The Efficacy of Conservation Expenditures: Evidence From Local Ballot Measures

By Dylan Hogan, Eyal G. Frank, Joséphine Gantois, Anouch Missirian*

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Abstract

What should we expect if we increase biodiversity financing, as global treaties are calling for, by $200 billion a year? To better inform conservation expenditure policies, we estimate the effect of conservation expenditures on local biodiversity and land cover using voting data on local ballots that allocate funding towards a variety of conservation purposes. Our analysis compares ballots that narrowly passed or failed using a dynamic regression discontinuity design. We estimate that following a conservation ballot passing, bird abundance increases by 0.3 standard deviation, and green vegetation cover increases by five percent. In dollar terms, we estimate that increasing conservation expenditures by $25 million leads to approximately 0.2 standard deviations higher bird abundance and three percent higher green vegetation. Further analysis reveals that one state, which accounts for roughly 20 percent of the ballots, is solely driving this result: New Jersey. Our findings highlight that conservation spending can have meaningful impacts on biodiversity; however, context and institutional details are highly important.

*Hogan: School of International and Public Affairs, Columbia University (email: dth2133@columbia.edu); Frank: Harris School of Public Policy, University of Chicago, CEPR and NBER (email: eyalfrank@uchicago.edu); Gantois: Institute for Resources, Environment and Sustainability, and Food and Resource Economics Program, University of British Columbia (email: josephine.gantois@ubc.ca); Missirian: Toulouse School of Economics, INRAE, University of Toulouse Capitole and CEPR (email: anouch.missirian@tse-fr.eu). We are grateful for comments made by participants at the ASSA, the LEEP Seminar at the University of Exeter, the Cired seminar. We thank Guillermo Parra for excellent research assistance. Anouch Missirian acknowledges financial support from the Agence Nationale pour la Recherche (EUR CHESS # ANR-17-EURE-0010). All errors are ours.

1 Introduction

Global policy discussions on how to halt and reverse biodiversity losses emphasize an annual financing gap of $200 billion, yet there is little empirical evidence about the return on conservation spending. Despite this knowledge gap, countries are developing National Biodiversity Strategies and Action Plans as part of the Kunming-Montreal Global Biodiversity Framework, developed at the 15th Conference of the Parties of the Convention on Biological Diversity (UNEP FI 2023). The new framework and national plans call to develop sustainable supply chains, create markets for biodiversity offsets, invest in natural infrastructure, support conservation NGOs, and implement nature-based solutions (Deutz et al. 2020)—with the goal of mitigating potential negative impacts on human well-being that scientists warn will be caused by extinction rates that are 100 to 1,000 times higher than what is considered to be normal background levels (Ceballos et al. 2015; Ceballos and Ehrlich 2023).

Habitat loss is regarded to be the main driver, by far, of the decline in biodiversity (Brooks et al. 1997; Pimm and Raven 2000). As a result, area-based conservation is considered an imperative tool in preventing further collapse of populations of wild plants and animals. Depending on land values, and associated opportunity costs, land use restrictions that often accompany many protected areas are seen as a potentially costly policy instrument. Evaluating how effective conservation expenditures are with respect to promoting biodiversity gains has been of long-standing interest (Baylis et al. 2016; Langhammer et al. 2024), however, studying this research question faces two key challenges: (i) identifying unprotected areas that can approximate the relevant counterfactual, and (ii) observing conservation-related outcomes at a spatio-temporal scale that aligns with the scale of the conservation policy (Ferraro and Pressey 2015).[1]

In this paper, we make a key contribution that estimates the biodiversity benefits from spending on land conservation. We use a series of votes on local

[1] With forest cover and policies that aim to reduce deforestation being a notable exception.

ballots that allocate funds towards conservation goals. Our empirical strategy uses the fact that some votes narrowly fall above or below the vote margin, which allows us to implement a dynamic regression discontinuity design. This approach overcomes the empirical challenges discussed earlier as it provides us with a setting where: (i) the votes that narrowly fail to pass provide a compelling counterfactual to the votes that do pass, and (ii) the local scale of the conservation measures approved in the ballots aligns with the resolution of available data on bird abundance. Our main finding is that local conservation spending modestly increases bird abundance. We estimate that, on average, an increase in conservation expenditures of $25 million results in about 0.3 standard deviation increase in the local wild bird population, which we consider as a valid proxy for biodiversity and ecosystem conditions. Testing for different dimensions of heterogeneity reveals that the improvements in bird abundance are concentrated in the ballots that occur in one state: New Jersey, which has the highest number of ballots, accounting for close to 20 percent of all ballots, and a large state-wide program Green Acres that encourages local fundraising via these open space ballots, and provides matching funds for open space conservation.

Local governments use ballots to approve allocations of funds for conservation projects. From 2003 to 2023, 1,237 votes passed that approved a total of $64 billion (2020 USD), averaging at $3 billion (2020 USD) a year, roughly on par with federal expenditures through the Endangered Species Act and the Conservation Reserve Program—the leading federal programs for species and habitat protection. Conservation expenditures are directed toward multiple purposes, but often include purchasing land to preserve it as open space, restoring habitat for species, preserving watersheds, creating trails for recreation, or offsetting the potential environmental degradation from infrastructure projects.

Our measure of conservation outcome is local bird abundance and diversity. Birds are an excellent proxy for overall biodiversity and ecosystem health (Fraixedas et al. 2020; USGS 2022), and happen to be extremely well monitored around the globe in general (Moussy et al. 2022) and in the United

States in particular (Horns et al. 2018; Johnston et al. 2025), making them ideal to track the response of local ecosystems to conservation spending. Even though the conservation ballots do not necessarily target wild bird populations, we argue that the rationale for using standardized bird abundance as the key outcome is that improvements to the natural environment would likely correlate with higher suitability for wild birds. We match each vote with bird abundance data we obtain from the citizen science platform eBird. After adjusting the raw data to account for different levels of effort, and the likelihood of observing birds at specific times of day or season, we transform the data to standardized bird abundance scores. We use this variable as our main conservation outcome.

Using the fact that ballots often pass or fail close to the vote margin, we implement a regression discontinuity design (RDD). However, because we are interested in how the outcome evolves in the years after the ballot passes, we estimate a dynamic RDD, as in Cellini et al. (2010). This approach provides a more efficient estimation as it recognizes that part of the error term for the unit of observation is time-invariant. The key assumption of our research design is that other predictors of bird abundance do not change discontinuously at the vote margin, but instead, have smooth distributions for passing and failed ballots. We provide several static RDD results that speak to the validity of this assumption.

We complement the analysis on bird abundance by using data on green vegetation and land cover. Because open spaces, parks, and wildlife habitats are often explicit goals of the conservation ballots, we expect that successful votes will have an effect on the landscape. We test whether conservation expenditures affect land use by estimating how green vegetation, as captured by the Enhanced Vegetation Index, and the share of natural vegetation land change after a successful ballot. We find that green vegetation increases by five percent, but we do not estimate any changes in the share of land under natural vegetation.

Relevant Literature.— A recent literature has emerged about biodiversity financing (Hutchinson and Lucey 2024), however, it focuses mostly on the role of private firms and their exposure to biodiversity risks. Giglio et al. (2023) highlight the existence of both physical and transition risks associated to biodiversity loss—the fact that firms may be affected directly by biodiversity loss *per se*, and indirectly by the policies aimed at curbing it—and quantify the materiality of "biodiversity risks." Their subjective metrics (survey of finance experts) show that both risks are deemed "very important" now and even more so in the future (by about 30 percent of respondents), while their observational metric (equity price fluctuations in response to biodiversity news) attests to their actual joint importance: investors are already pricing aggregate biodiversity risk, although they believe it to be underpriced for now. Using a different metric of biodiversity risk exposure (the Corporate Biodiversity Footprint) Garel et al. (2024), find a similar result: while in the cross-section biodiversity risk does not explain returns, a "biodiversity premium" could be measured in the immediate aftermath of salience shocks (e.g., a UN conference on biodiversity).

Closer to our focus here is the work by Flammer et al. (2023) on biodiversity funds, a relatively new financial device that delivers projects aimed at preserving or restoring biodiversity, bundled in financial portfolios. They review the deals of one of the largest such private equities over 2020-2022, and highlight general characteristics: pure private capital only ventures in safer (in return), less ambitious (in extent), high-expected return deals, whereas blended finance (public/private) enables other riskier, vaster, and less remunerative projects to be financed as well. The research does not go beyond those financial aspects, and in particular, the actual biodiversity consequences of such schemes are outside the scope of the paper.

The findings in this paper complement previous work on the efficacy of conservation actions, which is distinctly different than the focus of this paper: financing of conservation. Indeed, a vast literature now documents the effects of command-and-control approaches to conservation (e.g., designating protected species, land-based policies proscribing activities, outlawing or restricting cer-

tain practices), a large part of it highlighting unintended consequences that compromise their efficacy (Lueck and Michael 2003; Chimeli and Soares 2017; Runge et al. 2019; Fienup and Plantinga 2021; Englander 2023) or their costs (Frank et al. 2025). Incentive-based policies have largely been studied as well, most notably in the case of payments for ecosystem services focusing on forest cover conservation (Wunder et al. 2020). They tend to highlight positive but modest gains (Wunder et al. 2024), with concerns over additionality (did the program pay for nothing?) and leakage (was conservation here matched by destruction there?), and mixed empirical evidence (Alix-García et al. 2012; Jayachandran et al. 2017). Enrollment in voluntary land easements is one of the largest conservation programs managed at the federal level in the United States, and studies document both the price response to the tax incentive (Parker and Thurman 2018) as well as the inframarginality of those who bid into the Conservation Reserve Program (Aspelund and Russo 2025). Finally, conservation actions relying on information provision and behavioral mechanisms have mostly focused on design and direct reaction to the intervention (e.g., Espinosa and Treich 2021), and have seldom evaluated their effects on conservation outcomes (Yokessa and Marette 2019).

A small literature documents the efficacy of raising conservation funds through the local ballot system in the United States. It focuses primarily on the socio-economic impacts of allocating funds through that mechanism (notably, Lang 2018 documents the impact of municipality-level votes on housing prices). One exception is Kroetz et al. 2014, which describe the extent to which the allocation process aligns conservation funding with endangered species ranges and outlines room for improvement. We uniquely estimate the causal impact of allocating funds on bird population outcomes and thus recover an estimate of the cost effectiveness of conservation funds in conservation terms.

Local governments raising funds for conservation highlights the continued relevance of local institutions, not only federal ones. Previous studies have documented the role of institutions in conservation. From the seminal work by Ostrom (1990, 1999) on how local communities can organize to govern the

use of common pool resources, to more recent examples of both historical and contemporary settings. For an excellent review on the evolution of conservation institutions in the United States, see Parker and Lueck (2024). Howlader (2023) documents how several programs following the Dust Bowl in the United States reduced soil erosion, and increased grassland restoration. Aronoff and Rafey (2023) find that decentralized offset markets in Florida led to substantial wetland restoration. Madhok (2025) reports how informed consent given by tribal communities in India lowers the deforestation impact of development projects.

2 Local Conservation Funding Through Tax Rates & Bonds

The focus of our paper is evaluating how votes that award funds toward conservation projects affect conservation outcomes. These votes are passed at either state or local government levels in order to support open space conservation. Each such ballot that is up for a vote proposes either a tax increase or a bond as the funding mechanism for the expenditure. As part of the ballot, either all of the proposed raised funds are allocated for conservation, or only a subset of the funds is earmarked for open space conservation.

These ballots are not designed and brought up to a vote at random. There is a range of local characteristics that predict a higher likelihood for a conservation ballot, such as: places with more imperiled species, larger water bodies (e.g. lakes and wetlands), larger intact open spaces, or conversely, places that have seen large habitat modification and loss of open spaces. In addition, communities that are, on average, more affluent, educated, and are experiencing faster economic growth are more likely to propose such ballots (Kotchen and Powers 2006; Nelson et al. 2007; Banzhaf et al. 2010).

Even though not all ballots pass, a sufficient number of them do, making this an important source of conservation funding in comparison to other forms of conservation expenditures. The Trust for Public Land tracks these ballots

over time (see Section 3 for more details), and reports that in 2020, $1.82 billion were approved for conservation purposes. Other sources of funding for conservation projects in the United States are available through public and private sources. At the federal level, expenditures made as part of the Endangered Species Act (ESA) or the Conservation Reserves Program (CRP) represent some of the largest conservation spending. In the 2020 fiscal year, total ESA expenditures, across all agencies and species were close to $1.3 billion (Fish and Wildlife Service 2020). The US Department of Agriculture issued $1.68 billion in 2020 in payments as part of the CRP (Department of Agriculture 2020). Private sources of funding reach similar magnitudes. For example, The Nature Conservancy spent $1 billion in 2020 on purchasing conservation land and easements (The Nature Conservancy 2020).

