

Four dimensions of sustainable governance for National Scenic Trails

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ABSTRACT

Sustainable management of protected areas requires attention to the structures, processes, institutions, and funding mechanisms that support them. When protected areas transcend multiple jurisdictions and landownerships, effective governance requires engagement of multiple institutions. In the United States, 11 National Scenic Trails (NSTs) extend across multiple states, landownerships, and jurisdictions, with regional and national partnerships enhancing management capacity. Trail governance requires a systems approach – coordinating among governmental and nongovernmental partners at multiple scales. We conducted 17 interviews with NST administrators and partners and gathered secondary data about trail characteristics and governance to explore existing trail capacities. Here, we explore NSTs along four dimensions of governance that shape trail management: structural and foundational elements, landownership regimes, trail funding, and partnerships. Understanding these dimensions can inform managers of NSTs and other protected areas crossing multiple jurisdictions, helping them recognize strengths and gaps in institutional form and capacity, and strategies for effective governance.

Management implications

Sustainable management of protected areas depends on understanding the institutions, processes, funding mechanisms that support them. This article seeks to understand the governance networks supporting long-distance trails in the National Trail System (USA). Results help resource managers identify strengths and gaps in institutional capacity along four dimensions: structural and foundational characteristics, landownership and management patterns, federal and private contributions, and partnership characteristics. By exploring these capacity dimensions, we provide insights intended to be useful to managers of specially designated protected areas with multiple overlapping jurisdictions, such as scenic highways, scenic river corridors, and marine heritage areas.

1. Introduction

In the United States, National Scenic Trails (NSTs) were established by the National Trails System Act of 1968 (U.S.C. 1241-51) to provide a system of iconic Trails of natural, historical, or cultural importance (P.L.

90-543). National Scenic Trails receive funding from Congress, and each trail is administered by either the U.S. Forest Service (USFS) or National Park Service (NPS), though trails cross many public and private land jurisdictions. Federal trail administrators coordinate with governmental and nongovernmental partners – operating at the national to local scale – to prioritize and implement trail construction and maintenance. Private financial contributions for trail stewardship are managed by dozens of nongovernmental partners and are matched by thousands of volunteers contributing time and labor. Accordingly, sustainable management of NSTs requires coordination among a complex network of governmental and nongovernmental actors and the ability to harness budgetary, personnel, and managerial capacity from multiple sources.

Outdoor recreation takes place within a social-ecological system with feedback loops to adapt to social, economic, technological, and ecological changes (Morse, 2020). A social-ecological systems framework offers conceptual support for understanding and adapting to such changes in protected area planning (Cerveny & Miller, 2019; McCool, 2019; Spenceley & Snyman, 2017). Social-ecological systems frameworks emphasize the system's dynamism, complexity, and resilience (Levin et al., 2013). Effective governance across diverse ownerships is a

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fundamental component of sustainable and resilient social-ecological systems. As part of outdoor recreation and protected area planning systems, NSTs traverse multiple eco-regions, landownerships (e.g., public, private), jurisdictions (e.g., state, tribal, county), and special designations (e.g., wilderness). Governing NSTs with such a large geographic scope involves a constellation of diverse institutions, with numerous land management agencies operating at multiple levels in a complex socio-political environment, collaborating with nongovernmental organizations, private entities, and communities (Cervený et al., 2021). Thus, the NST system can be considered a nested social-ecological system, with each trail operating within the larger system's framework.

The diversity of institutions governing and stewarding NSTs and variations in geographic and jurisdictional settings creates challenges of consistency in sustainable recreation management. This is further complicated by varying interpretations of sustainable recreation implementation across land management agencies (Selin, 2017, 2018). Traditional notions of sustainable development emphasize three pillars of economic, environmental, and social sustainability (Brundtland Report 1987; Purvis et al., 2019). A working definition of sustainable recreation for public lands in the U.S. expanded the three pillars to include emphases on healthy communities and stewardship (Cervený et al., 2020a). Recent conversations about sustainable public management have embraced a fourth “institutional” pillar (Alibašić, 2018), which concerns whether governing agencies have the capacity to maintain resources over the long term and how they might expand capacity (Pfahl, 2005; USFS, 2010). This involves consideration of a full range of capacity elements: financial, human, physical, informational, and managerial resources (Lusthaus et al., 2002). Adaptive capacity refers to an institution's ability to respond to dramatic or rapid change through shifts in policy or reinvestments (Staber & Sydow, 2002). The complexity of sustainable recreation management suggests a need for adaptive strategies for service delivery, culture change among service providers and managers, and novel approaches to inclusive governance and shared stewardship of recreation resources. We build on this foundation to explore institutional capacity as it relates to the sustainability of the NST system.

This article examines the variation in NST governance across trails to provide insights into their sustainable management as a system. We

conducted interviews with NST administrators and nongovernmental partners for nine of the eleven NSTs to learn about trail governance, institutional capacity, and patterns in challenges managers face. We explore variations in: (a) structural and foundational elements that shape trail governance; (b) landownership and management patterns; (c) federal appropriations and private contributions; and (d) partner roles and characteristics. We then discuss how challenges associated with NST management are framed and shaped by these four dimensions. Our intention is to help managers understand the interaction of various institutional factors that influence sustainable recreation management and offer theoretical insights about the complexity of sustainable governance in protected area designations that extend across multiple jurisdictions and landownership regimes.

