The Cost of Species Protection: The Land Market Impacts of the Endangered Species Act*

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Abstract

Protecting species' habitats is the main policy tool employed across the globe to reduce biodiversity losses. These protections are hypothesized to conflict with private landowners' interests. We study the economic consequences of the most extensive and controversial piece of such environmental legislation in US history—the Endangered Species Act (ESA) of 1973. We assemble the most comprehensive data on species conservation efforts, land transactions, and building permits to date. By comparing parcels with identical histories of protections we show that, on average, the ESA shifts transactions from inside to outside of the protected area and leads to a slight appreciation in residential and vacant land values outside of critical habitats. We also show that the federal regulator determines borders for areas with the most stringent protections to avoid large effects on land values, only where it is explicitly allowed to take economic criteria into account. These average findings mask significant heterogeneity at the species and location level, which we document. Furthermore, we find no evidence of the ESA affecting building activity as measured by construction permits. Overall, even taking into account species-level heterogeneity, the number of possibly negatively affected parcels is extremely small. This suggests that the capitalization of the economic impacts of the ESA through the land market channel are likely minor, despite potential delays to development through permitting, for which we provide suggestive evidence. Our findings do not rule out economically significant impacts in a few highly constrained land markets with ESA protections amplified by local regulatory action.

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1 Introduction

Monitored population sizes of mammals, birds, fish, reptiles, and amphibians have dropped by an average of 68 percent over the past 50 years (World Wildlife Fund 2020). Out of the four million assessed species worldwide, roughly 25 percent are considered threatened and face extinction, often within decades (IPBES 2019). Although a certain degree of extinction is to be expected, current rates are estimated to be 2–3 orders of magnitude larger than what is considered natural (Barnosky et al. 2011; Dirzo et al. 2014; Pimm et al. 2014; Ceballos et al. 2015). Habitat loss is by far the most significant driver of extinction, as humans have altered 75 percent of the land surface on Earth (IPBES 2019). Hence, the protection of natural habitats advocated for by biologists and ecologists has become the most important policy tool globally to prevent species from following a path to extinction, especially as climate change is expected to increase pressure on habitats and extinction risk. An effort under the auspices of the United Nations is underway to double the area of protected land to 30 percent globally, relative to 2017 levels. Doing so, which entails imposing restrictions on development of both public and private lands, is being met with opposition from private landowners and developers, who are concerned about the potential effect on their land or property.

We examine the economic consequences of the 1973 US Endangered Species Act (ESA)—considered by some as the "most important US law protecting biodiversity" (Owen 2012)—which served as a blueprint for conservation legislation in Australia, Canada, Europe, Asia, and Latin America. It is also the most controversial federal environmental regulation (Shogren et al. 1999; List et al. 2006). Critics have raised concerns about costs imposed on private landowners, in terms of both lowering of property values and delaying development—resulting in claims that the ESA is the "strongest environmental law in the world" (Goble 2005).

The key contribution we make in this paper is to provide a comprehensive evaluation—going beyond the species-specific case studies that are common in the literature—of how land markets respond to the ESA protections. We do so by testing five specific hypotheses as to how the ESA may affect land markets. First, we study whether the observed *number* of land or housing transactions differs just inside versus just outside the border of the protected areas before and after the imposition of the two main types of ESA restrictions the US Fish and Wildlife Service (FWS) uses. Second, we test whether restrictions on land development in the biologically determined protected areas lead to changes in housing and land *values* for properties located inside, outside, and proximate to the border. Third, we are the first to explicitly test whether the act's most controversial aspect, the FWS designation of critical habitat (CH), has measurable impacts beyond those caused by the biologically determined species habitat (SH) listing. The FWS considers CHs as "areas of habitat believed to be essential to the species' conservation." It does not see designation as an additional level of protection, as it does not extend the scope or severity of the statutory protections already awarded by listing the species. However, in practice, it has been hypothesized that a CH designation highlights for local regulators where to focus their regulatory activity to minimize harm to species. Fourth, we test whether locally controversial listings or designations have measurably different effects relative to species and transactions in locations where there was no public controversy about the enactment of statutory protections. Fifth and finally, we examine whether the listing of a species under the ESA itself has a measurable effect on the frequency and timing of the issuance of building permits and habitat conservation plans. Importantly, we do not examine the direct or indirect value of biodiversity, as others have done (Frank 2024; Frank and Sudarshan 2024; Hanley and Perrings 2019; Weitzman 1992; Metrick and Weitzman 1998), or determine which species or lands should be protected, if one were to choose the boundaries of protected lands in an optimal fashion (Weitzman 1993).

To test these hypotheses, we assembled the most comprehensive dataset on the spatial extent and type of ESA land restrictions for more than 900 species in the contiguous United States, going back to the beginning of the act. To causally estimate the economic impact of the act, we matched these data using space and time identifiers to data on housing and land transactions (CoreLogic) that span five decades and cover all land markets. Our analysis uses staggered and spatial differences-in-differences research designs, where we use the uncertainty about the timing of when protections are awarded as a time series of shocks to local land markets. The key identifying assumption is that landowners are severely limited in anticipating when and where ESA protections will be awarded. By further adding significant data on species-level lawsuits, building permits from the Army Corps of Engineers (ACE), county-level construction permit Census data, and (for the first time in the literature) the nationwide individual building permits, we can go much beyond simply looking at housing prices and more fully characterize both the overall impacts of the ESA and their heterogeneity (e.g., by species, region, and outcome).

In what follows, we show evidence of six main findings. First, the number of sales in areas eventually designated as CH, perceived as the act's most stringent restriction, is massively lower than those just outside these areas—both before *and* after designation. This suggests that the FWS draws these boundaries by proactively taking into account local housing market characteristics, which it is permitted to do. We also show that this is not the case for the biologically determined SH designations. Second, we show that, on average, the effects of the ESA on housing prices inside versus outside of SHs and CHs are not statistically different from zero. For SHs, this zero is precisely estimated and persistent. For CHs, the effect is noisier, but we can rule out the much larger impacts found by some case studies. We observe these patterns even when focusing on the subsamples where treatment intensity is arguably higher and where we would expect larger impacts *ex ante*. Third, we show evidence of an appreciation in the value of homes within 2km *outside* of the CH boundary. The effect is precisely estimated, robust to sample composition, and consistent with increases in amenity value of being close to a now more protected area, in addition to higher predicted scarcity of housing supply due to growing land use restrictions. Fourth, we show substantial heterogeneity in land market impacts at the species level, suggesting the external validity of single species or market studies is severely limited. Fifth, using both aggregate and micro-level data on building permits, we show that the ESA does not appear to affect permitted building activity in more restricted land markets. Finally, we document and quantify the burden imposed on developers in terms of the length of habitat conservation plans and heterogeneity therein; for a small share of species, we find a significant increase in time between application and issuance of building permits.

2 Relevant Literature

There is a long history of papers examining the economic effects of federal environmental regulation on land markets (such as the Clean Air Act, Clean Water Act, and CERCLA "Superfund") (Currie and Walker 2019; Keiser 2019; Greenstone and Gallagher 2008) and beyond (such as the Weatherization Assistance Program, fuel economy standards, and fuel content regulation) (Fowlie et al. 2018; Ito and Sallee 2018; Auffhammer and Kellogg 2011). This paper focuses on the land market impacts of the ESA, a federal regulation that touches almost all public and private land in the lower 48 states.[1] The literature, which largely focuses on single species in specific locations, generally finds a negative impact of ESA restrictions on land and property values. However, we find no such evidence for an average treatment effect in our comprehensive examination.

For instance, Greenstone and Gayer (2009) report a small, negative impact on property values in plant-species-specific CH areas. Mamun et al. (2023) find that the average impact of CH on land values is not distinguishable from zero but show evidence of underlying heterogeneity. Auffhammer et al. (2020) and List et al. (2006) find negative impacts on vacant lands in CH areas. The effect on permit issuance is mixed; Zabel and Paterson (2006) note a decrease in CA, whereas Sims et al. (2019) find a positive but statistically insignificant impact in New England. Bahrami et al. (2024) study how protected areas, not exclusively due to ESA listings, affect vacant land prices from 2010 to 2020 and find a 45 percent decline in value. Our findings suggest limited external validity of species or

[1] With respect to the ESA, economists have studied various aspects of the act. See Brown and Shogren (1998) and Ando and Langpap (2018) for excellent reviews of studies on the ESA in economics.

location-specific studies, making it important to evaluate those studies in a broad context of treatment effect heterogeneity. Evaluations are limited of conservation policies at the national or continental scale, with work by Grupp et al. (2024)—who document how land protections in the European Union fail to increase green land cover—reflecting a notable exception.

In line with the literature, we find suggestive evidence that accords with the notion of pre-emptive development due to protected area designation. List et al. (2006) observe an increase in permit applications in CH areas prior to final designation. Similarly, Lueck and Michael (2003) report increased forest plot harvest probability in anticipation of protection. Additionally, Bošković and Nøstbakken (2017) find decreased oil lease auction values in protected areas in Alberta, Canada. This literature indicates negative economic impacts of protected areas on local economies.

Our study also relates to literature on land use and housing regulations' effects on property values (Turner et al. 2014). Generally, land-use regulations increase property values by restricting housing supply (see Quigley and Rosenthal (2005) for a review) and raising construction costs (see Glaeser and Gyourko (2003), Glaeser et al. (2005), and Quigley and Raphael (2005)). Our research examines the effect of proximity to protected areas on housing prices. Given restricted housing supply within protected areas, we might expect higher property values nearby. Conversely, values within protected areas could decrease due to increased construction costs.

Protected areas not only restrict supply but also provide green, open spaces that enhance nearby property values (see McConnell and Walls (2005) and Reeves et al. (2018)). Conversely, proximity to developed areas can affect property values either positively (e.g., shopping malls; Zhang et al. (2019)) or negatively (e.g., fast food restaurants; Drewnowski et al. (2014)). Thus, our work identifies the combined effects of restricted housing supply, amenity value of open spaces, and reduced commercial activity on property values near protected areas. More broadly, previous studies have also documented how labor markets respond to area-based conservation that places land use restrictions (Ferris and Frank 2021; Szabó and Ujhelyi 2024), as well as drilling decisions for oil and gas (Melstrom 2017).

Methodologically, we contribute to the hedonics literature on capitalization of (dis)amenities into property values. Since Rosen (1974), the hedonics methodology has advanced significantly. New techniques include Tiebout sorting (Kuminoff et al. (2013)), semiparametric methods (Bajari and Benkard (2005)), and quasi-experimental approaches (Lucas W Davis (2004), Chay and Greenstone (2005), Kuminoff and Pope (2014), Muehlenbachs et al. (2015)). We use a quasi-experimental approach, leveraging the staggered rollout of ESA restrictions to identify their impact on property and land values.

3 The ESA & Restrictions on Private Property Development

The ESA was enacted in 1973 with a unanimous US Senate vote (Mann and Plummer 1995). Its stated purpose is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" (Endangered Species Act of 1973). Two federal agencies are responsible for listing species as either "threatened" or "endangered" and managing their recovery: the FWS and the National Marine Fisheries Services (NMFS).

Species gain protections under the ESA after either the FWS or NMFS conducts a review process and finds them "warranted" for protection. This process starts due to an internal review process, a petition by a third party, or a court ruling following an action-forcing lawsuit. The relevant agency issues a biological opinion based on "the best available scientific knowledge."

The agencies make two key determinations with regards to protecting a species' habitat: species *listings* and CH *designations*. Before a species can be protected under the ESA, it must be added to the federal lists of endangered and threatened wildlife and plants. A species is included in the list, or listed, once it is determined to meet the act's definition of endangered or threatened. The listing is a function of the scientific review alone, which is conducted by wildlife biologists at the agencies. Economic factors cannot be taken into account at this stage.[2]

When a species is proposed for listing as endangered or threatened under the ESA, some receive a CH designation for all or some of the biological habitat—the SH. Areas of the SH that are designated as CHs are specific areas that are deemed essential for the conservation of an endangered species. These designations might lag, often by years, after the listing. They cannot, however, preempt a listing. Also, all CHs are a subset of the SHs. We use the terms *listing* and *designation* to refer to these two tools available to the agencies under the ESA.

The ESA provides regulatory tools to restrict any actions that can jeopardize the survival of a species, without the need to first demonstrate a favorable cost-benefit comparison — a result of key words left out of the legislation, which led the US Supreme Court to interpret that the act aims to prevent extinction at "whatever the cost" (Mann and Plummer 1995). Section 9 of the act does, however, contain a provision exempting persons (e.g. landowners and developers) from its restrictions if compliance would cause "undue economic hardship."

The regulatory power of the ESA arises primarily from Section 7, which requires federal agencies to consult with the FWS and NMFS to ensure that their activities will not adversely affect listed species or their CHs. Specifically, Section 7(a)(1) of the act asserts that the process is meant to ensure that federal agency actions and private actions with a federal nexus, those requiring federal approvals, permits, or funding, are "not likely to jeopardize the continued existence" of a listed species or adversely modify habitat that is important for its survival. Before proceeding with the action, the agency must determine whether any listed species may be present and affected.

Section 7 frequently impacts real-estate development projects, resulting in restrictions and costs on private land. For example, if development is slated for land containing wetlands,

[2] See Online Appendix B for more information on the listing process and sections of the ESA.

then the developer must obtain a discharge permit from the ACE under Section 404 of the Clean Water Act. If the wetland contains endangered SH (e.g., California vernal pools, red-legged frog), then the ACE must consult with the FWS before issuing a discharge permit. The ACE can only issue a permit once the planned development has been modified to satisfy the FWS that the listed species are not adversely impacted.

Concurrently with listing a species, Section 4(a)(3) of the ESA requires the Secretary of the Interior or Commerce—"to the maximum extent prudent and determinable"—to designate its CH. These contain physical or biological features *essential* to the conservation of the species and may require special management or protection. CH determinations must be based on the best scientific data available and can account for *economic effects*, effects on national security, and other relevant effects. As a result, Section 4(b) allows the Secretary to remove areas from CH if the biological benefits are outweighed by the economic costs.

The ESA can impose costs on project developers on private land through the anti-take provisions of Section 9. A 1995 ruling by the Supreme Court established that the definition of "harm" in the ESA can include habitat modification or alteration (Powell 1995). Thus, when listed species are present, the ESA forbids developers from significantly modifying or degrading habitat where it actually kills or injures wildlife, directly or indirectly. In practice, this prohibition requires developers to reduce the scale of their project, move its location, or redesign it, such as through densification in a way to reduce the negative impacts on species. All of these actions may create additional costs through direct outlays, reduced revenues, project delays, and additional uncertainty.

Reviews by legal scholars of the ESA have determined it does not prohibit land development, as some critics argue. Houck (1993) summarizes that "there is no evidence that formal consultation under the Endangered Species Act is stopping the world. Little evidence shows that it is changing it very much at all." In reviewing 4,048 biological opinions spanning 2005 to 2009, Owen (2012) finds that agencies and regulated entities benefit from the multiple opportunities to modify their plans such that they can avoid a jeopardy or adverse modification determination. In fact, only 7.2 and 6.7 percent of the 4,048 biological opinions result in jeopardy or adverse modification determinations, respectively.

Designations can impose incremental costs beyond those associated with listings. A designation is highly controversial, and as Shogren et al. (1999) write, “private parties seek not to have their lands designated in this way.” Houck (1993) notes that it is a “red flag to the development community and that community’s representatives in Congress.” Beyond the formal mechanisms established by the ESA, designation can be a signal to local regulators where habitat protections should be prioritized and impacts avoided. Local land-use authorities in theory have wide latitude to restrict or modify land development projects and can alter requirements on the basis of a CH designation. Interviews with 15 FWS and NMFS biologists reveal that they mostly think of designations as improving the negotiating power of the agency and that they make the other federal agencies and regulated entities “take the ESA a little more seriously” (Owen 2012).

4 Conceptual Framework on Land Markets & Statutory Protections

The ESA may impact property and land values via a multitude of channels, across both time and the type of property affected. Figure 1 breaks down the effect of ESA actions (listing or designation) by stage (after the proposed and after the finalized rule), location (inside versus outside the protected area), and whether the affected transaction is for a residential property versus for a vacant land. This leaves eight different equilibrium adjustments for each of the two actions. Figure 1 summarizes the main predictions regarding the supply and demand of residential properties and vacant lands following either action.

In general, changes to the supply in each stage and market are unambiguous. For example, after a rule is proposed but not yet finalized, properties might be pre-emptively developed or vacant land may have a “fire sale,” both shifting out the supply curve. After the rule is finalized, development costs are higher, and supply shifts in for residential properties. The direction of the shift is *ex ante* clear. On the demand side, however, the direction is ambiguous, creating uncertainty in the predictions regarding the overall effect. For example, after the finalization of a rule on residential properties, current or future property owners might enjoy the likelihood of greater open space and less development, which would shift out demand. Alternatively, property owners or prospective buyers could be worried about possible complexities in being able to modify their property and the associated costs, which might shift in demand. Hence, in summary, as the demand effects are ambiguous both inside and outside of the residential property areas after the proposal and finalization of protections—the sign and magnitude of the equilibrium effect cannot be clearly determined *ex ante*. Overall, for the combined net effects, theory predicts that prices for vacant lands will go down *inside* the protected area but up *outside* of it. Because of the ambiguity in the demand response for residential properties, we cannot fully determine the net effect *ex ante*. In Online Appendix C, we provide a detailed interpretation of each subpanel in Figure 1.

5 Species Listings, Property Values & Permits Data

Our goal is to generate a comprehensive estimate of the impacts of the ESA on land markets, for the contiguous United States, spanning the years 1976–2019. We bring together data on all the ESA species-level events that can lead to or form expectations of land-use restrictions. We combine the precise ESA location data on biological and CHs with geocoded land and housing transaction data. Furthermore, we are the first in this literature to be able to add precisely geocoded permits for new construction. Our focus is on species whose habitats are, at least in part, terrestrial—meaning we exclude solely aquatic species (e.g., fish and crustaceans). In addition to the regulatory steps that award statutory protections to species, we add data on petitions submitted to the FWS and lawsuits against the FWS that seek to force it to list a species or designate CHs for a listed species.

To better account for variation in treatment intensity under the ESA, we collect additional data generated at the time of the listing and the observed workload the species has generated for the FWS. For each species, we obtain the Recovery Priority Number (RPN, which codifies the degree of threat, recovery potential, and taxonomic distinctness) and its classification for posing a conflict with land development. We further collect data on the consultations the FWS has for each species, under Section 7 of the ESA (see Section 3 for more details).

We examine additional channels through which the ESA could affect land markets by collecting data on a variety of permits directly connected to land development. We collect data on building-level new construction permits, county-level construction permits, permits from the ACE that ensure the land development complies with both the Clean Water Act and ESA, and the development of Habitat Conservation Plans that allow a developer to obtain an incidental take permit (see Online Appendix B for more details). In this section, we briefly summarize each dataset and provide a detailed account of how we obtained them. In Online Appendix D, we provide further details on each data item and ample information on data processing. We summarize the key variables used in the analysis in Table D1. Overall, this is the most extensive dataset related to the ESA ever constructed in terms of depth of information as well as temporal and spatial scale.

Listings and Designations: The ESA provides us with multiple time series of local shocks to land markets. Since its enactment in 1973, almost every year has seen at least one proposal or decision to list a species or designate a CH. We construct the full history of Proposed and Final Rules by first using the FWS Species Data Explorer API. Unfortunately, the API offers incomplete information on dates, so we fill in missing date and event information by manually reviewing the publications in the Federal Register.

The timing of the listings is staggered and often concentrated in small batches, so several species receive their proposed and final rules on the same day. We interpret this pattern as an indication of some degree of uncertainty regarding the exact timing of when ESA restriction might apply. See Figures 2a and 2b for a summary of the time between a proposed and final rule for each species.

Habitat Definitions: The phased introduction of land-use restrictions applies to certain localities but not others, depending on the geographic extent of the species' habitat. The FWS has maps that delineate the habitat ranges and CHs for the listed species, which we have obtained, processed, digitized, and matched to the listing and designation dates. We use these to define the treated areas. See Figures 2c and 2d for the areas that were under some form of ESA statutory protections by decade, for either listings or designations. In some cases, when species are delisted, the spatial information regarding their habitat or CH is no longer available in the main FWS repository. In other cases, the CH (but not the SH) might undergo revisions. To address these issues, we use previous snapshots of the FWS habitat repository or construct them manually from information available in the Federal Register. See Online Appendix D for a full description of this process.

Lawsuits and Petitions: The decision to list a species or designate CHs may follow a petition submitted to or a lawsuit filed against the FWS. We filed a FOIA request to extend the data on lawsuits against the FWS from Langpap (2022) to cover those filed from 1988 until 2019. In addition, we also manually classified each lawsuit as either supporting or opposing additional conservation measures. For example, a lawsuit could be filed to list a species that the FWS has decided is unwarranted for protection (supportive) or challenge the boundaries of a CH (opposing). Using a similar process to the one we use to obtain the date for the listing and designation rules, we also collect the date for petitions, which are used by non-government actors to initiate a formal review of the conservation status of a species by FWS.[3]

[3] For more details about the petition process, see this excellent one-page summary: https://www.fws.gov/sites/default/files/documents/endangered-species-act-petition-process.pdf. Accessed 5/13/2024.

Recovery Priority Numbers & Section 7 Consultations: We seek to account for land-use restrictions heterogeneity by using proxies for locations or species with "high treatment intensity." We obtained, through two separate FOIA requests to the FWS, data at the species level on the Recovery Priority Numbers (RPNs) and the number of consultations submitted to the FWS. When listing a species, the FWS assigns an RPN, ranging from 1 to 12, that combines information about three main categories, in lexicographic order: extinction threat, recovery potential, and evolutionary uniqueness.[4] Each RPN can include a flag for potential conflict with economic activities, namely, land development, that might arise from listing.[5] We use the data to classify species as "ever conflict" if they ever had a conflict flag in our data. In addition, since 2008, the FWS stores all the consultation requests, filed under Section 7 of the ESA, in the Tracking and Integrated Logging System (TAILS) database. We match each consultation to the species and construct a measure of the number of total consultations received by the FWS since 2008. Combined, we consider two groups of species as potentially experiencing more binding land-use constraints: those that ever had a conflict flag or have an above-median number of FWS consultations.

Property Transactions: We obtained transactions data from the CoreLogic Tax and Deed Data. This dataset provides, at the transaction level, the exact location, date of sale, and sale price— allowing us to classify transactions as occurring during the pre-treatment or posttreatment period and inside or outside the protected area. Our main outcome of interest is the sale price. However, the data also allow us to examine the volume of transactions within distance bins outside and inside the affected area as an additional outcome. See Online Appendix D for additional details on coverage and processing of the CoreLogic data.

[4] Given that we have data after to 1983, the year that the FWS began assigning RPNs to species, 6 percent of the species do not have an RPN.

[5] The process is discussed in detail in the Federal Register publication https://archives.federalregister.gov/issue_slice/1983/9/21/43096-43105.pdf#page=3. Accessed 5/13/2024.

Land Development Permits: Land-use restrictions under the ESA could make it harder to obtain a construction permit. To study the potential effects on housing supply through the permitting channel, we collected data on various land development permits. We obtain county-level data on new residential construction permits as collected by the US Census Bureau's Building and Permits Survey (BPS) and complement these with geocoded permits by the ACE and geocoded new construction permits we purchased from BuildZoom. Finally, we obtain data on Habitat Conservation Plans (HCPs). When analyzing data at the county level, to capture undevelop ed parcels' average exposure to protected lands, we aggregate CH and SH area within a county using population weights. We also calculate the unique protected area in the county to avoid double-counting protected land covering multiple species.

6 Estimating the Impacts of the ESA on Land Markets

Our goal is to estimate the economic impacts on the market value of a parcel of land that are caused by the proposed rule to list or designate under the ESA—separately for residential and vacant lands. In an ideal setting, one would randomly assign protected status to habitats for endangered species across space and time—mimicking a randomized controlled trial. This is clearly not feasible in practice, as habitats are proposed and possibly assigned via a lengthy regulatory process, as discussed in Section 3. This complex process commences with information emerging about a species' possible high extinction risk without statutory protections. The exact timing of when that process starts, and whether and when a species moves forward in the process into a proposed or final rule, is uncertain. But of key importance to this paper is that it is not easy for individual private landowners to predict or manipulate that process, as our research design relies on the assumption that the timing of listing and designation rules are plausibly exogenous to actions of land market participants—this allows us to recover the causal impact of listing and designation on home values.

Our empirical approach to identify the economic impacts of the ESA compares properties on both sides of the spatial boundaries of either SH ranges or CHs, before and after their listing or designation, respectively. We define the treatment as both the ESA-induced timing of the change in land-use restrictions and the distance to the border. This flexible approach allows us to test whether the effect of the listing or designation affects properties fully contained inside the habitats differently than those outside the borders. Statutory protections that restrict land use can spill over to properties outside the protected area. These indirect effects can operate in opposite directions to one another (see Section 4 and Online Appendix C for a discussion of the mechanisms that affect land prices following land-use restrictions). As a result, we allow the impact on parcels to vary by distance to the border, thus capturing heterogeneous effects by distance to the newly imposed restrictions.

When estimating the effects of ESA protections, we pay careful attention to the onset of treatment and the distance bandwidth around the border that defines the sample. Protections for species are awarded through multiple ESA events related to the proposal and finalization of statutory rules, which could affect the market's valuation of individual parcels. Consequently, four periods can be considered as the beginning of treatment: the proposal or finalization of a species' listing or designation. In addition to the proposed and final rules, land markets can already respond to information from petitions to the FWS to extend protections to species or lawsuits that seek to force the FWS to take action (see Sections 3 and 5 for more details on the institutional details and data on petitions and lawsuits).

Just as each step of the ESA process over time can have a differential treatment effect, the effect on properties can change based on their location relative to the border of the protected area. Inside it, statutory protections apply equally. However, properties outside of it are only affected *indirectly* (e.g. via the increased likelihood of decreased development in bordering areas inside the protected area). In the analysis, we focus on properties that are within 10km of the border.

We showcase these temporal and spatial dimensions of ESA statutory protections by summarizing how land markets responded in the case of the protections awarded to the *pygmy owl*. This case demonstrates that multiple events can provide information to land markets regarding future land-use restrictions. This case study is also helpful because List et al. (2006) have documented that land markets were highly responsive to its CH designation. In Figure 3, we plot the moving average of the ratio of sale prices inside versus outside the protected area and how these ratios changed over time given the owl's listing and designation. We also report the mean sale price separately for inside and outside the protected area. For SH, we observe high price volatility up to the mid-1990s, likely driven by the small number of transactions in the data. Following the proposed listing rule in December 1994, we observe a steady decline in the ratio of residential prices, which plateaus after the final designation of CH in July, 1999. For CH, we see a similar decline in the ratio of prices following the proposed listing around the *yet-to-be-announced* border. This suggests that land markets are able to predict where the FWS will draw the border. In both habitat types, the decline in the ratio of the prices appears to be due to the prices increasing *outside* of the protected area rather than the prices inside declining. After the species was delisted, we see prices inside the CH diverging sharply from those outside. In summary, this case study is helpful in documenting the various potential definitions for treatment onset and the importance of examining where prices are changing around the border and in what direction.

Throughout the analysis, we hold the definition of the pretreatment period constant but consider different definitions of treatment onset in Online Appendix A. We regard the pretreatment period as the time before any proposed rule to list or designate. The onset of treatment is defined as the first date that a proposed listing rule is published. This allows us to test whether proposal has a statistically different impact, if any, from finalization. To identify the effect of the different stages of ESA protection, we always compare the posttreatment set of parcels to the pretreatment set, dropping the "in-between" parcel transactions.

In the main analysis, our focus is on the treatment effect of the proposed rules to either list or designate. This means that when we examine the treatment effect of listing, the pretreatment period (before the proposed rule) proceeds continuously into the posttreatment period (after the proposed rule). However, when we examine the treatment effect of the CH, the posttreatment period (after the proposed designation) might take place *after* the proposed or final listing rule. To focus on the treatment of interest—proposed CH designation—we drop parcel transactions between the date of the proposed listing and the date of the proposed designation. This allows us to cleanly compare pre- and post-event for each of the individual stages of ESA protection. We summarize the research design in Figure 4.

In summary, we study the net effect of ESA regulations on land markets using three techniques. First, we employ a staggered difference-in-differences (DD) design, where we compare the transaction values of properties inside and outside and before and after a listing or designation. This leverages the rollout in protections over time and relies on the uncertainty regarding the exact timing of the enactment of protections. Second, we conduct a spatial DD, comparing transactions in distance bins around the border of the protected area, before and after the listing or designation. This allows us to determine whether any observed price differences before and after the treatment onset are driven by depreciation or appreciation, inside or outside the protected area. Third, we use variation in the amount of land under ESA statutory protections to examine changes in various types of construction permits.

Throughout our analysis, our key identifying assumption is that the ESA actions, determined at the federal level, act as plausible exogenous shocks to local land markets. We also assume that in the absence of ESA regulations, land values and construction permits inside and outside the protected areas would have developed along parallel trends.

We need to consider two main potential confounders in terms of the bias they might introduce to the analysis. One is that land development results in habitat loss, increasing the probability of a species listing. In addition, land development might have a negative effect on prices or price growth due to increased supply. Combined, we can sign the effect of this confounding element to have a negative bias, resulting in attenuated estimates. If land development that occurs pre-ESA protection is truly a meaningful confounder in this setting, then we should expect to observe pretrends when estimating a staggered DD specification. The second relates to the designation of CHs. The FWS can take into account economic factors when deciding which parts of the SH to designate (though it cannot do so for the listing decision). This means the FWS might not designate highly valuable lands. If so, which is very plausible, then we are recovering a lower bound of the effect, as the highest-value transactions are not affected.[6] However, the FWS has repeatedly claimed that any observed economic effect would be solely due to listing, an argument we can empirically test using the data on SH and listing timing.

6.1 Main Regression Specifications

6.1.1 Staggered DD

We use the natural logarithm of the transaction price, $\ln(\text{Sale Price}_{(i)(t)})$, where property (i), denotes the physical location of the property with indices ZCTA5 z, in county c, in state s, in FWS region r, with distance d to the border b; and transaction time (t) denotes the year y and month m.[7] The use of a two-way fixed effect estimator is appropriate in this setting, despite the staggered treatment, because of the large group of never-treated observations (Borusyak et al. 2024).[8] The DD specification estimates the effect of enacting

[6] Because climate change is expected to accelerate species loss, increase threatened species, and change migratory patterns, the ability of the FWS to avoid high-cost areas may decrease, potentially causing the cost of the ESA on land markets to increase.

[7] A ZCTA5 is an area defined by the Census Bureau, roughly equivalent to a five-digit ZIP code.

[8] Staggered DD methodologies are frequently used in economics (Autor 2003; Stevenson and Wolfers 2006; De Janvry et al. 2015; Alacevich et al. 2021). More recent literature has identified concerns with common staggered DD methods. The primary concern is that the two-way fixed effect estimator is a variance-weighted average of treatment effect parameters and, given heterogeneous treatment effects, can produce negative weights, resulting in incorrect estimates of the average treatment effect. Methods to diagnose negative weights in a staggered DD setting have been recently explored (Goodman-Bacon 2021), and estimators robust to heterogeneous treatment effects have been proposed by Sun and Abraham (2020), Callaway and Sant'Anna (2021), De Chaisemartin and D'Haultfœuille (2020a), and De Chaisemartin and d'Haultfoeuille (2020b). However, as Borusyak et al. (2024) discuss, a large control group negates the issues that the recent literature has raised. The key intuition is that with many never-treated units, those are sufficient to estimate the temporal fixed effects, and any unwanted comparisons between late- and early-treated units receive a very small weight in the estimated average treatment effect.

ESA protections on properties inside relative to those outside the protected area, before and after the event of interest:

$$\ln(\text{Sale Price}_{(i)(t)}) = \sum_{\substack{\tau \in \{\underline{T},\ldots,\overline{T}\} \\ \tau \neq -3}} \mu_{(i)\tau}(\pi_\tau + \beta_\tau \omega_{(i)}) + \omega(\text{Inside})_{(i)} + \phi_z + \rho_{yr} + \eta_{mr} + \alpha_b + \boldsymbol{X_{(i)(t)}\theta} + \varepsilon_{(i)(t)} \quad (1)$$

The specification in Equation (1) estimates the dynamic development of transaction prices for properties inside versus outside the protected area. The evolution of the treatment is estimated by including leads and lags, in the form of $\mu_{(i)\tau}$, that equal one when the transaction is τ quarters from the event of interest. We set the omitted category to be *three* quarters away from the end of the pretreatment period—proposed listing rule—to make it easier to test for any anticipatory effects. We include two sets of leads and lags to test for the differential effect on properties inside. We interact them with $\omega_{(i)}$, a dummy variable that equals one when the property is inside the protected area. The set of coefficients, β_τ, measure the dynamic development of transaction prices that is different for properties inside the protected area, whereas the set of coefficients π_τ measure how prices change over event time for properties inside and outside of it. The dummy variable, $(\text{Inside})_{(i)}$, equals one for properties that are ever inside the habitat and zero otherwise. Including this dummy variable allows us to absorb any pooled and time-invariant features shared across protected areas.

We are interested in isolating the residual variation that is not explained by baseline characteristics or pooled time effects. To account for time-invariant properties in land markets, we include fixed effects for ZCTA5, ϕ_z. This controls for any areas that are predominately more rural relative to urban or have higher development opportunities and helps mitigate the omitted-variable bias by controlling for unobservables at a very localized level.[9] To flex-

[9] Kuminoff et al. (2010) demonstrate how including spatial dummies in a DD framework improves the

ibly control for time trends, we include sample year-by-FWS region fixed effects, ρ_{yr}.[10] To account for seasonality in land markets, we include calendar month-by-FWS region fixed effects, η_{mr}. The fine-scaled time fixed effects allow us to more accurately capture real business cycles or changes in local conservation efforts and legislation. To better compare across listings and designations, we also include a species fixed effect, α_b.

Larger and newer properties will likely sell for higher prices. We control for this by including a set of property characteristics, $\boldsymbol{X_{it}}\theta$. Specifically, we include quintiles for the parcel area size (relative to the global distribution of parcel size) and include fixed effects for the total number of rooms (bedrooms and bathrooms) and construction year of the property. Any unobserved heterogeneity is captured by the error term, $\varepsilon_{(i)(t)}$. We cluster the standard errors at the ZCTA5 level and examine how different levels of clustering affect the precision of the estimates in Online Appendix A.

6.1.2 Spatial DD

Property prices might develop differently after the enactment of statutory protections, and those changes might not be uniform with respect to distance from the border of the protected area. Our paper adds to a long literature using a spatial DD approach (Kiel and Zabel 2001; Currie and Walker 2011; Lucas W. Davis 2011; Linden and Rockoff 2008; Bento et al. 2015; Muehlenbachs et al. 2015; Albouy et al. 2020; Diamond and McQuade 2019), whereby the effect of treatment varies with distance to the (dis)amenity or regulation. We modify the specification in Equation (1) to focus on changes in distance bins of 1km before and after treatment onset. To allow for including any potential anticipatory effects in the treatment period, we classify the two quarters before the proposed rule as part of the treatment period. We allow the effect to vary up to 10km distance on either side of the protected border.

estimation of marginal willingness to pay in a setting with time differentiated data.

[10] The contiguous United States is divided into seven FWS regions: Northeast, Southeast, Southwest, Pacific Southwest, Pacific, Mountain, and Midwest.

$$\ln(\text{Sale Price}_{(i)(t)}) = \sum_{\substack{k\in\{\underline{k},\ldots,\overline{k}\}\\ k\neq k_0}} \lambda_{(i)}(\gamma_k + \delta_k \psi_{k(t)}) + \nu(\text{Post})_{(t)} + \\ \phi_z + \rho_{yr} + \eta_{mr} + \alpha_b + \boldsymbol{X_{(i)(t)}}\boldsymbol{\theta} + \varepsilon_{(i)(t)} \quad (2)$$

The spatial DD focuses on a set of distance bins, $\lambda_{(i)}$, instead of leads and lags. Each distance bin dummy equals one when property i is located in distance bin k. We center distance at the border and measure distance from the border inside in negative values and distance from the border outside in positive values. As before, we include two sets of dummies, but this time for distance bins. The first set of distance bin dummies captures the average transaction price from the border as a function of distance, both before and after the potential enactment of land-use restrictions—captured in the γ_k coefficients. The second set is interacted with a dummy, $\psi_{k(t)}$, that equals one when the transaction takes place after the onset of treatment. The coefficients of interest, δ_k, measure how prices change around the border after the land-use restrictions apply. The dummy variable, $(\text{Post})_{(t)}$, equals one for time periods after the treatment onset and zero otherwise. This specification allows us to directly test for any violations of the stable unit treatment values assumption in the form of spillovers on the properties that are outside the border. All other variables are the same as in Equation (1).

6.1.3 Two-Way Fixed Effects

The timing of a land transaction is another meaningful source of heterogeneity. As more events unfold, more information exists about the certainty of listing and how much the protections will be binding. We estimate a modified specification that focuses on the transactions 0–3km *inside* and 0–6km *outside* the protected area. We define separate event dummies and estimate their interactions with the distance bins using the following specification:

$$\ln(\text{Sale Price}_{(i)(t)}) = \sum_k \sum_e \psi_{ke}(\text{Distance}_k)(\text{After}_e) +$$

$$\sum_k \kappa_k(\text{Distance}_k) + \sum_e \varphi_e(\text{After}_e) + \quad \phi_z + \rho_{yr} + \eta_{mr} + \alpha_b + \boldsymbol{X_{it}\theta} + \varepsilon_{izcsdbym} \tag{3}$$

We define three distance bin dummies, Distance_k: one if the property is up to 3km inside the protected area and two more for properties outside of it, up to 3km and 3–6km. We define the event dummies, After_e, as equal to 1 if the transaction takes place after one of the following events: petition or lawsuit regarding the species, proposed listing rule, final listing rule, proposed designation rule, and final designation rule. Once the event occurs, the dummy variable switches from zero to one and maintains that value even as other events occur. Our interest is in the interactions of the distance bin dummies and the event dummies, captured by the set of coefficients ψ_{ke}. We also include the dummies for the distance bins and events, while excluding the dummy for the 3–6km outside the protected area, which serves as the omitted category. All other variables are the same as in Equation (1).

7 Main Land Market Outcomes Estimation Results

7.1 Transaction Counts

Before we turn to the analysis of how listing and designation impact the *value* of built-up and vacant parcels, we examine what happens to the *number* of transactions inside and outside of the SH and CH boundaries. In Figure 5, we summarize the number of transactions in 1km distance bins relative to the border of SHs and CHs, before the proposed (light) and after the finalized (dark) listing or designation event. For species listings, we observe slightly more residential property transactions after the finalized listing (dark line) relative to before the proposal (gray line) across all distance bins for residential (Panel a) and vacant lands (Panel c). Furthermore, we find no visible discontinuity in the number of transactions at the species border before or after for residential property and vacant land transactions. This finding is consistent with the requirement discussed in Section 3 that FWS cannot take into account nonbiological (e.g., economic) considerations when setting species boundaries.

We now turn to the case of CH designation, where a starkly different pattern emerges. First, a clear, sizable discontinuity at the border appears for both residential properties (Panel b) and vacant land transactions (Panel d) *prior* to proposed designation. It grows when we look at the transactions outside of the border after the finalized designation. The sharp discontinuity of transaction counts, with significantly fewer inside the CH area, is one of our most interesting findings. It is strong evidence that FWS takes housing market activity into account when drawing CH boundaries, which, as Section 3 discusses, it is allowed to do. The difference right at the boundary is economically and statistically significant, indicating a sixfold difference in sales in adjacent communities. See Figure A1 for estimation results using either the transaction rate or a dummy variable for nonzero transactions (to capture movement along the extensive margin).

7.2 ESA Impacts on Property Values: Species Habitats

We now turn to the average impact of the ESA on property values across species and start with the results for residential properties located near the border of an SH. The first set of results uses the staggered DD design from Section 6.1.1 with our most restrictive set of property transactions (those with nonmissing data on parcel size, number of rooms, and year of construction). In Panel (a) of Figure 6, we demonstrate that properties within SHs sell for the same average price before and after the determination of SHs, compared to properties located up to 10km away—when comparing properties sold two years before and after the proposed listing. This effect is precisely estimated, and we can rule out even small economically significant estimates.

Although the staggered difference approach allows us to recover what happens to the value of properties inside relative to properties outside the SH, it does not allow us to recover what happens to the level of prices inside and outside the border—only their difference. We hence now turn to the spatial DD approach discussed in Section 6.1.2, which allows us to estimate what happens to prices by distance from the border. Panel (c) in Figure 6 displays our estimated effects using the same sample as in Panel (a). Relative to the excluded bin of 5km outside the border, we see no statistically significant differences in property values from listing, except for a small and statistically significant decrease 10km inside the habitat, which is based on less than 1 percent of the observations.

As in Panel (a), our sample in Panel (c) includes transactions that have taken place only two years before the proposed listing or two years after the final listing. In Panel (e), we expand our sample to include transactions to those that happen within five years of the listing, which we believe to be a worthwhile comparison, as land markets adjust slowly due to permitting and the general duration of new construction. Expanding our sample amplifies some of the patterns we found using the more restricted sample. We see a marginally statistically significant drop in residential property values from just inside to 5km inside the habitat border. We can rule out the very large effects that some of the papers cited in the literature review find. On the outside, we see a slight appreciation 8–10km outside the SH. This appreciation is not large but statistically significant. This is consistent with buyers perceiving listing as an improvement in amenity value or a policy-induced reduction in construction activity inside and near the SH border, which in turn pushed prices up in possibly more saturated markets further away from the border.

The treatment intensity of the ESA is not necessarily equal across listings, potentially masking meaningful impacts on sale prices in Figure 6, as those results represent average effects across all types of transactions. In Figure 7, we break down the estimation for different types of transactions by whether they were "ever conflict," "high ACE permits," or "high FWS consultations," as defined in Section 5. Due to sample size limitations for subgroups, all results in the subgroup analysis use the larger sample of five years pre- and post-listing, which also allows us to capture longer-term effects. For all three subgroup analyses, the pattern is almost identical to that for the full sample shown in Figure 6c. For the "ever-conflict" subsample in Figure 7a, we do not see a statistically different effect of listing for any of the bins. We next turn to Panel (b), where the pattern for the "high ACE permit" sample is essentially identical to the overall results, with negative yet not statistically significant effects inside the listed area and positive and significant appreciation of values in the 8–10km bin outside the listed area. The most pronounced difference from the overall sample comes from the "high FWS consultations" subsample. We see negative and statistically significant point estimates for the first two bins inside the listed area (and the 6km bin) and statistically significant appreciation in the 8 and 9km bins outside the listed area. This suggests that species that draw more regulatory attention from the FWS might lead to small but measurable decreases in housing value inside the species border in more contested land markets.

A sample of repeated sales has the clear benefit of allowing us to focus more narrowly on the residual variation within each property, from before to after ESA protections are imposed. However, we are severely limited by the data, as even in the case of SHs, the sample size of the repeated sales samples is two orders of magnitude smaller than the baseline sample—making any estimation using this sample severely underpowered. Unsurprisingly, we fail to detect any changes in sale prices, on average, around the border of SHs when using repeated sales, even when allowing for different treatment onsets (see Figures A20–A22).

