Policy and the social burden of bald eagle recovery

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Funding information
Dominion, Inc.; The Center for Conservation Biology; Virginia Department of Wildlife Resources; Virginia Department of Transportation; U.S. Army Corps of Engineers; U.S. Department of Defense; National Park Service; U.S. Fish and Wildlife Service

Abstract
One of the challenges of applying endangered species policy on private property is striking an equitable balance between species protection and civil liberties. The future of many imperiled species depends on a public-private trust. We estimate the social burden of managing bald eagles on private lands within the lower Chesapeake Bay (1976–2016). We quantify the area of private and government-owned land deemed critical around nests and estimate the value of private properties as an index of burden. The bald eagle population increased from 30 to 1052 breeding pairs and the land within nest buffers increased from 384 to 10,670 ha with >80% on private lands. Estimated value of private property “under guidelines” increased more than 900 fold. More than 94% of this burden was imposed after eagles reached recovery goals. Restricting activities on private lands to achieve diminishingly small conservation benefits threatens to undermine landowner participation in conservation efforts.

KEYWORDS
bald eagle, Chesapeake Bay, endangered species act, policy, private land, recovery, social burden

Recovery of the majority of the endangered species in the United States will ultimately depend on our ability to manage habitats on private lands (Bean 1998). This reality has led to debate about private property rights and the management of endangered species. The debate centers around the term “taking” under the opposing mandates defined within the Endangered Species Act (ESA: 16 U.S.C. § 1531) and the Fifth Amendment to the United States Constitution (e.g., Green 1998, Innes et al. 1998, Benson 2002). Under ESA [ESA sec 9(a)(1)(b)] it is unlawful for a private citizen to “take” any species classified as federally Threatened or Endangered. Among other actions, the term “take” refers to “harm” which may include disturbance or significant habitat modification. Restrictions on the free use of private land that arise from the prohibition on take under ESA are often viewed to represent a “taking” of private land by the public as prohibited under the Fifth Amendment which states “nor shall private property be taken for public use, without just compensation.”

One of the challenges of applying endangered species policy on private property is striking an equitable balance between species protection and civil liberties. Without due compensation, landowners that harbor endangered species and suffer losses due to restrictions are being asked to privately provision a public good (Brown and Shogren 1998, Melstrom 2020). Policy makers and regulators have the responsibility to insure that the level of burden borne by landowners is justified in terms of realized benefits to imperiled species. This responsibility includes
the reduction in landowner burdens as species recover and associated risks of extinction decline. The long-term effectiveness of endangered species law depends on public support (Jackson-Smith et al. 2005, Raymond and Schneider 2014). The application of inequitable burdens on private landowners has the potential to erode public support for endangered species policy.

As an iconic symbol of freedom within the United States, the bald eagle has a long history of federal protection. Prohibitions on “disturb” were first enacted under the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. 668-668d). Following widespread declines, bald eagles were listed as federally Endangered in 1967 under the Endangered Species Protection Act (16 U.S.C. 668aa-668 cc) and then subsequently under the replacement ESA of 1973. With this listing, ESA became the lead federal legislation protecting bald eagles. Recovery of the population led to downlisting of bald eagles from Endangered to Threatened in 1995 (60 FR 36000) and formal removal from ESA in 2007 (72 FR 37346). Since the delisting of bald eagles from ESA, the lead federal legislation protecting bald eagles has defaulted to BGEPA. As interpreted in the Notice (71 FR 8238) and the subsequent definition of terms (72 FR 31132) protection of bald eagles and their habitats under the BGEPA are very similar to that provided under the ESA. However, while the ESA includes a mechanism to provide exceptions and exemptions to the prohibitions against take (under sections 7 and 10) for take resulting from otherwise lawful activities, the BGEPA had no provisions to mitigate for hardships to landowners. This discrepancy was remedied by establishing a new permitting process authorizing limited take (50 CFR § 22.26, 74 FR 46836).

Since the crisis when eagles were formally listed during the 1960s, regulatory agencies have considered the area around active nests to be critical habitat (subject to the legal jeopardy of “harm”) and have managed disturbance by using spatial buffers and time-of-year restrictions on human activities (e.g., land development, recreational activities, mineral exploration). Despite the fact that recovery goals were met in the 1990s (64 FR 36453), this dual approach to nest management continues to be the federal standard in the post-delisting era (U.S. Fish and Wildlife Service [USFWS] 2007). The continued application of crisis-era restrictions after the crisis has passed risks overburdensing private landowners and undermining public confidence in regulatory policy.

