

Appendix

Tables

Table A1: **Red-Legged Frog, Normalized differences:** Pre-treatment comparisons for 2001 and 2006 policies

	(1)	(2)	(3)	(4)	(5)
Policy year	Acres	Precip.	Temp.	Hwy. dist.	City dist.
2001	0.254	-0.197	-0.02	0.231	-0.426
2006	0.113	0.393	-0.38	0.344	0.023

Notes: We calculate the normalized differences as $(\bar{X}_T - \bar{X}_C) / s_p$ where $s_p = \sqrt{s_T^2 + s_C^2}$, as described by Imbens and Wooldridge (2009). These differences use only pre-treatment data. Imbens and Rubin (2015) suggest that normalized differences greater than 0.25 may indicate cases in which linear regression methods are sensitive to specification (Imbens and Wooldridge 2009). In successive tables, we vary specifications to examine this possibility.

Table A2: **Bay Checkerspot Butterfly, Normalized differences:** Pre-treatment comparisons for 2001 policy

	(1)	(2)	(3)	(4)
Policy year	Acres	Serpentine	Flood plain	Slope
2001	0.294	0.566	-0.207	0.861

Notes: We calculate the normalized differences as $(\bar{X}_T - \bar{X}_C) / s_p$ where $s_p = \sqrt{s_T^2 + s_C^2}$, as described by Imbens and Wooldridge (2009). These differences use only pre-treatment data. Imbens and Rubin (2015) suggest that normalized differences greater than 0.25 may indicate cases in which linear regression methods are sensitive to specification (Imbens and Wooldridge 2009). In successive tables (i.e., Tables 4 and 11), we vary specifications to examine this possibility. The *serpentine* variable’s normalized difference is in fact beneficial for our identification strategy, as we will use it as an instrument—predicting treatment status.

“The Economic Impact of Critical-Habitat Designation: Evidence from Vacant-Land Transactions”
 by Maximilian Auffhammer, Maya Duru, Edward Rubin, and David L. Sunding

Table A3: Red-Legged Frog, Main regression results: Treated-county sample

	(1)	Dependent variable: Log(Price per acre)				(6)	(7)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lot size	-0.0432*** (0.006)	-0.0403*** (0.0058)	-0.0376*** (0.0053)	-0.0375*** (0.0053)	-0.0133*** (0.002)	-0.0361*** (0.0041)	-0.0222*** (0.0032)
Rainfall	-0.2407*** (0.015)	-0.2462*** (0.0128)	-0.2885*** (0.0267)	-0.2850*** (0.0261)	-0.1040*** (0.019)	-0.2178*** (0.0341)	-0.1209*** (0.0279)
Temperature	-0.1997*** (0.018)	-0.2135*** (0.0183)	-0.2616*** (0.0211)	-0.2634*** (0.0211)	-0.0677*** (0.022)	-0.2453*** (0.0207)	-0.0521* (0.0308)
Dist. to hwy.	-0.2548*** (0.032)	-0.2331*** (0.0286)	-0.0274 (0.0362)	-0.0404 (0.0331)	-0.2601*** (0.045)	-0.0237 (0.0409)	-0.2640*** (0.0600)
Dist. to city	-0.0505*** (0.007)	-0.0453*** (0.0062)	-0.1150*** (0.0179)	-0.1054*** (0.0170)	0.0229 (0.024)	-0.0834*** (0.0243)	0.1049*** (0.0312)
Post ₂₀₀₁		0.6325*** (0.0748)	0.6938*** (0.0657)	-0.0517 (0.4064)	1.0979** (0.462)	0.2936 (0.4532)	-0.9563 (0.7799)
RLF ₂₀₀₁		-0.7370*** (0.1238)	-0.7481*** (0.1246)	-0.7942*** (0.1162)	-0.1430 (0.121)	-0.8140*** (0.1520)	0.0056 (0.1656)
Post ₂₀₀₁ ×RLF ₂₀₀₁		0.2242 (0.1618)	0.1503 (0.1571)	0.2066 (0.1462)	-0.1932 (0.160)	0.2324 (0.1778)	-0.2284 (0.2223)
Post ₂₀₀₆		0.5632*** (0.0927)	0.5256*** (0.0799)	-0.2013 (0.4427)	0.3282 (0.468)	1.0380* (0.5325)	-0.8247 (0.9832)
RLF ₂₀₀₆		0.3102** (0.1493)	0.9488*** (0.1643)	0.9099*** (0.1562)	0.1291 (0.187)	1.0097*** (0.1680)	-0.0793 (0.3006)
Post ₂₀₀₆ ×RLF ₂₀₀₆		-0.7455*** (0.2858)	-0.7644*** (0.2540)	-0.6489** (0.2982)	0.0696 (0.310)	-0.7169*** (0.2467)	-0.1361 (0.4124)
N	5,207	5,207	5,207	5,207	3,046	2,707	1,531
Type of land	Res.	Res.	Res.	Res.	Non-Res.	Res.	Non-Res.
Zip 3 F.E.	F	F	T	T	T	T	T
Month-year F.E.	F	F	F	T	T	T	T
Land-use F.E.	F	F	F	F	T	F	T

