THE CREATION AND EXTENT OF AMERICA'S FIRST ENVIRONMENTAL AGENCIES

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ABSTRACT

Why do administrative agencies form and expand or shrink? We study America's oldest environmental bureaucracies - U.S. state wildlife agencies - from their inception during America's age of wildlife extermination to their manifestation as modern administrative agencies to gain insight. We develop a framework in which demand for agencies depends positively on the costs private landowners would incur to coordinate and self-regulate against overharvest and on the state's capacity to administer regulations. We test implications by examining the timing of state agency creation from 1870 through 1920, changes in the size of agency budgets since the mid-20th century , and the proportion of modern budgets spent on nongame species for which private control is least profitable. Estimates show that high levels of state capacity and private contracting costs, caused by small landholdings and weak rights against trespass, are associated with earlier and larger agencies with less focus on nongame.

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[T]here is no reason why, on occasion, such governmental administrative regulation should not lead to an improvement in economic efficiency. This would seem particularly likely when… a large number of people are involved and when therefore the costs of handling the problem through the market or the firm may be high.

It is clear that the government has powers which might enable it to get some things done at a lower cost than could a private organization. But the governmental administrative machine is not itself costless. It can, in fact, on occasion be extremely costly."

(Ronald Coase 1960, p.17-18)

I. INTRODUCTION

Government agencies are an obvious and important form of economic organization. At the federal level they control vast resources and are involved directly in the production of goods and services, and indirectly in the regulation of private sector activities. In the fifty U.S. states, agencies are just as pervasive where they are involved in many similar endeavors including education, law enforcement, public health, and transportation. For environmental and natural resources in particular, state agencies have a long history and today nearly all states have agencies to regulate agriculture, air quality, fish and wildlife, forests, minerals and energy resources, parks, state lands, and water.

Though agencies are important, there has been little systematic research in economics on the factors determining their creation and extent. Public interest theory suggests they will emerge to solve real or perceived market failure problems (e.g., Stiglitz 1989, Pinotti 2012), but interest group theory suggests they may emerge to transfer rents to well-organized groups (e.g., Stigler 1971, Peltzman 1976, Becker 1983). The literature on state capacity suggests that more populated states, and those with an existing governmental apparatus, are more likely to produce regulations and regulatory agencies (e.g., Mulligan and Schleifer 2005, Besley and Persson 2009). To our knowledge, no studies estimate the influence of these factors on the timing of agency creation, nor on the size and extent of specific governmental agencies, which is what we do here.

We study the creation and extent of state-level wildlife agencies, which are the nation's oldest environmental conservation bureaus. These agencies were formed during 1878 through 1932 in the wake of severe depletion of many native wildlife stocks and some well-known cases

of extinction.[1] Wildlife stocks rebounded during the 20th century after the emergence of agencies and the expansion of their budgets. Over time, some remained relatively small bureaus funded by hunting and fishing licenses while others grew into more expansive agencies engaged in many new tasks, such as managing and researching non-game species.

The history of wildlife agencies raises several questions. First, why did they not emerge earlier to stop the decimation of wild populations and what explains the timing of their creation? State regulatory laws to protect wildlife existed long before agency creation, implying that simply passing new laws was not sufficient. Second, why have agency budgets and allocations varied so much within and across states over time? As we show, the timing and extent of state agencies are not well explained by state population sizes or demographic composition.

Our framework for studying the creation and extent of agencies combines ideas on the evolution of property rights (e.g., Demsetz 1967, Anderson and Hill 1975, Shleifer 1998, Fitzpatrick 2006, Bubb 2013) and resource governance (e.g., North 1981, Smith 2002, Kaffine 2009) with ideas from studies of transaction costs and comparative institutional analysis in the tradition of Coase (1960), Williamson (1999), and Barzel (2002). The framework also draws from Mulligan and Shleifer (2005) who argue that the supply of regulation is determined by the fixed costs of setting up an administrative bureau and from a literature on state capacity, which evaluates when the state is most capable of effectively providing public goods (e.g., Rauch and Evans 2000, Besley and Persson 2009).

The cornerstone of our analysis is that management of natural resource assets - such as fish and wildlife populations but also air and watersheds and underground assets such as oil-gas reservoirs and groundwater aquifers - require a larger geographic scale of governance than the scale of ownership that typically dominates the land surfaces for urban and agricultural uses. Governance can be facilitated by granting ownership of landscape asset pieces to private landowners, or by granting ownership over the entire asset to governments. For example, ownership of subsurface mineral stocks follows private surface boundaries in the United States whereas subsurface mineral stocks are owned by governments in most other countries (Rasband et al. 2016). And wildlife stocks traversing private land are regulated, if not legally owned, by

[1] Most famously, the last passenger pigeon ("Martha") died in the Cincinnati Zoo in 1913 whereas beaver and American Bison populations were driven to near extinction in the late 19th century (Belanger 1988, Lueck 2002, Taylor 2011).

governments in the United States and Canada but in many European and African countries private landowners have strong ownership rights (Lueck 1989, 1991).

Our framework relates to but differs from Demsetz (1967) who hypothesizes that formal private ownership of economic resources, including wildlife, will emerge with rising values and increasing scarcity.[2] In contrast, we argue these factors will increase the probability that a formal governance regime will emerge, be it private, state, or a mixture.[3] Our general hypothesis is that the type of governance that emerges depends on the relative costs of private versus state control. On one hand, administration by state agencies circumvents the private contracting problem of establishing control over landscape assets, which becomes more difficult with increases in the environmental asset's spatial coverage relative to parcel sizes and with the costs of enforcing against trespass. On the other hand, governmental control requires set-up and administrative costs to monitor and steer the agency towards managing natural assets in an efficient way, which are higher when the state has limited capacity.

These tradeoffs are consistent with Coase (1960) who emphasized transaction cost conditions under which government administration might improve economic efficiency relative to control via market contracts as noted in the epigraph. This framing is also consistent with Williamson (1999), who argues that public bureaus arise where output is hard to measure and market provision is limited, and with Barzel (2002) who highlights the state's comparative advantage in law enforcement as an argument for public administration. It predicts that wildlife agencies would have formed earlier where private contracting costs were relatively high and where state administrative capacity was already broad. Once formed, the optimal extent (size and scope) of agencies will increase with private contracting costs. Flexibility in the relative mix of state versus private control across states will facilitate the capture of some resource rents that would otherwise be dissipated by complete agency management or complete private management.

To evaluate these implications, we develop a panel data set that comprises wildlife and related natural resource agencies for all states since 1860. The data indicate the timing of agency creation and include measures of budget size and allocation along with economic and demographic

[2] In the context of 17th century North America fur trade, Demsetz showed that property rights to hunting grounds were better defined and enforced by Native Americans when the value of furs, especially beaver pelts, rose. More generally, he posited that property rights become better defined and enforced when the marginal benefits of more complete ownership exceed the marginal costs.

[3] This follows the logic of North (1981) who held that institutions are created when the social benefits from creating them outweigh the transaction costs.

measures from the states at various time periods. Using survival analysis, we find that agencies tended to emerge first in states where private landholdings were small, where rights against trespass were weak, and where state administrative capacity was large. In modern times, from the mid-20th into the 21st centuries, as laws protecting rights against trespass have strengthened, we find (using difference-in-difference methods) that agency budgets have increased to a lesser extent in states where private landholding sizes have grown suggesting a movement back towards private control as private contracting costs fall.

To our knowledge, this study is the first empirical analysis to examine a demand-focused rationale for public bureaucracy using long panel data on U.S. state agencies. It complements recent work on the economic origins of government, which finds evidence that the public sector emerged in Iraq to help households coordinate for the provision of irrigation canals, a public good (Allen et al. 2023). Our research also relates to econometric work on how demographic and interest group factors explain variation in the scope of regulatory activity (e.g., Pinotti 2012, Mulligan and Shleifer 2005), and on how high transaction costs can reduce private conservation and lead to public governance of natural resources (e.g., Hansen and Libecap 2004, Lueck 1989 and 1991, Troesken and Geddes 2003). Our study is related to in-depth, qualitative research by Olmstead and Rhode (2015) who examine how the administration of U.S. and state regulations during the 19th and early 20th century assisted in the success of U.S. agricultural development by addressing animal disease problems that were not solved by market participants. It is also related to efforts to understand the rise of the federal regulatory state during America's progressive era (Glaeser and Shleifer 2003), and to in-depth historical analyses of environmental protection efforts, such as those for water quality (e.g., Keiser and Shapiro 2019).

II. History: From Game Laws to Administrative Agencies

State fish and wildlife agencies are the descendants of game laws passed by colonial governments whose goals were to prevent the over-harvest of valuable game animals. Created as an alternative to local and private law enforcement , these agencies started as small bureaus comprised of specialized game wardens (who enforced hunting and fishing laws) and became the modern bureaucracies we observe today.

A. Abundance, Decimation, and Recovery of Wildlife Populations

When European settlers first arrived in North America they were amazed by the abundance of wildlife. Harrington (1991) notes that early settlers in Georgia and Virginia observed the "woods abound with deer…" and where two hundred deer "in one herd have usually been observed." Tober (1981, 1) described a Massachusetts observer who noted, "I have seen pigeons… that to my thinking had neither beginning or ending, length of breadth, and so thick I could see no sun." Animals now typically associated with the American West were once present near the Atlantic coast from New York to Georgia. Elk herds could be found as far east as Pennsylvania until around 1867. In addition, jaguars, black bears, grizzly bears, mountain lions, bobcats, wolves, martens, fishers, river otters, and lynx were all in abundance in eastern regions during colonial times (Harrington 1991). Accounts of abundance were repeated as white explorers traveled west on the frontier. In 1804, Meriwether Lewis wrote in his journal "… immence [sic] herds of Buffalo deer Elk and antelopes which we saw in every direction feeding on the hills and plains" (Ambrose 1996, 168). Prairie dogs, prairie chickens, and mule deer were also found in vast numbers.

Despite the colonial abundance, many native wildlife stocks were near local and regional extinctions by the late 1800s, the height of the so-called "age of extermination" (Belanger 1988). As Figure 1 shows, the once ubiquitous white-tailed deer population had dwindled by more than 98%, from estimates of 37 million at the turn of the 18th Century to less than 500,000 by 1900. The deer population recovered through the 20th century such that deer are now overabundant in many areas (Raynor et al. 2021). Populations of antelope, elk, turkey, beaver, and waterfowl also recovered but other species, such as the American Bison and the passenger pigeon, did not. The passenger pigeon became extinct in and bison, while avoiding extinction, recovered to just ten percent of their pre-settlement numbers (Lueck 2003, Gates et.al 2010).

The severe decline in wildlife populations resulted, primarily, from exploitation by market hunters (Harrington 1991, Tober 1981, Belanger 1988) operating in a *de-facto* open access regime with limited information about populations and wildlife biology.[4] Markets for wildlife products (e.g., meat, hides, feathers) were widespread in major cities, especially by the late 19th century (Tober 1973). The abundance of wildlife led many commentators to deem that regulation and

[4] Other causes included the systematic killing of predators, loss of habitat (e.g., through deforestation and homesteading), and the introduction of exotic species (see Harrington 1991).

enforcement were unnecessary even as wildlife populations plummeted in many areas.[5] Eventually, however, sportsmen (i.e., recreational hunters) groups formed and banded with naturalists (i.e., environmentalists) to lobby for regulatory action (Tober 1981, Warren 1997). Population recoveries during the 20th century occurred in the wake of major governance changes (such as new state wildlife agencies) (Harrington 1991, Tober 1981).

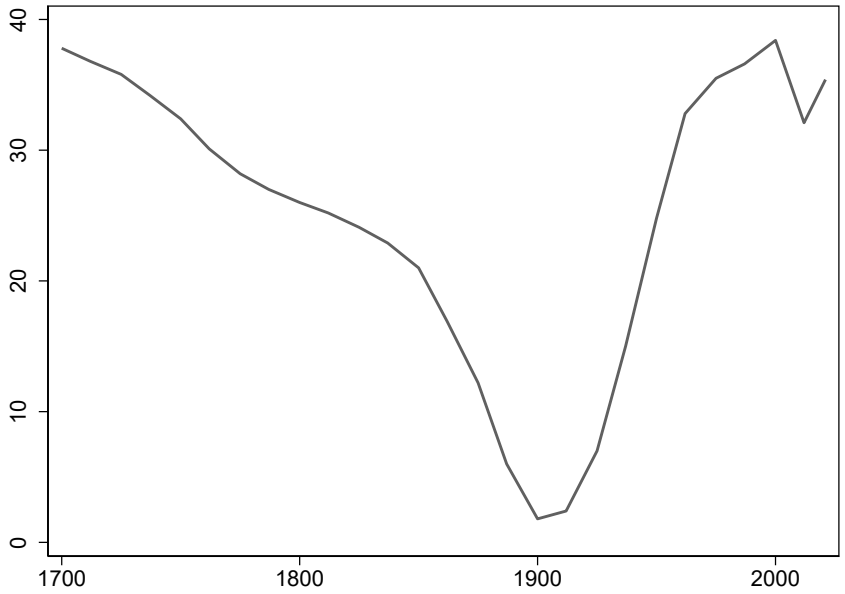

Figure 1: Estimated U.S. Deer Population, in Millions.
Source: Kent Webb, who provided the authors with the data underlying his chart of deer population within the continental U.S. at www.deerfriendly.com/decline-of-deer-populations. The horizontal axis shows year and the vertical axis shows population in millions.