Ballots provide funding for a variety of actions that promote conservation. Funding raised through taxes and bonds can be used to purchase land; restore habitats and wetlands; improve or create hiking trails; create, improve, or expand parks; promote conservation on farmlands; preserve historic sites; or address damages caused by infrastructure projects. Almost all ballots mention several conservation purposes. In Online Appendix B, we review several ballots and provide more details on each. In Table C1, we report the number of ballots that mention specific conservation purposes.

3 Conservation Votes, Bird Abundance, Land Use & Local Characteristics Data

The goal of the empirical analysis is to estimate the effect that additional conservation expenditures have on conservation outcomes and land use. To do so, we collect data on local conservation ballots that allocate funds for conservation purposes, along with data on bird abundance that serves as a proxy for local biodiversity, as well as data on land use and local characteristics. In what follows, we elaborate on the ballots and bird abundance data, our main treatment and outcome variables, and briefly describe the other data sets we

use. In the Online Appendix, we include additional details and summary statistics about they key variables.

3.1 Conservation Ballots

We use data on conservation funding ballots from the Trust for Public Land (TPL) (The Trust for Public Land 2024). The organization collects data on the administrative level the ballot is relevant for: state, county, or municipality, as well as the date, the votes cast, the threshold needed to pass, and the funds proposed to be allocated. Some ballots are entirely meant for conservation purposes, whereas others are broader, and conservation spending is only a share of the total funds that are on the ballot. The data also include information on the specific funding mechanism: taxes, obligation bonds, or other, along with the intended purposes of the conservation funds. Even though data exist as far back as 1988, our main sample uses data from 2003 to 2023 because the conservation outcome data are sparse in earlier years. Incidentally, this helps overcome the change in data collection that happened in 1996, when TPL started tracking elections in real time rather than building the dataset by researching historical archives.

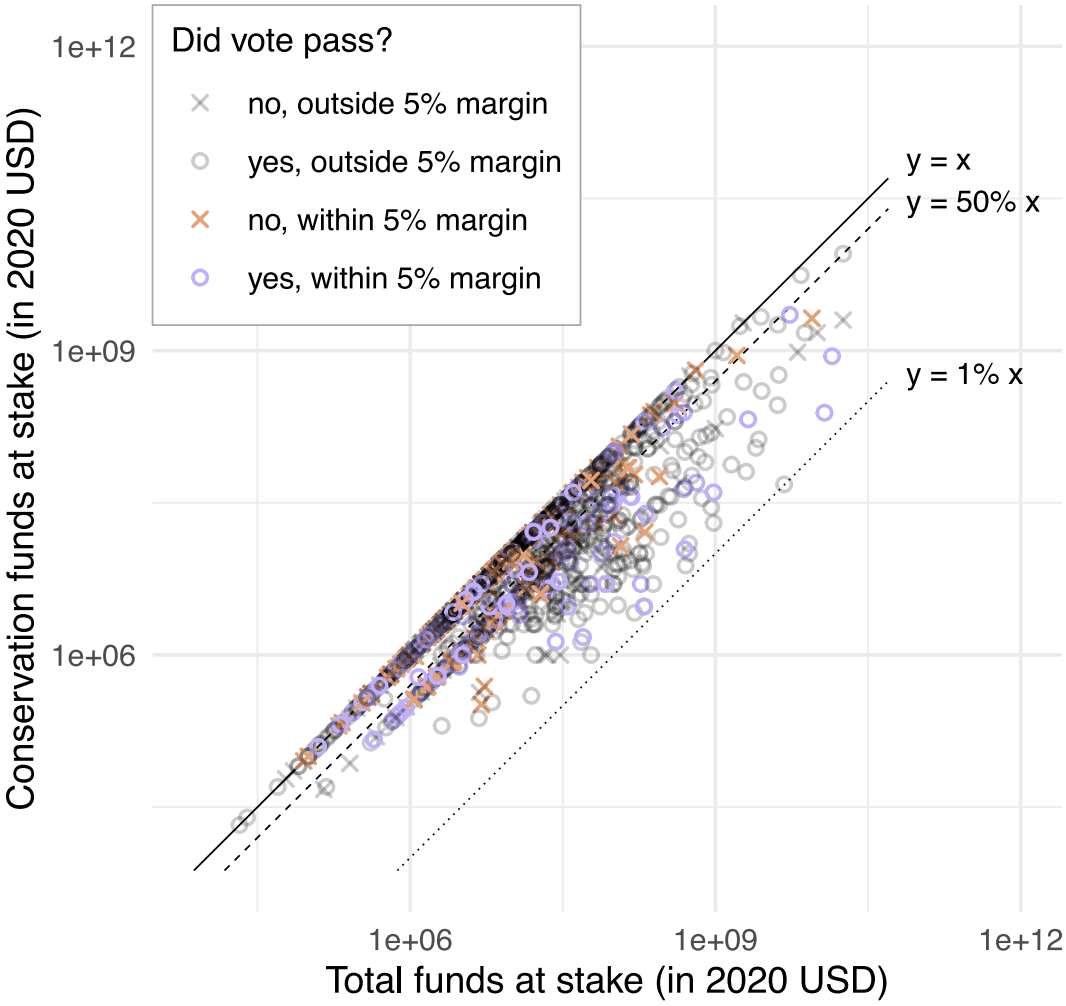
We present several summary statistics on the conservation ballots in Figure 1. In Figure 1a, we plot the amount of conservation funds at stake, relative to the total amount on the ballot. Since 1988, the mean amount of conservation funding per passing ballot is $51 million, with about $3.1 billion awarded each year (all in 2020 USD).[2] Many ballots propose allocating all of the funds at stake towards conservation, while others allocate as low as one percent of the funds at stake for conservation purposes. We denote the ballots that pass or fail within five percent of the vote margin in purple or red, respectively, and include a line to denote different shares of the ballot's allocation to conservation purposes. In Online Appendix B, we provide short summaries of several of these ballots.

We do not observe, in Figure 1b, strong evidence for bunching on either

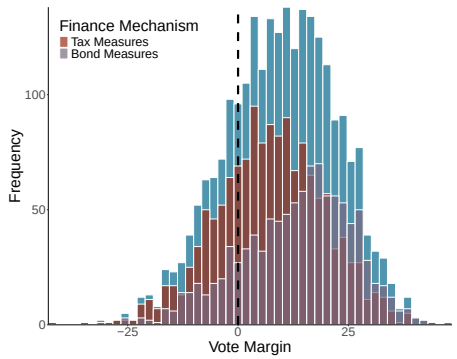
[2] These value changes only slightly if we consider passing ballots from 2003 onward: $52 million per ballot, and $3.06 billion a year, in 2020 USD.

Figure 1: Summarizing the Conservation Ballots Data

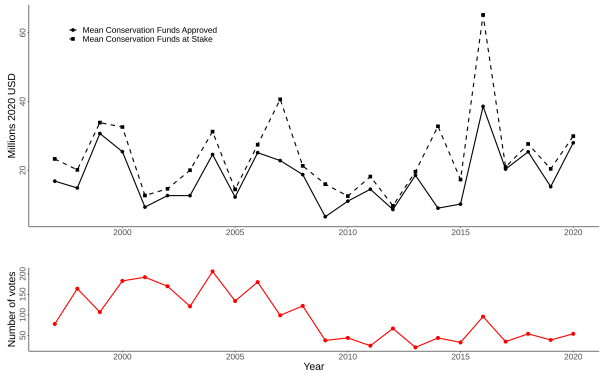
(a) Conservation Versus Total Funds at Stake



(b) Ballots Around Vote Margin



(c) Trends in Funding & Number of Ballots



Notes: We plot summary data from the TPL database on conservation ballots (2024). See text for more details.

side of the vote margin. Across the ballots in our data, a large share ends up passing—77 percent. But within five percent of the vote margin, the share of ballots that pass drops to 59 percent, reflecting a more even distribution of ballots that failed or passed. This holds for different financing mechanisms as well. Taxes reflect about 60 percent while bonds make up the other 40 percent of the financing mechanisms. Finally, the most common conservation purposes include open space, followed by recreation, parks, and farmland.

The amount of conservation funds at stake has held relatively steady in recent years, while the number of ballots has declined from about 150 a year to approximately 50 a year more recently. In Figure 1c, we plot the amount of conservation funds at stake for ballots that passed as well as all ballots, along with the number of ballots each year. Additional descriptive graphs on the number of votes (total over time, and total by state), the amount of funds allocated, and approval rate, by the type of jurisdiction and presidential party in office, as well as by financing mechanism are available in the Online Appendix, Figures C1-C5. In addition, we provide a summary of the counts and mean proposed conservation funding by the spatial level of the ballot, and conservation purposes in Tables C1 and C2.

3.2 Bird Abundance

Biodiversity outcomes are tracked using data on bird abundance and diversity. This is a pragmatic choice based on data availability, which is superior for birds (Moussy et al. 2022).[3] It is also a choice that makes scientific sense (Lawton et al. 1998; Larsen et al. 2012; Mekonen 2017; Fraixedas et al. 2020; USGS 2022; BirdLife International 2004). Several features make them valuable in addition to being extremely well monitored. First, they are present around the globe, and are very diverse (over 10,000 species globally, over 1,000 species in the United States alone). Second, they tend to be relatively high in the

[3] Moussy et al. (2022): "Birds were by far the most widely monitored taxonomic group, accounting for around half of all schemes." Birds and cycads are the only taxonomic groups with no data deficiency in the IUCN RedList conservation status assessment (www.iucnredlist.org).

food chain, and thus fluctuations in bird populations will also reflect changes at lower trophic levels (plants, insects), i.e., biodiversity more broadly, not just factors affecting birds only. Third, their biology is well documented and understood: this helps interpreting population fluctuations and trends (e.g., through diets, habitat requirements, environmental conditions on wintering grounds, etc.). Birds are also an outcome of interest in and of themselves, as birding is an increasingly popular recreational activity, and generates non-trivial revenue (U.S. Fish And Wildlife Service 2022).

We use data on bird presence and abundance as collected by citizen scientists and recorded in the eBird database (eBird 2021). The eBird platform was launched in the US in 2002 by the Cornell Laboratory of Ornithology and the National Audubon Society. It has since spread to many other countries, and has been used extensively to study wildlife bird populations. Citizen scientists submit birding logs without a strict sampling protocol to guide their observation efforts. As a result, effort in observation and sampling varies across users, location, and seasons. This potentially introduces non-classical measurement error as effort is likely to be higher where there are more people, more natural parks, when weather conditions are favorable for bird watching, or during bird migration season.

In an attempt to overcome the lack of one strict sampling protocol, the eBird platform provides users three effort-based recommended sampling protocols (Sullivan et al. 2009). We use data recorded using one of the three suggested protocols and discard of data obtained using the "casual observation" option. In doing so, we use 28 million records out of the 35 million logs that have been submitted between 2003 and 2023, which have documented 1,406 unique bird species.

Even though the lack of one strict sampling protocol over time presents measurement quality issues, data from eBird has proven instrumental in studying conservation as well as the presence and abundance of wild bird populations (Hurlbert and Liang 2012; Mayor et al. 2017). Economists have used eBird data to estimate how reductions in air pollution also benefited bird species (Liang et al. 2020), how the growing use of neonicotinoid insecticides has led

to declines in bird populations (Li et al. 2020), and how economic activity reduces biodiversity (Liang et al. 2021; Madhok 2025). Overall, eBird data is considered a valuable and informative source that adequately complements avian diversity data collected using systematic and randomized sampling protocols, with some caveats (Horns et al. 2018; Munson et al. 2010; Callaghan et al. 2018).

To overcome the inherent challenge of non-uniform observation effort, we follow the approach used in Liang et al. (2020) to absorb location and time factors that could systematically be correlated with effort and detectability.[4] Explicitly, we estimate the following regression specification at the birding trip level:

$$\begin{aligned} \log(\#\text{birds}_{iohdmt}) = & \beta_0 \text{hours}_{iohdmt} + \\ & \beta_1 \#\text{observers}_{iohdmt} + \\ & \theta_h + \alpha_{sm} + \Gamma_{it} + \varepsilon_{iohdmt} \end{aligned} \tag{1}$$

Where the outcome is the log of the total count of birds observed in county i during trip o and in year t, month m, day d, and hour h on the number of hours spent observing birds during that trip and the number of observers in the group. Both the number of hours and the number of observers in each group should predict a higher number of birds observed. In other words, they act as proxies for the birding effort that might change between groups of eBird users.

In order to further net out the signal that is solely due to true differences in bird population levels, net of birding effort, this approach relies on several fixed effects. These fixed effects include hour-of-day fixed effects θ_h, which capture that bird activity and the ability to detect birds changes at throughout the day. We include state-by-month fixed effects α_{sm}, which adjust for seasonality that

[4] Using the eBird data "as is" without first adjusting for the issue of non-standardized effort could invalidate any attempt to separately estimate what change in bird population levels is due to higher levels of conservation expenditures versus other predictors of bird observation effort.

could affect both the presence, abundance and birding preferences of eBird users, which we allow to vary by state.