Notes: This table displays the OLS estimates for the effect of critical habitat designation on land values in all treated counties (protecting California’s Red-Legged Frog). Columns (1) and (2) include an intercept. Columns (6) and (7) focus on the set of parcels sold multiple times during the sample period.. We cluster errors by county, quarter, and year. *Significance levels:* *10%, **5%, ***1%.

Table A4: Red-Legged Frog, Robustness of results to specification: Varying distance specifications and fixed effects

		Dependent variable: Log(Price per acre), Treated counties							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Post ₂₀₀₁	-0.5992 (0.653)	-0.0517 (0.406)	-0.1789 (0.527)	-0.0606 (0.412)	-0.0402 (0.418)	-0.0104 (0.498)	-0.1300 (0.407)	-0.1274 (0.531)
	RLF ₂₀₀₁	-1.0526*** (0.145)	-0.7942*** (0.116)	-0.2764** (0.116)	-0.7537*** (0.119)	-0.7581*** (0.120)	-0.7500*** (0.118)	-0.7890*** (0.118)	-0.2242* (0.118)
	Post ₂₀₀₁ ×RLF ₂₀₀₁	0.3654** (0.170)	0.2066 (0.146)	0.1723 (0.123)	0.1823 (0.146)	0.1644 (0.148)	0.1583 (0.144)	0.1922 (0.146)	0.1446 (0.120)
	Post ₂₀₀₆	-0.2675 (0.382)	-0.2013 (0.443)	-0.4370 (0.448)	-0.1102 (0.462)	-0.1156 (0.456)	-0.0979 (0.488)	-0.1729 (0.420)	-0.4984 (0.464)
40	RLF ₂₀₀₆	0.7061*** (0.168)	0.9099*** (0.156)	0.4712*** (0.150)	0.9346*** (0.156)	1.0673*** (0.159)	1.0302*** (0.161)	0.9094*** (0.153)	0.4705*** (0.147)
	Post ₂₀₀₆ ×RLF ₂₀₀₆	-0.9566** (0.376)	-0.6489** (0.298)	-0.5495** (0.227)	-0.6069** (0.288)	-0.5986** (0.292)	-0.6509** (0.297)	-0.5972** (0.291)	-0.5186** (0.220)
	<i>N</i>	5,207	5,207	5,207	5,207	5,207	5,207	5,207	5,207
	Geographic F.E.	Zip 3	Zip 3	City	Zip 3	Zip 3	Zip 3	Zip 3	City
	<i>N</i> levels of geog. F.E.	18	18	147	18	18	18	18	147
	Month-of-sample F.E.	T	T	T	T	T	T	T	T
	Lot size	F	T	T	T	T	T	T	T
	Rainfall	F	T	T	T	T	T	T	T
	Temperature	F	T	T	T	T	T	T	T
	Hwy. dist. spec.	None	Linear	Linear	2-deg. poly.	4-deg. poly.	Cubic spline	Semi-param.	Semi-param.
	City dist. spec.	None	Linear	Linear	2-deg. poly.	4-deg. poly.	Cubic spline	Semi-param.	Semi-param.

Notes: This table inspects the robustness of the main results by varying the specification of fixed effects and the distance covariates (distances to cities and highways). Specifically, this table focuses on column (4) of Table 7 (shown in column (2) of this table), which estimates the effect of protecting land using residentially zoned land in treated counties. In addition to second-degree polynomials, column (4) of this table also allows for a linear interaction—which is not statistically significant. The fourth-degree polynomials in column (5) does not implement the interactions. The *Semi-param.* specification in columns (7) and (8) refers to a semi-parametric binning, in which we construct bins (groups) using each distance-measure’s quartiles. We cluster errors by county, quarter, and year.

Significance levels: *10%, **5%, ***1%.