2. NST system overview

Under the National Trails System Act, the NST designation was established for “extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass” (P.L. 90-543). Since 1968, 11 NSTs have been designated, providing access to iconic destinations, scenery, recreation, and heritage opportunities (Fig. 1). The trails are designated by an act of Congress, based on an extensive study of each for its suitability, feasibility, and uniqueness and to obtain agreement among landowners and land managers (Congressional Research Service, 2020). Some NSTs were established on existing trails maintained by trail organizations or state entities, including a few trails linked to the pre-colonial era. The Appalachian Trail and Pacific Crest Trail were designated as part of the 1968 Act, followed by the Continental Divide Trail in 1978. These three iconic trails travel thousands of miles across multiple states and are host to many long-distance hikers, backpackers, and day users. Five trails in eastern and midwestern states were established in the 1980s: North Country Trail, Ice Age Trail, Florida Trail, Potomac Heritage Trail, and Natchez Trace Trail. The most recent designations (2009) included the Arizona Trail, Pacific Northwest Trail, and New England Trail.

Each NST traverses distinctive geographical features and operates in a different socio-political environment (Elkinton, 2013, 2018).

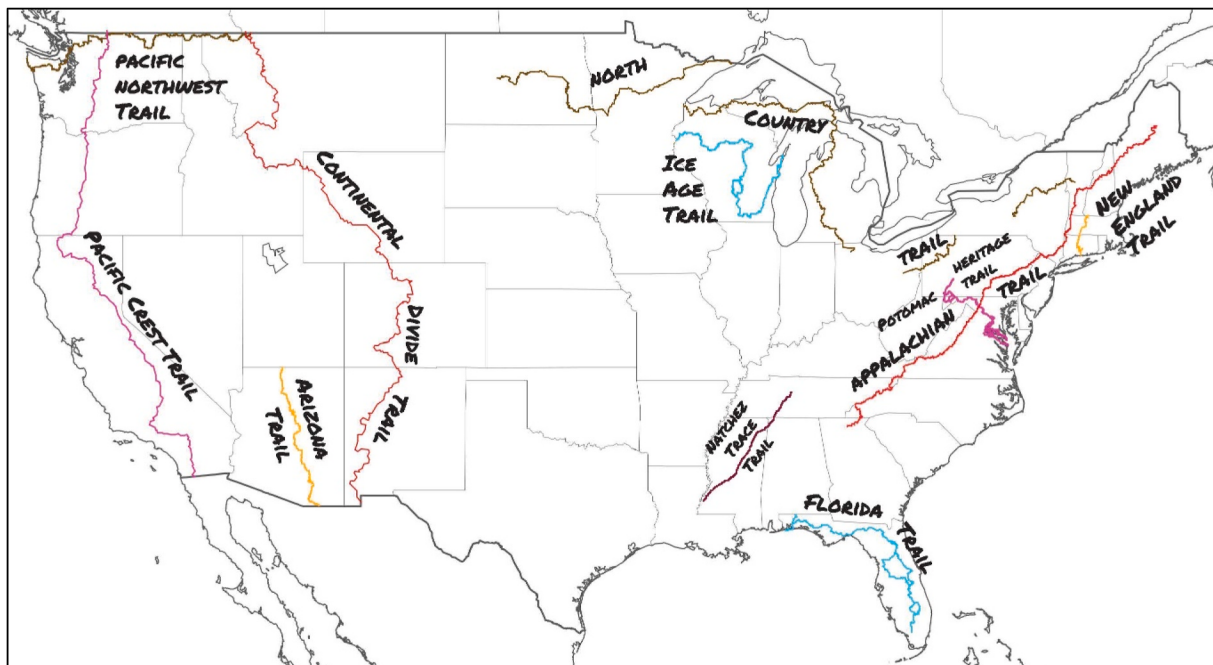


Fig. 1. Locations of National Scenic Trails in the United States (US Geological Survey (USGS) 2022).

Development and administration of NSTs is shaped by many factors, including location, length, visitation levels, landownership types (federal, state, tribal, local, or private), degree of completion, federal agency budgets, and volunteer resources. Built into the 1968 Act was the notion that trail stewardship is shared across many organizations. Coordination is required among nongovernmental trail organizations (NST partners), administrative units managing lands through which trails pass (NST managers), and the federal agencies that oversee the trails in their entirety (NST administrators) (Cerveny et al., 2021; Elkinton, 2018). The 1968 Act provides the framework for NST management and defines the authorities of NST administrators to establish comprehensive plans, conduct management activities, and acquire land.

3. Methods

Our study used a mixed-methods approach involving the collection of information about NSTs from secondary sources, and the collection of primary interview data with NST administrators and partners. We compiled secondary data from NST trail partner websites and annual/impact reports, federal websites maintained by NST administrators, NPS and USFS budget justification reports, annual “gold sheet” reporting from the Partnership for the National Trails System (PNTS), Congressional reports, the National Scenic Trails Act and its amendments (P.L. 90-543), the Omnibus Public Lands Act of 2009 (P. L. 111-11), and other publicly available sources. We also initiated direct email correspondence with NST administrators and partners to collect or clarify information about landownership, membership, and other details. Where detailed data were not available, we used Google MyMaps to calculate trail distances and further estimate landownership proportions. We organized and summarized data in spreadsheets.