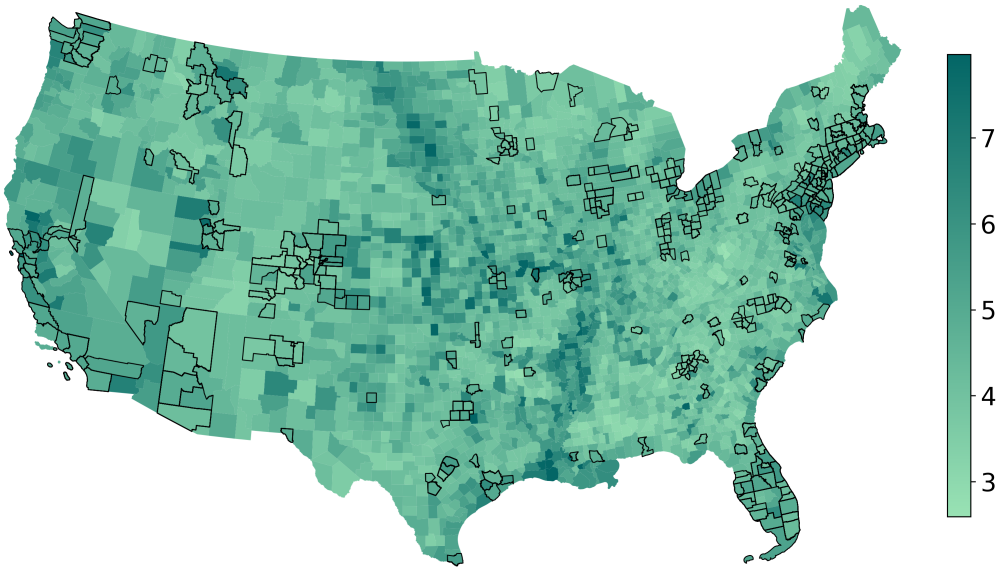
The key object of interest from this regression is Γ_{it}: the county-by-year fixed effect. This county-specific mean reflects the relative abundance of birds conditional on the proxies for preferences and detectability. We convert the estimate we obtain for Γ_{it} from Equation 1 to z-scores, which we use as our main conservation outcome of interest. In the Online Appendix, we also consider an alternative approach to adjusting eBird data for both time and location varying effort and changing ability of birders to detect and classify birds, developed in Madhok (2025).

The main benefit that eBird data provide us with is density of observations in the areas that are affected by the conservation ballots. This is a distinct advantage over the North American Breeding Bird Survey (NABBS), which has a repeating scientific protocol—negating the need to perform the adjustment discussed above. In Figure 2, we plot the overlap between counties for which we observe conservation ballots and the mean abundance of birds, as recorded in the eBird data, from 2003 to 2023. All counties have some density of eBird measurement. In the Online Appendix, Figure C6, we repeat this plot but use the NABBS instead. We observe many counties without NABSS data, and several of those counties also have conservation ballots.

3.3 Land Use Data

To evaluate mechanisms driving impacts on bird abundance, we collect data on the quantity and quality of vegetation in each jurisdiction. We measure vegetation quantity using the National Land Cover Database, which is an annual raster that allocates 30 meter pixels in the US to one of 16 land use categories. We aggregate the data from its native resolution to the county level by averaging pixels in the most relevant categories, i.e., forests, shrubs, grasslands, and wetlands. Our outcome of interest for land quantity is the share of the county covered by these land use types. For land quality, we obtain Enhanced Vegetation Index (EVI) data from the MODIS satellites.

Figure 2: Overlap of Counties With Conservation Ballots & eBird Data



Notes: Black borders denote counties where we observe conservation ballots between 2003 and 2023. County polygons are shaded according to the mean bird count in the county (in log points).

We average EVI data over the relevant land use pixels to the county level. Our outcome of interest for land quality is the log of annual average EVI.

3.4 Local Characteristics

If jurisdiction characteristics other than funds vary discontinuously across the vote threshold, this will threaten our causal identification assumption, as discontinuity in bird outcomes could be due to these discontinuities and not to the funding "treatment." We use data on county characteristics to test for discontinuity across relevant covariates, and match each vote to its county identifier.[5] We obtain annual county-level income and population data for 1988-2020 from the US Bureau of Economic Analysis; county-level local elec-

[5] If the vote happens at a level below the county, we match it to the county it resides in, and if the vote happens at a level above the county, we take a population-weighted mean of the county-level data that matches that aggregated level.

tion outcomes 1989-2021 from Benedictis-Kessner et al. (2023); county-level fair market rates 1983-2024 from the US Department of Housing; and weather data (annual temperature and precipitation averages) from the National Centers for Environmental Information.

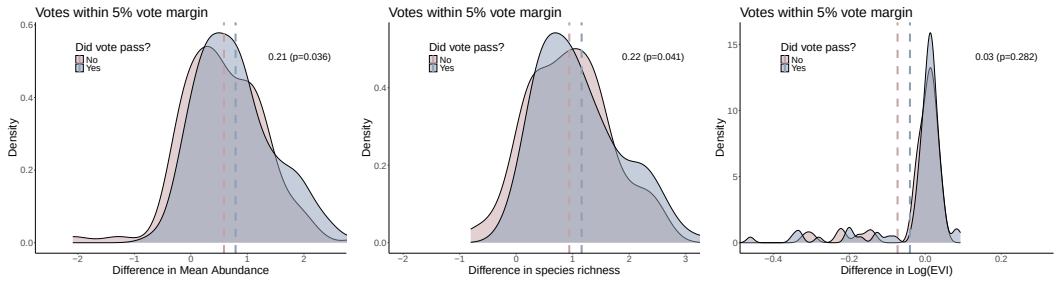
3.5 Descriptive Statistics

We summarize how bird abundance, the number of species, and green vegetation change in the years after a vote on a ballot, compared to the year prior to the vote. Explicitly, for each ballot that falls within five percentage points of the vote margin we calculate two means: (i) the mean outcome five to one years before the vote, and (ii) the mean outcome seven to 10 years after the vote. At the ballot level, we take the difference between those two means to arrive at a long difference in the outcome. Finally, in Figure 3, we plot kernel densities, separately for ballots that passed or failed to pass, and report the difference in means, as well as the p-value from a simple t-test with a null hypothesis that the two population means are equal.

There is considerable overlap between the kernel densities; however, we calculate that the means for bird abundance, species richness, and green vegetation index are higher for counties that passed a ballot, relative to those that did not, within a five percent vote margin. Mean bird abundance and species richness are higher by 0.21 and 0.22 standard deviations, respectively. For those two outcomes, we can reject the null hypothesis of no difference at the five percent significance level. For logged EVI values, the distributions are noisier, especially in their left tails. As a result, while the mean difference is 0.03, we cannot reject the null hypothesis of no difference at any conventional level of statistical significance. In the Online Appendix, we plot in Figure A1, similar distributions for ballots that are 10, 20, and 50 percentage points around the vote margin. Overall, expanding the bandwidth to 10 percentage points or above attenuates the differences between the means, such that we can no longer reject the null hypothesis of no difference at any conventional level of statistical significance.

Figure 3: Distributions of Bird Outcomes & Green Vegetation

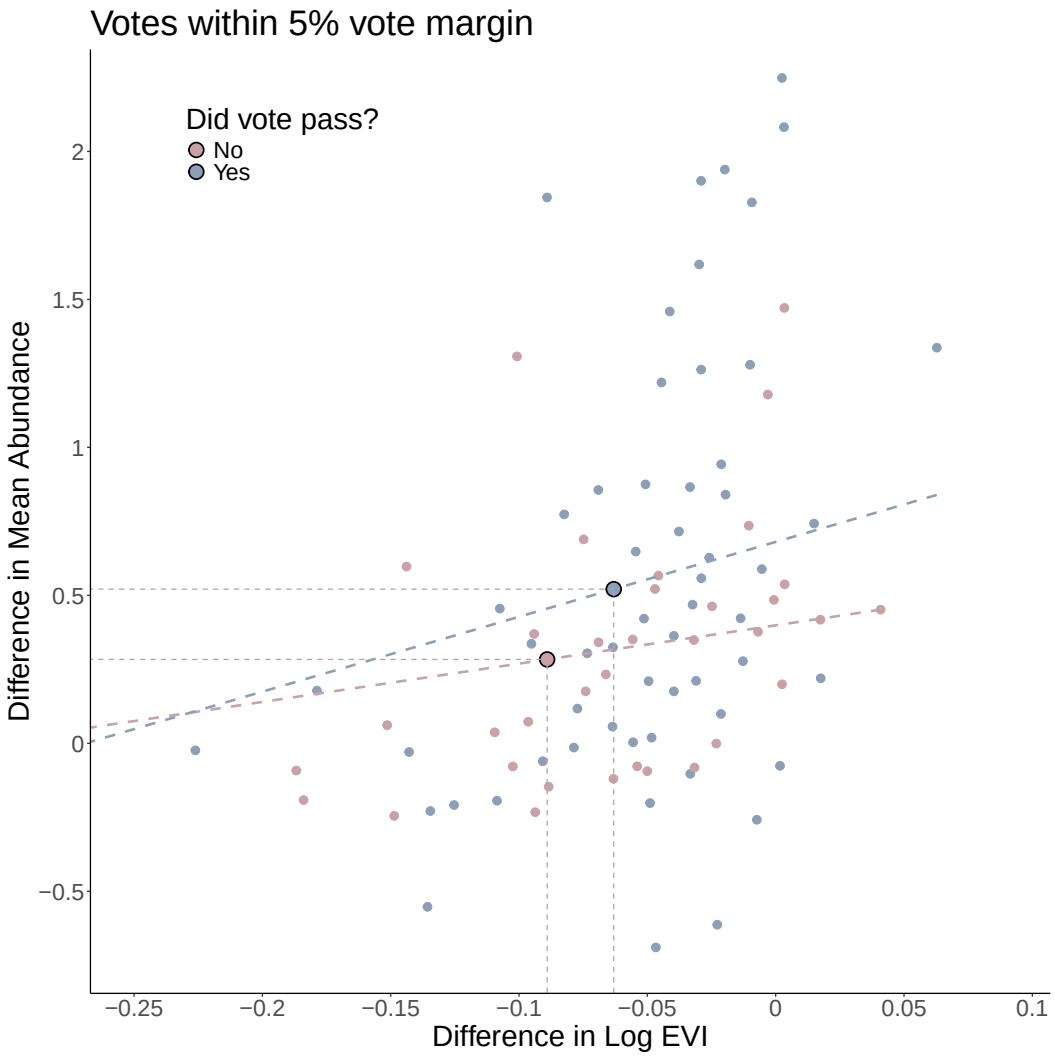
(a) Bird Abundance (b) Species Richness (c) Green Vegetation



Notes: We plot kernel densities for the long differences in each outcome (seven to 10 years after the vote, compared to five to one year before the vote). In the top right corner of each plot, we report the difference in means between ballots that passed relative to those that did not pass, within five percentage points of the vote margin, and the p-value from a t-test for mean equality.

We further use the long differences we constructed by plotting a scatterplot that correlates changes in bird abundance and green vegetation. In Figure 4, we focus on the ballots that are withing five percentage points of the vote margin. Similar to the mean differences in Figure 3, we observe that the mean changes in the outcomes are larger in the case of successful ballots relative to unsuccessful ones. Both fitted lines have a positive slope, indicating that increases in green vegetation (positive values on the x-axis), or smaller declines in green vegetation (negative values on the x-axis), are associated with larger increases in bird abundance. The scatterplot highlights three stylized facts: (i) most counties are experiencing declines in their green vegetation, (ii) the spread in bird abundance changes is larger for successful than unsuccessful ballots, and (iii) even counties that failed to pass a ballot can experience a meaningful increase in bird abundance.

Figure 4: Correlating Changes in Bird Abundance & Green Vegetation



Notes: For ballots within the five percentage point vote margin, we plot the long differences (seven to 10 years after the vote, compared to five to one year before the vote) in bird abundance relative to the long differences in the logged EVI values (capturing green vegetation). The large dots report the means for successful and unsuccessful ballots. Dashed lines are the linear fits, estimated separately for successful and unsuccessful ballots.

4 Comparing Conservation Votes Around the Vote Margin

Since the allocation of conservation funding through ballot measures is not randomized across jurisdictions, a straightforward comparison of bird abundance between counties that pass and those that reject a measure would be biased by other factors that influence both bird populations and the likelihood of measure approval. To avoid these sources of bias, we employ a regression discontinuity design (RDD) based on the vote share of the ballot measures, focusing on cases where proposals either narrowly passed or narrowly failed. This design exploits the quasi-random nature of close elections, under the assumption that jurisdictions on either side of a tight electoral margin are comparable in all respects except for the treatment itself. The validity of this identification strategy depends on the assumption that unobserved determinants of bird populations do not change discontinuously at the vote share cutoff. For our panel dataset on ballot measures and bird outcomes, a natural implementation of this design is to estimate the following RDD model:

$$y_{i,t+\tau} = b_{it}\theta_\tau + f(v_{it}) + u_{i,t+\tau} \tag{2}$$

where the bird abundance score in jurisdiction i observed τ years after the ballot vote in year t is regressed on a binary variable b_{it} that indicates whether the vote share v_{it} exceeds the vote threshold v^* and a flexible function f of the vote share.[6] Any unobserved factors are captured by the error term, u_{it}. The parameter of interest in Equation 2 is θ_τ, which represents the causal effect of conservation ballot approval on the relative abundance of birds τ years after the vote.