Private Wildlife Management

The amount of private enforcement prior to the formation of agencies was not systematically documented but was significant in some regions. Tober (1973, 1981) describes how private recreational hunting clubs of the 19th century filled some of the vacuum in wildlife law enforcement before state agencies and specialized game wardens emerged. Sportsmen sought to slow commercial hunting and paid to do so. The Association enforced a temporary moratorium on hunting and the population rebounded (Tober 1981). The Bloomington Park Association of Pennsylvania, incorporated in 1871, hired game wardens (deputized by county sheriffs) to patrol

[5] Tober (1981, 17), for example, notes that an Ohio Senate disposed of a passenger pigeon protection bill arguing that the birds "were so wonderfully prolific" that "no ordinary destruction can lessen them."

enclosed hunting grounds (Tober 1981).[6] The Hartford Game Club of Connecticut offered rewards for information about game law violations, and the New York Association for the Protection of Game employed detectives to roam market stalls in New York City in search of dealers with illegal wildlife products (Tober 1981).

There were also private efforts to stock and manage game and habitat. For example, in 1878 the Rutland County Deer Association of Vermont augmented a depleted deer population with deer acquired from private herds in New York. An association of sportsmen in Berks County Pennsylvania leased 3,000 acres from 15 farmers and in exchange received exclusive hunting and stocking privileges. In New Jersey, the landowner members of the Farmer's Mutual Protective Union issued hunting permits which were valid to registered hunters on all cooperative lands. The system provided 15,000 acres of exclusive hunting (Tober 1981, 124). Sportsmen clubs in New York reportedly had leased, owned, and fenced between 500,000 and 800,000 acres as private game parks in the Adirondack area (Tober 1981, 127).

Two obstacles to private contractual solutions to wildlife exist. First, as emphasized by Tober (1981) and Lueck (1989, 1991), wildlife populations move across geographic spaces that naturally exceed the size of most private landholdings. When the boundaries of wildlife populations exceed property lines, private contracting becomes a land assembly problem in which enough contiguous acres must be dedicated to the private wildlife reserve. As Coase (1960) emphasized, successful contracting becomes increasingly difficult with increases in the number of contracting parties (e.g., landowners, hunters, and wildlife recreationists).

Federal land policies in 19th and early 20th century America raised the number of relevant contracting parties by creating a mosaic of small private parcels sometimes scattered among tracts of public land. Federal land was incompletely transferred to private owners under policies such as the Land Act of 1800, the Preemption Act of 1841, the Homestead Act of 1862, and amendments to it thereafter (Allen 2019, Gates 1968). The remainder of federal lands were either transferred to state governments when statehood was gained, or they remained under federal control. In general, the agencies governing federal and state lands lacked authority to enforce and manage wildlife and hence these lands were effectively open access in the absence of wildlife agencies.

[6] In medieval England private gamekeepers were common (Tober 1981, Lueck 1989) and the surname "Parker" was a common nickname given to such gamekeepers who were also "keepers" of parks (see https://en.wikipedia.org/wiki/Parker_(surname)#cite_note-2).

All these factors meant that, in contrast to Great Britian, where the territorial requirements of wildlife such as deer, rabbit, and fox were often contained with a single private estate, ownership over habitat in America was more often fragmented or absent.

The second obstacle to private governance stemmed from law and norms governing trespass. Provided they did not violate game laws, federal and state court rulings during the 19th century confirmed that hunters had open access to private land that was unenclosed (by fencing) and unimproved or uncultivated (Freyfogle et al. 2019, Hynes 2013, Sigmon 2004, Sawers 2011).[7] States could try to override the default right to hunt and fish on unimproved land by legislation but in practice these laws were difficult to enforce when land was unenclosed, especially because the laws contradicted longstanding norms of open access to wildlife on these lands (Tober 1981, Sawers 2011). According to our analysis of state statutes, only three states had laws requiring hunters to gather landowner permission by 1850 and just nine states had these laws by 1890. In 2018, by contrast, approximately half of the states required permission (see Appendix Table A1). The eventual emergence of stronger trespass laws provided a stronger basis for private contracting but, until later in the 20th century, these laws remained difficult to enforce on unimproved lands (Tober 1981). Trespass laws and customs were intertwined during this period as well. Strong rights of trespass were opposed by subsistence and commercial hunters during the 19th century. Norms at the time considered wildlife to be common property that should be accessible to all (Freyfogle et al. 2019, Tober 1973, Sawers 2011).[8] Moreover, unless landowners hunting on their own land could be more effectively bound to the same wildlife laws applicable to other hunters, strong rights against trespass would have been akin to granting landowners ownership of the wildlife resource itself. Granting even *de facto* wildlife ownership to landowners was highly controversial and had little political support as emphasized by (Tober 1981) and reinforced by Warren's (1999) historical analysis of 19th century wildlife management in Pennsylvania.

[7] Numerous 19th Century cases from various states confirm this doctrine. For example, in 1818 the South Carolina Supreme Court rules that: "the right to hunt on unenclosed and uncultivated land has never been disputed, and it is well known that it has been universally exercised from the first settlement of the country up to the present time …" *McConico v Singleton* 9 SCL 244 (SC Ct App. 1818)

[8] Justice Oliver Wendell Holmes used this argument in a well-known Supreme Court decision case from Missouri, writing "[There is a] common understanding with regard to the large expanses of unenclosed and uncultivated land in many parts at least of this country. Over these it is customary to wander, shoot and fish at will until the owner sees fit to prohibit it. A license may be implied from the habits of the country." (see *McKee v. Gratz*, 260 U.S. 127, 136 (1922)). In this case a riparian landowner (Gratz) claimed that McKee trespassed when harvesting freshwater mussels from his land. The Supreme Court sided with Mckee, and the appellate court, relying, in part on the custom of open access on private lands.

C. From Wildlife Laws to Regulatory Enforcement Agencies

Laws to limit the harvest of wildlife emerged during the colonial period. The first of these game laws closed parts of the year to killing, or "taking," and applied to public and private land within a state's jurisdiction. By the end of the colonial period all colonies but Georgia had closed seasons for deer. West of the Mississippi, there were no game laws in any state or territory, other than restrictions on American Indian lands, until 1851. By the 1880s, all 48 continental states (or their respective territories) had game legislation, primarily in the form of statewide closed seasons and limits on trade in game and game products. Bag limits, which are daily or seasonal quotas on the number of animals that can be taken during a legal hunting season – emerged as a standard method of limiting take for fish and game. Iowa, for example, implemented the first bag limits for wild birds in 1878 (25 birds per hunter per day, extremely generous by modern standards).[9]

Local law enforcement authorities, rather than specialized game wardens, were initially charged with enforcing game laws in addition to their other duties (Tober 1981, Connery 1935). By the mid-1800s, game laws were becoming increasingly complex but were seldom enforced.[10] Bavin (1978) describes why this was likely the case. From the perspective of a local police officer, enforcing wildlife law entailed high costs – it required encountering armed hunters and learning complex laws – but low benefits because there was generally not additional compensation nor local political pressure for wildlife law enforcement. One important exception was when private conservation clubs paid enforcement agents to patrol against poaching on private lands managed for recreational hunting (Tober 1981).[11] Even then, local juries were often unwilling to enforce wildlife laws viewed as favoring privileged landowners (Tober 1973). Moreover, most land on the frontier was still in the federal domain but with almost no administrative or enforcement

[9] States also imposed restrictions on the legal methods of taking game, most of which are still in effect today. Today restrictions include prohibitions on explosives, automatic and other types of weapons. Restrictions and prohibitions on game trade also became a component of state (and later federal) wildlife management. By 1912 all states but Maryland had banned exports of all or some game products (Palmer 1912). In 1900 the federal Lacey Act outlawed the sale or transportation of game taken in violation of state laws. Today states still generally prohibit the sale of wild game and game products, though there are exceptions, most notably for fur bearing animals (e.g., mink, fox). States also created refuges for wildlife, where hunting was either prohibited of severely curtailed.

[10] A detailed study of New Hampshire wildlife history, for example, was unable to discover a single instance of the enforcement of a law protecting deer prior to the creation of the state's wildlife agency. The 19th Century Naturalist George Bird Grinnell suggested the early laws merely replicated English law and were never taken seriously by subsistence or commercial hunters (see Tober 1981).

[11] Tober (1981) argues that these private clubs were most effective. He states (pp.215-16): "Through 1885, which may be taken as the initiation of concerned efforts by states to enforce their own game laws, the most effective enforcement agencies were the sportsmen's clubs whose members brought violation to the attention of officials authorized to persecute them."

presence such that local police lacked the capacity and clear jurisdictional authority to enforce game laws.[12]

As wildlife populations continued to plummet there was, according to Tober (1981), a need to clarify and consolidate property rights to wildlife and enforcement authority to a single entity. "That logical mechanism… was a state-level administrative agency that might develop the necessary scientific expertise for wildlife management, enforce existing law by deploying agents in the field, and advocate the cause of wildlife before legislature and the public." The state-run game department, still intact today, is the governing body that emerged.[13] The first state game agencies were created in California and New Hampshire in 1878 and the last was created in Mississippi in 1932. As Figure 2 shows wildlife agencies generally emerged before state forestry, parks, water quality, and air quality agencies but after inland fishery commissions.[14]

Law enforcement was the central function of nascent wildlife agencies, which established game wardens funded by hunting license systems starting in the late 19th century (Palmer 1912, Bavin 1978). By 1900, roughly twenty states had a system that served to limit access to wildlife and raise revenue. By 1904, thirty-one states had nonresident fees, and by 1912 forty-six states had such licenses.[15]

Early wildlife agencies were typically autonomous bureaus with narrow jurisdiction over species valued by sportsmen or considered pests and varmints to landowners.[16] While many agencies still retain this organization and jurisdiction, others are part of larger "natural resource" or "environmental protection" agencies that also have regulatory jurisdiction over parks, forests,

[12] This remains true today where, especially in the western states, federal land agencies control large expanses of undeveloped land that is sometimes beyond the jurisdiction of local law enforcement.

[13] Important legal changes took place during the latter part of the 19th century that facilitated the emergence of wildlife agencies. Game laws were repeatedly challenged as illegal and even unconstitutional state action and many cases went to the Supreme Court. During the late 1800s there were many legal challenges to state authority to regulate fish and wildlife. A series of Supreme Court cases upheld this authority, culminating with *Geer v Connecticut* which gave constitutional support for state action in the regulation and management of wildlife (Lueck 1989).

[14] Tober (1981) argues that the fishery agencies were formed to engage in fish stocking efforts for both recreational and commercial fishermen. We are not aware of research on the timing and creation of the other natural resource agencies but discuss their relevance to state capacity in the empirical section.

[15] From their inception, nonresident licenses have been substantially more expensive than resident licenses. This discriminatory pricing has been challenged in court many times by nonresidents on the grounds that it violates the privileges and immunities clause of the U. S. Constitution (Art. IV., sec.2.). These challenges have been defeated at all levels, including the Supreme Court. More expensive licenses for nonresidents are found in all states today. The case upholding this practice was *Baldwin v. Fish and Game Commission* 436, U.S. 371 (1978).

[16] Agencies also had jurisdiction over pests and varmints and sometimes coordinated intentional efforts to drive them towards extinction, as was the case especially with wolves (Raynor et al. 2021) but also bears and sparrows.

and air and water quality. As of 2015, there were 18 autonomous agencies (38% of the lower 48 states), down from 30 autonomous agencies in 1950.[17] While early agencies typically focused on law enforcement, modern agencies also employ biologists and ecologists and engage in wildlife stocking, habitat acquisition and management, research, and education. Modern agencies not only manage traditional game populations (e.g., deer, turkey, elk, waterfowl) but are also responsible for nongame species such as lizards, bats, and songbirds.

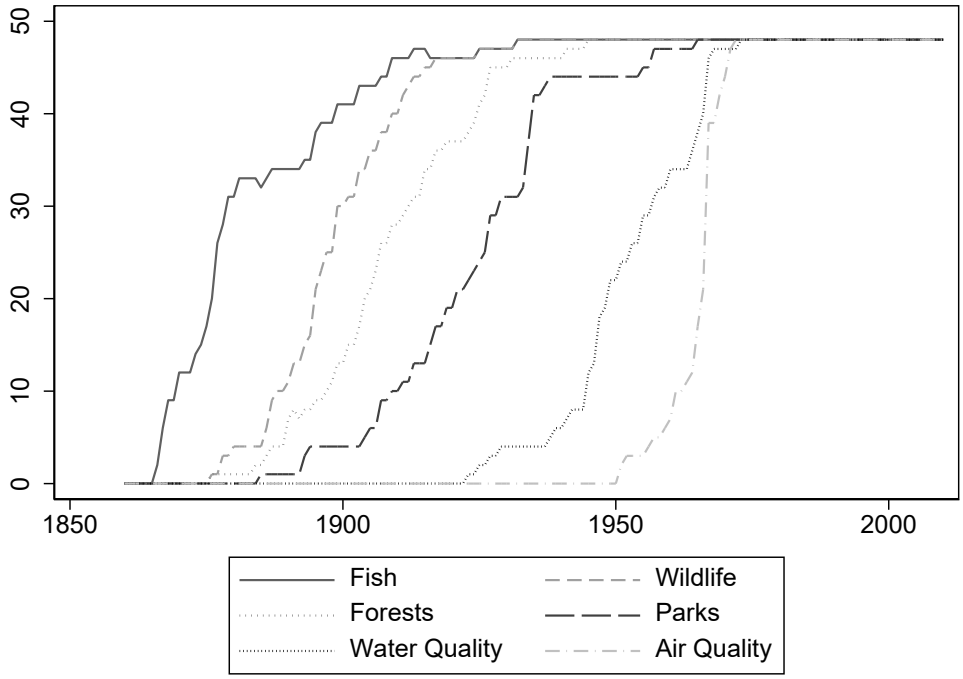

Figure 2: Creation of Environmental Agencies, 1860-2010.
Notes: The figure shows the cumulative number of states with an agency by a particular year. The sources are authors' compilation based various sources. Only 48 continental states examined.