We conducted semi-structured interviews with NST administrators and leaders of NST partner organizations in 2020. We contacted 20 individuals associated with 11 NSTs and completed 17 interviews (representing 9 of 11 NSTs). In total, we interviewed 8 NST administrators and 9 NST partners. We also interviewed three key informants with institutional knowledge about NSTs at the national scale. All interviewees were recruited using a standard recruitment letter and each participant voluntarily signed an online consent form prior to the interview. All but two interviews were conducted by phone or video-conference; these were conducted by email. The research team took all measures to protect human subjects and safeguard data, and all instruments were approved by the Utah State University Institutional Review Board [IRB #11413]. Interviews ranged from 30 to 75 minutes and were guided by questions about trail history, management objectives, visitation, and key issues. Interviews were either captured with verbatim notes or were audio-recorded and transcribed. We excerpted segments of text from our interview notes and organized them into documents and tables that we discussed, amended, and refined to develop themes and conceptual frameworks.

4. Results: National Scenic Trail dimensions of governance

To organize our findings, we present four dimensions of NST governance that we developed from our analysis of interview texts and secondary data. We identified and developed these dimensions to depict patterns we observed in institutional form and capacity, that play a central role in shaping the sustainability of trails in the system. We highlight similarities and differences among NSTs to contribute to understanding of the NST system’s diversity in operations and management. The Natchez Trace Trail and Potomac Heritage Trail were not

considered because NST administrators were not available for interviews and due to their incongruence with other NSTs.¹

4.1. Dimension 1: structural and foundational elements

This dimension explores the basic structure and foundational elements of each NST, including the age, length, and completion status of the trail. These essential trail features have implications for NST governance and the institutional capacity of agencies to collectively manage the trail. Trail administrators must develop comprehensive plans in coordination with land managers and include general provisions for acquisition, management, development, and use of the trail. To implement the comprehensive plan, NST administrators must develop an acquisition plan (detailed by fiscal year) and further site-specific plans (P.L. 90-543). The status of these processes and their policy requirements vary among NSTs.

Considering these structural and foundational factors for the nine NSTs, we describe a pattern of similarities (Table 1). Two trails, the Appalachian Trail and Pacific Crest Trail, are the oldest and most developed NSTs with protected trail corridors enabled by the 1968 Act, which makes it unnecessary to acquire additional lands or easements. Both trails exceed 2,000 miles in length, cross several states, and are considered “complete” in their on-the-ground trail mileage. Both trails have completed comprehensive plans and protected corridors established through the 1968 Act. Interviewees from the Appalachian Trail and Pacific Crest Trail suggested that trail completion is not a concern; their focus is on strengthening the network of trail connections and scoping trail expansion (in the case of the Appalachian Trail) as well as addressing maintenance needs associated with high visitor use.

The other trails in the NST system operate under different regulations that do not protect trail corridors. Instead, NST administrators work with landowners to acquire land based on the “willing seller” principle (P.L. 111-11). These provisions, incongruent across the system, can hamper NSTs’ abilities to protect, plan, and administer trail corridors. Another set of NSTs similar in this dimension consists of the four trails designated between 1978 and 1983. The Continental Divide Trail and North Country Trail – also the longest trails in the system – are incomplete, though the Continental Divide Trail has a much more established corridor on public land. For these two trails, acquisition planning language must include specific “objectives and practices” to be observed in trail management including identification of significant natural, historical, and cultural resources to be preserved and a protection plan for high potential historic sites or route segments. The Ice Age Trail and Florida Trail are similar in length (1,200–1,300 miles) and are also incomplete. Both have comprehensive land acquisition plans. Interviewees described similar challenges for these four NSTs, especially related to establishing a continuous and permanently protected trail corridor, a primary goal for promoting trail safety and enhancing visitor experiences. Incomplete NSTs must also invest staff resources in maintaining relationships with landowners and land trusts that enable routing trail segments on private lands, leaving fewer resources for other management activities. For these Trails, this can mean more resources spent working toward trail completion, and fewer on projects to enhance visitor experiences on existing segments.

Finally, the three trails designated in 2009 are all 1,200 miles or shorter and are at various stages in their planning processes. The New England Trail and Arizona Trail are both considered complete, while the Pacific Northwest Trail is not. Comprehensive planning is completed for one of these three NSTs, while the others are in-process. The Arizona Trail is almost entirely on public lands and does not need an acquisition

¹ Natchez Trace is a federal parkway with 60 miles of non-contiguous single-track trail. The Potomac Heritage Trail is heterogeneous in its composition of segmented urban greenway and gravel or asphalt trail interspersed with single-track and waterways.

Table 1

National Scenic Trails: designation, length, completion status, planning and land acquisition.

National Scenic Trail (NST)	Administering agency	Year designated	Length (miles)	Completion status	Planning Status and Provision	Land acquisition
Appalachian Trail	National Park Service	1968	2,190	Complete	Completed comprehensive plan and protected corridor.	Trail corridor established & protected through 1968 Act.
Pacific Crest Trail	U.S. Forest Service	1968	2,650	Complete	Completed comprehensive plan and protected corridor.	Trail corridor established & protected through 1968 Act.
Continental Divide Trail	U.S. Forest Service	1978	3,100	Incomplete	Completed comprehensive plan; objectives & practices.	Land acquisition based on “willing seller.”
North Country Trail	National Park Service	1980	4,600	Incomplete	Completed comprehensive plan; objectives & practices.	Land acquisition based on “willing seller.”
Ice Age Trail	National Park Service	1980	1,200	Incomplete	Completed comprehensive & acquisition plans.	Land acquisition based on “willing seller.”
Florida Trail	U.S. Forest Service	1983	1,300	Incomplete	Completed comprehensive & acquisition plans.	Land acquisition based on “willing seller.”
Pacific Northwest Trail	U.S. Forest Service	2009	1,200	Incomplete	Incomplete comprehensive plan & acquisition plan.	Land acquisition based on “willing seller.”
Arizona Trail	U.S. Forest Service	2009	800	Complete	Incomplete comprehensive plan; no acquisition plan needed.	Almost entirely on federal and state land.
New England Trail	National Park Service	2009	215	Complete	Incomplete comprehensive plan; some partner acquisition planning.	Land acquisition based on “willing seller.”

plan. The New England Trail has done some acquisition planning led by a partner organization, while the Pacific Northwest Trail does not have a complete comprehensive or acquisition plan. For these NSTs, emphasis is on completing these fundamental planning processes to ensure trail management is consistent across the NST.

