accept what results with interest and scientific curiosity." Aldo Leopold, one of the earliest proponents of wilderness, embraced a more complex view in advocating for wilderness as a "base-datum of normality, a picture of how healthy land maintains itself as an organism" while tacitly recognizing that Indigenous influence was an important part of that picture (Leopold 1949). That view was carried forward by his son, A. Starker Leopold, in advocating that biotic associations in national parks be maintained (or recreated where necessary) to preserve conditions that existed prior to Euro-American colonization (Leopold et al. 1963).

Scholars have argued that federal wilderness stewardship can fulfill the preservation goals of the act while not perpetuating colonial perspectives and attitudes (e.g., Clapp 2004). Hobbs and colleagues (2010) presented a suite of principles meant to reflect the core tenets of the act, including historical fidelity, autonomy of nature, ecological integrity and resilience, and managing with humility. Such an approach prioritizes a lack of permanent settlements and roads, the avoidance of machines, flourishing native wildlife, the avoidance of restrictions on natural disturbance processes, and the preservation of opportunities for solitude and spiritual contemplation. The latter priorities are particularly consistent with many tribal goals (Toupal 2003, Flood and McAvoy 2007). A handful of tribes have designated wilderness areas or used the term on their own lands to describe places where traditional activities have been prioritized to the exclusion of various other activities, such as road construction and timber harvest, to maintain their precolonization character and sacred values (e.g., Confederated Salish and Kootenai Tribes' Mission Mountains Tribal Wilderness, Taos Pueblo's Blue Lake Wilderness, and White Mountain Apache Tribe's Dził Ligai Si'án Tribal Wilderness; see figure 1) (Tribal Council of the White Mountain Apache Tribe 1977,



**Figure 1.** What is wilderness? This timeline identifies some of the divergent understandings of the wilderness concept across time and perception. This is not meant to be an exhaustive timeline but rather to represent some of the variety of meanings attached to the idea of wilderness.

McDonald et al. 2005). Carroll (2014) asserted that tribal parks managed according to Indigenous principles represent a reclaiming of space in settler colonial contexts; Stumpff (2000) presented multiple tribal examples as alternative models of wilderness stewardship. By contrast, Fletcher and colleagues (2021) argued for the abandonment of the wilderness term altogether given the

ways it has been used to disempower Indigenous peoples. The concept of wilderness embodies a variety of meanings; as we advance a wilderness stewardship approach with a more nuanced understanding of human-led actions in federal wilderness, we acknowledge these multiple and divergent meanings and the need to establish shared meanings when charting paths forward.

## Recognizing Indigenous influence across North America

The recognition that many superficially wild lands have coevolved with stewardship by Indigenous peoples has grown immeasurably since the passage of the Wilderness Act. Deur and colleagues (2020) noted that “northwestern North America abounds in under-reported anthropogenic landscapes,” highlighting vast trail networks marked by trees that have been modified for various cultural purposes within Dena’ina homelands included within the Lake Clark National Park and Preserve, the majority of which is designated or eligible wilderness. Turner and Deur (2024) highlighted examples from the Pacific Northwest of “root-digging grounds, berry patches, cedar stands, seaweed-picking rocks, and other culturally tended habitats and landscapes.” Garry oak woodlands have been identified as an example of ecosystems maintained or created via human stewardship that may date as far back as the late Holocene (McCune et al. 2013); prairies and openings that support camas (*Camassia* spp.), bear grass (*Xerophyllum tenax*), and other understory plants that, in turn, provide habitat for ungulates have also been linked to management by ancestral Indigenous communities (Peter and Shebitz 2006, Carney and Connolly 2024). Armstrong and colleagues (2023) noted the occurrence of forest gardens marked by culturally significant species, including Pacific crabapple (*Malus fusca*), a species long understood to reflect Indigenous cultivation; they asserted that future research will likely demonstrate the presence of forest gardens across Alaska, Washington, Oregon, and northern California—areas long inhabited by Indigenous peoples and interlaced with federal wilderness.

In the Eastern United States, Indigenous cultural landscapes have been recognized in important examples such as Kentucky’s Red River Gorge, which contains the Clifty Wilderness and hundreds of rock shelters. Research within the gorge has documented how Indigenous people evolved with these landscapes through gardening of domesticated plants and use of fire to promote nut-bearing trees, although further research is needed to better understand the ecocultural history of these landscapes (Gremillion 2015, Gearner 2023).

In the Southwestern United States, awareness of cultural landscapes is extensive, as is the inconsistency of language and concepts describing their position within wilderness. Many Indigenous civilizations are associated with “archaeo-ecosystems containing ‘high-priority’ plant species” (Pavlik et al. 2021). Indigenous people domesticated at least six species of agave that are predominantly clonal, are more palatable than wild agaves, occur near habitation and agriculturally engineered archaeological sites, and were traded or transported between Mexico and Arizona (Hodgson et al. 2023). At least four of these species can be found in designated wilderness (Wendy C. Hodgson, Desert Botanical Garden, Phoenix, Arizona, United States, personal communication, 22 May 2025). Another related species, Hohokam agave (*Agave murpheyi*), was a subject of debate over whether it should be federally listed under the Endangered Species Act because it had been cultivated and manipulated by humans (Burgess 1994); domesticated species are not included in the Red List compiled by the International Union for Conservation of Nature ([www.iucnredlist.org/about/faqs](http://www.iucnredlist.org/about/faqs)). These plants may appear too humanized to be conserved, but they occur in places considered by the Wilderness Act to be untrammelled by man. As Nabhan (1995) remarked, “Whether one sees the cultivation that human hands have done in a particular landscape depends to some extent on whether one looks for it and whether one is prepared to see it. ‘Wilderness’ is a concept that can incline one not to look [and therefore] not to see.”