In the context of local ballot measures and school facility investments, Cellini et al. (2010) show that Equation 2 is inefficient. In particular, the error term $u_{i,t+\tau}$ includes a component that varies across jurisdictions and is fixed

[6] In most cases the vote threshold is 50 percent, but it can be 60 or 66 percent in some jurisdictions.

within a jurisdiction over time. Under the RDD identifying assumption, this fixed effect is uncorrelated with b_{it} conditional on sufficiently flexible controls for the vote share, but reduces precision. They show that pooling data from multiple τ and controlling for jurisdiction-level heterogeneity produces more precise estimates of θ_τ.

To this end, we implement the dynamic RDD estimation procedure introduced by Cellini et al. (2010). For each (i,t) combination with an election, we select bird abundance observations for jurisdiction i within a window between five years prior to the vote and ten years after the vote, i.e., $[t-5, t+10]$. The windows constructed from each vote (i,t) are combined into a dataset in which observations are uniquely identified by the jurisdiction i, the date of the focal election t, and the number of years between the focal election and the year the outcome is measured τ.[7] We then estimate

$$y_{it\tau} = b_{it}\theta_\tau + f(v_{it}, \gamma_\tau) + \alpha_\tau + \kappa_t + \lambda_{it} + e_{it\tau} \tag{3}$$

which includes fixed effects for the focal election λ_{it}, the calendar year κ_t, and the number of years since the focal election α_τ. $f(v_{it}, \gamma_\tau)$ is a focal election-specific third-order polynomial in the vote share, which varies with τ. The objects of interest are the θ_τ coefficients, which capture the dynamics of the causal effect of a conservation ballot τ years after it is approved. Any unobserved heterogeneity is captured by the error term, $e_{it\tau}$, which we cluster at the ballot level.

4.1 Examining Local Characteristics Around the Vote Margin

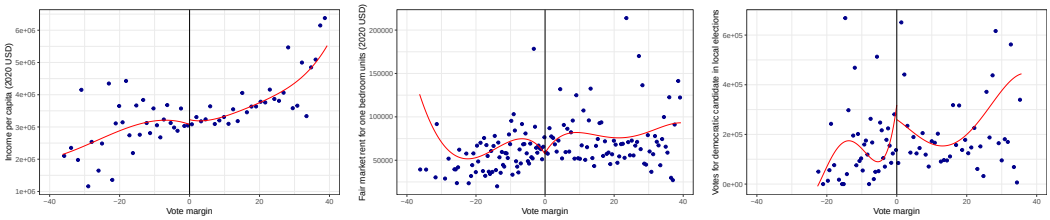
The key assumption in our dynamic RDD research design is that other covariates that predict local bird abundance do not change discontinuously around the vote margin. To support the validity of the continuity assumption, we

[7] Note that this construction is similar in nature to the stacked difference in differences design. However, importantly, our identification relies primarily on votes close to the vote threshold, rather than a parallel trends assumption.

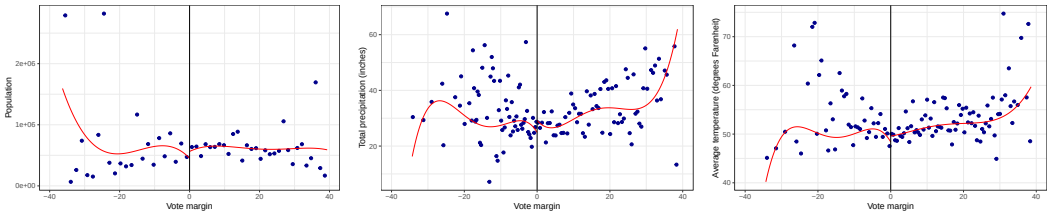
estimate Equation (2) for a variety of covariates at the county level. In Figure 5, we report static regression discontinuity plots for income levels, fair market rents for one-bedroom apartments, the vote share for democratic candidates in local elections, population levels, total precipitation, and mean temperatures. None of these local characteristics exhibits a sharp change at the vote margin, which we interpret as supporting the key assumption underlying the research design.

Figure 5: Static RD Results for Local Characteristics

(a) Income per Capita (b) Fair Market Rent (c) Democratic Vote Share



(d) Population (e) Total Precipitation (f) Mean Temperature



Notes: We plot different characteristics of the jurisdictions that propose conservation ballots. In addition, we also plot a fourth-degree polynomial, allowing it to change on either side of the vote margin.

5 The Effects of Conservation Funding on Bird Abundance & Land Use

We present the main results that in the years that follow a successful ballot vote, bird abundance increases by 0.25 standard deviations, and green vegetation increases by three percent. These effects increase to 0.3 standard deviations and five percent in the subsample of ballots that use taxes as the

financing mechanism. Subsequent heterogeneity analysis reveals that the results are driven entirely by the state of New Jersey, which accounts for roughly 20 percent of all votes within five percent of the vote margin.

5.1 Evidence for Higher Bird Abundance Following Successful Ballots

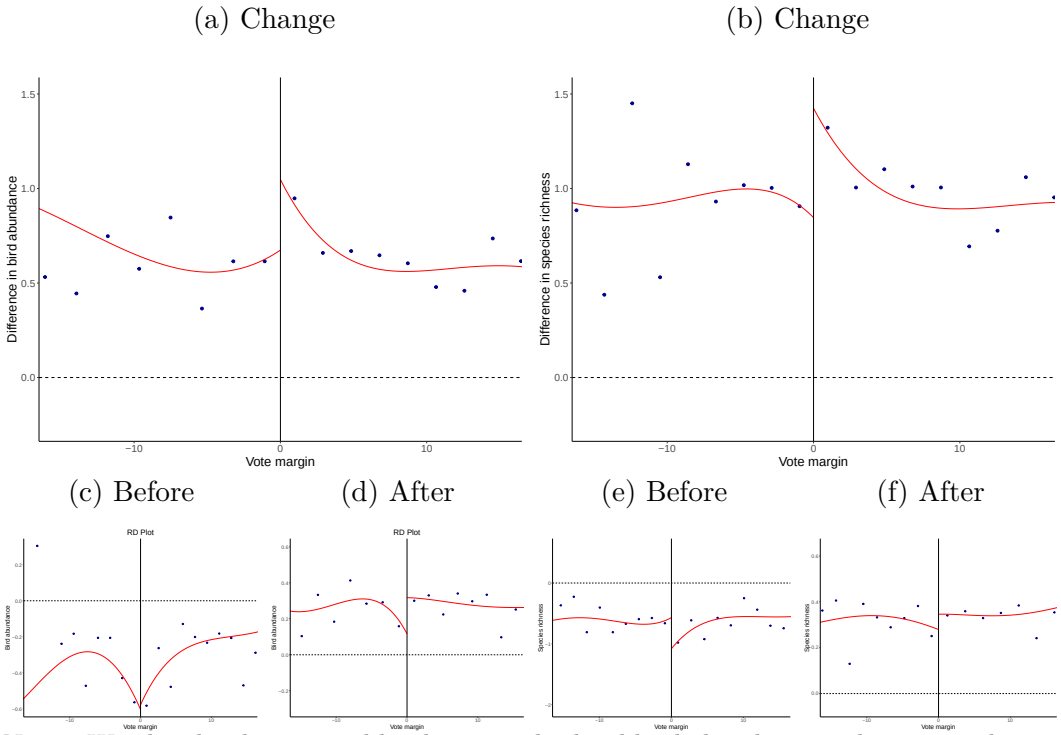
We estimate a sharp discontinuity at the vote margin cutoff for the long differences in bird abundance and species richness. In Figure 6, we plot the static RD comparisons, using Equation (2), for the long differences, as well as the means in the years before and after the vote. Around the vote margin, bird outcomes are fairly similar—consistent with counties that pass a conservation ballot with a large majority being in a high conservation equilibrium, and vice-versa. In other words, counties right above the vote margin receive a positive shock to their conservation funding, while counties on either end away from the vote margin are less likely to exhibit *changes* to their bird outcomes if baseline funding allocations persist.

We examine the evolution of these long-run differences using the dynamic RD estimation. We plot the estimation results of Equation (3) in Figure 7 for the full sample. We do not observe a pre-trend in the four leads that precede the ballot passing. In other words, there do not appear to be systematic differences in how bird abundance or species richness are evolving over time between successful and unsuccessful ballots. We interpret this as evidence in favor of the notion that conservation funding increases after a ballot passes is the key feature that leads to changes in bird outcomes. The staggered manner in which these ballots are voted on, and the lack of bunching around the vote margin—which reduces concern about manipulation around the cutoff—further support a causal interpretation of this finding. On average, bird abundance and species richness increase by about 0.3 standard deviation in the years after ballot approval (Table A1).

Relative improvement in the abundance of birds occurs in the first few years after the vote, and stabilizes at the new level about five years after the ballot

Figure 6: Static RD Estimation Results for Bird Outcomes

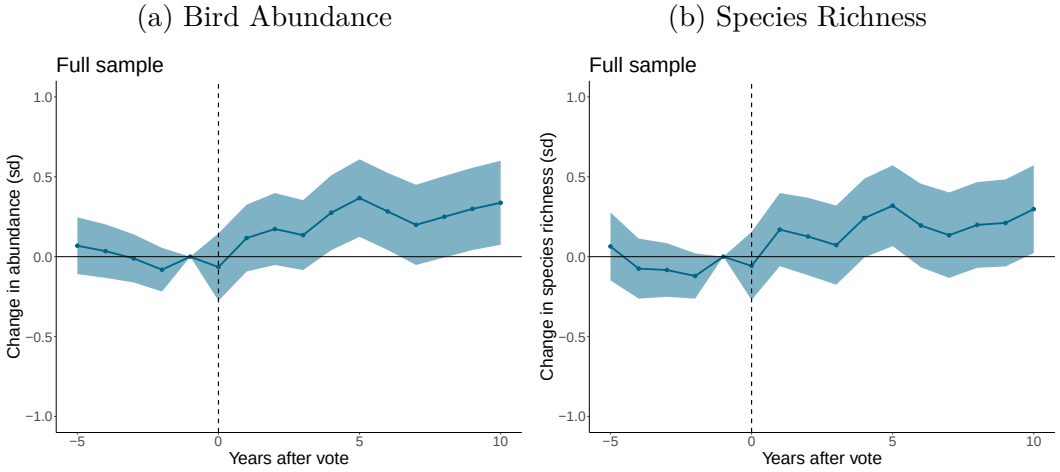
Bird Abundance | **Species Richness**



Notes: We plot the changes and levels in standardized bird abundance and species richness. Red lines are fourth-degree polynomial fits that are allowed to be different on either side of the vote margin.

passes. There are two main explanations as to why we should not expect the effect to be instantaneous. First, even after the ballot passes, it could take time until the approved conservation funds are used and environmental conditions change. Second, recovery of bird populations will depend on their fecundity, which will determine the pace at which they are able to fill the larger niche. Alternatively, instead of interpreting the increase in bird outcomes to be a result of improvements in environmental conditions, it is also possible that places that pass the ballot also manage to sustain environmental conditions relatively the same, while those that have failed to pass the ballot experience continued environmental degradation.

Figure 7: Dynamic RDD Estimation Results for Bird Abundance



Notes: Estimation results for the specification in Equation (3), plotting the coefficients and 95% confidence intervals. The outcome is the standardized bird abundance score. The sample spans 2003 to 2023. Standard errors are clustered at the vote level.

To link the increase in bird abundance to the amount of conservation funding, we divide the 0.3 standard deviation increase by the mean conservation expenditure in our sample for a successful ballot within five percentage points of the vote margin, of $39.8 million (2020 USD). We express this result as an increase of $25 million in conservation expenditures leads to approximately 0.2 standard deviation increase in bird abundance.

