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CONTRIBUTED PAPER

Harnessing visitors' enthusiasm for national parks to fund cooperative large-landscape conservation

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Abstract

Spillover impacts pose challenges for the management of protected areas (PAs). The issue of external threats encroaching on PAs has long been recognized, but a corollary—that PA conservation can increase costs borne by neighboring governments or landowners—is less well appreciated. In some contexts, basic principles of fairness and cooperation suggest that PA users should help pay these costs. Several countries have developed mechanisms for distributing the costs of spillover impacts to PA users, but not the United States. Here, we investigate whether and how US park visitors could help address one type of spillover, the need for wildlife conservation efforts beyond park boundaries, using a case study of the Greater Yellowstone Ecosystem (GYE). We examine a "conservation fee" recently proposed in the Wyoming legislature, along with tax-based alternatives. After exploring some costs of wildlife conservation in GYE, we estimate that a fee of up to $10 per vehicle could generate up to $13 million annually, and tax-based approaches considerably more. We consider legal, political, and governance challenges, and ways to mitigate them. The GYE could serve as a demonstration site for visitor funding of cooperative, large-landscape conservation, for potential future expansion in the US and beyond.

KEYWORDS

Grand Teton National Park, greater Yellowstone ecosystem, human-wildlife conflict, large landscape conservation, national parks, park visitation, protected areas, wildlife migration, Yellowstone national park

1 | INTRODUCTION

A growing number of conservation practitioners and policymakers in the US aim to conserve large landscapes as a means of securing biodiversity, open space, water quality, economic opportunity, and climate resilience (McKinney, Scarlett, & Kemmis, 2010). Existing parks and protected areas (PAs), where wildlife populations are often an important conservation focus, are central to many emerging large-landscape initiatives. Some PAs, such as US National Wildlife Refuges, exist primarily to protect wildlife habitat. Others, such as US National Parks, are mandated to protect wildlife among a broader set of values. Fulfilling this mandate to protect wildlife can pose challenges for PA managers because wildlife population viability may require that populations access surrounding

areas, where their abundance can cause economic damage and political conflict. For example, populations of large carnivores (Woodroffe & Ginsberg, 1998), ungulates (Griffith et al., 2002; Thirgood et al., 2004), birds (Lambertucci et al., 2014), and salmonids (Darimont et al., 2010) important to PAs are known to require large swaths of habitat in surrounding areas. This can result in human safety risks, agricultural damage, development restrictions, and other costs beyond park boundaries, reducing tolerance for wildlife. While it is increasingly common for such issues to be addressed via cooperative, large-landscape conservation (e.g., Berger et al., 2014; National Parks Science Committee, 2012), funding for such efforts is limited (McKinney et al., 2010).

While greater funding for conservation efforts beyond PA boundaries could help reduce these challenges, it is difficult to find. In the US, the budget of the National Park Service (NPS) is perennially strained, particularly due to a current deferred maintenance backlog of more than $11 billion (USDOI Budget Justification Fiscal Year, 2019). Meanwhile, state wildlife agencies, which are primarily responsible for wildlife management outside national parks (Nie et al., 2017), face their own budget limitations (Willms & Alexander, 2014). Many state wildlife agencies are funded primarily through the sale of hunting and fishing licenses, which is problematic because revenues are expected to decline as the popularity of hunting and fishing wanes (USFWS, 2016), and because the emphasis on game species can inadvertently limit attention to non-game species (AFWA, 2016). In this context, some agencies and NGOs are seeking alternative sources of funding (AFWA, 2016; Willms & Alexander, 2014).

Recreational visitors to PAs provide one potentially promising source of new revenue for large-landscape conservation measures. PAs are increasingly popular, and visitors are willing to pay for access to them. Globally, terrestrial PAs receive up to 8 billion visits per year, with visitors spending an estimated $600 billion on their experiences (Balmford et al., 2015). Measures of consumer surplus suggest visitors may be willing to pay $250 billion more (Balmford et al., 2015). In the US, more than 300 million people visit national parks each year (https://irma.nps.gov/Stats), and the average American taxpayer may be willing to pay as much as $400 more per capita in annual taxes to benefit national parks (Haefele, Loomis, & Bilmes, 2016). Eco-tourism, including wildlife-watching, is a major driver of PA popularity and related spending in many areas (e.g., Balmford et al., 2009; Twining-Ward, Li, Bhammar, & Wright, 2018). Thus, PA visitors may be a willing and potent source of support and funding for large-landscape conservation.