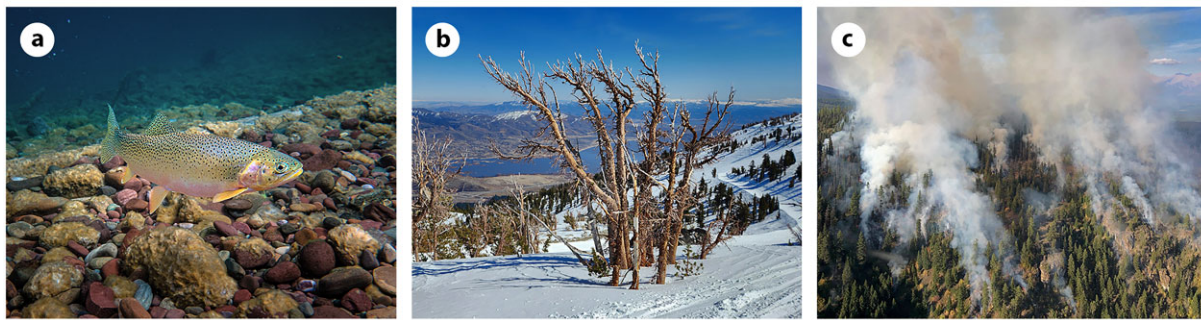
Intentional burning by tribes was one of the most influential Indigenous stewardship practices, producing widespread effects across North America, including within areas today designated as wilderness (Kimmerer and Lake 2001, Stewart 2002, Berkey et al. 2021). Multiple lines of evidence support and affirm the prevalence and influence of such burning, from oral histories (Barrett and Arno 1999, Christianson et al. 2022, Tulowiecki 2024) to pollen and charcoal sediment cores (Mathewes et al. 2020, Booth et al. 2023) to records of fire found in tree rings (Carter et al. 2021, Roos et al. 2022). Along with fires ignited by lightning, such burning helped shape fire regimes and ecosystems (Knight et al. 2022, Roos et al. 2023). For example, the Indian Heaven Wilderness in Washington has a legacy as a summer gathering place for many Northwest tribes, where intentional burning was long used to steward huckleberries and supplement wildfires (Mack 2003). However, fire suppression and conifer encroachment have prompted a decline in the area’s huckleberries; federal policies, including wilderness restrictions, have inhibited the maintenance and restoration of the berry fields (Mack 2003).

## Ecological stressors in wilderness may warrant management actions

Novel and compounding ecological stressors are affecting protected landscapes around the world, prompting discussion about the purpose and priorities of natural resource management during an era of instability and change (Craig 2010, Schuurman et al. 2020, Jones et al. 2025b). Despite Zahniser’s wish to protect wilderness within its boundaries (Zahniser 1963), wilderness areas are embedded within a matrix of nonwilderness lands and share a common atmosphere and climate; fire, plants, animals, pollutants, and microbes can cross into and out of wilderness. Therefore, wilderness is not isolated from rapid global environmental change (Aycrigg et al. 2022, Jones et al. 2025b). In the present article, we examine three global ecological stressors and potential management actions that can mitigate impacts: the intensifying problems posed by climate connectivity failure (i.e., species range shift failures), invasion by nonnative species, and altered fire regimes (see figure 2).

## Climate connectivity failures amplify the threat of species extirpation

Global warming is expected to accelerate species extirpations and extinctions through the loss of habitat and range shift failures (Williams et al. 2003, Urban 2015, Parks et al. 2023a). For many protected areas, the threat of species loss is not new. Although such areas commonly support higher species richness and abundance compared to other landscapes (Gray et al. 2016), insufficient functional connectivity for migration and dispersal across human-dominated landscapes, among other factors, has resulted in protected areas that are often unable to slow biodiversity loss (Brennan et al. 2022, Parks et al. 2023a). Climate change is expected to amplify this problem. For example, recent modeling indicates that 58% of protected areas are at risk of climate connectivity failure, suggesting that landscapes such as wilderness may be unable to serve as stepping stones for species undergoing climate-induced range shifts and pursuing suitable habitat under a warming climate (Parks et al. 2023a). Other research similarly demonstrates the risk of biodiversity loss from climate impacts on habitat (Thomas et al. 2004, Menéndez et al. 2006, Hoegh-Guldberg et al. 2008, Corlett and Westcott 2013). Notably, wilderness areas often contain alpine and subalpine zones,



**Figure 2.** These photographs demonstrate specific examples related to climate connectivity failure, invasion by nonnative species, and altered fire regimes. (a) The westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), a cold-water species declining in population because of factors such as habitat loss and barriers to range shifts and threatened by warming waters associated with climate change, was targeted for conservation in Montana's Scapegoat Wilderness before the project was withdrawn in response to legal action. (b) Whitebark pine (*Pinus albicaulis*) populations are declining rangewide as a result of factors that include white pine blister rust (*Cronartium ribicola*), a nonnative invasive species. Wilderness accounts for 41% of the species' current range, but more than two-thirds of whitebark pine's range will lie within wilderness by the middle of the twenty-first century. However, wilderness restrictions have been listed as a challenge to restoration efforts. (c) More than a century of fire exclusion has induced long-term, substantial, and negative effects to fire-adapted wilderness ecosystems. Restoring human-ignited fire, as seen here in Montana's Mission Mountains Wilderness, may be necessary to mitigate the unintended consequences of fire suppression and the removal of Indigenous fire. Photographs: (a) Glacier National Park, (b) Sean Parks, and (c) Andre Du Lac.

habitats that support critical ecosystems (Keane 2000) and culturally valued foods, fibers, and medicines (CSKT 2017) and that are particularly vulnerable under warming conditions (Rice et al. 2018, Parks et al. *in press*). As the planet warms, protecting species within wilderness boundaries will be increasingly insufficient in preventing extirpation and extinction.

