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Plastic Catch · Susan Schultz
porcelain and wood sculpture

Grizzly bear restoration and economic restructuring in the Greater Yellowstone Ecosystem

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Abstract

Reformers of the US Endangered Species Act often present its protections as a hindrance to economic prosperity in rural counties by placing the welfare of animals above that of people. This position suggests that lost livestock grazing, restrictive land and water use regulations, and compromised property rights preclude human well-being. This may be particularly acute in western states where large predator conservation requires many acres of pristine habitat embedded in a mosaic of public and private lands. This paper examines the proposition by analyzing the result of conservation of an apex predator—the Yellowstone grizzly bear (*Ursus arctos horribilis*)—and its impact on human economic well-being in the Greater Yellowstone Ecosystem. The conclusion is that, in this case, such conservation policy did not foreclose human prosperity. Rather, conservation is associated with gains in economic welfare of residents.

Introduction

The US Fish and Wildlife Service (USFWS) announced in June 2017 that grizzly bears in and around Yellowstone National Park would no longer be listed under the protection of the Endangered Species Act (ESA) (Balint et al. 2011; USFWS 2017); by September 2018, a US federal district judge restored ESA protections for the bears. This was not the first time the bear had been a candidate for delisting only to have it reversed in federal court. During the initial effort to delist the bears in 2007, the decision was reversed by the courts in 2009. That decision was appealed in 2010 and upheld in 2011 (Nokes 2019). In 2013 USFWS once again recommended grizzly bears be removed from the threatened species list and the decision was implemented in 2017, leading to the 2018 decision (USNPS 2018). Since its initial ESA listing in 1975, the population of bears has increased toward recovery levels and most agree that this population will be delisted soon and management of the bear will fall to the wildlife agencies of Montana, Idaho, and Wyoming. In the interim, the legal back and forth underscores the fundamental success of four decades of grizzly bear protection and management.

In this paper the case study of restoration of the Yellowstone grizzly bear is used to examine the contention that apex predator conservation is a threat to regional prosperity by presenting the following narrative:

1. The listing and subsequent recovery of the Yellowstone grizzly bear is associated with a shift by public lands managers away from commodity development (e.g., timber harvest) and toward a conservation-dominated landscape;
2. As a result, large-scale unspoiled landscapes were preserved/restored in the Greater Yellowstone region;
3. These landscapes act as attractants for humans seeking qualitative amenities such as scenic beauty, recreation, and ruralness; and
4. Human population growth and job growth in the Greater Yellowstone Ecosystem was not foreclosed by conservation of the Yellowstone grizzly bear, but tradeoffs associated with conservation-driven prosperity exist.

At any given time, the ESA is the subject of a host of proposed reforms by commodity interests and members of Congress. Proposed areas of reform include issues of private property impacts, curtailing litigation by environmental advocates, and changing requirements for species listing and delisting. Many reforms are aimed at the perceived economics of endangered species recovery (Rosen 2007) and negative impacts to rural economies (Shogren and Tschirhart 2008; Langpap, Kerkvliet, and Shogren 2017).

The default position of some reformers is that species protection hinders economic prosperity by placing the welfare of animals above people. This position is often framed as "jobs versus the environment" and suggests that lost livestock grazing, restrictive land and water use regulations, and compromised property rights curtail economic opportunity in rural counties where endangered species often live (Melstrom, Lee, and Byl 2018). This may be particularly acute in western states where large predator conservation requires many acres of pristine habitat that are embedded in a mosaic of public and private lands (Sillero-Zubiri and Laurenson 2001). This paper examines the proposition of the tradeoff between conservation of an apex predator, the Yellowstone grizzly bear (*Ursus arctos horribilis*), and human economic well-being in the Greater Yellowstone Ecosystem. The conclusion is that, in this particular case, such conservation efforts do not foreclose human prosperity and are, in fact, associated with gains in economic welfare of residents.

Background

The decline of the grizzly bear. The history of the grizzly bear in the lower 48 United States is similar to that of large predators the world over. Population declines are the result of active management (i.e., predator control) and habitat loss (Mattson and Merrill 2002). When Lewis and Clark explored the West in the early 1800s, an estimated 50,000 grizzly bears roamed between the Pacific Ocean and the Great Plains (Knibb 2008). West of the 100th meridian, bears ranged from Mexico to Alaska. As European settlement expanded over the next hundred years, available habitat rapidly disappeared with a commensurate decline in bear numbers (Mattson and Merrill 2002). Between the 1920s and 1930s, the grizzly bear lost 98% of its habitat to ranching and timber harvest in the contiguous United States. By 1975, of the 37 populations known to exist in 1922, only six remained (Mattson and Merrill 2002). When Yellowstone National Park was established in 1872, no one knows what the population of bears was, but by 1975, the number of bears in the Greater Yellowstone Ecosystem is estimated to have been between 136 and 312 individuals (Congressional Research Service 1987; Mattson and Craighead 1994; Mattson and Merrill 2002; Smith 2016).