We examine the social burden of applying nest management standards for bald eagles on private lands within the lower Chesapeake Bay over a 40-year period (1976–2016). We quantify the amount of private and government-owned land that falls within management buffers and estimate the value of private properties under restrictions imposed by federal guidelines. Although these two metrics (land area, property value) are clearly indirect measures of opportunity costs imposed on private landowners under regulatory guidelines, we believe they represent a relative measure of social burden that may be compared over time. It should be noted that application of management guidelines on private lands is not absolute but considered on a case-by-case basis to temper the impact on landowners and that a permit process has been available under ESA and is now available under BGEPA to provide hardship exceptions.

1 | METHODS

1.1 | Study area

The Chesapeake Bay is the largest estuary in the North America, containing more than 19,000 km of tidal shoreline. The Bay’s wide salinity gradient, shallow water, and climate have made it one of the most productive aquatic ecosystems in the world and a convergence area for waterbirds throughout the Western Hemisphere (Erwin et al. 2007). Bald eagles breed throughout the estuary primarily from the Atlantic Ocean to the fall line. The fall line is an erosional scarp where the metamorphic rocks of the Piedmont meet the sedimentary rocks of the Coastal Plain. The geologic formations along this boundary frequently determine the landward extent of tidal influence. The Chesapeake Bay was the site of the first successful European settlement in North America and the natural landscape has been altered by European culture for more than four centuries. Forest cover has varied dramatically since European settlement reaching a low of 50% in the late 1800s, but is now the dominant land cover except in areas with intensive agriculture (Brush 2001). The human population in counties surrounding the Bay has increased by 50% since the 1950s (http://www.census.gov). The Chesapeake Bay landscape lies within the second largest mega-region (BoWash) in the world accounting for 2.2 trillion dollars in economic activity or 20% of the gross domestic product of the United States (Florida et al. 2008). Consumption of open land to fuel residential and industrial development across the Bay landscape increased to 110 km²/yr (Goetz and Jantz 2004) resulting in an increase in urban sprawl (Boesch and Greer 2003).

1.2 | Eagle data

We surveyed the study area for breeding bald eagles annually (1976–2016) using a standard two-flight
approach (Watts et al. 2008). We conducted nest surveys between late February and the end of March to locate new nests and to check the status of known nests. We used a Cessna 172 aircraft to systematically overfly the land surface at an altitude of approximately 100 m to detect eagles and nests. The aircraft was maneuvered between the shoreline and a distance of 1–3 km to cover the most probable breeding locations. Survey effort and coverage was consistent throughout the study period. Nests detected were plotted on either 7.5-min topographic maps or GPS-enabled tablets and given unique alpha-numeric codes. We examined each nest to determine its condition and status. We consider a breeding territory to be “occupied” if a pair of birds was observed in association with the nest and there was evidence of recent nest maintenance (e.g., well-formed cup, fresh lining, structural maintenance). We conducted a second flight from mid-April through mid-May to check occupied territories for breeding. We express population growth rate as the average doubling time calculated using the growth equation $N_t = N_0 e^{rt}$, where $N_t$ is the population size in 2016, $N_0$ is the population size in 1976, $e$ is the base of the natural logarithm, $r$ is the intrinsic rate of increase, and $t$ is the time interval between population estimates. With this configuration, $t_{\text{double}} = \ln(2)/r$.

1.3 | Land and value data

We quantified the collective land area falling within bald eagle management buffers every five years throughout the study period. We extended management buffers out from nest coordinates to a distance of 660 ft (201 m) as prescribed by federal standards (U.S. Fish and Wildlife Service 2007). We then merged buffer polygons to eliminate double counting due to overlaps in buffers of adjacent territories. We stratified resulting merged polygons according to land ownership (private, government) and jurisdiction (counties, independent cities). We overlaid polygons of current state and federal lands (https://www.dcr.virginia.gov/natural-heritage/cldownload) on buffer areas to subdivide lands according to ownership for each five-year interval with consideration of acquisition dates of each property. We then overlaid boundaries for counties and independent cities to associate lands within management buffers with appropriate jurisdictions. We used ArcGIS 10.2.2 (ESRI, Redlands, CA) for all spatial analyses.