Although PA visitation in the US already brings significant revenue to local economies, these funds flow mainly to the tourism and hospitality industries (NPS, 2017), not to those who bear the direct costs of wildlife conservation, such as neighboring state and local governments or landowners. In several international settings, however, governments use PA entrance fees to fund wildlife conservation or rural development. For example, in India, all tiger reserves transfer all visitor fee revenues to a conservation foundation which funds human-wildlife conflict mitigation efforts, among other things (NTCA, 2012). In Uganda, 20% of entry fees are transferred to local communities (Uganda Wildlife Statute, 1996); several other African countries mandate the use of a portion of visitor revenues locally. This model has not been applied to US national parks. Instead, in the US, entrance fees are used mainly for repair and maintenance of park assets and development of visitor services (16 USC § 6,807). The federal government does make "Payments in Lieu of Taxes" (31 USC §§ 6,901–6,907) to local governments to make up for the fact that federally owned lands are not generally subject to property taxation. However, these funds may be used for any governmental purpose (31 USC § 6,902[a]) and are not, to our knowledge, often dedicated to conservation.

Here we ask whether park visitation could yield new revenue in support of large-landscape conservation in the US. We use the Greater Yellowstone Ecosystem (GYE) and its wide-ranging wildlife as a case study. Although wildlife are only one of many motivations for park visitation and large-landscape conservation, they can be an especially important one—particularly in the GYE, which now harbors North America's most diverse assemblage of terrestrial large mammals. First, we explore wildlife conservation challenges beyond park boundaries in the GYE, measures commonly taken to address those challenges, and their costs. Next, we examine a specific, 2018 resolution of the Wyoming state legislature proposing that Yellowstone and Grand Teton National Parks (YNP and GTNP) collect a "conservation fee" from visitors (Wyoming Legislature, 2018). We then explore tax-based alternatives. We discuss some key tradeoffs among these approaches, and suggest ideas for their implementation.

2 | LARGE-LANDSCAPE CONSERVATION IN THE GREATER YELLOWSTONE ECOSYSTEM

The GYE spans about 19 million acres of Wyoming, Montana, and Idaho, and is considered one of the world's most intact temperate ecosystems (Clark, 2008; Lynch, Hodge, Albert, & Dunham, 2008). At its core lie YNP and GTNP, established in 1872 and 1929 to protect scenic landscapes for public enjoyment, and now highly valued

for their wildlife. Five large carnivores—the gray wolf, grizzly bear, black bear, mountain lion, and coyote—range widely across the ecosystem (Figure 1). Six ungulates—bison, moose, elk, mule deer, pronghorn, and bighorn sheep—migrate seasonally up to 260 km in and out of parks, with year-round ranges encompassing wilderness areas, multiple-use public lands, and private lands (Berger, 2004; Middleton et al., 2020) (Figure 1). A native salmonid, the cutthroat trout, spawns each spring in streams across the landscape (Haroldson et al., 2005). More than 5 million people visit the parks annually (NPS, 2018). In a 2016 survey, 83% of visitors said that "viewing wildlife in their natural habitat" was an "extremely" or "very" important motivation for their visit (NPS, 2017).

Since YNP was created, new national forests, wilderness areas, and state wildlife preserves have also been established, protecting millions of acres of additional habitat. Land-use restrictions, hunting and fishing regulations, and endangered-species protections have helped wildlife recover from an era of overharvest and persecution. The GYE has played a major role in development of the