The steady loss of bear habitat has been described as resembling a retreating ice cap (Knibb 2008). As large expanses of habitat began to recede, then fragment, the bears eventually disappeared, leaving a few small remnant populations scattered across the West. Movement between isolated ("island") populations is problematic given high levels of development and associated road systems. Today, those islands constitute 2% of the species' former range and hold populations totaling 1,500 bears in the states of Idaho, Montana, Wyoming, and Washington on (Mattson and Merrill 2002; Feldhamer, Thompson, and Chapman 2003).

USFWS recognizes six isolated populations of bears in the lower 48 states: North Cascades Ecosystem of north-central Washington, Selkirk Mountains Ecosystem of northern Idaho, Cabinet–Yaak Ecosystem of northwest Montana and northern Idaho, Northern Continental Divide Ecosystem of north-central Montana, Bitterroot Recovery Ecosystem in the Bitterroot Mountains of east-central Idaho and western Montana, and the Yellowstone area in northwest Wyoming, eastern Idaho, and southwest Montana. The Yellowstone population has been the primary focus in recent delisting debates, although bears in the Northern Continental Divide are emergent candidates for delisting in the future.

The Greater Yellowstone Ecosystem. The region known as the Greater Yellowstone Ecosystem (Figure 1) was originally adopted as a formal management concept as early as 1971 by the National Park Service and was defined as the range of the Yellowstone grizzly bear by John Craighead and Frank Craighead (Congressional Research Service 1987).[1] The region comprises two national parks (Gunther et al. 2015), five national forests, and numerous other federal and state jurisdictions (Clark et al. 1991).

Approximately 64% of this 97,985-km^2 area is in federal ownership (Kurtz 2010), which acts as an ecological sanctuary for wildlife and a recreational refuge for the nearly 500,000 residents and 7,000,000 yearly visitors to the area (Hansen, Rasker et al. 2002; Johnson, Maxwell, and Aspinall 2003; Hansen and Phillips 2018). These lands are home to key predator species (grizzly bear, gray wolf, wolverine), prey species (elk, deer, moose), and a host of birds and smaller mammals, as well as a variety of vegetation, including coniferous forests, arid shrublands, and grasslands. Several major