Table A5: Red-Legged Frog, Robustness of results to specification: Varying climate/weather specifications and fixed effects

	Dependent variable: Log(Price per acre), Treated counties						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post ₂₀₀₁	-0.0517 (0.406)	-0.1789 (0.527)	-0.0332 (0.380)	0.0629 (0.351)	0.0433 (0.384)	-0.2950 (0.450)	-0.2284 (0.503)
RLF ₂₀₀₁	-0.7942*** (0.116)	-0.2764** (0.116)	-0.6758*** (0.120)	-0.6859*** (0.116)	-0.6975*** (0.115)	-0.7370*** (0.115)	-0.2821** (0.117)
Post ₂₀₀₁ ×RLF ₂₀₀₁	0.2066 (0.146)	0.1723 (0.123)	0.1957 (0.147)	0.1783 (0.141)	0.1630 (0.139)	0.1682 (0.142)	0.1743 (0.121)
Post ₂₀₀₆	-0.2013 (0.443)	-0.4370 (0.448)	-0.1463 (0.434)	-0.1884 (0.416)	-0.2128 (0.384)	-0.2558 (0.364)	-0.4991 (0.421)
RLF ₂₀₀₆	0.9099*** (0.156)	0.4712*** (0.150)	0.9445*** (0.156)	1.0424*** (0.153)	1.0471*** (0.150)	0.9516*** (0.152)	0.5429*** (0.154)
Post ₂₀₀₆ ×RLF ₂₀₀₆	-0.6489** (0.298)	-0.5495** (0.227)	-0.5646* (0.300)	-0.6387** (0.302)	-0.6222** (0.309)	-0.6648** (0.287)	-0.5650*** (0.216)
<i>N</i>	5,207	5,207	5,207	5,207	5,207	5,207	5,207
Geographic F.E.	Zip 3	City	Zip 3	Zip 3	Zip 3	Zip 3	City
<i>N</i> levels of geog. F.E.	18	147	18	18	18	18	147
Month-of-sample F.E.	T	T	T	T	T	T	T
Lot size	T	T	T	T	T	T	T
Hwy. dist.	T	T	T	T	T	T	T
City dist.	T	T	T	T	T	T	T
Rainfall spec.	Linear	Linear	2-deg. poly.	4-deg. poly.	Cubic spline	Semi-param.	Semi-param.
Temperature spec.	Linear	Linear	2-deg. poly.	4-deg. poly.	Cubic spline	Semi-param.	Semi-param.

Notes: This table inspects the robustness of the main results by varying the specification of fixed effects and the functional form of the climate covariates (precipitation and maximum temperature). Specifically, this table focuses on column (4) of Table 7 (shown in column (1) of this table), which estimates the effect of protecting land using residentially zoned land in treated counties. In addition to second-degree polynomials, column (4) of this table also allows for a linear interaction. The fourth-degree polynomials in column (5) does not implement interactions. The *Semi-param.* specification in columns (7) and (8) refers to a semi-parametric binning, in which we construct bins (groups) using each climate-measure’s quartiles. We cluster errors by county, quarter, and year. *Significance levels:* *10%, **5%, ***1%.

Table A6: Red-Legged Frog, Robustness and heterogeneity: Examining the role of local comparisons in treatment estimates

	Dependent variable: Log(Price per acre), Treated counties						
	(1)	(2)	(3)	(4)	(5)	(6a)	(6b)
Post ₂₀₀₁	-0.0517 (0.406)	-0.2337 (0.214)	-0.0972 (0.527)	-0.2419 (0.659)	0.5686*** (0.125)	-0.0869 (0.567)	-1.7173*** (0.446)
RLF ₂₀₀₁	-0.7942*** (0.116)	-0.4032*** (0.148)	-0.4124*** (0.152)	-0.3219** (0.134)	-0.4603** (0.203)	-0.1741 (0.185)	-1.8814*** (0.432)
Post ₂₀₀₁ ×RLF ₂₀₀₁	0.2066 (0.146)	0.1329 (0.182)	0.1496 (0.184)	0.2503* (0.149)	0.1477 (0.249)	0.0422 (0.214)	0.4362 (0.408)
Post ₂₀₀₆	-0.2013 (0.443)	-0.0981 (0.284)	-0.3183 (0.435)	-0.1267 (0.528)	-0.4545 (0.492)	-0.7982 (0.588)	-0.8124** (0.335)
RLF ₂₀₀₆	0.9099*** (0.156)	0.7474*** (0.170)	0.7412*** (0.170)	0.4852*** (0.178)	1.3017*** (0.235)	0.5962*** (0.181)	1.6463*** (0.391)
Post ₂₀₀₆ ×RLF ₂₀₀₆	-0.6489** (0.298)	-0.7392** (0.348)	-0.8422** (0.353)	-1.0110*** (0.355)	-0.6834 (0.492)	-0.5506* (0.323)	-0.6506 (0.706)
<i>N</i>	5,207	5,207	5,207	5,207	5,207	3,027	790
Standard covariates	T	T	T	T	T	T	T
3-digit zip (Zip 3) F.E.	T	T	T	F	F	T	T
City F.E.	F	F	F	T	F	F	F
Month-of-sample F.E.	T	F	T	T	F	T	T
Zip 3 by quarter-of-sample F.E.	F	F	F	T	F	F	F
City by quarter-of-sample F.E.	F	T	T	F	F	F	F
City by month-of-sample F.E.	F	F	F	F	T	F	F
<i>N</i> unique levels of F.E.s	208	769	959	1,100	1,580	195	187