Modern wildlife agencies are small compared to other state agencies. Across all agencies, the expenditures on fish and wildlife in 2008 amounted to 0.24 percent of total state revenues, ranging from a high of 1.36 percent (Montana) to a low of 0.04 percent (New York). Wildlife agency funding comes mostly from hunters and anglers, either directly through licenses or indirectly through federal taxes on hunting and fishing equipment (Lueck and Parker 2022). A

[17] Even these distinctions do not include all the possibilities. For example, Pennsylvania still has a Game Department that is separate from its Fisheries Department, and a few states (e.g., Maryland) have separate departments for marine fisheries that are often focused on commercial species.

substantial and increasing amount of license revenue comes from non-resident licenses.[18] The amount of state general funding received varies considerably, ranging from close to zero in many states to well over 50 percent in other states, some of which is dedicated for the management of non-game species. This a relatively new function for state wildlife agencies: only four states had nongame programs prior to 1970 and 16 states began their programs during or after 1980. As of 1998 – which is the most recent year of systematic data collection – the average agency spent about 5.4 percent of its budget on nongame management.

III. Agency Creation: Economic Framework and Empirical Estimates

In this section we develop an economic rationale for the state-run game agency system that emerged in the U.S.[19] Our approach is to employ comparative institutional analysis in the tradition of Coase (1960). The narrative generates hypotheses on differences in the timing of agency creation across U.S. states, and we test them with data from the turn of the 20th Century.

Starting with the observation that most American wildlife during the 19th century was effectively open access, the key question is why and when would state control emerge as an alternative to the fledgling emergence of private control.[20] State and private control were (and are) both costly and imperfect but we assume there were conditions under which state regulation was expected to generate higher present value net gains from wildlife. We hypothesize that state agencies were created upon meeting these conditions.

Although scientific wildlife management became important after Aldo Leopold's (1933) treatise, the key regulatory activity that private parties or state agents could undertake around the turn of the 20th century involved setting limits on hunting and coordinating their enforcement. Hence, the key theoretical question is: when could a state increase expected net gains from wildlife by assuming monopoly authority to set and enforce limits? Importantly, state (but not private) authority extended to public and private land.

A. Costs of Private Control

[18] Nationwide, 30 percent of license revenue came from non-residents in 2002, up from 22.1 percent in 1965. At the state level, three states generated more than 70 percent of their license revenue from non-residents in 2002 (Colorado, Montana, and Wyoming) and four states generated less than 10 percent from non-residents (California, Massachusetts, Ohio, and Washington).

[19] Like Allen et. al's (2023) "Economic Origins of Government", we provide informal reasoning rather than mathematical theory to motivate empirical tests.

[20] Lueck (1989) finds that the law in 19th century Great Britain gave landowners dominant wildlife control.

We hypothesize the costs of private control were an important determinant of contracting failure and agency creation. These depended on the security of legal rights against trespass and the pattern of land ownership within a state. To illustrate, first consider a hypothetical case in which a single private estate ($N=1$) fully spanned the habitat necessary for a population of valuable wildlife (e.g., deer herd) and the owner held a legal right with probability $\pi = 1$ to enforce access and use against trespassers. We expect the single owner to choose a level of investment in regulation and enforcement that maximizes his long-run expected net gains from the renewable resource. The optimized net gains would depend on the flow of revenue from the stock derived from harvest and the costs of monitoring and enforcing against poaching.[21]

In reality, legal rights against trespass at the turn of the 20th century were insecure and incomplete such that $\pi < 1$ as discussed in Section II. This implies that investment in wildlife and rents under private control would be less than first-best, even if $N = 1$, and that both would approach zero if π approached zero. Rights against trespass were especially weak for unimproved and uncultivated lands when compared to improved and cultivated lands. Moreover, many tracts of land were not yet privatized at the turn of the 20th century and remained in the public domain as unchosen homestead plots or as unattended public lands. Private parties had limited authority to enforce hunting restrictions on these lands and any agreement to do so was effectively similar to $\pi < 1$ on private lands.

The pattern of land ownership at the turn of the 20th century can be characterized as small scattered private parcels interspersed with public lands governed as open access for wildlife. Public lands were especially prevalent in the states west of the Mississippi River. Private parcels were small relative to the territorial requirements of many species, such as deer and waterfowl, and in this sense were 'fragmented' with respect to the habitats of wild populations. Holding constant π, fragmented ownership of wildlife habitat (i.e., $N > 1$) reduced private incentives to invest in regulation and enforcement relative to a $N=1$ benchmark for two reasons. First, as in models of common property, the incentive of any landowner to invest decreases with N because his share of the net gains attributable to his investment effort is falling in N. Like models of non-cooperative equilibrium among landowners, this leads to overharvest and depletion (e.g., Conrad 2010). Second, the costs of cooperating for better resource control rises with N, the number of

[21] The costs would also include the opportunity cost of dedicating land to habitat instead of alternative land uses.

individuals with ownership claims (see, e.g., Coase 1960, Demsetz 1967, Ostrom 1990, Libecap 1989, Leonard and Parker 2021).

B. Costs of State Control

The dissipation of net gains under incomplete and fragmented private ownership generated expected benefits from the creation of a new organization, the wildlife agency. The expected benefits were the capture of some of wildlife's inherent net value lost under private regulation, net of the costs of establishing and maintaining an agency. Under perfect public regulation, the agency would face the same costs as the first-best, single owner benchmark and have the same incentive to find and choose an optimal level of investment in the regulation and enforcement of hunting, on both private and public land. Under these conditions, the resulting rent would be identical to those achieved under the single owner benchmark.

Public regulation was and is imperfect, however. Relative to private owners who live on the land, an agency presumably had (and has) less information about wildlife populations and hunting pressures in local environments. Theories of government and bureaucracy imply that public agents would and do have weaker incentives to find and detect violators, when compared to private owners, because they are not residual claimants of profit from selling rights to wildlife (see e.g., Niskanen 1968, Wilson 1991). Historical accounts for early wildlife agencies, for example, showed that warden positions were sometimes granted as political favors and wildlife laws were selectively enforced (Belanger 1988, Tober 1981).

While these public agency costs may have not varied in systematic ways across time and U.S. states, the costs of establishing and maintaining an effective agency likely did vary with state capacity at the turn of the 20th century. Establishment costs involve a fixed cost (F) of creating a specialized agency empowered to regulate and enforce rights to wildlife. Fixed costs included the effort to set up a legal and administrative foundation through the process of legislation, administrative organization, and state court jurisdictional decisions. We hypothesize that a state with more existing administrative law and bureaucracy (e.g., non-wildlife agencies) would have a lower F than a state with limited institutions and resources. Establishment costs would also fall with the emergence of wildlife agency templates from other states to replicate, and perhaps with the amount of legal precedent on the legitimacy of state action in other states.[22] The general

[22] There are also collective action costs of lobbying for regulatory action, which likely depend on the heterogeneity of political interests (Olson 1965).

implications are that expected net gains from wildlife under state agency control were inverse to *F*, and that *F* was reduced by state capacity and the prevalence of templates in other states to replicate.

C. Implications for Timing of Agency Creation

To summarize, we hypothesize that private motivation to invest in wildlife regulation and enforcement was decreasing in the legal authority of private parties to enforce against trespass on a tract of land, and in *N*, the number of private landholdings inhabited by a stock of wild animals (e.g., a herd of deer). This implies that wildlife populations and rents under purely private control were declining in the acreage of uncultivated and unimproved land (which was effectively open access for hunting) and in *N*, the number of private landholdings overlapped by wildlife. We hypothesize that state agency regulation was more likely to capture greater net rents than captured by purely private regulation in states where costs to establish and maintain a new, specialized bureau at the turn of 20th century were relatively low. Below are implications about the timing of state agency creation when holding other factors constant.

Implication T1. A decrease in *F*, agency establishment costs, will accelerate agency creation.

Implication T2: An increase in open access land (public land and private land without trespass protection) will accelerate agency creation.

Implication T3: An increase in the average size of private land holdings will accelerate agency creation.

D. Empirical Model of Agency Creation

To test these implications, we estimate a duration (survival) model with time varying covariates.[23] The data sample includes the 48 continental states and begins in 1870.[24] Note that some states were still territories at this time. The sample ends in 1920; by that time only one state (Mississippi) had yet to create a wildlife agency. For this reason, censoring is not an issue.

Each state in the sample appears for each year until, and including, the year of agency creation. States are deleted from the sample after an agency is formed because their covariates provide no additional information about the causes of agency formation and because no state has

[23] Duration models are commonly used in economics and political science to assess how the timing of regulatory events correlates with economic and political variables. They have been used to assess wildlife conservation decisions (Ando 1999) and historical state-level regulatory activity (e.g., Geddes and Lueck 2002).

[24] Alaska and Hawaii did not become states until 1958 well after all other states had established wildlife agencies.

abolished an agency. For example, California created an agency in 1878, so it appears in the sample only from 1870 through 1878. As a result of this process, the estimating sample is an unbalanced panel of states from 1870 until the year of agency creation with 1,336 state-year observations.

The dependent variable is an indicator denoting whether a state has an agency and equals one for a state-year observation during the year an agency was formed and is otherwise zero. Figure 2 shows the cumulative establishment of wildlife and other natural resource agencies. The analysis assumes the probability of agency creation in a specific year depends on time-invariant and time-variant factors, initial conditions, and conditions the year before creation. We use a Cox proportional hazards model to estimate the probability of a state "surviving" to year *t* without a wildlife agency.

The model estimates a non-parametric baseline hazard rate (h_0) and assumes that independent variables proportionally shift the hazard rate in each period (Cox 1972, Wooldridge 2010). Therefore, we estimate the hazard rate in state *s* and year *t* with:

$$h(t_s) = h_0(t)\exp\{\beta X_s + g(t)(\gamma Z_{st})\}. \quad (1)$$

where X_s is the vector of time-invariant variables and Z_{st} is the vector of time-varying covariates. The coefficients β and γ are proportional shifters of hazard rates to be estimated.

E. Data and Variables

The key independent variables measure state capacity, land ownership as it relates to private costs of contracting and coordinating for wildlife control, and demographic characteristics for 1870 to 1920. Data sources include Agricultural Census reports and historical U.S. Census data downloaded from Haines et al. (2010). From these sources, we retrieved time-variant data on the acreage of improved farms, the acreage of unimproved farms, the number of large farms (those exceeding 1,000 and 500 acres), the state's population, the state's proportion of the population in cities exceeding 100,000, and the state's proportion of the population born in the United States. We have interpolated annual within-decade data by assuming linear changes but the results are robust to using only decadal level data.

We use two variables to measure the costs of setting up an agency. The first, NUMBER OF AGENCIES, is the time-variant running count of the number of state agencies governing health, agriculture, inland fish, forests, and parks. This variable, which ranges from 0 to 5, should cause earlier agency formation (i.e., positive effect) if the presence of other agencies lowers the fixed costs of adding agencies. More agencies (higher state capacity) should reduce the costs of wildlife

agency formation due to complementarities in institutional and capital assets deployed for the regulation and enforcement of natural resource laws. The second variable, % OF REGION WITH WILDLIFE AGENCY, is a time variant variable that measures the percentage of other states within the region that have developed a wildlife agency at a point in time. This variable ranges from 13 to 24 percent and should cause earlier agency creation (i.e., positive effect) if neighboring states with wildlife agencies offer a template that lowers the administrative cost of setting up an agency.[25]

The land area of a state (or territory if prior to statehood) is the sum of NON-FARM ACRES, UNIMPROVED FARM ACRES, and IMPROVED FARM ACRES. IMPROVED FARM ACRES were private lands for which unpermitted access to hunters could be legally denied but with coordination effort required by landowners. [26] UNIMPROVED FARM ACRES, by contrast, were uncultivated and unenclosed and effectively open access for hunting because of the structure of trespass norms and laws during this period of agency formation. The variable NON-FARM ACRES was a mix of public land and private forest and residential land meaning an unidentifiable (to us) portion of this category was open access for hunting. Our theoretical reasoning, therefore, implies that increases in unimproved farm acres will increase demand for agency intervention and cause earlier agency formation.[27] This implies that a state's number of open access acres, rather than its share, is relevant because the number of acres is what determines potential net gains to be captured from introducing public agency governance.

The variables NUMBER FARMS > 1000 ACRES, NUMBER FARMS > 500 ACRES, and AVERAGE FARM ACRES measure the amount of private farmland held in large tracts. More land held in large tracts decreases landowner costs of coordinating and contracting for wildlife control and hence we predict these variables should be associated with delays in wildlife agency creation, after conditioning on the number of acres in private farmland.

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[25] Alternatively, or additionally, this variable could be a proxy for the spillover-effects of state agency formation such that the existence of more agencies in neighboring states raises the strategic benefit of creating an agency.

[26] Improved land is defined by the Agricultural Census in 1920 as: "land regularly tilled or mowed; land in pasture that had been cleared and tilled; land in gardens, orchards, vineyards and nurseries; land occupied by buildings, yards, barnyards, etc." Prior to 1910 there was no specific mention of land occupied by buildings. In 1900, improved land included all land not classed as unimproved which was defined as "land which has never been plowed, mown, or cropped including land once cultivated but now grown into trees and shrubs." In the earlier census years improved land was simply cleared land.

[27] One might be concerned that the amount of unimproved land was endogenous to wildlife depletion and hence the demand for a wildlife agency. Fencing, however, was expensive and limited in the 19th century and hunter trespass was a minor factor in the decision to fence or improve land, which depended mainly on livestock and crop prices (Anderson and Hill 1975, Hornbeck 2010). For these reasons, we treat unimproved farmland as a plausibly exogenous measure of the amount of state land that was open access for hunting.