All the results so far have focused on residential property transactions, which is land with built structures on it. The CoreLogic data also contain sales data for vacant lands, which we classify into "residential" and "nonresidential." The former has additional flags in the data that suggest residential zoning or development potential but no built structures. The latter could be agricultural or commercial/industrial. Figure 8 repeats the estimation underlying Figures 6 and 7 but for vacant lands, separated into residential and nonresidential. Panel (a) shows the effects for listing by distance bins for 83 species and about 225,000 residential vacant land transactions. Broadly, we fail to observe any statistically significant effects on land values inside or outside of the listing boundary. The effects for the "ever-conflict" subsample shown in Panel (b) are identical, but the sample size is cut in half.

Results for nonresidential vacant lands suggest larger effects for "controversial" species listings, yet interpretation and precision are limited by a smaller sample size. Figure 8c shows an imprecisely estimated "zero effect" across almost all bins. The "ever-conflict" subsample only has about 50,000 observations in it, and the estimation results are extremely noisy. We see decreases in land values just inside and outside the boundary, which are statistically significant and large, further stressing the limits to external validity of single species or land market studies that dominate the literature.

7.3 ESA Impacts on Property Values: CHs

We next turn to estimating the impact of CH designation on property values. These regressions drop transactions that occur between proposed listing and proposed designation (as described in Figure 4), and hence these results reflect the long-run impacts of listing. We include these transactions and discuss additional sources of heterogeneity in the next section. In Panel (b) of Figure 6, we fail to reject that properties that are sold inside CHs, up to 10km away from the border, sell for the same average price after the designation of CH as before relative to properties outside. The point estimates in the post period are uniformly negative. However, unlike for listing, this effect is much less precisely estimated. Yet we can rule out changes in prices larger than 15 percent—which is significantly smaller than what has been found in the single-species papers we reviewed.

The spatial DD approach highlights a fundamentally different pattern than the staggered DD estimation as prices change inside and outside of the CH. The first thing we note in Figure 6d is the insufficiently large number of observations inside the CH to power the estimation of all 10 bins inside. We have hence collapsed all sales further than 2km from the CH boundary into the 2km bin. We find no significant drop in property values inside the CH. However, a different picture emerges just outside the CH boundary, with evidence of a statistically and economically significant increase in property values within the first two bins. The point estimates for this increase are 6 and 5 percent, respectively, and we cannot rule out an increase of up to 10 percent for these two bins. This finding is strongly consistent with amenity value and scarcity channels, whereby properties in highly active housing markets improve knowing that development in their "backyard" just became more challenging. These findings are robust to expanding our sample to transactions five years before the proposed listing and five years after the finalized designation (Panel f). The distance bin approach hence highlights an important phenomenon: the relative price of parcels inside the boundary drops, but this is via not a depreciation effect on those parcels but an appreciation of those just outside. Research has until now only been able to identify the net effect; our paper sheds light on this important mechanism.

The main instance where we do observe meaningful and precisely estimated lower sale prices of about 10 percent inside CHs is when we focus on new construction of residential properties (Online Appendix Figure A9, see panels d and f). However, we are limited in our ability to interpret those results, as the sample size shrinks by an order of magnitude, and we only observe about a third of the species relative to the full sample.

In Figure 7, we break down the estimation for the different subgroups for CH designation. Again, due to sample size limitations, all results in the subgroup analysis use the larger sample of five years before and after listing. For the "ever-conflict" subsample in panel (d), we see a qualitatively similar pattern to the full sample, yet the appreciation just outside the designated area is no longer statistically significant.

In Panel (e), in the pattern for the "high ACE permit" sample, we see the most pronounced difference from the overall results. We now detect a statistically and economically significant decrease in value 2km inside the CH. Although the number of transactions inside the CH post designation is very small (less than 2 percent of the sample), we continue to see significant increases just outside the boundary (1–2km). For the "high FWS consultations" subsample in Panel (f), we see no statistically significant effects inside or outside of the boundaries. These results suggest that different treatment intensities are linked to potential location-specific constraints and how those operate through the federal nexus.

In Online Appendix Figure A7, we observe more evidence for the ability of land markets to correctly infer where the CH border will be designated. We observe this for a subset of species that might have higher treatment intensity and CHs are proposed for designation with a five-year delay relative to the proposed listing rule—although this is a relatively small number of species (19–34). Despite the smaller number of species, we estimate meaningful and precise higher sale prices inside CHs following the proposed listing rule—when there is no knowledge regarding the yet-to-be-announced CH border.

Turning to vacant lands, Panel (e) in Figure 8 shows the effects for designation by distance bins for 48 species and ≈110,000 residential vacant land transactions. We see no statistically significant effects on land values inside or outside of the listing boundary, except for a small and marginally significant appreciation 2km outside the habitat. The results for the "ever-conflict" subsample shown in Panel (f) are similar in showing no detectable effect.

Panels (g) and (h) show the same regressions but on the smaller sample of nonresidential vacant lands. Panel (g) shows a significant and sizable appreciation of lands just outside the boundary but no evidence of a drop in value for the small number of observations inside the boundary. The "ever-conflict" subsample mirrors these findings with a noisy estimate of some appreciation just outside the boundary. Given the extremely small sample sizes for the CH analysis of vacant lands, these results should be interpreted with caution.

The results we have covered thus far are those from our main specification and treatment onset assignment. In Section A.2 of the Online Appendix, we report results from varying the definition of treatment onsets, sample composition, finer temporal and cross-sectional fixed effects, clustering standard errors at higher levels of aggregation, changing the definitions of the subgroups of higher FWS consultations and ACE permits, and changing the outcome of interest to transaction count, as well as normalizing sale price by area. Next, we examine key dimensions of potential heterogeneity.

7.4 Heterogeneity by Species & Timing of Treatment

Although our results suggest that the average long-run effect of the ESA on property values is small for species listings and modest for CH designations, concluding the analysis with this finding would fail to highlight two significant sources of heterogeneity that appear to be meaningful in addition to the subgroup analysis shown in Figure 7, which determine the impacts experienced by landowners across the contiguous United States.

7.4.1 Species-Level Effects

The size of our dataset allows us to examine the effect on land values at the individual species level by running the regression from the previous sections but allowing the coefficient β_1 on the treatment variable in Equation 3 to vary by species. Figure 9 displays the distribution of estimated coefficients for this staggered DD estimation. We plot the distributions for these coefficients (unweighted, weighted by the number of transactions, weighted by the inverse of the standard error, and weighted by the mean of the preproposal price). The left column of graphs displays the results for SHs; the right column displays the distributions for CH designations. Each row reports the distribution of coefficients for a different land type. The takeaway is simple—the heterogeneity in species-level effects is massive.[11]

For SHs and residential properties, we observe larger densities for negative price effects inside the protected areas after the proposed listing. This finding is especially striking when we weight the coefficients by the number of total transactions—highlighting that more negative effects are concentrated in land markets with higher transaction volume. These distributions capture the overall average negative treatment effect we observe in the spatial DD (see Figure 6, Panels c and e); however, that is masking this important heterogeneity by species and land market. From the results we report in Figure 9, Panel (a), we learn that the negative effect we estimate in the spatial DD is attenuated by the few cases where the

[11] We further examine heterogeneity by species in Tables A9–A12, where we fail to find meaningful correlations between the species-specific effects and a variety of species-level characteristics.

effect is positive.

For residential properties in CHs, we also observe more density for negative coefficients. This pattern holds across the different weighting alternatives. More importantly, the density curves are skewed to the left, highlighting that in some combinations of species and land markets, the effects are negative and of greater magnitude than where they are positive. The price effects for residential properties, in both species and CHs, are largely centered around 0. An analysis that aggregates all of these species-specific effects will fail to capture the larger density of the negative effects, especially those that point to nontrivial reductions in land values.

The wide range of effects we estimate here highlights the difficulties in making blanket statements regarding the impacts of ESA protections on land markers. Critics of the ESA often point to cases where conservation led to considerable losses in land values. It is likely that the coefficients in the negative tails of these distributions are those that get the attention of policy circles and are raised as potential cautionary tales. However, those left-tail cases are not representative of the entire span of effects experienced by different land markets.

For vacant lands, those that we classify as residential and nonresidential, we observe distributions that display more heterogeneity, though symmetric and centered at 0. However, these distributions are also more compressed, with substantial density for effects, positive and negative, farther away from the center than for residential properties. Although we observe this pattern of wider dispersion for both species and CHs, we are more limited with CHs and vacant lands because of the smaller number of species, land markers, and transactions. Two facts contribute to the lower sample size of vacant lands around CH border. First, not all species receive a designation. Second, vacant land transactions are sparser relative to residential property transactions.

7.4.2 ESA Treatment Timing

The process through which ESA listing and designation decisions take place means that no clear event qualifies as the single onset of treatment. A listing has both proposed and final rules, and a designation can have its own set of proposed and final rules, which do not necessarily overlap with the listing rules. In addition, petitioning or filing an action-forcing lawsuit against the FWS can also provide meaningful information to land markets. This yields potentially five or six events of interest.

Each event changes landowner expectations regarding the probability of binding land-use constraints that arise from ESA protections. In the results discussed earlier, we focused on the proposed listing or designation as the event of interest and aggregated the different events in the posttreatment period. For example, for SHs, we did not attempt to disentangle the effect after the final listing of the species from the one between the proposed and final listing. Aggregating the different treatment events can lead to estimating an average null effect if those distinct events have effects that offset each other.

The progression and evolution of ESA events provide more information about the certainty of listing and the degree to which land-use protections will be binding. As a result, the timing of a land transaction relative to the timing of each distinct ESA event is another meaningful source of heterogeneity. We estimate how sale prices change as the ESA events progress over time—effectively estimating a coefficient for each block in Figure 4, using the specification in Equation (3). Our goal is to estimate how sale prices change inside versus outside, as the ESA treatment stages advance from some common knowledge about potential ESA protection, to the realization of statutory protections.[12]

The results from this empirical exercise highlight the challenge of making a statement about the average treatment effect of land-use restrictions that follow ESA listings and designations. We discuss these results in greater detail in the Online Appendix, Section A.3. As a high-level summary of these findings, we do observe lower sale prices inside

[12] We focus our estimation on the 3km inside the protected area and up to 6km outside.

protected areas after the proposed listing rule. However, those effects are often temporary and either partially or fully offset after the final listing or designation. When we combine the estimates for the effects after the proposed and final listings, the net results are often small effect sizes for which we cannot reject the null hypothesis of a zero effect at the 5 percent significance level. Another pattern that broadly holds is that properties outside the protected area appreciate after the final listing. Finally, we estimate that sale prices are lower after a lawsuit or petition event; however, we have transaction data for only a small number of species that have a lawsuit or petition (e.g., 28 species relative to 195 for SHs).

8 The Impacts of the ESA on Construction Activity

Restrictions on land use that follow ESA protections might not be fully captured in the price of lands and properties—as the total effect on prices is ex-ante ambiguous (see Section 4 for more details). Another avenue through which the act might impose additional costs is procedural delays in developing land parcels. Such delays and uncertainty about their magnitude and cost might have effects on land markets not immediately captured in prices. Following the listing and designation decisions, private land developers might experience longer wait times for permits. Permits are required from several local and federal entities, and each must consult with the FWS to verify the approval does not present a risk to the survival of a listed species (referred to as the "federal nexus," see Section 3 for more details). Land developers can expect delays to increase with the number of protected species that are considered to have a habitat in the proposed project area.

In this section, we present several descriptive empirical facts that examine whether ESA protections have an effect on the permitting process for construction activity. We fail to find that more area under protection is correlated with meaningfully lower construction activity, yet we do observe longer delays—especially for larger projects. We begin with reviewing overall construction permits, study permits issued by the ACE, examine the time from application to approval of construction permits, and summarize the time it takes to complete an HCP (which is required in some cases and done preemptively in others to avoid costly delays and restrictions).

Instead of the timing of treatment and distance to the border of the protected area, we focus on the amount of local land area where development could be restricted by the ESA. We construct a county-year level dataset on the amount of land under the purview of the ESA. Explicitly, we calculate the sum of the number of acres that are part of SHs or CHs. We either count the unique acres in each category or allow the double-counting of overlapping acres. Counting the total, not necessarily unique, acres allows us to capture potential increases in treatment intensity if multiple protected species that occupy the same habitat increase the probability of action by the FWS that could delay development. To account for how acres in more densely populated areas might be more affected, we use population weights when constructing the different acre totals (see the Online Data Appendix for more details on the construction of these data).

8.1 Evaluating Changes to Housing Supply Using Construction Permits

Aggregate construction activity might decline if more species become protected in a locality and those restrictions prove binding. We use data on total construction permits and find no relationship between county acres that are habitats of protected species and total permits issued. Figure 10 shows binned scatter plots for the logged number of construction permits, level of permits, or permits per capita (per 1,000 people), versus the total (not necessarily unique) acres of SHs. We summarize the data as either the permits versus acres in a given year, by bin, or the first differences of permits versus the first differences of acres.

Across the three ways we use the number of permits data (logs, levels, or rates), we fail to detect a sharp and meaningful gradient where potential higher ESA treatment intensity is correlated with lower construction activity. Most of the distribution of the permits versus acres in a given year is a flat slope. If anything, construction permit numbers increase near the top end of total SH acres (see Online Appendix, Figure A31 for a comparison using unique acres). An alternative way to examine this relationship is to look at the changes, in first differences, in permits and protected acres. We summarize those first differences in binscatters; in these figures, we observe negative slopes, yet their magnitude suggests modest impacts. For logged permits and permit rate, the magnitude of change is bounded by less than 0.1 standard deviation of the logged permits, or permit rate. In levels, the slope is steeper, reflecting a change of about 0.3 standard deviations.

Land markets might respond to intensifying protections with a delay, making it harder to observe an effect on construction activity in the first differences approach. To account for responses that occur over longer time horizons, we repeat the first differences approach for second up to fifth differences in the Online Appendix, Figure A32. When we examine fourth and fifth differences (permits and protected acres today relative to four or five years ago), we observe slopes that are four to five times larger than in the first differences case—as high as 0.5 standard deviations. However, interpretation becomes more challenging as the measurement spans longer time horizons. At best, these results provide suggestive evidence that over the time scale of years, growing ESA protections can suppress, on average, construction activity by nontrivial magnitudes.

8.2 Evidence for Potential Delays Using ACE Permits

The ACE, like all federal agencies, is required to consult with the FWS before it issues development permits. The ACE makes it clear that no construction work may commence "until a permit has been issued by the Corps that the requirements of the ESA have been satisfied."[13] For example, in 2021, the ACE revoked a permit for housing developments in Trestle Creek and Lake Pend Oreille, Idaho. It was issued in 2009, but after a lawsuit, the

[13] See the ESA section on the ACE website for more details: https://www.nww.usace.army.mil/Business-With-Us/Regulatory-Division/Permit-Processes/ESA-Endangered-Species-Act/. Accessed: August 5th, 2023.

ACE determined that canceling it was warranted because it jeopardized the habitats of the bull trout (a fish species listed as threatened since 1999). The developers could still apply for a new permit, but that would require a full environmental review, an environmental impact statement, public interest review with a period open for public comments, and a full consultation with the FWS.[14]

A landowner who applies for a permit from the ACE faces uncertainty about the type of permit they will obtain, if at all, and how long it will take. ACE's first decision is whether an application for a permit falls under an exemption. Starting in 2002, the ACE has issued fewer permits, as more applications have been granted exemption under different categories.[15] If the application is not found to be exempt or denied, a permit can be issued as either a Letter of Permission or Standard Permit (see the Online Data Appendix for more details on the permit types). The specific permit action is an important feature of how ACE permitting might change as a result of additional ESA protections. In Figure D5, we summarize the secular trends in the total number of permits, by decision outcome, and by permit type.

Binding ESA protections could lead to higher permit denial rates and a shift toward longer review times and approvals with added stipulations. Standard permits result in longer, well above 120 days, approval processes relative to a letter of permission. In addition, permits issued with special conditions might involve costly compliance costs.

We modify the method of counting habitat acres that we used for total construction permits in two important ways. First, we allow all species, not just the not solely aquatic species, to contribute. Second, we narrow the spatial extent in each county in which we

[14] For more details, see: https://www.khq.com/news/idaho_news/army-corps-stopping-housing-development-on-lake-pend-oreille/article_d283429c-3aba-11ed-8dee-e79e83376d1c.html. Accessed: August 5th, 2023.

[15] The ACE uses a set of guidelines, the nationwide permits, to offer exemptions from review in cases where the development is expected to have a "minimal impact the nation's aquatic environment." The ACE offers a summary that helps assess which activities or projects fall under the exemption or not. See https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Obtain-a-Permit/ for more details (Accessed June 13, 2024). As part of the 2002 nationwide guidelines, which updated the 1996 nationwide permits guidelines, the ACE made modifications to nine existing permit types and to six general conditions, while adding one new general condition (US Army Corps of Engineers 2002).

count the acres to a 10km buffer around lakes and rivers. These two changes mean that we are focusing on species whose habitats are in, or near, aquatic features, which might be relevant to the ACE when granting a permit. In other words, we construct a measure of protected acres that are more connected to the decision making process by only counting acres that are near water bodies. To distinguish this count of acres from the previous one, we refer to this as "near-water habitats."

The composition of permits issued by the ACE leans more toward private landowners and developers experiencing greater regulatory stringency due to higher levels of protected acres under the ESA. In Figure 11, we plot binned values for the percent of permits issued with special conditions, the percent of permits issued as standard, or the share of denied permits as a function of total species acres near-water habitats, in log points. All three panels suggest a convex relationship between listed acres and the share of permits that are likely to reflect higher costs and longer delays for developers. Online Appendix Figure A33 shows similar changes in the composition of permit type changes relative to unique, instead of total, acres. In addition, in Figure A34, we observe that the total counts of permit applications and permit denials are increasing with higher protected acres, yet the latter is increasing relatively more, leading to the observed higher share of denied permits.

8.3 Evidence for Potential Delays Using Individual Construction Permit Approvals

We examine delays in construction permits by using data on the time between permit application and approval dates. This provides the most direct measure of potential delay; however, we observe these permits only for a subsample of land markets and years. Our analysis relies on data we purchased from BuildZoom on new construction building permits (see Section 5 for more details). Each permit is geocoded and has a unique identifier, allowing us to calculate the time between its application and approval. Using the location and timing information for each permit, we classify it as inside or outside of the protected area and label it as filed before or after the proposed listing or designation rule.

We observe what we can interpret as weak, at most, evidence that would support longer approval time for new construction permits. In Figure 12, we plot similar regressions output as in Figure 6, only instead of using the logged sale price as the outcome, we use the number of days from application to issuance. In the two years after a proposed listing rule, we observe an increase of about 25 days, on average, inside the protected area (Panels a and c). However, those increases are noisily estimated and vanish once we extend the sample to five years after the proposed listing rule (panel e). CHs have no meaningful effect in the two years after the proposed designation rule (Panels b and d). In contrast, we do observe a spike in approval time of about 100 days inside the CH, but only when extending the sample to five years after the proposed designation (Panel f). As in the previous results for inside the CHs, these results reflect but a fraction, approximately 2 percent, of the total permits in the sample. Even when we examine the distribution of approval time, we fail to find a clear pattern of longer delays inside after protections are proposed (Figure A30) (as demonstrated by the similarity in the distributions marked by the red dashed and solid lines).

8.4 Evidence for Potential Delays Using Habitat Conservation Plans

Our analysis of construction permits as measured by the Census, ACE, and data from BuildZoom did not reveal reduced building activity, reflecting a null, on average. However, the composition of ACE permits suggested longer delays, which was sometimes supported by BuildZoom data. We test for other regulatory mechanisms through which the ESA might introduce compliance costs that require additional planning, which could delay projects.

To more accurately evaluate how the ESA might delay construction projects, we use data on Habitat Conservation Plans (HCPs). When a landowner seeks to develop land that is considered a habitat of a listed species, their project is likely to go under review by the FWS (see Section 3 regarding the federal nexus). The FWS might determine that the developer needs to obtain an incidental taking permit, which establishes mandatory steps for the landowner to reduce the damage that might occur to the species' habitat during development. The process to obtain such a permit requires an HCP.

In other cases, landowners might preemptively develop an HCP even before a species is listed. If their HCP is approved by the FWS, then they receive a "no surprises assurance." This means that if the species does become listed during development, they will not need to create a new plan or undertake any precautionary steps that were not outlined in the approved HCP. Landowners have referred to HCPs as "burdensome" (Murray 1997) and costly, especially for small landowners (Paulich 2010) and blamed the FWS for using negotiations and delays to reduce the approved level of development (Sheldon 1997). We use data on the time from the first initiated date of an HCP to its final approval from 1990 to 2019 and summarize the data as simple histograms in Figure 13.

On average, an HCP takes about five years. Although this is a long period, this simple mean hides important heterogeneity. Many HCPs take more than twice that time. In Figure 13a, we show that the distribution in years between HCPs for all land uses and construction projects is similar. Focusing on the latter, we find that projects that cover larger areas, request a longer duration for their incidental taking permit, and were initiated before 2001 take considerably longer (Panels b–d). For example, projects above the median level of land covered or permit duration rarely get approved under four years and average two years more for planning periods (Panels b and c). We document small, if any, differences in approval periods between animals and plants, aquatic and nonaquatic species, species listed as endangered relative to threatened, or species that ever receive a CH designation (Panels e–h).

Evidence on the compliance costs involved with an HCP is scarce. A notable example is a detailed review by Surrey et al. (2022) of 43 plans. They calculate that ESA compliance costs reflect at least 77 and up to 97 percent of total projected HCP costs. Their review summarizes that the median small-scale plan has costs of about $4 million, and a large-scale plan has a median cost of $100 million. The largest cost item, by an order of magnitude, is restoring and/or purchasing of habitat to mitigate damages from the proposed development. Construction sectors have considerable heterogeneity; the real-estate development sector has by far the highest median cost at close to $180 million—larger by one or two orders of magnitude. In short, HCPs present a substantial challenge to land developers in terms of both the time it take to compile and approve them and the compliance costs.

9 Conclusions

We compile a new national data set and use it to evaluate how land markets respond to protections on species under the ESA. Our main findings recover how listing and designation decisions affect property sale prices. On average, the listing of species under the act results in small noisily estimated reductions in sale price inside the habitat range of the species, while designations of critical habitats mostly lead to price increases right outside the protected area—in large part because the border is drawn right where the volume of transactions was already low. We find considerable heterogeneity in these average effects across sub-groups in which the ESA restrictions might be more binding, as well as dispersed distributions of species-specific effects. These findings advance our understanding of the impacts of the ESA over the past decades across the contiguous US. The fact that we observe several cases where prices respond meaningfully to ESA protections validates the importance of papers that study individual species listings and designations, however, those estimates need to be interpreted against the more muted distribution of ESA treatment effects.

We supplement the sale price analysis by descriptively summarizing how construction permit activity correlates with more land under ESA statutory protection, and find suggestive evidence that while the amount of construction is not changing, the ESA might be delaying construction activity. These findings corroborate more anecdotal sentiments expressed in policy circles and popular writings about the ESA. Further research is needed on how land developers respond and adjust to ESA-based restrictions on land use. Further work is also needed on how the ESA is implemented and enforced in different locations, and how ESA implementation changes over time, is an important avenue for future research in economics and policy/law. We also note that for a proper benefit-cost analysis, one requires credible estimates of the benefits of species protection. This is a challenging, but most important area of applied research going forward.

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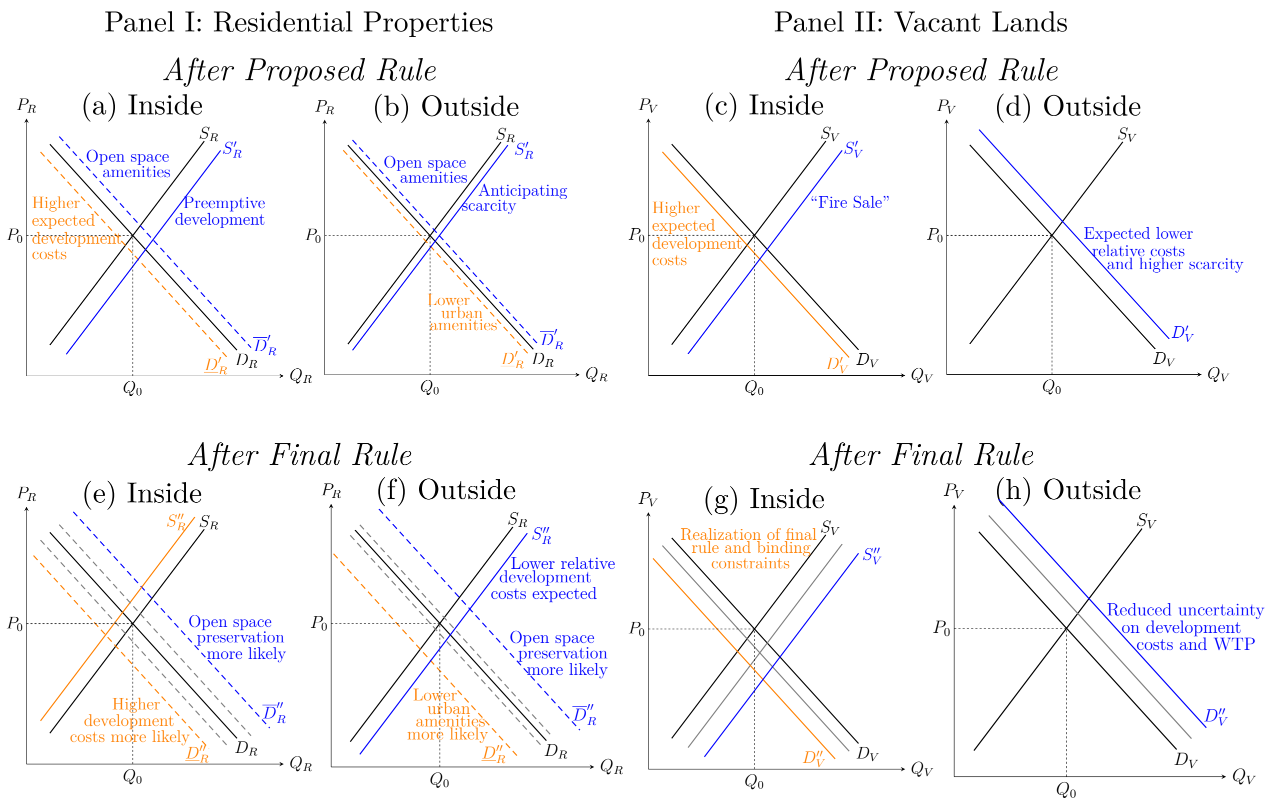
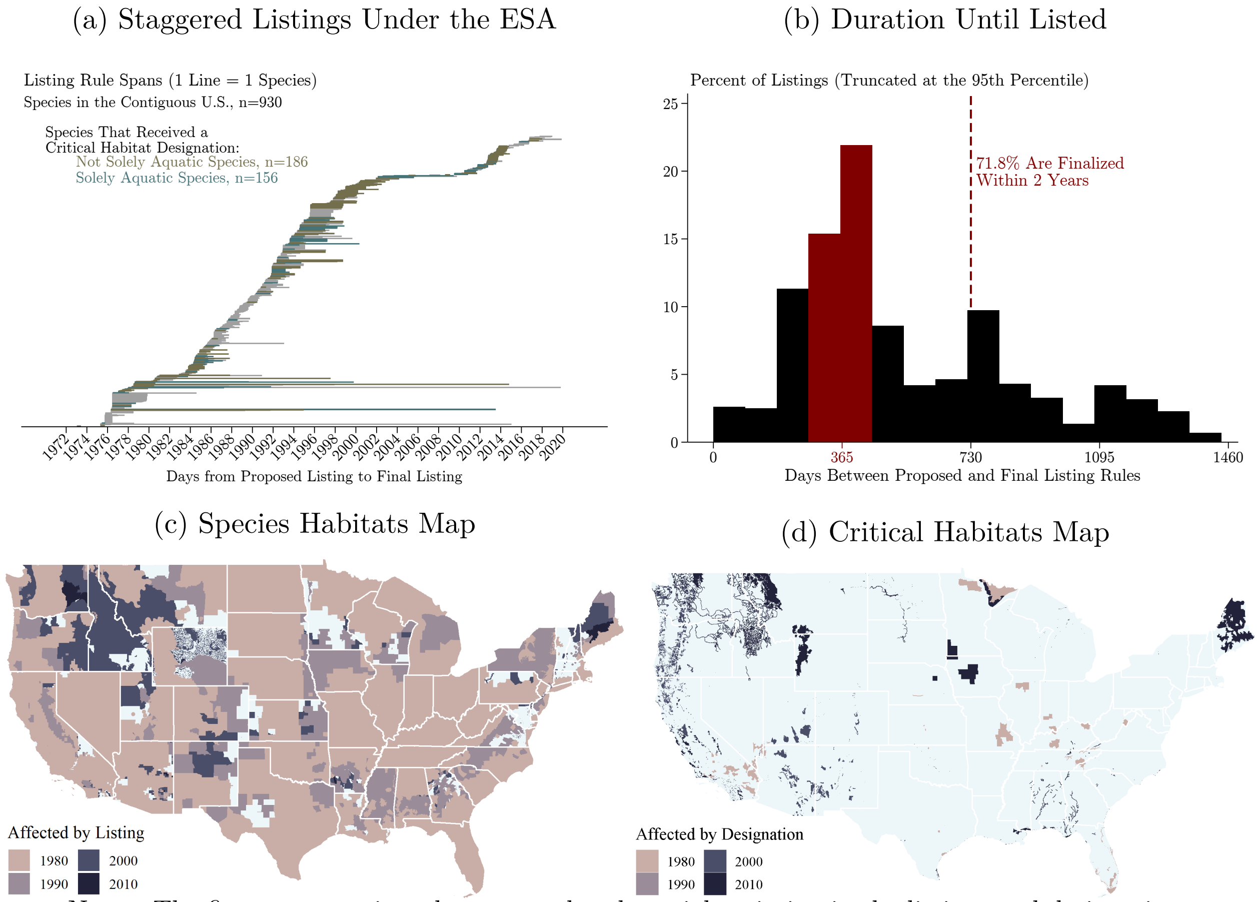
Figure 1: Theoretical Framework for Evaluating the Effects of Proposed and Final Rules



Notes: Each subpanel summarizes the theoretical predictions regarding the effects of statutory protections by the ESA. We consider how the effects could be different for either residential properties or vacant lands, after the proposed or final rule, inside or outside the protected area. In each subpanel, the solid black lines depict the equilibrium in the market prior to any proposed rule for ESA action. Solid blue lines denote a shift outward of either supply or demand, and yellow solid lines denote an inward shift. We use dashed line to denote ambiguity about the direction of the change (e.g., in Subpanel (a) where demand can either increase or decrease). To highlight the potential intensification of effects after the proposed rule, we use gray lines, dashed or solid, in the post-final-rule period to denote the location of the supply and demand curves in the post-proposed-period (e.g., in the change from (a) to (e), where demand curves shift more inward or outward, depending on the direction of the effect).

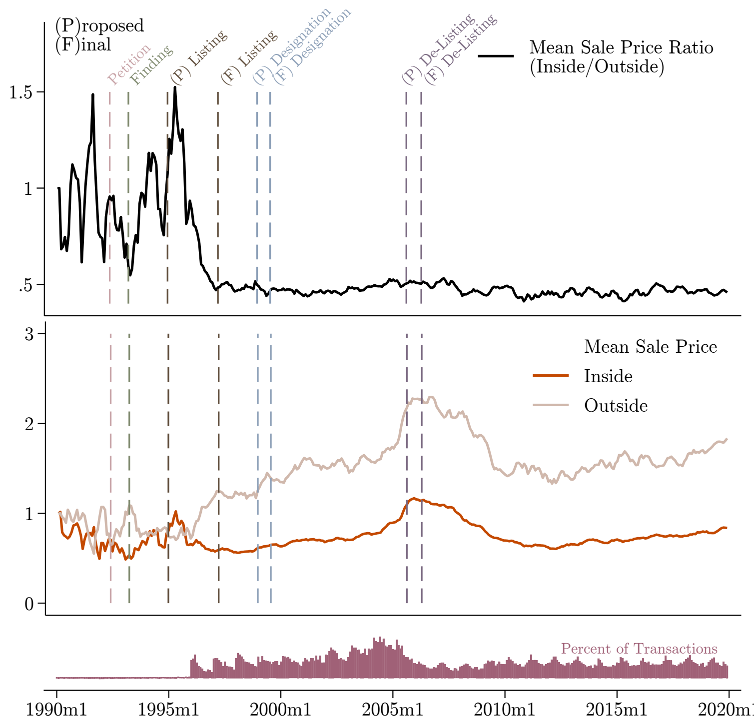
Figure 2: ESA Listings & Designations in the Contiguous United States



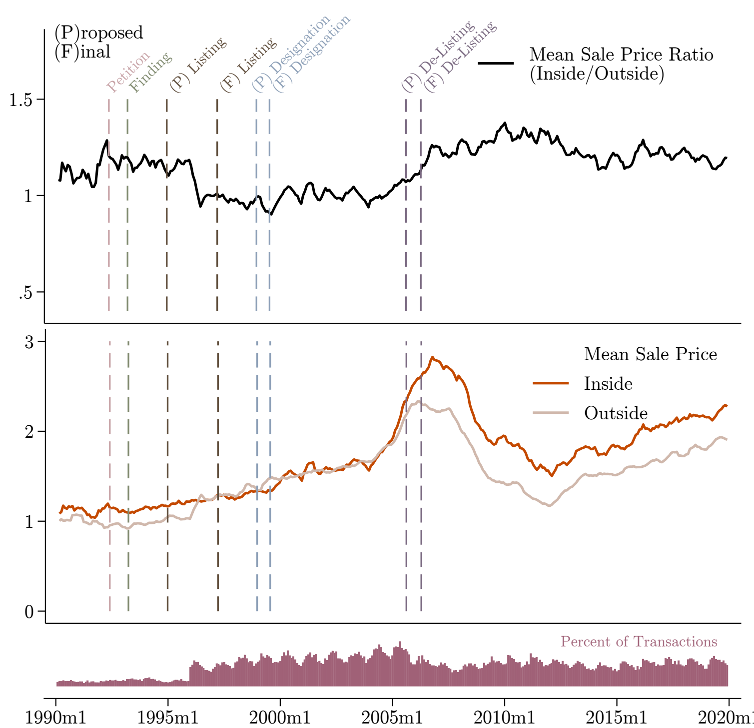
Notes: The figure summarizes the temporal and spatial variation in the listings and designations under the ESA. (a) The staggered phasing of species into protections, and the time in between their first proposed rule to list, and the final rule that confirms the listing, and awards statutory protections. Each line begins and ends on the date of the proposed and final rules for a specific species. (b) Summary of the duration between listing rules, truncated at the 95th percentile. (c) A map of habitat areas, by decade of their final rule, after excluding habitat areas that cover more than 99 percent of a state's land area. (d) Same as (c), only for critical habitats.

Figure 3: Temporal & Spatial Dimensions of the ESA: The Pygmy Owl Case Study

(a) Species Habitat



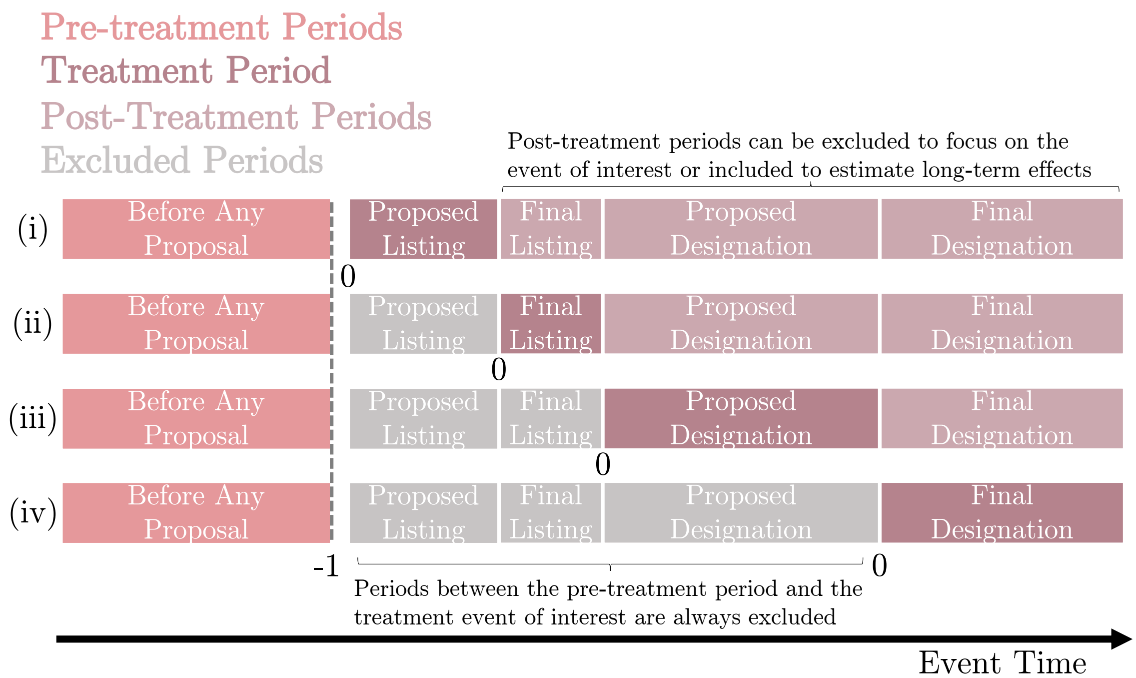
(b) Critical Habitat



Notes: Prices of residential properties in 2019 USD, normalized relative to January 1990. These prices are truncated at the 99th percentile, of which we take a 6-month moving average. Vertical dashed lines denote important ESA events related to the pygmy owl.

Figure 4: Schematic Research Design for Staggered Treatments

(a) Potential Comparisons Based on Fish and Wildlife Service Actions



(b) Example: Two Species, Case (ii)

Calendar Time	1	2	3	4	5	6	7	8	9
Species I	B	B	B	P	P	P	F	F	F
Species II	B	B	P	P	F	F	F	F	F
Event Time	-3	-2	-1				0	1	2
Species I	B	B	B	~~P~~	~~P~~	~~P~~	F	F	F
Event Time	-2	-1			0	1	2	3	4
Species II	B	B	~~P~~	~~P~~	F	F	F	F	F

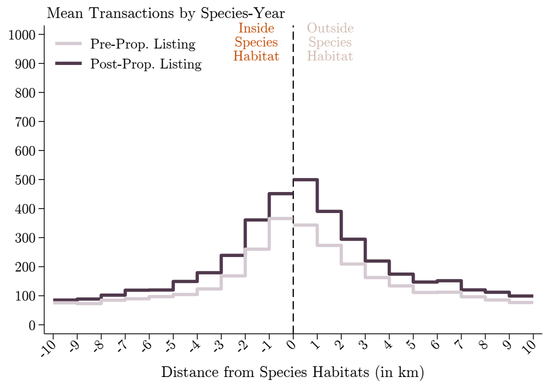
Notes: These figures summarize how we align ESA events in event time. First, we count the time up to the proposed listing of the species as negative event time. We treat these as the pretreatment periods. We then focus on a specific ESA event, such as a final listing or proposed designation, and count periods following the event as positive event time. Any periods between the first proposal to list or designate and the ESA event of interest are excluded them from the regression. Because species vary in their duration spent in each status, each event block is of a different length. See text for more details. Panel (a) shows the four possible comparisons we can make for each species based on the listing and designation events as determined by the Fish and Wildlife Service. Panel (b) shows an example of case (ii) from panel (a) for two species, where we focus on the effect of the final listing (F). We recenter before any proposal (B) and exclude the time periods where the species have a proposed listing status (P).

Figure 5: Number of Residential Property Transactions Around Habitat Borders

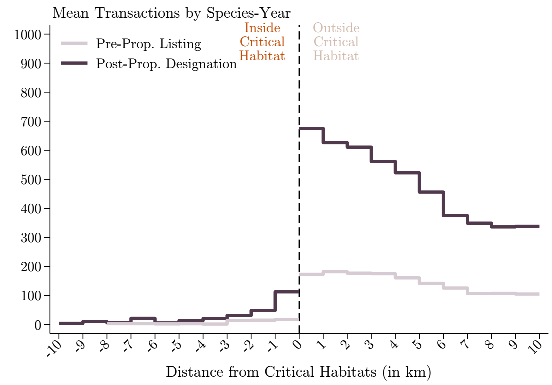
Species Habitat **Critical Habitat**

Residential Properties

(a)

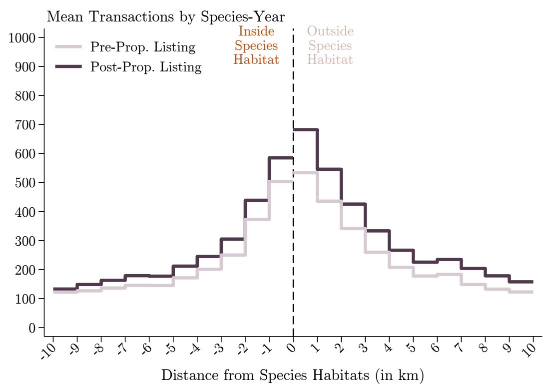


(b)

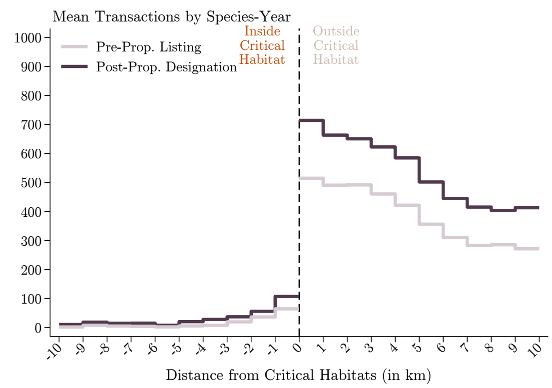


Vacant Lands

(c)



(d)



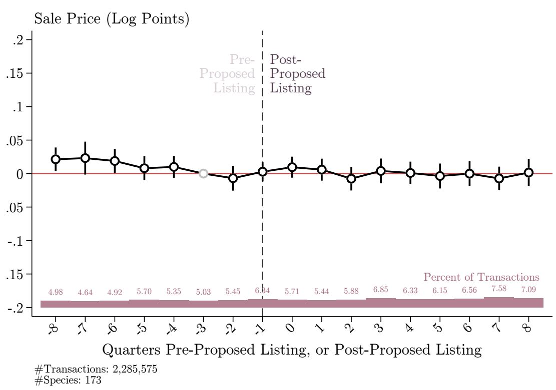
Notes: The figures summarize the number of transaction around the border of the species and critical habitats (CHs) before the listing proposal and after the final listing (SHs) or final designation (CHs). For residential properties and not solely aquatic species, we plot the transaction counts normalized by the number of species and the number of years of data available for before and after the proposed and final rules.