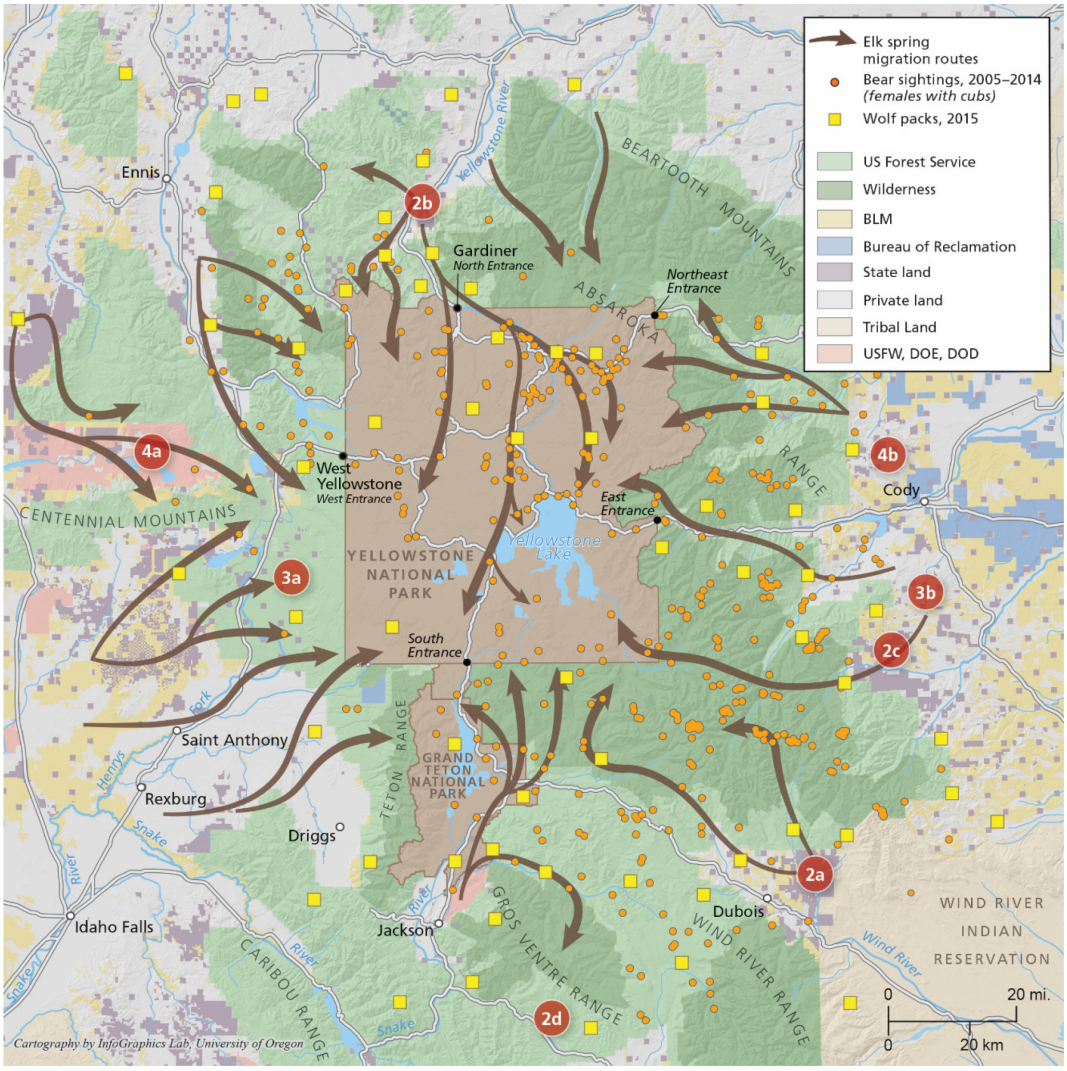

FIGURE 1 Wide-ranging wildlife. Five species of large carnivores and eight species of ungulates roam widely across the GYE, frequently crossing out of parks into multiple-use public and private lands. This map illustrates the movements and distributions of three key species: the elk, the grizzly bear, and the gray wolf. The major spring migration routes of 11 partially-migratory elk herds are shown in brown, based on GPS movement data collected from female elk in these herds between 2002 and 2015. The distribution of grizzly bears is shown with orange dots, which are the locations of bears observed in aerial surveys during mid-summer 2015. The distribution of wolves is shown with yellow squares, which are centroids of wolf pack polygons estimated from VHF and GPS observations in 2015. The red, numbered circles indicate the approximate locations of the exemplar habitat conservation, wildlife passage, and wildlife conflict mitigation projects that are discussed in later figures. Modified and reprinted with permission from Wild Migrations: Atlas of Wyoming's Ungulates (2018), Oregon State University Press, and Atlas of Yellowstone, Second Edition, University of California Press (Forthcoming)

"ecosystem management" paradigm for large-landscape conservation (Clark, 2008). Yet many challenges persist, including encroaching development, intense recreational use, extensive road and fence networks, invasive species, wildlife diseases, and climate change. Several of these challenges are exacerbated by ongoing population growth in the GYE (Hansen & Phillips, 2018). Generally, these challenges are greatest outside the national parks. In particular, private lands comprise 7 million acres (or 30%) of the GYE, including productive, low-elevation riparian corridors preferred by wildlife (Hansen & Phillips, 2018). These lands are highly vulnerable to habitat fragmentation and loss, as well as human-wildlife conflicts. Some large carnivores in GYE, particularly grizzly bears, can injure or kill people, and all of them are known to kill domestic animals (e.g., Nelson et al., 2016). The ungulates that populate the parks and adjacent wilderness areas in masse each summer can, by winter and spring, damage crops and fences, and impact cattle operations via forage competition and disease spread (Cross et al., 2010; Irby, Zidack, Johnson, & Saltiel, 1996; Middleton & Allison, 2016) (Figure 1). These abundant wildlife, and efforts to mitigate their impacts, can impose special costs and pressures on state agencies and landowners. In essence, although advocates for park wildlife and neighbors of parks broadly agree on the importance of wildlife conservation, there is a mismatch in the levels of wildlife diversity and abundance they seek to maintain—opening up a basis for negotiation and cost-sharing.