In addition to controlling for total population, the variables PERCENT URBAN POP and PERCENT U.S. BORN POP serve as controls for the collective action costs of privately governing wildlife without a state government agency. These are factors that Tober (1981) stressed as important in generating demand for state regulatory action to conserve wildlife. Large cities contained markets for wild game, which may have been a force that prompted state agency creation by increasing the demand for hunting under open access.[28] Tober (1981), and especially Warren (1997), discuss at length how immigrants, particularly from southern and eastern Europe, were primary actors in market hunting and considered by native borne citizens to be the culprits of wildlife decimation.[29]

To control for organized interest group demand for wildlife conservation, we employ information provided by Tober (1981) to create a time invariant variable, SPORTSMAN GROUP. This variable is equal to one if a statewide sportsman association existed in either the late 1870s or in 1891, the two points in time documented by Tober (1981, p. 66). These sportsmen groups formed to lease private land for hunting and to promote the enforcement of laws to preserve fish and game and may have affected the timing of agency formation.[30]

We add further controls in some specifications to assess the robustness of the main coefficients of interest. We add fixed effects for U.S. regions, based on the 1900 census, to non-parametrically control for regional factors potentially correlated with landholding patterns, state capacity, demographics, and the timing of agency creation. We also add two measures to control for a state's inherent wildlife carrying capacity: state annual precipitation (measured over the 20th century) and state mean elevation.[31] Table A2 shows summary statistics for the duration analysis sample, which contains 1,336 state-year observations. The graphs in appendix figure A1 plot the minimum, mean, and averages for the farmland and population variables by decade, from 1870 through 1920.

[28] Lueck (2003) and Taylor (2011) show how the rise of hide markets for bison led to the rapid decimation and near extinction of that once ubiquitous animal.

[29] William Hornaday, an outspoken 19th century opponent to market hunting, was particularly critical of Italian immigrants who "root out the native American and take his place and income. Toward wildlife the Italian laborer is a human mongoose… The Italians are spreading, spreading, spreading. If you are without them today, tomorrow they will be around you." (cited in Tober 1981, p. 53).

[30] Below we discuss the potential role of "private politics" (Baron 2003) in determining agency origins and extent.

[31] Data are unavailable to systematically measure changes in wildlife populations across states over time.

F. Identification Assumptions and Estimation Results

Our central identification assumption is that the state capacity and land ownership patterns are exogenous to agency timing, conditional on covariates and regional fixed effects. While this assumption is untestable, reverse causation is unlikely. State capacity and land ownership were pre-determined with respect to agency formation. Omitted variables are a greater threat to identification, which is why our model includes regional fixed effects and demographic covariates to control for factors that may be correlated with both agency timing and state capacity and land ownership. We also include placebo tests for the timing of non-wildlife agencies. These robustness checks suggest that omitted variable biases are not driving the key results.

Table 1 presents the Cox model estimates of (1). Columns 2 and 4 add control variables for climate and elevation, while columns 3 and 4 include indicators for six regions as defined by the 1900 Census.[32] The reported coefficients are interpreted below and Figure A2 in the appendix shows the baseline hazard function.

The setup costs and state capacity variables are statistically important. The point estimates on % OF REGION WITH WILDLIFE AGENCY indicate that a 10% increase in the neighboring states with a wildlife agency is associated with an increase in the hazard rate of agency creation of 17% to 23%.[33] This result is consistent with set-up costs falling with the number of templates to replicate for nearby states.[34] Increases in NUMBER OF NON-WILDLIFE AGENCIES is also associated with an earlier agency. The point estimates indicate that an additional non-wildlife agency (e.g., forestry, fish, parks) is associated with a 52% to 69% increase in the hazard rate of agency creation. These findings indicate that wildlife agencies were more likely to be created when states had more administrative capacity in general (T1).

UNIMPROVED FARM ACRES is associated with an increasing hazard, and hence earlier years of agency creation. The point estimates imply that a 10 percent increase in unimproved farm acres is associated with a 9% to 21% increase in the rate of agency creation, based on the smallest and largest coefficients (0.94 in Column 1 and 2.18 in Column 4). This result is consistent with the

[32] The estimation method is a Cox regression using the 'Breslow Method' for ties.
[33] The coefficients have already been transformed from hazard rate ratios and therefore can be interpreted as standard regression estimates.
[34] There are other potential explanations; for example, the returns from public wildlife enforcement in one state may increase when neighboring states also have public agencies, especially given that wildlife crosses state borders.

theoretical argument (T2) that unimproved farmland accelerated the timing of agency creation because trespass was generally not enforceable on unimproved lands.

Table 1: Duration Model Estimates of Wildlife Agency Creation, 1870-1920

	Predicted Sign	(1)	(2)	(3)	(4)
Setup Costs and State Capacity					
% Region with Wildlife Agency	+, T1	1.777***	1.752***	2.061***	2.307***
		(0.572)	(0.636)	(0.774)	(0.773)
Number of non-wildlife Agencies	+, T1	0.521**	0.603***	0.699**	0.689**
		(0.211)	(0.207)	(0.272)	(0.278)
Land Contracting Costs (logged)					
Unimproved Farm Acres	+, T2	0.943*	0.938*	1.960**	2.181**
		(0.487)	(0.491)	(0.778)	(0.880)
Farms > 1000 Acres	-, T3	-0.568**	-0.521*	-1.540***	-1.380***
		(0.289)	(0.304)	(0.374)	(0.371)
Controls					
Log of Improved Farm Acres		x	x	x	x
Log of Non-Farm Acres		x	x	x	x
Log of Total Population		x	x	x	x
Percent Urban Pop		x	x	x	x
Percent US Born		x	x	x	x
Sportsmen Group		x	x	x	x
Log of Mean Precipitation			x		x
Log of Mean Elevation			x		x
Region Fixed Effects				x	x
Observations		1,336	1,336	1,336	1,336

Notes: The coefficients are shown, not hazard rates. Standard errors adjusted for clusters in the 48 states, p-values in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Column 1 shows predicted signs and the corresponding theoretical implication. There were 47 'failures' out of 48 states. The regressions employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

Number Farms > 1000 Acres is associated with a later year of agency creation, consistent with the theoretical narrative (T3). The point estimates imply that a 10 percent increase in the number of farms exceeding 1,000 acres is associated with a 5% to 15% decrease in the rate of agency creation, based on the smallest and largest coefficients (Column 2 and 3). These findings are consistent with less demand for agency creation when fewer landowners are necessary to contract over private wildlife control.

None of the demographic variables are robustly significant (see Table A3). In contrast to Mulligan and Shleifer (2005), more populated states are not associated with earlier state agencies, at least not after controlling for the other determinants. Although Tober (1981) and others emphasized the potential importance of demographics to wildlife agency creation (e.g., urban vs.

rural populations and US vs. foreign-born populations), we find no evidence of systematic relationships. Instead, the timing of agency creation is explained best by open access land, contracting costs, state capacity, and setup costs.

G. Robustness

One of the key findings is that large private landholdings – those greater than 1000 acres – delayed the timing of wildlife agency creation. The 1,000-acre threshold is somewhat arbitrary, but, as shown in Table A4 of the appendix, the results are robust to other available definitions of 'large farms.' The coefficients are larger (in absolute value), and measured with more precision, if we consider 'large' farms to be those greater than 500 acres rather than 1,000 acres. We also find similar relationships when we measure landowner-contracting costs with the average farm size rather than the number of farms over 500 or 1,000 acres (see T3).[35]

As an additional robustness check, we estimate linear probability models (LPM) using cross-sectional data for 1890 and 1900. The dependent variable is an indicator for whether a state had a wildlife agency in those years. Appendix Table A5 shows the results. The findings are consistent with the duration model in that increases in UNIMPROVED FARM ACRES and % OF REGION WITH WILDLIFE AGENCY are associated with an increased probability of an agency and increases in NUMBER FARMS > 1000 ACRES are associated with a decreased probability of an agency.

To assess the extent to which the estimates show spurious correlations, we conducted a series of placebo tests, in which we switch the dependent variable to signify the timing of the creation of agencies for public health, agriculture, inland fisheries, forests, and parks. Table 2 shows the placebo estimates, which can be compared with wildlife agency duration estimates from Column 3 in Table 1.

The placebo tests detect few systematic relationships between the land ownership (contracting cost) variables and the timing of non-wildlife agency creation. The one exception is that a greater number of larger landholdings (FARMS > 1000 ACRES) corresponds with later park agency creation. This may mean that the same private contracting advantage conveyed by large farms for private wildlife management may have also been conveyed for parks and recreational management. The null results on all the other placebo tests strengthen the inference that contracting costs played a causal role in affecting wildlife agency creation rather than being spuriously related

[35] When including multiple measures of farm size (e.g., farms over 1000 acres and farms over 500 acres), the coefficients sometimes become insignificant due to the high collinearity of the measures.

to omitted factors at the state-year level that generally led to the creation of state-level administrative agencies. Setup cost and state capacity variables also explain the timing of non-wildlife agency creation. This is as expected because the contribution of these variables to agency timing is not specific to the wildlife resource. Table A6 in the appendix shows the full set of covariate estimates and suggests that demographic variables were relatively more important in predicting the timing of the other agencies.

Table 2: Placebo Duration Model Estimates of non-Wildlife Agency Creation, 1870-1920

	Wildlife (1)	Inland Fish (2)	Forests (3)	Agriculture (4)	Health (5)	Parks (6)
Setup Costs and State Capacity						
% REGION W/ RELEVANT AGENCY	2.061***	4.726***	5.712***	4.515***	4.616***	8.555***
	(0.774)	(1.270)	(1.593)	(1.316)	(1.065)	(2.651)
NUMBER OF OTHER AGENCIES	0.699**	0.604**	0.203	0.228	0.765***	0.564
	(0.272)	(0.274)	(0.340)	(0.271)	(0.296)	(0.546)
Land Contracting Costs (logged)						
UNIMPROVED FARM ACRES	1.960**	0.712	0.303	0.332	-0.002	-0.102
	(0.778)	(0.527)	(0.886)	(0.453)	(0.396)	(1.578)
FARMS > 1000 ACRES	-1.540***	-0.284	0.027	0.205	-0.039	-1.078**
	(0.374)	(0.207)	(0.350)	(0.176)	(0.232)	(0.507)
Observations	1336	597	1734	728	653	2153
# of States with 'Failure'/Subjects	47/48	47/48	37/48	46/48	48/48	19/48

Notes: The coefficients are shown, not hazard rates. Standard errors, not shown, are adjusted for clusters in the 48 states. * p<0.1, ** p<0.05, *** p<0.01. The models here replicate the Column 3 of Table 1

We also test the robustness of the findings to the inclusion of controls for state trespass laws. Our theoretical framing, and the historical narrative of 19th century American wildlife depletion, suggests that laws and norms granting open hunting access to unimproved lands frustrated private management in states with large amounts of unimproved lands and this, in turn, was a catalyst for wildlife agency creation. To further test for this possibility, we have collected data on state variation in trespass laws as summarized in Table A1 of the appendix. Most states lacked trespass laws during the 19th century but a few required landowners' permission to hunt on any private land and others made it illegal to hunt on private land if the landowner posted a "no hunting" sign.

Table A7 in the appendix estimates agency timing with the inclusion of two indicators for each type of law. The key results on UNIMPROVED FARM ACRES and FARMS > 1000 ACRES are

essentially unchanged. The signs on the trespass law categories are erratic and generally insignificant. This is not surprising because hunting trespass laws were weak and unenforced during this period as discussed in Section 2. [36]

IV. AGENCY EXTENT: ECONOMIC FRAMEWORK AND EMPIRICAL ESTIMATES

The previous section demonstrates that differences in landowner contracting costs and state capacity give explanation to the timing of agency creation as public regulatory and enforcement entities. In this section, we ask iff the same factors help explain the size of wildlife agencies using data from the mid-20th to the early 21st centuries. The key issue here is that, in addition to assuming the role of game warden, wildlife agencies expanded their role over time to include active management of wildlife and habitat (e.g., stocking populations through game reserves, planting wildlife forage, and researching and monitoring wildlife populations). We begin with a discussion of the economic forces at work and end by employing panel data on agency budgets and budget allocations to assess the logical implications of our reasoning.

A. Economic Logic of Variation in Agency Size

We measure agency size by budget expenditures (B) and assume that B depends on the costs of delivering a chosen combination of law enforcement and management effort. If all the land in the state – whether public or private - were controlled by the agency, the budget would reflect the recreational demand for wildlife,[37] the amount of land (habitat) in the state, and the unit costs of the chosen levels of agency enforcement and management, which we assume fall with state capacity. This implies that agencies would be larger in larger states where recreational demand for wildlife populations is greater, and where states have more administrative capacity to support larger public agencies.

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[36] The trespass laws are time variant because laws were added, repealed, and amended over time. This raises concerns that their timing may have been co-determined with the timing of the public choice to create an agency. This is possible but unlikely important with respect to influencing our empirical estimates for two reasons. First, as we note in Section II, the weak trespass regime prior to the turn of the century was reinforced by federal and state court cases and local norms there was uncertainty as to whether state statutes would override legal precedent and local norms. Because of this, the weakness of trespass law prior to the turn of the 20th century was arguably less a reflection of state statute and more a reflection of populous preferences supporting norms of public access to wildlife. Second, as we note in Section II, most changes in state trespass statutes occurred well after the creation of agencies, which is consistent with trespass laws being predetermined with respect to agency creation.