Figure 6: Proposed Listing & Designation Effects on Residential Properties in CONUS

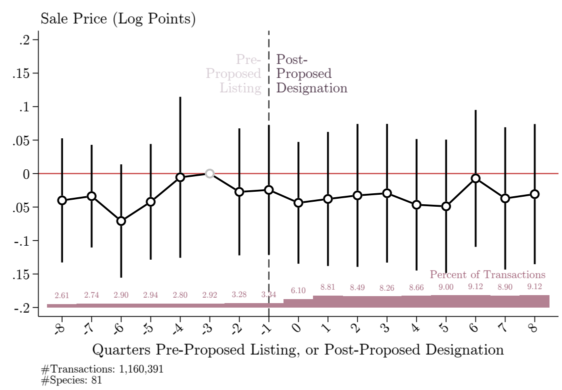
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

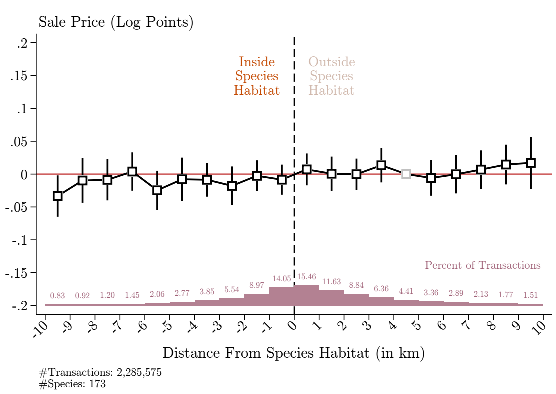
(a) Staggered DD



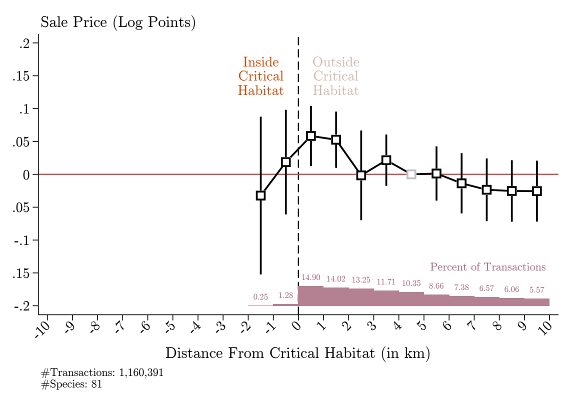
(b) Staggered DD



(c) Spatial DD

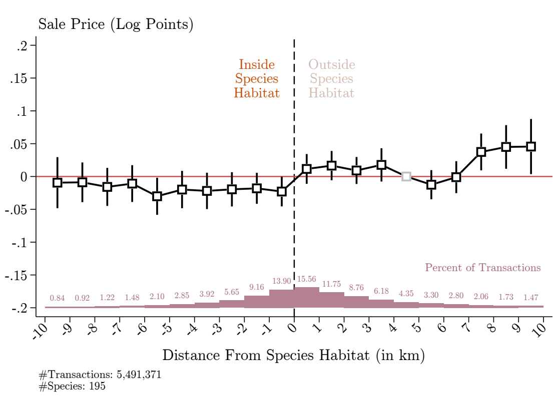


(d) Spatial DD

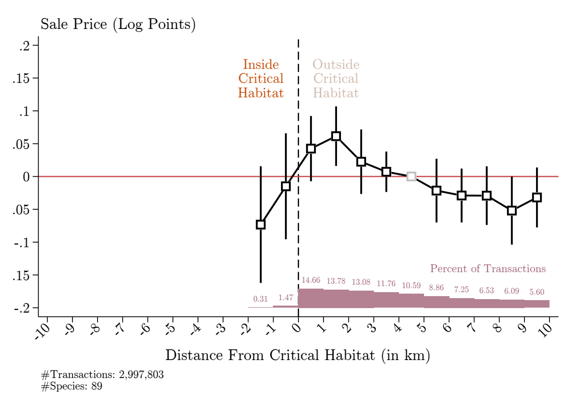


Five Years Before & After Proposed Rule

(e) Spatial DD

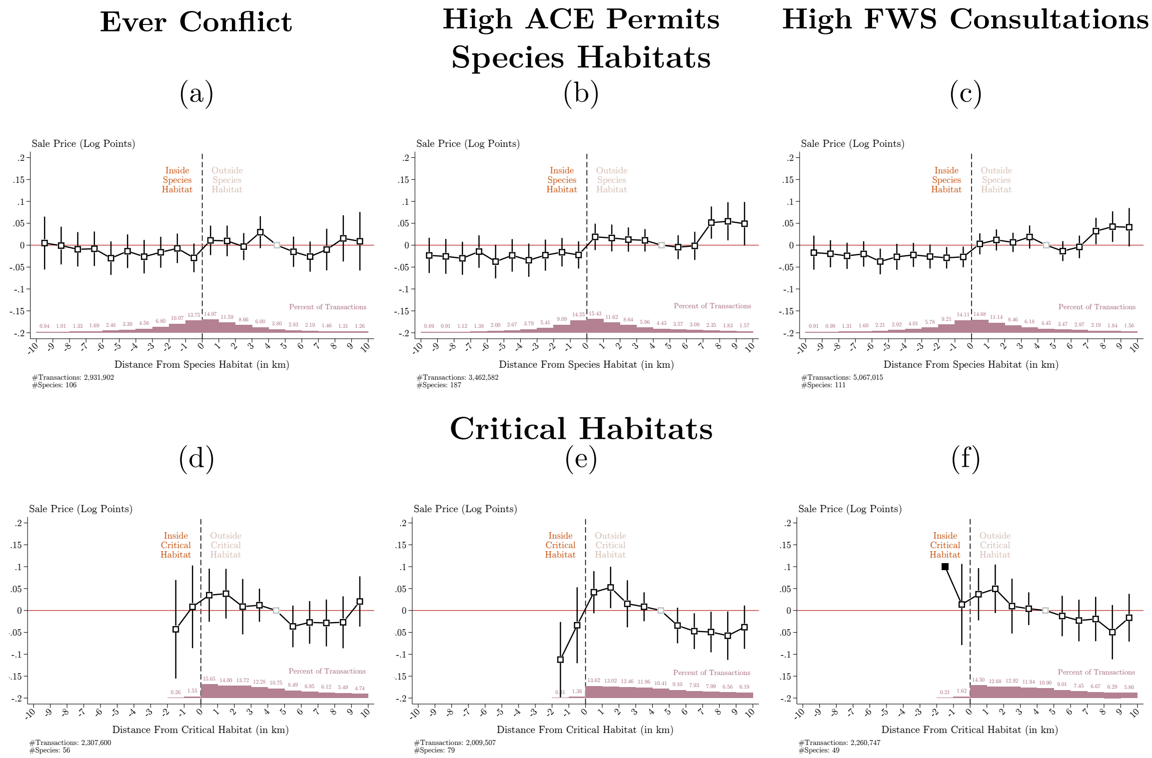


(f) Spatial DD



Notes: Coefficients and 95 percent CIs from Equations (1) and (2). The sample includes all transactions for properties 10km from the border of a species or critical habitat. Each regression includes ZCTA, species, listing history (see main text), controls for total number of rooms and area quintiles, as well as sample year and calendar month by FWS region fixed effects. Standard errors are clustered at the ZCTA level.

Figure 7: Proposed Listing & Designation Effects on Residential Properties in CONUS for Subgroups



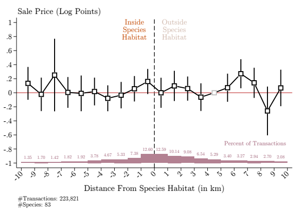
Notes: Same as in Figure 6, only for the five years before and after the proposed rules and subsamples.

Figure 8: Proposed Listing & Designation Effects on Vacant Lands in CONUS for Subgroups

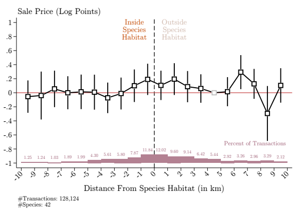
Residential Vacant Lands		Non-Residential Vacant Lands	
Full Sample	**Ever Conflict**	**Full Sample**	**Ever Conflict**

Species Habitats

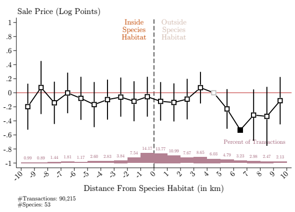
(a)



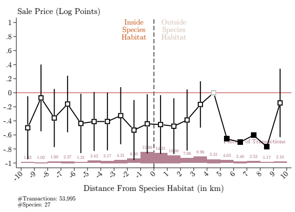
(b)



(c)

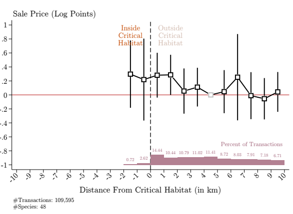


(d)

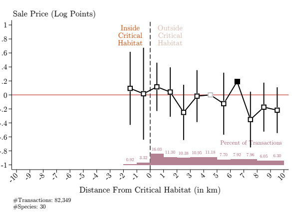


Critical Habitats

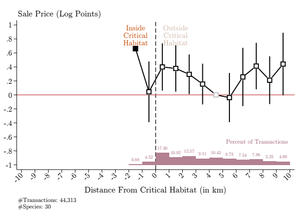
(e)



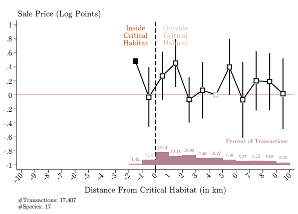
(f)



(g)



(h)



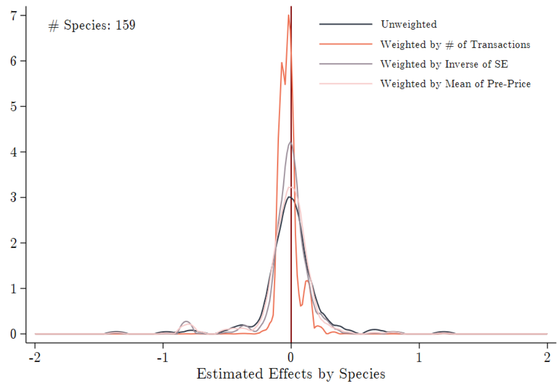
Notes: Same as in Figure 6, only for vacant lands instead of residential properties and using the five years before and after the proposed rules for the full sample and the ever-conflict sample.

Figure 9: Proposed Listing & Designation Effects on Sale Prices by Species

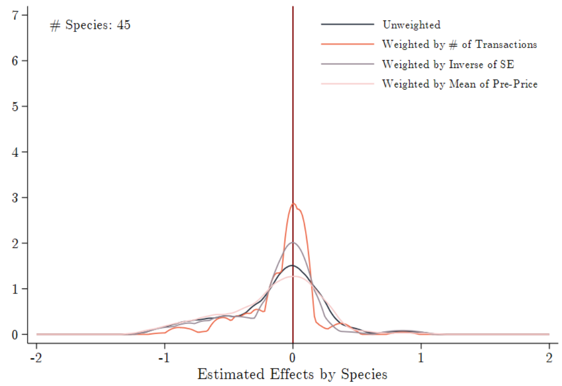
SH **CH**

Residential Properties

(a)

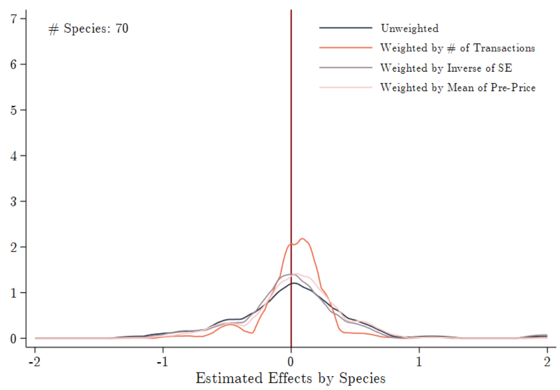


(b)

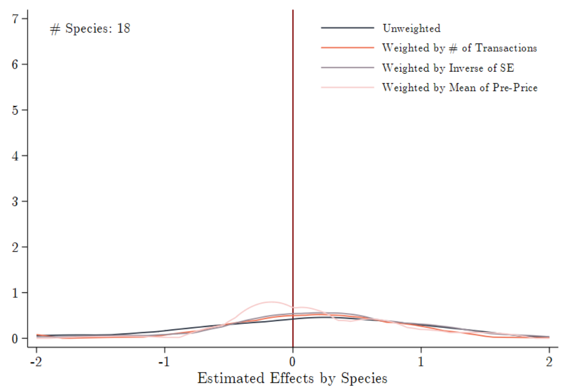


Residential Vacant Lands

(c)

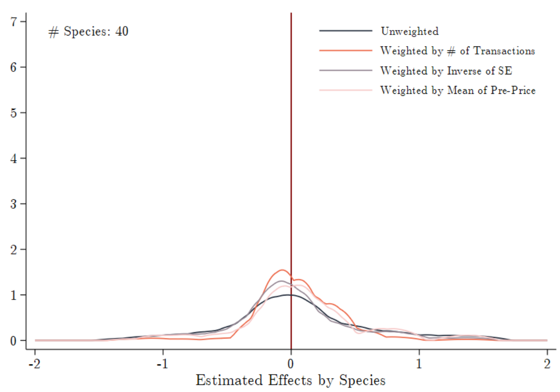


(d)

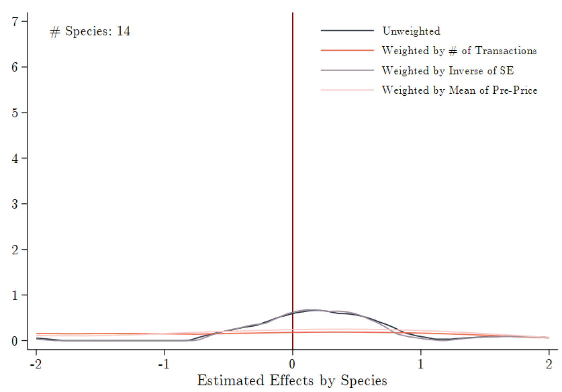


Non-Residential Vacant Lands

(e)



(f)

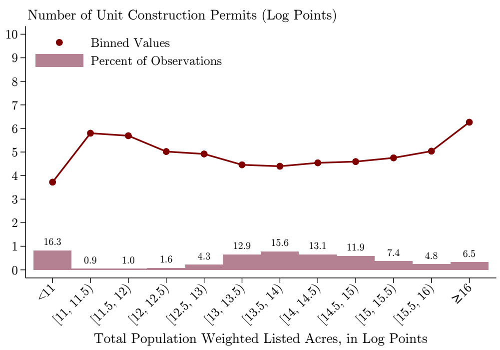


Notes: We plot kernel densities of coefficients obtained from estimating Equation (3), for the logged sale price, and interacting the post-inside coefficients with a species dummy. The sample spans five years before and after the proposed listing (for SHs) or the proposed listing and proposed designation (critical habitats). For easier visual inspection, we truncate the distributions at ± 2.

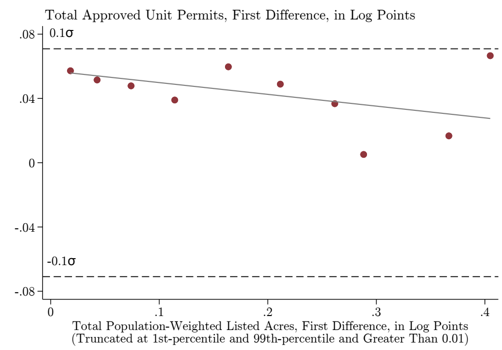
Figure 10: Construction Permits & Protected Acres

Logs

(a) Total Listed Acres

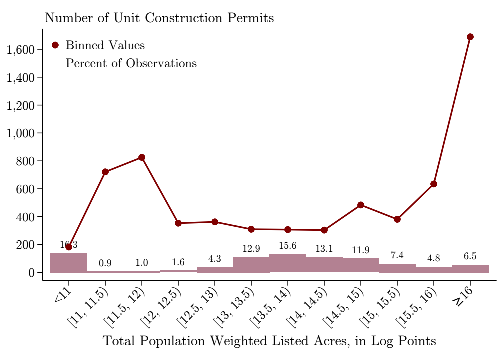


(b) Δ Total Listed Acres

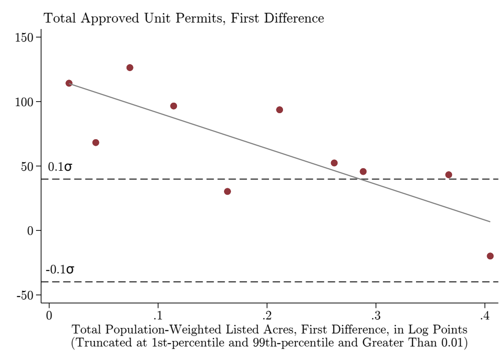


Levels

(c) Total Listed Acres

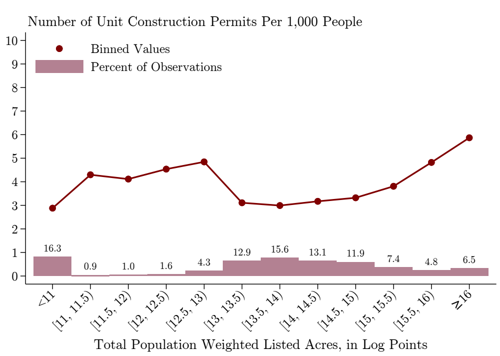


(d) Δ Total Listed Acres

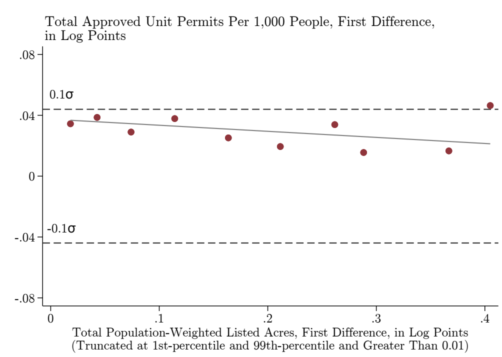


Rates

(e) Total Listed Acres



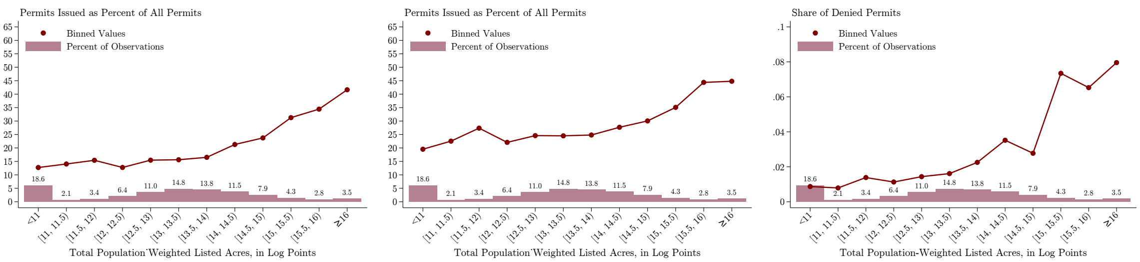
(f) Δ Total Listed Acres



Notes: Panels in the left column summarize construction permits (in logs, levels, and per capita rates) relative to the logged value of the total number of SH (population-weighted) acres, in equal-interval bins. We bottom- and top-code the bins at 11 and 16 to allow for easier visual inspection. Panels in the right column summarize the first differences of permits and protected acres using equal-density bins. We plot bounds of 0.1 standard deviation around zero on the y-axis to allow for easier interpretation of the slopes.

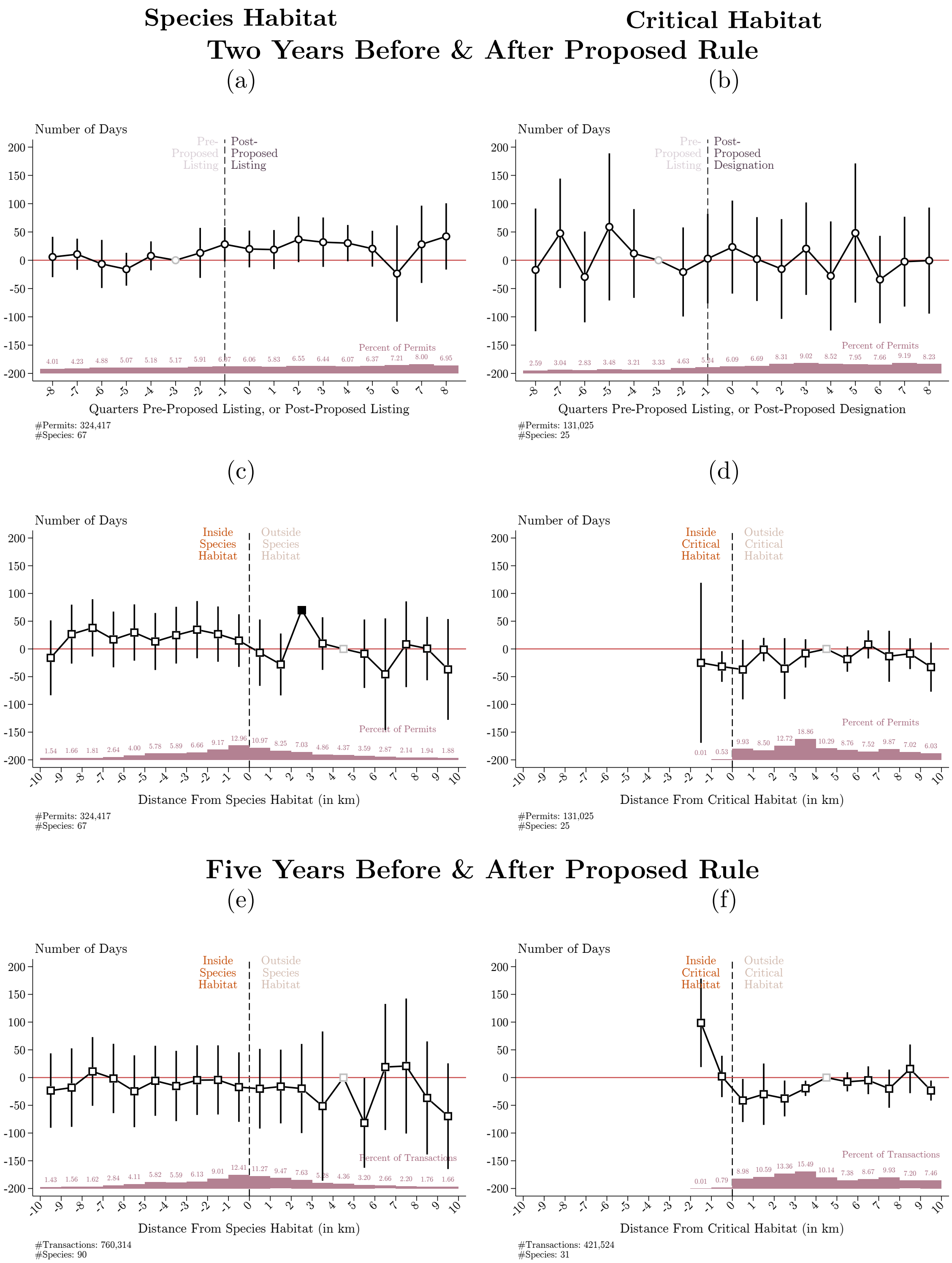
Figure 11: Army Corps of Engineers Permits in Near-Water Habitats

(a) % Special Conditions (b) % Standard Permits (c) Share of Denied Permits



Notes: Data at the county-year level for 2,839 counties, on permits issued by the Army Corps of Engineers (ACE) as a function of total listed SH area, weighted by population. We plot the composition of permits, measured as the percent, relative to all issued permits, of permits issued with special conditions (the action taken by the ACE), as permits issued as standard permits (the permit type issued by the ACE, which involves a longer processing period of approximately 120 days), or the share of permits that were denied.

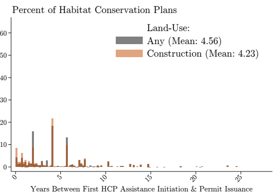
Figure 12: Proposed Listing & Designation Effects on Building Permits in CONUS



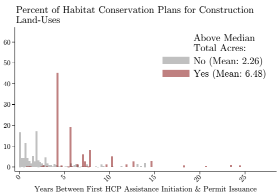
Notes: Same as in Figure 6, but instead of the outcome of the logged sale price, we use the outcome of the number of days between a construction permit application data and its issuance date.

Figure 13: Potential Delays From Habitat Conservation Plan Approvals

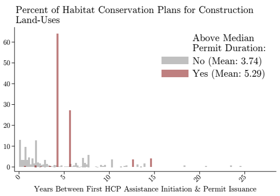
(a) Land-Use



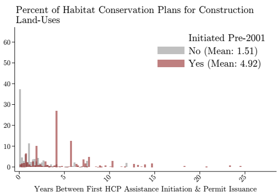
(b) Total Acres



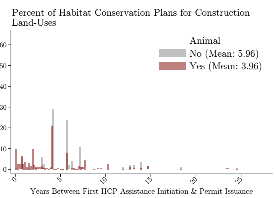
(c) Permit Duration



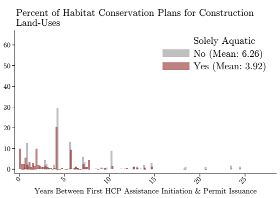
(d) Initiated Pre-2001



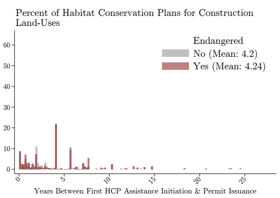
(e) Animals VS. Plants



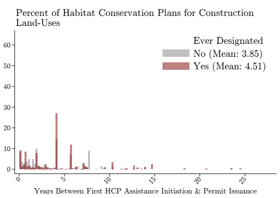
(f) Solely VS. Not Solely Aquatic



(g) Endangered VS. Threatened



(h) Designated Critical Habitats



Notes: The years between the first documented date and the approved date of a Habitat Conservation Plan.

Online Appendix

A Additional Results

A.1 Estimating Changes in Transaction Counts

In the main text, we plotted raw data on the mean number of transactions around the protected area border, before and after proposed rules for listing and/or designation (see Figure 5). Here, we examine in more detail how the volume of transactions changes around the border. In Figure A1, we present spatial DD results that use either the transaction rate or a dummy for nonzero transactions. In both cases, the unit of observation is the ZCTA, and we aggregate transactions at the quarterly level. We define the transaction rate as the number of transactions in a given ZCTA-year-quarter, normalized by the mean number of transactions in the ZCTA for two years before the proposed listing date. The transaction rate captures changes in the intensive margin, relative to the local baseline volume of transactions. In contrast, the dummy for nonzero transactions captures the extensive margin regarding construction and land market activity.

We observe higher transaction rates around the border of SHs, on both sides of the border. However, we observe a higher likelihood of nonzero transactions outside of the border or right inside of it within the first distance bin. Right outside, the likelihood of more than zero transactions in a ZCTA-year-quarter is about 0.05 percentage points higher, reflecting a 20 percent increase relative to the mean. These results do not change meaningfully if we allow the sample to span four or 10 years around the proposed listing rule, but the relative effect size shrinks by about half as the mean value of the nonzero transaction dummy doubles from 0.025 to 0.052. For critical habitats (CHs), we observe higher transaction rates and a higher likelihood of nonzero transactions in the 0–4km outside. Right outside, we observe transaction rates that are higher by a value of five, relative to a mean transaction rate of about 45. Inside, those transaction rates drop by 5. Similarly, we observe slight increases in the likelihood of nonzero transactions outside the CHs but sharp drops inside the CHs. The results for CHs are more precisely estimated in the shorter four-year window but qualitatively similar in the 10-year sample.

A.2 Robustness Checks for Main Estimation Samples & Specifications

We present a series of figures where we replicate the main analysis we summarize in Figure 6. In each subsequent figure, we make changes to the sample, specification, or pre- or posttreatment definition. Each change is meant to address a potential concern or test for the sensitivity of the results to changes in the baseline choices we report in the main text.

A.2.1 Variations to the Treatment Onset Events

We begin by changing the pretreatment definer to allow for earlier treatment onset. Instead of using the proposed listing rule, as we do in the main text, we define the end of the pretreatment period as the earliest of the petition to list a species (if a petition was submitted), a lawsuit against the FWS that challenges a decision not to list a species (if such a lawsuit was filed), and the proposed listing rule. We refer to the earliest of these three potential events as the "first ESA event." We keep the posttreatment event as either the proposed listing rule (SHs) or the proposed designation rule (CHs).

In Figure A2, we observe that prices around the SH border respond earlier, with a 2.5 percent drop, on average, in the sale price inside, following the first ESA event (Figure A2a). This negative effect on prices is more precisely estimated than what we report in Figure 6a. However, we do not observe the same precisely estimated negative effect for SH in the spatial DD regressions (Panels c and e), especially when we allow the sample to extend to five years before and after each event. For CHs, the estimation is much noisier, but we observe the same key pattern as before: sale prices increasing right outside the border.

Years can elapse between petitions and proposed listing rules. In Figure A3, we modify the first ESA event to focus on either a lawsuit or proposed listing rule but do not allow petitions to count as a treatment onset event. The only meaningful difference we observe is for SHs: larger and more precisely estimated reduction in the sale price inside in both the staggered and spatial DD. We further test how lawsuits might affect the sale price by reporting estimation results only for the species that had an action-forcing-lawsuit before their proposed listing rule. This is a small subset of species (e.g., only 26 species in the SHs case relative to 173 species in the full sample). In Figure A4, we report that prices around the border of the SH begin to drop right after the lawsuit, by as much as 5 percent. The sample size is much smaller in the case of CHs, making the estimation results too noisy to interpret meaningfully.

In the main text, we use the proposed listing or proposed designation as the post-treatment onset event. In Figure A5, we use the final listing for both the SHs and CHs as the posttreatment onset event. We find similar results as those in Figure 6.

To allow for easier comparison of the species and CHs results, we also produce a set of results for CHs where the pretreatment and posttreatment defining events are both the proposed listing rule—the same as for SHs in the main text. In Figure A6, we first plot the set of results for the staggered and spatial DD using the four-year time window and then for the spatial DD using the 10-year time window. We observe a similar increase in sale prices outside of the CHs when we include transactions that occur up to five years after the proposed listing rule, albeit with less precisely estimated increases. In some cases, the proposed listing rule and the proposed designation rule have the same date. Other cases have considerable delays (in years) between the two. In an additional set of results, we repeat this estimation but only for species that had at least two or five years between the proposed listing and designation rules. The results in the four-year sample remain noisy and hard to interpret, but in the 10-year sample, we observe a clear pattern of higher sale prices outside the CH. We do not see a decline in sale prices inside the CH, but those coefficients are extremely noisy.

In Figure A7, we continue to use proposed listing as the treatment onset but focus on the 10-year window and report results for the three subgroups of interest of ever-conflict species, high ACE permits, and high FWS consultations. In the ever-conflict and high-ACE-permits subgroups, we estimate similar increase in sale prices outside the protected area, but more importantly, we also estimate precise increases in sale prices *inside* the CH (Panels d–f). This is noteworthy because the treatment onset event is the proposed listing period, for species that had at least five years between their proposed listing and designation rules. This result further supports the notion that land markets anticipate future land-use restrictions around the edge of current development, and lands are bought to potentially develop them before statutory protections are awarded. However, the number of species in each comparison is much lower than in the full sample because not many have five years between proposed listing and designation rules. For completeness, we also report the spatial DD analysis using proposed listing rule as the treatment onset for vacant lands around CH borders in the 10-year window sample in Figure A8. Overall, the results remain noisy but show higher sale prices outside the protected area for the vacant nonresidential lands and imprecisely estimated higher sale prices inside the CHs for both types of vacant lands.

A.2.2 Varying the Composition of Transactions or Species

In the variations reviewed thus far, we focused on changing the timing of the treatment onset. Next, we turn to results that change the composition of transactions. In the main text, we use all transactions, both existing and new construction. However, new construction homes might exhibit a different response. We already observed that the number of transactions changes around the borders of protected areas (Figures 5 and A1). In Figure A9, we repeat the main estimation as in Figure 6 but focus on sales of new construction properties. The sample has an order of magnitude fewer transactions when focusing on new construction properties. This also means we observe about a third of the listings and designations relative to the full sample. This sharp drop in land markets, species, and number of transactions limits what we can study with respect to new construction specifically. It is perhaps then not surprising that the results are very noisy, especially for CHs. However, for CHs, we also see no increase in sale prices outside the border but large and precisely estimated declines of about 10 percent in the sale prices inside. For completeness, we also report the results from the complementary sample of existing homes (not new construction properties) in Figure A10, where we observe effectively the same results as in Figure 6.

In the main text, we did not separate species listed as threatened from those listed as endangered. Although the letter of the law does allow for stricter restrictions regarding land use for endangered species, in practice, the two categories end up receiving almost identical treatment by the FWS. In Figures A11 and A12, we estimate two separate sets of results for endangered and threatened species, respectively. Two key differences arise for the results around the border of SHs. First, for endangered species, we observe some evidence of a downward trend before the proposed listing rule, which is reversed after the proposed listing rule (Figure A11a). In the 10-year window sample, we estimate imprecise increases in the sale price right outside of the SH (Figure A11e). Second, for threatened species, we observe a clear drop of about 5 percent in the sale prices of properties inside the SHs, following the proposed listing rule—but only in the sample where we include transactions up to five years after the proposed listing (Figure A12e). For CHs, the results for endangered and threatened species are relatively similar, although we lose some statistical power and have noisier estimates when separating the two cases.

In one final check for the sensitivity of the results for the composition of species, we include crustaceans. In the main text, our focus is on not solely aquatic species—that is, species whose habitats are at least somewhat terrestrial. We classify crustaceans as solely aquatic because although they can live outside water, they tend to habitat in coastal areas, around water. Unsurprisingly, including them does not change the estimated results, as only eight such species appear in our data (after applying the other data filters discussed in the data section and the Online Data Appendix). We present those results in Figure A13.

In addition to changing the species, we also examine how changing the geographic extent affects the results. In the main text, we use transactions of properties and vacant lands in both urban and rural areas. In Figure A14, we validate that our sample is mostly comprised of property transactions that occur in urban locations. We use the US Department of Agriculture 2023 Rural-Urban Continuum Codes to classify counties as metro (urban) or non-metro.[16] The results that focus on metro areas are nearly identical to those we report in Figure 6 because the transactions are located almost entirely in metro areas (e.g., for SHs, the metro area subsample reflects 96.1 percent of the full sample).

A.2.3 Variations to the Baseline Regression Specification

In the main text, we report results that include year and month fixed effects that we allow to vary by FWS region, along with ZCTA fixed effects, while clustering at the ZCTA level. Here we present results for the spatial DD using the 10-year time window, with the same treatment onset definitions as in Figure 6, but we change either the fixed effects or clustering level of the standard errors.

We change the baseline fixed effects in three ways. First, we allow the year and month fixed effects to vary by state instead of FWS region. This nests the FWS fixed specification and allows more flexible control for time trends and seasonality that might be different between states within the same FWS region. Second, we replace the temporal fixed effects with FWS-by-year-by-month fixed effects. This nests the original specification but allows for more granular changes within the year and for evolving seasonality. Third, we use the baseline temporal controls but include census tract fixed effects. This nests the ZCTA fixed effects but allows for more granular control for time-invariant characteristics that might be different between census tracts within the same ZCTA. We find no meaningful differences in these results (Figure A15) relative to those in the main text.

We change the clustering level to either the county or species levels. The justification for

[16] For more details, see: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/. Accessed: November 15, 2023.

clustering the standard errors at the ZCTA level is that we expect transactions to have strong serial correlation and to be exposed to similar shocks within neighborhoods, which ZCTAs offer a good approximation of. A more conservative approach is to cluster at a higher level, such as city or town, or even at a higher level, such as the county. Alternatively, if we are worried that shocks are mainly correlated through the channel of FWS decisions, we could cluster at the level of the species, allowing standard errors to be more flexibly correlated across ZCTAs or even counties. From the results in Figures A16 and A17, we summarize that changing the level of clustering does little to the precision of the estimates.

A.2.4 Variations to the Definitions of Subgroups

In the main text, we explore heterogeneity across three main subgroups: (i) ever-conflict species, (i) high ACE permits, and (iii) high FWS consultations. For the second and third groups, we classify ZCTAs or species as having above-median permits or consultations, respectively. One concern is that the higher treatment intensity that is a result of higher permits or consultations arises more in the tail of the distribution. By using the median to classify the subgroups, we might attenuate the higher treatment intensity and mask important dimensions of heterogeneity. Here, we present results that use higher quantiles than the median (the 75th and 90th percentiles). We simply use the same data and process as in the main text but focus on ZCTAs or species that have even higher permits or consultations.

The coefficients we report in Figures A18 and A19 are larger than those in Figure 7. For SHs, for transactions that occur in locations with high ACE permits, we observe a higher appreciation right outside the border but nearly no change in sale prices inside of it (Figure A18 Panels a and b). For FWS consultations, we observe almost no difference when defining the high FWS subgroup as those above the 75th percentile (Figure A19a) but do observe larger price reductions inside the SHs when using the 90th percentile cutoff (Figure A19b). Unsurprisingly, the estimation results are not precisely estimated, as we are limiting the sample size. For CHs, for the high ACE permits and high FWS consultation subgroup, the effects in the more narrowly defined subgroups have larger magnitudes—higher increases outside and larger reductions inside—yet they are also more noisily estimated (Figures A18 and A19, Panels c and d).

A.2.5 Variations Using Repeated Sales Sample

In the main text, we do not require properties to be sold before and after the listing of species or designation of CHs. The main advantage of using repeated sales of the same properties before and after the treatment onset is that it allows for including property fixed effects, such that the residual variation is more plausibly narrowed down to the difference caused by the ESA protections. However, this often restricts the sample to a fraction of the total number of transactions.

In Figures A20–A22, we report estimation for a repeated sales sample around the SH border. We do so only for SHs because the sample size of repeated sales for CHs is far too small. In each figure, we report the estimation results for the same specification as in Figure 6 in the left column. To the right of each figure, we then report the estimation results of using the repeated sales sample and including a parcel fixed effect. Reporting both results side by side allows to easily compare whether changes in the results are due to the change in sample composition or in the specification.

In short, we find nearly no evidence of any meaningful changes in the repeated sales samples, regardless of when we choose the treatment onset (proposed listing, first ESA event, or first ESA event when excluding petitions). Drawing inferences from this exercise to the broader sample is challenging because the sample size goes down by two orders of magnitude (from over two million to just 40 thousand transactions).

A.2.6 Variations on the Outcome of Interest

Throughout the analysis, our focus has mostly been on the logged sale price of a transaction, or the number of transactions in an area. Here, we present results for variations that normalize the sale price by area or examine whether property characteristics change in response to ESA protections.

In Figures A23–A25, we report the estimation results when we first normalize the sale price by the parcel area and then transform it using the natural logarithm. We repeat the estimation using the proposed listing rule, the first ESA event, and the first ESA event when excluding petitions. Across all the area-normalized results, we fail to detect a clear change around the protected area border, following either of the three treatment onsets. The results are noisily estimated, especially in the case of CHs.

In contrast, if we use the living area (the constructed area of the house) instead of the parcel area, we observe similar patterns as when we use the logged sale price without normalizing by parcel area. In Figure A26, we similarly see prices increase outside of the CH and decrease inside; however, those are imprecisely estimated both outside and inside. We observe more muted responses around the SHs, but when we extend the time window to five years, we observe the sale price increases outside and decreases inside the SH, but those are imprecisely estimated as well.

Next, we examine whether the parcel area, living area, or number of total rooms change around protected areas, following proposed listing or designation rules. In Figure A27, for SHs, we see that the parcel area of transactions around the border is smaller, by as much as 5 percent. For CHs, we see an increase both right outside and inside the border, but those are noisily estimated. If we focus on living area (Figure A28), we see no change around the border of SHs but modest increases of 2–3 percent around the CH border. Finally, we fail to detect meaningful changes in the number of rooms (Figure A29).

A.3 Treatment Timing Heterogeneity

We report the detailed results on the treatment timing heterogeneity we cover briefly in the main text, Section 7.4.2. We begin with the results for residential properties and proceed to residential and nonresidential vacant lands. For each property type, we report both the full detailed estimation results and linear combinations of coefficients from each regression.

A.3.1 Residential Properties

In Table A1, we present the linear combinations for listing and designation, without further disentangling the effects after the proposed and final rules. In Table A2, we report the full set of coefficients, including the one we estimate for the change in sale price after a lawsuit or petition (if either exists for the species). In both tables, the sample and specification are the same, but we report the linear combinations to simplify the comparison and estimates we think are of interest (e.g., the total effect after both proposed and final listing rules).

The comparison between the distinct versus linear combinations of coefficients places a spotlight on the importance of estimating the different ESA events separately. For example, we observe that SHs, on average, have no change inside after the listing rules (Table A1, Column 1). If we examine the proposed and final listing events separately, we observe that the aggregate result masks the changes that happen after either a lawsuit or petition is filed, and the proposed listing, which are precise declines of 3–4 percent (Table A2, Column 1).[17] Outside of the SHs, we estimate sale prices decline by more than 5 percent after a lawsuit or petition are filed but then increase by 4 percent after the final listing rule (Table A2, Column 1).

A similar issue occurs for CHs—on the outside, we fail to reject a null effect after the listing or designation (Table A1, Column 2), whereas if we focus on the time after the proposed listing, we estimate prices increase by more than 45 percent (Table A2, Column 2). Throughout the comparisons around the CH border, the properties that are inside the CH are also always inside the SH (because the CH is a subset of the SH). This means that the properties outside of the CH—the comparison group—might be inside or outside of the SH. If we restrict the comparison group that is outside of the CH to the properties that are still inside the SHs, we estimate similar effect sizes (Tables A1 and A2, Column 3). This

[17] When interpreting coefficients, we convert them to percent changes using e^{β}-1

restricted comparison allows us to compare properties that receive the exact same statutory protections because they are all inside the SH, but some also receive a designation. According to the letter of the law and the position of the FWS, no additional effect should arise from a designation. However, the results from the marginal CH comparison suggest that land markets do infer an important signal from the designated border.

Outside of the CH, properties increase in value by over 40 percent after the proposed listing, and they experience a similar increase inside the CH after the proposed designation (Table A2, Column 2). We offer two interpretations for this pattern. First, we argue that increases in value after the proposed listing but before the proposed designation can be rationalized if buyers are already aware that the FWS will likely designate the CH border where development extends to at the time of the proposed listing. Second, the increase in value inside suggests that the proposed designation rule removes some uncertainty about the border, leading buyers to race to buy up properties before the final designation. Although we estimate large and precise increases after the proposed rules to list or designate, both inside and outside of the CH, we observe an imprecisely estimated decline after a lawsuit or petition (Table A2, column 2).

The results are meaningfully different in the ever-conflict subsample. For SHs, we observe smaller imprecise declines, by about half (Table A2, Column 4). For CHs, we observe prices drop by over 40 percent after the lawsuit or petition stage, or the proposed listing.[18] Again, the timing of these reductions suggests that buyers can correctly predict, on average, where the CH border will be drawn. We do observe appreciation right outside the CH, but those results are imprecise and an order of magnitude smaller relative to the estimated declines inside. However, recall that the effects inside are estimated based on a small fraction (less than 2 percent) of the total number of observations in the sample.