Agencies and other stakeholders currently have limited capacity to address these costs and pressures at a large scale across the GYE. Only one public entity, the Greater Yellowstone Coordinating Committee (GYCC), has an explicit mission to foster conservation across jurisdictional boundaries in the ecosystem. The GYCC is composed of representatives of federal land and wildlife management agencies in the GYE, and although it meets regularly to set priorities and fund projects, it has only one staff member, a meager annual budget of about $300,000, and no non-federal representation (Clark, 2008). To contextualize these challenges, we next profile common conservation activities in GYE with large-scale benefits, and estimate their costs where possible. Our goal is not a comprehensive inventory, but a brief illustration of key efforts by various stakeholders to sustain wildlife outside the parks—efforts which could be amplified by greater cooperation including, importantly, cost-sharing (Figures 2–4).

2.1 | Habitat conservation and restoration

New wildlife habitat protection in the GYE is often achieved via acquisition, conservation easements, or public-land resource lease retirements (Figure 2). Full-fee acquisition of land is uncommon because of the financial and political issues surrounding public ownership (Merenlender, Huntsinger, Guthey, & Fairfax, 2004), but in one 2015 example, The Conservation Fund paid $1.7 million for a 1.5-km^2 parcel where 5,000 mule deer migrate through a 400 m bottleneck near Pinedale, Wyoming. This land—which had been slated for lakeside

FIGURE 2 Habitat conservation and restoration. Many habitat projects conducted in outlying areas of the GYE benefit wide-ranging wildlife, including populations that spend part of their year in parks and wilderness areas. Exemplars include: (a) the acquisition of 41,156 acres of private land by the state of Wyoming to establish the Spence and Moriarity Wildlife Habitat Management Area; (b) the acquisition of 3,770 acres of private land by the state of Montana to establish Dome Mountain Wildlife Management Area; (c) the acquisition of a conservation easement by The Nature Conservancy of Wyoming on the privately owned Pitchfork Ranch; and (d) the acquisition and retirement of natural-gas leases across ~40,000 acres of the Bridger-Teton National Forest by a coalition of NGOs. Protecting ungulate seasonal ranges and/or migrations routes was a goal of all these projects, but each also benefited many other species including large carnivores, birds, and fish

FIGURE 3 Wildlife passage. The GYE has seen a growing number of conservation projects intended to increase landscape permeability for migratory wildlife. Exemplar wildlife passage projects benefiting populations that range into the parks and wilderness areas include: (a) a wildlife overpass and accompanying fencing proposed by the Idaho Department of Transportation to reduce motorist collisions with migratory elk and moose in Island Park, Idaho; (b) ~11 miles of wildlife-friendly fence modification on a private ranch near Cody, Wyoming supported by a USDA-NRCS Regional Conservation Partnership project and benefiting migratory elk and pronghorn populations

FIGURE 4 Human-wildlife conflict management. A growing number of conservation projects in the GYE also seek to reduce potential conflict between wildlife and people, particularly by mitigating livestock losses to large carnivores and crop damage by ungulates. Exemplars include: (a) An effort by the Centennial Valley Association to reduce conflict with large carnivores across ~385,000 acres by deploying full-time range riders to increase human presence around livestock, monitoring large carnivore presence and activity levels via a camera-trap network, and reducing attractants that can draw carnivores near livestock by removing livestock carcasses; (b) the "Bear Wise" community education and conflict reduction program that the Wyoming Game and Fish Department uses to educate members of the public about minimizing the risk of adverse interactions with grizzly bears. This program also includes livestock carcass removal and other efforts to reduce attractants

cottages—was transferred to the State of Wyoming as a wildlife habitat management area.[1] Conservation easements, where a landowner sells or donates rights—typically the right to subdivide and develop the property (Merenlender et al., 2004)—are more common. Over the past two decades, agencies and NGOs have spent ~$282 million on easements within counties that intersect the GYE (Trust for Public Land, 2019). A 2003 study estimated that establishing easements on key private lands in the GYE would cost ~$687 million (Heart of the Rockies Initiative, 2003). On public land, buyout and retirement of public-land mineral and grazing leases are increasingly common. For example, the Trust for Public Land spent $8.75 million to retire federal energy leases on 58,000 in Wyoming's Hoback Basin in 2012 (Leonard & Regan, 2019). Although we do not present estimated costs here, agencies and NGOs also invest in extensive habitat restoration across the GYE, such as by rehabilitating riparian areas and removing invasive plants.

2.2 | Wildlife passage

Another common strategy to conserve wildlife across the GYE is maximizing landscape permeability (Figure 3). Highway crossing structures facilitate wildlife movement

while increasing motorist safety. In one recent project in the Green River Basin of the southern GYE, the Wyoming Department of Transportation (WYDOT) installed two overpasses, six underpasses, and associated roadway fencing to facilitate safe mule deer and pronghorn crossing, at a cost of approximately $9.7 million (Sawyer et al., 2013). A recent study in Teton County, Wyoming, estimated that crossing structures on high-risk roadways would cost $310,000 per mile (Huijser et al., 2018), and separately, the Western Transportation Institute (WTI) identified about 1,504 miles of high-risk roadways in the GYE (Hardy, Willer, & Roberts-Williamson, 2007). Together, these studies suggest crossing infrastructure across the GYE could cost $500 million. Crossings may offer a significant return-on-investment: for instance, in Wyoming, collisions with wildlife are estimated to cost $24–29 million annually in injuries and other damages, and $20–23 million in losses of harvestable wildlife (Riginos et al., 2016). Another means of increasing landscape permeability is wildlife-friendly fencing. One project in a major deer migration corridor improved 35 miles of fencing, at a cost of $13,000–$24,000 per mile (S. Kilpatrick, personal communication).