[37] As explained in Section II, commercial hunting of American wildlife has been widely prohibited by states since the late 19th century and the 1905 Lacy Act added federal enforcement.

This reasoning does not account for the reality that state agencies do not directly control all land in a state and wildlife management is jointly provided by private landowners. Demand for private hunting access can give landowners strong incentives to manage their land for habitat, especially for game species.[38] And, while wildlife agencies have retained exclusive control over wildlife law enforcement since their inception, they did not (and do not) have a monopoly over wildlife management.

We assume that private wildlife management is influenced by the amount and size of private landholdings. Letting $L = L_P + L_G$ denote the mix of (exogenously determined) private and government land in the state, we expect increases in L_G to decrease private management. Holding constant the land mix, we expect private provision to decrease with increases in N, the number of landowners who must contract with one another to create large contiguous blocks of land managed for game populations. This implies that private management is increasing in L_P and decreasing in L_P/N, the average size of private landholdings.

The extent to which the budget sizes of wildlife agencies are influenced by private management depends on whether private provision is a substitute or complement for public management. If it is a substitute, then private provision will "crowd out" public provision, which is an assumption discussed in the concluding section. That is, states with larger landholdings and more private land will have smaller wildlife agencies.

A final distinction can be made between the management of game vs. nongame species. Whereas game species are used 'consumptively' (by recreational hunters and consumers of wildlife products), the enjoyment of non-game species, such as songbirds and bats, is 'non-consumptive.' Game for consumptive use is a private good, because use for this purpose is rivalrous. Nongame species are more like public goods because nonuse benefits (e.g., wildlife viewing) are not rivalrous and typically not excludable meaning private landowners will find it more difficult to generate revenue from nongame when compared to game. Assuming that non-game management is undertaken only by public agencies whereas game management is undertaken by a mix of private and public managers depending on the extent of landowner contracting costs implies that the proportion of total agency expenditures spent on non-game

[38] As we noted in section II, private landowners during the early and mid-20th centuries gained relatively strong rights against trespass and hence were no longer required to provide free hunting access (see Appendix Table A1). These rights against trespass helped create private markets for hunting access.

species increases with decreases in private landowner contracting costs. In other words, in states where private contracting costs for managing game species are low, state agencies will specialize in non-game management.

The theoretical narrative implies the following about agency budgets.

Implication B1. Agency budgets will be larger in states with greater state capacity.

Implication B2. Agency budgets will increase with increases in the amount of public land in a state.

Implication B3. Agency budgets will decrease with increases in the number of large private landholdings or their average size.

Implication B4. The proportion of budgets spent on nongame will increase with the number of large private landholdings or their average size.

B. Data and Variables

To assess the implications for agency budget size we employ a panel data set spanning five-year intervals from 1952-2007. We have collected wildlife budgets and similar annual data for state parks, forests, and public health agencies.[39] These data come from U.S. Census surveys of state government finances. Total expenditures over this period range from $1.4 million to $489 million in inflation adjusted 2007 dollars (see appendix Table A8). Appendix Figure A3 shows that an increasing amount of expenditures come from state general appropriations, rather than hunting and fishing license sales.

To assess the implications for budget allocation we use data on non-game expenditures, available for 1986, 1992, and 1998, which come from surveys on *State Wildlife Diversity Program Funding* conducted by the Audubon Society (Cerulean and Fosburgh 1986) and the International Association of Fish and Wildlife Agencies (Edelson 1994; Richie and Holmes 2000). Expenditures on nongame species over 1986-1998 ranges from zero in two states (Mississippi and New Hampshire in 1986) to 39 percent (in Hawaii, which is an outlier) and the mean is 4.4 percent. Overall the trend is towards expanding expenditures on nongame.

To measure landowner contracting costs we use data on farm acres from the Agricultural Census reports (downloaded from Haines et al. 2010) and include total acres in farms, the number

[39] Our framework treats 'budgets' and 'expenditures' as the same, but the data consistently report expenditures rather than revenues, so our empirical analysis focuses on expenditures.

of 'large farms' (e.g., farms exceeding 1,000 and 500 acres), and average farm size by state. These data were generally collected in five-year intervals over 1950 to 2010 (e.g., 1982, 1987, 1992, 1997, 2002, and 2007). As Figure A4 highlights, there was stark growth in the total farm acres and, especially, average farm size over 1850-2010. Total farm acreage fell after 1960 while average farm size doubled from less than 200 acres to over 400 acres. These time patterns, which differ across states, provide important empirical variation in landowner contracting costs that our econometric analysis exploits. These changes in farm sizes are driven by technological changes in agricultural processes that have differentially affected regions and states (Sumner 2014). These processes appear to be exogenous to changing demand for wildlife recreation over time and across states.

To measure state capacity we use annual data on each state's total revenue.[40] These data come from U.S. Census surveys of state government finances. The measure for state capacity used during this period (1952-2007) differs from that used for the estimates of the timing of agency creation. During this later time period state governments are fully modern administrative states compared to the turn of the century period examined for agency creation, so the use of state total revenue is more appropriate.

To control for land and habitat we collected data on total state area, acres owned by federal agencies, and acres in farms. The data on federal landholdings come from Public Lands Statistics and Census reports for select years between 1944 and 2007 for this variable.[41] We treat the FEDERAL ACRES variable as time invariant because the reported changes over time have been minor compared to the wide variation in federal acres across states.

We also control for the organizational structure of wildlife agencies. Some are autonomous, free-standing entities whereas others are embedded within larger and hierarchical natural resource departments and these organizational differences might affect wildlife agency budgets and resource allocation. To account for this possibility we use an indicator variable – AUTONOMOUS AGENCY – to denote the case in which the agency is autonomous rather than part of a hierarchy. These measures are time variant because, over time, wildlife agencies have tended to be combined into large hierarchies.

[40] Pinotti (2012) measures state capacity in a similar way.

[41] The U.S. Dept. of Interior published annual "Public Land Statistics Reports in recent years (see www.blm.gov/about/data/public-land-statistics). State-level data on public land also come from tables in U.S. statistical abstract reports of the U.S. Census Bureau, and, in some cases, from reports of the land holding agencies.

In this empirical analysis of the wildlife agency budgets and allocation we use a slightly different set of explanatory variables than used in the analysis of agency timing. There are two reasons for this difference. The first reason stems from data availability: some measures, such as federal ownership of land and state-level tax revenues were not systematically collected over 1870 to 1920. The second reason is economic relevance. As noted above the number of regional states with a wildlife agency, the number of non-wildlife agencies in a state are relevant for the study of agency creation but not for the study of modern agency expenditures. The same is true for acreage in uncultivated farmland. Other variables, such as the organization structure of environmental and resource agencies within a modern state government, are relevant for the study of modern expenditures but not for the study of agency creation.

C. Estimates of Agency Expenditures

To examine agency size, we estimate equations (2) and (3) using the 1952-2007 panel.

(2) $$ln\, B_{st} = \alpha_s + \theta_t + \gamma StateCapacity_{st} + \pi Landownership_{st} + \delta X_{st} + \varepsilon_{st}$$

(3) $$ln\, B_{st} = \theta_t + \gamma StateCapacity_{st} + \pi Landownership_{st} + \delta X_{st} + \gamma Z_s + \varepsilon_{st}$$

The notation s refers to the 48 states (excluding Alaska and Hawaii) and the t refers to each year, spanning five-year intervals over 1952 to 2007, so that B_{st} is the wildlife budget for state s in year t. The notation X_{st} refers to time variant controls (e.g., population, per-capita income, and total state revenues) and the Z_t refers to time invariant variables such as state total acreage. The notation θ_t refers to year fixed effects for each of the 12 census years to control for trends in fish and wildlife demand and other time-related factors.

Equation (2) differs from equation (3) because (2) allows each state to have its own intercept, by including state fixed effects. The key coefficients π in (2) measure relationships between land ownership and budgets based on within-state variation over time in factors such as farm composition and income per capita. The coefficients π in (3) measure relationships between wildlife agency budgets based on both cross-state and within-state time variation. The specification (2) is a preferred design for identification of the causal effects of landownership because unobservable, time invariant differences across states (e.g., mix of wildlife species endemic to an area) are absorbed by the state fixed effects. We show the pooled estimates of equation (3), however, to demonstrate relationships between important time-invariant (and relatively time invariant) variables such as federal land ownership.

Table 3 shows key estimates of (2) and (3). Variables that we treat as time invariant – total acres, federal acres, mean precipitation, and mean elevation – are dropped in Columns 1-3 because

of the inclusion of state fixed effects.[42] All standard errors are clustered by state to account for possible serial correlation within states over time. Because all variables are logged the coefficient estimates have elasticity interpretations.

Table 3: Panel Estimates of Agency Expenditures on Wildlife, 1952-2007

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
State Capacity							
LOG OF STATE REVENUE	+, B1	0.435***	0.347***	0.350**	0.573***	0.569***	0.584***
		(0.155)	(0.089)	(0.168)	(0.208)	(0.206)	(0.195)
Land Contracting Costs							
LOG OF FEDERAL ACRES	+, B2				0.157**	0.155**	0.160***
					(0.060)	(0.060)	(0.058)
LOG OF FARMS > 1000 ACRES	-, B3	-0.097**			-0.019		
		(0.041)			(0.071)		
LOG OF FARMS > 500 ACRES	-, B3		-0.107*			0.017	
			(0.062)			(0.103)	
LOG OF AVE. FARM ACRES	-, B3			0.263			-0.218**
				(0.191)			(0.093)
Controls							
LOG OF TOTAL ACRES					x	x	x
LOG OF FARM ACRES		x	x	x	x	x	x
AUTONOMOUS		x	x	x	x	x	x
LOG OF POPULATION		x	x	x	x	x	x
LOG OF PER CAPITA INCOME		x	x	x	x	x	x
LOG OF MEAN PRECIP					x	x	x
LOG OF MEAN ELEVATION					x	x	x
State Fixed Effects		x	x	x			
Year Fixed Effects		x	x	x	x	x	x
Observations		576	576	576	576	576	576
Adjusted R-squared		0.800	0.781	0.800	0.806	0.806	0.813

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The balanced panel data cover 5-year intervals from 1952-2007 with t = 12 time periods and s = 48 states. The variables TOTAL ACRES, FEDERAL ACRES, MEAN PRECIPITATION, and MEAN ELEVATION are dropped from Columns 1-3 because we treat the variables as time invariant.

Our measure of state capacity is positively associated with wildlife agency spending with or without state fixed effects. A 10 percent increase in total state revenue is associated with a 3.5 to 5.9 percent increase in wildlife agency budgets.[43]

[42] To create information on the federal land and farm variables into years for which we lack data, we impute missing values by imposing linear growth between data points.

[43] We also estimated the same specifications using the 5-year lag of (logged) state revenue in lieu of contemporaneous revenue to address the endogeneity of state revenue to fish and wildlife agency expenditures. The results are almost identical. This is because the endogeneity problem is minimal due to fish and game expenditures compromising such as small component of overall state budgets (see Section 2).

The estimated specifications employ each of the three measures of farm size. Comparing the results across Columns 1-3 versus Columns 4-6 we note the following patterns. First, in both sets of estimates there is evidence that lower landowner contracting costs, as measured by the prevalence of large farms, are associated with smaller wildlife budgets as the theory predicts. In Columns 1-2, we find that agency budgets decrease by an amount ranging from 1 to 2.5 percent with a 10 percent increase in the number of farms exceeding 1,000 and 500 acres. Column 3, however, shows no correlation between changes in average farm size and changes in wildlife agency budgets. By contrast, budgets in the pooled regression estimates of Columns 4-6 are negatively related to changes in average farm size, but not with the number of farms exceeding 1,000 and 500 acres. In Column 6, a 10 percent increase in average farm size across states is associated with a 2.3 percent decline in agency budgets.

Why do wildlife agency budgets respond to the number of farms exceeding 1,000 and 500 acres in the estimates with state fixed effects and to average farm size in the estimates without state fixed effects? Both results are consistent with theory. In the pooled analysis, average farm size is a better proxy for landowner contracting costs because it is a more continuous when compared to 'large farm' measures that rely on 1,000- and 500-acre thresholds. Hence, the Column 6 result is more meaningful than the null findings in Columns 4 and 5. Average farm size is a less precise measure of contracting costs in the analysis with state fixed effects because identification in that analysis is based on wildlife budget responses to changes in farm composition over short, 5-year intervals. Our concern is that 5-year changes in average farm size are driven by suburban development, which would affect wildlife habitat independent of contracting costs. By contrast, 5-year changes in the number of 1,000 or 500-acre farms should mainly reflect the changing structure of agriculture, which should not affect habitat independent of contracting costs.

The Column 4-6 estimates show that a 10 percent increase in federal land is associated with a 1 to 1.5 percent increase in wildlife agency expenditures. Appendix Table A9, which shows all coefficient results, indicates that state populations have no significant association with fish and wildlife expenditures, perhaps because the larger demand induced by larger populations is offset by habitat loss associated with more people.

To examine the robustness of the results we have replicated the panel model specifications in Columns 1-3 of Table 3 but added region-specific year effects. These estimates are reported in Table A10 and control for potential time trends in wildlife demand or wildlife habitat that may be

similar within regions. We have also replicated the pooled model specifications of Columns 4-6 of Table 3 but added region fixed effects to control for possible omitted variables that vary across regions (e.g., suitability of land for wildlife habitat). In general, adding the region-specific year effects and the region fixed effects strengthens evidence supporting the theoretical framework.