4.2. Dimension 2: landownership and management patterns

NST designations result in trail corridors that cross multiple jurisdictions, and the mosaic composition of these landownerships has a strong influence on institutional capacity. Some NSTs have a proportionately large federal landownership, which simplifies coordination for the trail administrator. Even for these trails, federal lands exist as individual management units across multiple agencies. Each federal agency manages its lands according to its own provisions and commitments to stakeholders that must be balanced alongside the needs of the NST. This requires coordination among unit supervisors and NST administrators. On trails that pass through a patchwork of landownerships that include state, local, and private lands, these coordination challenges are greater. Interviewees described that NST administrators work closely with multiple agencies and landowners and must navigate myriad planning processes, compliance requirements, and agency regulations to plan along the length of the trail. One trail administrator described the challenges of understanding compliance regulations for multiple entities (federal, state, local) and the need to engage with dozens of entities along the trail in the planning process.

We explored landownerships to understand variations among NSTs (Fig. 2). For five trails, at least 70 percent of the land base is managed by federal agencies. Except the Appalachian Trail, these trails are all in the western United States. The Appalachian Trail is unique in that the trail corridor is protected by the enabling legislation, providing a federal corridor of protection even where the trail passes through private and nonfederal lands. Three trails – the Florida Trail, Ice Age Trail, and North Country Trail – all have a high proportion of state landownership, and state land agencies are critical nonfederal partners on these trails. The North Country Trail links several existing state-sponsored trails along its path and state agencies play an important role supporting these sections. Finally, the New England Trail is unique in its high proportion of trail miles on private lands. Here, the NST administrator uses resources to engage hundreds of corporate and family landowners to create a seamless visitor experience. This patchwork of landownership makes consistency across the trail a resource-intensive challenge in terms of coordinating trail surface, signage and markers, maintenance levels, access, and communications, often requiring additional investments and external support.

The proportion of governmental and private landowners along an NST influences how challenges are addressed. Those trails located predominantly on public lands must be managed in conjunction with adjacent forest management practices, which may not always align with NST goals. For example, energy development, grazing, and timber harvesting on public lands may alter scenic landscapes and recreation opportunities. On trails near state and private lands, interviewees mentioned development pressures related to agriculture and cell towers, wind turbines, utilities, and other infrastructure. Some trails pass close to suburban areas that are increasing in residential density, that can contribute to loss of scenic quality, biophysical degradation, or noise and light pollution. As a result, landownership patterns affect the types of issues that emerge and how they can be addressed. Some trails, because of their location, may be more vulnerable to external changes or development on adjacent private or public lands.

4.3. Dimension 3: federal and private contributions

Another dimension important to sustainable governance relates to the resources (financial and non-financial) available to manage each NST. To estimate available resources, we considered each trail's total “budget” to include three main sources: (1) federal funds appropriated through Congress, (2) the value of volunteer hours conducted on management activities (calculated by multiplying the annual value of a volunteer hour by the total number of volunteer hours reported), and (3) the amount of private financial contributions reported. It is important to note that there are other smaller sources of funds that are likely used for trail management activities (e.g., through partner organizations and local administrative units) but these three main sources are annually reported in a consistent way and likely represent the bulk of the resources.

We compiled and averaged these numbers over a five-year period for nine NSTs. The appropriated funds reported for each trail represent a five-year average (FY 2016–2020) of the “actual” budget figures reported by the administering agency for each trail in the National Park Service and the U.S. Forest Service's annual budget justifications.² The value of volunteer hours and private financial contributions represents a five-year average (CY 2016–2020) of the figures reported by the PNTS in their annual “gold sheets.” Fig. 3 shows the proportion of each trail's annual total “budget” that comes from each of the three major sources.

² Annual budget justifications for the National Park Service: <https://www.nps.gov/aboutus/budget.htm> Annual budget justifications for the U.S. Forest Service: <https://www.fs.usda.gov/about-agency/budget-performance>.