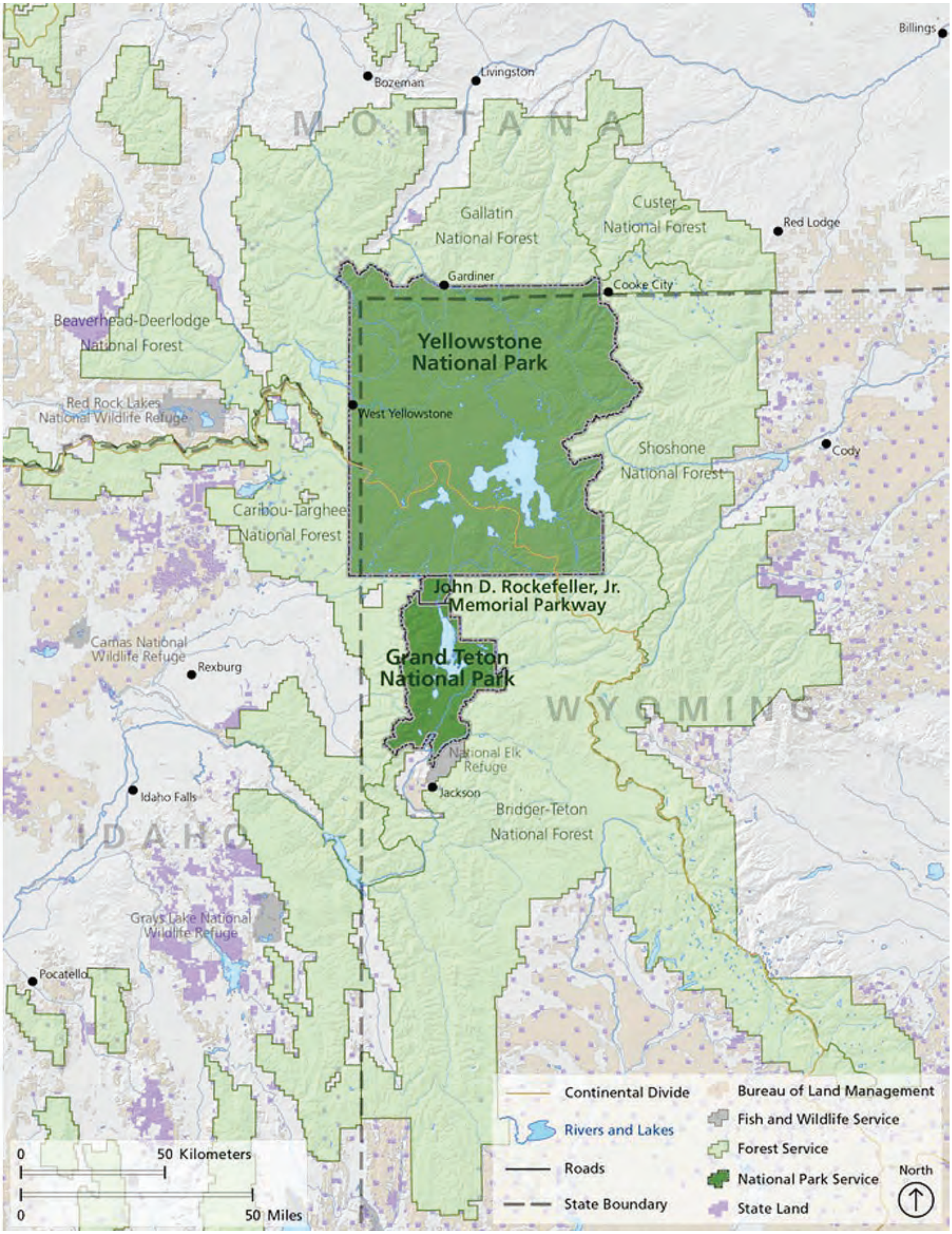


FIGURE 1. The Greater Yellowstone Ecosystem: Public land management and geographic features (USNPS 2018).

river systems originate in the region and elevational gradients range from lowland river valleys (<1800m above sea level) to the Grand Teton (4165m) (Johnson, Maxwell, and Aspinall 2003). The region is considered the world's largest intact temperate-zone ecosystem.

The Endangered Species Act. The ESA was passed by Congress and signed by President Nixon in 1973 (16 USC 1531–1544, 87 Stat. 884). The intent was to protect species at risk from extinction due to the "consequence of economic growth and development untempered by adequate concern and conservation." The act is administered by two federal agencies, USFWS and the National Marine Fisheries Service.[2]

Two categories exist for the management of declining numbers of a species under the protection of the ESA. *Endangered species* are those at imminent risk of extinction throughout all or a significant portion of their range. *Threatened species* are likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range without early intervention to protect them. In simple terms, endangered species are at the brink of extinction while threatened species are likely to be at the brink at some point in the future. Operationally, "threatened" status provides more flexibility to managers to deal with states, individual landowners, and habitat restoration. Shortly after passage of the ESA, the Yellowstone grizzly bear was listed as "threatened" in 1975 and efforts to restore the population of bears began.

Yellowstone grizzly bear recovery. Recovery efforts post-listing began with the creation of the Interagency Grizzly Bear Study Team (IGBST), an interdisciplinary group of scientists and biologists responsible for long-term monitoring and research efforts on grizzly bears in the Greater Yellowstone region.[3] The core science focus of the IGBST is to study bear population trends as well as bear mortality and other survival issues. Some of the management issues the IGBST have undertaken include mapping mortality, food sources, bear dispersion, population demographics, and mitigating human/bear interactions. As required by provisions of the ESA, the best available science would be used to recover the bear in the whole of the Greater Yellowstone Ecosystem, without reference to possible economic or other impacts of the recovery. Under the guidelines of the act, USFWS developed a grizzly bear recovery plan and hired a grizzly bear recovery coordinator. In 1983, the Interagency Grizzly Bear Committee (IGBC) was formed to coordinate management efforts and research actions across the other recovery zones. The Yellowstone Ecosystem Subcommittee (YES) is the organization within IGBC charged with recovery of the grizzly in the Greater Yellowstone Ecosystem.

Three levels of geography describe the recovery efforts within the Greater Yellowstone Ecosystem (Figure 2). The first is the Distinct Population Segment (DPS) comprising the Yellowstone grizzly bear. The DPS boundary in Figure 2 illustrates the isolation of Yellowstone bears from those to the north in the Northern Continental Divide Ecosystem recovery area. Inside the DPS boundary is suitable grizzly bear habitat where the bear population will be monitored using a variety of observation techniques. This Demographic Monitoring Area (DMA) is the boundary within which all observation data for the population are applied. These data inform both population estimates and mortality thresholds. Finally, the Primary Conservation Area (PCA) is where occupancy by grizzly bears is anticipated and acceptable for management. The PCA is identified as a bear-secure area where the recovered population is maintained and acts as a source population for the continued expansion of the population of Yellowstone bears.

The capital stock of grizzly bears is fertile females. Historically, observations of unduplicated adult female bears accompanied by cubs-of-the-year (the COY index) have been used to document grizzly bear population trends; however, the method has potential inherent bias based on the hours of survey effort and the sightability of bears during the survey (Boyce 2001; Doak and Cutler 2014; van Manen et al. 2014). The details of population models are far beyond the scope of this paper, but the assumptions of each model results in somewhat different long-term population trends and so affects future management strategies (Doak and Cutler 2014; van Manen et al. 2014). Several methods of observation have been used to estimate the number of bears, including the COY index (Boyce 2001) and