As with our analysis of agency timing, we conducted a series of placebo tests of state agency expenditures on public health and hospitals, agriculture, parks, and forestry. These estimates are shown in Appendix Table A11 and mimic the state-fixed effects specifications in Column 1 of Table 3 and the pooled specifications of Column 6 in Table 3. The results indicate that our empirical measures of landowner contracting costs are not relevant for explaining agency expenditures on health, agricultural, or parks. For example, an increase in the number of large farms is associated with *larger* agricultural budgets (as opposed to *smaller* wildlife agency budgets as shown in Table 4).[44]

D. Estimates of Non-Game Budget Share

Our theoretical discussion implies that landowner contracting costs should affect state agency expenditures on game management relative to expenditures on non-game management because it is difficult for private landowners to profit from non-game (which has public good characteristics), even with relatively low landowner contracting costs. The implication is that the proportion of agency expenditures on non-game should be decreasing in landowner contracting costs. To test that prediction, we estimate the total amount of non-game spending and the proportion of the budget spent on non-game using a pooled regression model spanning the years 1986, 1992, and 1998. For this analysis there are only 142 observations because some states did not always report their non-game spending.

Table 4 shows the coefficient estimates. The dependent variable in Columns 1-2 is the log of non-game spending.[45] The dependent variable in Columns 3-4 is the proportion of total spending on non-game. Columns 2 and 4 include region fixed effects whereas Columns 1 and 3 do not. We do not include state fixed effects because there is relatively minor within-state variation in the

[44] We do find, however, that state forestry agency expenditures respond negatively to changes in the number of large farms, and to increases in average farm size. Although we do not have specific theory or data set to examine forestry agencies in detail, we note that private management of factors such as wildfire prevention, tree disease, and timber reseeding may require landowner coordination that becomes more costly when private land holdings, including tree farms, tend to be small.

[45] For the two observations for which non-gaming spending is zero, we have added a one before making the log transformation.

dependent and key explanatory variables over 4-year intervals within this 12-year period. Because this is a pooled analysis, we measure farm ownership composition with average farm acres for reasons discussed in the context of Table 3.

Table 4: Pooled Regression Estimates of Nongame Expenditures, 1986, 1992 & 1998

		Y= ln(Nongame Spending)			Y = % of Spending on Nongame	
	Predicted Sign	(1)	(2)	Predicted Sign	(3)	(4)
State Capacity						
LOG OF STATE REVENUE	+, B1	0.820	0.473	?	0.010	0.005
		(0.567)	(0.609)		(0.040)	(0.040)
Land Contracting Costs						
LOG OF FEDERAL ACRES	+, B2	0.350***	0.310**	?	0.006	0.012
		(0.123)	(0.146)		(0.007)	(0.009)
LOG OF AVE. FARM ACRES	+, B4	0.537**	0.445	+, B4	0.049***	0.064***
		(0.218)	(0.268)		(0.017)	(0.019)
Controls						
LOG OF TOTAL ACRES		x	x		x	x
LOG OF FARM ACRES		x	x		x	x
AUTONOMOUS		x	x		x	x
LOG OF POPULATION		x	x		x	x
LOG OF PER CAPITA INCOME		x	x		x	x
LOG OF MEAN PRECIP.		x	x		x	x
LOG OF MEAN ELEVATION		x	x		x	x
Region fixed effects			x			x
Year fixed effects		x	x		x	x
Observations		141	141		143	143
Adjusted R-squared		0.615	0.658		0.240	0.300

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The panel is slightly unbalanced because a few states did not report their nongame spending in each year of the survey. Here t = 3 time periods (1986, 1992, and 1998) and s = 48 or 47 states, depending on the year. As with Table 2, the estimates here employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

The key finding in Table 4 is that landowner contracting costs, as measured by average farm size, are positively associated with the proportion of budgets spent on nongame (B4). The point estimates imply that a 10 percent increase in average farm size is associated with a 0.0049 to 0.0063 increase in the proportion of spending on non-game. These are large coefficients relative to the mean of the dependent variable, which is 0.044. They imply a 10 percent increase in average farm size is associated with an 11 to 14 percent increase in the dependent variable, relative to the mean. The finding that the proportion of nongame spending rises with larger landholdings suggests large landholdings facilitate private management of game species (e.g., deer) to a greater extent than they facilitate private management of non-game species (e.g., lizards, bats, turtles). Generally,

the findings suggest that public goods demand for agency management would persist even if the private landowners could profitably manage game animals.

V. DISCUSSION AND CONCLUSION

Government agencies manage and regulate important environmental assets but there has been little systematic research on the factors determining their creation, size, and scope. We study U.S. state wildlife agencies from their inception in colonial game laws of the 1700s to their manifestation as modern hierarchical environmental agencies to gain insight. There is consensus that wildlife agencies emerged to consolidate enforcement authority and were likely necessary to stop the decimation of wildlife during the 19th century. But questions remain that we address here. Why did wildlife agencies emerge at different times in different states? And what prevented private conservation at a large scale to stop the decimation of wildlife that marked the 19th Century?

The traditional explanations are ideological and political: wildlife agencies were the outgrowth of the progressive era and a growing public interest in conservation. We instead offer an economic explanation. Wildlife agencies lower the costs of managing a large-scale environmental asset that spans small private landholdings but this solution became feasible only when states gained sufficient administrative capacity. Our econometric results support qualitative evidence from economic history: both suggest that agencies emerged in response to the high private costs of controlling mobile wildlife as state capacity to regulate expanded.

Our analysis suggests the agency solution – at least for game management - has become less important in some states over time as trespass laws have strengthened and rural landholdings have grown in size. The empirical assessments of agency budgets indicate that agencies are relatively small in states comprised of mostly private land where landholdings are large when compared to states compromised of public land and smaller landholdings. Demand for agency management of nongame species (a kind of public good) remains relatively large across all states in modern times, however. We argue this is because private contracting is fundamentally less effective for these species, which is evidenced by their prevalence to be listed as endangered while game populations, such as deer, have prospered (see, e.g., Ando 1999, Raynor et al. 2021).

Our study shows how the institutional choice between private versus public governance of natural resources depends on the coordination costs private parties face in self-regulating versus the capacity of the state to organize and enforce formal regulations. These factors are important in

the developing world today where poaching markets continue to threaten wildlife in Africa and Asia, where law enforcement is often scant, and where private provision of ecosystem services is challenged by fragmented land ownership and weak private property rights (see, e.g., Salzman et al. 2018, Fenichel and Abbott 2014, Jack et al. 2008).

Our results, however, suggest the continued rise of the regulatory state described in Glaeser and Shleifer (2003) is not inevitable in the context of natural resource management. On the contrary, once state regulatory enforcement was firmly established, the extent to which the state engaged in detailed resource management depended on the costs of private management. The regulatory state appears to have been "crowded out" to some extent by voluntary, private management during much of the 20th and early 21st century. This finding adds to the literature on the interaction between governmental and private land and resource conservation (e.g., Albers et al. 2008, Parker and Thurman 2011). Although states had a comparative advantage in law enforcement in the 19th and early 20th century, this did not always translate into a comparative advantage for day-to-day, detailed management. Hence, the direction of the crowding out is reverse of standard economic intuition: private action crowded out governmental action.

A related literature in "private politics" is also relevant and has been shown to be a prominent factor in the provision of public goods (e.g., Baron 2001, Baron 2003, Kitzmueller and Shimshack 2012) as is the literature on bottom-up environmentalism via citizen initiatives (e.g., Crain et al. 2021, Banzhaf et al. 2010). This literature focuses on the behavior of activists (e.g., consumers, environmentalists) attempting to alter firm behavior. The history of wildlife agencies does not always fit this model as most collective action ("public politics") was aimed at changing laws and regulations and establishing agency authority, rather than influencing landowner management. Still, as we note in section II, sportsmans' associations did put pressure on landowner and hunting markets before the turn of the 20th century. While we chose not to focus on politics (private or public) in this study, there are of course, political equilibria that could be explored with more detailed data on the groups involved in collective action in future research.

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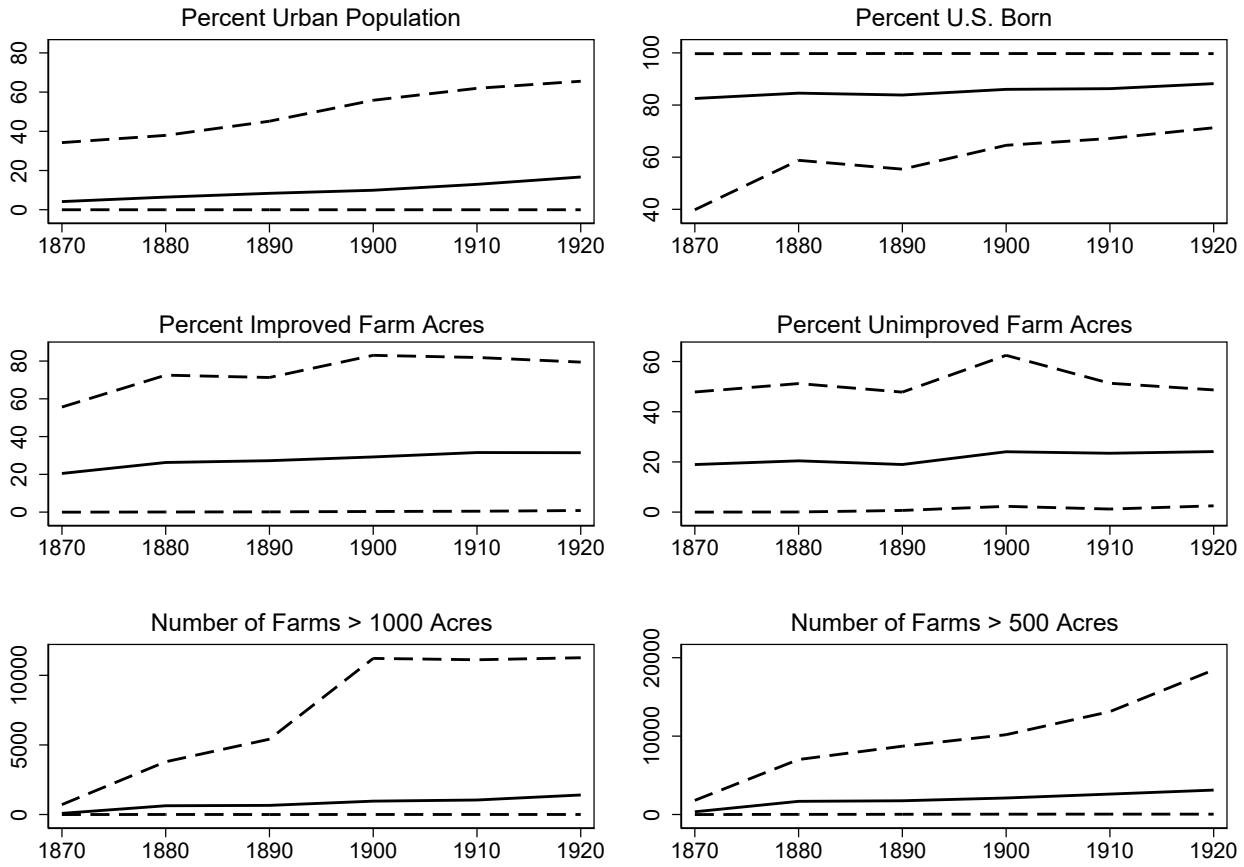

Figure A1: Mean, Minimums, and Maximums for Key Duration Analysis Variables

Notes: The plots show means (solid line) and minimums and maximums (dashed lines) for each state-year combination over 1870-1920.

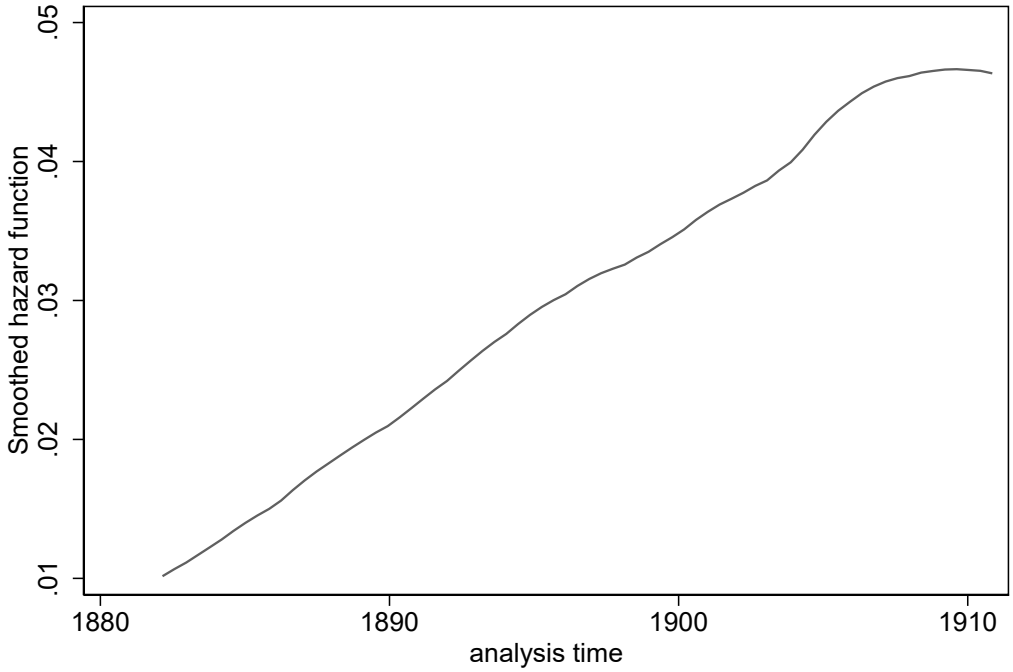

Figure A2. Baseline Hazard Function for Agency Creation. Figure shows probability of agency adoption from 1880-1910 when covariates in Column 1 of Table 1 are evaluated at their means.