Notes: This table inspects the robustness and heterogeneity underlying the main results by (A) varying the specification of fixed effects and (B) splitting the sample into more similar geographies. Specifically, this table focuses on column (4) of Table 7 (shown in column (1) of this table), which estimates the effect of protecting land using residentially zoned land in treated counties. Columns 2–5 vary the geographic and temporal fixed effects. Columns (6a) and (6b) estimate the model using *only* observations in the two-digit zip codes 93 and 95, respectively. *Standard covariates* refers the standard set of covariates used throughout the paper (lot size, rainfall, temperature, and distances to the nearest highway and city). We cluster errors by county, quarter, and year. *Significance levels:* *10%, **5%, ***1%.

Table A7: Bay Checkerspot Butterfly, Robustness of results to specification: Varying the functional form of slope

Dependent variable: Log(Price per acre), San Mateo and Santa Clara Counties						
	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
RLF ₂₀₀₁	-0.0143 (0.391)	0.0007 (0.385)	-0.0047 (0.384)	0.0145 (0.388)	0.0310 (0.382)	0.0259 (0.381)
Post _{RLF,2001} × RLF ₂₀₀₁	-0.1037 (0.264)	-0.0966 (0.263)	-0.0933 (0.265)	-0.1768 (0.265)	-0.1774 (0.264)	-0.1753 (0.266)
BCB ₂₀₀₁	0.5575 (0.479)	0.4196 (0.470)	0.4474 (0.472)	3.8642** (1.725)	4.0702** (1.799)	4.1682** (1.809)
Post _{BCB,2001} × BCB ₂₀₀₁	-1.5335** (0.598)	-1.4446** (0.596)	-1.4773** (0.601)	-6.2448*** (2.245)	-6.6406*** (2.294)	-6.7726*** (2.300)
<i>N</i>	3,433	3,433	3,433	3,433	3,433	3,433
Standard covariates	T	T	T	T	T	T
Slope functional form	Linear	Quartic poly.	Cubic spline	Linear	Quartic poly.	Cubic spline
Census-tract F.E.	T	T	T	T	T	T
Month-of-sample F.E.	T	T	T	T	T	T
Serpentine IV	F	F	F	T	T	T
<i>N</i> Census tracts	249	249	249	249	249	249
<i>N</i> months	240	240	240	240	240	240

Notes: This table inspects the robustness of the main results by varying the functional form of the slope variable (the normalized differences indicated the results may be particularly sensitive to specifications of slope). Specifically, this table focuses on columns (3) and (4) of Table 4—shown here in columns (1) and (4), respectively. The month-of-sample fixed effects absorb the double-difference’s standard *Post* indicator. *Standard covariates* refer to the covariates used in the main results—wetland, flood plain, farm-land types, and urban-growth boundaries. We cluster errors by county, quarter, and year. *Significance levels:* *10%, **5%, ***1%.