5.2 Evidence for Higher Green Vegetation Following Successful Ballots

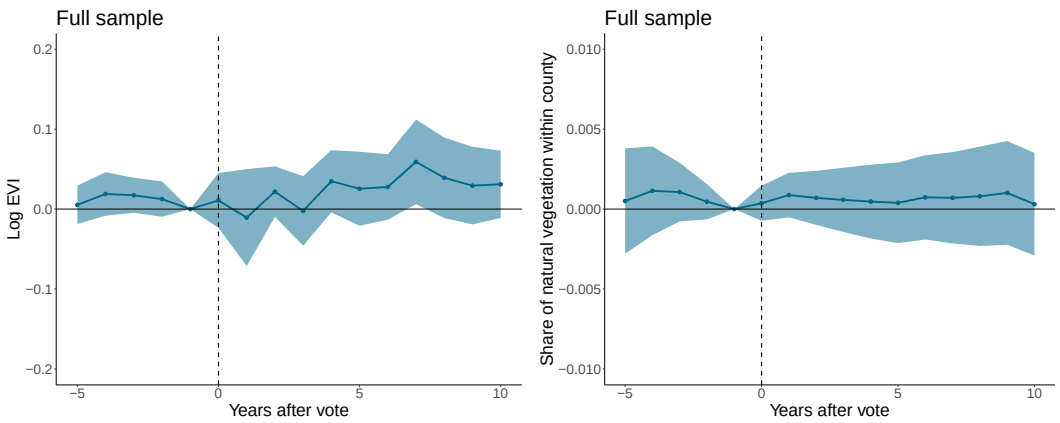
Higher conservation expenditures, enabled by successful ballots, could potentially lead to ecosystem restoration. We use the same research design to study whether land use outcomes respond to successful ballots. First, we test whether green vegetation increases using the Enhanced Vegetation Index (EVI). Second, we test for changes in the share of land that is classified as having natural vegetation. The natural land share speaks directly to extensive margin changes—as it will increase when degraded lands are restored back to natural landscapes—while the EVI captures extensive as well as intensive margins—as

it will increase as both existing natural landscapes and newly converted ones contribute to more green vegetation.

Following successful ballots that use tax measures as their financing mechanism, where bird abundance is higher relative to unsuccessful ballots, we observe similarly higher green vegetation cover, on average, by five percent. However, there does not appear to be any change in the share of natural vegetation land. We interpret this as evidence that it is the existing natural landscapes that are improving and contributing to the conditions that lead to the higher bird abundance. In the case of ballots that use bonds as their financing mechanism, we observe no increase in vegetation cover, and a drop in the share of natural vegetation land after the vote, which is preceded by a declining trend.

Figure 8: Dynamic RDD Estimation Results for Land Cover

(a) Green Vegetation Cover (b) Share of Natural Vegetation Land



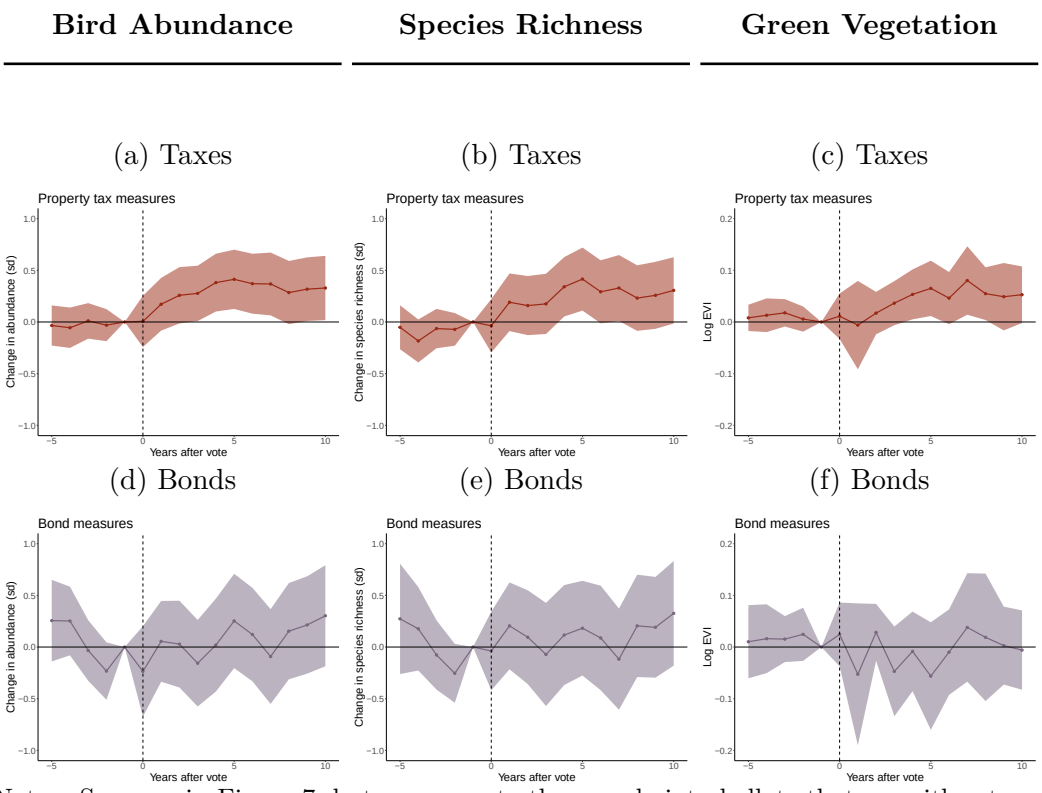
Notes: Same as in Figure 7, only the outcome is either the logged Enhanced Vegetation Index (EVI) or the share of land that is covered by natural vegetation.

5.3 Heterogeneity Analysis

Throughout the analysis thus far, we have only examined how outcomes vary by the financing mechanism. Here we explore several other dimensions of heterogeneity such as: the share of funds at stake that are earmarked for conservation, conservation purpose, and differences across states.

Financing Mechanism.— Ballots that rely on tax measures appear to drive the effect we recover in the full sample. Roughly 60 percent of the ballots are funded by imposing new property or sales taxes (hereafter, taxes), while the remaining ballots rely on the county or municipality issuing bonds. We separate our sample by the financing mechanism and report the dynamic RD estimation results in Figure 9. Increases in bird abundance, species richness, and green vegetation are concentrated in the ballots that use taxes. For bonds, we report noisily estimated zero change in all three outcomes.

Figure 9: Dynamic RDD Estimation Results by Financing Mechanism



Notes: Same as in Figure 7, but we separate the sample into ballots that use either taxes or bonds as their financing mechanism.

High Amounts & Share of Conservation Funds.— A ballot can propose funding for conservation and non-conservation projects. Some ballots allocate 100 percent of their funds at stake for conservation purposes, but that

can drop as close to one percent (see Online Appendix Figure 1a). At the same time, there is considerable variation in the total amount allocated for conservation purposes across ballots, irrespective of the share they reflect of the total amount on the ballot. Either a higher share or a high amount of conservation funds might be indicative of more ambitious conservation goals and projects. We test whether ballots with higher shares of their funds earmarked for conservation, or ballots with larger conservation funding amounts, result in larger bird abundance gains. We repeat our baseline estimation for ballots that use taxes as their funding mechanism, separately for ballots with more than half, or less than half, of their total funds earmarked for conservation. We then repeat this exercise, but separate the ballots by those with amounts above or below the median amount of conservation funds.

Bird abundance increases more after a successful ballot where half or more of the funds are for conservation purposes, or the funding amount is above the median. In Figure 10, we plot the estimation results when using the tax-financed ballots, separated by above or below 50 percent of the share of conservation funds at stake, or above and below the median amount of conservation funds. In all cases, we do not see evidence for a pre-trend in the evolution of bird abundance in the years before the vote. For the high share of conservation funds at stake ballots (Figure 10a), we estimate an increase of about 0.5 standard deviations, higher than 0.3 in the full sample; however, we cannot reject that the two effects are equal. For the low share of conservation funds at stake ballots, we estimate an increase closer to 0.25 standard deviations. In addition, the change in bird abundance happens more rapidly in the high than in the low share of conservation funds at stake. For the high-share ballots, bird abundance increases as early as one year after the vote, and stabilizes about three years after the vote. In the low-share ballots, bird abundance meaningfully increases five years after the vote, and tends to stay at that level onward. Results for the above-median conservation amount are only slightly larger than the below-median amounts, yet the confidence intervals in both cases are wide, often including zero, such that we cannot reject that the coefficients are equal.

Conservation Purpose.— Each ballot can include several purposes (see Section 2 for more details). We cannot easily disentangle one purpose at a time, because each ballot mentions several; however, we can exclude ballots that mention specific purposes. Excluding the frequently mentioned categories of farmland and recreation, we discover that excluding ballots that mention farmland as a conservation purpose barely changes the results, while omitting ballots that specifically mention recreation effectively nullifies the effect. In Figure 11, we plot the estimation results from the full sample (all financing mechanisms) when excluding either farmland or recreation. Farmland purposes are mentioned in 22 percent of the ballots, whereas recreation purposes are mentioned in 41 percent of the ballots. We recover a similar magnitude of the effect when excluding farmland purposes, however, the estimation results lose some precision. If we omit recreation purposes, we recover coefficients that are close to zero, yet we cannot interpret them as precisely estimated zeroes.

Bird Characteristics.— Our analysis has pooled all bird species together, ignoring potential differences between migratory and non-migratory birds, differences in population trends, differences in diets, differences in protection status, and differences in preferred habitats. We decompose some of these heterogeneity dimensions in Figures 12 and 13, for migratory status and population trends, respectively.

Separating by migration status is important for several reasons. While some migratory birds are known for their high fidelity to a very specific breeding location, those species can be expected to disperse, on the whole, very well, and be expected to respond faster to improvements in habitat. On the other hand, those same species face environmental pressures on their wintering grounds and could be expected to benefit less from improvements from locations that they inhabit only part-time. Finally, the physiological adaptations necessary for migration could make those species otherwise distinct in the way they respond to environmental change. Migratory and non-migratory (resident) species indeed differ in their response to conservation funding: Fig-

ure 12 shows no effect on resident birds (b), whereas abundance increases and remains high after the approval of a ballot for migratory species (a).

Figure 13 presents the results by species population trend, i.e., whether the species abundance is overall declining (a), stable (b), or increasing (c), according to the IUCN (International Union for Conservation of Nature). The species with either a decreasing or increasing population trend see a marked abundance increase (and stabilization at the higher value 4-5 years out) after a ballot passes. The measures enacted seem then to not only benefit the species that are already doing well (c), but also those of probable conservation interest (a).

Differences Across State Groups.— The number of conservation ballots is not uniformly distributed across states. From 2003 to 2023, out of 1,612 ballots, New Jersey, Massachusetts, and Pennsylvania each had 314, 233, and 114 ballots, respectively (see Figure C5 for the full distribution by state). New Jersey alone reflects 19.5 percent of all the ballots in our main sample. Both New Jersey and Massachusetts have formal programs (the Green Acres program and the Community Preservation program, respectively) that provide assistance to municipalities for submitting local ballots for conservation funding, which likely underlies this pattern. Assistance includes matching state funds for some conservation projects. In Figure 14, we report evidence that the observed increase in bird abundance is strictly driven by one state: New Jersey. When we exclude New Jersey and Massachusetts (33.9 percent of the sample), we do not detect any change in bird abundance.

The fact that the increase in bird abundance is solely concentrated in New Jersey also helps us explain why we find an effect for tax measures but not for bonds. Out of the total number of ballots put up for a vote by New Jersey (n=314), 97.8 percent used tax measures. If we narrow the ballots down to the five percent around the vote margin, out of the 97 ballots, 96.9 percent used tax measures.[8] In other words, only conservation ballots in New Jersey

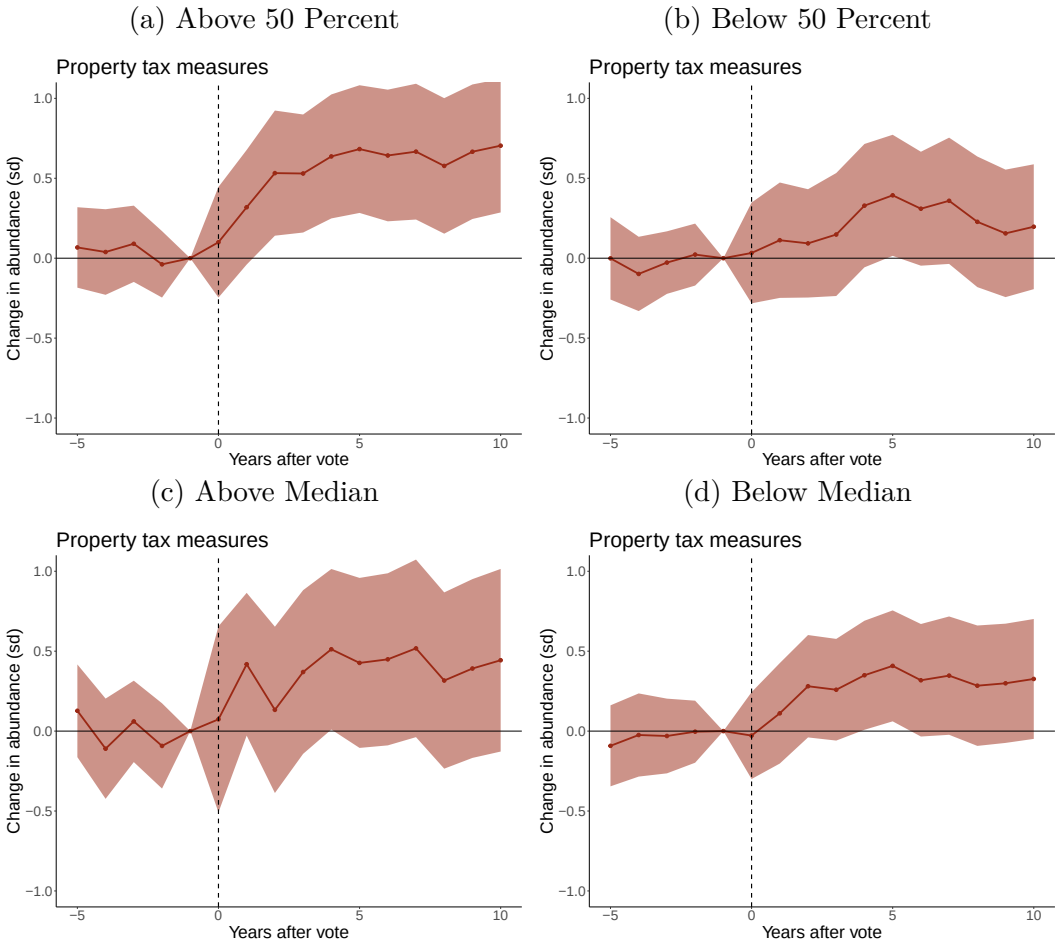
[8] For the 314 ballots, 218 passed while 96 failed, reflecting 69.4 and 30.6 percent. Around the five percent vote margin, out of the 97 ballots, 53 passed while 44 failed, reflecting

appear successful in increasing bird abundance, and nearly all of those ballots use tax measures—which echoes back to the results in Figure 7 where only tax measures have a positive effect on bird abundance.