[18] In Table A2, Column 5, some cases have an insufficient number of transactions to estimate some of the interactions, such as after the proposed listing, outside 0–3km, or after final listing, outside, 3-6km.

A.4 Vacant Lands

Vacant land transactions exhibit even larger price response heterogeneity to the different treatment stages than residential properties. Land markets respond to early information—lawsuit, petition, or proposed listing—about ESA protections. We observe these early price responses in both residential and nonresidential vacant lands, in either SHs or CHs.

Residential vacant lands around the border of an SH appreciate by 14.5 percent after the proposed listing rule (Table A3, Columns 1 and 4). Before the final listing, we observe higher prices inside in both the full and ever-conflict samples, but appreciation right outside the border is smaller by half, and imprecise, in the full sample. These higher prices do not persist and mostly return to baseline levels after the final listing rule, where we can no longer reject the null hypothesis of a zero effect on price for the linear combination of the proposed and final listing rules (Table A5, Columns 1 and 4). In Figure 6e, we observe noisy reductions in price inside the first 3km into the SHs in the five years after the proposed rule (relative to a similar, but different omitted category).

In CHs, the price response reverses and occurs sooner than in SHs. After either a lawsuit or petition, prices drop sharply by 70 percent or more across all distance bins (Table A3, Columns 2 and 5). This finding suggests that land markets respond strongly and negatively to the uncertainty regarding the listing and designation, especially to the yet-to-be-determined (at the time of lawsuit or petition) border of the CH. However, when we narrow the control sample down to include only parcels that are in the SH (Table A3, Columns 3 and 6), we no longer detect a meaningful or precise drop in price.

Following the proposed listing rule, vacant lands that are outside and near the border see a massive sharp increase in value—more than doubling relative to the baseline levels (Table A3, Columns 2, 3, 5, and 6). Parcels further away from the border also see large increases, yet their magnitudes are halved. These effects diminish, by more than half, after the proposed designation rule. This finding suggests that land markets anticipate stricter land-use restrictions and are attempting to preemptively sell or develop vacant lands before the potential spotlight effect of the designation is realized. It is important to remember that the number of transactions inside CHs is very low, both before and after ESA protections are awarded (see Figure 5). In addition, the response in land markets around the CH border has both a price response and an effect on the number of transactions, which increase right outside the border and drops inside the protected area (see Figure A1).

Nonresidential vacant lands experience smaller, and imprecisely estimated, price changes around SHs. However, they experience larger and statistically significant price changes, in both positive and negative directions, around CHs. Inside the CH, prices more than double after a proposed listing, yet those increases are offset by drops that occur after the final listing and proposed designation (Table A4, Columns 2, 3, 5, and 6). The sharp drops in prices are twice as large, and only precisely estimated, in the ever-conflict subsample (Columns 5 and 6). Following the designation, the sign of the effect in the distance bins right outside the CH switches from positive to negative but remains meaningfully large and precisely estimated in the distance bins further away from the border (Table A4, Columns 2, 3, 5, and 6). We interpret these results as evidence for a rush to develop before a final listing or proposed designation along with a strong aversion to nonresidential vacant lands after the proposed designation rule. When we pool coefficients for the listing and designation effects, we continue to recover a null effect on vacant land prices around SHs but large price increases after the listing rules that are mostly offset after the designation rules, outside of the CHs (Tables A4 and A6). An important caveat is that the sample sizes for nonresidential vacant lands are less than a third than those of residential vacant lands and so should be interpreted with caution.

A.5 Distribution of Days from Application to Issuance of Construction Permits

In the main text, we used the data from BuildZoom on the days from the application to the issuance of a new construction permit to estimate how the mean number of days changed around the protected area border before and after the proposed listing or designation. Here, we present more descriptive comparisons by plotting the distributions of the number of days, inside versus outside, before versus after. In Figure A30, we use a maroon color to denote distributions inside the protected area, and gray outside. We use dashed lines to denote distributions before the proposed listing or designation and solid lines for after.

For SHs, we do not observe large differences in the distribution of days from application to issuance for the permits that are located inside the SH. This is the case whether we focus on the four years around the proposed listing rule (Panel a), use the full sample when including all years before and after the proposed listing rule (Panel c), focus on ever-conflict species (Panel e), or impute missing dates (Panel g).[19] For the permits filed outside the SH, we observe a reduction in the density of very low number of days after the proposed listing. This might suggest greater attention to permits filed that are close to the border of the SH or simply be evidence of congestion if more permits are shifting from inside to outside of the SH. For CHs, we observe some shift toward higher approval periods, but only in the case of the ever conflict species. In all other cases, we fail to observe any meaningful changes in the distribution before and after.

A.6 Variations to Descriptive Results on Construction & ACE Permits

In the main text, in Figure 10, we plot how the construction permits (measured by the Census) correlate with higher ESA treatment intensity, which we define as the logged population-weighted total acres under protection. We count acres even if they overlap to capture potential increases in the probability of binding land-use constraints. In Figure A31, we restrict

[19] In some cases, we impute missing completion dates for permits that have had an application date but have not received an issuance date yet. For each county, we take the latest issuance date and use that to fill in the issuance dates for permits with an application date only. We think of this imputation as capturing the lower bound for the time between application and issuance. In other words, we know that the permit is still pending and that other permits in the county were approved as of the latest issuance date. If the permit ended up receiving an issuance later than our imputed date, then our imputed measure captures a lower bound for the duration of approval to issuance.

the ESA-protected acres to unique acres only, meaning we do not count overlapping acres as new protected acres. We observe a slightly flatter curve, with large spikes at the tail.

We also report in the main text binscatters that summarize how the first differences in construction permits are correlated with first differences in total protected acres and how longer differences in construction permits (second differences, third differences, etc.) respond to the same first difference in total protected areas. In other words, we compare the change in construction permits from $t + s$ to t, relative to the change in total protected acres from $t+1$ to t, where s ranges from 2 to 5. Another way to think of this exercise is as a descriptive impulse response where the impulse is the short-term change in total protected acres, and the response is the longer-term change in construction permits.

In Figure A32, we plot the binscatters for logs, levels, and rates of construction permits. We observe larger negative slopes when taking longer differences, four or five years after the change in protected areas. In other words, larger increases from t to $t+1$ are correlated with larger declines in construction permits from t to $t+4$ or $t+5$. However, as other fundamentals could be changing over these time horizons, and we are more limited in interpreting the changes at the county level as quasi-experimental variation in protected acres, we do not interpret these findings as causal evidence.

A.7 Treatment Timing Heterogeneity Using the BuildZoom Data on Potential Delays

For completeness, we also report results that examine the treatment timing heterogeneity in the time from construction permit application to issuance, using the BuildZoom data. We report the detailed results in Table A7 and the linear combinations of the listing and designation coefficients in Table A8. We mostly fail to observe meaningful changes to construction permit delays around SHs. Inside the CHs, we estimate an acceleration in approval time right after the proposed listing rule, followed by a sharp increase in approval time after the final listing (Table A7, Column 2). This suggests that land markets try to preemptively develop around what they anticipate will be the CH border. This combined effect of listing is negative but imprecisely estimated (Table A8, Column 2). In the ever-conflict subsample, we observe a large increase in approval time after the listing, which is mostly offset after the designation (Table A8, Column 4). In both samples (full and ever conflict), we estimate that inside the CH, the time from application to issuance shrinks after the designation. This suggests that removing uncertainty about where the border might pass helps in resolving some pending approvals. However, these changes in approval time do not appear to be all that different than the changes that we estimate outside of the CHs, in either the 0–3km or 3–6km ranges.

A.8 Exploring Correlation of Species-Specific Effects & Observable Characteristics

In the main text (Figure 9), we report the distributions of the species-specific coefficients we obtain for the change in sale prices for properties inside the SHs or CHs, after the proposed listing or designation rules. Here, we take those coefficients and examine whether their sign and magnitude are associated with observable characteristics. This is a purely descriptive and correlational exercise. We report results where we have a nontrivial number of coefficients to compare: SHs, residential properties and vacant lands, and CHs, residential properties. In Tables A9–A12, we summarize how the results from a regression of the coefficients on each characteristic separately and all of them combined.

We include dummy variables for whether the species had a lawsuit or a petition, the decade of the listing, whether the recovery priority number assigned to the species at the time of the listing is medium or high, and whether the species is flagged as ever conflict, along with dummies for taxonomic group and FWS region. In addition, we also include continuous measures, such as the number of FWS consultations, share of transactions in metro areas, and logged mean price before the proposed rule.

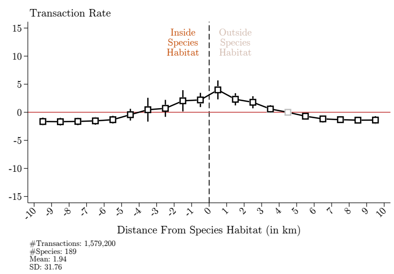
Throughout the four tables, we fail to detect a clear and meaningful insight that highlights a specific attribute. In other words, we do not find suggestive evidence for a particular characteristic that appears to correlate with the estimated effect of being inside a protected area, after the proposed protections.

Figure A1: Changes in Transaction Counts Around Protected Area Borders

Transaction Rate

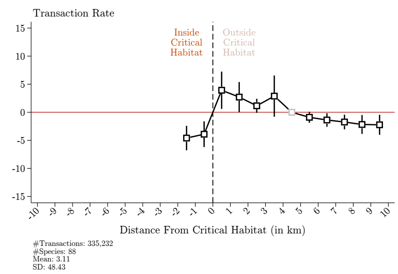
Species Habitat

(a) Four-Year Window Sample

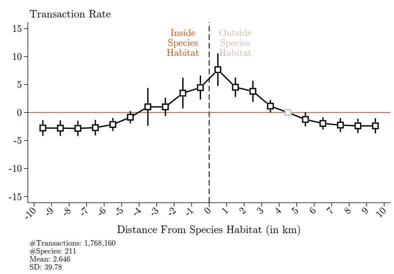


Critical Habitat

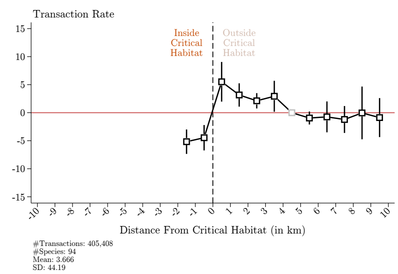
(b) Four-Year Window Sample



(c) Ten-Year Window Sample



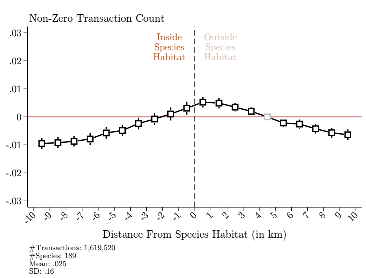
(d) Ten-Year Window Sample



Non-Zero Transaction Count

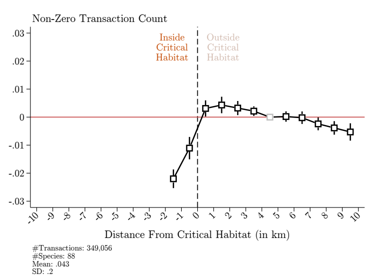
Species Habitat

(e) Four-Year Window Sample

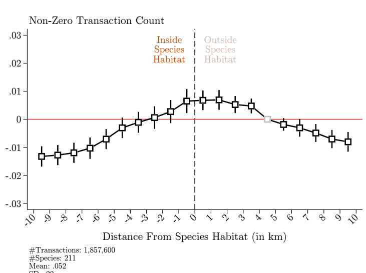


Critical Habitat

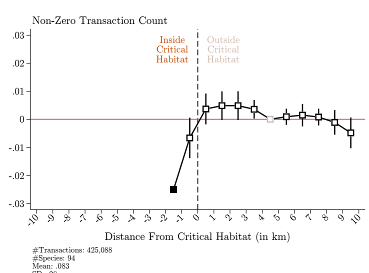
(f) Four-Year Window Sample



(g) Ten-Year Window Sample



(h) Ten-Year Window Sample



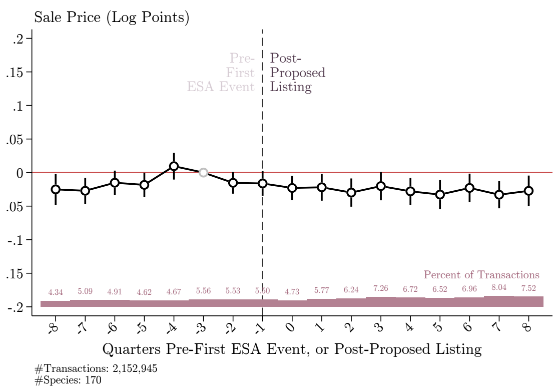
Notes: Estimation results for the specification in Equation (2). We aggregate transactions to the ZCTA-year-quarter level. We plot results for the transaction rate—the number of transactions relative to the preproposed listing mean of transactions in each ZCTA (Panels a–d), or the nonzero transactions dummy (Panels e–h).

Figure A2: Assigning Treatment Onset as the First ESA Event

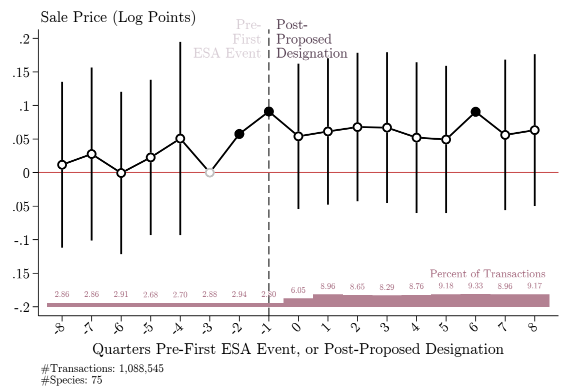
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

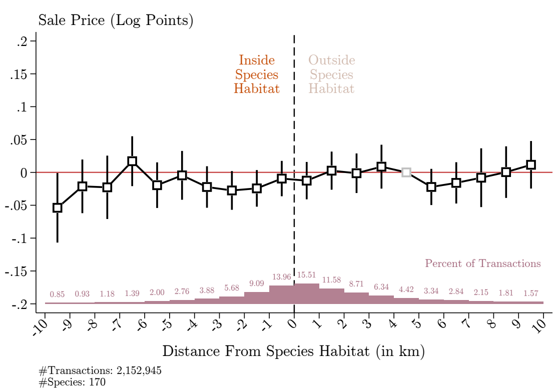
(a) Staggered DD



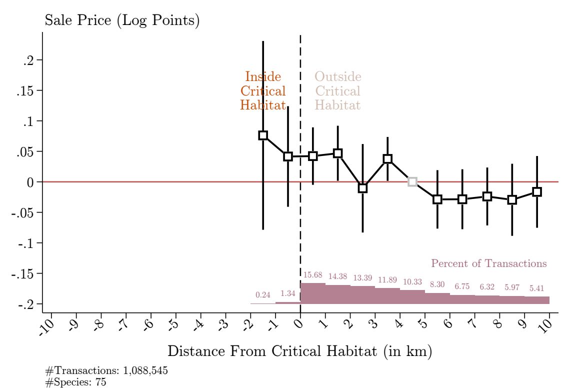
(b) Staggered DD



(c) Staggered DD

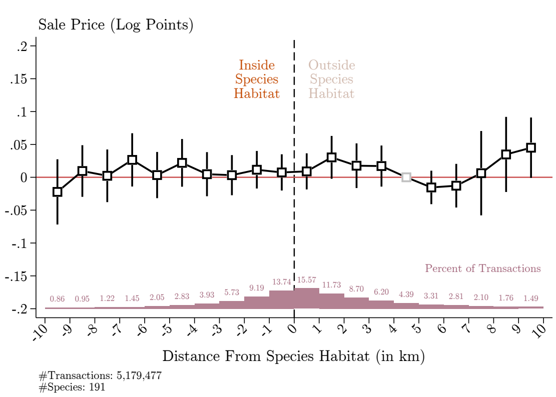


(d) Staggered DD

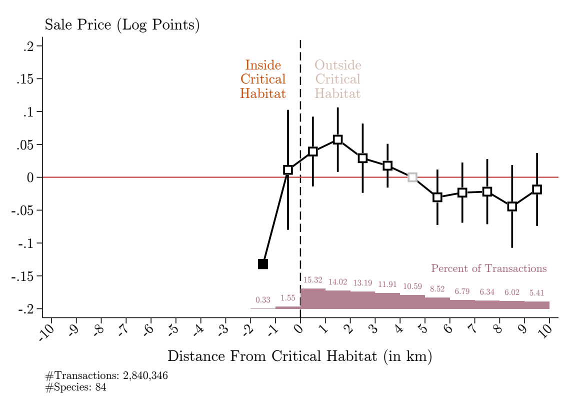


Five Years Before & After Proposed Rule

(e) Staggered DD



(f) Staggered DD



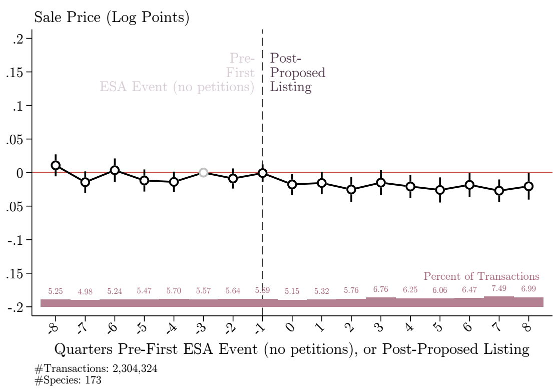
Notes: Same as Figure 6, but allowing the pre-treatment period to end at the earliest of either a petition, lawsuit, or a proposed listing rule.

Figure A3: Assigning Treatment Onset as Either Lawsuit or Proposed Listing

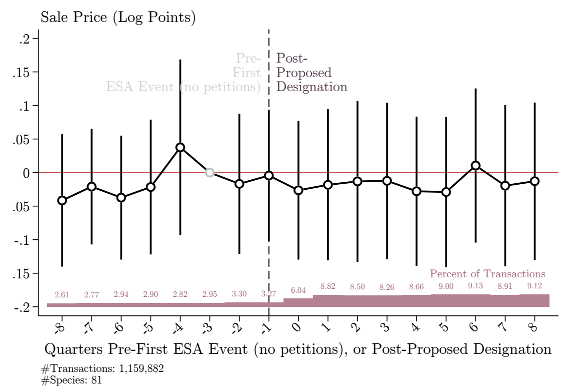
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

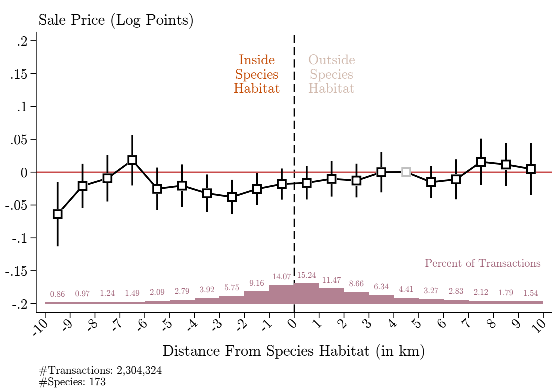
(a) Staggered DD



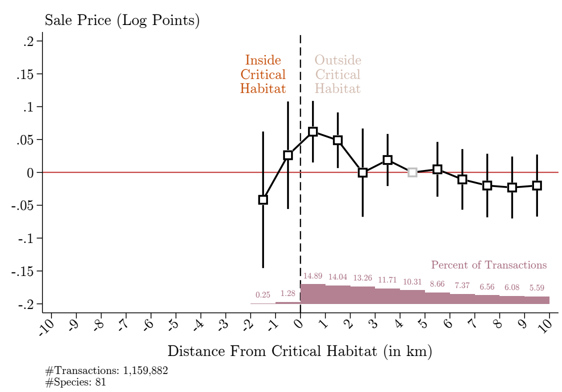
(b) Staggered DD



(c) Spatial DD

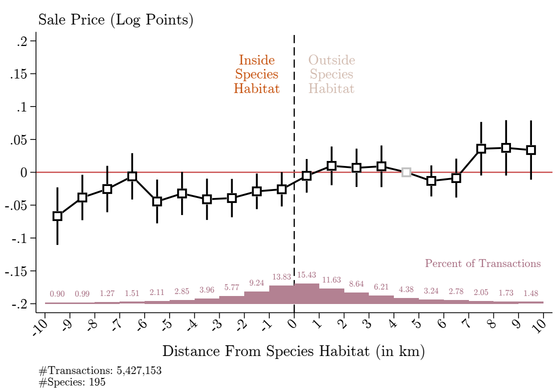


(d) Spatial DD

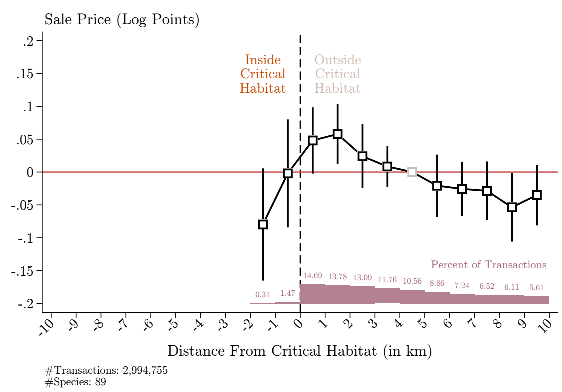


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



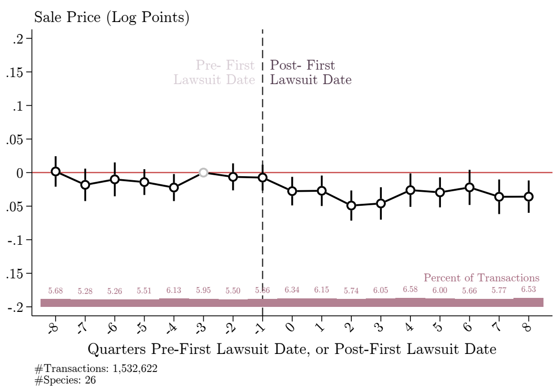
Notes: Same as Figure 6, but allowing the pre-treatment period to end at the earliest of either a lawsuit, or a proposed listing rule.

Figure A4: Estimating the Treatment Effect of Action-Forcing-Lawsuits

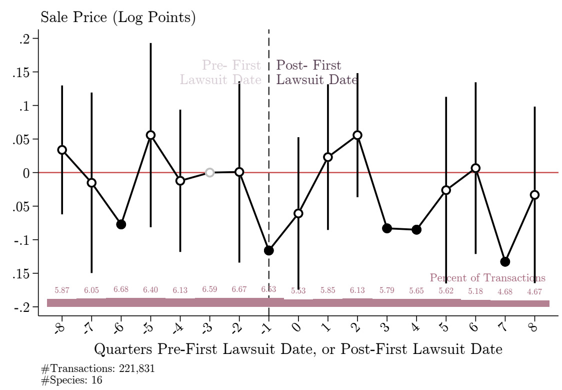
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

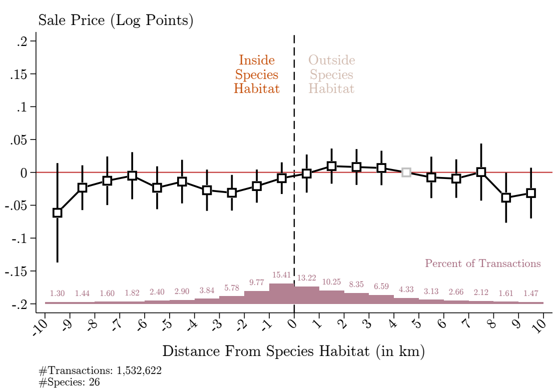
(a) Staggered DD



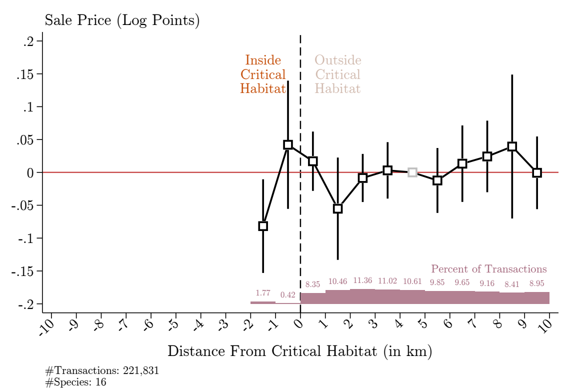
(b) Staggered DD



(c) Spatial DD

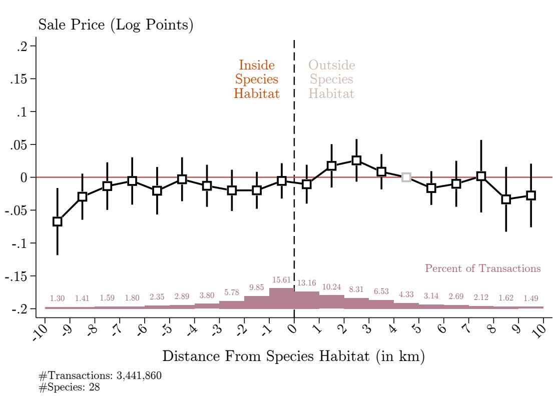


(d) Spatial DD

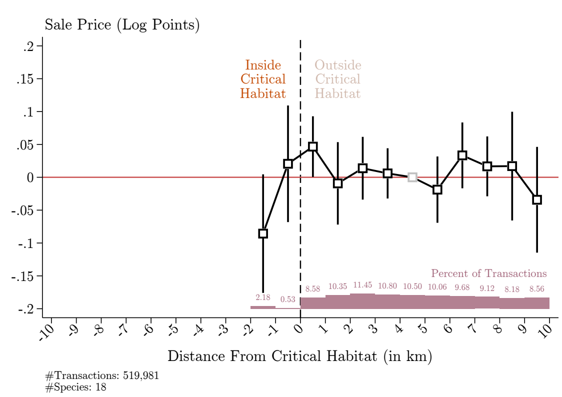


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



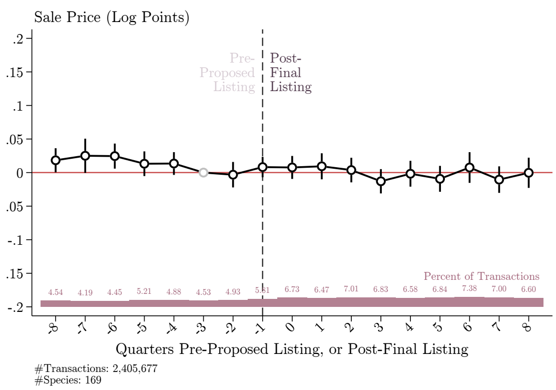
Notes: Same as Figure 6, but focusing on the sub-sample of species that had an action-forcing-lawsuit filed before the proposed listing rule.

Figure A5: Assigning Final Listing as the Posttreatment Onset Event

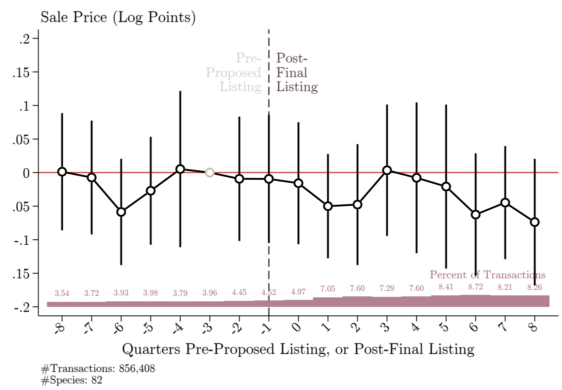
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

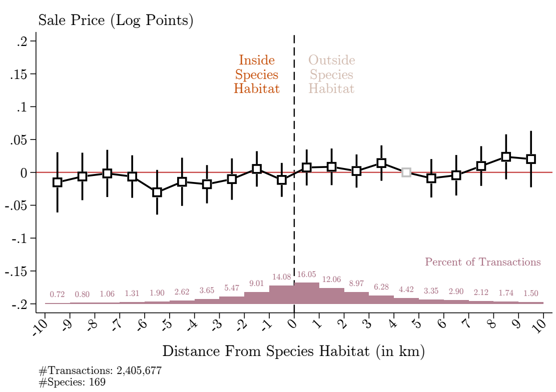
(a) Staggered DD



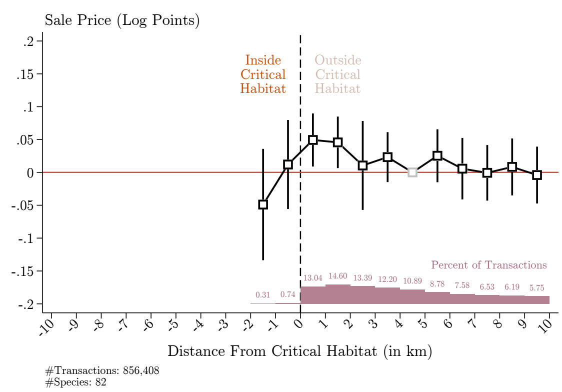
(b) Staggered DD



(c) Spatial DD

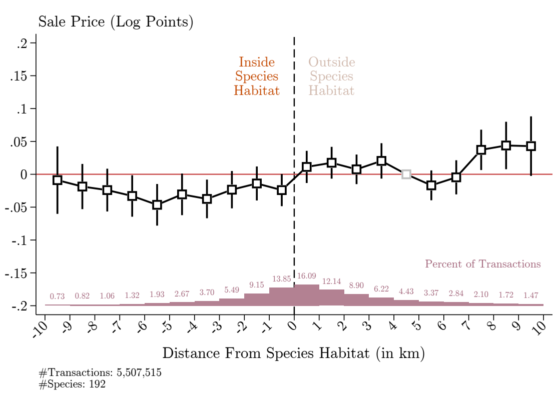


(d) Spatial DD

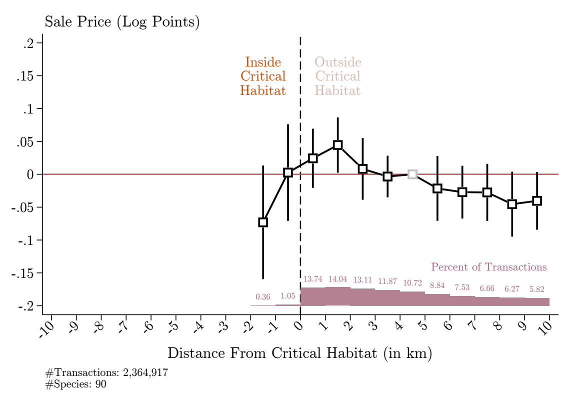


Five Years Before & After Proposed Rule

(e) Spatial DD



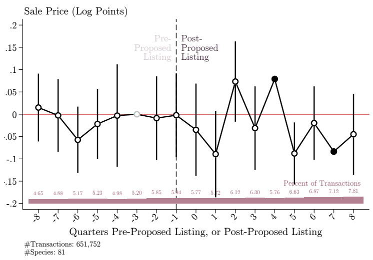
(f) Spatial DD



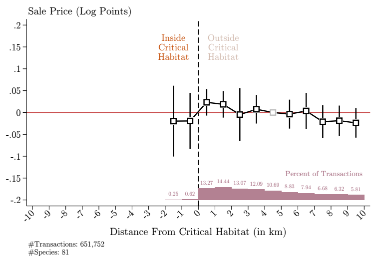
Notes: Same as Figure 6, but using the final listing as the post-treatment onset event for both species and critical habitats.

Figure A6: Assigning Proposed Listing as Treatment Onset for Critical Habitats

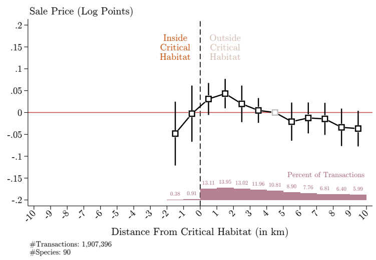
Staggered
(a)



Spatial +/- 2 Years
(b)

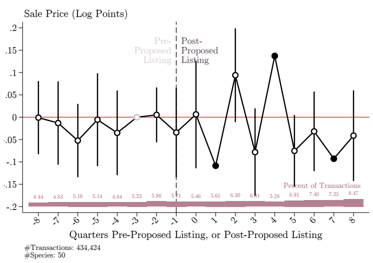


Spatial +/- 5 Years
(c)

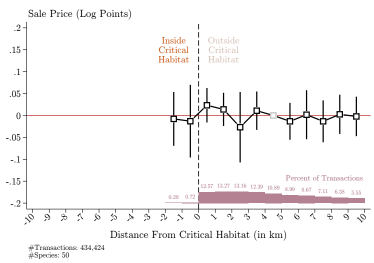


Proposed Listing & Designation Rules are at Least Two or Five Years Apart

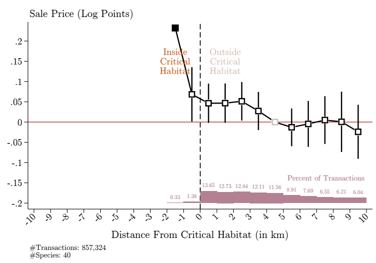
(d)



(e)



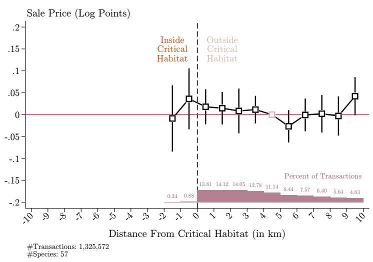
(f)



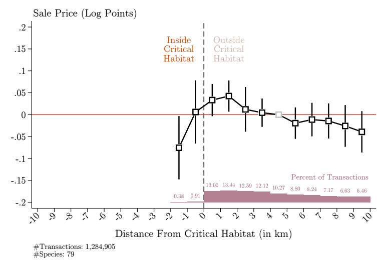
Notes: Same as Figure 6, but focusing on critical habitats only, using the proposed listing as the pre- and post-treatment onset event.

Figure A7: Sub-Group Analysis for Critical Habitats When Using Proposed Listing as Treatment Onset

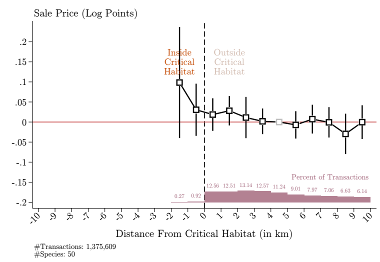
Ever Conflict
(a)



High ACE Permits
(b)

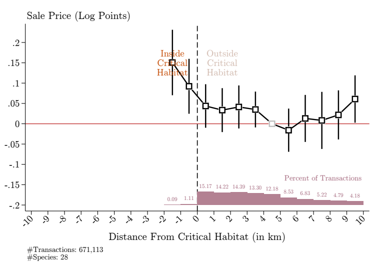


High FWS Consultations
(c)

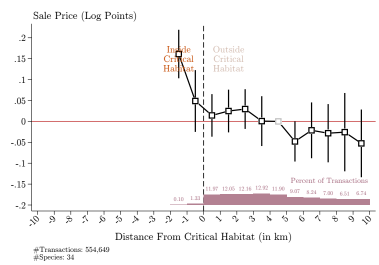


Proposed Listing & Designation Rules are at Least Five Years Apart

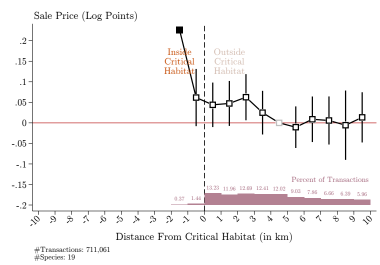
(d)



(e)

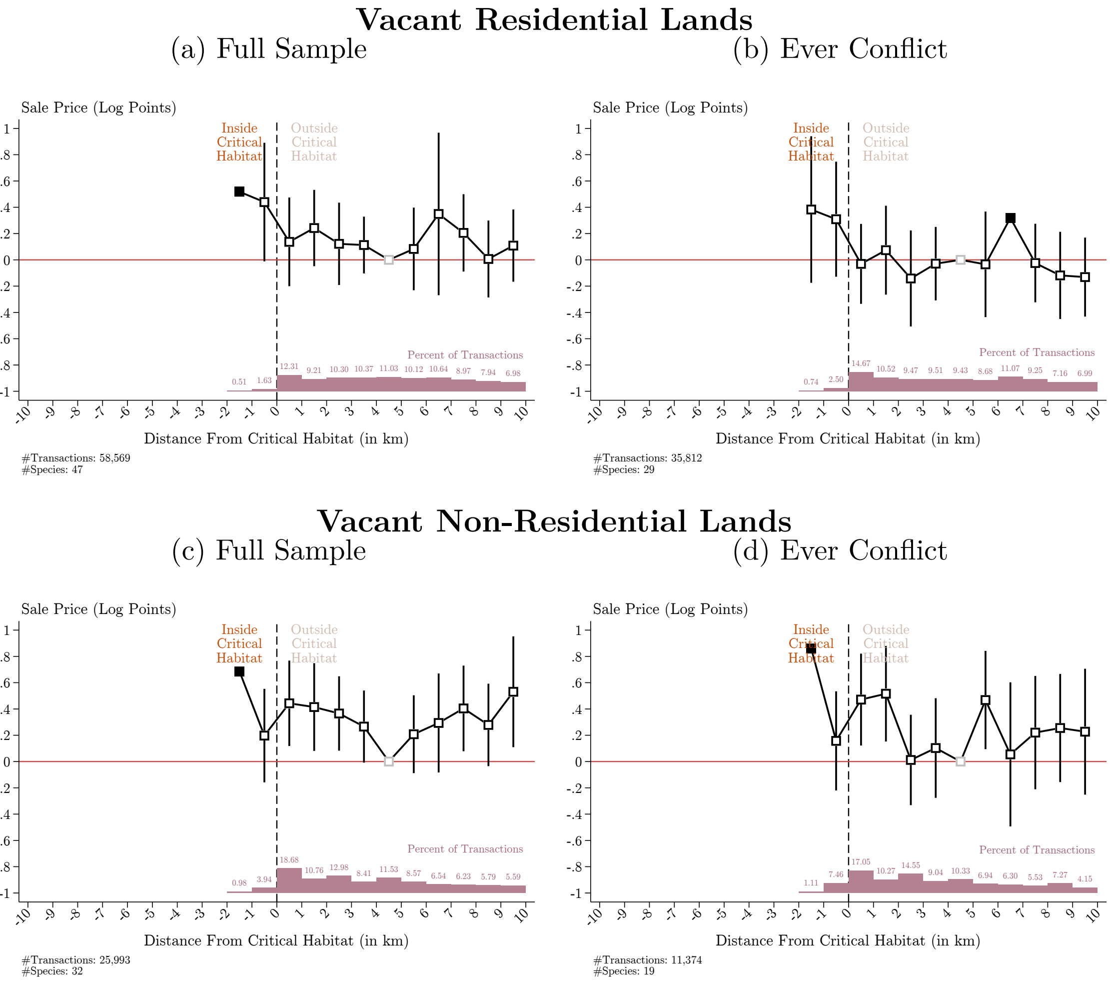


(f)



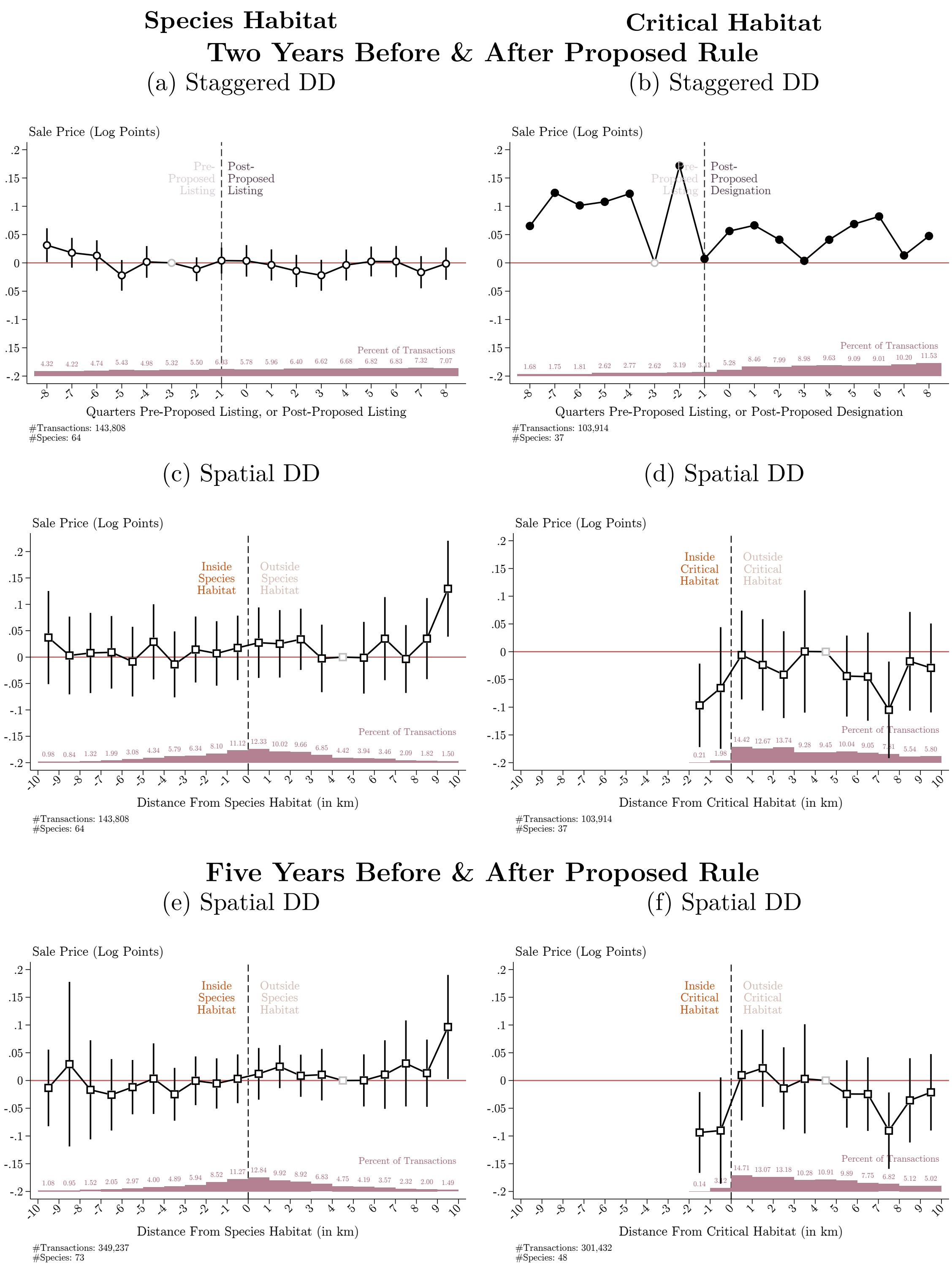
Notes: Same as Figure 6, but focusing on critical habitats only, by sub-group, using the proposed listing as the pre- and post-treatment onset event.

Figure A8: Assigning Proposed Listing as Treatment Onset for Vacant Lands Around Critical Habitats



Notes: Same as Figure 8, but focusing on critical habitats only, using the proposed listing as the pre- and post-treatment onset event.