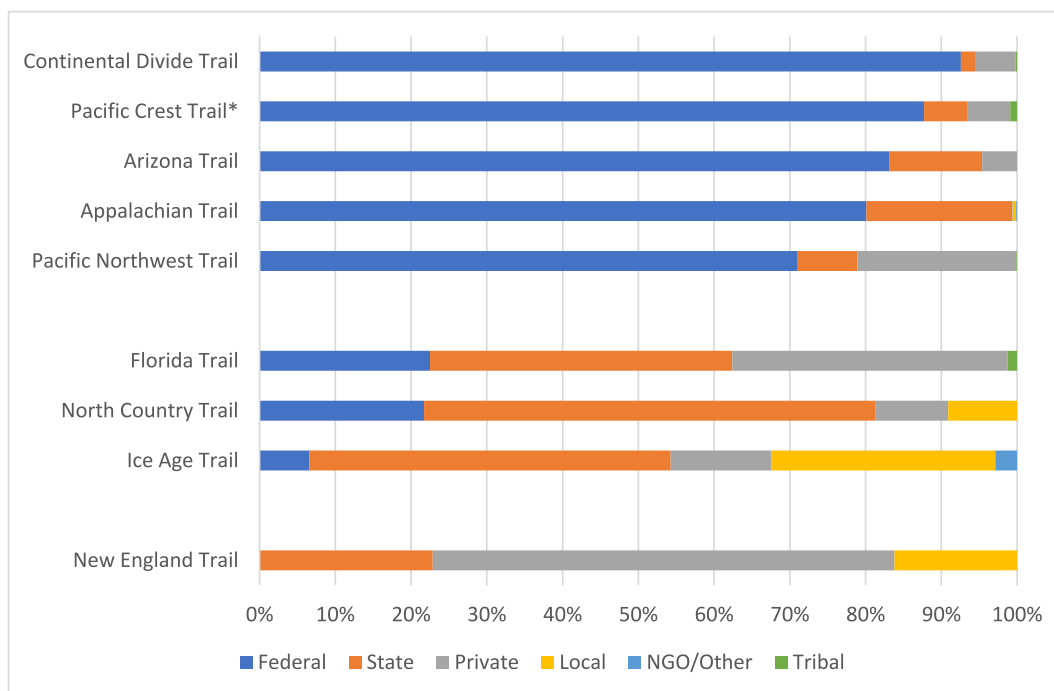


Fig. 2. Percentage of trail mileage by landowner category for National Scenic Trails.¹

¹ For the Pacific Crest Trail, the categories “state” and “private” were combined in the original data. Here they are split evenly for an approximation of these two categories.

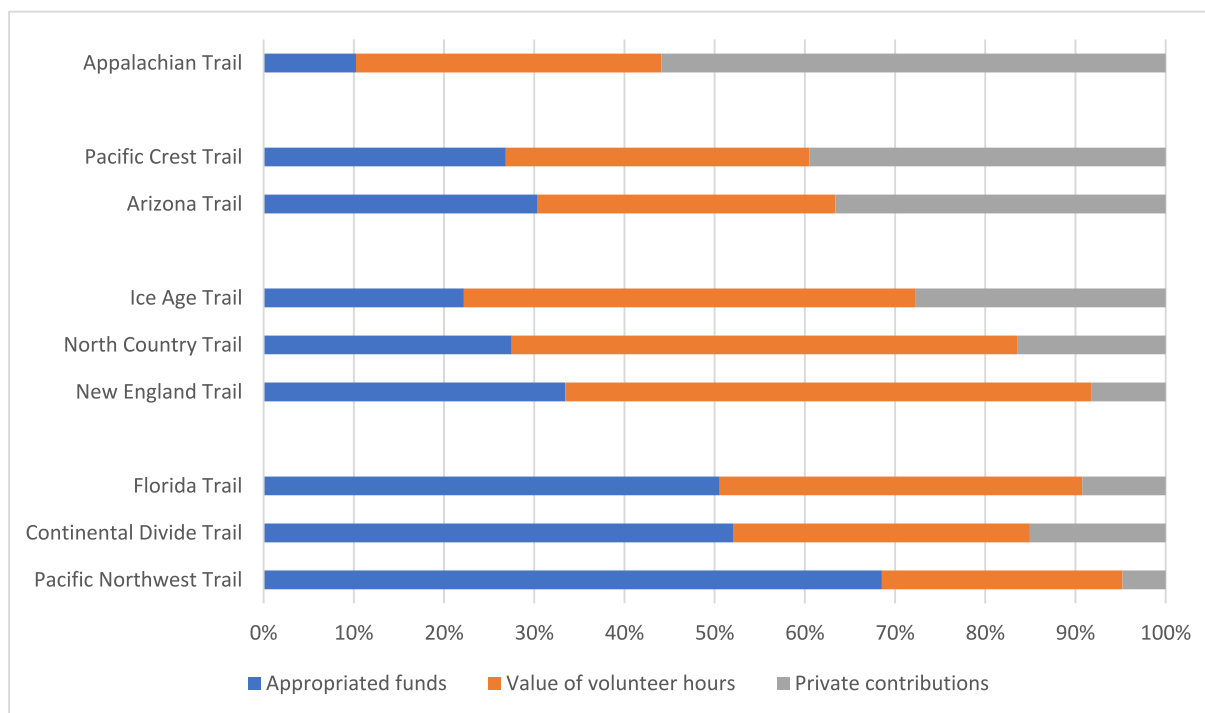


Fig. 3. Federal appropriated funds, value of volunteer time, and private financial contributions to National Scenic Trail management: Five-year average proportions of trail “budgets” (2016-2020).

Table 2

Federal appropriated funds, value of volunteer time, and private financial contributions to National Scenic Trail management: Five-year average of trail “budgets” (2016–2020).