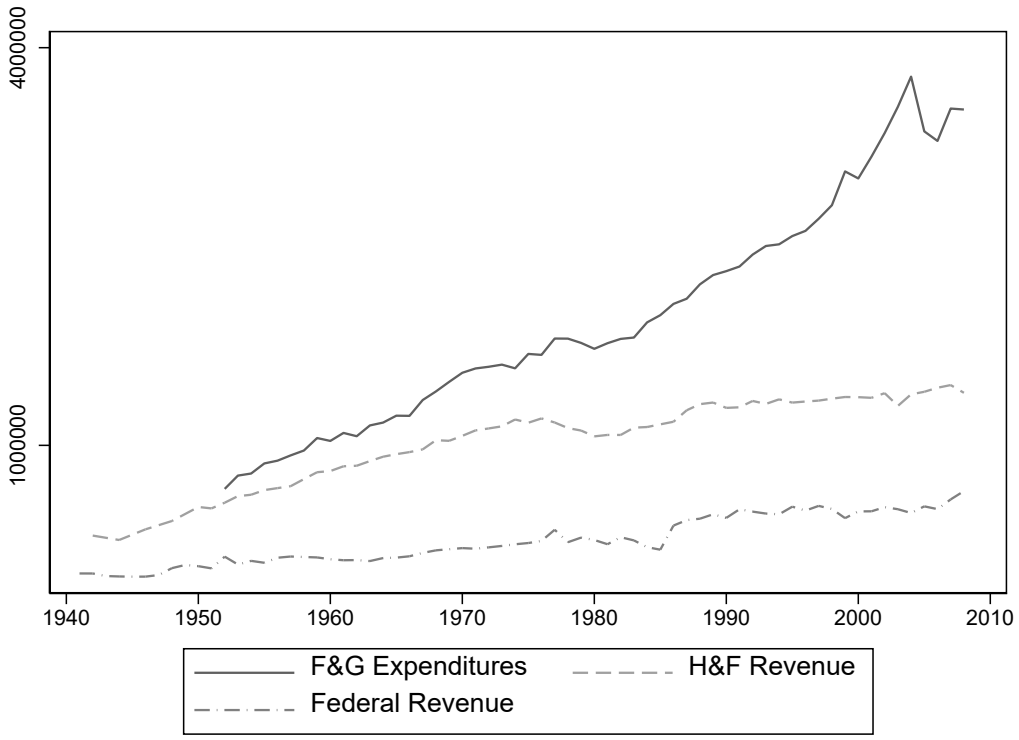

Figure A3: Aggregate Wildlife Agency Expenditures and Revenue Sources, 1940-2010.
Notes: Alaska and Hawaii are excluded. The vertical axis is in thousands of 2008 dollars (e.g., the range is from 1 to 4 billion). F&G denotes expenditures on fish and game and H&F denotes revenue from hunting and fishing sales. Sources: Source: U.S. Census, Annual Survey of State Government Finances, for F&G expenditures and U.S. Fish and Wildlife Service for H&F Revenue and Federal Revenue. Federal revenue data are available at https://www.fws.gov/media/fy-1939-2022-wr-apportionments (visited on July 18, 2024). Hunting and fishing license revenue are available with login access.

Figure A4: Agricultural Land, 1850-2010. Source: Statistical abstracts of the U.S. and National Census of Agriculture for various years.

Table A1: Summary Data on State Trespass Laws

Year	**Trespass Regime 1** Requires landowner permission to hunt	**Trespass Regime 2** Requires posting to keep hunters off unenclosed and uncultivated land	**Trespass Regime 3** Requires posting to keep hunters off of any private land	**Trespass Regime 4** Unenclosed and uncultivated lands accessible for hunting
1850	3	0	1	2
1860	6	0	2	4
1870	7	2	2	11
1880	5	2	3	13
1890	6	2	4	17
1900	9	4	7	19
1910	11	4	10	19
1920	11	5	10	18
1930	11	6	12	17
1940	12	7	12	16
1950	12	7	13	16
1960	13	7	13	15
1970	15	9	14	10
1980	19	10	16	3
1990	20	10	17	1
2000	20	10	17	1

Source: The authors' compilation and interpretation of state trespass statute. In the early years of the data, many states lack any trespass statute. In these instances, trespass law was determined by common law precedence, which favored open access for hunting (cite federal court ruling). Posting means that for landowners to keep others off their land they must place boundary signs ("post") indicating the land is private property and closed to hunting.

Table A2: Summary Statistics for Duration Analysis

	Mean	St. Deviation	Minimum	Maximum
Land Variables				
NON-FARM ACRES (000S)	26,175	28,453	162.3	151,603
IMPROVED FARM ACRES (000S)	6930.4	6,696.6	0.338	28,556
UNIMPROVED FARM ACRES (000S)	7,006.5	10,255	4.003	106,230
FARMS > 1000 ACRES^{+}	704.48	1,282.8	0	11,220
FARMS > 500 ACRES^{+}	1,789.7	2,068.1	0	12,038
AVERAGE FARM ACRES	183.65	173.40	24.80	1,301
Demographics				
TOTAL POPULATION (000S)	1,194.5	1,089.5	9.118	5,814.8
PERCENT URBAN POP	5.855	10.55	0	43.71
PERCENT U.S. BORN POP	86.74	11.92	39.85	99.77
SPORTSMEN GROUP	0.485	0.499	0	1
Setup Costs and State Capacity				
% OF REGION WITH WILDLIFE AGENCY	12.62	23.91	0	100
NUMBER OF NON-WILDLIFE AGENCIES	1.797	1.153	0	5
Geographic Variables				
MEAN PRECIP (INCHES)	38.68	14.85	9.5	60.1
MEAN ELEVATION (FEET)	1,684.1	1,891.2	60	6800

Notes. There are 1336 state-year observations for all variables. + For a small number of state-year combinations, there are zero farms greater than 1000 and 500 acres. In these cases we have added a "1" the log of the variable is defined. The variables are described and defined in the text. Three states – Oklahoma, North Dakota, and South Dakota - enter the duration analysis data set in 1890 because the agricultural census first reported land data for these states and territories in 1890.

Table A3: Duration Model Estimates of Wildlife Agency Creation, 1870-1920, with All Coefficients

	Predicted Sign	(1)	(2)	(3)	(4)
Setup Costs and State Capacity					
% Region with Wildlife Agency	+, T1	1.777***	1.752***	2.061***	2.307***
		(0.572)	(0.636)	(0.774)	(0.773)
Number of non-wildlife Agencies	+, T1	0.521**	0.603***	0.699**	0.689**
		(0.211)	(0.207)	(0.272)	(0.278)
Land Contracting Costs (logged)					
Unimproved Farm Acres	+, T2	0.943*	0.938*	1.960**	2.181**
		(0.487)	(0.491)	(0.778)	(0.880)
Farms > 1000 Acres	-, T3	-0.568**	-0.521*	-1.540***	-1.380***
		(0.289)	(0.304)	(0.374)	(0.371)
Controls					
Log of Improved Farm Acres		-0.065	0.050	0.827	0.945
		(0.253)	(0.330)	(0.730)	(0.820)
Log of non-Farm Acres		0.011	0.116	0.015	0.024
		(0.192)	(0.225)	(0.438)	(0.411)
Log of Total Population		-0.028	-0.617	-0.370	-1.038
		(0.488)	(0.589)	(1.013)	(1.458)
Percent Urban Pop		0.009	0.022	0.045	0.048
		(0.022)	(0.024)	(0.029)	(0.034)
Percent US Born		-0.036	-0.064**	-0.023	-0.054
		(0.023)	(0.027)	(0.044)	(0.043)
Sportsmen Group		-0.338	-0.273	-1.103**	-0.633
		(0.368)	(0.388)	(0.477)	(0.687)
Geographic Controls					
Log of Mean Precipitation			2.748***		2.367
			(1.065)		(2.192)
Log of Mean Elevation			0.796*		0.099
			(0.435)		(0.523)
Region Fixed Effects		No	No	Yes	Yes
Observations		1336	1336	1336	1336

Notes: The coefficients are shown, not hazard rates. Standard errors adjusted for clusters in the 48 states, p-values in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Column 1 shows predicted signs and the corresponding theoretical implication. There were 47 'failures' out of 48 states. The regressions employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

Table A4: Robustness of Survival Model Estimates of Wildlife Agency Creation, 1870-1920

	(1)	(2)	(3)	(4)	(5)	(6)
Land Contracting **(logged)**						
FARMS > 1000 ACRES	-1.540***			-1.227*	-1.232***	
	(0.374)			(0.650)	(0.462)	
FARMS > 500 ACRES		-2.172***		-0.648		1.889***
		(0.559)		(1.077)		(0.691)
AVERAGE FARM SIZE			-2.434**		-1.346	-2.099*
			(1.059)		(1.256)	(1.247)

Notes: The coefficients are shown, not hazard rates. All estimates include the same co-variates and region fixed effects as Column 3 of Table 1. We chose the Column 3 specification to balance the tradeoff between power and potential omitted variables but the results are similar when we instead mimic the other specification in Table 1.

Table A5: Linear Probability Model Estimates of if State had Wildlife Agency in 1890 or 1900

	Predicted Sign	(1)	(2)	(3)	(4)
Setup Costs and State Capacity					
% Region w. Wildlife Agency	+, T1	1.037***	0.000	0.610***	0.968***
		(0.276)	(.)	(0.176)	(0.322)
# of non-wildlife Agencies	+, T1	0.010	-0.003	0.070	0.054
		(0.044)	(0.061)	(0.084)	(0.079)
Land Contracting Costs (log)					
Unimproved Farm Acres	+, T2	0.445***	0.444**	0.129	0.148
		(0.097)	(0.168)	(0.155)	(0.201)
Farms > 1000 Acres	-, T3	-0.157***	-0.230***	-0.149	-0.264**
		(0.100)	(0.159)	(0.082)	(0.135)
Controls					
Log of Improved Farm Acres		-0.154	-0.016	0.098	0.319**
		(0.100)	(0.159)	(0.082)	(0.135)
Log of non-Farm Acres		0.016	0.059	-0.018	-0.050
		(0.054)	(0.072)	(0.048)	(0.062)
Log of Total Population		-0.022	-0.037	-0.136	-0.095
		(0.107)	(0.139)	(0.142)	(0.177)
Percent Urban Pop		0.002	0.003	0.008	0.008
		(0.006)	(0.007)	(0.007)	(0.006)
Percent US Born		-0.005	-0.005	-0.005	-0.009
		(0.006)	(0.007)	(0.007)	(0.008)
Sportsmen Group		0.012	-0.060	-0.148	-0.287*
		(0.099)	(0.146)	(0.138)	(0.153)
Region Fixed Effects		No	Yes	No	Yes
Observations (states)		48	48	48	48
Adjusted R^2		0.613	0.638	0.588	0.672
Mean of Dependent variable		0.23	0.23	0.63	0.63

Notes: The coefficients are estimated with a linear probability model. P-values in parentheses, based on robust standard errors. * p<0.1, ** p<0.05, *** p<0.01. In Columns 1 and 2, the dependent variable is an indicator for having an agency in 1890. In Columns 3 and 4, the dependent variable is an indicator for having an agency in 1900. The regressions employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

Table A6: 'Placebo' Duration Model Estimates of non-Wildlife Agency Creation, 1870-1920, with all Coefficients

	Wildlife	Inland Fish	Forests	Agriculture	Health	Parks
	(1)	(2)	(3)	(4)	(5)	(6)
Setup Costs and State Capacity						
% Region w/ Relevant Agency	2.061***	4.726***	5.712***	4.515***	4.616***	8.555***
Number of Other Agencies	0.699**	0.604**	0.204	0.228	0.765***	0.564
Land Contracting Costs (logged)						
Unimproved Farm Acres	1.960**	0.712	0.303	0.332	-0.002	-0.102
Farms > 1000 Acres	-1.540***	-0.284	0.027	0.205	-0.039	-1.078**
Controls						
Log of Improved Farm Acres	0.827	0.459	-0.378	-0.484	-0.513	-0.114
Log of non-Farm Acres	0.015	-0.415**	0.483	0.248	-0.205	-0.506
Log of Total Population	-0.370	-0.728	-0.163	0.239	1.387***	2.240
Percent Urban Pop	0.000	-0.000	-0.000	-0.000	-0.000	0.000
Percent US Born Pop	-0.023	-0.069**	-0.028	-0.012	-0.157***	-0.007
Sportsmen Group	-1.103**	0.950**	1.667***	1.423**	-1.255**	-3.882**
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1336	597	1734	728	653	2153
# of States with 'Failure'/Subjects	47/48	47/48	37/48	46/48	48/48	19/48

Notes: The coefficients are shown, not hazard rates. Standard errors, not shown, are adjusted for clusters in the 48 states. * p<0.1, ** p<0.05, *** p<0.01. The models here replicate Column 3 of Table 1.