Assisted migration has been identified as a strategy with the potential to mitigate species extirpation under warming conditions (McLachlan et al. 2007, Hoegh-Guldberg et al. 2008); however, this approach has proven controversial in protected areas (Hewitt et al. 2011). Such is the case in Montana's Scapegoat Wilderness, where a recent project to conserve native westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) was proposed and then withdrawn. Populations of westslope cutthroat trout have declined in the last century because of habitat loss and fragmentation, hybridization, and competition with and predation by nonnative species (McIntyre and Rieman 1995). Climate modeling indicates that warming waters and alterations to fluvial connectivity are likely to exacerbate habitat loss for this cold-water species (Isaak et al. 2015). In Montana, westslope cutthroat trout remain in only 27% of their historical range and are genetically unaltered in just 2.5% of that range (Liknes and Graham 1988). The Scapegoat Wilderness project aimed to establish a population of genetically pure westslope cutthroat trout in a high-elevation watershed (Pierce et al. 2018). This location was considered an ideal refuge, with waters likely to remain cold even under predicted warming and protection from invasion by nonnative species by 50-foot falls (Pierce et al. 2018). A federal Minimum Requirements Analysis conducted in 2016 determined that the long-term gains from the project outweighed the short-term negative effects to wilderness character. According to agency personnel, the project aligned with legal requirements to conserve cutthroat trout in their historical range, responded to ongoing and predicted habitat losses from climate change, and sought to prevent the species' listing under the Endangered Species Act (MFWP 2020). Shortly after the Forest Service authorized the project, several advocacy groups filed a temporary restraining order and preliminary injunction (*Wilderness Watch et al. v. Marten et al.* 2021). The Forest Service withdrew its authorization thereafter, effectively terminating the project. For species such as westslope cutthroat trout, identifying cold water refuges insulated from invasion by nonnatives may be necessary

to create a climate shield to ensure species survival (Isaak et al. 2015). This example raises complex questions about the role of wilderness as a resource for species conservation and the acceptability of management responses to climate connectivity failures.

### Invasions by nonnative species threaten wilderness ecosystems

Although some species will not be able to migrate between isolated wilderness areas as the climate changes, other species are moving freely in and out of wilderness. The introduction of nonnative invasive species, key drivers of biodiversity loss within protected areas (Randall 2000, Genovesi and Monaco 2013), has increased worldwide over the last 200 years (Seebens et al. 2017). These species—either intentionally or unintentionally introduced by humans into ecosystems (Hulme 2009)—are capable of altering ecosystem functions and processes, including displacing, outcompeting, and hybridizing native species (Cole and Landres 1996). While coping with nonnative invasives is not a new challenge (Stewart and Hull 1949), climate change may be a potent factor in compounding the rate and effects of invasions (Pyke et al. 2008, Mainka and Howard 2010, Willis et al. 2010).

Wilderness areas are vulnerable to invasion. A survey conducted in 2014 showed that 56% of wilderness managers across all agencies consider invasive species as a potential threat of high or very high concern; invasive species were ranked second only behind concerns about a lack of political and financial support in a list of top ten threats to wilderness (Dawson et al. 2016). One notable example can be found in Hawai'i Volcanoes National Park, which includes 123,100 acres of designated wilderness (35% of the park) and 121,015 acres of eligible wilderness (an additional 34% of the park). There, the invasion of the faya tree (*Morella faya*) has displaced the endemic 'ōhi'a lehua tree (*Metrosideros polymorpha*) across large areas and contributed to an invasional meltdown by facilitating a significant increase in the two-spotted leafhopper (*Sophonia rufofascia*), a nonnative invasive insect known to feed on the area's endangered plants (Simberloff and Von Holle 1999, Lenz and Taylor 2001, Foxcroft et al. 2013).

The rangewide decline of whitebark pine (*Pinus albicaulis*), a slow-growing, long-lived species found in high-elevation forests in southwestern Canada and the western United States

(including numerous wilderness areas), provides another example of devastating invasion. Whitebark pine populations are threatened by white pine blister rust (*Cronartium ribicola*), an invasive fungus introduced to North America around the turn of the twentieth century (Mielke 1943), as well as altered fire regimes, climate change, and outbreaks of mountain pine beetles (*Dendroctonus ponderosae*; Tomback and Sprague 2022). Assessments by the Forest Service indicate that white pine blister rust poses an existential threat to whitebark pine (Tomback et al. 2022), which was recently listed as threatened under the Endangered Species Act (US Fish and Wildlife Service 2022). This could be considered particularly troubling for several reasons. Within high mountain ecosystems, whitebark pine acts as both a foundational and key-stone species: whitebark pine communities provide key habitat for many wildlife species, their large seeds feed numerous birds and mammals, and they help regulate snowmelt, reduce soil erosion, and serve as nurse trees to less hardy vegetation, promoting community stability and diversity (Keane et al. 2017). As a traditional food source for the Confederated Salish and Kootenai Tribes (CSKT), whitebark pine (known as *sčipálq̓* in the Salish language) is a species of cultural significance (CSKT 2017). In response to the whitebark pine's decline, the CSKT have developed a biocultural restoration plan for the Flathead Reservation. Notably, this plan employs the concept of two-eyed seeing, braiding together knowledge from Indigenous wisdom and Western science to restore not only whitebark pine but also human and cultural relationships with this species who stand “present, watching over the people from the ridgetops” (Durglo et al. 2022).

Whitebark pine is expected to experience an 80% reduction in climatically suitable area by the middle of the twenty-first century (Parks et al. *in press*). Wilderness could play a critical role in efforts to conserve the whitebark pine (Keane 2000). Wilderness currently accounts for 41% of the species' range, but more than two-thirds of the whitebark pine's range will lie within wilderness by the middle of the twenty-first century (Parks et al. *in press*). As such, planting rust-resistant whitebark pine seedlings in wilderness may be necessary to restore and delist the species (Keane et al. 2017). However, whitebark pine's restoration within wilderness remains controversial. The 2022 National Whitebark Pine Restoration Plan listed wilderness restrictions as one of several challenges. Some such as Landres (2010) hold that maintaining a hands-off approach to respect nature's autonomy is a greater priority than whitebark pine's preservation. However, others assert that, in the realm of nonnative invasive species compounded by climate change, enforcing a protection regime without active management will be insufficient in preventing major biodiversity loss and substantial ecosystem service changes (Mainka and Howard 2010, Genovesi and Monaco 2013).