Figure A9: Results for New Construction Properties



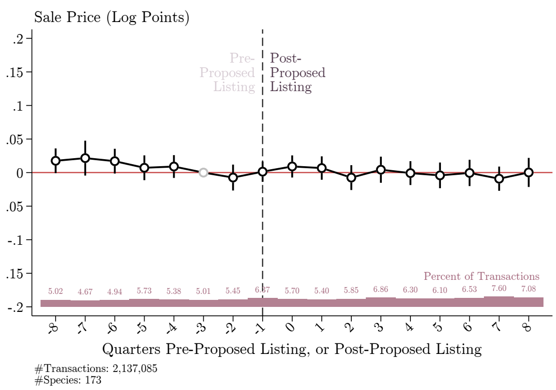
Notes: Same as Figure 6, but focusing on sales of new construction properties only.

Figure A10: Results for Existing Residential Properities (Not New Construction)

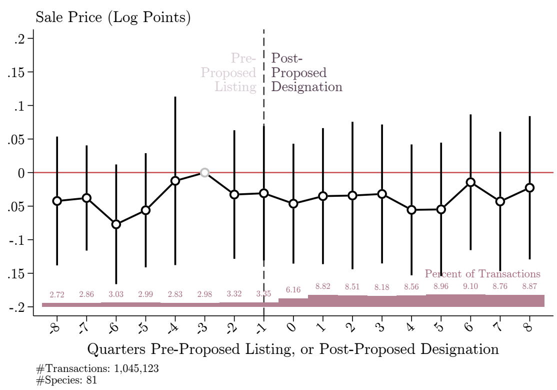
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

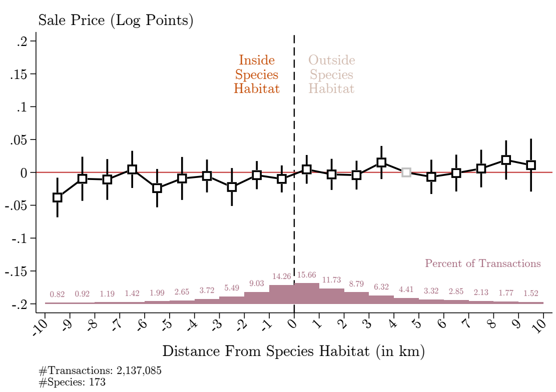
(a) Staggered DD



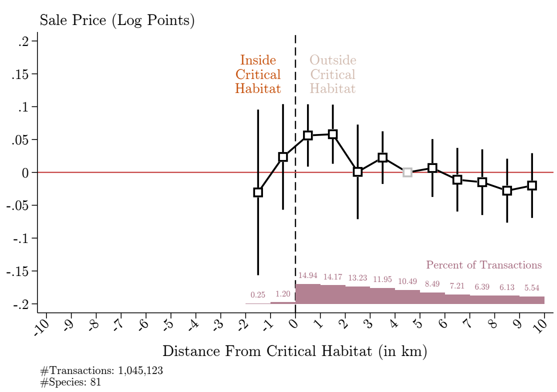
(b) Staggered DD



(c) Spatial DD

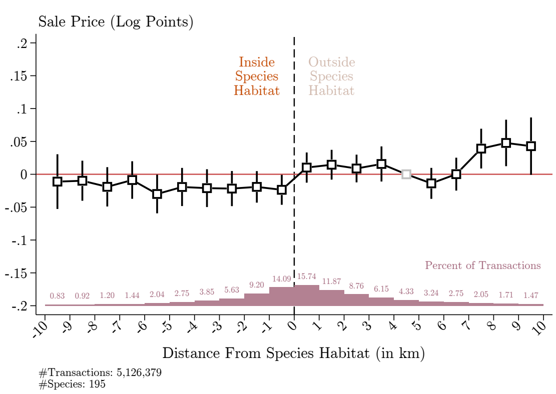


(d) Spatial DD

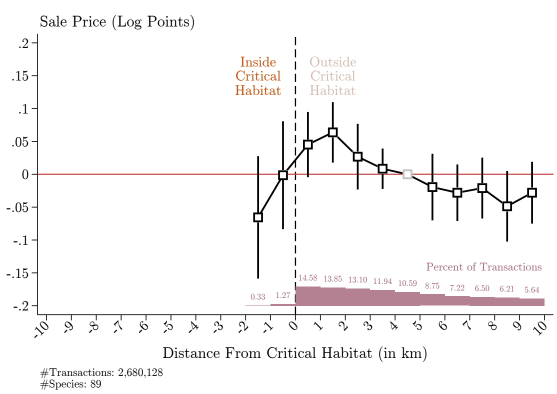


Five Years Before & After Proposed Rule

(e) Spatial DD



(f)



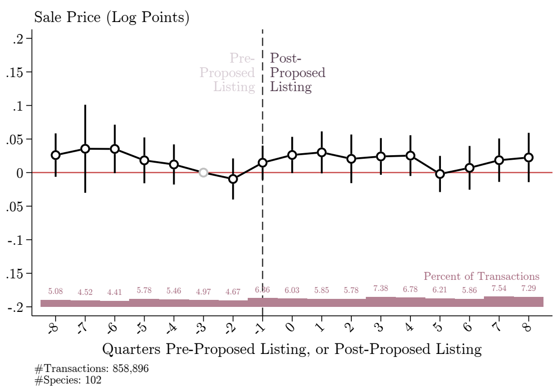
Notes: Same as Figure 6, but focusing on sales of existing homes (not new construction properties) only.

Figure A11: Results Using Endangered Species Only

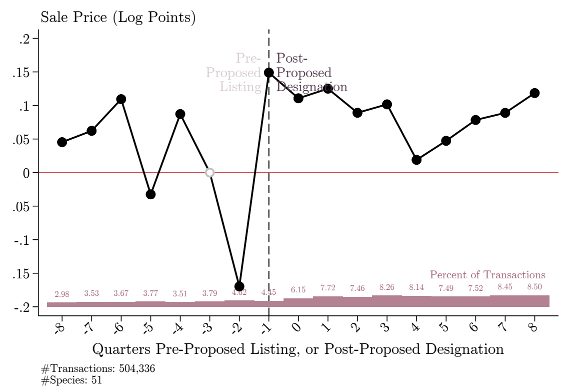
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

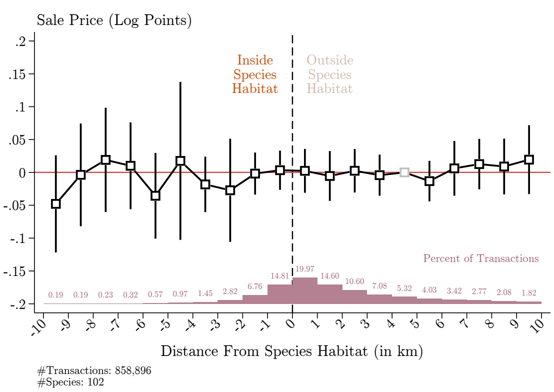
(a) Staggered DD



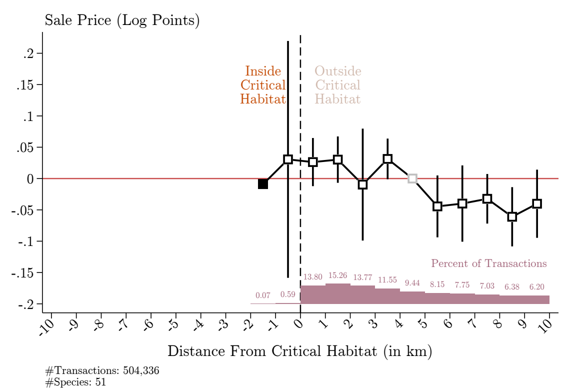
(b) Staggered DD



(c) Spatial DD

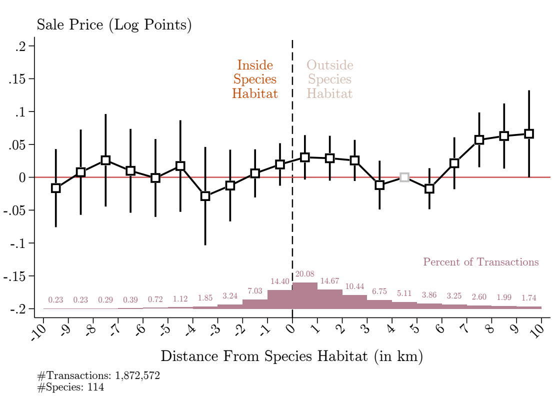


(d) Spatial DD

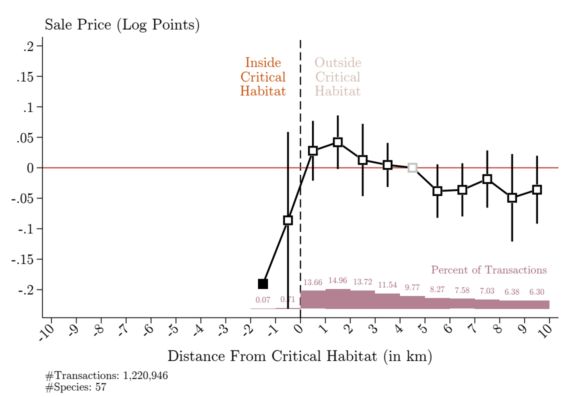


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



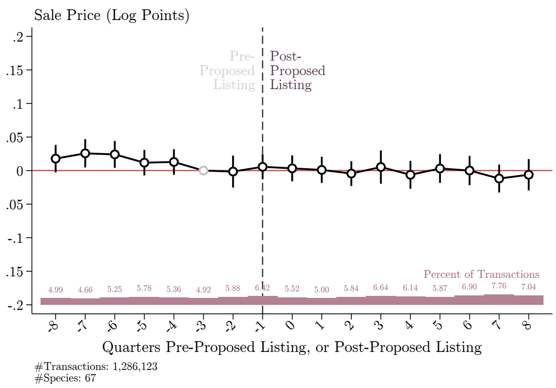
Notes: Same as Figure 6, but focusing on species listed as endangered.

Figure A12: Results Using Threatened Species Only

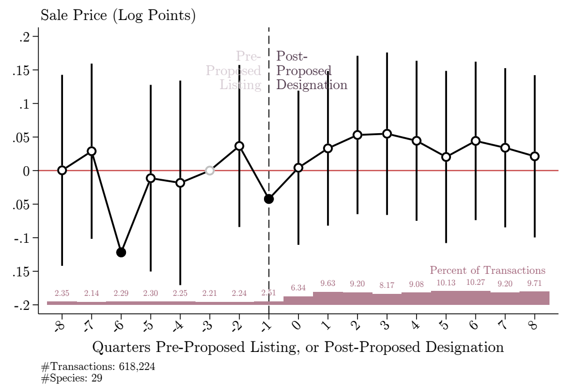
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

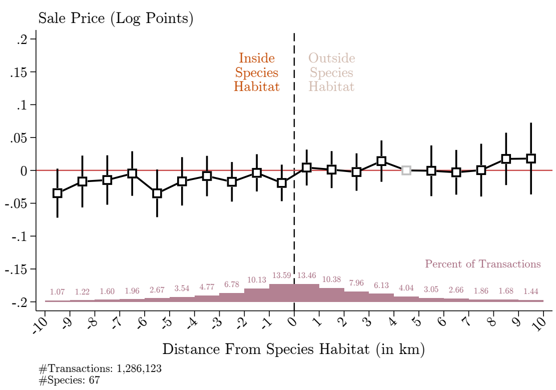
(a) Staggered DD



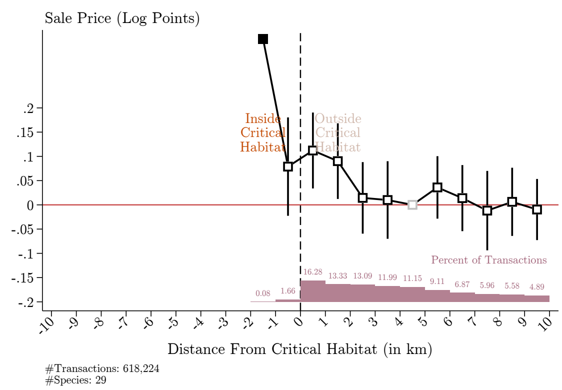
(b) Staggered DD



(c) Spatial DD

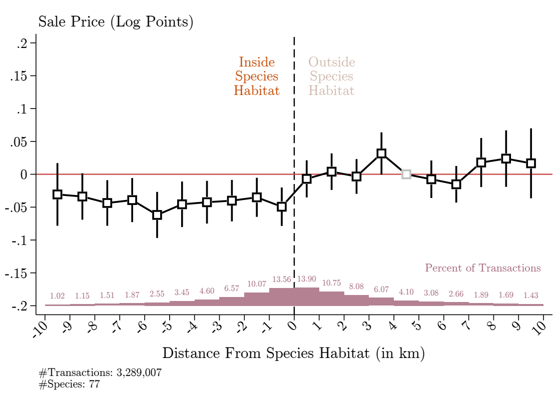


(d) Spatial DD

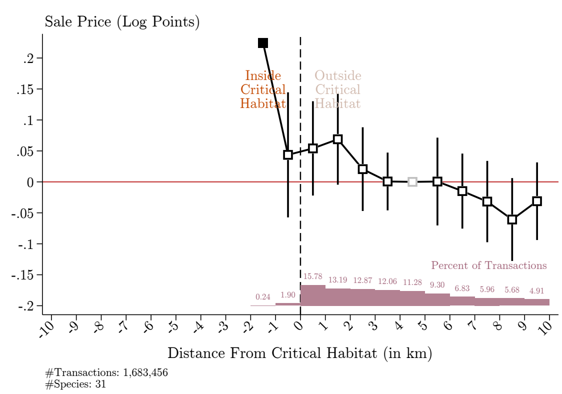


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



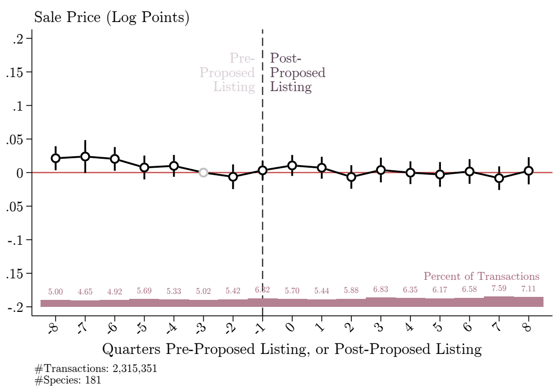
Notes: Same as Figure 6, but focusing on species listed as endangered.

Figure A13: Results for Not Solely Aquatic & Eight Crustacean Species

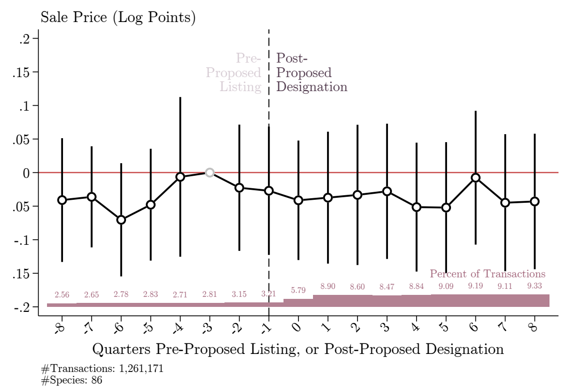
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

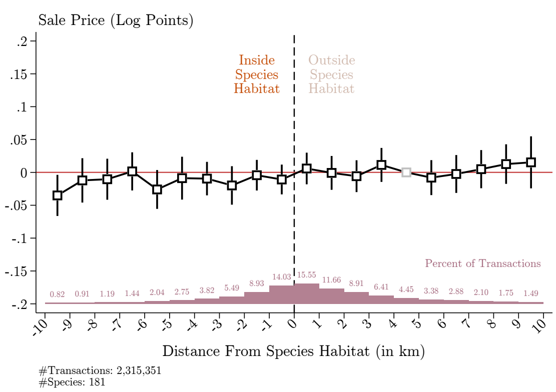
(a) Staggered DD



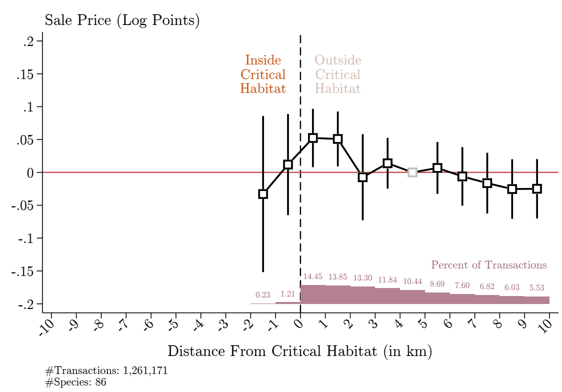
(b) Staggered DD



(c) Spatial DD

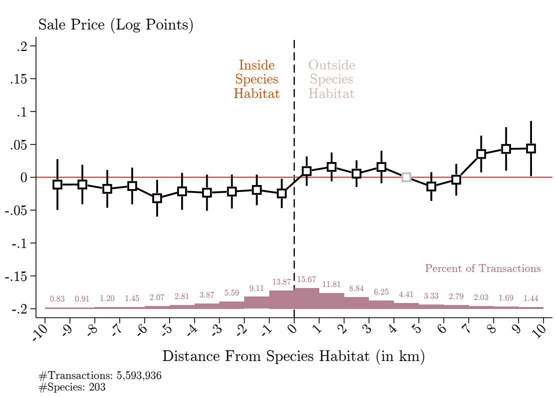


(d) Spatial DD

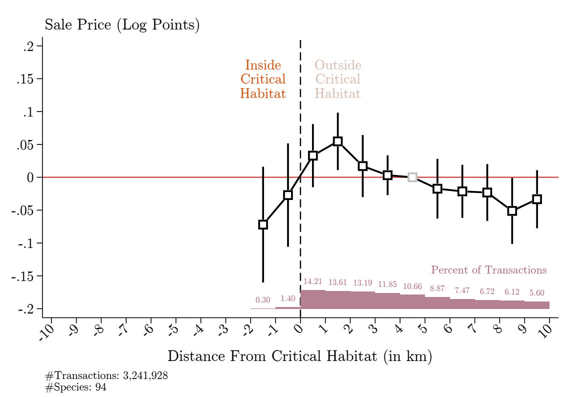


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



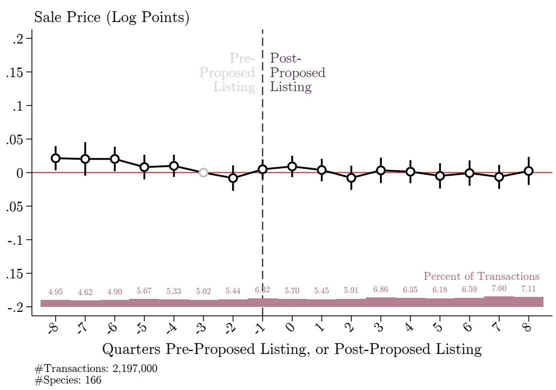
Notes: Same as Figure 6, but including previously excluded eight crustacean species.

Figure A14: Results for Residential Properties in Metro Areas

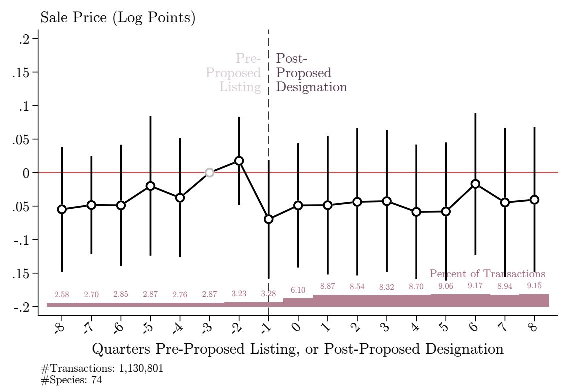
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

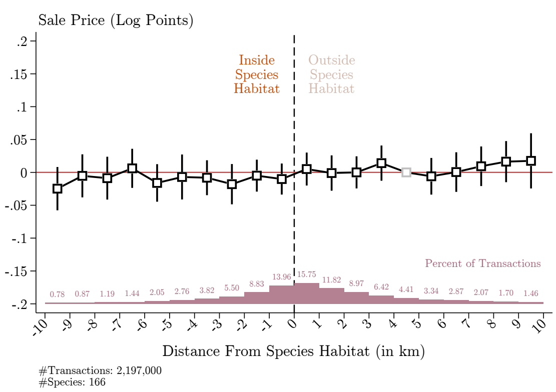
(a) Staggered DD



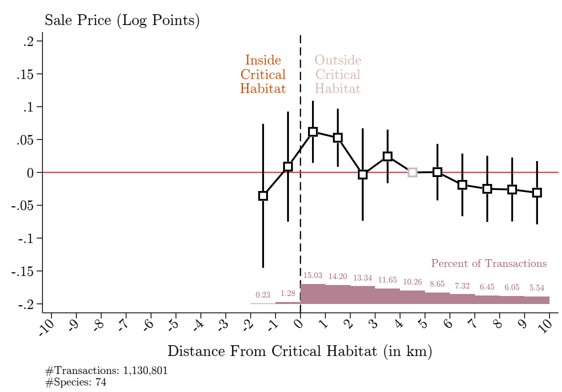
(b) Staggered DD



(c) Spatial DD

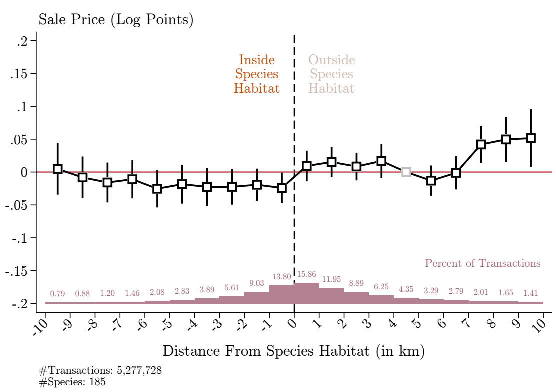


(d) Spatial DD

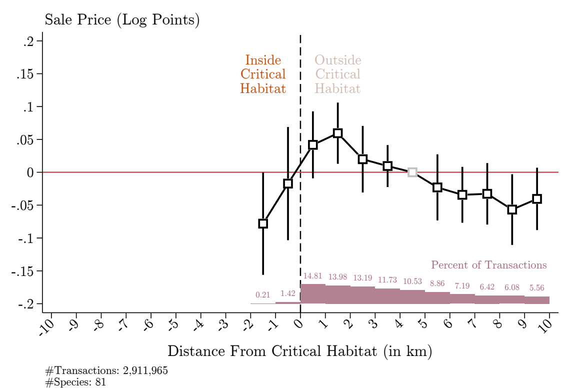


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



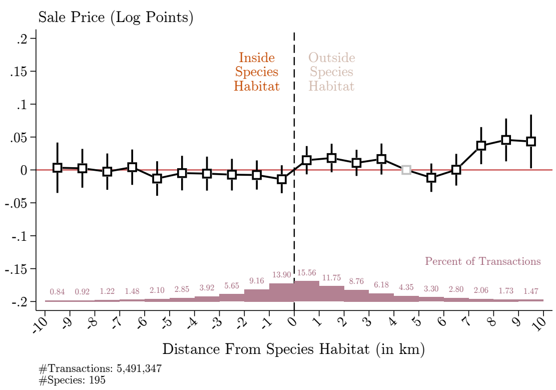
Notes: Same as Figure 6, but including transactions in metro areas only.

Figure A15: Changing Fixed Effects in the Baseline Specification

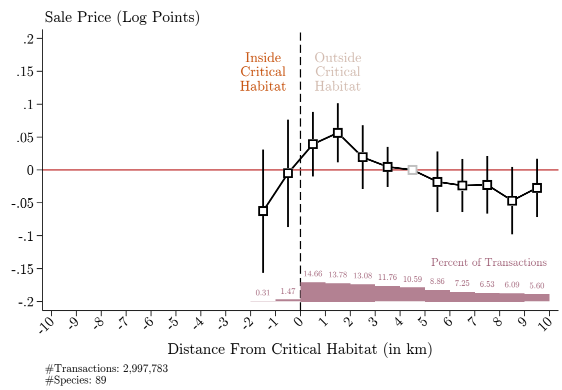
Species Habitat **Critical Habitat**

State-by-year, state-by-month, ZCTA

(a) Spatial DD

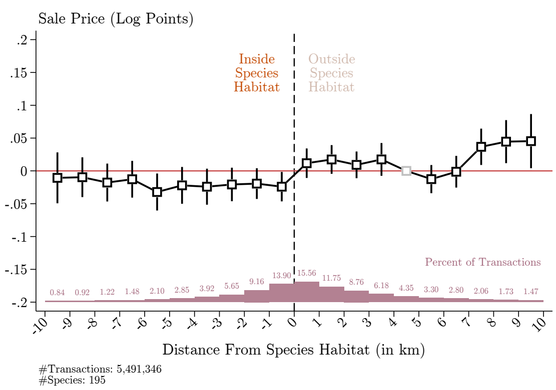


(b) Spatial DD

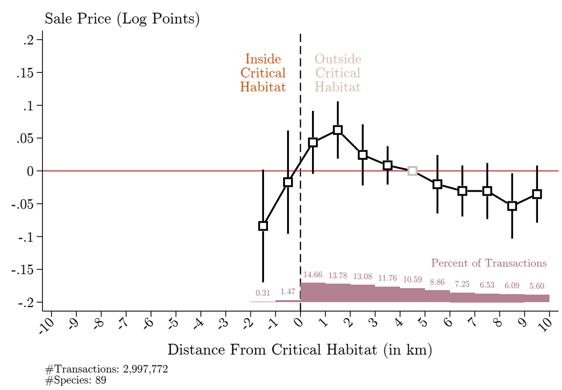


FWS-by-year-by-month, ZCTA

(c) Spatial DD

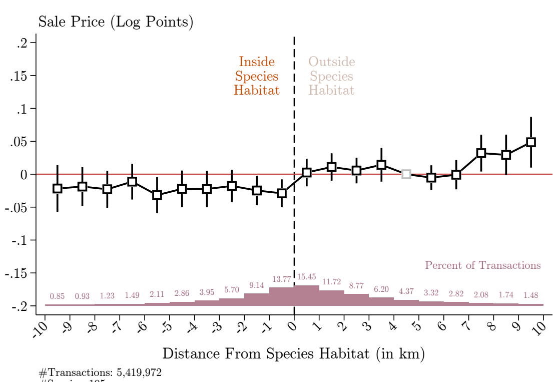


(d) Spatial DD

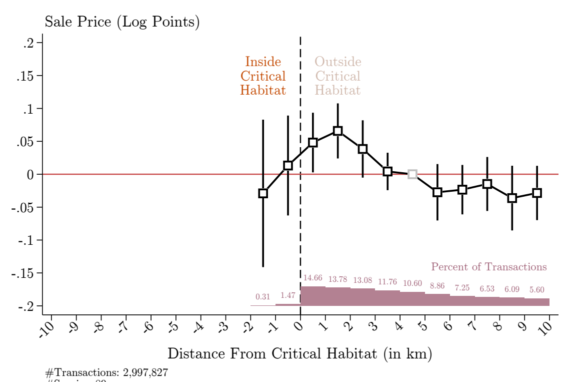


FWS-by-year, FWS-by-month, census tract

(e) Spatial DD



(f)



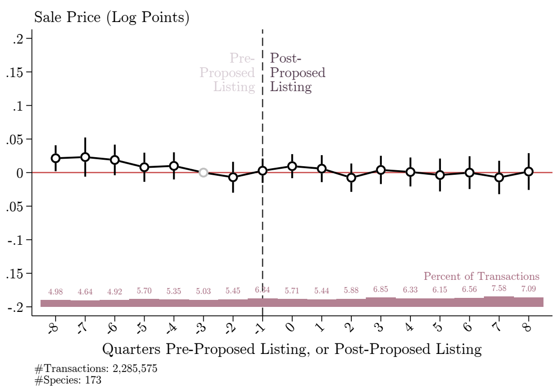
Notes: Same as Figure 6, but including different fixed effects relative to the baseline specification.

Figure A16: Clustering Standard Errors at the County Level

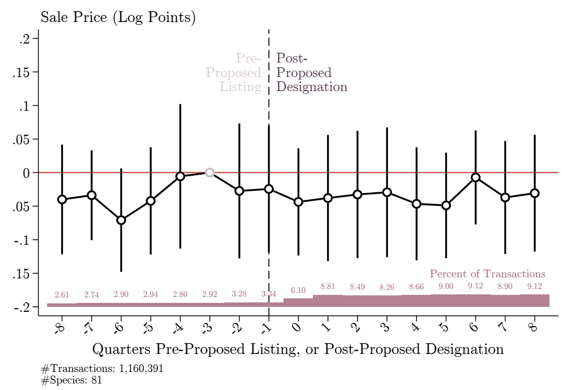
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

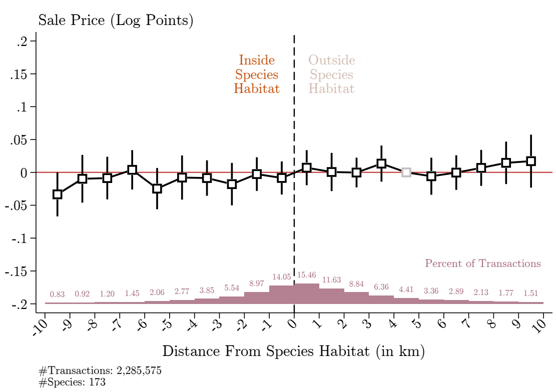
(a) Staggered DD



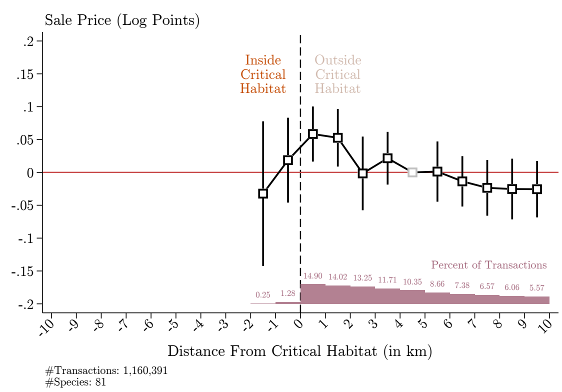
(b) Staggered DD



(c) Spatial DD

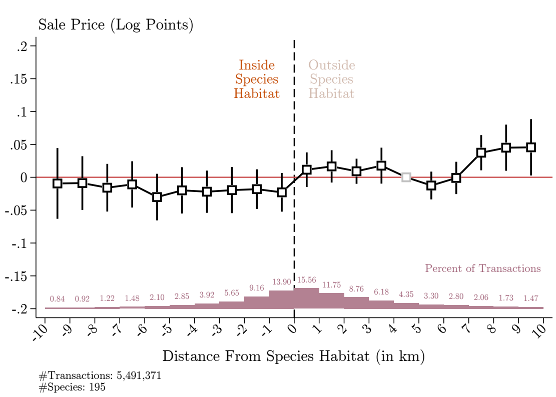


(d) Spatial DD

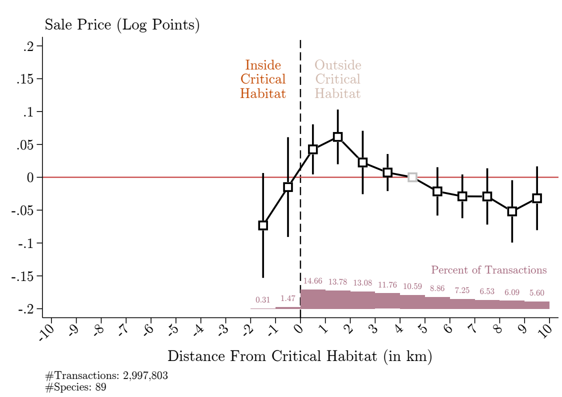


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



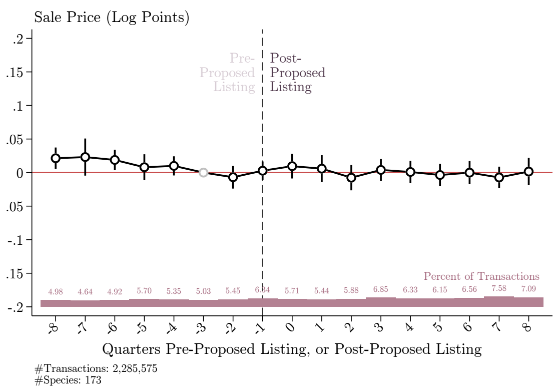
Notes: Same as Figure 6, but clustering standard errors at the county level.

Figure A17: Clustering Standard Errors at the Species Level

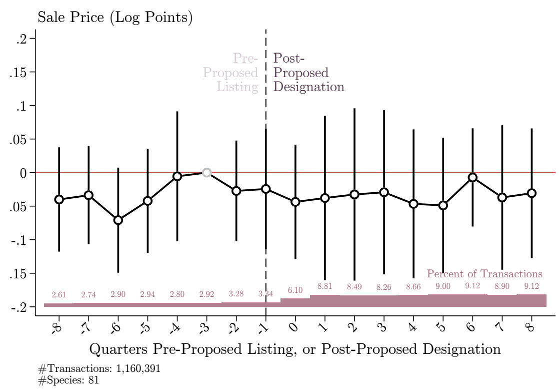
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

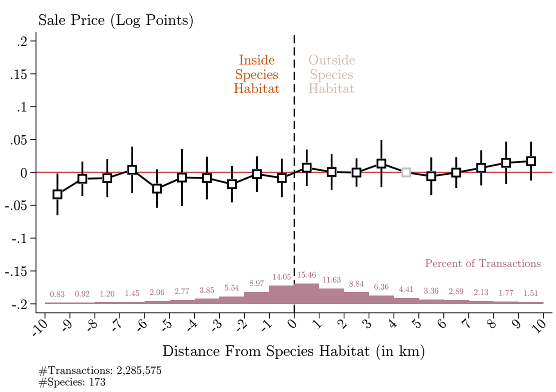
(a) Staggered DD



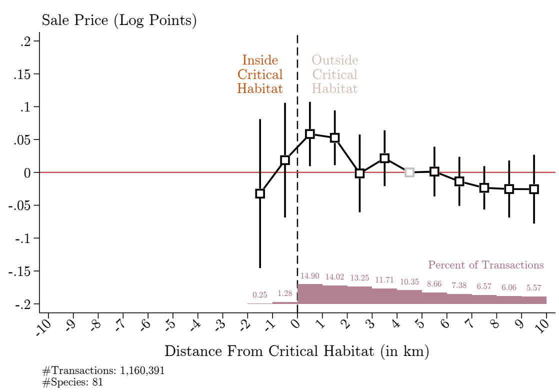
(b) Staggered DD



(c) Spatial DD

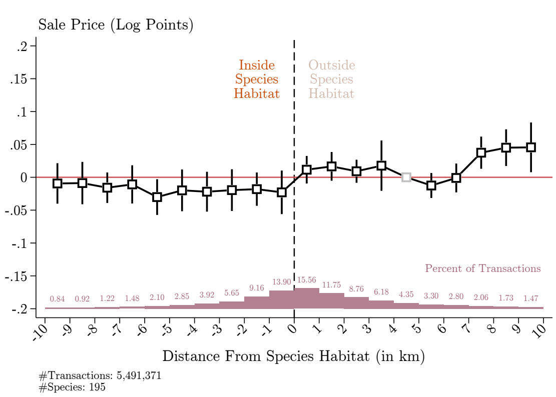


(d) Spatial DD

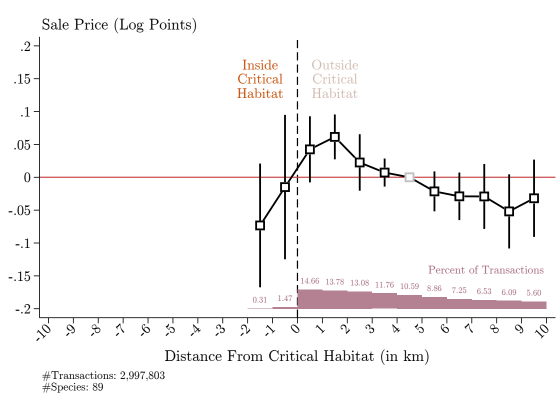


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD

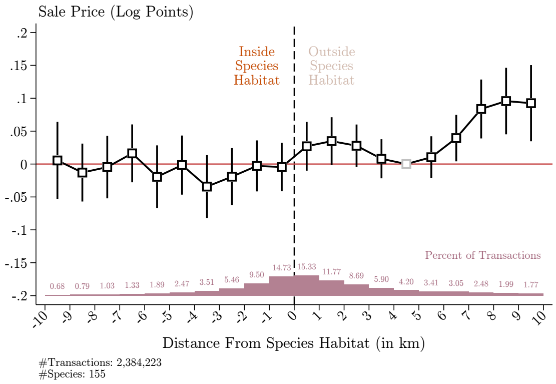


Notes: Same as Figure 6, but clustering standard errors at the species level.

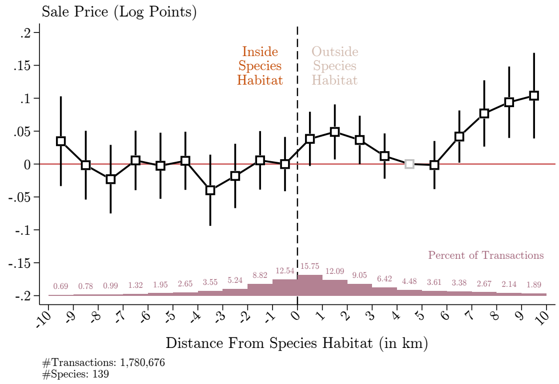
Figure A18: Reclassifying High ACE Permits

SH

(a) Above 75th Percentile

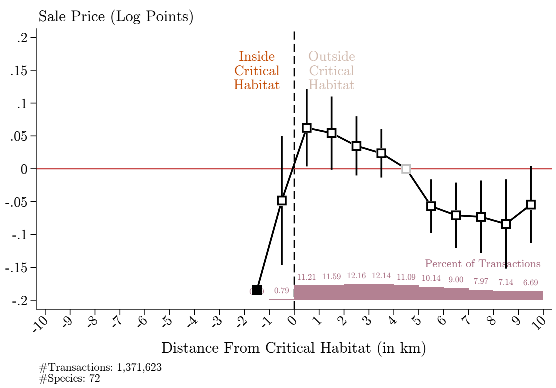


(b) Above 90th Percentile

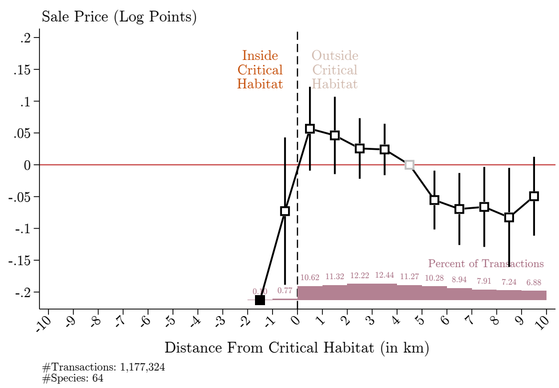


CH

(c) Above 75th Percentile



(d) Above 90th Percentile

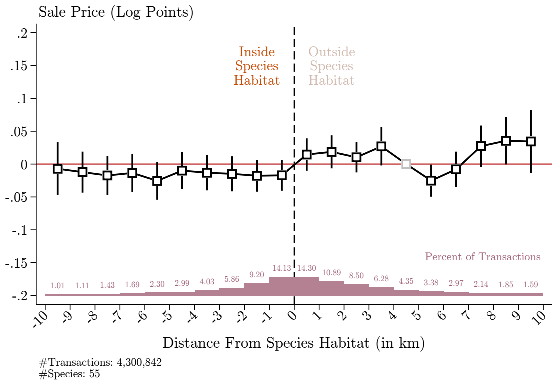


Notes: Same as in Figure 7, panels b and e, but focusing on ZCTA with higher ACE permits than above-median ACE permit counts.

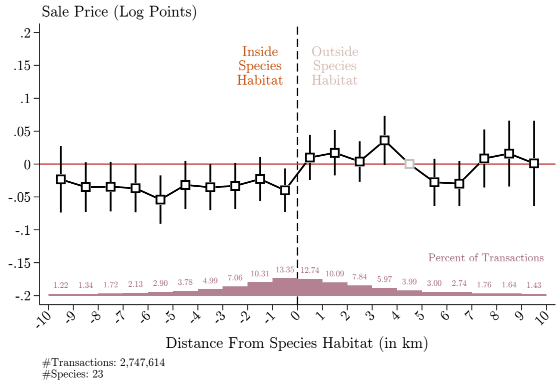
Figure A19: Reclassifying High FWS Consultations

SH

(a) Above 75th Percentile

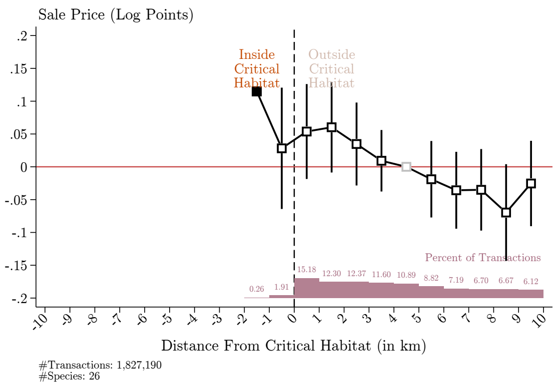


(b) Above 90th Percentile

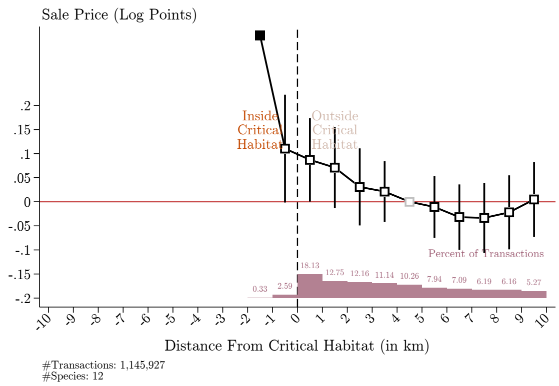


CH

(c) Above 75th Percentile



(d) Above 90th Percentile



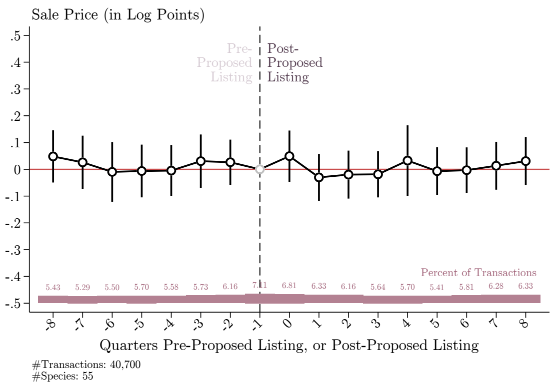
Notes: Same as in Figure 7, panels c and f, but focusing on species with higher FWS consultations than above-median FWS consultation counts.