Surprisingly, it is not that ballots in New Jersey allocate much larger funding for conservation. If anything, quite the opposite. On average, ballots that narrowly passed (below five percent of the vote margin) allocate $19 million for conservation, ranging from as low as $0.14 to as high as $476 million (2020 USD). For similar ballots not placed in New Jersey, the mean amount is $47, ranging as low as $0.18 million to as high as $2.8 billion (2020 USD). A caveat to this analysis of funding amounts is that we do not know the extent of matching state funds, if any, for New Jersey and Massachusetts ballots. In addition, the stated purposes of the ballots appear to be somewhat different, but not vastly so, in New Jersey relative to other states. Within five percent of the vote margin, 61 percent of ballots include recreation purposes, relative to 49 percent in other states.

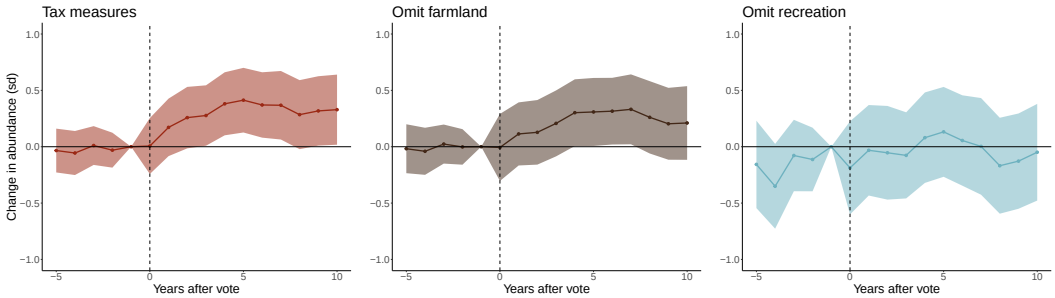
54.6 and 45.4 percent—a more even distribution, similar to that in the full sample of ballots around the vote margin.

Figure 10: Dynamic RDD Estimation Results by Share & Amount of Conservation Funds



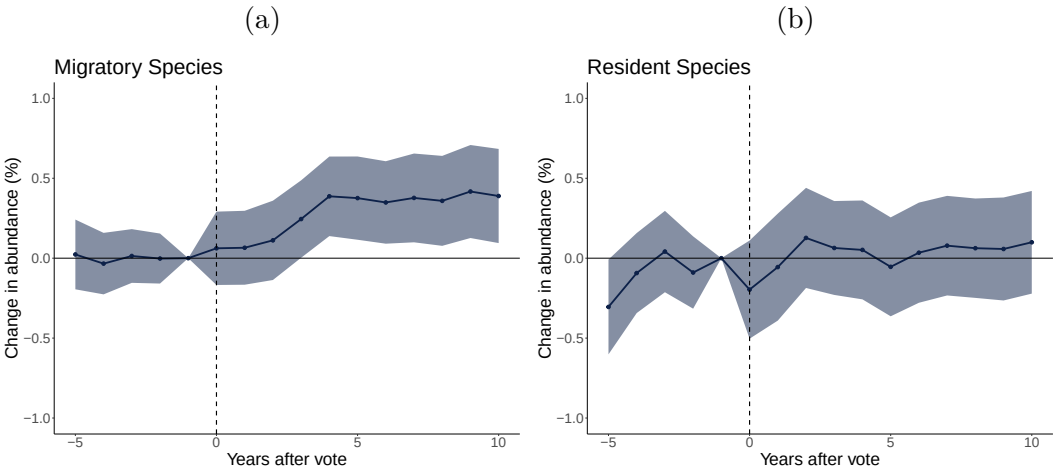
Notes: Same as in Figure 7, but we focus on the ballots that uses taxes as their funding mechanism, and report results separately for ballots with more than half or less than half of the total funds as conservation funds (panels a and b), or ballots with above or below the median amount of conservation funding (panel c and d).

Figure 11: Excluding Specific Conservation Purposes from the Sample



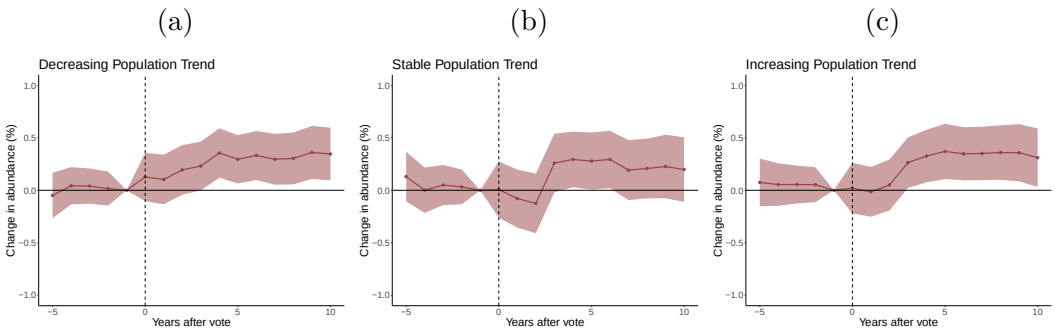
Notes: Same as in Figure 7, but we focus on all financing mechanisms while excluding specific conservation purposes as mentioned the in the TPL data.

Figure 12: Dynamic RDD Estimation Results for Migratory and Resident Species



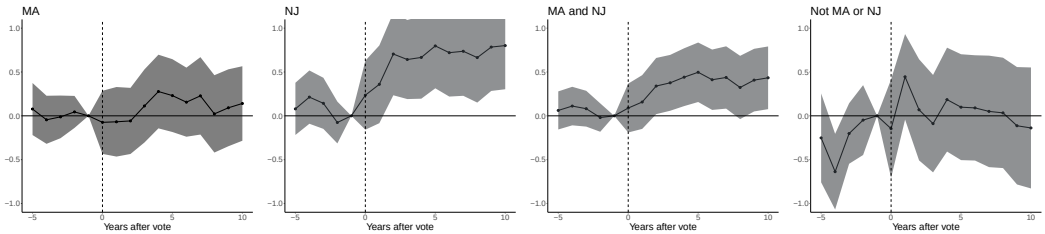
Notes: Same as in Figure 7, but we focus on species designated as migratory and resident. We assign bird species to categories based on the Global Register of Migratory Species (Riede 2001) and estimate abundance conditional on birding effort separately for each group.

Figure 13: Dynamic RDD Estimation Results by Population Trend



Notes: Same as in Figure 7, but we categorize species based on overall population trends. We assign bird species to decreasing, stable, and increasing population trend categories based on the International Union for Conservation of Nature Red List. We estimate abundance conditional on birding effort separately for each group.

Figure 14: Differences Across States in Bird Abundance Changes



Notes: Same as in Figure 7, for all financing mechanisms, but separating out the sample into different state groups.

6 Conclusions

We study how local increases in conservation funding, approved through local ballots, affect bird abundance—proxying for biodiversity and ecosystem functioning. Our analysis compares the ballots the narrowly passed to those that narrowly failed, and finds that five years after the approval of the ballot, we see, on average, meaningful improvements in bird abundance. The results are geographically concentrated in New Jersey, even though ballots passed by that state do not appear to be different in magnitude of conservation scope relative to other states.

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Online Appendix

A Additional Results

A.1 Descriptive Statistics for Wider Bandwidths Around the Vote Marging

A.2 Dynamic RDD Estimation Results for Bird Abundance

A.3 Examining Bird-Watching Effort Around the Vote Margin

There are two main channels that can lead to higher bird abundance in the eBird data. One is a true increase in the suitability of the local environment to support a higher population level of different bird species. Another explanation is that the environment is more appealing, and as a result, the number of eBird observers that visit the site, and the number of visits made by observers increase. Our adjustment to the eBird data already residualizes the bird abundance data on the number of observers; however, there might be a non-linear effect that our specification does not capture (see Section 3 and Equation (1) for more details). Instead of estimating variations of the specification in Equation (1), we test directly for whether the number of observers, or the number of hours spent observing birds, respond to the conservation ballot passing in an abnormal way that would raise concern about the ability of the residualization step to net out birder effort.

Analysis of the effort variables in the eBird data does not reveal persistent increases in the number of observers or observation hours that offers a compelling alternative explanation to the pattern in bird abundance. In fact, we interpret these results as allowing us to reject large increases in observation effort as the magnitude of the coefficients in Figure A2 is small relative to mean levels of 2 and 1.32, for observers and hours. In addition, we do not

Table A1—Effect of Conservation Ballot Measures on Relative Bird Abundance

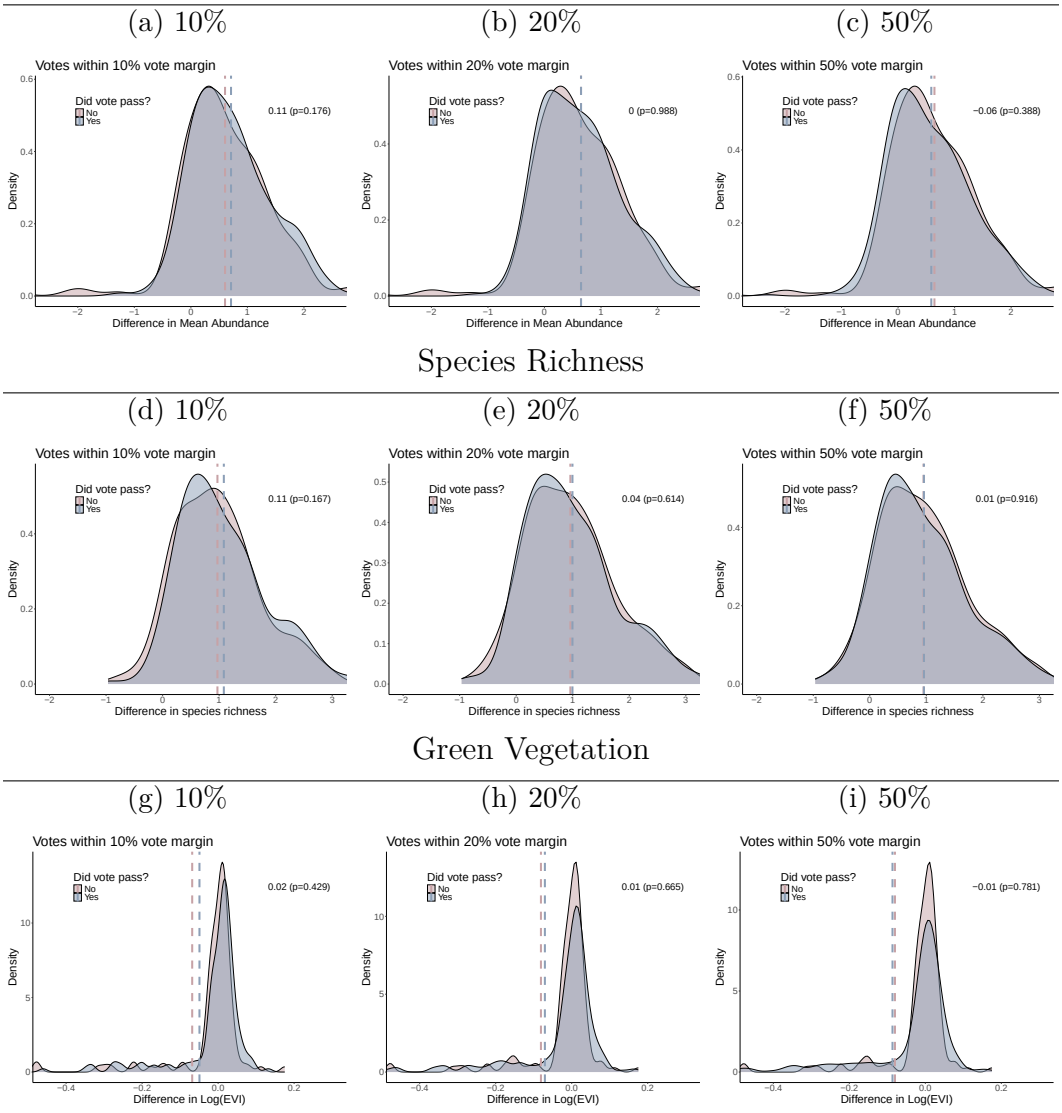
	Full sample	Property tax	Bond
$\tau = -5$	0.0683	-0.0338	0.2556
	(0.0905)	(0.0992)	(0.2014)
$\tau = -4$	0.0348	-0.0558	0.2519
	(0.0854)	(0.0997)	(0.1696)
$\tau = -3$	-0.0111	0.0107	-0.0332
	(0.0768)	(0.0878)	(0.1494)
$\tau = -2$	-0.0815	-0.0306	-0.2325
	(0.0697)	(0.0791)	(0.1417)
$\tau = 0$	-0.0650	0.0061	-0.2357
	(0.1075)	(0.1266)	(0.2233)
$\tau = 1$	0.1166	0.1717	0.0550
	(0.1067)	(0.1302)	(0.1995)
$\tau = 2$	0.1730	0.2581*	0.0286
	(0.1147)	(0.1392)	(0.2141)
$\tau = 3$	0.1348	0.2769**	-0.1567
	(0.1116)	(0.1367)	(0.2136)
$\tau = 4$	0.2752**	0.3808***	0.0193
	(0.1195)	(0.1426)	(0.2295)
$\tau = 5$	0.3666***	0.4130***	0.2524
	(0.1237)	(0.1463)	(0.2329)
$\tau = 6$	0.2828**	0.3705**	0.1214
	(0.1230)	(0.1480)	(0.2308)
$\tau = 7$	0.1990	0.3679**	-0.0918
	(0.1280)	(0.1551)	(0.2340)
$\tau = 8$	0.2495*	0.2845*	0.1537
	(0.1299)	(0.1562)	(0.2377)
$\tau = 9$	0.2990**	0.3177**	0.2135
	(0.1314)	(0.1570)	(0.2403)
$\tau = 10$	0.3371**	0.3289**	0.3027
	(0.1341)	(0.1587)	(0.2495)
Observations	13,177	6,769	6,408
R^2	0.55262	0.54927	0.55572
Within R^2	0.01288	0.01484	0.02253