Table A7: Duration Model Estimates of Wildlife Agency Creation, 1870-1920, with Controls for State Trespass Laws

	Predicted Sign	(1)	(2)	(3)	(4)
Setup Costs and State Capacity					
% of Region with Wildlife Agency	+, T1	1.747***	1.691***	2.063***	2.264***
		(0.581)	(0.607)	(0.790)	(0.774)
Number of non-wildlife Agencies	+, T1	0.554***	0.654***	0.747***	0.717***
		(0.207)	(0.219)	(0.266)	(0.266)
Land Contracting Costs (logged)					
Unimproved Farm Acres	+, T2	1.057**	1.150**	2.036***	2.197***
		(0.503)	(0.485)	(0.761)	(0.853)
Farms > 1000 Acres	-, T3	-0.513*	-0.481*	-1.412***	-1.278***
		(0.284)	(0.282)	(0.373)	(0.370)
Demographics					
Log of Improved Farm Acres		-0.208	-0.104	0.513	0.606
		(0.267)	(0.328)	(0.803)	(0.910)
Log of non-Farm Acres		0.044	0.222	0.094	0.109
		(0.199)	(0.254)	(0.506)	(0.471)
Log of Total Population		-0.022	-0.791	-0.352	-0.908
		(0.467)	(0.574)	(1.038)	(1.475)
Percent Urban Pop		0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Percent US Born		-0.033	-0.063**	-0.017	-0.043
		(0.022)	(0.026)	(0.048)	(0.048)
Sportsmen Group		-0.373	-0.187	-1.233**	-0.786
		(0.406)	(0.419)	(0.553)	(0.824)
Geographic Variables (logged)					
Mean Precip			3.201***		2.040
			(1.095)		(2.366)
Mean Elevation			0.881**		0.110
			(0.433)		(0.637)
Trespass Laws					
Landowner Permission Required		0.798	1.131**	0.735	0.739
		(0.514)	(0.562)	(0.554)	(0.603)
Illegal to Hunt on Posted Land		-0.559	-0.266	-0.666	-0.550
		(0.642)	(0.522)	(0.624)	(0.737)
Region Fixed Effects		No	No	Yes	Yes

Notes: The coefficients are shown, not hazard rates. Standard errors adjusted for clusters in the 48 states, p-values in parentheses. * p<0.1, ** p<0.05, *** p<0.01. There were 47 'failures' out of 48 states and all regression include 1336 observations. The regressions employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

Table A8: Summary Statistics for Analysis of Agency Expenditures, 1952-2007

	Mean	St. Deviation	Minimum	Maximum
Dependent Variables				
AGENCY EXPENDITURES (000S)	40,556	43,454	1,388	488,976
Land Variables				
TOTAL ACRES (000S)	39,619	29,730	677	168,217
FEDERAL ACRES (000S)	8,699	14,670	2.0	61,378
FARM ACRES (000S)	21,181	22,717	49.6	145,601
# FARMS > 1000 ACRES	3,383	4,573	1.6	25,341
# FARMS > 500 ACRES	7,380	8,736	7.0	48,602
AVERAGE FARM SIZE	664	1,085	56	6,518
State Capacity				
STATE REVENUE (000,000S)	17,024	26,840	282.7	311,426
Controls				
AUTONOMOUS AGENCY	0.458	0.498	0.0	1.0
TOTAL POPULATION (000S)	4,700	5,073	181	36,226
INCOME PER CAPITA	25,294	9,104	7,316	58,770
MEAN PRECIPITATION (INCHES)	36.82	14.13	9.5	60.1
MEAN ELEVATION (FEET)	1,751	1,836	60	6,800

Notes. There are 576 state-year observations for all variables spanning 5-year intervals over 1952-2007. In general, the annual measures match the years of the USDA Census of Agriculture. In years where the USDA census does not match, we have interpolated the data assuming linear growth to cover missing years. All monetary values are in 2007 dollars, adjusted by the federal CPI.

Table A9: Panel Estimates of Agency Expenditures on Wildlife, 1952-2007, with All Coefficients

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
State Capacity							
LOG OF STATE REVENUE	+, B1	0.435***	0.347***	0.350**	0.573***	0.569***	0.584***
		(0.155)	(0.089)	(0.168)	(0.208)	(0.206)	(0.195)
Land Contracting Costs							
LOG OF FEDERAL ACRES	+, B2				0.157**	0.155**	0.160***
					(0.060)	(0.060)	(0.058)
LOG FARMS > 1000 ACRES	-, B3	-0.097**			-0.019		
		(0.041)			(0.071)		
LOG OF FARMS > 500 ACRES	-, B3		-0.107*			0.017	
			(0.062)			(0.103)	
LOG OF AVE. FARM ACRES	-, B3			0.263			-0.218**
				(0.191)			(0.093)
Controls							
LOG OF TOTAL ACRES					0.348	0.343	0.376
					(0.292)	(0.289)	(0.277)
LOG OF FARM ACRES		0.364***	0.286**	0.196	-0.054	-0.097	-0.033
		(0.133)	(0.138)	(0.159)	(0.156)	(0.175)	(0.145)
AUTONOMOUS		-0.039	-0.035	-0.049	0.065	0.070	0.111
		(0.068)	(0.065)	(0.069)	(0.103)	(0.108)	(0.105)
LOG OF POPULATION		-0.027	0.095	0.248	-0.223	-0.207	-0.289
		(0.135)	(0.131)	(0.169)	(0.191)	(0.189)	(0.182)
LOG OF PER CAPITA INCOME		0.767**	0.648***	0.743**	0.863**	0.843**	0.968***
		(0.311)	(0.177)	(0.299)	(0.331)	(0.329)	(0.292)
LOG OF MEAN PRECIP.					0.569***	0.540**	0.236
					(0.199)	(0.213)	(0.261)
LOG OF MEAN ELEVATION					-0.010	-0.007	-0.055
					(0.074)	(0.067)	(0.074)
CONSTANT		-6.739*	-5.012**	-9.736**	-12.390***	-12.072***	-10.808***
		(3.923)	(2.131)	(4.570)	(4.007)	(4.041)	(3.599)
State fixed effects		Yes	Yes	Yes	No	No	No
Year fixed effects		Yes	Yes	Yes	Yes	Yes	Yes
Observations		576	576	576	576	576	576
Adjusted R-squared		0.800	0.781	0.800	0.806	0.806	0.813

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The balanced panel data cover 5-year intervals from 1952-2007 with t = 12 time periods and s = 48 states. The variables TOTAL ACRES, FEDERAL ACRES, MEAN PRECIPITATION, and MEAN ELEVATION are dropped from Columns 1-3 because we treat the variables as time invariant.

Table A10: Panel Estimates of Agency Expenditures on Wildlife with Region Effects, 1952-2007

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
State Capacity							
LOG OF STATE REVENUE	+, B1	0.424**	0.467**	0.326*	0.476**	0.466**	0.401**
		(0.193)	(0.201)	(0.190)	(0.218)	(0.220)	(0.184)
Land Contracting Costs							
LOG OF FEDERAL ACRES	+, B2				0.126*	0.124*	0.117**
					(0.065)	(0.065)	(0.057)
LOG FARMS > 1000 ACRES	-, B3	-0.131**			-0.025		
		(0.050)			(0.069)		
LOG OF FARMS > 500 ACRES	-, B3		-0.235***			0.037	
			(0.083)			(0.109)	
LOG OF AVE. FARM ACRES	-, B3			0.161			-0.407***
				(0.221)			(0.092)
Controls							
LOG OF TOTAL ACRES					0.358	0.349	0.396*
					(0.250)	(0.245)	(0.214)
LOG OF FARM ACRES		0.265	0.297	0.214	0.028	-0.042	0.182
		(0.239)	(0.239)	(0.248)	(0.163)	(0.179)	(0.132)
AUTONOMOUS		-0.026	-0.024	-0.031	0.037	0.045	0.057
		(0.072)	(0.073)	(0.075)	(0.093)	(0.094)	(0.085)
LOG OF POPULATION		-0.086	-0.107	0.089	-0.153	-0.125	-0.225
		(0.208)	(0.209)	(0.207)	(0.203)	(0.205)	(0.172)
LOG OF PER CAPITA INCOME		0.651*	0.609*	0.852**	0.635*	0.601*	0.913***
		(0.335)	(0.322)	(0.333)	(0.369)	(0.355)	(0.277)
LOG OF MEAN PRECIP.					0.687***	0.638***	0.124
					(0.227)	(0.226)	(0.246)
LOG OF MEAN ELEVATION					-0.064	-0.061	-0.191***
					(0.065)	(0.059)	(0.066)
State fixed effects		Yes	Yes	Yes	No	No	No
Region fixed effects		No	No	No	Yes	Yes	Yes
Year effects		Yes	Yes	Yes	Yes	Yes	Yes
Region year effects		Yes	Yes	Yes	No	No	No
Observations		576	576	576	576	576	576
Adjusted R-squared		0.835	0.837	0.833	0.835	0.817	0.835

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The balanced panel data cover 5-year intervals from 1952-2007 with t = 12 time periods and s = 48 states. The variables TOTAL ACRES, FEDERAL ACRES, MEAN PRECIPITATION, and MEAN ELEVATION are dropped from Columns 1-3 because we treat the variables as time invariant.
Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The balanced panel data cover 5-year intervals from 1952-2007 with t = 12 time periods and s = 48 states. The variables TOTAL ACRES, FEDERAL ACRES, MEAN PRECIPITATION, and MEAN ELEVATION are dropped from Columns 1-3 because we treat the variables as time invariant. As with Table 1, the estimates here employ the 9 regions defined in the 1900 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.

Table A11: 'Placebo' Panel Estimates of Agency Expenditures, Various Years from 1952-2007

	(1) Health	(2) Parks	(3) Agriculture	(4) Forestry	(5) Health	(6) Parks	(7) Agriculture	(8) Forestry
State Capacity								
LOG OF STATE REVENUE	0.312**	-0.152	0.079	0.097	0.277*	-0.203	0.143	-0.183
	(0.150)	(0.370)	(0.175)	(0.480)	(0.158)	(0.361)	(0.163)	(0.438)
Land Contracting Costs								
LOG OF FEDERAL ACRES					-0.039	0.059	0.167**	-0.303
					(0.055)	(0.258)	(0.071)	(0.193)
LOG OF FARMS > 1000 ACRES	-0.056	-0.052	0.091*	-0.385**				
	(0.059)	(0.191)	(0.052)	(0.149)				
LOG OF AVE. FARM ACRES					0.183	0.437	0.545***	0.318
					(0.164)	(0.418)	(0.137)	(0.425)
Controls								
LOG OF TOTAL ACRES					x	x	x	x
LOG OF FARM ACRES	x	x	x	x	x	x	x	x
AUTONOMOUS	x	x	x	x	x	x	x	x
LOG OF POPULATION	x	x	x	x	x	x	x	x
LOG OF PER CAPITA INCOME	x	x	x	x	x	x	x	x
LOG OF MEAN PRECIP					x	x	x	x
LOG OF MEAN ELEVATION					x	x	x	x
State fixed effects	Yes	Yes	Yes	Yes	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	576	335	528	552	576	335	528	552
Adjusted R-squared	0.933	0.378	0.753	0.505	0.933	0.385	0.776	0.491

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The dependent variables are state-level annual expenditures on health, parks, agriculture, and forestry. The columns have different numbers of observations because of differences in expenditure data availability. The specifications in 1-4 mimic Column 1 of Table 3. The specifications in 5-8 mimic Column 6 of Table 3.

Table A12: Pooled Regression Estimates of Nongame Expenditures, 1986, 1992 & 1998, with All Coefficients

		Y= ln(Nongame Spending)			Y = % of Spending on Nongame	
	Predicted Sign	(1)	(2)	Predicted Sign	(3)	(4)
State Capacity						
LOG OF STATE REVENUE	+, B1	0.820	0.473	?	0.010	0.005
		(0.567)	(0.609)		(0.040)	(0.040)
Land Contracting Costs						
LOG OF FEDERAL ACRES	+, B2	0.350***	0.310**	?	0.006	0.012
		(0.123)	(0.146)		(0.007)	(0.009)
LOG OF AVE. FARM ACRES	+, B3	0.537**	0.445	+, B4	0.049***	0.064***
		(0.218)	(0.268)		(0.017)	(0.019)
Controls						
LOG OF TOTAL ACRES		-0.305	-0.257		-0.029	-0.040*
		(0.606)	(0.520)		(0.026)	(0.024)
LOG OF FARM ACRES		0.007	0.184		-0.001	-0.002
		(0.290)	(0.285)		(0.012)	(0.014)
AUTONOMOUS		-0.236	-0.178		-0.015	-0.013
		(0.199)	(0.204)		(0.011)	(0.011)
LOG OF POPULATION		-0.034	0.253		0.023	0.036
		(0.599)	(0.672)		(0.041)	(0.042)
LOG OF PER CAPITA INCOME		1.395	0.520		0.014	-0.053
		(1.147)	(1.082)		(0.063)	(0.066)
LOG OF MEAN PRECIP.		0.927	1.304*		0.044	0.074*
		(0.641)	(0.677)		(0.030)	(0.043)
LOG OF MEAN ELEVATION		0.147	-0.034		0.010	0.008
		(0.195)	(0.184)		(0.008)	(0.009)
CONSTANT		-19.018	-9.801		-0.679	-0.109
		(13.021)	(14.056)		(0.722)	(0.778)
Region fixed effects		No	Yes		No	Yes
Year fixed effects		Yes	Yes		Yes	Yes
Observations		141	141		143	143
Adjusted R-squared		0.615	0.658		0.240	0.300

Notes: * p<0.1, ** p<0.05, *** p<0.01. All standard errors are clustered at the state level. The panel is slightly unbalanced because a few states did not report their nongame spending in each year of the survey. Here t = 3 time periods (1986, 1992, and 1998) and s = 48 or 47 states, depending on the year. As with Table 3, the estimates here employ the 9 regions defined in the 1890 Census. Region 1 is CT, ME, NH, VT, MA, RI. Region 2 is NJ, NY, PA. Region 3 is IL, IN, MI, OH, WI. Region 4 is IA, KS, MN, MO, NE, ND, SD. Region 5 is DE< VA, FL, GA, NC, SC, MD, WV. Region 6 is AL, MS, KY, TN. Region 7 is AR, LA, TX, OK. Region 8 is AZ, CO, ID, MT, NV, NM, UT, WY. Region 9 is CA, OR, WA.