2.3 | Human-wildlife conflict management

Agencies, NGOs, and landowners use various proactive and reactive measures to manage human-wildlife conflict (Miller et al., 2016) (Figure 4). For example, proactive measures such as increased human presence (i.e., range riding) and visual cues (i.e., fladry) can deter predators from pastures. Livestock carcass removal and improved campground food-storage infrastructure can reduce predator attractants. In Centennial Valley of the northwestern GYE, a program to provide predator monitoring, range riders, and carcass removal to participating ranches cost $85,000–$125,000 annually (K. Maplethorpe, personal communication). The states of Wyoming, Montana, and Idaho also have programs to compensate livestock producers for losses. In 2016, Wyoming paid $530,000 for damage by wolves, grizzly bears, black bears and mountain lions around the GYE (Wyoming Game and Fish Department, 2016). From 2012 to 2014, Idaho paid on average $260,000 annually for livestock losses from predation (USDA-APHIS Wildlife Services, 2016). In 2017, Montana paid $50,000 for livestock losses in the GYE (Montana Livestock Loss Board, 2017). In total, then, we estimate that compensation for livestock losses within the GYE currently costs the states about $800,000 per year. States also invest in various measures including compensation programs (Wagner, Schmidt, & Conover, 1997) to mitigate ungulates' consumption of agricultural crops and the risk of disease transmission from ungulates to livestock. For example, brucellosis is a disease often carried by elk that leads to infertility, lameness, and weight loss in cattle if they are infected—and from 2011 to 2016, Montana alone spent $7.5 million on its brucellosis management plan, which involves elk monitoring and quarantine of infected cattle (Montana Legislative Audit Division, 2017). The sustainability of such programs may come into question in eras of limited state revenue, suggesting the potential importance of cost-sharing with proponents or park wildlife who are interested in fostering social tolerance for high wildlife diversity and abundance. Many agricultural producers nationally, including in the GYE, already receive public subsidies—including low grazing fees on public lands and favorable tax status—and the complex question of what public interests they should accommodate in return is beyond the scope of our work. However, we note that producers on the frontiers of the GYE and other wildlands encounter an especially high abundance of large mammals that incur special damage.

3 | WYOMING'S RECENT PROPOSAL TO COLLECT A "CONSERVATION FEE" FROM PARK VISITORS

In 2018, the Wyoming legislature passed, with bi-partisan support, a resolution requesting that the NPS work with the states of Wyoming, Montana, and Idaho to collect a "conservation fee" at YNP, and with Wyoming to collect a conservation fee at GTNP, then dedicate the revenue to wildlife conservation outside parks (Wyoming Legislature, 2018). The initial resolution lacks detail, and the federal government's power over federal lands precludes states from compelling the US to impose such fees. Yet the proposal is worth exploring further as a potential opportunity to fund and expand cooperative, large-landscape conservation.

One approach would be for the US to voluntarily share some of the existing entrance-fee revenue—or raise the entrance fee—returning a portion of the revenue to the states for conservation purposes through cooperative agreements. Although national park managers are often reluctant to act beyond park boundaries (Keiter, 1985; Sax, 1980), state support could help them do so. However, this option would face several legal hurdles. First, the statute which authorizes the NPS to charge entrance fees at some units, the Federal Lands Recreation Enhancement Act (FLREA), limits the use of fee revenues to specific purposes (16 USC § 6,807). The only purpose explicitly mentioning wildlife is "habitat restoration

TABLE 1 Car fee

Year	$1 fee	$2.50 fee	$5.00 fee	$7.50 fee	$10 fee
2014	1,173,896	2,926,949	5,827,925	8,702,928	11,551,959
2015	1,384,118	3,451,108	6,871,592	10,261,453	13,620,689
2016	1,414,365	3,526,523	7,021,754	10,485,691	13,918,336
2017	1,359,676	3,390,166	6,750,249	10,080,249	13,380,166
2018	1,367,625	3,409,986	6,789,712	10,139,180	13,458,389
5-year total	6,699,680	16,704,732	33,261,232	49,669,501	65,929,538

directly related to wildlife-dependent recreation" (16 USC § 6,807(a)(3)(C)). The limits of this phrase have not been explored, but habitat protection and wildlife passage projects might not qualify as "habitat restoration," and human-wildlife conflict mitigation even less so. Moreover, FLREA does not explicitly authorize the funding of projects beyond park boundaries. A second hurdle is that the federal statute authorizing cooperative agreements provides the NPS with the authority to transfer only "appropriated funds" (54 USC § 101,702), which are generally understood to be funds allocated annually by Congress. Entrance fees, which are generated by the park itself, would not appear to qualify as "appropriated."