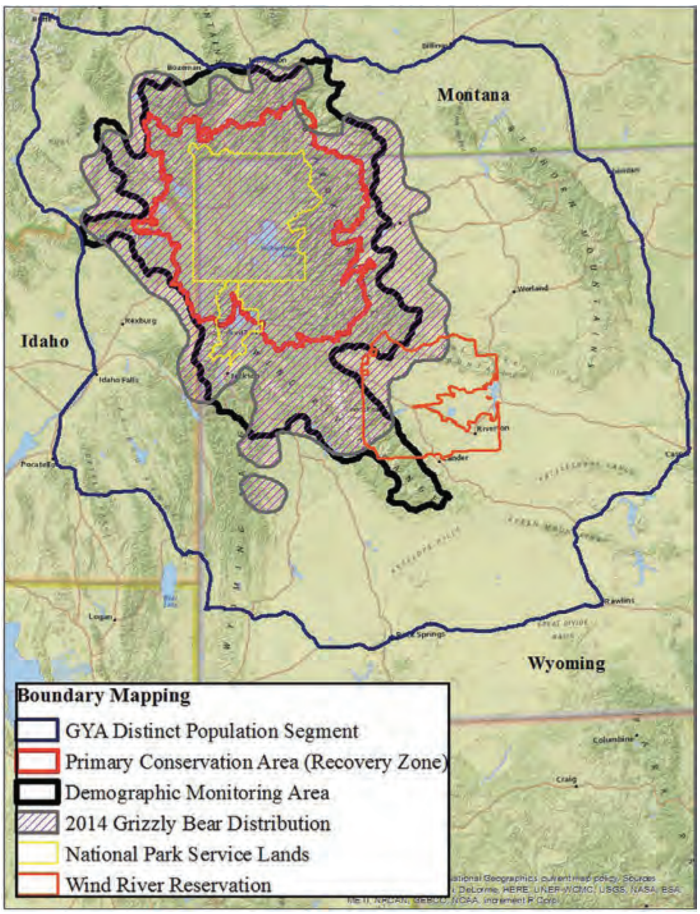


FIGURE 2. Grizzly bear recovery jurisdictions and planning areas for the Greater Yellowstone Ecosystem (WGFD 2016: vi).

various mark–recapture methods (Boulanger et al. 2002; Whittington, Hebblewhite, and Chandler 2018). Observations are interpreted using statistical estimators. During delisting negotiations it was agreed that the estimator Chao2 (Keating et al. 2002) would be used, even though some argue it underestimates bear numbers by up to 50% (van Manen et al. 2014). The fear of those opposed to delisting is that a different estimator could increase the official count in the DMA to 300–400 bears more than agreed-to objectives. If so, this would make more bears available for hunting or other "discretionary mortality."

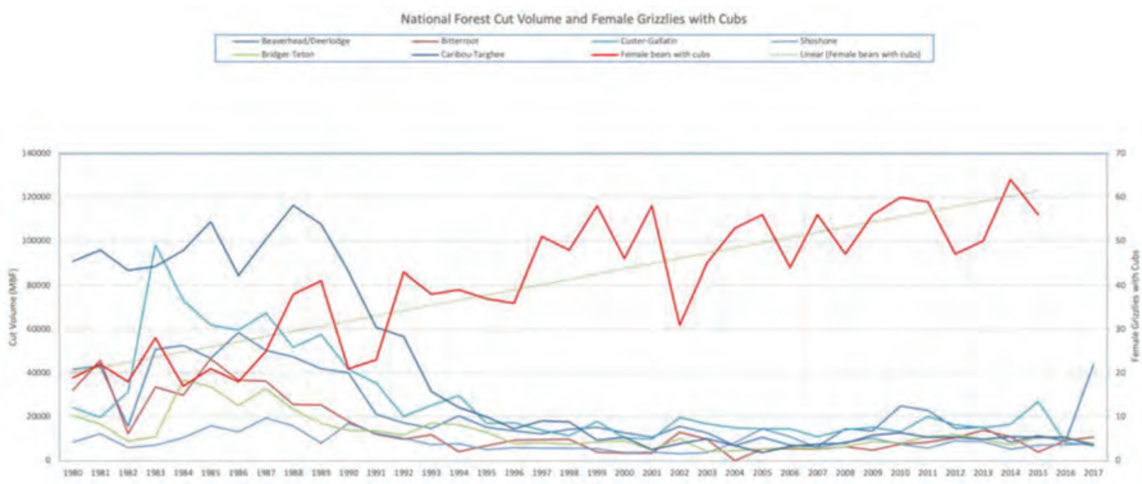
Opponents and proponents of grizzly bear recovery disagree on many details with respect to population trends, counting methods, demographics, and changes to food sources as a result of climate change; however, most agree the bear has made a substantial recovery from the date of listing. In 2018, population estimates ranged from 500 to 1,000 bears, with 718 being the accepted figure by YES (van Manen et al. 2014).

When grizzly range was assessed in 2017, 94% of the 49,930-km^2 DMA was utilized by bears; in 2019, IGBC considered 100% of the DMA to be occupied. Additionally, bears now occupy an additional 18,806 km^2 outside the DMA, or 38% of their total range (Koshmri 2019). Figure 3 below shows the expansion of the population over the last several decades.