Notes: Table provides coefficient estimates and standard errors from equation 3 for each τ relative to the year before the ballot measure was passed ($\tau = -1$). Standard errors are clustered at the vote level. Note that these estimates reflect those shown in Figure 7.

observe changes in bird-watching effort that raise concerns about the ability of the abundance model in Equation (1) to capture and adjust for effort.

We report that in the full sample, on average, there is no long-term change in the number of observers or in the amount of observation hours after a conservation ballot passes. In the case of ballots that use tax measures, we see a more pronounced increase in the number of observers in the three and four years after the ballot passes, but the effect dissipates quickly, and the number of observers returns to its pre-vote level. Importantly, the periods in which the number of observers is somewhat higher does not align with the dynamic response of bird abundance, which gradually increases and stabilizes about five years after the vote. In terms of the number of observation hours, they decline slightly and remain lower 10 years after the vote. In the case of ballots that use bonds, there is no change in the number of observers, yet the amount of observation hours jumps instantaneously and remains stable at the new level. Even though observation hours increase for bond ballots, we do not observe any change in bird abundance for that subsample in Figure 7.

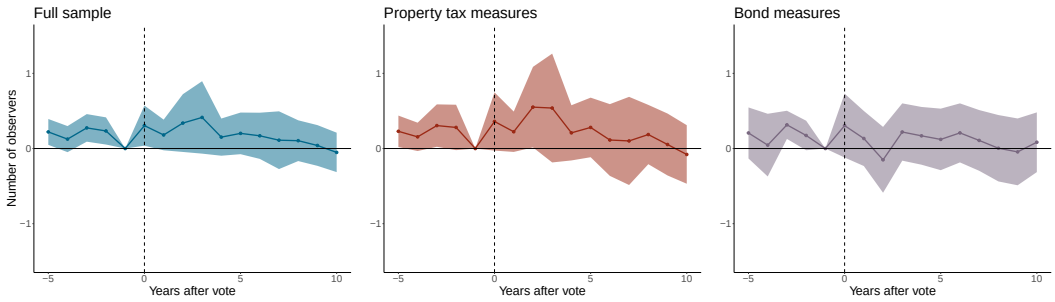
Figure A1: Distributions of Bird Outcomes & Green Vegetation



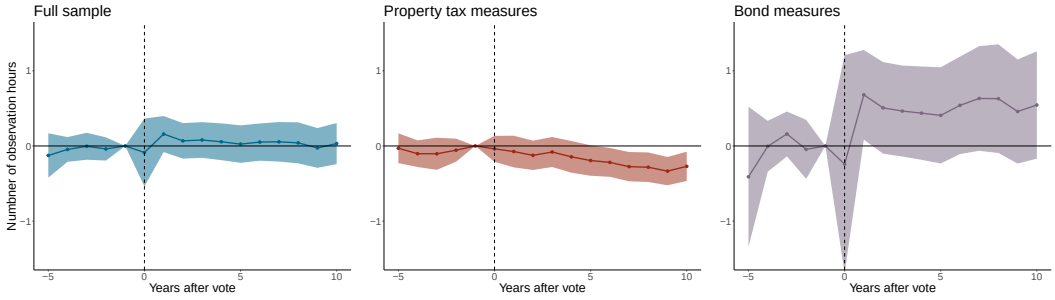
Notes: Same as in Figure 3, but for wider bandwidths around the vote margin.

Figure A2: RDD Estimation Results for Bird-Watching Effort

(a) Number of Observers



(b) Number of Observation Hours



Notes: Same as in Figure 7, but the outcomes are either the number of recorded observers or the number of observation hours as recorded in the eBird data.

Online Appendix

B Additional Background

B.1 Example open space projects and their ballot history

To illustrate what open space projects consist in, we selected projects semi-randomly among high-funding projects that passed within 5% of the vote threshold, such that the examples span the entire time period. We give more details below on each of these sample projects, including their complete ballot history.

- In 1998, Douglas county approved a 0.17% sales tax extension, 100% of which ($165 million) was to preserve parks, trails (connectivity), historic resources, and open spaces; this sales tax was first approved in 1994, and further extended beyond the scope of the 1998 vote through subsequent votes.

- In 2006, Orange county approved a 0.5 center sales tax extension, 2% of which ($244 million) was to protect threatened and endangered species by acquiring and managing habitat preserves; the bulk of the funding was used for transportation projects and conservation funds were used to offset the impacts of these projects.

- In 2016, Charleston county approved a 0.5 center sales tax increase with a 25-year horizon, 10% of which ($210 million) was for transportation, roads, open space, and parks; the bulk of the funding was used to improve the transportation infrastructure; this referendum followed a similar proposal in 2000 that narrowly failed and a similar proposal in 2004 that passed.

- In 2022, Alachua county approved a 1% sales tax with a 10-year horizon, 50% of which ($246 million) was to conserve open spaces, parks, wildlife

habitats, and watershed areas; the remaining funds were designated for roads, fire stations, and affordable housing; this referendum followed a similar proposal in 2004 that narrowly failed and a similar but smaller proposal in 2008 that passed.

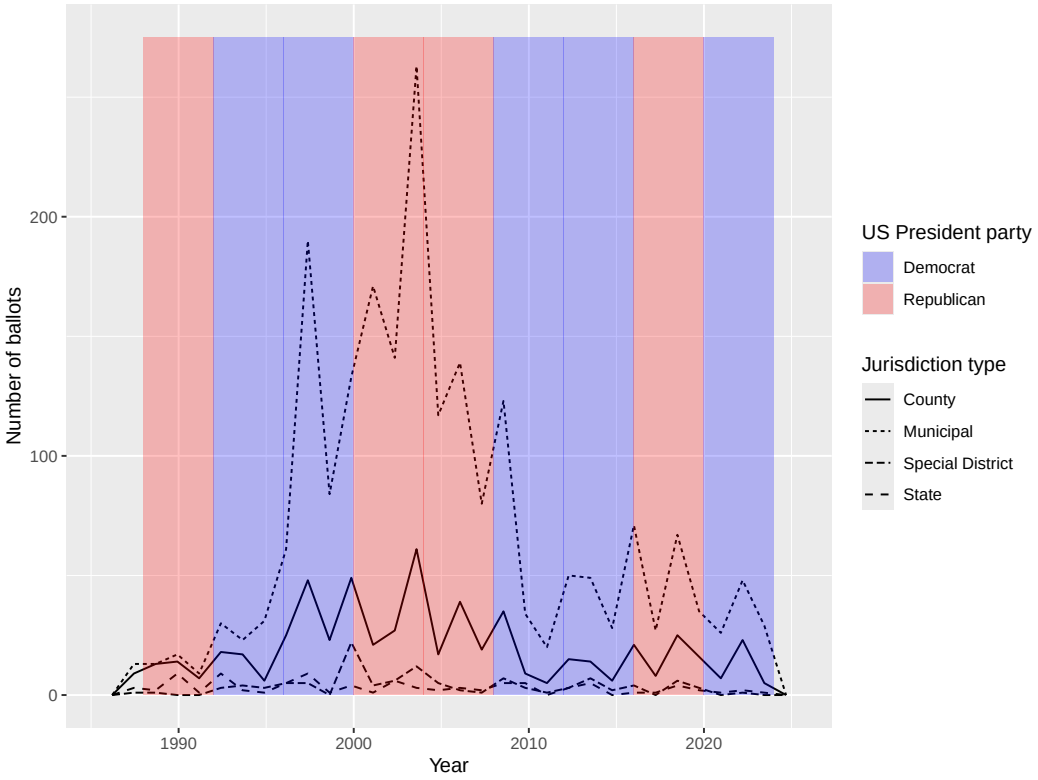
C Data Appendix

C.1 Additional Descriptive Summaries of the Ballots Data

In the main text, we present several summary statistics regarding the ballots data in Figure 1. Here we provide additional summaries, broken down by the jurisdiction and whether the President of the United States was from the Democratic or Republican party at the time. In Figures C1-C3, we plot the number of votes, the conservation funds allocated, and the approval rate of conservation ballots. Conservation ballots are predominantly concentrated in local municipalities, and peaked in number of ballots in the early 2000. We do not discern a clear pattern in terms of the presidential party that holds office. In Figure C4, we plot a version of Figure 1c where we separate ballots by their tax or bond financing mechanism. We do not observe a shift in the importance of one financing mechanism over the other. However, taxes are relatively more frequently used, and more recently have had higher conservation funds at stake than bonds. Finally, in Figure C5, we plot the number of ballots in each state.

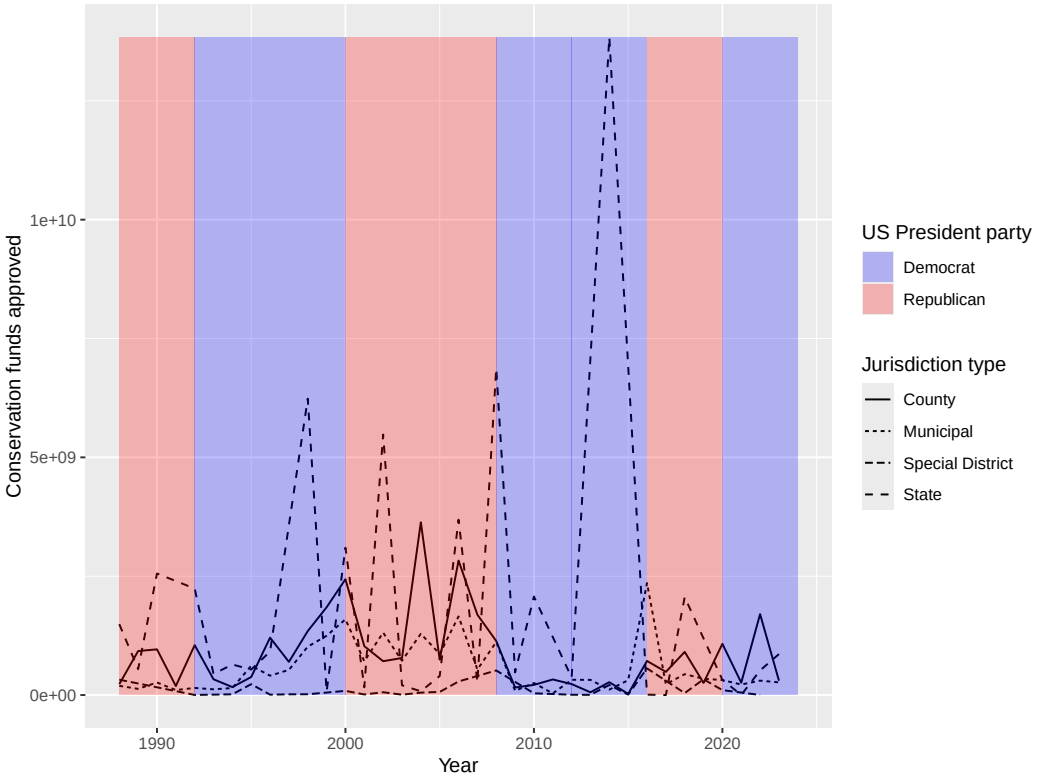
C.2 North America Bird Breeding Survey Overlap With Counties