To address the legal issues, and to assuage potential fears that states might divert revenues to purposes that do not enhance park resources, any strategy for raising conservation funds through entrance fees would probably need to be supported by new federal legislation. Although the Trump Administration's recent, abortive effort to raise NPS entrance fees shows that fee increases can face substantial political barriers,[2] carefully tailored legislation could reduce those barriers. For example, a demonstration program could allow increased fees at only YNP and GTNP for a set number of years. Specific constituencies, such as local residents, could be exempted from the conservation fee. A cooperative governance structure sufficient to ensure representation of key stakeholders could be established, and uses of revenues could be limited.

As of January, 2020, the entrance fee at YNP and GTNP is $35 per car and $30 per motorcycle. We estimated potential revenue generation via an additional conservation fee of $1 to $10, based on vehicle entrances to YNP between 2014 and 2018 (Table 1). We accounted for slight decreases in predicted visitor counts under this scenario due to price increases using a demand elasticity of 0.27 from Sage, Nickerson, Miller, Ocanas, and Thomsen (2017)—although it is important to note that demand for national park visits is relatively insensitive to entrance fees, which represent a very small percentage of the total cost of park attendance (Sage et al., 2017). Our resulting calculations indicate a potential yield of $11–$13 million annually (Table 1).

4 | ALTERNATIVE APPROACHES TO GENERATING REVENUE FROM PARK VISITORS

Broadly interpreted, the intent of the Wyoming resolution is to gain revenue from park visitors for wildlife management and conservation. In this sense, a narrow focus upon entrance fees may needlessly constrain the policy options. Alternative approaches could use increases in sales tax and/or the imposition of state lodging taxes to fund conservation efforts. Each alternative brings its own tradeoffs.

Under a tax-based approach, Wyoming could increase its state sales tax, and add a new lodging tax, within the parks or the GYE. The Buck Act of 1947 (4 U.S.C. 105(a)) allows states to collect sales and use taxes, including on lodging stays, inside national parks. Currently, Wyoming collects its standard sales tax of 4% within YNP and GTNP, plus 4 and 2% lodging taxes on behalf of Park and Teton Counties (as Wyoming does not assess a state lodging tax). Revenue from the sales tax is allocated to the state general fund, and the lodging tax revenues are returned to the counties where they are spent primarily on promoting tourism (Agreement Establishing the Jackson Hole Travel and Tourism Joint Powers Board, 2011; Park County Lodging and Tax Joint Powers Board Agreement, 1987). State legislation could increase the sales tax and establish a new state lodging tax. Those taxes could be geographically imposed within YNP and GTNP, or across the GYE. They could expressly direct new revenue to, for example, "protect and mitigate impacts to wildlife and the public outside the boundary of the parks," as the 2018 resolution directed (Wy HR005 2018). Public support may be increased if the taxes would affect only a defined area, impact mainly nonresidents, and benefit wildlife.

Wyoming has already seen considerable success with a similar tax concept through the creation of resort districts. In 2003, the Wyoming legislature passed the Resort District Act, enabling local voters to create a "resort district" in an area that "services the major portion of its economic well-being from businesses catering to

TABLE 2 Sales tax

Year	Visitors	1% tax	1.5% tax	2% tax
2014	3,513,484	9,469,353	14,184,802	18,887,433
2015	4,097,710	11,043,927	16,543,466	22,028,056
2016	4,257,177	11,473,714	17,187,274	22,885,302
2017	4,116,524	11,094,634	16,619,423	22,129,194
2018	4,115,001	11,090,529	16,613,274	22,121,007
5-year total	20,099,896	54,172,157	81,148,239	108,050,992

TABLE 3 Lodging fee

Year	Overnight stays	$1 fee	$2 fee	$3 fee	$4 fee	$5 fee
Fee revenue from concessionaires with YNP						
2014	560,372	559,857	1,118,683	1,676,479	2,233,244	2,788,979
2015	552,940	552,432	1,103,846	1,654,244	2,203,626	2,751,990
2016	579,227	578,694	1,156,324	1,732,888	2,308,387	2,882,821
2017	613,218	612,654	1,224,181	1,834,580	2,443,851	3,051,995
2018	632,913	632,331	1,263,498	1,893,502	2,522,341	3,150,017
5-year total	2,938,670	2,935,968	5,866,532	8,791,693	11,711,449	14,625,802
Fee revenue from all overnight stays in YNP						
2014	1,313,259	1,312,052	2,621,688	3,928,910	5,233,717	6,536,109
2015	1,368,511	1,367,253	2,731,989	4,094,209	5,453,912	6,811,099
2016	1,388,574	1,387,297	2,772,041	4,154,232	5,533,869	6,910,952
2017	1,447,980	1,446,649	2,890,635	4,331,958	5,770,619	7,206,617
2018	1,466,128	1,464,780	2,926,864	4,386,252	5,842,944	7,296,940
5-year total	6,984,452	6,978,030	13,943,217	20,895,560	27,835,060	34,761,716