## Altered fire regimes increase risk of ecological transformations

Across North America, historical fire regimes have been substantially altered due to the cessation of Indigenous burning, the introduction of large-scale, intensive livestock grazing and subsequent fine-fuels reduction, landscape fragmentation, and fire suppression (Haugo et al. 2019, Hessburg et al. 2019, Parks et al. 2025). As a result, many fire-adapted forest ecosystems have departed from historical conditions. These forested landscapes often become more spatially homogeneous (Hessburg et al. 2019) and exhibit increased fuel loads and forest density (Keane et al. 2002, Calkin et al. 2015). In some cases, the landscapes' species composition has shifted as conditions support fire-sensitive species over

fire-adapted species, resulting in forests with no ecological antecedent (Nowacki and Abrams 2008). Such changes can increase the vulnerability of forests to uncharacteristically severe wildfires, with fire severity further exacerbated by the hotter and drier conditions associated with climate change (Rogers et al. 2020, Haggmann et al. 2021, Parks et al. 2023b). While historical fire regimes supported ecosystems that were resilient to burning under those regimes (Hessburg et al. 2019), contemporary wildfires exhibit uncharacteristic severity (i.e., excessive fire-induced tree mortality) and are increasingly resulting in significant and lasting changes to forest ecosystems (Coop et al. 2020, Boerigter et al. 2024). This includes fire-driven conversions from forests to other vegetation types (Coop et al. 2020) and a suite of other adverse effects to ecosystem function (Holden et al. 2009).

The need to restore fire to wilderness has been recognized for decades (Heinselman 1965, Lotan et al. 1983). In the 1960s and '70s, several wilderness areas implemented programs to manage lightning-ignited wildfires and therefore allow fire on the landscape (Kilgore 1987, van Wagtendonk 2007, Miller 2020). Although this approach aligns with the untrammelled and natural qualities of wilderness, it has not led to broadscale restoration of historical fire regimes because of factors such as a lack of organizational commitment and a strong fire suppression bias (Botti and Nichols 2021). Notable exceptions include the Gila Wilderness, the Selway-Bitterroot Wilderness, the Frank Church-River of No Return Wilderness, the Bob Marshall Wilderness Complex, and Yosemite National Park, where lightning-ignited wildfires have been successfully managed over the course of decades (van Wagtendonk 2007, Hunter et al. 2014, Berkey et al. 2021). Contemporary conditions add additional complexity to this approach, as lightning ignitions burning in fire-excluded forests with increasing fuel aridity can produce unprecedented fire behavior and effects (McClure et al. 2024).

In response to the persistent need for fire, many have called for the expanded use of Indigenous fire stewardship and other types of beneficial fire (Lake et al. 2017, Long et al. 2021, North et al. 2024), as well as prescribed fire (Kolden 2019, Botti and Nichols 2021, CPL and ALWRI 2023). Research indicates such burns have the potential to reduce fuels and subsequent wildfire severity, increase ecological resilience, and begin to restore historical conditions (Coppoletta et al. 2019, Keifer et al. 2000, Jones et al. 2025a). However, some advocacy groups are vocally opposed, often citing human-ignited fire as an inappropriate intervention in wilderness (Yung 2008, Wilderness Watch 2025). The listing of prescribed fire in interagency strategy as a trammeling action and a strong institutional suppression bias may serve as barriers to implementing prescribed fire in wilderness (Landres et al. 2015, Botti and Nichols 2021, CPL and ALWRI 2023). Asserting the rationale of the *guardians not gardeners* philosophy, objections and lawsuits have been filed by wilderness advocacy groups, halting or severely impeding planned burning (Wilderness Watch 2017, Atkinson 2019, Wilderness Watch, Sequoia Forest Keeper, and Tule River Conservancy v. National Park Service 2023). In the meantime, uncharacteristically severe wildfires increasingly induce cascading, long-term, and negative effects within fire-adapted wilderness ecosystems (Boerigter et al. 2024). For example, many of California's highly fire-adapted giant sequoias have not survived recent wildfires (Shive et al. 2022), including groves within the Sequoia-Kings Canyon and Johns Krebs Wilderness areas (Ortega-Welch 2023). The 2020 Castle Fire killed an estimated 10%–14% of all large sequoias in the Sierra Nevada range (Stephenson and Brigham 2021). In New Mexico's Gila Wilderness, postfire debris flows prompted by uncharacteristically severe wildfires extirpated populations of

Gila trout (*Oncorhynchus gilae*), a federally listed species (Holden et al. 2009). In California's Mount Lassic Wilderness, fire exclusion and subsequent ecosystem changes have been a major factor behind the listing of the Lassics lupine (*Lupinus constancei*) as an endangered species (Tobias 2015, US Fish and Wildlife Service 2023). In Minnesota's Boundary Waters Canoe Area Wilderness, the absence of fire is changing fire regimes and contributing to the replacement of pine-dominated forests by mesic hardwoods; without a major reintroduction of fire, researchers anticipate a significant decline in pine-dominated forests, with the potential for these forests to disappear within 150 years (Frelich and Reich 2009).

Management actions that restore fire regimes and mitigate uncharacteristically severe wildfires could play a key role in building resilience and forestalling ecosystem transformations. In particular, human-ignited fire may be a necessary form of gardening that can counteract the suppression of lightning-ignited fires (itself a form of gardening). For managers, prescribed fire or facilitating Indigenous fire stewardship (see Hankins et al. *in press*) may be necessary to fulfill the Wilderness Act's mandate to preserve the natural conditions of wilderness for future generations. Indigenous fire stewardship and other forms of human-ignited fire (e.g., prescribed fire) may be particularly important in some wilderness areas given the historical relationships between Indigenous peoples and ancestral places now designated as wilderness.