Yellowstone grizzly bears and land use. The ESA and the other environmental legislation of the 1960s and 1970s had a profound influence on the use and management of both federal and nonfederal lands in the western states. This was particularly true of grizzly bear listing because of the large amount of public land involved. In 1975, land management agencies, including the US Forest Service, began to develop consistent management policy for grizzly bear recovery. Key to recovery is to identify and remove "habitat limiting factors" with respect to bear habitat. Among such factors were logging roads on national forests, which were identified in the original and subsequent recovery plans as the primary habitat threat (Brown 1982; Servheen 1982). In response, environmentalists pushed the agency to curtail clearcut timber harvests and, in turn, roads on the high-elevation national forests in Wyoming and Montana. This pressure would eventually result in the passage of the National Forest Management Act of 1976. In 1982 and 1993 updated grizzly bear recovery plans were developed to identify efficacious actions for recovery. Again, timber harvest was identified as the major threat. In 2003 the Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area was adopted by all agencies that manage and monitor bear habitat (Interagency Conservation Strategy Team 2007). By 2006 the national forests in the region had completed amendments to their forest plans. The amendments were multifaceted and focused on reduced timber harvest, more stringent food storage regulations in campgrounds, education of the public about grizzly bears, reduction of bear/livestock conflicts, and maintenance of grizzly bear food sources.

The impact of the sequence of bear management actions resulted in a steady decrease in timber harvest on the national forests within the Greater Yellowstone Ecosystem. Forest timber harvest volume fell steadily from the mid-1980s onward for a variety of reasons, including bear recovery policy. The regional bear population grew steadily during the same period (Figure 3).

FIGURE 3. Greater Yellowstone Ecosystem national forest cut volume (in MBF, millions of board-feet), 1980–2017, and population (corrected Chao2 estimates) of female grizzly bears with cubs-of-the-year in the Demographic Monitoring Area, 1980–2016 (Frank van Manen, US Geological Survey–Interagency Grizzly Bear Study Team: IGBST 2017: USNPS 2018).



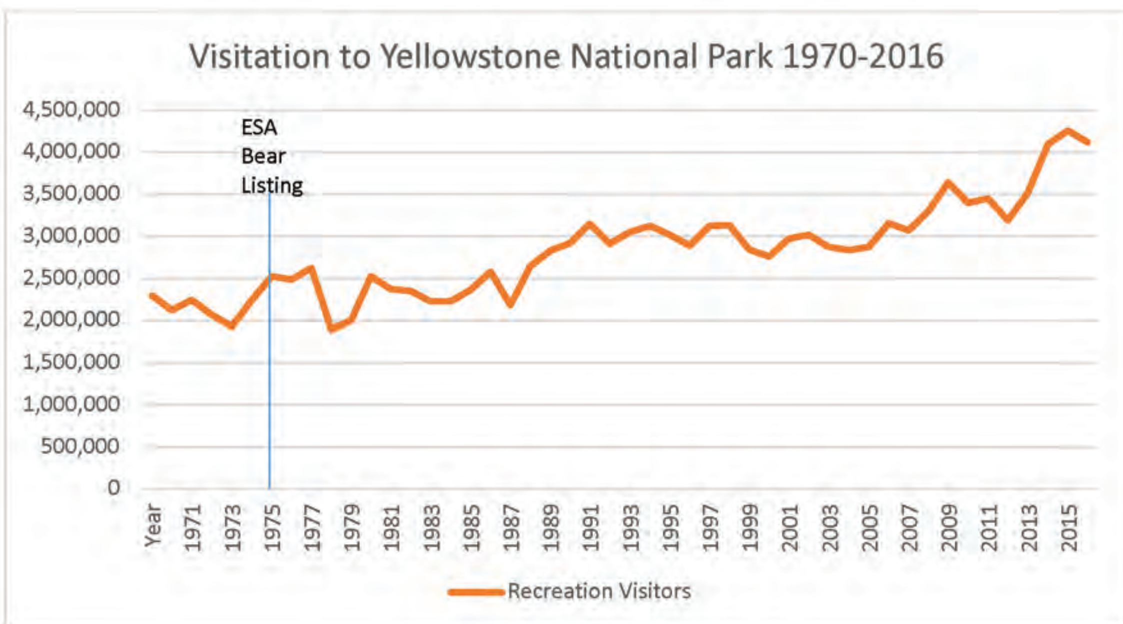
Generally, in the Greater Yellowstone Ecosystem the reduced harvest resulted in less disturbance for bears and preserved national forest lands for other uses such as recreation and protection of water quality, wildlife habitat, and scenic beauty. It also preserved some lands for consideration as designated wilderness.

Paradoxically, the previously large timber harvests may have had an unintended benefit for the environmental movement generally, and indirectly for bears and other charismatic species. Large-scale timber harvest required a large road network that provided ready public access to the national forest lands. In turn, the Forest Service constructed campgrounds and trails to support the increased interest in outdoor recreation. National forest recreation visitation increased from about 5 million in the early 1920s to 18 million in 1946, 93 million in 1960, and 233 million in 1975 (MacCleery 2008). By 2009, over 173 million people made recreational visits to national forests (Donovan, Cerveny, and Gatziolis 2016). Today, forest visits average 150 million people each year (USFS 2016). The boom in national forest recreation, along with the associated wilderness movement, focused Americans' attention on the values associated with wild lands. Today's support for bear conservation, among some, is attributable to people recreating on public lands (Kellert 1994).