Figure A20: Focusing on Repeated Sales for Baseline Specification & Treatment Onset

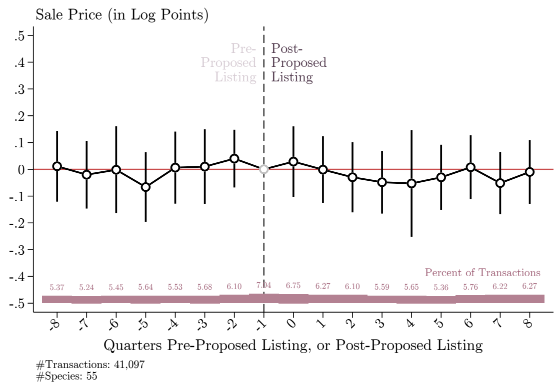
Without Parcel FE | **With Parcel FE**

Two Years Before & After Proposed Rule

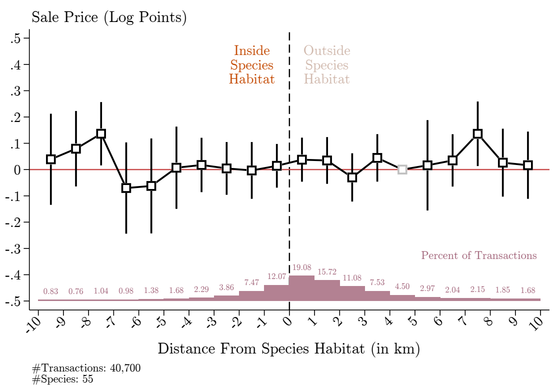
(a) Staggered DD



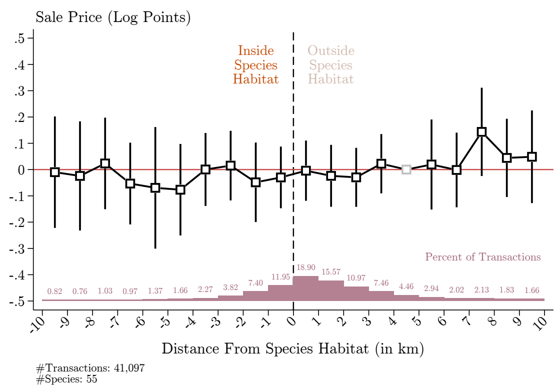
(b) Staggered DD



(c) Spatial DD

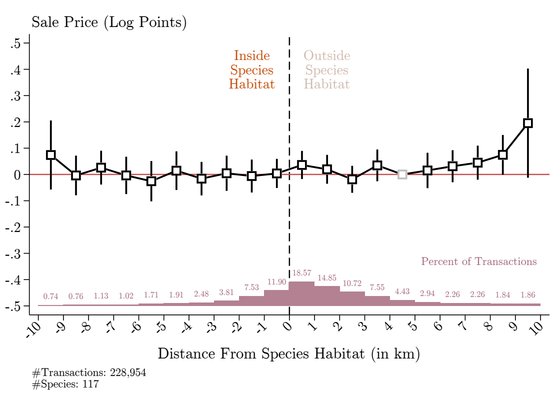


(d) Spatial DD

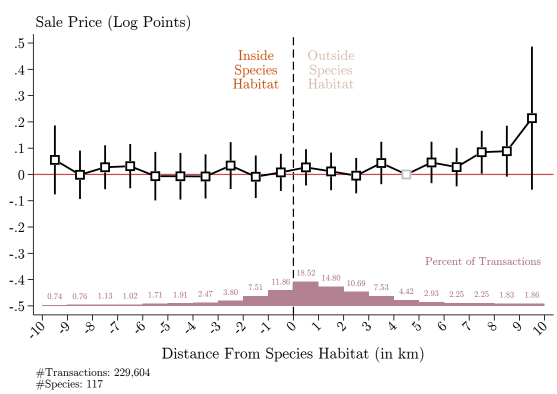


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



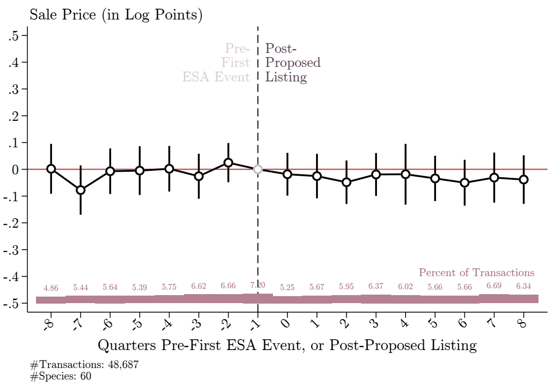
Notes: Same as in Figure 6, but using properties with repeated sales during the time window (having at least one sale before and one sale after the proposed listing rule).

Figure A21: Focusing on Repeated Sales for Baseline Specification & First ESA Event

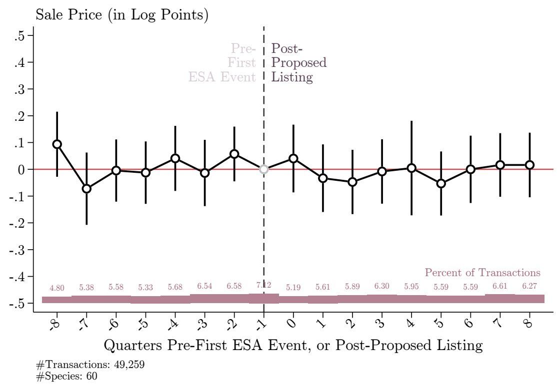
Without Parcel FE | **With Parcel FE**

Two Years Before & After Proposed Rule

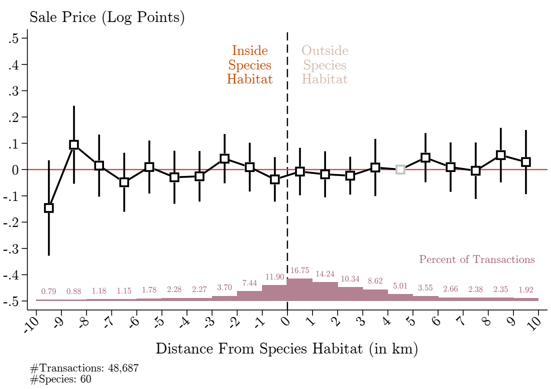
(a) Staggered DD



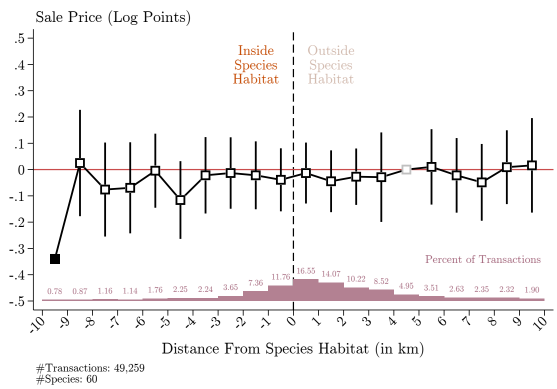
(b) Staggered DD



(c) Spatial DD

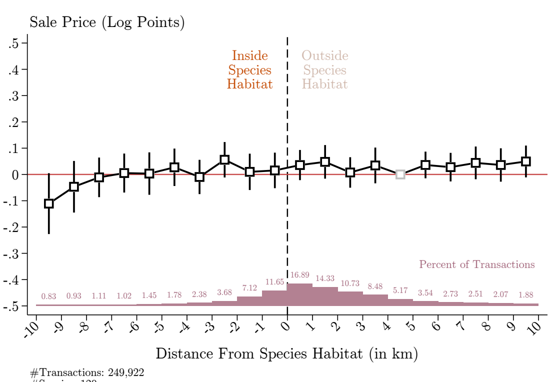


(d) Spatial DD

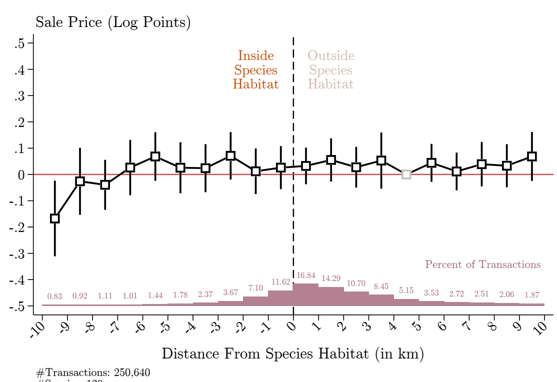


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



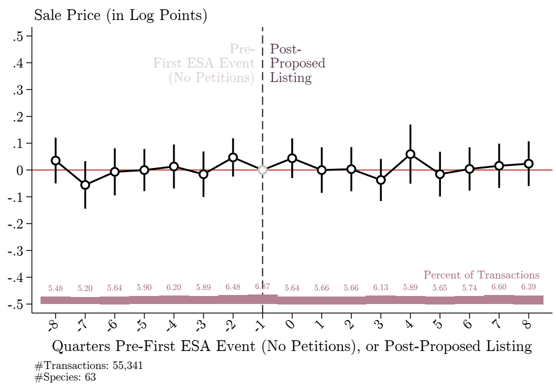
Notes: Same as in Figure 6, but using properties with repeated sales during the time window (having at least one sale before and one sale after the proposed listing rule), and using the first ESA event as the pre-treatment definer.

Figure A22: Focusing on Repeated Sales for Baseline Specification & First ESA Event (w/o Petitions)

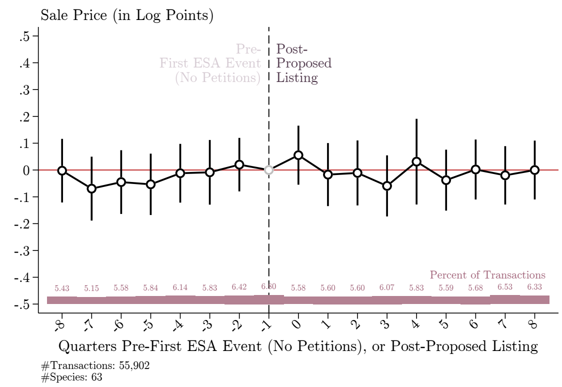
Without Parcel FE | **With Parcel FE**

Two Years Before & After Proposed Rule

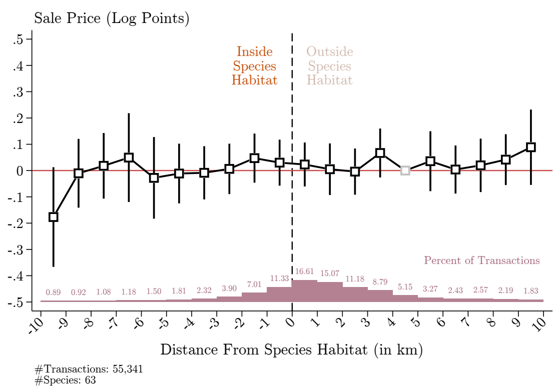
(a) Staggered DD



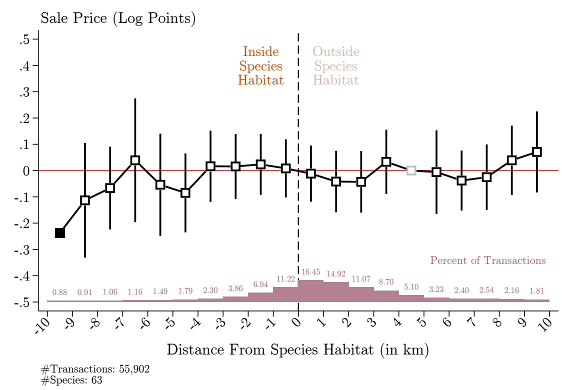
(b) Staggered DD



(c) Spatial DD

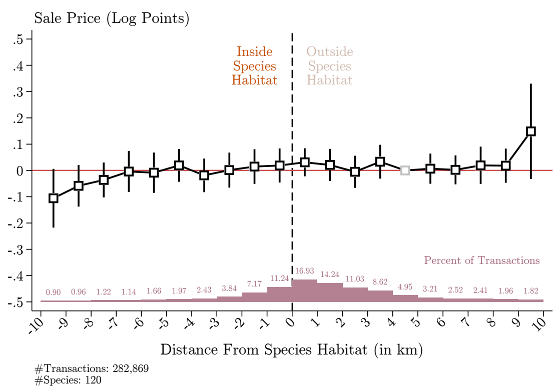


(d) Spatial DD

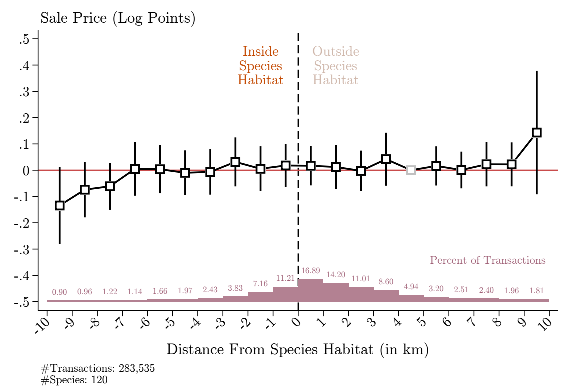


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



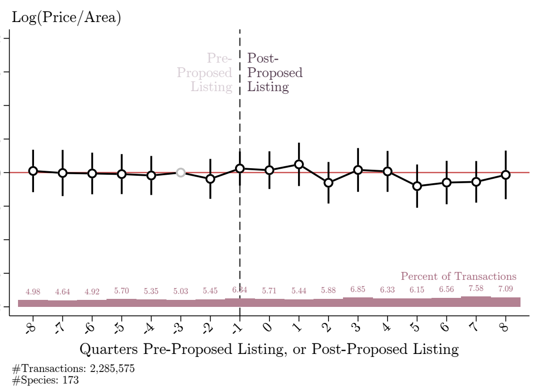
Notes: Same as in Figure 6, but using properties with repeated sales during the time window (having at least one sale before and one sale after the proposed listing rule), and using the first ESA event (excluding petitions) as the pre-treatment definer.

Figure A23: Estimation Results for Log(Sale Price/Area)

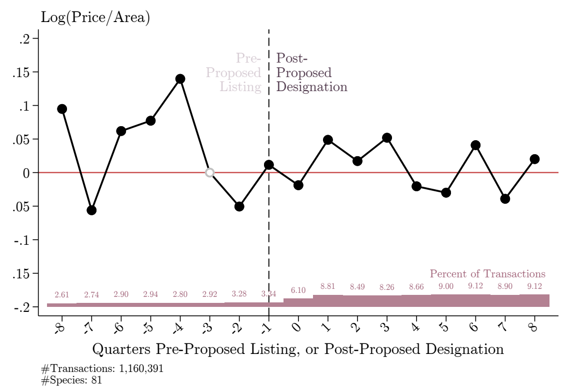
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

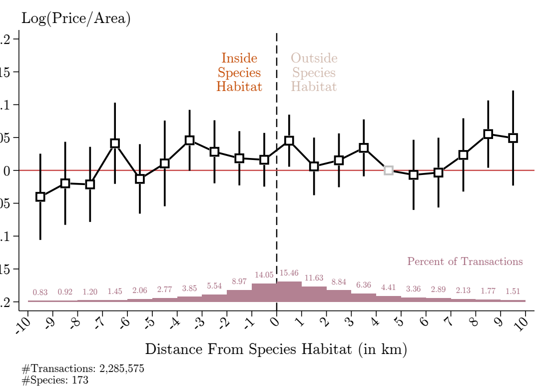
(a) Staggered DD



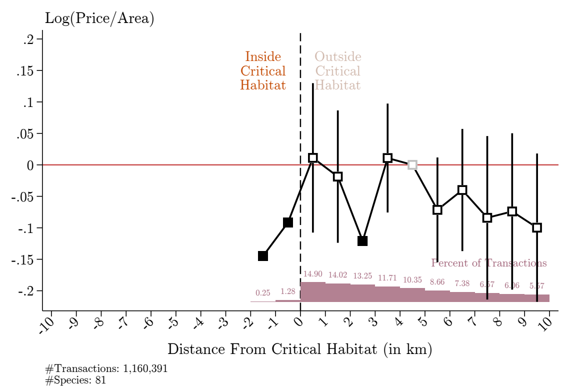
(b) Staggered DD



(c) Spatial DD

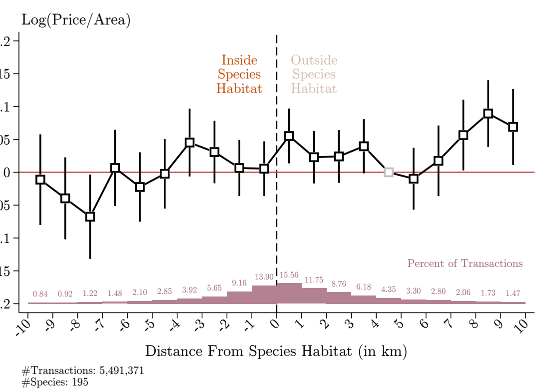


(d) Spatial DD

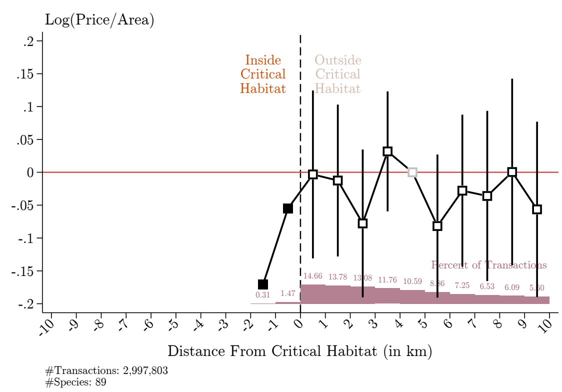


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



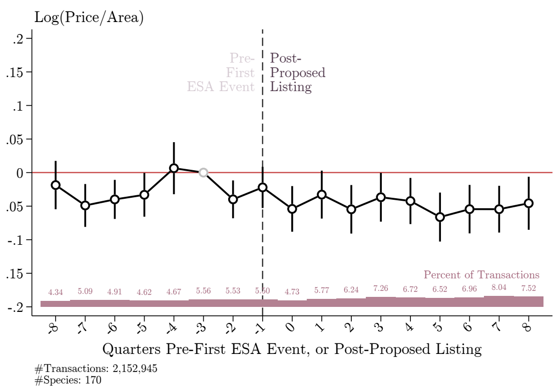
Notes: Same as in Figure 6, but using logged sale price divided by parcel area.

Figure A24: Estimation Results for Log(Sale Price/Area) & First ESA Event

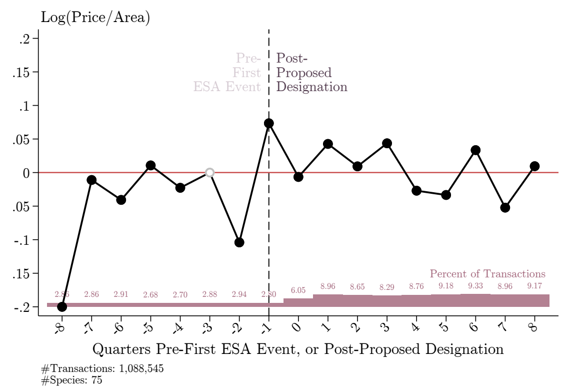
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

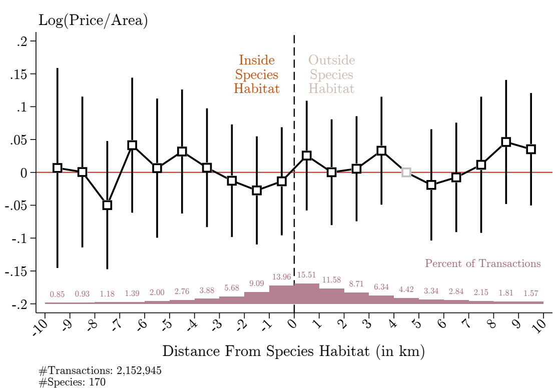
(a) Staggered DD



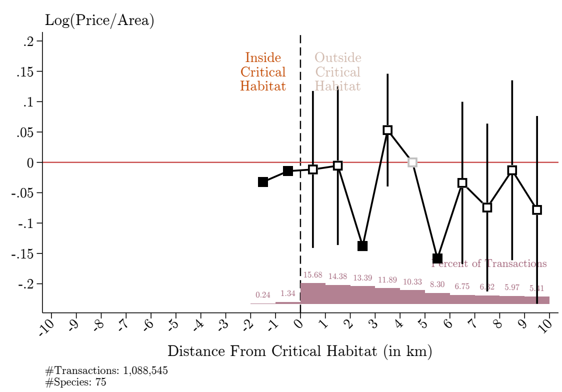
(b) Staggered DD



(c) Spatial DD

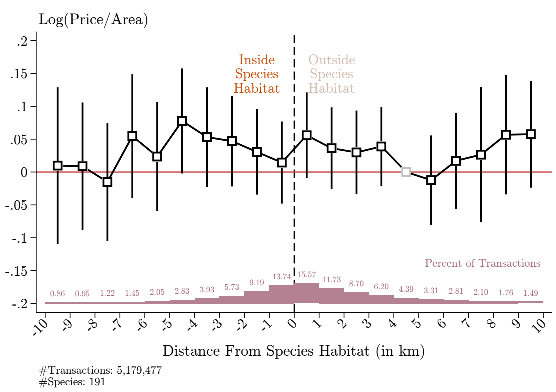


(d) Spatial DD

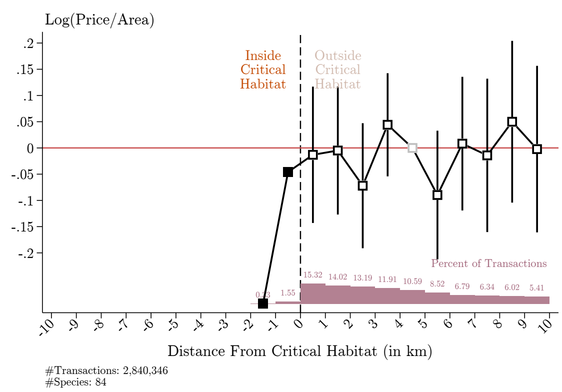


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



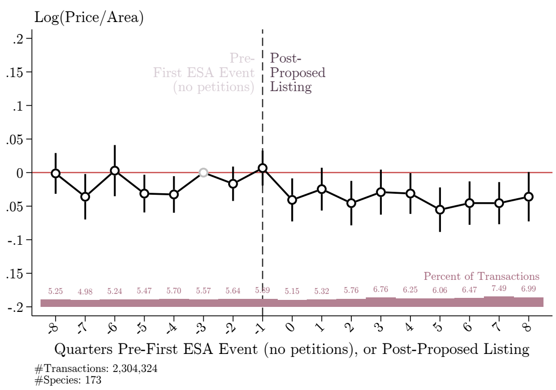
Notes: Same as in Figure 6, but using logged sale price divided by parcel area, and using the first ESA event as the treatment onset.

Figure A25: Estimation Results for Log(Sale Price/Area) First ESA Event excl. Petitions

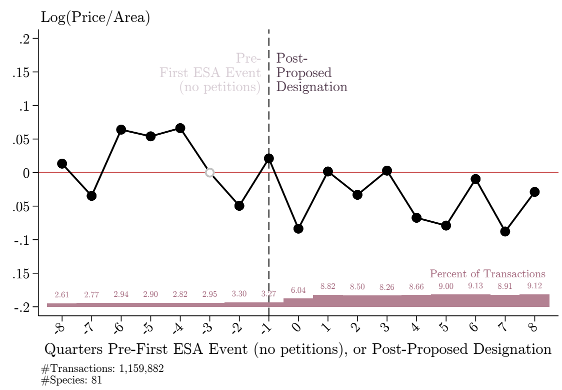
Species Habitat **Critical Habitat**

Two Years Before & After Proposed Rule

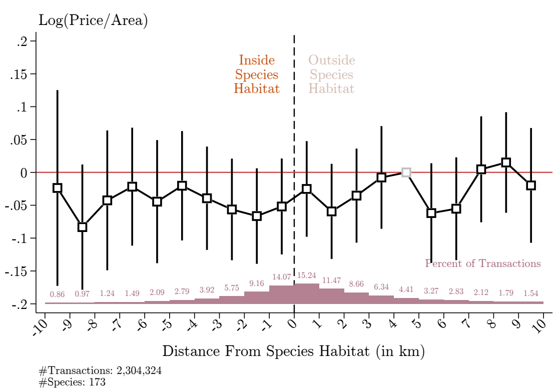
(a) Staggered DD



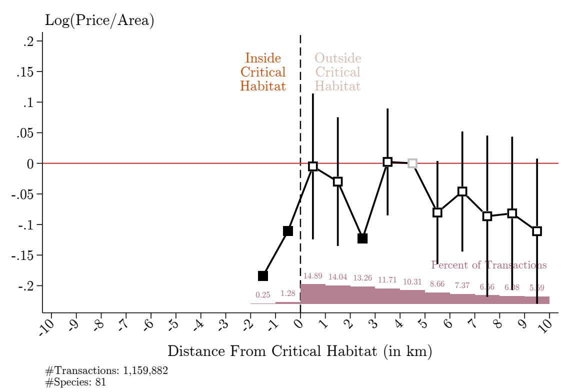
(b) Staggered DD



(c) Spatial DD

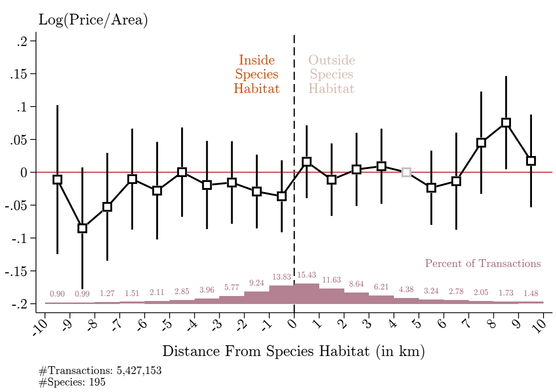


(d) Spatial DD

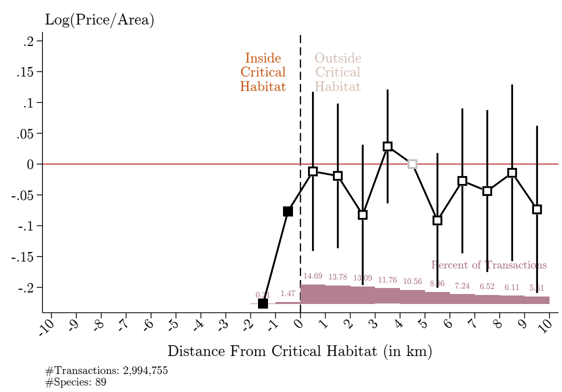


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



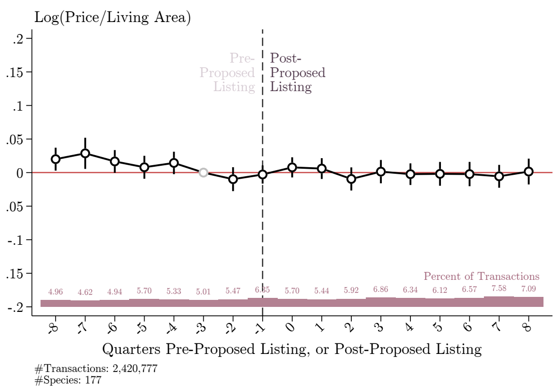
Notes: Same as in Figure 6, but using logged sale price divided by parcel area, and using the first ESA event as the treatment onset.

Figure A26: Estimation Results for Log(Sale Price/Living Area)

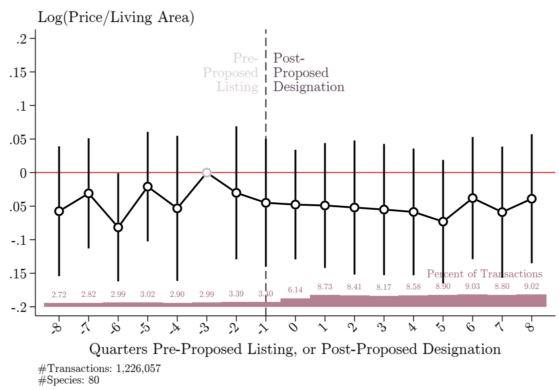
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

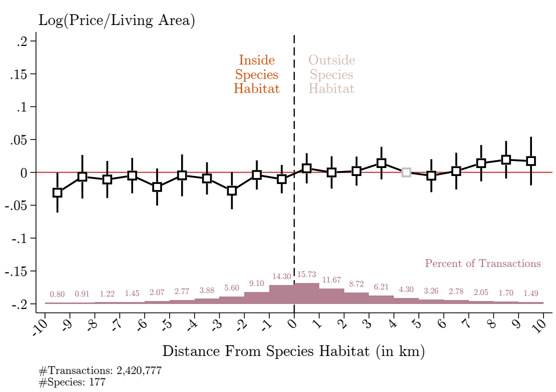
(a) Staggered DD



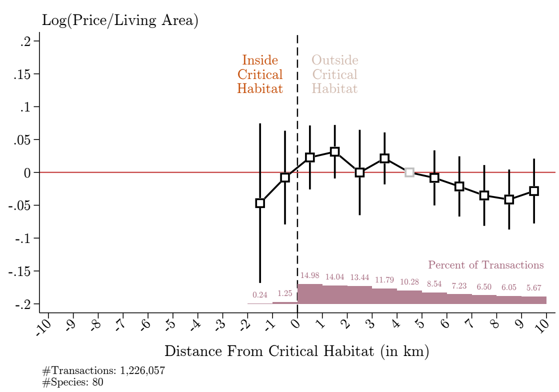
(b) Staggered DD



(c) Spatial DD

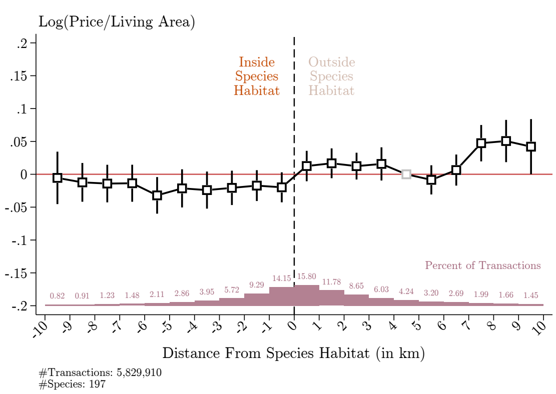


(d) Spatial DD

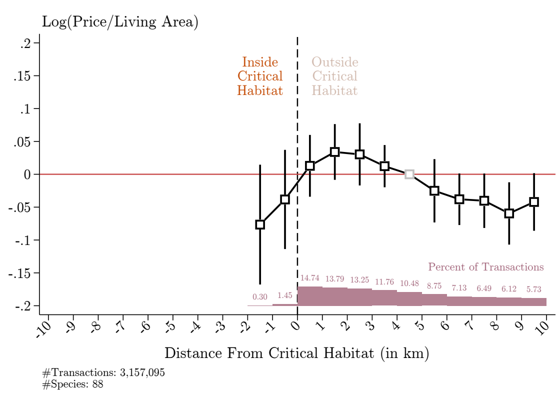


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



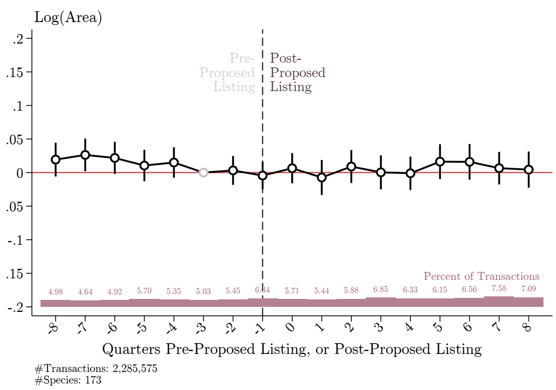
Notes: Same as in Figure 6, but using logged sale price divided by living area, and using the first ESA event as the treatment onset.

Figure A27: Estimation Results for Log(Area)

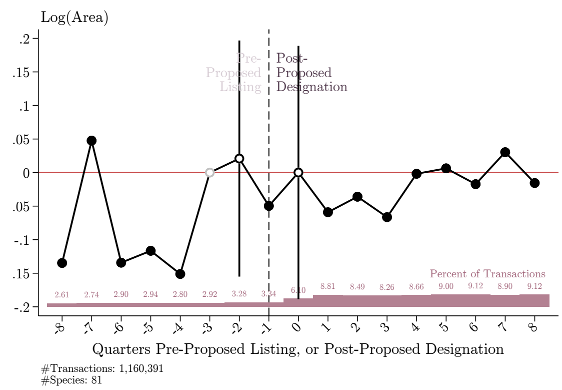
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

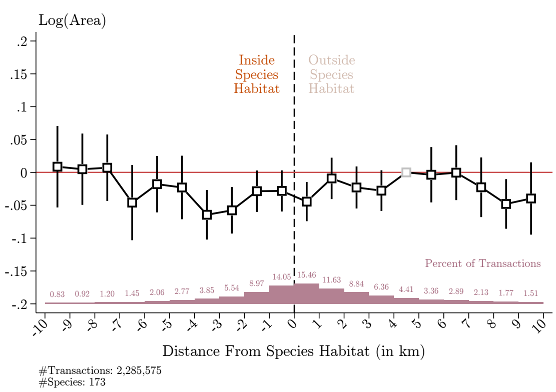
(a) Staggered DD



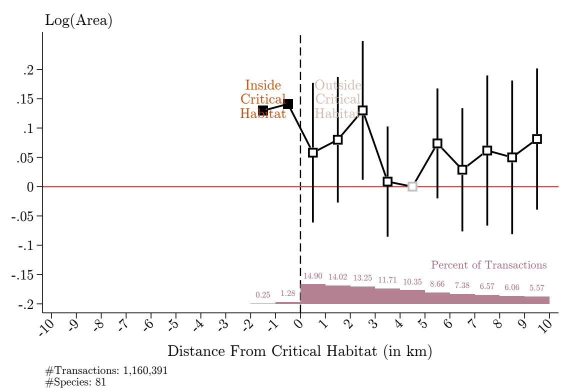
(b) Staggered DD



(c) Spatial DD

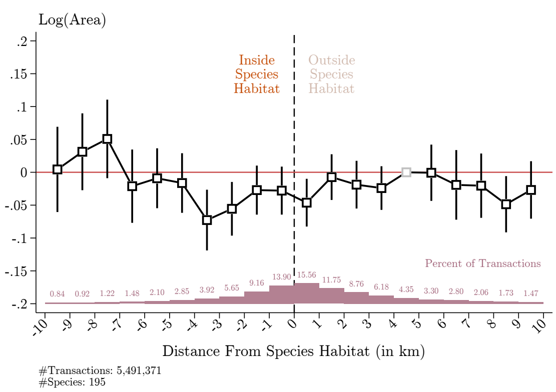


(d) Spatial DD

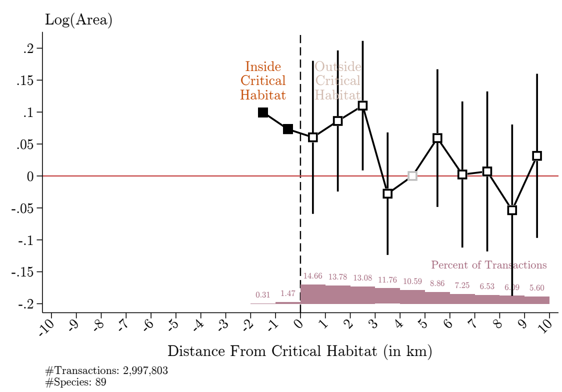


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



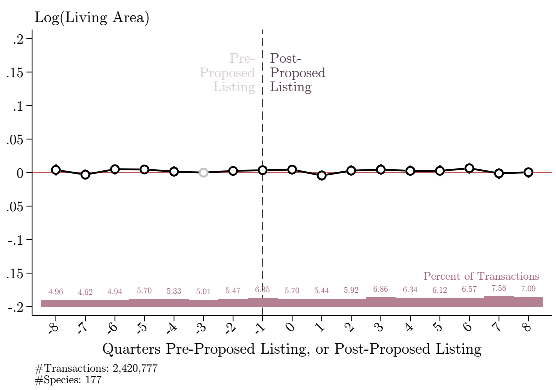
Notes: Same as in Figure 6, but using logged parcel area as the outcome.

Figure A28: Estimation Results for Log(Living Area)

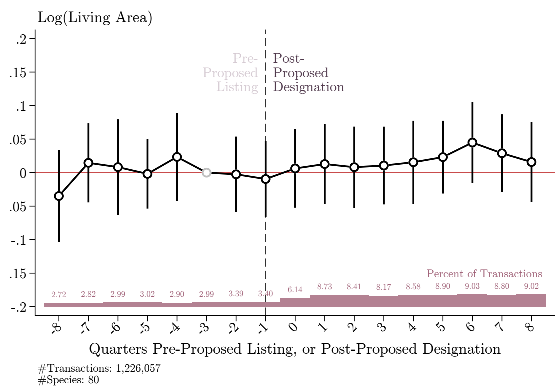
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

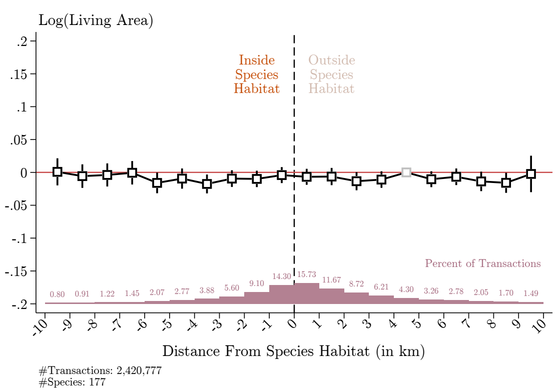
(a) Staggered DD



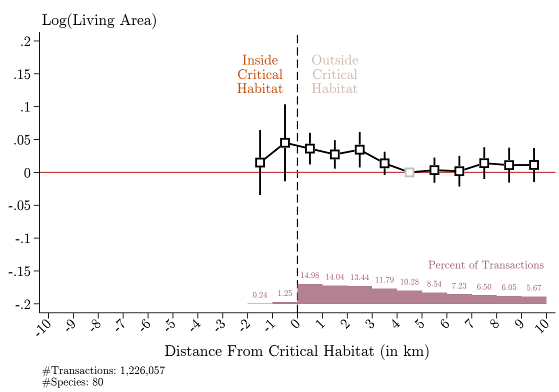
(b) Staggered DD



(c) Spatial DD

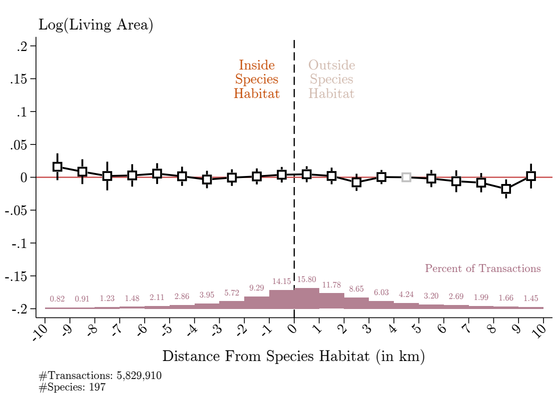


(d) Spatial DD

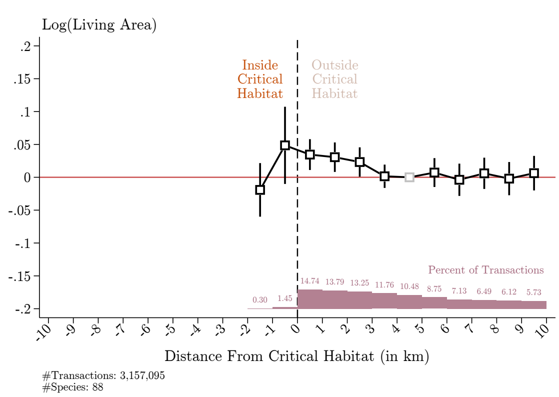


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD



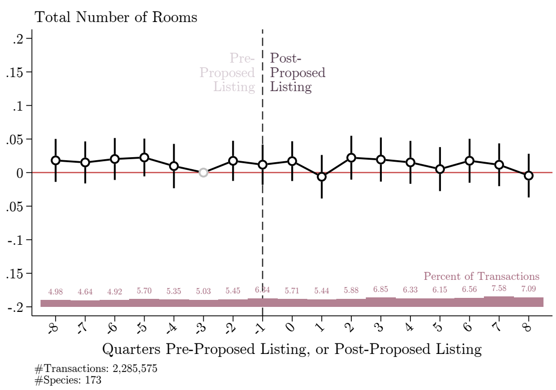
Notes: Same as in Figure 6, but using logged living area as the outcome.

Figure A29: Estimation Results for Total Rooms

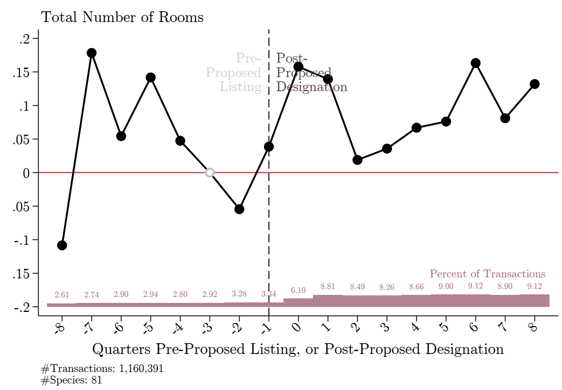
Species Habitat | **Critical Habitat**

Two Years Before & After Proposed Rule

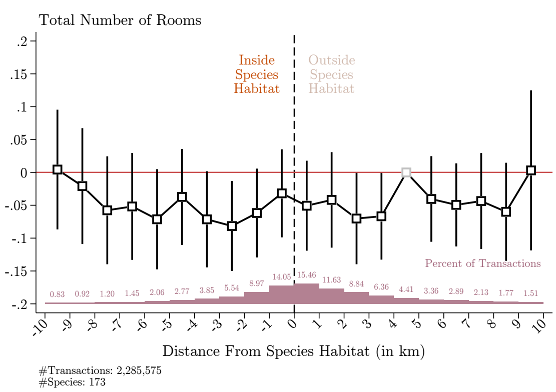
(a) Staggered DD



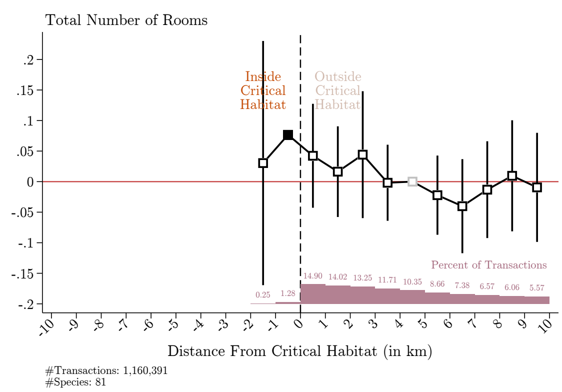
(b) Staggered DD



(c) Spatial DD

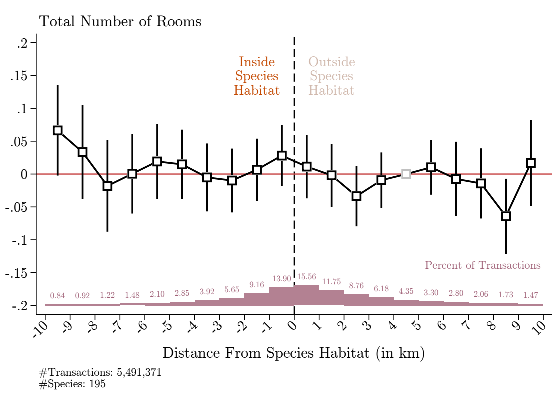


(d) Spatial DD

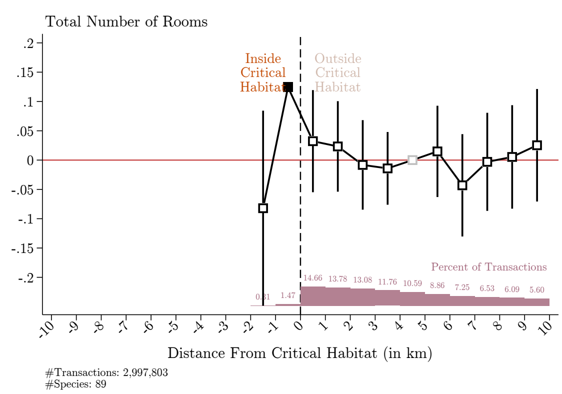


Five Years Before & After Proposed Rule

(e) Spatial DD



(f) Spatial DD

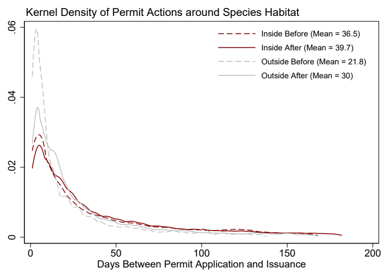


Notes: Same as in Figure 6, but using the number of total rooms as the outcome.