## Stewarding wilderness for the twenty-first century

The Wilderness Act remains a landmark piece of legislation. The legal protections it provides have been critical in protecting nearly 112 million acres of wilderness from development, mechanization, and resource extraction. However, the *guardians not gardeners* philosophy was conceived in a time when the immediate effects of human development were recognized, but indirect effects such as climate change and the full extent of fire exclusion were not. As Stephenson and Millar (2014) noted of the act's authors, their "careful choice of the term *untrammeled* was underlain by a critical assumption: that for generations to come Earth's environment would be inherently stable within its historically observed bounds of variation. The dominant thinking of the era had not yet awakened to the onset of rapid, human-induced, boundary-transcending global changes." Thus, in accordance with the dominant understandings of this time, an *untrammeled* wilderness was absent the intentional influence of humans and therefore was an area that could be successfully safeguarded at its borders (Stephenson and Millar 2014). However, many wilderness areas today are increasingly subject to large-scale, complex, and compounding unintentional human influences, as well as intentional human influences (i.e., the direct suppression of wildfires); furthermore, holding uniformly to this ideal ignores histories of Indigenous stewardship despite extensive evidence of such influence.

Researchers have posited that a narrow focus on the untrammeled ideal may misinterpret the intent of the act (Frelich and Reich 2009). According to Scott (2001), the act's definition of wilderness is best understood as containing two distinct components: the ideal and practical. While wilderness "untrammeled by man" represents an ideal vision for federal wilderness (as conceived by Zahniser and the other authors), the phrase that follows—"an area of wilderness is *further defined*" (US government 1964; italics added for emphasis)—provides a more concrete, detailed, and practical definition of wilderness. Notably, it is this second defi-

nition which mandates that wilderness retain its "primeval character and influence" and be "protected and *managed* so as to preserve its natural conditions," among several other values (US government 1964; italics added for emphasis). However, strict interpretations of the untrammeled ideal often supersede the practical understanding and may, at times, lead to the explicit exclusion of wilderness from landscape-scale restoration projects (Appel 2015). As Appel (2015) remarked, "Should the USFS omit all wilderness areas from consideration for [restoration] treatment, the results would possibly run against the intent of the Wilderness Act and the definition of wilderness."

Finally, it is important to note that, in addition to agency interpretations of the act, the courts' interpretation greatly affects wilderness management. Long and Biber (2014) saw evidence that the courts have repeatedly affirmed the permissibility of active management to restore native species and ecosystems, given appropriate justifications. Appel (2015), however, viewed the courts as generally expressing a hands-off view, noting that this position may become increasingly complicated by climate change.

## Guardians and gardeners: An approach to wilderness stewardship in an era of global change

We suggest a wilderness stewardship approach that maintains the spirit of human restraint and humility at the core of the act while recognizing that the no-management default implied by the *guardians not gardeners* philosophy obscures the historical influence of Indigenous stewardship and may not allow for sufficient response to the effects of other stressors of change. Of the five wilderness qualities considered by current interagency strategy to comprise wilderness character (i.e., the essential attributes of wilderness mandated by the act for preservation), the untrammeled quality (i.e., a hands-off approach) is given extra weight as a tiebreaker or first among equals (Landres et al. 2015). Therefore, in complex scenarios where there are recognized trade-offs between preserving some wilderness qualities and degrading others, a no-action approach is given priority over qualities such as the natural quality (i.e., native species and natural ecological conditions and processes) (Boerigter et al. 2024, Landres et al. 2015). The act does not mandate that the untrammeled quality should receive this special status; in fact, no aspect of wilderness is emphasized as more or less important in the act's definition of wilderness (US government 1964, Landres et al. 2015). However, this current prioritization upholds an ideal of wilderness as, first and foremost, uninhabited and uninfluenced by people.

We suggest that a *guardians and gardeners* approach allows wilderness managers to reexamine the priority given to the untrammeled quality, thereby recognizing that many of the landscapes designated as federal wilderness were not unpeopled or unstewarded. Rather, Indigenous peoples influenced the natural conditions of many landscapes now designated as federal wilderness through traditional practices such as Indigenous burning (Anderson 2013, Kimmerer and Lake 2001, Klimaszewski-Patterson et al. 2020, Kipfmüller et al. 2021). Given both these long histories of Indigenous stewardship and the extensive present-day impacts of anthropogenic climate change, management will likely be necessary to preserve the natural conditions of many wilderness landscapes—one of the primary mandates of the act (US government 1964)—and to support healthy and resilient wilderness ecosystems through this time of immense change. Like a gardener nurtures processes such as growth and fertilization, a wilderness area's natural conditions can be and, in

some cases, may need to be cultivated by land stewards. Many tribes identify such tending—restorative actions that affirm the importance of reciprocal relationships between people and land—as key to ecocultural restoration (Hankins 2024, Long et al. 2020). Therefore, a *guardians and gardeners* philosophy recognizes the importance of Indigenous practices and relationships with wilderness and provides increased acceptability for targeted, temporary, and restrained management actions that support core wilderness values. For example, the disruption of historical fire regimes within the Sequoia-Kings Canyon and John Krebs Wilderness areas has contributed to uncharacteristically severe wildfires and, subsequently, unprecedented declines in giant sequoia populations, a defining species for these wilderness areas (Shive et al. 2022). Following a *guardians and gardeners* approach, fire exclusion and the associated increase in likelihood of high-severity wildfires could be considered as such a severe risk to the natural conditions of these wildernesses as to impel management actions to restore the natural process of fire. In this way, stewardship can help maintain wilderness character, ecological integrity, and human-land relationships.