The other habitat-related issue cited in the recovery plans was the availability of lands where bears could den and give birth unmolested. In the Greater Yellowstone Ecosystem, this primarily meant the national parks and wilderness areas. During the listing period, visitation to Yellowstone National Park went from about 2,200,000 in 1970 to over 4,000,000 in 2016 (Figure 4). For the first half of the period visitation grew slowly, except for short precipitous drops during the oil shocks of 1973 and 1979, and during the Yellowstone fires of 1988. By 1992 visitation had recovered and increased to over 3,000,000. Between 1990 and 2008, visitation remained relatively flat. With the recent growth since 2012, however, the impact of growing numbers of visitors to Yellowstone (and Grand Teton) is increasingly seen by managers as cause for concern. However, Yellowstone National Park tourist visitation effects on bears post-listing are minimal compared with the period prior to listing.

Beginning in 1970, bear managers focused on denying bears sources of human food and garbage, and translocating problem bears to the remote Yellowstone backcountry; many of these aggressive management actions resulted in mortality events either directly or indirectly caused by humans (Congressional Research Service 1987; Clark et al. 1991; Gunther 1994; Mattson and Craighead 1994; Smith 2016). After a highly critical report from the National Academy of Sciences on Yellowstone grizzly management, the National Park Service revamped its management in favor of bear recovery and fewer mortalities. Subsequent policy aimed at controlling access to trash in gateway communities, prohibition of tourists feeding bears, and public education efforts have been successful at reducing human–bear interactions in the park.

FIGURE 4. Visitation to Yellowstone National Park, 1970–2016 (USNPS 2018).



Most visitation to Yellowstone is concentrated at highly developed sites, such as Old Faithful and other geyser basins where tourists stay on paved trails and boardwalks, and on paved roadways in vehicles where close encounters with bears are unlikely under recovery management regimes (although some bears are hit by cars each year). Backcountry permits are not a significant portion of park visitation and tend to cluster in a few popular locations. Three hundred backcountry campsites are available on a highly limited basis for small groups and many are restricted during periods of bear activity.

Bear viewing is a popular pastime for visitors, but in itself has little long-term effect on the bears. Other tourist activities, however, may inadvertently create impacts on bears, including short-term displacement from high-quality food near roads and human-caused mortality (roadkills). These impacts can be mitigated with education, staffing to manage roadside viewing, and the expanded use of bear-resistant garbage cans and food-storage devices in boxes in parking lots and campgrounds (Gunther et al. 2018).

Today, the main visitor impact is human-habituated and human food-conditioned bears moving out of the park and thus becoming more susceptible to human-caused mortality in gateway communities, farms, and ranches (Gunther et al. 2015, 2018). Human habituation is an adaptive behavior that stems from being in close proximity to people for an extended period of time. In such conditions, bears may become very tolerant of crowds, traffic, and noise. Human food-conditioned bears are those that seek out human development in search of food rewards (human, pet, and livestock foods, as well as garbage). Food-conditioned bears are often secretive and less tolerant of humans and so engage in higher rates of conflict with people than do human-habituated bears. Both types of bear behavior often result in management action by state or local authorities if the bear leaves the confines of the park and falls under a less bear-friendly management policy.

Finally, wilderness and wilderness recreation captured the public mind in the 1970s and visits to particularly high-profile wilderness areas increased rapidly (Roggenbuck and Watson 1989). Ten designated national wilderness areas have been established within the Greater Yellowstone Ecosystem; all are home to the grizzly bear. Wilderness policy as it affects bears is relatively benign and relatively unchanged from the time the species was first listed. Wilderness designation requires low-impact, nonmotorized recreation and few people explore the deep backcountry. The high-elevation forests are home to white bark pine and army cutworm moths—both important food sources for bears (Mattson, Blanchard, and Knight 1992). In wilderness, bears remain undisturbed, encounters are usually brief and usually consist of a moment of excitement for human and bear alike.

Today, the primary cause of bear mortality is linked to sport hunting. Patterns of mortality have changed over time, and those changes may be important for future management of the bears. In an analysis conducted by the IGBST for 1998–2007, hunting-related mortality events accounted for 22% (n=38) of total bear deaths (n=214). Eighty percent of those deaths were due to "defense of life" (hunter self-defense), while most of the remainder were cases of mistaken identity where a grizzly bear was thought to be a black bear. Four percent of deaths were due to predation by other bears and 3% were removals of problem bears—usually due to conflicts with cattle (IGBST 2009). The distribution of mortalities has shifted, from generally being evenly distributed across the landscape, toward Wyoming in the Shoshone and Bridger-Teton national forests. More importantly, bear mortalities have spread beyond the DMA generally. The change in mortality patterns may be due to more bears leaving the park because of population pressure and/or a shift in food sources from vegetation to meat (Mattson, Blanchard, and Knight 1991; Barber-Meyer 2015; Hopkins et al. 2017; Gunther, Bramblett, and Wesselmann 2018).

Social and economic transitions in the Greater Yellowstone Ecosystem

Historically, the lands west of the 100th meridian served as a source of the nation's natural resource base, including mineral, timber, and agricultural development. They were characterized by low human population densities and vast tracts of undeveloped public and private lands (Stegner 1974; Power 1991; Johnson and Beale 1999). The historical economy of the Greater Yellowstone Ecosystem was also driven by resource development—mining, farming, and timber production and associated industries (Power 1991; Johnson and Rasker 1995; Power and Barrett 2001).