We estimated the monetary value of properties within bald eagle management buffers for each year and jurisdiction within the study area using Assessment/Sales Ratio Studies (1976–2016) conducted by the Virginia Department of Taxation (http://www.tax.virginia.gov). In accordance with Section 207 of Title 58.1 of the Code of Virginia, the Virginia Department of Taxation conducts an annual real property assessment/sales ratio study each year covering every independent city and county in the Commonwealth. The study estimates the existing assessment/sales ratio for each locality by comparing assessed values to the actual selling prices of real property for each year for the purpose of adjusting tax assessments. The study provides an average property value for each jurisdiction. We applied this average value to the collective area of management buffers on private lands for each jurisdiction and then summed values by year in order to assess the long-term pattern of social burden. These estimates should be considered conservative since they are based on jurisdictional averages and a large portion of the bald eagle nests occur on waterfront property that has a value well above the average.

2 | RESULTS

Between 1976 and 2016 the number of bald eagle pairs within the lower Chesapeake Bay increased exponentially with an average doubling time of 8 years corresponding to an average annual increase of 8.7% (Figure 1). The breeding population exceeded the numerical recovery goal (USFWS Chesapeake Bay Bald Eagle Recovery Plan) in 1994. The number of pairs supported on government-owned lands alone exceeded the numerical recovery goal in 2009. In lockstep with the eagle population, the total amount of land falling within critical habitat buffers increased from 384 to 10,670 ha (Figure 2). In 2016, the percentage of land within restrictive buffers accounted for by privately held lands was 80.7 (8607 ha).

The estimated value of private property within regulatory buffers increased more than 900 fold (1.53 million to 1.39 billion) between 1976 and 2016 with an average doubling time of 4 years (Figure 3). This dramatic increase in the value of private property “under regulation” is due to (1) growth in the eagle population, (2) the increase in overall property valuations and most significantly (3) the increased colonization of urbanized jurisdictions with markedly higher property values. On average, jurisdictions supporting bald eagles experienced a 1327 ± 118.8% (mean ± S.D.) increase in property values between 1976 and 2016. Increases in valuations varied dramatically between jurisdictions from 439% to more than 3525%. In 2016, the per-unit-area value of properties varied between jurisdictions by a factor of 275. Colonization of “high-end” jurisdictions in recent years has accelerated the collective burden on private landowners. The estimated value of properties in 1996, two years after numerical
FIGURE 1  Results of aerial surveys for occupied bald eagle nests (1976–2016) within the lower Chesapeake Bay. The population increased from 30 to 1052 breeding pairs with an average doubling time of 8 years.

FIGURE 2  The area of private and government-owned land under regulatory restrictions (201-m disturbance buffers imposed areas around nests) within the lower Chesapeake Bay (1976–2016). By 2016 80.7% of lands under restrictions were privately owned.

FIGURE 3  The value of privately owned lands under regulatory restrictions within the lower Chesapeake Bay (1976–2016) as assessed using annual sales ratio studies. The value of lands under restriction increased due to (1) increase in the bald eagle population on private lands, (2) increase in land valuations, and (3) colonization of high-end jurisdictions.
population goals were met, was 79.5 million such that 94% (1.31 of the 1.39 billion) of the estimated burden in 2016 had been imposed since the population was deemed to be recovered.

3 | DISCUSSION

Bald eagles within the lower Chesapeake Bay have recovered. By 2016 the breeding population had exceeded the recovery goal by a factor of ten. In general, the population has recovered and bald eagles have appropriately been removed from protection under the ESA. However, during the period between formally reaching recovery goals and actual delisting, measures of burden borne by private landowners increased 17-fold. In addition, delisting from ESA led to a transition in the lead federal legislation protecting bald eagles from ESA to BGEPA. BGEPA carries the same prohibitions on “disturb” as the ESA and management buffers around active eagle nests continue to be used including activity and time-of-year restrictions such that the burden borne by private landowners continues to mount to the present day. By the end of this study, 94% of the total regulatory burden on private landowners had been imposed during the post-recovery period.