Furthermore, we assert that a meaningful difference exists between managerial restraint and the decision not to manage, a distinction the framers of the act appear to have acknowledged in their inclusion of both an idealized and practical definition of wilderness. Management actions intended to mitigate negative human-induced effects, restore natural processes, and improve ecosystem Resilience must demonstrate restraint by adhering to Minimum Requirements Analysis standards. In a survey by Watson and colleagues (2015), wilderness visitors reported positive support for actions considered to improve naturalness, including removing nonnative invasive species, assisting native species to recover, and restoring historical fire regimes. Engaging in such actions could be interpreted as an act of humility: rather than ignoring the impacts—both positive and negative—of past and present human influence, these actions are an acknowledgement and an attempt to restore natural conditions where human actions have exerted influence. For example, management in several wilderness areas has recognized beneficial human fire as the minimum tool necessary to restore naturalness (Boerigter et al. 2024). In this way, managing to restore natural fire cycles serves as a corrective to the suppression of previous wildfires, a widely accepted practice that nevertheless disrupts historical fire regimes. Choosing not to manage may mean an acceptance of the significant, long-term, and predominantly negative effects that accompany fire exclusion, the removal of traditional Indigenous practices (e.g., cultural fire), and climate change (Hessburg et al. 2021). Although some may believe this to be an acceptable cost (Landres 2010), we see value in a more nuanced approach (see figure 3).

By reframing the decades-old wilderness management dilemma to focus on restrained action over inaction, managers may be encouraged to frankly assess the ecological and cultural states of the wilderness areas they steward, including assessing the potential benefits of management actions (i.e., positive impact on naturalness or the potential for engagement with local tribes) given current and projected stressors; identifying leverage points where small interventions could lead to significant positive outcomes (Hobbs et al. 2011); and concretely articulating long-term management objectives to protect and preserve a range of wilderness values. Chazdon and colleagues (2024) questioned the false dichotomy between deliberate human actions and natural processes of ecosystem recovery; they proposed a continuum-based intervention framework that recognizes nature's intrinsic recovery potential and the various

roles that people can play in assisting this process. Jones and colleagues (2025b) called for conserving landscape dynamics (i.e., wildfire and cultural burning) over specific features of value (e.g., old-growth forests), shifting from a static view of nature that employs a fortress conservation model of exclusive protection to a dynamic view that embraces natural disturbances and Indigenous concepts of stewardship. There is no one-size-fits-all approach to wilderness management; potentially, some wilderness areas (or portions of wilderness areas) may best be managed according to a strict hands-off philosophy. However, applying a no-management default to all wilderness landscapes may sacrifice the act's mandate to manage wilderness so as to preserve natural conditions.

Furthermore, a *guardians and gardeners* approach to wilderness management better recognizes enduring relationships between Indigenous peoples and many wilderness landscapes and can provide support for the continuity of Indigenous traditional practices where they coevolved with wilderness and where tribes want to steward. In 2023, the federal Wildland Fire Mitigation and Management Commission recommended a set of 148 policy priorities to address the United States' wildfire crisis. Included in these priorities were recommendations to support federal agencies in forming equitable and meaningful costewardship and comanagement agreements with tribes, supporting tribal self-governance to enable beneficial fire practices, and providing authority to the US Department of Agriculture to share, defer, or transfer decision-making to tribes for management of Forest Service programs or activities (Wildland Fire Mitigation and Management Commission 2023). Although formulating a restorative stewardship plan does not hinge on resolving the legal distinctions between costewardship and comanagement, supporting affiliated tribes in guiding management may be especially important for designated wilderness areas because of the historical reliance on hands-off management (aside from fire exclusion). In instances where traditional practices can no longer be carried out by tribes, managers can support tribes in revitalizing their knowledges, practices, and connections to place (Hankins et al. *in press*). Managers may also consider managing in ways that result in similar ecological outcomes. For example, Anderson and Barbour (2003) proposed a simulated Indigenous management model, an approach that applies historical Indigenous knowledge and practices alongside Western management techniques. At a minimum, wilderness managers could implicitly acknowledge both the historical influence of human-ignited fire and the natural role of fire on the landscape by considering igniting prescribed fire at locations where previous fires were successfully suppressed, mitigating the unintended consequences of fire exclusion (Jones et al. 2025b).

Recognizing that certain designated wilderness areas are cultural landscapes shaped by Indigenous stewardship can influence the management of these areas, with the land serving as an instructive guide (Lake 2007, Norgaard and Tripp 2019). For example, the cessation of cultural burning and the suppression of wildfires across the ancestral lands of the Karuk Tribe, including areas of wilderness, have resulted in negative ecological and cultural effects (Norgaard and Tripp 2019). Suppression activities have damaged sacred sites (Norgaard 2019), the cessation of fire has allowed woody encroachment on formerly open areas (Norgaard and Tripp 2019), and high-severity wildfires on their own have the potential to adversely affect traditional cultural properties and landscapes. For decades, the Karuk Tribe has worked to revitalize and restore practices of cultural fire within their ancestral territory, including by removing barriers to cultural fire, examining the impacts of burning on species of cultural significance, and recording

### Guardians *and* gardeners: Wilderness stewardship in an era of global change

In contrast with the *guardians not gardeners* philosophy of wilderness stewardship, the *guardians and gardeners* approach presents a nuanced understanding of human-led actions in federal wilderness. The three key elements of this philosophy are outlined below.

This approach recognizes the influence of historical Indigenous stewardship within wilderness and its continuing importance today and may better support managers as they address the environmental complexities of the twenty-first century and work to fulfill the Wilderness Act mandate to ensure the enduring resource of wilderness for future generations.



① **The *guardians and gardeners* approach maintains the core values of the Wilderness Act**, including ecological integrity, biodiversity, managerial restraint, no roads or other developments, minimum use of mechanized equipment and modern technology, preservation of sacred, spiritual, and seclusion values, and support for natural processes like fire.

② **The *guardians and gardeners* approach recognizes the importance of Indigenous traditional practices on lands now designated as wilderness and supports tribes seeking active roles as stewards.** This aligns with federal trust responsibilities such as consultation and co-stewardship. Where tribes are no longer able to steward, this approach may also include management activities that produce similar ecological outcomes to traditional practices in recognition of the important role of human stewardship of wilderness.