National Scenic Trail (NST)	Appropriated funds	Value of volunteer hours	Private contributions	Total annual “budget”
Appalachian Trail	\$1,591,000	\$5,263,614	\$8,681,421	\$15,536,035
Pacific Crest Trail	\$1,827,800	\$2,291,421	\$2,686,454	\$6,805,675
Ice Age Trail	\$841,000	\$1,898,270	\$1,050,003	\$3,789,273
North Country Trail	\$981,000	\$1,997,405	\$587,480	\$3,565,885
Continental Divide Trail	\$1,675,800	\$1,060,225	\$484,535	\$3,220,560
Florida Trail	\$1,300,000	\$1,032,669	\$237,892	\$2,570,561
Arizona Trail	\$493,200	\$535,877	\$594,275	\$1,623,353
Pacific Northwest Trail	\$836,800	\$325,776	\$58,241	\$1,220,817
New England Trail	\$128,000	\$222,988	\$31,620	\$382,608

Table 2 shows the total average amounts from each of the main sources and the annual total “budget” they create.

The Appalachian Trail is atypical among NSTs, receiving more than half of its budget from private contributions and only 10 percent of its budget from appropriated funds (Fig. 3). It also has the largest total budget (about \$15.5 million), more than twice that of any other trail (Table 2). The budgets for the Pacific Crest Trail and Arizona Trail are spread roughly equally across the three sources, though the Pacific Crest Trail has about four times the total budget of the Arizona Trail. The Ice Age Trail, North Country Trail, and New England Trail all have relatively high proportions of volunteer hours (half or more) comprising their total budgets. The New England Trail has the lowest total budget (about \$0.4 million), while the other two fall in the middle, with total budgets of about \$3.5 to \$3.8 million. The Florida Trail, Continental Divide Trail, and Pacific Northwest Trail all have relatively high proportions of appropriated funds (more than half), and lower proportions of private contributions. Over two-thirds of the Pacific Northwest Trail’s total budget comes from appropriated funds, the highest in the system, and five percent comes from private contributions.

Trail management requires resources to engage people (staff, volunteers, or contractors) to provide administrative leadership and technical expertise, and complete on-the-ground operations. It also requires resources to pay for equipment, materials, and land acquisitions. Interviews revealed the ways NST administrators, who are often understaffed and have shared duties for other programs, are assembling needed resources to meet growing needs. For example, while previously it was common for federal land managers to employ large trail crews with specialized expertise, now NST partners and trained volunteers are playing this role in trail maintenance, reflected in the high proportion of their “budget” some trails derive from volunteer hours (Fig. 3). While recent influxes of federal funding to address maintenance backlogs on federal lands have helped NST investments in some segments, in others, where trails cross private lands or when trail projects are managed by NST partners, access to federal funding is more limited and may not qualify for services typically provided by the administering agency (e.g., planning, consulting, compliance).

4.4. Dimension 4: partnership characteristics

The engagement of nonfederal partners in the governance of the NST system was built into enabling legislation, which was designed “to encourage and assist volunteer citizen involvement in the planning, development, maintenance, and management ... of trails” (P.L. 90-543). Nongovernmental partners expand federal agencies’ capacities for trail management by leveraging resources in the form of funding, personnel, technical expertise, equipment, and social networks (McPadden & Margerum 2014). Nongovernmental partners serve trail advocacy, maintenance, fundraising, convening, volunteer management, and community building roles (Cerveny, Derrien, & Miller, 2020bb), and are eligible to receive grant and foundation funding. Nonfederal governmental partners (states, counties) often assist with land acquisition and trail planning, particularly on segments that they manage and work closely with trail organizations.

Nongovernmental partners support the NST system at various levels. The PNTS coordinates efforts across all NSTs and National Historic Trails, identifying mutual priorities and information needs, leveraging capacity, and seeking funding opportunities. The PNTS represents a significant voice for the trail system (Elkinton, 2018). At the individual-trail level, each NST has a different constellation of nongovernmental trail organizations, with models reflecting local conditions and idiosyncratic organizational approaches that offer different opportunities to expand capacity for trail management through strategic relationships.

Institutional diversity and capacity across the NST system can be appreciated by comparing the characteristics of NST partnership structures and characteristics (Table 3). The Appalachian Trail and Pacific Crest Trail stand out based on the size of the partner organization staff, number of members of the partner organization and volunteers. Most NST partners fall in the middle, engaging 3,000–5,000 members and 500–1,000 volunteers. Considering the number of staff, volunteers, and members of NST partners, some NSTs have greater support than others. As one of the newer trails in the system, the Pacific Northwest Trail has less capacity in terms of volunteers and member support.

Many interviewees perceived the Appalachian Trail and Pacific Crest Trail as having the most desirable model of NST partnership, where a strong, central NST partner coordinates trail maintenance and public events through local chapters or other regional trail entities. These two NST partners were noted for being well-staffed and resourced and having embraced a comprehensive, networked approach for convening stakeholders and leveraging resources. The Arizona Trail, Continental Divide Trail, and others with predominantly federal landownership also follow this model of a central NST partner. When NST partners – especially those in a strong central role – experience changes in leadership or undergo a reorganization, it can take time to rebuild relationships and activate resources. For NSTs with a more diverse distribution of land-ownerships (i.e., the Florida Trail, North Country Trail), the NST partner generally convenes a consortium of federal, tribal, state, and private entities across the trail’s length. In the case of the New England Trail, two non-profit partners split responsibilities geographically along state borders. For the Ice Age Trail, responsibilities are split between an NST partner and the state of Wisconsin. Sustainable management of NSTs is contingent on the strength of individual NST partners and administrators, and the quality of these public-private relationships. Trails with more established NST partners have access to staff with administrative and technical expertise and more support in the form of volunteer hours and private contributions (Dimension 3). High-functioning partnerships

Table 3

Partnership structures and characteristics in the National Scenic Trail system.