Over the past three decades there has been a decline in the relative importance of extractive industry and a rise in the importance of other economic sectors (Rasker and Hansen 2000; Hansen, Rasker et al. 2002; Johnson, Maxwell, and Aspinall 2003; Gude et al. 2006; Rickman and Wang 2018). This economic shift is often attributed to the presence of "natural amenities" that act as attractants to new residents and add to the region's prosperity (Power 1980; Johnson and Rasker 1995; Hansen, Rasker et al. 2002; Johnson, Maxwell, and Aspinall 2003; Gude et al. 2006; Hansen and Phillips 2018; Rickman and Wang 2018).

With a more diversified economy have come higher rates of population growth. During the years of grizzly recovery, between 1970 and 2015, the population of the Greater Yellowstone region more than doubled (+111.6%) and the number of homes tripled from 79,128 in 1970 to 227,687 in 2015 (Hansen and Phillips 2018). New arrivals to the region are attracted by a variety of attributes, including good air transport, a thriving economy (much of it in tech), high-quality recreation, clean and safe communities, and scenic beauty (Dillman 1979; Power 1991; Johnson and Rasker 1995; Johnson and Beale 1999; Rudzitis 1999, Rasker and Hansen 2000; Power and Barrett 2001; Hansen, Rasker et al. 2002; Johnson, Maxwell, and Aspinall 2003; Gude et al. 2006; Bergstrom 2012; Cortes, Davidsson, and McKinnis 2015; Swanson 2016; Bergstrom 2018, Rappaport 2018). Housing needs for the expanding population has spurred a growth in construction trades, materials, and producer services, such as architecture, interior design, and maintenance. The present economy of the region is dominated by the construction trades, producer services industries, retirement incomes, and recreation (Headwaters Economics 2019).

Most growth in the region is centered in the micropolitan communities of Bozeman and Livingston, Montana; Jackson, Wyoming; Victor/Driggs and Rexburg, Idaho, and the surrounding rural countryside in all three states.[4] Economic diversification and population growth have enhanced prosperity in the region as more opportunities for education, health care, transportation, and entrepreneurship have emerged. Micropolitan communities typically attract a well-educated workforce with high social capital (DeVol 2018; Rappaport 2018).

The regional economic and social transformation is important. In a typical regional economy, with a well-defined economic base, rural locations were often at a competitive disadvantage with respect to the supply and quality of labor, access to markets, and transportation costs (Dillman 1979; Johnson and Rasker 1995; Gude et al. 2006). Reliance on a narrow and potentially precarious economic base, especially one grounded in commodity development, may result in high levels of poverty, while amenity-driven rural communities exhibit greater resiliency in the face of economic uncertainty (Morzillo et al. 2015). Such poverty is often antithetical to conservation.

Discussion

The conservation success of the restoration of the Yellowstone grizzly bear is undisputed. Unresolved is the role broad-scale conservation of an apex predator plays on human prosperity. The changes to the regional economy of the Greater Yellowstone Ecosystem during the decades of bear conservation suggest bear-friendly conservation policy did not foreclose regional prosperity. In fact, traditional measures of economic wellbeing have grown steadily while economic opportunity has expanded. Direct causality is difficult if not impossible to determine, but the historical frame where gains in conservation often come at the expense of local economic interests is clearly not the case in the Greater Yellowstone Ecosystem (Power and Barrett 2001; Gude et al. 2006; McGranahan, Wojan, and Lambert 2010; McShane et al. 2011; Heagney et al. 2015). Rather, both the bear and human systems thrive.

Bear recovery took place before and during a period of rapid social and economic transition in the region. These shifts were and continue to be facilitated by the bear recovery efforts. The introduction of grey wolves to Yellowstone National in 1995 was paved by the political success of bear recovery, while amenity migration gained notice because of the influx of new residents looking for a high quality of life (Johnson and Rasker 1995). Today, bison management in and around Yellowstone is informed by bear recovery lessons (Windh, Stam, and Scasta 2019; Zellmer, Panarella, and Wood 2020).

Maintenance of biodiversity requires large areas of high-quality public and private landscapes. These same landscapes are attractants to those with human and financial capital, as evidenced by the growth of a diverse array of economic activity in the region. The past history of commodity development in the Rocky Mountains demonstrated that over-exploitation often results in degraded landscapes for people and nature. Current energy and mineral development efforts in the West seems destined to mirror the past, but such commodity development typically does not result in long-term sustainable rural economies (Power 1980; Johnson 1998; Rudzitis 1999, Power and Barrett 2001; Bergstrom 2018).

Benefits of recovery. Reformers of the ESA suggest that future reform should consider human economic wellbeing in the context of species recovery at the same scale as recovery efforts—that is, at the ecosystem/regional level. By doing so, policymakers would consider ecosystem-wide impacts of ESA-based conservation rather than those on a specific industry or group of landowners. This could form the basis for large-scale economic restructuring as rural economies capitalize on their natural assets. This may be particularly true when much of the landscape is in public ownership rather than private. While a common criticism of the ESA is that the costs of conservation are disproportionally carried by private landowners, in the Greater Yellowstone Ecosystem most bear habitat is on public land. A regional cost/benefit analysis of conservation would likely favor conservation.