Resistance to the removal of protections following the recovery of imperiled species is due in part to fears about losing hard-fought gains when the regulatory framework that led to recovery is dismantled (Henson et al. 2018). For many conservation-reliant species, these fears may be justified because sustaining recovery will require continuous management investments following recovery (Scott et al. 2005). However, this concern does no hold true for bald eagles. The primary rationale for passing BGEPA was to curtail the widespread killing of eagles primarily by shooting. During the intervening years, direct killing of eagles has become an increasingly minor cause of mortality (Russell and Franson 2014). The primary reason for listing under ESA was population decline linked to dichloro-diphenyl-trichloroethane (DDT). The use of DDT was banned by the Environmental Protection Agency throughout the United States in 1972 (37 FR 2875). A secondary concern that prompted listing was loss of habitat due to land development and associated human disturbance. Over the past thirty years, bald eagles have colonized urban areas throughout their range and have demonstrated the capacity to habituate to human activity (Millsap et al. 2004, Schirato and Parson 2006, Goulet et al. 2021). Removal of land-use restrictions on private landowners will not result in a population reversal below recovery goals. Despite the fact that 80% of nests fall within private lands, recovery goals have been met on conservation lands alone for more than a decade. Unlike some endangered species with localized distributions, the fate of the bald eagle does not depend on the actions of a single or small number of landowners. Bald eagles are widespread and occupy properties owned by tens of thousands of owners reducing the population-level risk of actions taken by single owners.

The underlying intent and structure of BGEPA and the ESA differ. BGEPA provides a prohibition on the “taking” (e.g., pursue, kill, capture, molest or disturb) of eagles. Although the ESA has the same prohibitions on take, the intent is population recovery and established population objectives are designed to serve as triggers for the reduction of protections once achieved. Unlike ESA, BGEPA does not have a population focus and does not include a process for curtailing protections once population objectives are achieved. When we attempt to retrofit (define the same prohibitions and implement the same management guidance) BGEPA to assume the lead legislation on population maintenance we encounter the unintended consequence of increasing the social burden without limit. Moving forward, BGEPA must be reimagined to include mitigation of social burden in geographic areas where risks to the population are low.

The bald eagle is a highly visible case study in regulatory overreach that resulted in the overburdening of private landowners. Restrictions on activities within private lands to achieve vanishingly small conservation benefits threaten to undermine support for conservation that depends on landowner participation. The case is complicated by the fact that bald eagles have not only been protected under ESA but also under an independent federal statute (BGEPA). However, regardless of the lead legislation, the decision to impose costs on private landowners must be tempered by the biological need and the burden of this justification falls on the taxpayers. Successful recovery of most imperiled species will require the maintenance of a public-private trust. In the long term the importance of protecting this trust to the assemblage of imperiled species will supersede the interests of a single species, particularly when that species has fully recovered. Decisions made to maintain guidance for land-use restrictions following the delisting of bald eagles and during the transition to BGEPA have not served to strengthen this trust.

AUTHOR CONTRIBUTIONS

Bryan Watts – conceptualization, bald eagle data collection, land value data collection, formal analysis, and manuscript writing and editing. Mitchell Byrd – bald eagle data collection and manuscript review.

ACKNOWLEDGMENTS

We thank all of the agency and university administrators who have supported this project over the decades.
Numerous people have assisted with surveys including J. Abbott, K. Cline, F. Scott, B. Paxton, and R. Lukei. Regular survey pilots have been S. Beck, M. Crabbe, J. Reed, and C. Shermer. We thank the many private citizens and government employees who have provided information and assistance over the years. B. Paxton performed spatial analyses. M. Pits and C. Coleman assisted with data management. The annual eagle survey has been funded by many sources over the decades including Virginia Department of Wildlife Resources, U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Defense, U.S. Army Corps of Engineers, Virginia Department of Transportation, Dominion, Inc., and The Center for Conservation Biology.

**CONFLICT OF INTEREST**
The authors declare no conflict of interest.

**DATA AVAILABILITY STATEMENT**
All data used in this study will be made available online through the dryad data repository upon acceptance of this paper. doi:10.5061/dryad.r4xgxd2g3

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**How to cite this article:** Watts, B. D., & Byrd, M. A. (2022). Policy and the social burden of bald eagle recovery. _Conservation Science and Practice_, 4(9), e12764. https://doi.org/10.1111/csp2.12764