Figure A30: Distributions of Days from Application to Issuance of Construction Permits

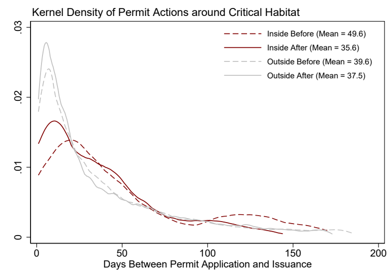
Species Habitat

(a) Four-Year Window Sample

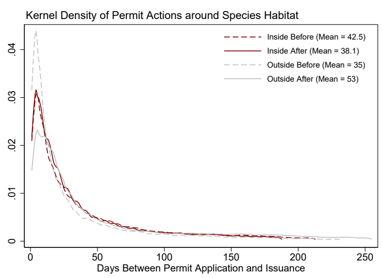


Critical Habitat

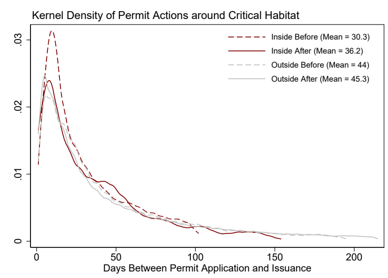
(b) Four-Year Window Sample



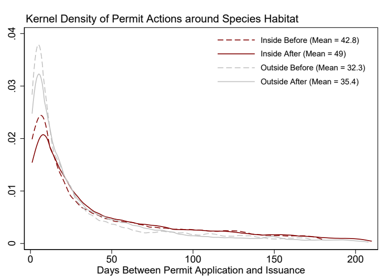
(c) Full Sample



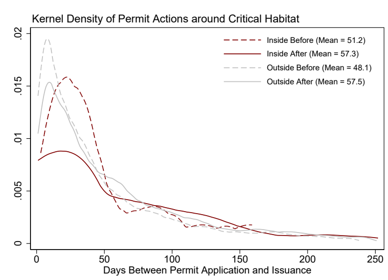
(d) Full Sample



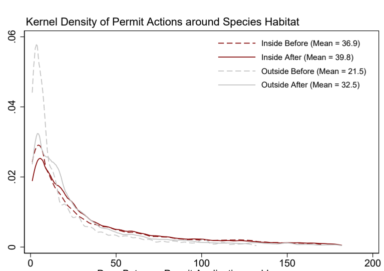
(e) Ever Conflict Species



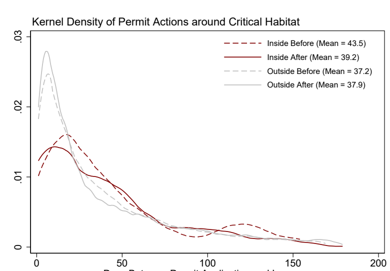
(f) Ever Conflict Species



(g) Lower Bound



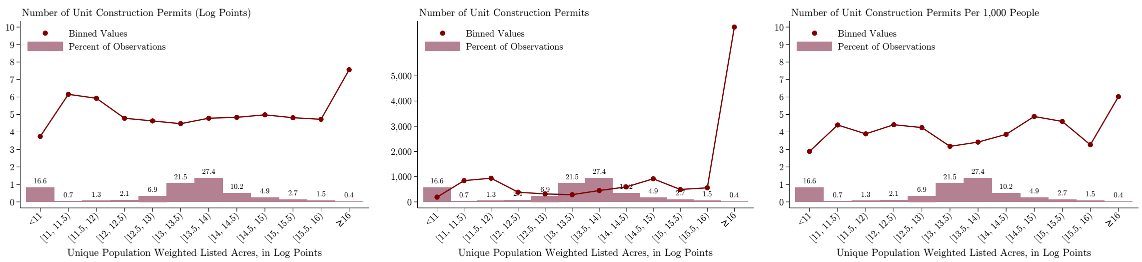
(h) Lower Bound



Notes: We summarize the BuildZoom data by plotting kernel densities for the days between a permit application and its issuance for permits inside or outside a protected area, before or after a proposed listing or designation rule. We exclude values above the 90th percentile to allow for easier visual inspection.

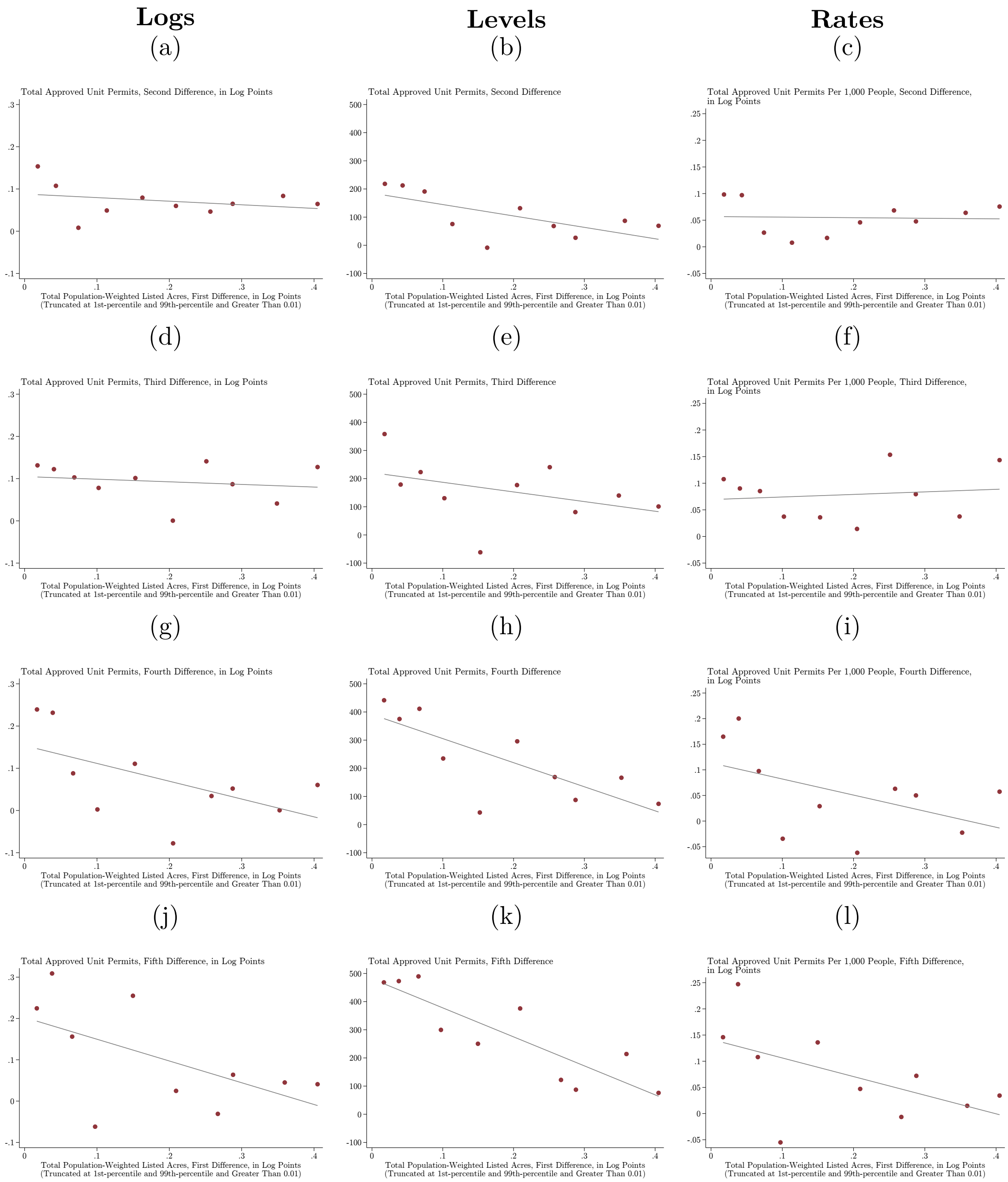
Figure A31: Construction Permits & Unique Protected Acres

Logs	**Levels**	**Rates**
(a)	(b)	(c)



Notes: Same as in Figure 10, only using unique protected acres instead of total protected acres.

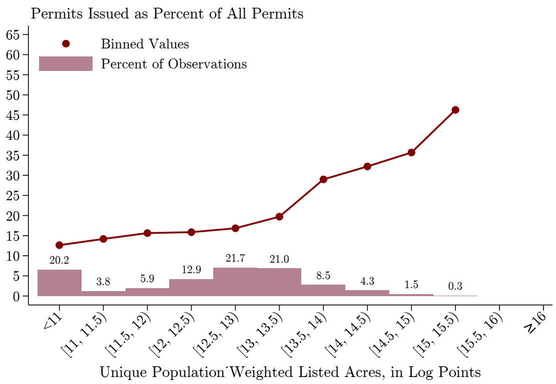
Figure A32: Approved Unit Permits Differences Binscatters



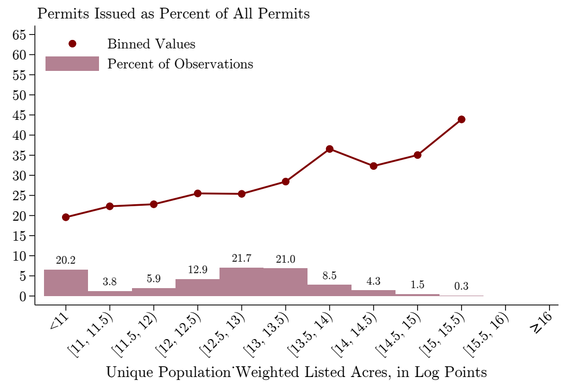
Notes: Same as in Figure 10, only using higher-order differences for the change in construction permits.

Figure A33: Army Corps of Engineers Permits in Near-Water Habitats

(a) % of Permits Issued with Special Conditions



(b) % of Permits Issued as Standard Permits

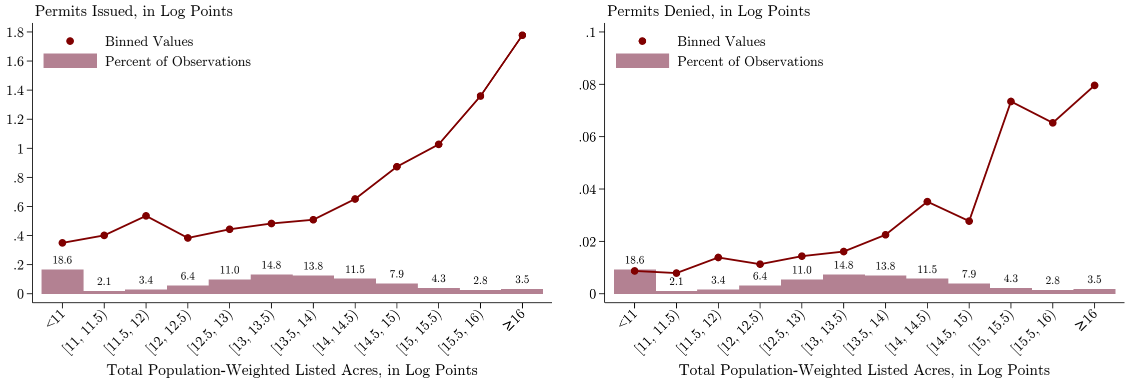


Notes: Same as in Figure 11, only using unique acres instead of total acres.

Figure A34: Army Corps of Engineers Permit Counts (Near-Water Habitats)

(a) Permit Count

(b) Denied Permit Count



Notes: Same as in Figure 11c, only plotting the counts (in log points) of the permits and denied permits, instead of the share of denied permits.

Table A1.
Examining Timing of Treatment for Residential Properties

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×Listing	.003	-.254	-.131	.007	-.372*	-.364*
	(.008)	(.261)	(.225)	(.01)	(.208)	(.209)
Inside[0-3]×Designation		.372*	.302		.439	.38*
		(.214)	(.226)		(.273)	(.212)
Outside[0-3]×Listing	.041***	.173	.349**	.033***	.043	.066
	(.01)	(.175)	(.136)	(.012)	(.033)	(.098)
Outside[0-3]×Designation		.007	-.113		.06	-.014
		(.072)	(.088)		(.165)	(.087)
Outside[3-6]×Listing	.03**	.13	.273**	.026*	-.036	-.026
	(.013)	(.176)	(.135)	(.014)	(.056)	(.097)
Outside[3-6]×Designation		.009	-.066		.105	.061
		(.074)	(.088)		(.17)	(.086)
R^2	0.655	0.687	0.696	0.689	0.707	0.715
N	5,047,035	2,281,547	1,986,153	2,659,457	1,811,624	1,636,347
Clusters	6,235	1,625	1,380	3,789	1,199	1,039

Notes: Linear combinations of coefficients estimated using the specification in Equation (3). The sample consists of all transactions inside the protected area, up to 3km, and up to 6km outside of the protected area. We report estimates around the borders of the species habitats (Columns 1 and 4), and critical habitats (Columns 2, 3, 5, and 6). In columns 4–6, we restrict the sample to species that were flagged as potential cases of with conflict real-estate development. In Columns 3 and 6, we narrow the comparison by only including transactions outside of the critical habitats if they are also within the species habitat (in order to focus on the marginal effect of the critical habitat designation).

Table A2.
Examining Timing of Treatment for Residential Properties

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×LP	-0.038***	-0.217	-0.234	-0.017	-0.561*	0.061
	(0.015)	(0.157)	(0.156)	(0.018)	(0.306)	(0.285)
Inside[0-3]×PL	-0.027**	-0.133	-0.145	-0.007	-0.513**	-0.444**
	(0.011)	(0.219)	(0.219)	(0.015)	(0.201)	(0.207)
Inside[0-3]×FL	0.030***	-0.121	0.014	0.014	0.141***	0.081
	(0.009)	(0.187)	(0.139)	(0.012)	(0.050)	(0.049)
Inside[0-3]×PD		0.390*	0.422**		0.433	0.361*
		(0.200)	(0.202)		(0.315)	(0.199)
Inside[0-3]×FD		-0.018	-0.120		0.006	0.019
		(0.069)	(0.088)		(0.101)	(0.073)
Outside[0-3]×LP	-0.058***	-0.238	-0.233	-0.014	-0.555*	0.091
	(0.018)	(0.158)	(0.150)	(0.021)	(0.308)	(0.270)
Outside[0-3]×PL	-0.000	0.402***	0.407***	0.020		0.061
	(0.012)	(0.106)	(0.103)	(0.016)		(0.097)
Outside[0-3]×FL	0.041***	-0.229	-0.057	0.012	0.043	0.005
	(0.010)	(0.179)	(0.132)	(0.014)	(0.033)	(0.023)
Outside[0-3]×PD		-0.020	-0.039		0.008	-0.082*
		(0.040)	(0.041)		(0.223)	(0.047)
Outside[0-3]×FD		0.027	-0.074		0.052	0.068
		(0.060)	(0.078)		(0.090)	(0.073)
Outside[3-6]×LP	-0.065***	-0.272*	-0.277*	-0.079***	-0.578*	0.046
	(0.020)	(0.159)	(0.150)	(0.029)	(0.308)	(0.271)
Outside[3-6]×PL	-0.008	0.377***	0.348***	0.021	-0.036	0.019
	(0.015)	(0.107)	(0.103)	(0.023)	(0.056)	(0.097)
Outside[3-6]×FL	0.038***	-0.247	-0.075	0.005		-0.045
	(0.014)	(0.179)	(0.133)	(0.022)		(0.028)
Outside[3-6]×PD		-0.018	0.006		0.059	-0.003
		(0.043)	(0.042)		(0.227)	(0.046)
Outside[3-6]×FD		0.027	-0.072		0.047	0.065
		(0.061)	(0.078)		(0.090)	(0.073)
R^2	0.655	0.687	0.696	0.689	0.707	0.715
N	5,047,035	2,281,547	1,986,153	2,659,457	1,811,624	1,636,347
Clusters	6,235	1,625	1,380	3,789	1,199	1,039

Notes: Detailed results of the estimation summarized in Table A1. LP: Lawsuit or petition (earliest of the two); PL: Proposed Listing; FL: Final Listing; PD: Proposed CH Designation; FD: Final CH Designation.

Table A3.
Examining Timing of Treatment for Residential Vacant Lands

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×LP	0.013	-1.150**	-0.005	-0.001	-1.167**	-0.132
	(0.068)	(0.562)	(0.277)	(0.073)	(0.583)	(0.308)
Inside[0-3]×PL	0.136**	0.541	0.746	0.198***	0.485	0.784
	(0.068)	(0.486)	(0.632)	(0.071)	(0.594)	(0.648)
Inside[0-3]×FL	-0.075	0.158	-0.122	-0.126*	0.142	-0.119
	(0.070)	(0.479)	(0.566)	(0.075)	(0.590)	(0.581)
Inside[0-3]×PD						
Inside[0-3]×FD		-0.241	-0.193		-0.218	-0.271
		(0.163)	(0.281)		(0.167)	(0.287)
Outside[0-3]×LP	0.080	-1.412**	0.162	0.094	-1.419**	0.029
	(0.083)	(0.630)	(0.313)	(0.090)	(0.649)	(0.347)
Outside[0-3]×PL	0.098	1.723***	1.806***	0.183**	1.635***	1.873***
	(0.071)	(0.491)	(0.581)	(0.076)	(0.558)	(0.620)
Outside[0-3]×FL	-0.026	0.136	0.275	-0.038	0.545**	0.583***
	(0.071)	(0.159)	(0.169)	(0.080)	(0.264)	(0.224)
Outside[0-3]×PD		-1.330***	-1.619***		-1.750***	-1.945***
		(0.480)	(0.515)		(0.595)	(0.596)
Outside[0-3]×FD		-0.001	0.085		0.004	0.007
		(0.144)	(0.247)		(0.148)	(0.242)
Outside[3-6]×LP	0.036	-1.432**	-0.222	-0.054	-1.418**	-0.389
	(0.092)	(0.641)	(0.330)	(0.109)	(0.665)	(0.366)
Outside[3-6]×PL	0.045	0.803***	0.422	0.157	0.714***	0.265
	(0.081)	(0.181)	(0.330)	(0.095)	(0.210)	(0.308)
Outside[3-6]×FL	-0.070	-0.072	-0.020	-0.200**	0.018	0.004
	(0.085)	(0.109)	(0.156)	(0.101)	(0.145)	(0.155)
Outside[3-6]×PD		-0.382**	-0.052		-0.372*	0.177
		(0.153)	(0.214)		(0.205)	(0.195)
Outside[3-6]×FD		0.015	-0.009		0.024	-0.100
		(0.166)	(0.265)		(0.174)	(0.261)
R^2	0.505	0.482	0.513	0.532	0.504	0.547
N	189,501	76,418	54,449	108,335	58,863	43,397
Clusters	3,754	1,039	835	2,366	840	718

Notes: See Table A2.

Table A4.
Examining Timing of Treatment for Nonresidential Vacant Lands

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×LP	0.064	-1.029**	-0.993*	-0.003	0.017	-0.454
	(0.091)	(0.433)	(0.544)	(0.121)	(0.192)	(0.421)
Inside[0-3]×PL	0.030	3.700***	3.461***	0.015	1.870***	1.882***
	(0.089)	(0.358)	(0.366)	(0.136)	(0.341)	(0.479)
Inside[0-3]×FL	-0.023	-1.998***	-1.747*	-0.060	0.451	0.566*
	(0.088)	(0.736)	(0.908)	(0.138)	(0.328)	(0.290)
Inside[0-3]×PD		-1.525**	-1.519**		-2.716***	-2.757***
		(0.630)	(0.638)		(0.422)	(0.435)
Inside[0-3]×FD		0.765**	0.644		1.046***	0.935***
		(0.376)	(0.419)		(0.268)	(0.262)
Outside[0-3]×LP	0.087	-0.969**	-0.615	0.170	0.072	-0.085
	(0.115)	(0.438)	(0.553)	(0.145)	(0.163)	(0.407)
Outside[0-3]×PL	-0.001	1.184***	3.240***	0.114	-0.084	1.612***
	(0.098)	(0.249)	(0.294)	(0.161)	(0.262)	(0.439)
Outside[0-3]×FL	-0.097	-1.046*	-0.931	-0.223	-0.411	-0.442*
	(0.100)	(0.594)	(0.763)	(0.160)	(0.259)	(0.264)
Outside[0-3]×PD			-2.248***			-1.741***
			(0.243)			(0.361)
Outside[0-3]×FD		0.874**	0.843**		1.195***	1.200***
		(0.385)	(0.424)		(0.264)	(0.250)
Outside[3-6]×LP	0.176	-0.820*	-0.326	0.243	0.059	0.078
	(0.121)	(0.435)	(0.560)	(0.166)	(0.185)	(0.394)
Outside[3-6]×PL	0.200	0.936***	0.893***	0.384	-0.650*	-0.705
	(0.157)	(0.220)	(0.238)	(0.247)	(0.346)	(0.466)
Outside[3-6]×FL	-0.216	-1.127*	-1.153	-0.329	0.002	-0.048
	(0.169)	(0.579)	(0.762)	(0.270)	(0.314)	(0.319)
Outside[3-6]×PD						
Outside[3-6]×FD		1.021***	1.029**		1.396***	1.422***
		(0.387)	(0.419)		(0.262)	(0.241)
R^2	0.465	0.376	0.360	0.483	0.417	0.442
N	76,928	23,347	17,288	46,376	12,823	8,980
Clusters	1,998	524	393	1,308	384	284

Notes: See Table A2.

Table A5.
Examining Timing of Treatment for Residential Vacant Lands (Pooled from Table A3)

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×Listing	.062	.699**	.624	.072	.628**	.665
	(.049)	(.279)	(.405)	(.059)	(.306)	(.416)
Inside[0-3]×Designation		-.241	-.193		-.218	-.271
		(.163)	(.281)		(.167)	(.287)
Outside[0-3]×Listing	.072	1.859***	2.082***	.146***	2.18***	2.456***
	(.054)	(.5)	(.594)	(.055)	(.599)	(.65)
Outside[0-3]×Designation		-1.33***	-1.535***		-1.747***	-1.938***
		(.5)	(.570)		(.611)	(.64)
Outside[3-6]×Listing	-.026	.732***	.402	-.043	.732***	.268
	(.058)	(.203)	(.368)	(.068)	(.236)	(.335)
Outside[3-6]×Designation		-.366*	-.061		-.348	.077
		(.216)	(.339)		(.255)	(.319)

Notes: See Table A1.

Table A6.
Examining Timing of Treatment for Nonresidential Vacant Lands (Pooled from Table A4)

	Main Sample			Ever Conflict Sample		
	SH	CH	M. CH	SH	CH	M. CH
	(1)	(2)	(3)	(4)	(5)	(6)
Inside[0-3]×Listing	.007	1.702**	1.714*	-.045	2.321***	2.448***
	(.07)	(.797)	(.981)	(.088)	(.446)	(.552)
Inside[0-3]×Designation		-.759	-.875		-1.671***	-1.822***
		(.688)	(.741)		(.495)	(.51)
Outside[0-3]×Listing	-.097	.138	2.309***	-.109	-.495***	1.169**
	(.073)	(.502)	(.737)	(.097)	(.149)	(.498)
Outside[0-3]×Designation		.874**	-1.405***		1.195***	-.54
		(.385)	(.499)		(.264)	(.445)
Outside[3-6]×Listing	-.016	-.191	-.26	.056	-.648***	-.753**
	(.094)	(.497)	(.722)	(.117)	(.105)	(.356)
Outside[3-6]×Designation		1.021***	1.029**		1.396***	1.422***
		(.387)	(.419)		(.262)	(.241)

Notes: See Table A1.

Table A7.
Examining Timing of Treatment for Permit Approval Duration

	Not Solely Aquatic		Ever Conflict	
	SH	CH	SH	CH
	(1)	(2)	(3)	(4)
Inside[0-3]×LP	0.126*	0.278	0.043	-0.181
	(0.073)	(0.215)	(0.075)	(0.509)
Inside[0-3]×PL	-0.079	-1.061***	0.050	-0.047
	(0.080)	(0.312)	(0.073)	(0.108)
Inside[0-3]×FL	0.056	0.658**	-0.026	2.421***
	(0.068)	(0.281)	(0.071)	(0.377)
Inside[0-3]×PD		-0.349		-1.734***
		(0.251)		(0.384)
Inside[0-3]×FD		-0.567**		-0.768***
		(0.233)		(0.169)
Outside[0-3]×LP	0.143	0.309*	0.107	-0.282
	(0.090)	(0.181)	(0.091)	(0.456)
Outside[0-3]×PL	-0.051	-2.070***	0.009	0.459
	(0.086)	(0.432)	(0.088)	(0.493)
Outside[0-3]×FL	0.041	-0.003	0.057	-0.272*
	(0.079)	(0.121)	(0.103)	(0.141)
Outside[0-3]×PD		0.898**		-0.328
		(0.366)		(0.503)
Outside[0-3]×FD		0.046		0.068
		(0.093)		(0.077)
Outside[3-6]×LP	0.247**	0.262	0.105	-0.459
	(0.099)	(0.243)	(0.132)	(0.442)
Outside[3-6]×PL	-0.114	-1.552***	0.147	-0.270
	(0.099)	(0.516)	(0.102)	(0.654)
Outside[3-6]×FL	-0.119	0.085	-0.352***	-0.096
	(0.096)	(0.141)	(0.135)	(0.138)
Outside[3-6]×PD		0.593		0.418
		(0.479)		(0.663)
Outside[3-6]×FD		-0.055		-0.025
		(0.138)		(0.081)
R^2	0.355	0.143	0.407	0.249
N	658,476	206,150	364,290	165,380
Clusters	1,962	287	1,374	420

Notes: See Table A2. The outcome variable is the log of days between permit application and issuance.

Table A8.
Examining Timing of Treatment for Permit Approval Duration (Pooled from Table A7)

	Not Solely Aquatic		Ever Conflict	
	SH	CH	SH	CH
	(1)	(2)	(3)	(4)
Inside[0-3]×Listing	-.022	-.404	.024	2.374***
	(.064)	(.394)	(.076)	(.403)
Inside[0-3]×Designation		-.916***		-2.502***
		(.33)		(.422)
Outside[0-3]×Listing	-.01	-2.073***	.066	.187
	(.079)	(.443)	(.099)	(.5)
Outside[0-3]×Designation		.945**		-.26
		(.388)		(.495)
Outside[3-6]×Listing	-.233***	-1.467***	-.206*	-.366
	(.086)	(.518)	(.112)	(.639)
Outside[3-6]×Designation		.537		.393
		(.479)		(.648)

Notes: See Table A1. The outcome variable is the log of days between permit application and issuance.

Table A9.
Species by Species Estimations for SH, Residential Lands

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lawsuit	0.045										0.083**
	(0.034)										(0.039)
Petition		0.034									0.026
		(0.036)									(0.048)
Listing Decade: 1990			-0.047								0.033
			(0.071)								(0.087)
Listing Decade: 2000			-0.010								0.103
			(0.069)								(0.100)
Listing Decade: 2010			-0.005								0.192
			(0.072)								(0.126)
Consultations (1000s)				0.000							-0.006
				(0.002)							(0.004)
RPN: medium					-0.043						0.013
					(0.054)						(0.071)
RPN: high					-0.008						0.023
					(0.047)						(0.068)
Ever Conflict						-0.044					-0.049
						(0.043)					(0.051)
Birds							-0.047				-0.031
							(0.032)				(0.087)
Crustaceans							-0.236***				-0.292**
							(0.020)				(0.132)
Flowering Plants							-0.038				0.032
							(0.038)				(0.061)
Insects							-0.054				-0.010
							(0.038)				(0.074)
Lichens							-0.111***				-0.159
							(0.020)				(0.153)
Mammals							0.004				0.001
							(0.061)				(0.095)
Reptiles							0.025				0.119
							(0.037)				(0.075)
Percent Metro								0.001			0.002
								(0.001)			(0.002)
Log Mean Price Pre									-0.050		-0.142**
									(0.043)		(0.064)
Pacific										-0.007	-0.032
										(0.035)	(0.047)
Southwest										-0.036	-0.045
										(0.033)	(0.069)
Midwest										0.048	0.048
										(0.056)	(0.069)
Southeast										0.035	0.036
										(0.081)	(0.108)
Mountain										0.024	0.068
										(0.035)	(0.063)
Pacific Sw										0.002	0.030
										(0.041)	(0.051)
Constant	-0.026	-0.022	0.015	-0.009	0.004	0.017	0.023	-0.076	0.583	-0.020	1.366*
	(0.030)	(0.029)	(0.064)	(0.021)	(0.034)	(0.035)	(0.020)	(0.119)	(0.510)	(0.039)	(0.696)
N	165	165	161	165	156	156	165	165	165	165	155
R^2	7.8e-03	4.3e-03	7.2e-03	2.5e-05	4.6e-03	7.3e-03	.012	4.6e-03	.013	7.2e-03	.103

Notes: omitted categories. Five outlier species with coefficients greater than 1 were dropped from the analysis.

Table A10.
Species by Species Estimations for SH, Residential Vacant Lands

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lawsuit	-0.075										0.008
	(0.124)										(0.187)
Petition		0.063									0.110
		(0.133)									(0.210)
Listing Decade: 1990			0.268								0.232
			(0.166)								(0.222)
Listing Decade: 2000			0.115								0.105
			(0.243)								(0.289)
Listing Decade: 2010			0.143								-0.439
			(0.147)								(0.343)
Consultations (1000s)				0.008							0.012
				(0.008)							(0.008)
RPN: medium					0.013						0.284*
					(0.139)						(0.161)
RPN: high					-0.068						0.124
					(0.151)						(0.179)
Ever Conflict						-0.203					-0.103
						(0.132)					(0.182)
Birds							0.011				-0.150
							(0.126)				(0.235)
Crustaceans							0.030				-0.059
							(0.133)				(0.212)
Flowering Plants							-0.029				-0.305
							(0.236)				(0.339)
Insects							-0.461				-0.815**
							(0.312)				(0.342)
Lichens							-0.113				-0.046
							(0.153)				(0.308)
Percent Metro								-0.007**			-0.008**
								(0.003)			(0.004)
Log Mean Price Pre									0.011		0.239*
									(0.075)		(0.124)
Pacific										0.275**	0.359
										(0.127)	(0.226)
Southwest										-0.087	-0.285
										(0.177)	(0.251)
Midwest										0.174	0.389*
										(0.151)	(0.217)
Southeast										-0.033	0.240
										(0.183)	(0.244)
Mountain										0.224	0.474
										(0.202)	(0.285)
Pacific Sw										-0.076	-0.177
										(0.138)	(0.191)
Constant	0.032	-0.044	-0.166	-0.025	0.025	0.118	0.050	0.575**	-0.140	-0.056	-2.210
	(0.088)	(0.118)	(0.129)	(0.069)	(0.070)	(0.096)	(0.091)	(0.254)	(0.911)	(0.124)	(1.355)
N	74	74	72	74	68	68	74	74	74	74	68
R^2	4.9e-03	3.4e-03	.033	6.4e-03	4.5e-03	.034	.094	.117	4.5e-04	.09	.484

Notes: omitted categories

Table A11.
Species by Species Estimations for SH, Nonresidential Vacant Lands

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lawsuit	-0.035										-0.563
	(0.261)										(0.333)
Petition		-0.238									0.614*
		(0.222)									(0.326)
Listing Decade: 1990			-0.183								-0.731
			(0.319)								(0.498)
Listing Decade: 2000			-0.322								-1.078
			(0.303)								(0.673)
Listing Decade: 2010			-0.245								-1.112*
			(0.286)								(0.551)
Consultations (1000s)				0.005							-0.021
				(0.010)							(0.027)
RPN: medium					0.234						0.151
					(0.265)						(0.294)
RPN: high					0.142						0.033
					(0.251)						(0.355)
Ever Conflict						-0.515**					0.007
						(0.220)					(0.402)
Birds							0.105				-0.580
							(0.388)				(0.446)
Crustaceans							0.572				0.528
							(0.428)				(0.395)
Flowering Plants							0.462				0.102
							(0.390)				(0.237)
Insects							0.447				0.127
							(0.398)				(0.847)
Lichens							0.061				-0.224
							(0.416)				(0.486)
Percent Metro								0.001			-0.003
								(0.002)			(0.004)
Log Mean Price Pre									-0.005		0.273
									(0.120)		(0.173)
Pacific										0.138	0.390
										(0.171)	(0.327)
Southwest										0.354	0.775*
										(0.222)	(0.374)
Midwest										0.486*	0.771*
										(0.252)	(0.399)
Southeast										-0.052	-0.020
										(0.299)	(0.347)
Mountain										-0.515**	-0.401
										(0.209)	(0.375)
Pacific Sw										0.144	0.222
										(0.174)	(0.215)
Constant	-0.016	0.118	0.241	-0.053	-0.158	0.311*	-0.326	-0.135	0.024	-0.199	-2.669
	(0.250)	(0.187)	(0.258)	(0.119)	(0.196)	(0.179)	(0.380)	(0.129)	(1.476)	(0.161)	(1.919)
N	44	44	41	44	40	40	44	44	44	44	39
R^2	6.5e-04	.029	.037	2.5e-03	.02	.112	.134	2.2e-03	3.7e-05	.111	.627

Notes: omitted categories

Table A12.
Species by Species Estimations for CH, Residential Lands

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Lawsuit	0.193*										0.244
	(0.113)										(0.224)
Petition		-0.134									-0.312
		(0.118)									(0.207)
Listing Decade: 1990			-0.112*								-0.353
			(0.065)								(0.291)
Listing Decade: 2000			-0.202								-0.899**
			(0.177)								(0.378)
Listing Decade: 2010			-0.233***								-0.888**
			(0.086)								(0.399)
Consultations (1000s)				0.107**							0.055
				(0.045)							(0.116)
RPN: medium					-0.133						0.071
					(0.165)						(0.217)
RPN: high					0.213*						0.105
					(0.122)						(0.156)
Ever Conflict						0.248**					-0.011
						(0.121)					(0.294)
Birds							-0.338***				-0.480
							(0.094)				(0.310)
Crustaceans							0.251**				-0.213
							(0.112)				(0.314)
Flowering Plants							0.079				0.011
							(0.167)				(0.220)
Insects							0.185				-0.061
							(0.112)				(0.265)
Lichens							-0.288				-0.585*
							(0.190)				(0.306)
Mammals							-0.178*				-0.510
							(0.094)				(0.295)
Percent Metro								-0.000			-0.002
								(0.001)			(0.002)
Log Mean Price Pre									-0.106		0.091
									(0.093)		(0.199)
Pacific										0.269	0.202
										(0.163)	(0.288)
Southwest										0.195*	0.183
										(0.100)	(0.212)
Midwest										-0.469***	-0.226
										(0.115)	(0.334)
Southeast										0.078	0.029
										(0.161)	(0.359)
Mountain										0.306***	0.144
										(0.089)	(0.273)
Pacific Sw										-0.045	-0.459*
										(0.109)	(0.244)
Constant	-0.259***	-0.053	0.037***	-0.181***	-0.214**	-0.315***	-0.187*	-0.126	1.139	-0.239**	-0.190
	(0.092)	(0.099)	(0.000)	(0.065)	(0.093)	(0.101)	(0.094)	(0.089)	(1.118)	(0.112)	(2.552)
N	46	46	46	46	43	43	46	46	46	46	43
R^2	.064	.031	.027	.05	.136	.094	.2	1.6e-04	.019	.212	.726

Notes: omitted categories

B Additional Background on the ESA

The Endangered Species Act (ESA) was enacted in 1973 with a nearly unanimous vote—passing in the House with a vote of 390-12 and the Senate with a vote of 92-0 (Mann and Plummer 1995). At the time, the act was seen by many in Congress as either an attempt to resolve a disagreement between the Departments of Defense and Interior regarding the protection of sperm whales, whose oil was used in submarines, or a needed step in implementing the recent ratification of the Convention on International Trade in Endangered Species (Mann and Plummer 1995). The act states its purpose as "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" (Endangered Species Act of 1973, Pub. L. No. 93-205, 87 1973). Two federal agencies are responsible for listing species as either "threatened" or "endangered," and managing their recovery: the Fish and Wildlife Service (FWS) and National Marine Fisheries Services (NMFS).

Adding to the list of threatened and endangered species begins with a notice of review. This simply provides a formal declaration that the agency is assessing if a species meets the criteria for listing. The agency can release a notice of review based on the information it has that suggests the species might meet the criteria, a petition submitted to the agency requesting a review process, or a court ruling that settles an action-forcing-lawsuit where the agency is directed to begin a review process. After the review process, the agency announces it has found the species to be unwarranted for listing, warranted but precluded at the time due to agency priorities and other constraints, or warranted. For the latter, it proceeds to release a proposed rule for listing the species, with a minimum of 60 days for public comments. Unless the agency proceeds with an emergency listing, it waits 12 months until it releases the final rule to list or withdraws the proposed rule. The ESA also includes a nondiscretionary mandate to to designate critical habitats (CHs). CHs also require a similar proposed and final rule process. At times, the agency releases the proposed and final rules for listing and designation on the same dates, but at other times, designation can lag after listing by several years, if the species receives a proposed designation at all.[20]

The petition process allows citizens or NGOs to request that the FWS review a species and consider its status for listing. The FWS either rejects that the information is substantial enough within 90 days or proceeds to conduct a full review. Even if the species is found to be warranted for listing, the FWS might delay releasing a proposed listing rule for several years by listing it as a candidate species.

The exemption from needing to conduct a cost–benefit analysis when proposing to list a species is more of a legislative "mishap" than by direct intention. Two versions of the bill existed, one each for the House and Senate committees. The version that was adopted was mostly based on the one drafted by the Senate committee that removed the word "practicable." This is what allows the agencies to avoid taking into account economic considerations. This form of balancing mechanism is often found in similar legislation (Mann and Plummer 1995). Another important difference is the definition of "taking" with respect to Section 9. In the version passed by the House, "take" meant a direct injuring or killing of a listed species; in the version passed by the Senate, it included any action that could "harm" a listed species, allowing for a very broad interpretation of the ESA's antitake provisions (Petersen 1999). As E.U. Curtis Bohlen, Deputy Interior Secretary, commented, "[a]s the bill drifted through the Hill ... there were probably not more than four of us who understood its ramifications" (Mann and Plummer 1995). Section 9 does, however, contain a provision exempting persons from its restrictions if compliance would cause "undue economic hardship."

In the main text, we focus on Section 7. Here, we provide details on additional relevant information regarding other sections of the ESA. Section 10 of the ESA allows for certain limited exemptions to its prohibitions against private actions resulting in "take." Notably, the Secretary of the Interior may issue permits to take listed species if the take is "incidental" to an otherwise legal activity, which means that the act of injuring/killing/harming a habitat or protected species happened despite the developer's best efforts to avoid it. Incidental

[20] For a summary of the process, see https://www.fws.gov/sites/default/files/documents/ESA-Section-4-Listing.pdf. Accessed 8/13/2024.

take permit (ITP) applications must include a "habitat conservation plan" (HCP) detailing the expected effect on the species, how the holder will minimize and mitigate these effects, the alternatives considered, and reasons for rejecting them. To issue an ITP, the secretary must find that the taking will be incidental, its effects will be minimized and mitigated, the conservation plan is adequately funded, and the taking will not appreciably reduce the likelihood of the species' survival and recovery. HCPs and ITPs are frequently used by real estate developers operating on private land as a means of complying with the ESA when listed species are present.

The designation of CH can impose incremental costs beyond those associated with listing. A more detailed definition of CHs is the area occupied by the species when it is listed that contains physical or biological features essential to its conservation and that may require special management or protection, as well as specific areas not occupied by the species when it is listed that are essential for conservation.

When CH is unoccupied by the species, the requirements of Sections 7 and 10 have traditionally resulted in additional costs to a project where none would be borne under Section 9's antitake provisions.[21] Beyond the formal mechanisms established by the ESA, the designation can be a signal to local regulators where habitat protections should be prioritized and impacts avoided. Local land-use authorities typically have wide latitude to restrict or modify development projects and can alter requirements on the basis of a designation.

[21] In 2018, the US Supreme Court ruled that an area is eligible to be designated as CH under the ESA only if the area is habitat for the relevant threatened or endangered species. The court vacated the US Court of Appeals for the Fifth Circuit's decision, which held that the ESA has no habitability requirement, and remanded the case to the Fifth Circuit to consider the meaning of habitat under the ESA. Thus, land can no longer be designated as CH if it is unoccupied by a listed species.

C Detailed Interpretation of Conceptual Framework

In the residential property market (Figure 1, Panel I), the supply of properties is comprised of real-estate developers, and demand is comprised of home buyers. On the supply side, after a rule is proposed, suppliers have an incentive to increase development before finalization to preempt higher costs after finalization (Panel a). This response is more likely in areas where real-estate values are high, land available for development is scarce, and the probability of binding development constraints is high. The theory and empirical literature strongly agree about the direction of the shift of the supply curve (see, for example, List et al. (2006), Lueck and Michael (2003), and Bošković and Nøstbakken (2017)). However, this part of the market has significant ambiguity arising from the demand side. Certain home buyers will value the potentially higher likelihood of open space amenities being preserved (as described in McConnell and Walls (2005)), resulting in higher demand inside, which we show by the shift to $\overline{D}'_R$. On the other hand, homeowners might worry about the possible costs they may face if they decide to develop or remodel their property (as described in Glaeser and Gyourko (2003), Glaeser et al. (2005), and Quigley and Raphael (2005)), lowering demand inside the protected area, which we show by $\underline{D}'_R$. The relative magnitudes of the demand shift determine the predicted equilibrium outcome inside the proposed protected area.