This case study has wider relevance. The Greater Yellowstone Ecosystem is emblematic of other regional clusters of high-quality public land that form greater ecosystems. Some are home to listed species. For example, in the Pacific Northwest, the National Marine Fisheries Service has listed 28 species of West Coast salmon and steelhead under the ESA. Salmon and steelhead hatch in freshwater inland rivers and streams, mature in the ocean, and then return to the place of their birth to spawn. Such a dynamic life cycle requires high-quality landscapes and water quality—features that closely mirror the habitat needs of grizzly bears. If and when anadromous fisheries in the Pacific Northwest are restored, amenity-driven economic opportunities in local communities could emerge. Other currently or potentially listed species offering similar possibilities for economic renewal including grey and red wolves, lynx, and sage grouse. Conservation of these apex species could support habitat for numerous lesser species and help produce a suite of beneficial ecosystem services. Bear and European bison restoration efforts are active parts of a larger rewilding movement in much of Eastern Europe. All these restorations could play a key role in revitalizing rural communities in their respective regions.

Tradeoffs of recovery. Not all ecological and human-related trends in the Greater Yellowstone Ecosystem are positive and the region's popularity may have negative long-term results—in some cases, for the Yellowstone grizzly bear. The most comprehensive examination of regional ecological integrity for the Greater Yellowstone Ecosystem is found in Hansen and Phillips (2018). They conclude that potential stressors to the system have intensified dramatically in recent decades due to impacts of human population growth on private lands and impacts from climate change. They identify four vital signs of ecological integrity that are deteriorating: seasonal snowpack, river and stream conditions, wildfire propensity, and forest mortality/viability (Hansen and Phillips 2018). Some (Mattson, Blanchard, and Knight 1992; Gunther et al. 2015, 2018; Hansen and Phillips 2018; USNPS 2018) suggest climate change will have a significant effect on bear populations, most notably on vegetation and insect food sources (Mattson, Blanchard, and Knight 1991; IGBST 2017).

In terms of human prosperity, while the general trends are positive; housing costs/affordability, structural poverty, and recreation overcrowding potentially compromise the qualitative amenities that attract increasing numbers of in-migrants to the region (Johnson 1998; Johnson, Maxwell, and Aspinall 2003; Bergstrom 2012, 2018). In-migration to the region outpaces natural population increases, and some counties are among the highest in rural areas of the US; following those increases, home density is expected to double in the next 30 years (Hansen and Phillips 2018). Much of this growth occurs on rural lands adjacent to public land boundaries, thereby exacerbating impacts to wildlife (Theobald 2014). As the Yellowstone grizzly bear population continues to increase, managers can expect more human–bear interactions and perhaps erosion of social tolerance for bears as they move beyond the DMA. At the least there will be greater pressure to actively manage bears as they expand their range far beyond park and forest boundaries. This may include sport hunting seasons and removal of habituated bears.

Finally, not all conservation efforts result in prosperity or economic opportunity (McShane et al. 2011). Areas where social, institutional, and economic systems are adequately developed will respond to amenity-driven opportunity. For example, markets for predator-friendly agricultural products encourage conservation efforts and conservation nonprofits can be a significant source of employment in rural counties (Pejchar et al. 2007). In less-developed economies that often lack functional institutional frameworks, conservation and amenity-driven development may be more problematic. However, such regions often respond by building institutions where conservation and economic opportunities coexist (Ostrom 2005, 2015).

Conclusion

This case study disputes the assertions of opponents of the Endangered Species Act who suggest it impedes economic opportunity for rural communities. In the case of the Yellowstone grizzly bear, conservation of an apex predator via the protections of the ESA did not foreclose regional human prosperity in the Greater Yellowstone Ecosystem. Indeed, large-scale protection of public landscapes, spurred by grizzly bear conservation efforts, preserved ecological features that act as attractants to humans. They also preserved an array of ecosystem services beneficial to other species. Changes in the regional forest land management regime, influenced in part by bear conservation, are associated with changes in the regional economy and resultant human prosperity of the region. Future reform to the ESA should take into account regional economic impacts rather than focus on potential harm to a single producer or local industry. Such efforts could revitalize rural economies in decline due to unevenness in commodity production markets.

Acknowledgments

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Endnotes

1. While originally defined as Yellowstone grizzly bear range, the Greater Yellowstone Ecosystem has also been described as a "protected area-centered ecosystem" (Hansen, Davis et al. 2011). The system can also be described as a "vibrant economic zone" (Headwaters Economics 2019).
2. USFWS enforces federal wildlife laws under CITES; manages endangered species, migratory birds, nationally significant fisheries; and conserves wildlife habitat (e.g., wetlands). The National Marine Fisheries Service (a division of the National Oceanic and Atmospheric Administration and informally known as "NOAA Fisheries") is responsible for the stewardship of national marine resources and offshore fisheries.
3. IGBST would later become the model for the other ecosystem-level study groups concerned with management of bison, salmon, spotted owls, and other species scheduled for recovery under the ESA.
4. A *micropolitan area* is an urbanized area with a population between 10,000 and 50,000, usually contained in one county. In 2019, there were 551 Micropolitan Statistical Areas in the United States.

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