recreational and personal needs of persons traveling to or through the area" and to impose an additional sales tax for local use (Wyo. Stat. Ann. § 18–16-1012018). Wyoming currently has two resort districts: the Teton Village Resort District, created in 2004, and the Grand Targhee Resort District, created in 2015. Each collects an additional 2% sales tax (Wyoming Taxpayers Association, 2017). In fiscal year 2017–2018, the Teton Village Resort District's 2% sales tax generated $3.1 million (TVRD Tax Collections, 2018). Montana has a similar measure in place, and the town of West Yellowstone has collected a resort tax since 1986 (Grau, 2016); the additional 3% sales tax generated an additional $1.7 million in revenue for the town in FY 2015 (Grau, 2016). The same approach could be applied to create a Grand Teton and Yellowstone National Park Resort District or perhaps a Greater Yellowstone Resort District, within which an additional 1–2% sales tax could be charged and the revenue directed toward conservation efforts.

The potential revenues from a sales and/or lodging tax increase are substantial. Based on the past 5 years of visitation to YNP, assuming the average visitor spends $270 in gateway communities (Duffield, Patterson, & Neher, 2006), we estimate that a 1–2% tax increase could yield $18 to $22 million annually (Table 2). We used demand elasticity estimates from Sage et al. (2017) to include a reduction in visits due to the tax. Again, we note that this small increase in the sales tax represents a negligible expense for park visitors and is not predicted to substantially affect visitation. We also estimated potential revenues from a small lodging fee assessed on concessionaires, ranging from $1 to $5 per bed, per night. Again, because the average visitor spends nearly $900 per trip (Duffield et al., 2006), this increase would likely have a miniscule effect on total visits. After accounting for this effect, based on the past 5 years of visitation, we estimate that a lodging fee levied on concessionaires within the park could generate $2.7 to $3 million annually (Table 3). If the fee were levied on campers too, revenues range from $6.9 to $34.7 million over the same period.

Alternatively, states could use authority under the Buck Act to collect sales tax on park entrance fees—which none currently do. If Wyoming were to collect its 4% sales tax on entrance fees, it could generate $1.40 per car. In 2018, this would have generated $1.9 million of new revenue. As this approach relies upon existing

authorities and does not require the adoption of a new tax—merely the application of that tax on a new transaction—it may be more favorably received by the public and policymakers.

5 | DISCUSSION AND FUTURE DIRECTIONS

National-park visitation has been harnessed to fund large-landscape conservation in several international settings, but not in the United States. Using the GYE and its wildlife as a case study, we considered two approaches to generate potential funding—one based on a proposed conservation fee at park entrances, and another based on hypothetical tax increases targeted to the national parks or the ecosystem. For YNP, we estimated that a conservation-fee approach charging $1 to $10 per vehicle could raise $1 to $13 million annually, and that tax-based approaches could raise $0.6 million ($1 lodging fee) to $22 million (2% tax increase) annually. These amounts would grow larger if multiple approaches were combined and the funds were used to leverage additional public and private resources. Indeed, in one recent year, the GYCC's limited project funds were matched more than four-fold by other stakeholders in the ecosystem (Clark, 2008). For purposes of illustration, based on costs of common conservation activities in the GYE, new annual revenue on the order of $10–20 million could provide matching funds for several conservation easements or highway crossings; several projects to mitigate human-wildlife conflicts on private lands; and the entire annual cost of state compensation for livestock depredations around the GYE.

Clearly, the collection of a conservation fee at park entrances would face a number of legal, ethical, and political challenges. The most obvious legal challenge is that current federal law may not permit the use of entrance-fee revenue beyond park boundaries, or for all wildlife conservation purposes—leading to a political challenge in the need to pass new legislation. A conservation fee may also face serious ethical and political challenges if it increases barriers—real or perceived—to park visitation. Indeed, the cost of visiting parks is one of multiple barriers faced by people of color in visiting the US National Parks (Scott & Lee, 2018). It is conceivable that this challenge could be overcome if fee or tax increases were relatively small, and the affected public felt that the funds would be used for legitimate large-landscape conservation efforts that truly enhance park resources. For instance, prior research has shown that park visitors are willing to pay to compensate ranchers for wolf predation on their livestock (Duffield et al., 2006). A significant political challenge is that the existing Wyoming resolution, which proposed to transfer conservation-fee revenue to the state's wildlife agency, would give unilateral control to a single entity in a complex, multi-jurisdictional landscape. This could increase, not reduce, cross-jurisdictional management conflicts. Conceivably, this issue could be overcome if the federally collected funds were instead transferred to an entity seen to represent the range of interests in the GYE—for example, a subcommittee of the GYCC with not only federal, but state, tribal, NGO, and landowner representation. This approach could have the added advantage of increasing the GYCC's capacity and representativeness, which have been lamented (e.g., Clark, 2008; Lynch et al., 2008). Alternatively, funds could be transferred to a state-level conservation funding body such as Wyoming's Wildlife and Natural Resource Trust (https://wwnrt.wyo.gov/) and restricted to specific uses within a defined geographic area.