③ **The *guardians and gardeners* approach provides for ecological integrity through targeted and temporary management actions that serve as a bridge.** Actions may include replanting, restocking, removal of non-native invasive species, and fuel reductions.

**Figure 3.** Guardians and gardeners: Wilderness stewardship in an era of global change.

the fire wisdom of Indigenous knowledge holders (Norgaard 2019, Sowerwine et al. 2019, Greenler et al. 2024). A recent collaboration between the Karuk Tribe and Greenler and colleagues (2024) produced a simulation model of cultural ignition location, frequency, and timing across the Karuk Aboriginal Territory, affirming the impact of cultural fire on vegetation, resources, and other fire-dependent processes. According to Greenler and colleagues (2024), “This work demonstrates the importance of cultural burning for developing and maintaining the ecosystems present at the time of colonization and underscores the need to work collaboratively with Indigenous communities to restore ecocultural processes in these systems.”

Similarly, dendrochronological research conducted in the Boundary Waters Canoe Area Wilderness and informed by discussions, site visits, and shared interpretation with Indigenous knowledge-holders from multiple communities indicates that frequent historical burning by the Anishinaabe people reinforced and amplified existing vegetation and landscape patterns, specif-

ically the prevalence of open red pine forests (Kipfmüller et al. 2021, Larson et al. 2021). In the absence of human-augmented surface fires, the terrestrial landscape of the wilderness has undergone significant changes in structure, composition, and function, including negligible red pine regeneration, higher prevalence and density of fire-intolerant trees, and increased vulnerability to high-severity fire (Frelich and Reich 2009, Kipfmüller et al. 2021, Larson et al. 2021). Current plans by the Superior National Forest to restore human-ignited fire to 26,000 acres within the Boundary Waters Canoe Area Wilderness acknowledge the wilderness as an ancestral homeland where Indigenous fire stewardship sustained forests and culture (Fernberg Corridor Landscape Management Project 2025). The project identified honoring treaty rights and promoting tribal interests as motivating needs; in the spirit of shared stewardship, collaboration and consultation took place with representatives from federally recognized tribes connected to the landscapes of the Boundary Waters Canoe Area Wilderness (Fernberg Corridor Landscape Management Project 2025). Notably,

however, this project is opposed by wilderness advocates as “a prime example of humans imposing their will on Wilderness” (Wilderness Watch 2025).

In recent years, managers at several wilderness areas have demonstrated a stewardship model that is more inclusive of tribes and traditional practices. In 2024, the Bureau of Land Management established a costewardship agreement with Tohono O’odham Nation that includes Arizona’s Baboquivari Peak and Coyote Mountains Wilderness areas (Silversmith 2025); in California, the National Park Service is collaborating with the Federated Indians of Graton Rancheria to include tribal perspectives and traditional ecological knowledge into the management of Tomales Point, a majority of which is part of the Phillip Burton Wilderness (Point Reyes National Seashore 2024). In Alaska’s Glacier Bay Wilderness, homelands of the Huna and Gunaaxoo Tlingit Clans, the area’s wilderness character is now defined to include a sustained connection between the Tlingit and the wilderness (Lindholm 2023). The development of Glacier Bay’s 2023 Backcountry and Wilderness Management Plan included consultations with the Hoonah Indian Association and the Yakutat Tlingit Tribe and established pathways for collaboratively addressing challenges related to access and traditional fishing and hunting (Lindholm 2023). According to Lindholm (2023), “Reimagining the existing [wilderness] system while creating alternative systems will move us forward to a brighter shared future. Our multicultural society needs wilderness now more than ever.”

Tribal lands managed as wilderness can also provide valuable examples of alternative models of wilderness stewardship. In examining management practices on tribal lands such as the Mission Mountains Tribal Wilderness (stewarded by the Confederated Salish and Kootenai Tribes) and Sacred Blue Lake (Taos Pueblo), Stumpff (2000) underscores the important roles of spirit, ecology, knowledge, and governance in shaping Indigenous approaches to stewardship. Indigenous stewardship practices are often value driven, recognize deep spiritual connections between tribes and wildlands, and center an ethic of reciprocity, ecological and spiritual restoration, and cultural practices and knowledge (Stumpff 2000). According to Stumpff (2000), “From the Indian perspective, value drives use; therefore, value is reinforced by human use and presence in the cycles of natural processes... Only when the human experience can be put back into nature will it be possible to create collaborative preservation strategies that work.”

## Practical considerations for wilderness managers

While the present article has been focused largely on guiding principles for long-term wilderness stewardship, we recognize managers face various practical bounds in pursuit of those goals. In addition to typical constraints such as capacity, funding, and feasibility, managers proposing actions within wilderness must negotiate processes of agency approval and weigh restraint and appropriateness; they may also need to foster public and agency support given dominant hands-off perspectives regarding wilderness management (CPL and ALWRI 2023).

Wilderness managers must complete a Minimum Requirements Analysis for proposed actions within federally designated wilderness areas, with some policy variances depending on the administering agency. Actions deemed “necessary to meet minimum requirements for the administration of the area for the purpose of [the] act” are permissible (US government 1964). For example, despite the listing of prescribed fire as a trammeling action by interagency strategy (Landres et al. 2015), such burning

is permitted where it is the minimum action to preserve wilderness character (CPL and ALWRI 2023). Therefore, prescribed fire has been implemented in several wilderness areas (Boerigter et al. 2024). In addition, the act provides a number of qualifying provisions. For example, it states that “such measure may be taken as may be necessary in the control of fire, insects, and diseases” and “in emergencies involving the health and safety of persons within the area” (US government 1964). According to an analysis by legal scholars, a majority of potential management actions are permissible in wilderness so long as substantive analyses and proper procedures demonstrate these actions are necessary for conservation and are the minimum action (Long and Biber 2014).