If the rule is finalized (Panel c), the change in supply switches direction to a decrease in development. Once the species is awarded statutory protections, the remaining uncertainty is how much those would delay or prevent development. The uncertainty in how stringently the FWS, or local regulators, will choose to enforce the protections will unambiguously raise the expected costs for real-estate developers relative to a baseline of no protections. If developers are minimizing their exposure to risk, they will lower the weight in their portfolio on assets inside the protected area, possibly to zero. The change in demand remains ambiguous in the post-final-rule period. However, it is likely to be larger than in the post-proposed-rule period, given the certainty regarding the existence of the statutory protections.

Outside of the protected area, supply unambiguously increases in both periods (Panels b and d). Real-estate developers might expect higher scarcity of lands suitable for residential development inside the protected area (Quigley and Raphael (2005)) and respond by increasing supply in anticipation of those protections (Subpanel ii). The supply outside the protected area might increase further after the final rule if development costs are lower outside relative to inside, $\overline{S}''_R$. In addition, home buyers might further increase their demand because of the higher likelihood for the preservation of open spaces (McConnell and Walls (2005)), $\overline{D}''_R$ (Subpanel d). However, they might also appreciate more urban-like amenities and other amenities that come with higher population and residential development densities (see, for example, Zhang et al. (2019), Waddell et al. (1993)). For them, preservation of open spaces reflects a disamenity, lowering their demand, $\underline{D}''_R$ (Subpanels b and d).

In the vacant lands market (Figure 1, Panel II), the supply is comprised of landowners and real-estate developers. Home buyers looking to build a new structure now represent demand. The predictions for what happens to land values after a proposed and finalized rule is more straightforward, as the direction in which supply and demand move is unambiguous. Inside the protected area, supply will likely increase after the proposed rule as landowners offer their vacant lands as part of a "fire sale" (Subpanel e). However, the expectations for potentially higher development costs inside the protected area will likely also reduce the demand by both developers and buyers (Subpanel v). The realization of the protections and potential increase in the likelihood of binding development constraints will exacerbate both effects in the post-final-rule period (Subpanel vii). Finally, changes in the supply of vacant lands outside the protected area are not expected; however, we expect demand to increase due to growing scarcity, especially in the post-final-rule period (Subpanels vi and viii).

D Additional Details on Data Sources and Processing

We cover the data and the steps we took in preparing them for analysis in greater detail than in the main text. We begin with the history of listing and designation events under the Endangered Species Act (ESA) and preprocessing of shapefiles for SHs, discuss the transactions data from CoreLogic, and cover the construction permits data and auxiliary data used in their analysis. Throughout, we present figures and tables that help summarize broad trends and patterns in the data.

D.1 Constructing the ESA Listing & Designation History

We started by downloading All Reports from FWS Species Data Explorer. The dataset is a near-comprehensive list of ESA rules published in the Federal Register. The raw data contain more than 56,000 rows; each row is associated with a unique ESA decision related to one species. We briefly describe the columns that were salient to our dataset construction:

- Common Name: Common name of the species.
- Scientific Name: Scientific name of the species.
- ESA Listing Date: Date of a species being listed as endangered or threatened for the first time. This field is empty if a species has never been listed.
- Is Foreign?: Identifies if a species is found in the United States or not.
- Action Type: Identifies the intended action (listing, delisting, uplisting, critical habitat designation, etc.) of published document.
- Publication Type: Identifies the nature of ruling (final rule, proposed rule, proposal withdrawal, emergency ruling, etc.).
- Publication Date: The date of publication of rule in the Federal Register.

- Range Shapefile: Filename for the range shapefile of individual species. This name contains the species identification code and population identification code.

- Species Group: Identifies the class of the species (insect, mammal, bird, etc.).

Using the information in the columns, we first subset the data to species found in the United States. Additionally, we remove all rows associated with publications that are not related to listing or critical habitat (CH) designation (Candidate Notice of Review, Notice of Public Hearing, etc.). We are left with 7,596 observations. We exclude all species not found in the contiguous United States. Finally, we use Publication Type, Publication Date, and Action Type to identify proposed and final rulings of listing, designation, and any modification thereof.

For the most part, we automated these processes. However, for about 100 species, incomplete or inaccurate information resulted in missing dates or unusual chronology of events (such as CH designation predating the listing). To solve this issue, we consulted the Federal Register, identified the accurate information, and manually corrected the dataset.

D.1.1 Documenting Revisions to Critical Habitat Borders & Filling Missing Protected Area Polygons

In most cases, CHs are designated and remain unchanged throughout the time the species is listed. However, CHs do get revised. This can lead to large changes over time in their extent and borders. Another concern regarding protected area definitions is that if a species becomes delisted, the FWS removes all records of its protected area (SHs or CHs) to avoid any confusion about the status of statutory protections under the ESA.

We address these two concerns in a similar way. When available, we use snapshots of older protected area repositories to obtain previous spatial definitions of CHs or the areas of the SHs if the species was still listed during the time period of the relevant snapshot. If those are unavailable, we turn to the Federal Register and extract the exact coordinates that define the CH and manually construct the polygon. Combined, our repository of protected areas represents the most comprehensive data set on ESA protections across time, to a degree that the FWS does not have available.

D.2 Processing the CoreLogic Transaction Data

The CoreLogic dataset is split into several files. It includes transactions as early as 1976 and extends to 2021. Some states have many more years of data than others. In our first preprocessing step, we go through the entire raw dataset and use the column FIPS CODE to extract and save observations by state. Second, we identify observations with missing coordinates but with addresses and re-geocode them using ArcGIS. We exclude records missing location, date of sale, or price and filter out any non-arms-length transactions. We use different flags to remove non-arms-length transactions and remove any transactions that have a sale price below USD 1,000. We are left with over 37 million and 3 million residential and vacant land records, respectively, that are within 10km of a CH border and over 116 million and 10 million residential and vacant land records, respectively, that are within 10km from a SH border. See Figure D1 for a summary of total transactions around protected area borders.

We then drop transactions with a sale price below or above the first and 99th percentile values and those that happened after 2019, during the COVID-19 pandemic. Our main sample includes transaction records that also include data on the total number of rooms and parcel area (for residential properties) or the parcel area alone (for vacant lands). We construct the former as the sum of number of bedrooms and number of bathrooms and, for residential properties, drop transactions with a total number of rooms below or above the first and 99th percentile values. We then drop properties whose age is negative and define land footage quintiles. Since not all transactions had a ZCTA, we constructed a new ZCTA variable by assigning coordinates with missing ZCTA values to 40km hexagons (from the EPA). We restrict each analysis to a certain subsample of species, but solely aquatic species are removed from all analyses. We define a species as not solely aquatic if it is either nonaquatic or an amphibian or a reptile whose habitat is a polygon as opposed to a line (river). Finally, we restrict the analysis sample to species for which we have a minimum of 50 transactions in both the pre- and posttreatment periods.

The data on properties around protected area borders are more dense in some states. See Figure D3 for a summary of the share of transactions (relative to the total number of transactions) in each state, by land use type and protected area border.

D.2.1 Calculating Distances Between Properties & Protected Area Borders

To complete the distance calculation process within a reasonable amount of time, we first conduct a densification on all boundaries of CHs and SHs. This replaces the curve segments in the boundary lines with a large set of vertices via linear interpolation. We set the maximum distance between the vertices to be 100m. The distance between the properties and the nearest CHs and SHs are calculated based on the kd-tree algorithm in the RANN package in R. It searches for the nearest point in the set of densified critical (species) habitat points for all properties and returns both the index of the nearest point and the distance between them. We use the index to find the nearest critical (species) habitat polygon. To determine whether a property is inside its nearest critical (species) habitat or not, we check whether they intersect with each other. If so, the property is inside the polygon, and we set the distance to be negative. For properties outside the polygon, we set the distance to be positive. Finally, we keep all pairs of property and the nearest polygon if their distance is below 10km. We then use the st_join function (sf package) to determine whether a transaction occurs within a critical habitat/species range, or outside. Our analysis produces distances for all transactions within 10km of a critical habitat/species range.

Following the calculation of distances, we perform a postprocessing step to merge and harmonize the data. The objective to assign each transaction to one or fewer species ranges or CHs. First, transaction-range candidates within 10 kilometers of a boundary (Panel B of Figure D4) are identified. Second, they are assigned to treatment or control based on whether they are inside or outside their range (Panel C of Figure D4). Third, transaction timing determines whether an observation is pretreatment, precontrol, posttreatment, postcontrol, or contaminated by a previous treatment and ineligible for use in estimation (Panel D of Figure D4). We summarize this in Figure D4, which provides a visual description of how the data are constructed for the analysis.

The set of transaction ranges for a given transaction can contain more than one candidate, as some transactions are within 10km of two or more existing habitats. To remedy this and produce a single range for each transaction, we follow the following procedure. First, only candidates that are within 200m of the minimum distance for a transaction are kept. This decision rule keeps multiple candidates when boundaries are precisely overlapping or fuzzy or slightly deviating. Second, the candidates are sorted by transaction identifier, listing date, and final listing date (or final designation date for CHs). The candidate with the earliest first listing date is kept; in a tie, the candidate with the earliest final listing date (or the final designation date for CHs) is kept. This procedure ensures we only assign one transaction to exactly one range and that range is the closest to the transaction and corresponds to the earliest treatment. Treatment histories are maintained for each transaction to allow for comparing transactions with different treatment statues but identical histories. In short, a species range boundary can only be used once to identify an average treatment effect or conditional average treatment effect for the earliest range, as transactions for later ranges sharing the same boundary will have different treatment histories.

Our final program merges the transaction data with the species information, distance to habitat, and an inside CH indicator. Census tract fips codes and zip codes are added using the tidycensus package. We construct a parcel identifier using the following procedure. First, we use the unique parcel identifier when available. If missing, we use the assessor parcel number, county name, and state fips code. If the assessor parcel number is missing, we use the latitude and longitude. Finally, we flag and remove duplicates in the data.

D.3 Additional Data on Land Development Permits

In the main text, we only briefly discuss the sources of data for the building permits and HCPs. Here, we provide additional information about each data item, and its processing.

Building Permits Survey: We obtain county-year level data on new residential construction permits from the US Census Bureau's Building and Permits Survey (BPS), an annual mail survey of permit-issuing jurisdictions. It provides the total number of approved residential housing construction permits for buildings and units, 1990–2019, for each county.

Army Corps of Engineers (ACE) Permits: Geocoded permits issued by the ACE authorize various types of development projects in wetlands and other waters. The ACE issues nationwide permits, allowing for a variety of prespecified development activities that have only minimal negative effects on the environment. For activities deemed to have an impact above and beyond what is allowed by those permits, a developer must obtain an individual permit, which is a key component of ACE permits and results in one of three types of decisions: (i) issued without special conditions; (ii) issued with special conditions; and (iii) denied. The ACE may add special conditions to ensure that the activity does not jeopardize related laws, *including the ESA*. Data are obtained from two sources: post-2008 from the publicly available data management system and data in the same format between 1990 and 2008 through a FOIA request to the ACE. We aggregate the data to construct variables on the total number of ACE permit applications and the share of permits across final decisions. Similar to the panel assembly of the construction permits data, the CHs and SHs are aggregated in a county-year panel using population weights. Finally, we use the ACE data to flag locations at the ZCTA level that experience an above-median number of ACE permits because those might reflect locations that have more binding land-use restrictions. See Figure D5 for a summary of the secular trends in the ACE data.

Habitat Conservation Plans: Habitat Conservation Plans (HCPs) are required for private parties who intend to undertake projects that may result in damages to endangered and threatened species. We obtained the data on HCPs through a FOIA request to the FWS. The data cover complete information on all conservation plans submitted to the FWS since the early 1980s, including the applicant, plan location, area acreage covered, listed species, plan status, intended land use, and dates indicating when the first assistance regarding the plan started, the application was received, and the permit decision was made. We link the HCP data with the listing status of endangered and threatened species and the designation status of CH. We measure the timeline of a plan by the number of years between the date an applicant first initiates assistance and the date the final decision regarding the permit is made. We also construct dummies on whether the HCP submission is before the designation of the CH, the listing and designation status, and the type of the species. The final dataset covers 7,851 unique HCPs in the contiguous United States, spanning 1990 to 2020.

BuildZoom New Construction Permits: To more carefully examine how the ESA might affect permits, we obtained data on geocoded permits for new construction from BuildZoom, including their application and issuance dates—allowing us to study potential delays in permit approvals.[22] Our sample includes data up to 2022, which we truncate to focus on 1980 to 2019. We choose 1980 because that is when we observe a nontrivial share of permits and the end of 2019 to avoid overlapping with the COVID-19 pandemic.

D.4 Summarizing Duration Between FWS Actions

In Figure D6, we summarize the number of months from a lawsuit seeking to force a listing of species or petition requesting the FWS reviews a species and the proposed rule to list a species, if one was published. In all cases, it takes well above a year, sometimes more than

[22] See https://www.buildzoom.com/data for more details. BuildZoom permits data are now offered as part of CoreLogic's RealQuest service. Purchasing the data was made possible with funding by the Becker Friedman Institute at the University of Chicago.

10 years, between the initial petition or lawsuit and the resulting proposed listing rule.

D.5 Urban Versus Rural Composition of the Sample

In Figure D7, we document that nearly all of our data are concentrated in urban locations, formally defined as metro areas according to the US Department of Agriculture 2023 Rural-Urban Continuum Codes.

D.6 Gridded Population Data

We use gridded population data to aggregate measures of protected area coverage to the county level. Measures include the share of a county, total area in a county, and unique area covered by species or CHs. The distinction between total area and unique area is that the former allows for double-counting: if two SHs contain overlapping areas, we double-count that to obtain our total area measure, whereas we count it only once for our unique area measure.

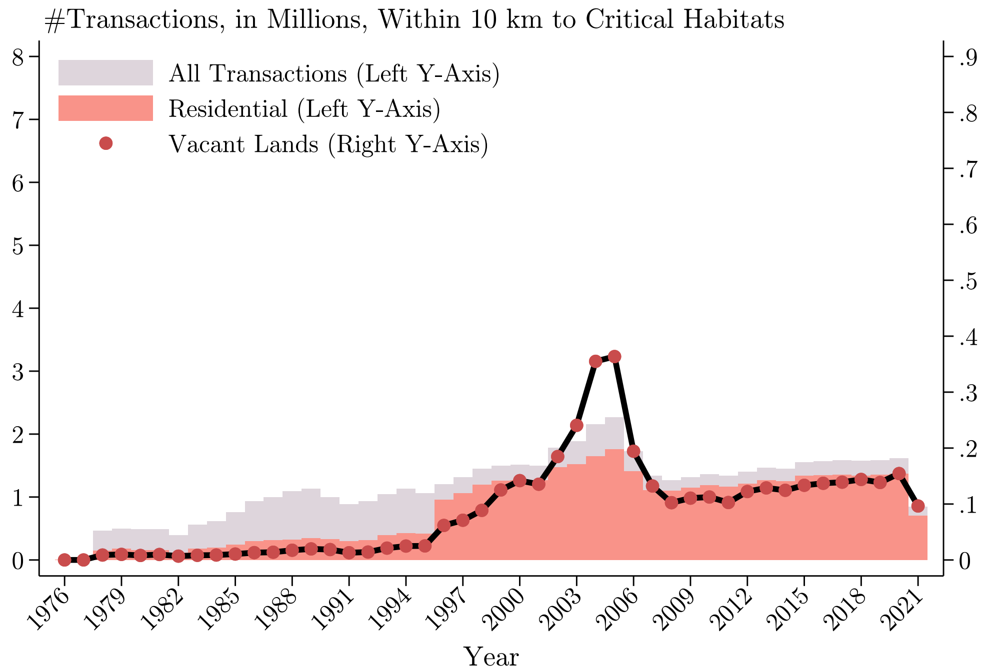
Using population weights to aggregate our protected areas allows us to more precisely measure how much the average undeveloped parcel in a county is exposed to protected land. To illustrate the reasoning behind this procedure, consider two identically sized counties containing identical amounts of protected land. The first county's protected land overlaps entirely with an urban area, but the second county's is located in a sparsely populated and largely undeveloped area. The counties' unweighted exposure measures would be the same, but the population-weighted exposure measure would be larger in the first, because protected land may have a different impact on building activity in a developed area. Although we recognize that population is an imperfect proxy for residential building activity, we argue that they should be highly correlated. Across most of our specifications, population-weighted exposure measures yield qualitatively similar point estimates with smaller confidence intervals relative to unweighted measures.

We use NASA's Socioeconomic Data and Applications Center (SEDAC) US Census Grids for our population weights. The grids downscale census block-level population data to a 30 arc-second (approximately 1 square km) grid. Population is allocated proportionally within a census block. The Ugrids do not differ from the Global Rural-Urban Mapping Project, another SEDAC data product that uses nighttime lights data to downscale global population to a 30 arc-second grid. The data are available for 1990, 2000, and 2010; we use 1990 data.

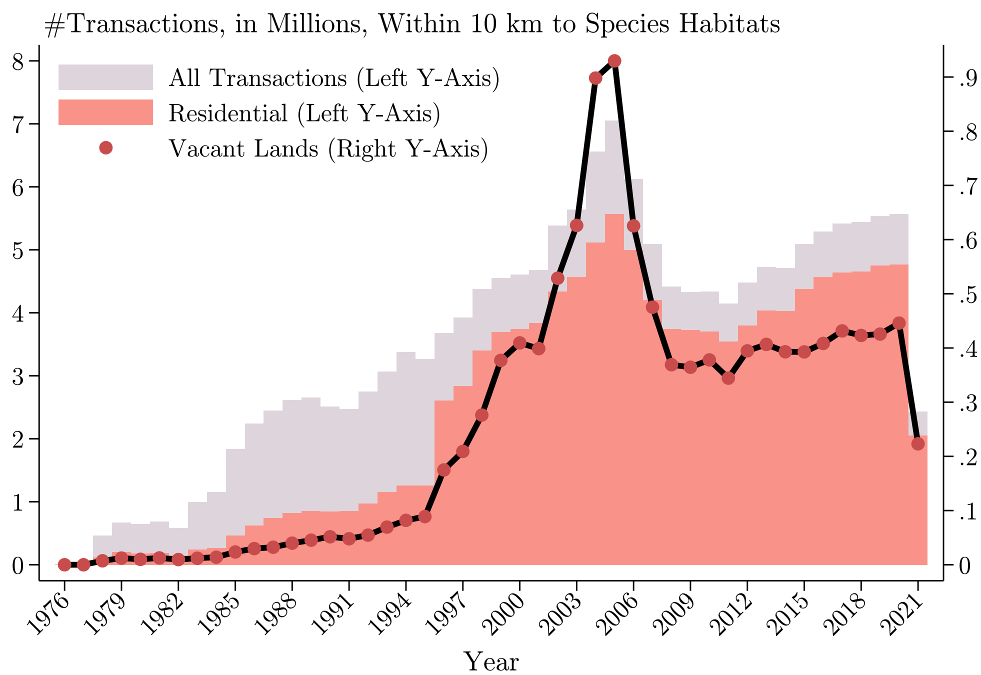
We use US county shapefiles provided by the Census Bureau to aggregate our habitat data to the county level. To account for slight temporal variation in county boundaries during our sample period, we use the 2000 shapefile for 1990–2000, the 2010 shapefile for 2001–2010, and exact year shapefiles for 2011–2019.

Figure D1: Summary of Transaction Counts for the Contiguous US

(a) Critical Habitats



(b) Species Habitats



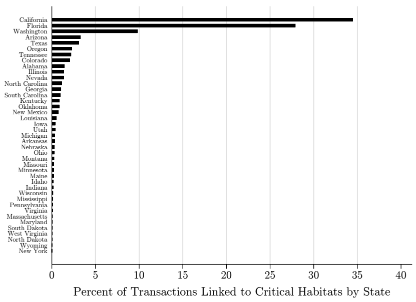
Notes: The total number of transactions, by type, by year, for properties that are within 10km of a critical habitat border (a) or a SH border (b).
Source: CoreLogic Tax and Deed History Data. Data on species and critical habitats from the FWS.

Figure D2: Share of Transactions Across States, by Land-Use, by Sample

Critical Habitats

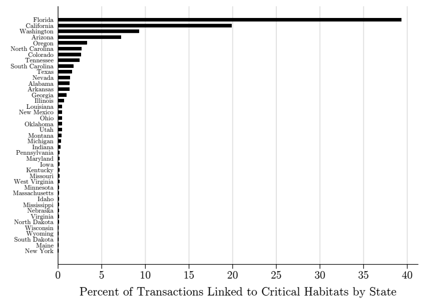
Residential

(a) Full Sample

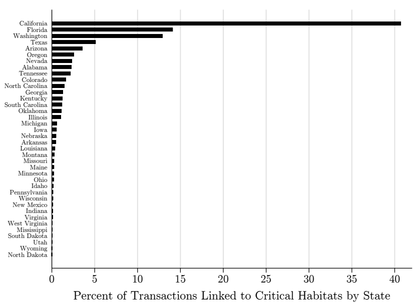


Vacant Lands

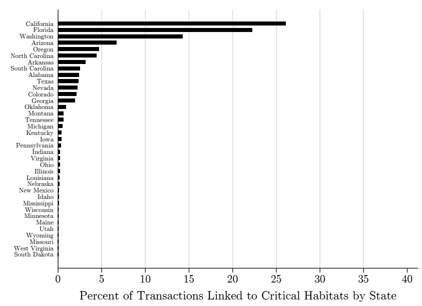
(b) Full Sample



(c) Ten-Year Window Sample



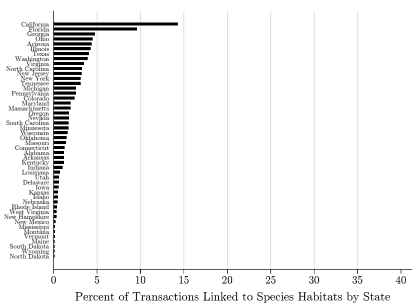
(d) Ten-Year Window Sample



Species Habitats

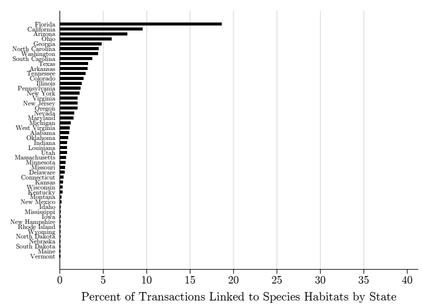
Residential

(e) Full Sample

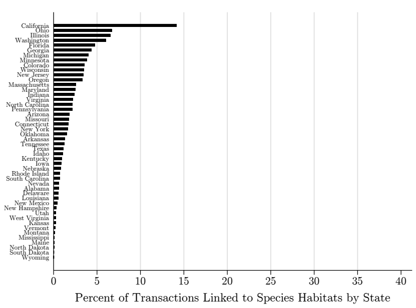


Vacant Lands

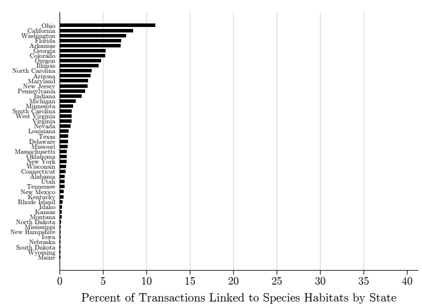
(f) Full Sample



(g) Ten-Year Window Sample



(h) Ten-Year Window Sample



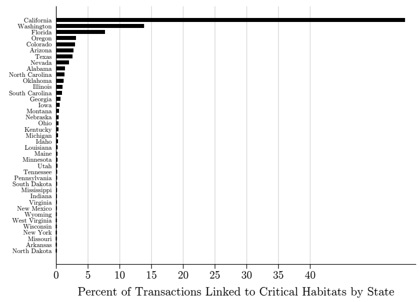
Notes: Share of transaction by state for either the full sample, or the sample centered around two years before the listing proposal, and two years after either final designation (critical habitats), or final listing (SHs).

Figure D3: Share of Transactions Across States, by Land-Use, by Sample with Restrictions

Critical Habitats

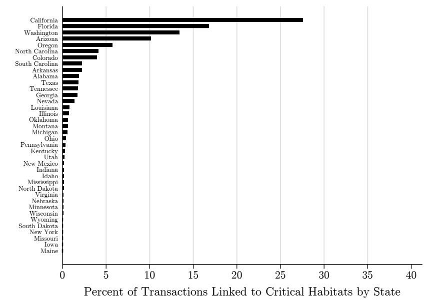
Residential

(a) Full Sample

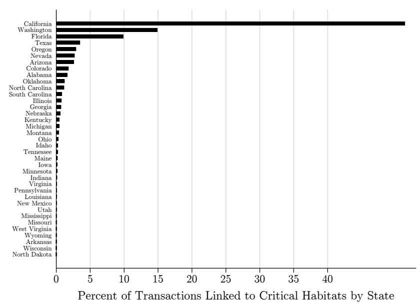


Vacant Lands

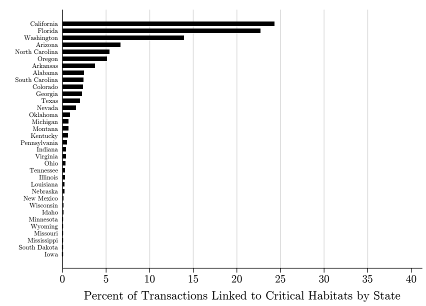
(b) Full Sample



(c) Ten-Year Window Sample



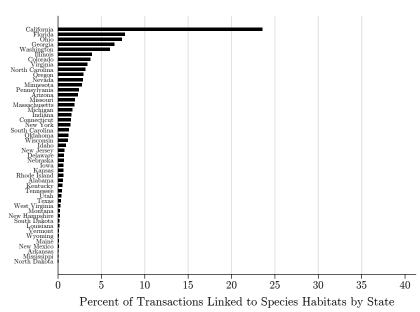
(d) Ten-Year Window Sample



Species Habitats

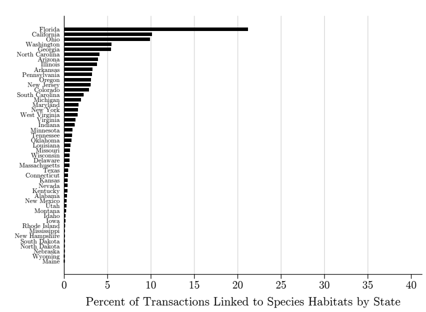
Residential

(e) Full Sample

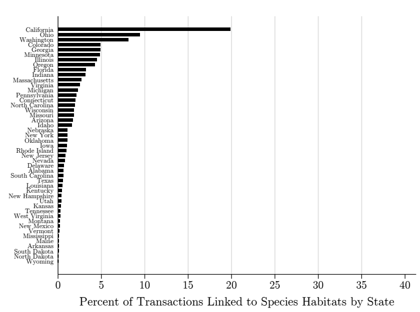


Vacant Lands

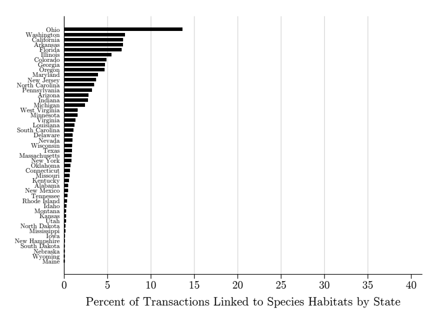
(f) Full Sample



(g) Ten-Year Window Sample

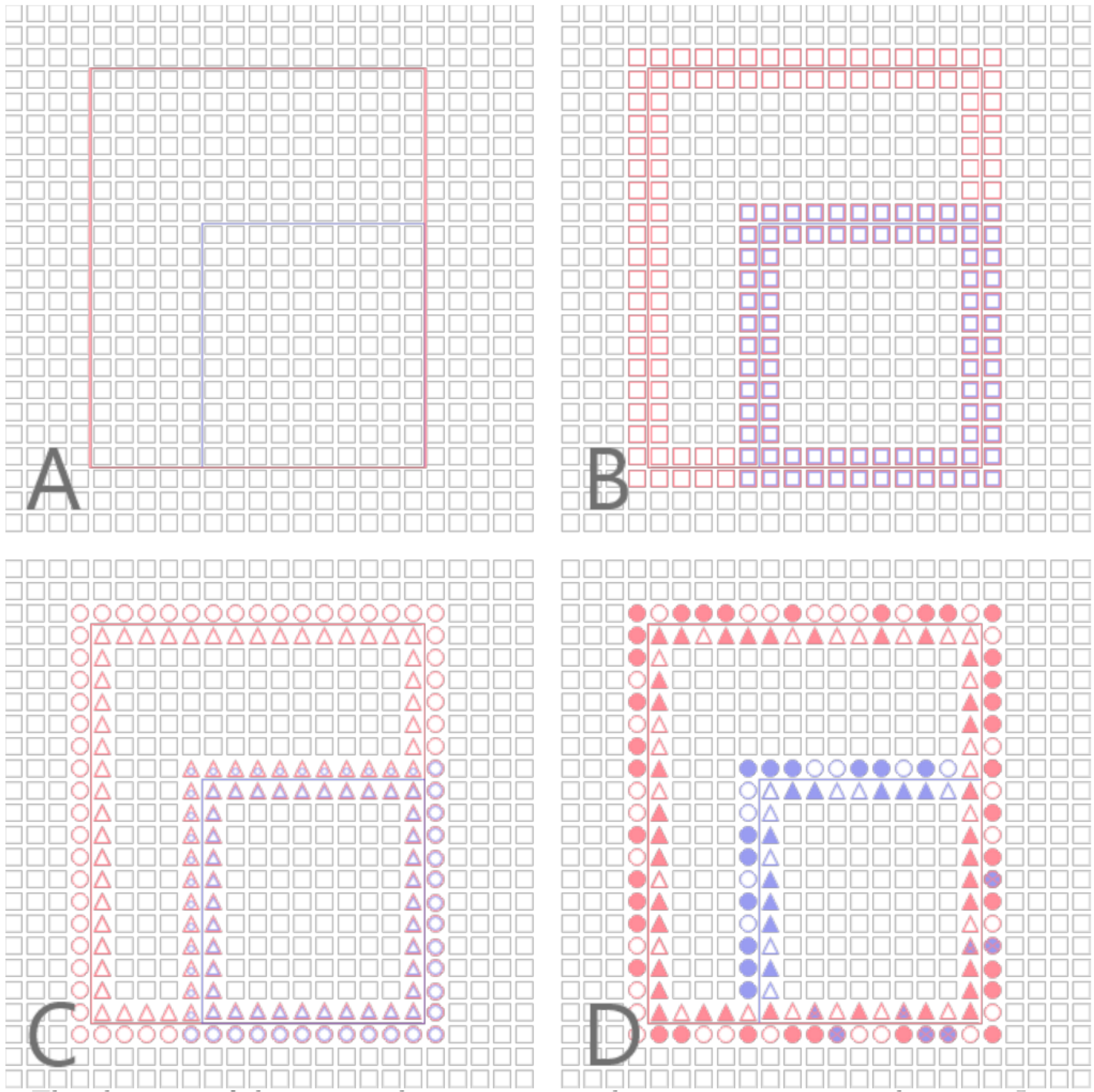


(h) Ten-Year Window Sample



Notes: Share of transaction by state for either the full sample, or the sample centered around two years before the listing proposal, and two years after either final designation (critical habitats), or final listing (SHs).

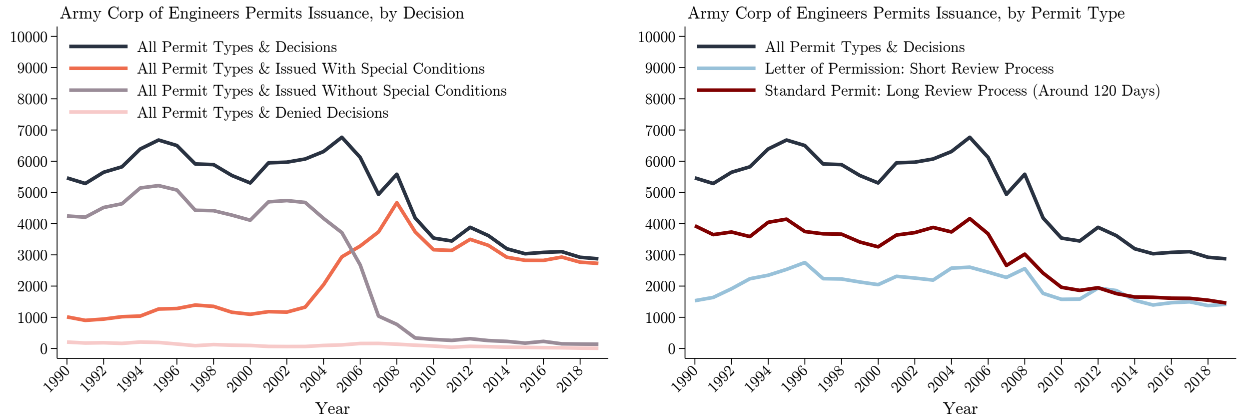
Figure D4: Descriptive Diagram of Construction of Data for Protected Areas



Notes: The objective of this approach is to assign each transaction to a single range. In Panel A, gray squares represent transactions, and blue and red boundaries represent species ranges. Let the red species range occur before the blue species range. NThis implies that the blue range overlaps the red range. In Panel B, distances are calculated for each transactions to all ranges. Only transactions within a given distance (10km) of any range comprise the list of candidate transaction ranges. Transaction-range candidates in the diagram are assigned the color of the range. In Panel B, that some transactions are candidates for both the red and blue ranges (red squares with blue squares inscribed). Panel C shows how transactions are assigned to inside (triangles, treated) or outside (circles, control) their respective ranges. Panel D illustrates four key concepts. First, the timing of the transaction relative to the listing date of the range to assign the transaction to before (hollow shapes) or after (solid shapes) range listing. Second, when boundaries are shared spatially (see the lower right corner of the red range), the candidate with the earliest listed range (red) is kept. Third, the upper left corner of the blue range is inside the red range but does not share a boundary with the red range and can therefore be used for estimation of the marginal effect of the blue range conditional on already receiving the red treatment. Fourth, transactions that occur after the red and blue ranges (circles and triangles with blue fill and a red crosshatch) at a boundary shared by the red and blue range cannot be used to estimate the treatment effect of either range and are identified and removed from the analysis

Figure D5: Secular Trends in Army Corps of Engineers Permits Issuance

(a) By Decision (b) By Permit Type

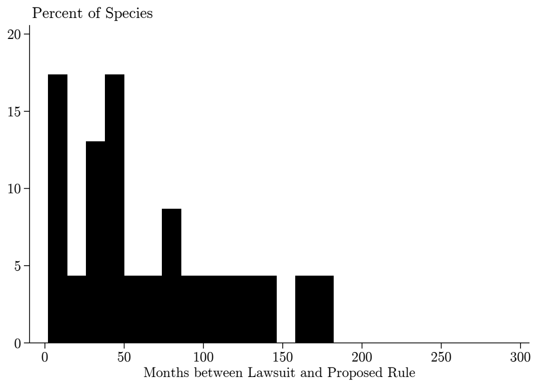


Notes: National-level summary on permits issued by the Army Corps of Engineers, by decision type (a) or type of permit (b).
Source: Army Corps of Engineers.

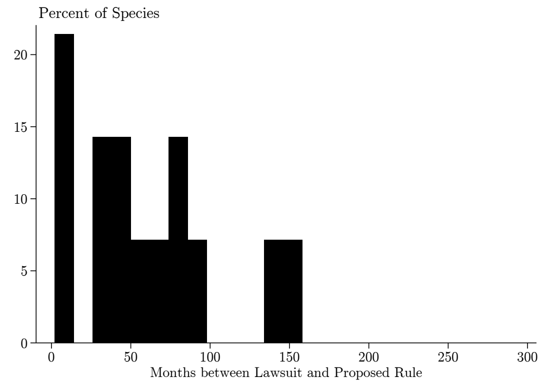
Figure D6: Time to Proposed Listing

Lawsuit until Listing

(a) SH

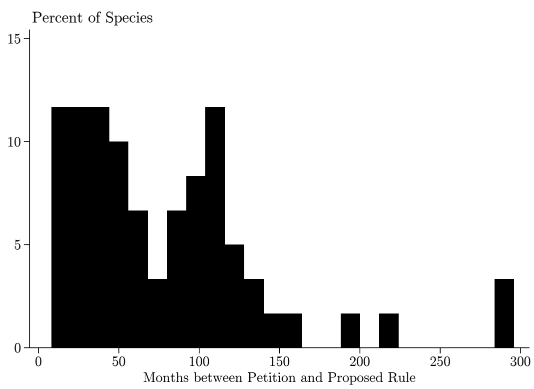


(b) CH

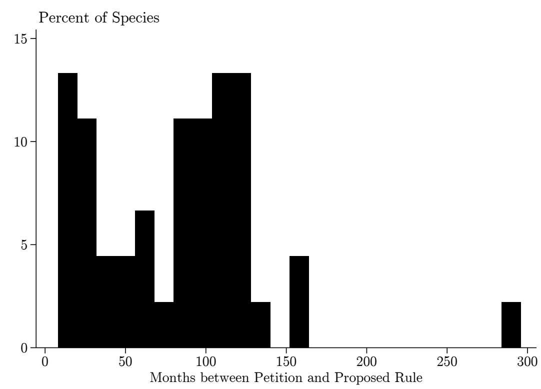


Petition until Listing

(c) SH



(d) CH

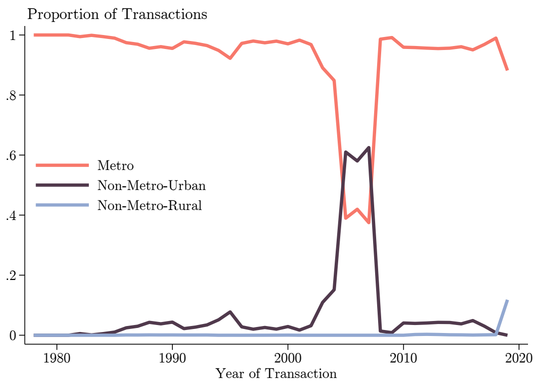


Notes: Only includes species where lawsuit or petition comes before proposed listing.

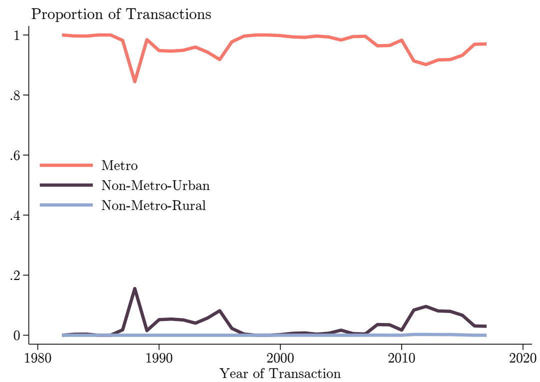
Figure D7: Urban VS. Rural Transactions by Year

+/- 2 Years

(a) SH

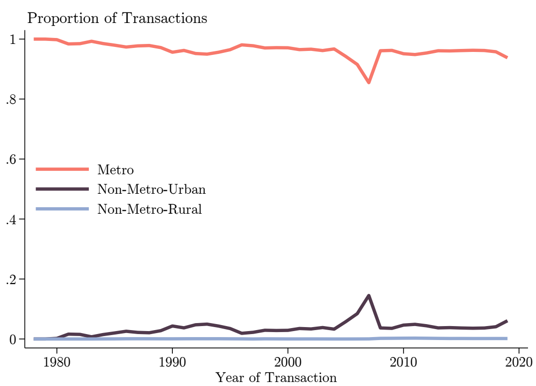


(b) CH

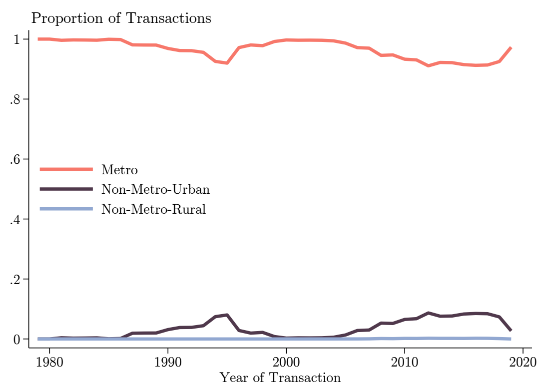


+/- 5 Years

(c) SH



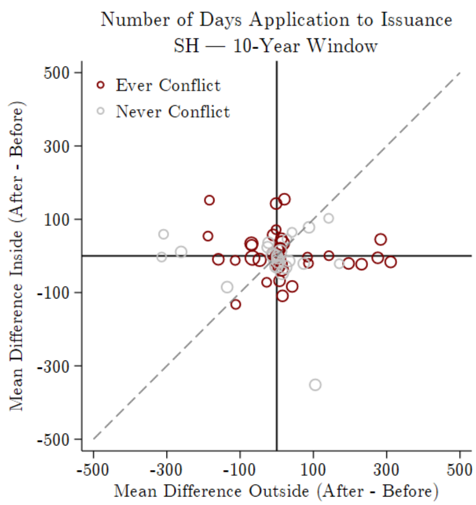
(d) CH



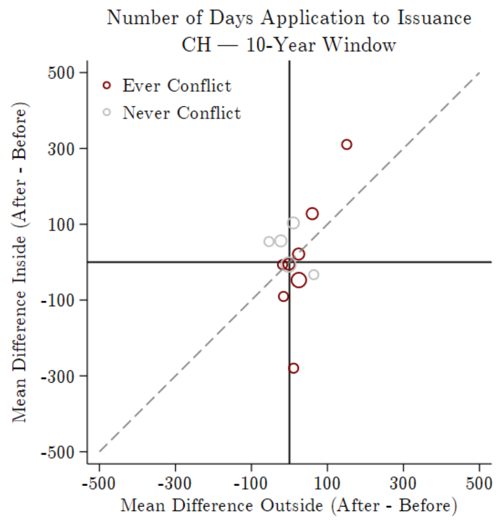
Notes: We use the US Department of Agriculture 2023 Rural-Urban Continuum Codes to classify counties as metro (urban) or nonmetro.

Figure D8: Number of Days from Permit Application to Issuance

(a) Species Habitat



(b) Critical Habitat



Notes: +/- 5 years. 63 SH species & 13 CH species. SH truncated at +/- 500, excluding one species (Buena vista lake ornate shrew (4.81, -2239.33)).

Table D1.
Summary Statistics for Sale Prices Around Protected Area Borders

	Percentile						
Mean	25	50	75	SD	Min	Max	N
Panel A. Species Habitats, Residential Properties							
295,813.78	135,358.82	219,476.04	359,370.66	282,845.79	6,631.05	3,188,071.61	4,9166,154
Panel B. Species Habitats, Vacant Lands							
464,589.29	94,907.30	253,420.00	459,261.40	925,557.67	2,061.59	15,955,689.72	952,527
Panel C. Critical Habitats, Residential Properties							
415,939.17	182,733.71	304,821.95	517,488.15	389,258.42	13,637.31	4,067,703.70	12,477,607
Panel D. Critical Habitats, Vacant Lands							
710,742.16	165,455.16	355,038.30	732,227.61	1,321,711.46	2,145.90	2,3877,636.56	174,986

Notes: Summary statistics for the sale price (in 2019 USD) of either residential properties or vacant lands around the borders of species or critical habitats. For each sample, we apply the standard data filters (see Data Appendix text for more details) but include the entire span of the sample.

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