National Scenic Trail	NST Partnership Structure	Members ^a	Staff ^a	Volunteers ^b
Appalachian Trail	Appalachian Trail Conservancy (founded 1925) oversees 31 affiliated clubs along trail length.	42,000	67	3,562
Pacific Crest Trail	Pacific Crest Trail Assoc. (founded 1977) manages network of trail partners and their own maintenance groups.	13,700	27	832
Ice Age Trail	Ice Age Trail Alliance (founded in the 1970s; 19 chapters) works with State of Wisconsin Dept. of Natural Resources and NPS.	5,560	17	1,499
North Country Trail	North Country Trail Assoc. (founded 1981), coordinates state/local partners and has 29 local chapters.	3,703	13	988
Florida Trail	Florida Trail Assoc. (founded 1966; 19 chapters) is a consortium for federal & state agencies and trail groups.	4,500	10	524
Arizona Trail	Arizona Trail Assoc. (founded 1994) coordinates with federal agencies, user groups, and communities to maintain trail.	1,636	11	2,271
Continental Divide Trail	Continental Divide Trail Coalition (founded 2012) was reorganized from the dissolved Continental Divide Trail Assoc. Coordinates local/regional partners across the trail.	2,525	13	501
New England Trail	Connecticut Forest & Park Assoc. (founded 1930s); Appalachian Mountain Club (AMC)-Western Mass. Chapter (founded 1950s).	Unknown ^c	9 (CT) 0 (MA)	636
Pacific Northwest Trail	Pacific Northwest Trail Assoc. (founded 1977) coordinates local/regional partners and maintenance crews.	223	5	190

^a For all trails, this figure comes from 2020 annual reports or impact reports.^b This figure comes from the 2020 PNTS annual “gold sheet”.^c While we know that there are 3,400 members of the AMC chapter that oversees the Massachusetts section of the trail, the New England Trail is one small segment of a large trail system that the group oversees. Membership in the CFPA is unknown.

can influence the pace and scale of trail investments. In contrast, when NST partners experience tricky leadership transitions or face administrative challenges, personnel gaps, or lack access to volunteers, additional support may be needed.

5. Summarizing the four dimensions

National Scenic Trail designations are superimposed on a pre-existing patchwork of public and private lands, representing a unique type of “protected area,” with each trail demonstrating diverse management priorities and partnership approaches. In its emphasis on the role of volunteers and nongovernmental partners, the National Trails System Act (P.L. 90-543) has resulted in tiers of partnerships among federal and nonfederal entities, whose coordination is needed for long-term sustainability. Table 4 depicts a summary of findings showing how trails vary across the NSTs along the four dimensions of sustainable

governance.

Each NST falls along the four dimensions in different ways. The Appalachian Trail and Pacific Crest Trail are well developed, completed, and have a protected corridor and long-standing NST partners engaged in advocacy, volunteer support, fundraising, and other roles. Without this protected corridor status, the other seven trails work across land-ownership types to acquire easements and complete the trail. Trails more frequently crossing ownership types also need to exert more effort in promoting consistency of management across the NST. Some trails have strong state partners providing support in land acquisition and planning. Trails closer to population centers or with more name recognition may be in a better position to recruit volunteers or solicit private donations. When challenges in trail operations emerge, such as trail damage caused by weather or visitor use, these challenges are addressed in different ways depending on the combination of these four dimensions that shape institutional capacity.

Table 4

Summary of National Scenic Trails across four dimensions of governance.

	Dimension 1: Structural and Foundational Characteristics	Dimension 2: Landownership and management patterns	Dimension 3: Federal and private financial and volunteer resources	Dimension 4: Partnership characteristics
Appalachian Trail	First to be designated, >2,000 miles, completed path and planning.	Federal, state, local partners. Trail corridor is protected.	High proportion of private contributions. Largest in total “budget” across three categories.	Long-term, well-sourced professional partner with large volunteer base.
Pacific Crest Trail	First to be designated, >2,000 miles, completed path and planning.	Predominantly federal lands. Trail corridor is protected.	Fairly even proportion across budget sources. Second largest total “budget.”	Long-term, well-sourced professional partner with sizable volunteer base.
Continental Divide Trail	Early designation, >3,000 miles, incomplete path and completed planning.	Predominantly federal lands.	High proportion of appropriated funds.	Partner recently reorganized, one partner organization works across trail.
North Country Trail	Medial designation, >4,000 miles, incomplete path and completed planning.	Federal, state, and private lands.	High proportion of volunteer time.	Strong engagement from state partners and NST partner with 19 local chapters.
Ice Age Trail	Medial designation, >1,000 miles, incomplete path and completed planning.	Federal, state, and private lands.	High proportion of volunteer time. Third largest total “budget.”	Partner provides access to volunteers and works closely with state.
Florida Trail	Medial designation, >1,000 miles, incomplete path and completed planning.	Federal, state, and private lands.	High proportion of appropriated funds.	Strong engagement from state partners and NST partner with 19 local chapters.
Pacific Northwest Trail	Recent designation, >1,200 miles, incomplete path and planning.	Predominantly federal lands.	Highest proportion of appropriated funds. Lower total “budget.”	Partner has small staff size and volunteer base.
Arizona Trail	Recent designation, 800 miles, completed path and incomplete planning.	Predominantly federal lands.	Fairly even proportion across budget sources. Lower total “budget.”	Trail partner works closely with federal agencies along length of trail.
New England Trail	Recent designation, 215 miles, completed path and incomplete planning.	Mixture of state, and private lands.	Highest proportion of volunteer time. Lowest total “budget.”	Two NST partners divided by state boundaries with coordination challenges.