For managers, the Minimum Requirements Analysis functions as a balancing test, helping evaluate if action is necessary and, if so, identifying the minimum technique, timing, and timeframe (see “Minimum Requirements Analysis” at <https://wilderness.net>). However, when proposed actions incorporate new approaches or rationales, wilderness managers may find themselves navigating uncharted territory, as is often the case with prescribed fire. In 2023, a Forest Service team of regional program managers aimed to provide guidance to managers seeking to comply with the federal Wildfire Crisis Strategy; this team developed an internal document with suggestions for completing a Minimum Requirements Analysis for prescribed fire in wilderness. In 2024, wilderness leadership began the process of updating the Forest Service’s wilderness management manual specifically to clarify policies related to fire management, which have not been updated since 1993. A current prescribed fire project spanning the Sequoia and Sierra National Forests, including ten wilderness areas, exemplifies the complexities involved in completing a Minimum Requirements Analysis (see the “Sequoia and Sierra National Forests Prescribed Fire Project” at [www.fs.usda.gov/r05/sierra/projects](http://www.fs.usda.gov/r05/sierra/projects)). This landscape-scale project raised questions about the process for how and when to undertake a Minimum Requirements Analysis and has required extensive coordination with Forest Service wilderness leadership to determine the appropriate approach. As such projects progress, they can act to clarify pathways and to serve as valuable examples for the federal wilderness community.

Furthermore, where management is determined to be necessary in wilderness, managers must consider which tools and technologies are appropriate. For example, the remoteness and ruggedness of many wilderness areas has led some managers implementing prescribed fire to propose aerial ignitions by drone or helicopter as a safer alternative to deploying fire personnel; however, overflights and mechanized equipment have long been restricted in wilderness. Decisions such as these are complex and would benefit from consideration by networks of managers with guidance from federal institutes such as the Arthur Carhart National Wilderness Training Center (<https://carhart.wilderness.net>) and federal strategies such as Minimum Impact Suppression Tactics, guidelines developed to support fire personnel in applying the minimum amount of force necessary to effectively achieve fire objectives (see the Fire Management Toolbox at <https://wilderness.net>). Manager knowledge is extensive and valuable, and tapping this human resource will likely be key. For example, some managers experienced with prescribed fire in wilderness have developed approaches that use natural features (e.g., rocky outcrops, rivers and lakes, and recently burned areas) as firelines in order to avoid the impacts of human-constructed firelines. Such approaches contrast notably with the high-impact interventions that may be used during fire suppression operations in wilderness (e.g., the use of bulldozers to create a fireline), which may occur with greater frequency as the likelihood of uncharacter-

istically severe wildfires increases (Boerigter et al. 2024, Courter 2021). Treating wilderness landscapes with prescribed or cultural fire may lessen the need for high-impact tactics such as these.

In addition to the complexities discussed above, wilderness managers often face internal and external scrutiny for management actions taken in wilderness (CPL and ALWRI 2023). Therefore, fostering support can be critical in achieving management goals. While wilderness visitors report generally positive attitudes toward restoration or renaturalization (e.g., removing nonnative species, assisting species recovery, restoring natural fire regimes), attitudes toward actions to mitigate the effects of climate change are generally negative (Watson et al. 2015). With this understanding, managers might consider framing proposed actions as restorative or explicitly linking climate-related actions to renaturalizing. Additionally, actions related to fire restoration have the potential to increase federal-tribal partnerships and other coalitions. While relationship-building with tribes—informed by histories of genocide, land dispossession, broken treaties, and ensuing distrust—will require committed effort over time (Lake et al. 2017), the benefits to these partnerships are many and great (Stumpff 2003, Marks-Block and Tripp 2021, Hankins et al. *in press*).

## Conclusions

Wilderness areas provide innumerable ecological, cultural, and social benefits to human and nonhuman communities alike. In this article, we celebrate wilderness landscapes and the protections ensured by the Wilderness Act while proposing a more nuanced stewardship approach that acknowledges Indigenous influence, recognizes contemporary and future environmental challenges that could not have been anticipated by the authors of the act, and provides managers the necessary rationale to respond to and act on these complex realities. As Zahniser acknowledged in “Guardians not gardeners,” wilderness preservation is itself a human concept (Zahniser 1963). During the period when Zahniser and his fellow authors drafted the Wilderness Act, that concept was rooted in the belief that natural forces could and should operate outside of human control and manipulation. Despite the persisting dominance of this hands-off ideal, wilderness management has rarely adhered to a strict *guardians not gardeners* philosophy, with certain forms of gardening commonly accepted while other gardening practices are often met with significant resistance. For example, fire suppression (i.e., intentional intervention by humans to hinder a natural ecological process) has been a clear and widely accepted form of gardening within wilderness for more than a century. However, the reintroduction of fire to wilderness through human-ignited fire remains a contentious form of gardening despite extensive ecological histories demonstrating the role of Indigenous cultural burning in shaping fire-adapted ecosystems across North America.

Nearly all wilderness areas were, are, and will continue to be shaped by people. While this influence is not necessarily or inherently negative, intentional and unintentional human actions in the current era have largely produced wide-ranging, substantial, and negative impacts on wilderness landscapes. Global ecological stressors such as climate change, intensifying invasions by nonnative species, and significantly altered fire regimes raise complex questions about the purpose and function of wilderness management and the role of wilderness landscapes during a time of immense ecological change. In response, we suggest a *guardians and gardeners* philosophy that does not impose a categorical divide between humans and wilderness and may allow for the implemen-

tation of management strategies that are better able to restore, maintain, and support healthy and resilient wilderness ecosystems. Furthermore, this philosophy has the potential to encourage greater recognition of historical Indigenous stewardship, increase collaboration between tribes and agencies managing wilderness, and expand existing wilderness stewardship models. By allowing intentional and unintentional human influences to affect wilderness while resisting management to mitigate the ensuing negative effects and promote resilience, we may risk the future of America's wilderness areas. In the twenty-first century, it may be necessary to carefully, thoughtfully, and compassionately reimagine the dominant wilderness philosophy.

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## Author contributions

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