Figure C1: Number of Votes Over Time



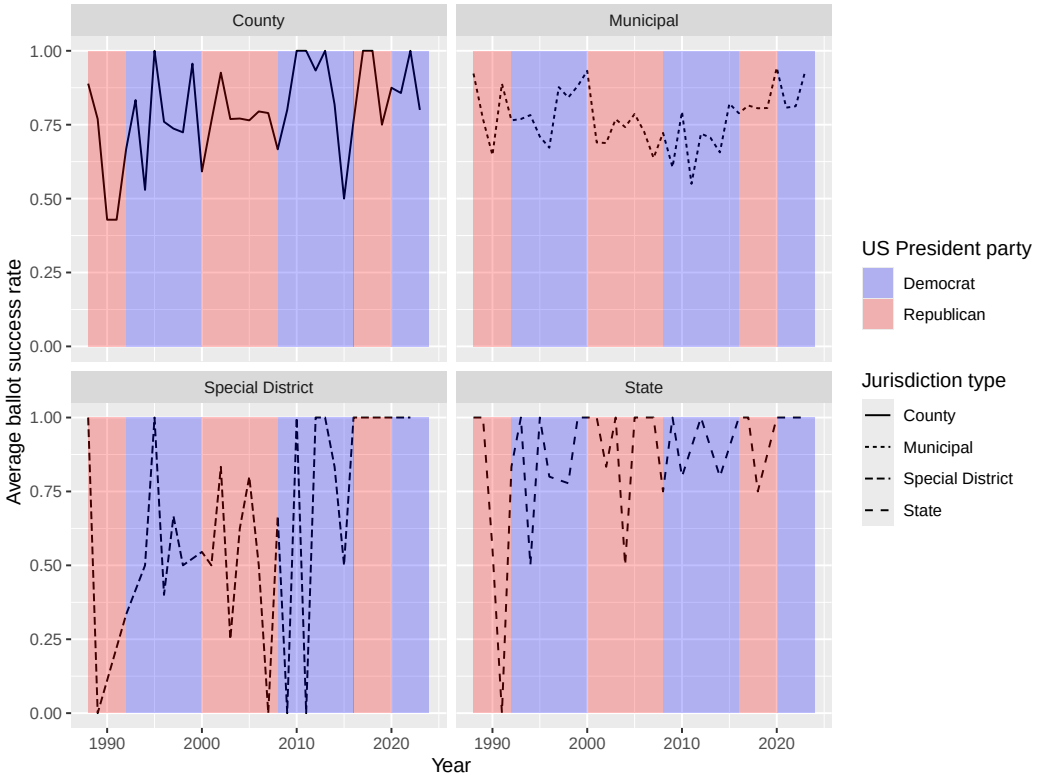
Notes: We plot the number of conservation ballots in the TPL data, by jurisdiction and presidential party.

Figure C2: Conservation Funds Allocated Over Time



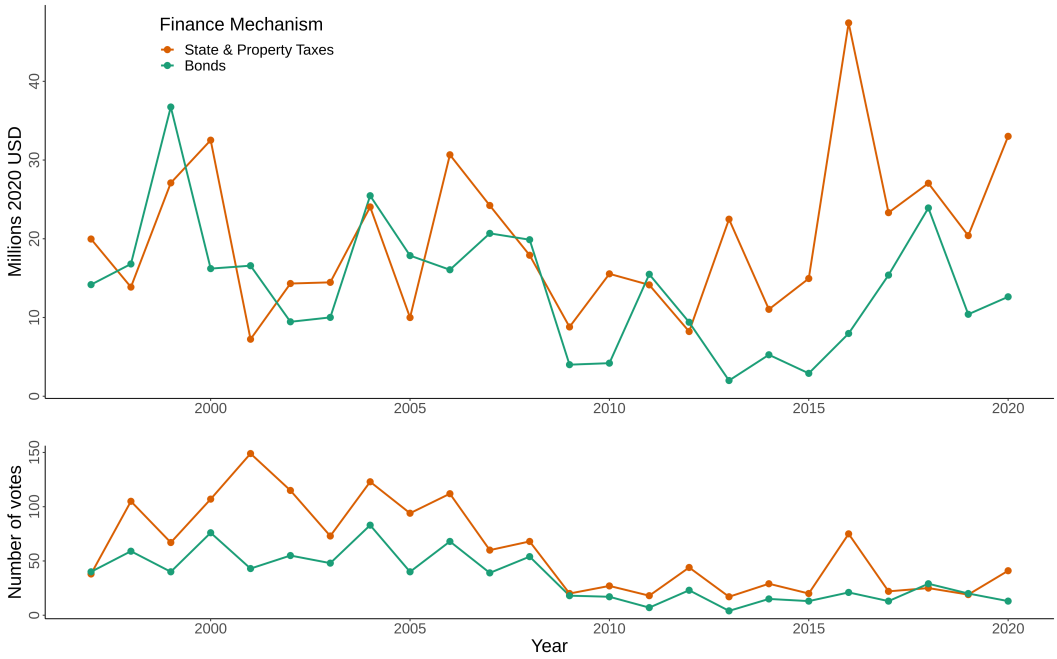
Notes: We plot the number of conservation funds, in 2020 USD, according to the TPL data, by jurisdiction and presidential party.

Figure C3: Conservation Funds Ballot Approval Rate Over Time



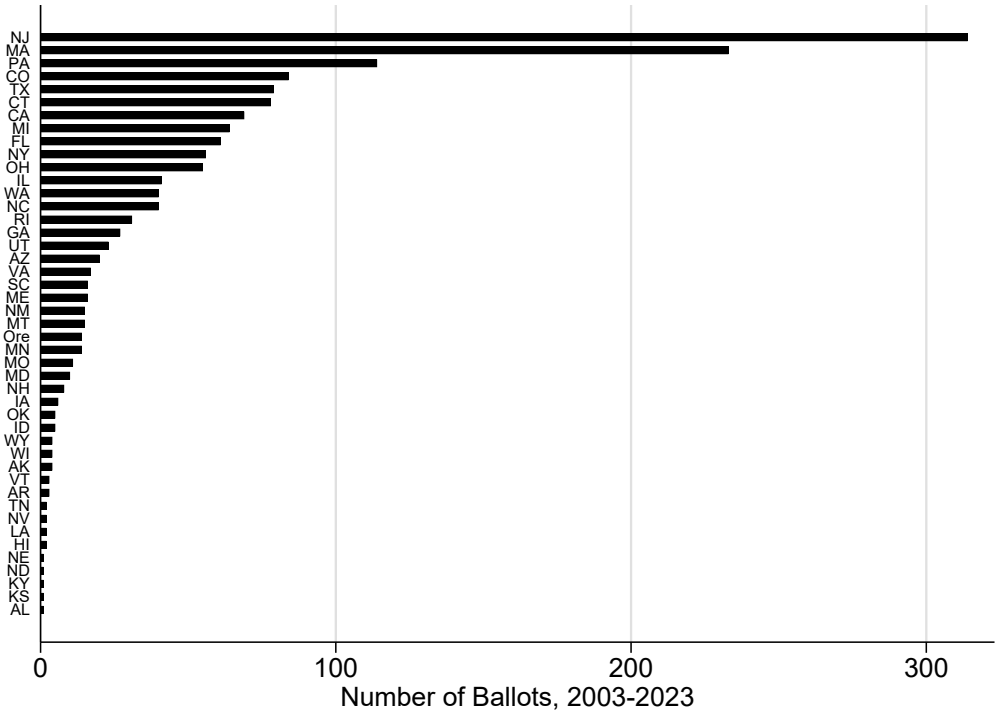
Notes: We plot the approval rate of conservation ballots in the TPL data, by jurisdiction and presidential party.

Figure C4: Trends in Funding & Number of Votes by Financing Mechanism



Notes: Same as in Figure 1c, but separated by financing mechanism.

Figure C5: Number of Ballots by State



Notes: The number of ballots in our main sample, spanning 2003 to 2023.

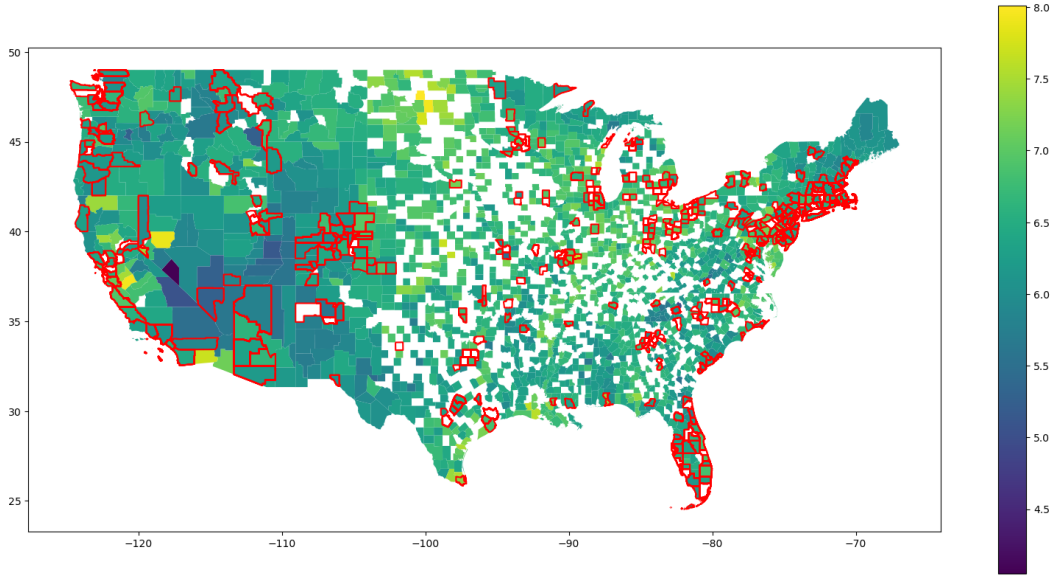
Table C1: Descriptive statistics for land conservation referenda: count of votes across different categories.

	All votes		Votes within 5% of threshold	
Did vote pass?	Yes	No	Yes	No
Panel A. Jurisdiction type				
County	261	54	36	28
Municipal	902	295	166	116
Special District	42	15	11	6
State	32	5	3	2
Panel B. Finance mechanism				
Bond	505	90	62	42
Income tax	54	23	13	10
Other	47	15	4	3
Property tax	502	214	112	83
Real estate transfer tax	19	2	4	
Sales tax	110	25	21	14
Panel C. Purpose (non exclusive categories)				
open space	1082	318	190	129
recreation	691	187	119	82
parks	484	116	65	50
farmland	301	100	52	41
trails	274	51	43	20
watershed protection	265	36	37	17
wildlife habitat	228	33	34	17
greenways	53	10	3	4
forest	45	12	10	5
wildfire prevention	6	1		1
climate	5			
flood protection	3			

Table C2: Descriptive statistics for land conservation referenda: average funds at stake (in US$ millions) across different categories.

	All votes		Votes within 5% of threshold	
Did vote pass?	Yes	No	Yes	No
Panel A. Jurisdiction type				
County	60.96	102.24	74.69	102.91
Municipal	11.65	9.29	7.57	8.54
Special District	47.46	9.90	25.11	12.88
State	889.91	1313.84	951.00	1115.00
Panel B. Finance mechanism				
Bond	33.13	33.81	61.30	61.44
Income tax	7.46	8.57	6.71	9.41
Other	135.96	356.57	19.02	304.83
Property tax	15.85	8.93	4.92	14.21
Real estate transfer tax	596.86	294.00	11.58	
Sales tax	127.94	155.65	119.68	100.79
Panel C. Purpose (non exclusive categories)				
forest	361.93	162.83	50.42	7.16
greenways	232.36	27.28	8.83	7.78
climate	158.76			
watershed protection	145.58	220.43	112.11	221.95
trails	105.13	64.58	36.65	47.70
wildlife habitat	102.64	314.08	48.85	227.49
parks	77.33	60.96	70.46	53.94
farmland	66.33	41.55	25.38	32.01
flood protection	53.69			
recreation	49.36	40.42	20.91	37.90
open space	45.69	34.37	24.26	37.97
wildfire prevention	33.02	70.20		70.20

Figure C6: Overlap of Counties With Conservation Ballots & NABBS Data



Notes: Same as in Figure 2 but using NABBS data instead of eBird data.