6. Discussion

National Scenic Trails face growing capacity challenges at all management levels (Grimm & Dietz, 2018; Lewis & Cho, 2011). When large-scale ecological, social, or economic changes occur, a wide range of interconnected state, federal and local actors must reconfigure relationships and communications to adapt to change. As a result, sustainable management of NSTs requires an understanding of the institutions, processes, funding mechanisms that support them. Some defining categorical factors for NSTs, such as the ability to acquire land, are static in legislation. Others, such as activism around partnerships, volunteerism, and funding, are more dynamic, allowing for the possibility for changes that could shift trails along these myriad dimensions. Given their variations in origin and intention, individual trails are not all progressing on a uniform trajectory. Instead, NSTs are characterized and measured by their own markers of maturity. What is possible for one trail is unlikely for another, given the complexity of designation characteristics, management plans, landownerships, budgets, or partner capabilities. As outdoor recreation patterns shift, ecosystems change, and issues emerge, it is likely the NST system will change in response.

The NST system is adaptive, dynamic, and supported by a web of stewardship partners and governmental actors at multiple scales. A deeper understanding of governance networks is essential to sustainable management of protected areas, and the functioning of those networks influences institutional capacity to support ecological dimensions of the system (Folke et al., 2005; Koontz et al., 2015). Awareness of these four dimensions of sustainable governance is helpful for protected area managers as they consider the ways that pressing issues can be met and addressed.

The NST system operates as a nested social-ecological system, with the governance of each of its trails determined by structural components such as its founding legislation and management plan; a political landscape determined by adjacent landowners, land managers, and the lead administering agency; and a support network shaped by partner organizations that channel the contributions of time and funds from private citizens. Some of these factors are more manipulable than others. For managers to enhance adaptive capacity within their governance networks, they need to work across these nested systems to identify and leverage creative funding sources and other resources. Each NST will require tailored strategies that build on its unique foundations, relationships, conditions, and stressors. Generally, though, the literature suggests that enhancing adaptive capacity will require strategic shifts to refocus the mission, adjust goals, cultivate personnel, or develop new partnerships (Staber & Sydow, 2002). National Scenic Trail administrators, managers, and partners will find it helpful to consider where their trails fall along the four dimensions we have presented and consider the effective strategies their similarly aligned peers have used. We see these four dimensions as a starting point for peer-learning and leveraging knowledge across the NST system, helping to connect managers with similar patterns in their governance systems to develop collective knowledge and expand adaptive capacity.

Scaling up to the national level, NSTs exist alongside other specially designated trails (i.e., National Historic Trails and National Recreation Trails) as part of the National Trails System, which fosters a network of administrative leaders, partners, and advocates. The lead nongovernmental partner organization, the PNTS, plays a central role advocating for trail funding and other needs, connecting partners with resources, and responding to national funding opportunities (e.g., infrastructure, transportation). A central system-wide partner serves an important role for identifying political, social, and ecological changes that affect all trails, such as potential declines in volunteerism or membership in trail organizations (Cervený et al., 2021; Thomas, 2015), or changes in weather patterns and natural disasters related to climate change. Fostering networks of peer-learning and collective action at all levels of nested social-ecological systems helps managers identify gaps or challenges for specific trails (relative to others) and target resources to

address these gaps, promoting system-wide resilience.

6.1. Limitations

This singular case study of a subset of long-distance trails in the United States is limited in scope and sample size. However, the insights gained in this investigation can be further operationalized and explored on other long-distance tracks and trails globally and other protected area designations that transcend management areas, such as scenic rivers and highways. Our representation of the dimensions of long-distance trail governance provides deeper insight into the fourth “institutional” pillar of sustainable development to suggest that the complexities of legislation, landownership, funding, and partnerships shape the degree to which protected area managers can leverage capacity to meet needs for the resources they manage.

7. Conclusion

Sustainable management of protected areas requires attention to governance and the capacity of natural resource institutions, their networks, and their approaches. National Scenic Trails represent a special type of protected area designation superimposed on existing patchwork of public and private landownerships. We identified four dimensions to help us understand the strengths and gaps in trail governance: structural and foundational characteristics, landownership and management patterns, federal and private financial and volunteer resources, and partnership characteristics. These dimensions shape institutional capacities and affect how outdoor recreation opportunities are provided on NSTs. Our review of nine NSTs revealed that while some trails have a relative abundance of institutional capacity along the four dimensions, others are variously constrained by foundational elements, jurisdictional challenges, budgets, or partnership opportunities. Rather than view each NST on a linear continuum of development, we consider them along these four dimensions to help identify gaps, synergies, and potential investments. Our insights are intended to be useful to those managing specially designated protected areas with multiple overlapping jurisdictions.

CRedit authorship contribution statement

Lee K. Cervený: The study was originally conceived by, lead on writing with substantive contributions from, All authors participated in data collection, Formal analysis, and interpretation. **Monika M. Derrien:** The study was originally conceived by, lead on writing with substantive contributions from, All authors participated in data collection, Formal analysis, and interpretation. **Caleb Meyer:** later expanded with contributions from, lead on writing with substantive contributions from, All authors participated in data collection, Formal analysis, and interpretation. **Anna B. Miller:** The study was originally conceived by, lead on writing with substantive contributions from, All authors participated in data collection, Formal analysis, and interpretation.

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