However, an approach based on conservation fees alone may be needlessly limiting. Park visitors stay at hotels and make purchases in and near parks. States have the power to tax these transactions—and perhaps even entrance fees. There is international precedent for this approach: in Indian tiger reserves, in addition to routing entry fees to conservation foundations, regulations permit the state government to levy a conservation fee on hotels of $7–$40 per room per month, which is also transferred to the foundations (NTCA, 2012). In the GYE context, a tax-based approach would circumvent many of the legal and political issues of the conservation-fee approach and require little federal-state cooperation. Although recent attempts to levy new taxes in Wyoming have failed, political opposition may lessen as state revenues from mineral excise taxes decline.[3] However, for the same reason, a tax-based approach would likely face concerns that state(s) would use the revenue for priorities other than conservation (e.g., education or health care). To address such challenges, a resort or special district board comprised of stakeholder representatives could be established, with a charter providing direction on allowable expenditures. Broader, regional cooperation could also increase effectiveness of spending, and potentially reduce political barriers since Wyoming, Montana, and Idaho all experience wildlife impacts associated with YNP and GTNP. Successful examples of large-landscape conservation in other contexts offer hope that a coordinating organization such as the GYCC could help resolve these governance challenges (Cumming et al., 2015; Taggart-Hodge & Schoon, 2016). Overall, the need for taxes to address publicly-valued conservation objectives has long been appreciated by economists, who emphasize the disconnect between those who benefit from conservation and those who incur many of the costs (Krutilla, 1967; Krutilla, Fisher, Hyde, & Smith, 1983).

Our investigation reveals some important tradeoffs for conservation practitioners and policymakers to consider.

These tradeoffs include issues of federal versus state and local legal authority; multilateral versus unilateral governance; and the likelihood of adherence to a conservation mission. For instance, a park conservation fee would require new federal law, but might have advantages in its conduciveness to regional governance and likely adherence to a conservation mission. A tax-based approach would circumvent the need for new federal law, but could easily drift away from a conservation mission and foster "opportunity-hoarding" by individual (e.g., local or state) stakeholders. Assessing the appetite of the public and key stakeholders for each alternative may be an important next step toward identifying and weighing such tradeoffs, and ultimately crafting a more specific and actionable proposal. At the same time it is important to note that tax-based approaches may be the only option in some areas because visitation to some public lands (e.g., USFS and BLM lands) does not require an entrance fee.

Despite lingering questions, the concept of using park visitation to fund large-landscape conservation and empower its proponents appears promising for systems with significant cross-boundary conservation needs and high visitation rates. This concept also appears consistent with the recent assessment that "the American people – including but not limited to visitors and residents of communities near parks – must be recruited as 'co-stewards' of the national parks" (National Parks Advisory Board, 2012). The GYE is an archetype for the challenge and promise of large-landscape conservation, which mediate the effectiveness of PAs globally. Certainly, wildlife conservation may not be a dominant concern in all settings; thus, we echo the observation of McKinney et al. (2010) that the design of large-landscape conservation initiatives will necessarily reflect their regional context. Even so, we contend that if the barriers we discuss herein can be overcome, the GYE may present a special opportunity to pilot and implement a broadly applicable, 21st-century model for large-landscape conservation that addresses important needs and concerns of PA neighbors.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Arthur D. Middleton conceived the paper, Harshad Karandikar reviewed international cases studies, Temple Stoellinger and Holly Doremus contributed legal analysis, and Bryan Leonard collected and analyzed economic data. Arthur D. Middleton led the drafting of the article with contributions from all the authors. All authors participated in critical revisions of the article.

ETHICS STATEMENT

This research does not use data from human or animal subjects.

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ENDNOTES

[1] https://www.jhnewsandguide.com/news/environmental/article_6c302dc0-84a6-5b15-8519-0a9c26de3bcc.html

[2] https://www.npr.org/2018/04/13/601980212/national-park-service-to-modestly-raise-entrance-fees-in-plan-to-cut-repair-back

[3] https://www.sfchronicle.com/news/article/Renewed-interest-shown-in-Wyoming-lodging-tax-14910128.php

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