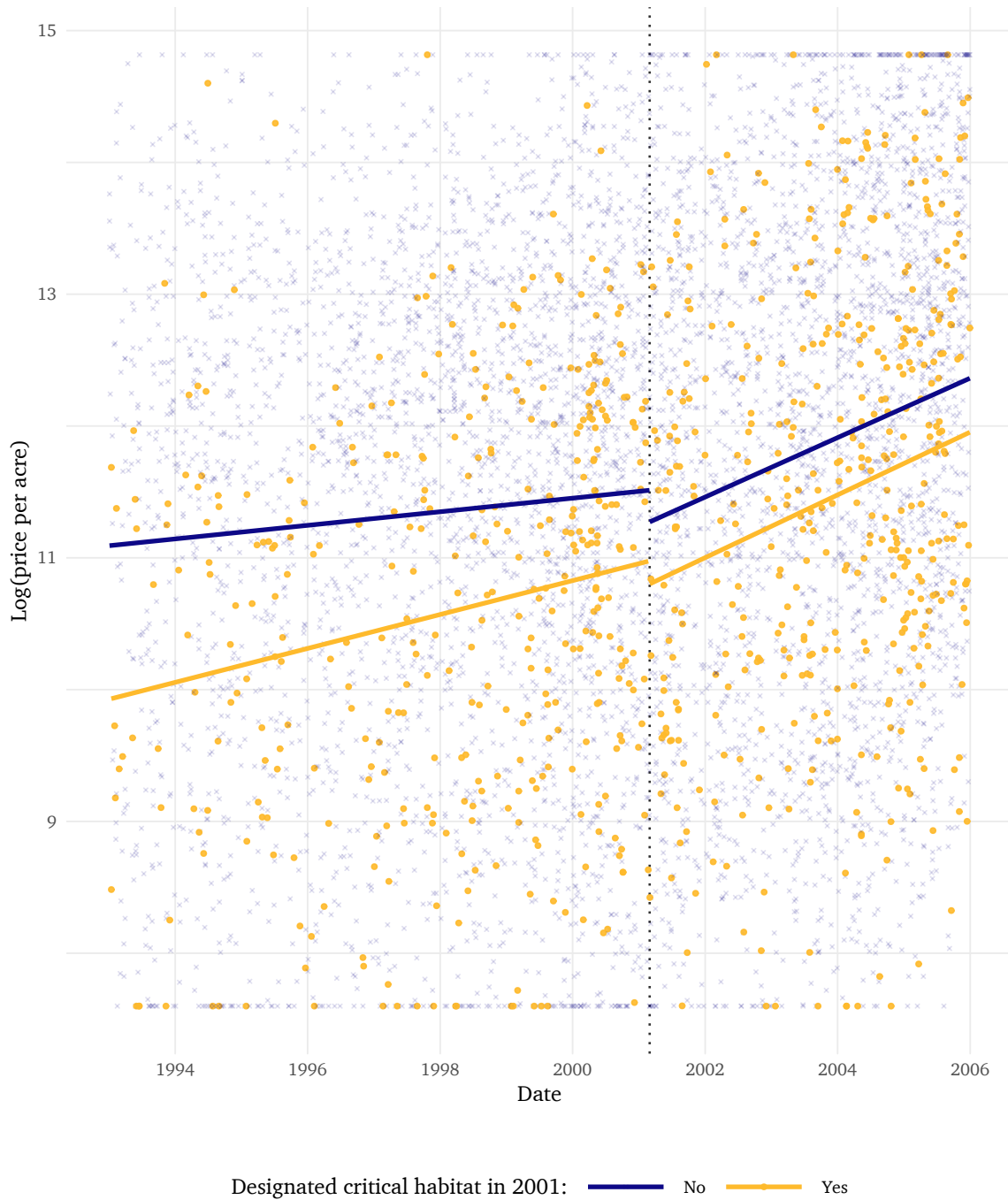
Table A8: **RLF and BCB:** Comparing main regression results with matching-based estimators

	Difference in differences			Matching
	(1)	(2)	(3)	(4)
Panel A: Red-Legged Frog				
RLF 2001 CH designation	-0.4774** (0.1859)	-0.4337* (0.2232)	-0.3942* (0.2258)	-0.8036** (0.2597)
Propensity-score overlap enforced	F	T	T	T
Controls for propensity score	F	F	T	
Panel B: Bay Checkerspot Butterfly				
BCB 2006 CH designation	-0.7842** (0.2156)	-0.8472** (0.3141)	-0.8450** (0.3210)	-0.8511* (0.5836)
Propensity-score overlap enforced	F	T	T	T
Controls for propensity score	F	F	T	

Notes: This table compares average-treatment-effect estimates based difference-in-differences estimators, matching estimators, and mixed, *doubly robust* methods. All estimates are on a percent scale (*i.e.*, -0.47 translates to a 47 percent decrease in price per acre), as opposed to log-points scale. The columns: (1) difference in differences (as specified in Tables 7 and 4), (2) difference in differences with propensity-score overlap enforced, (3) *doubly robust* difference in differences (also controlling for propensity score), and (4) nearest-neighbor matching based upon estimated propensity scores. Column (1) presents the originally estimated effects—column (4) in Table 7 (RLF) and column (3) in Table 4 (BCB). In each setting, we estimate the propensity score using a logistic regression in which the outcome variable is the difference-in-differences treatment indicator and the regressors are the controls from our previous regression specifications. To conform with double-difference based estimates, Column (4) compares the difference in the post-designation, matching-based estimate to the pre-designation, matching-based estimate. Standard errors are based upon 50,000 bootstraps. We clustered bootstraps by county, quarter, and year. *Significance levels:* *10%, **5%, ***1%.

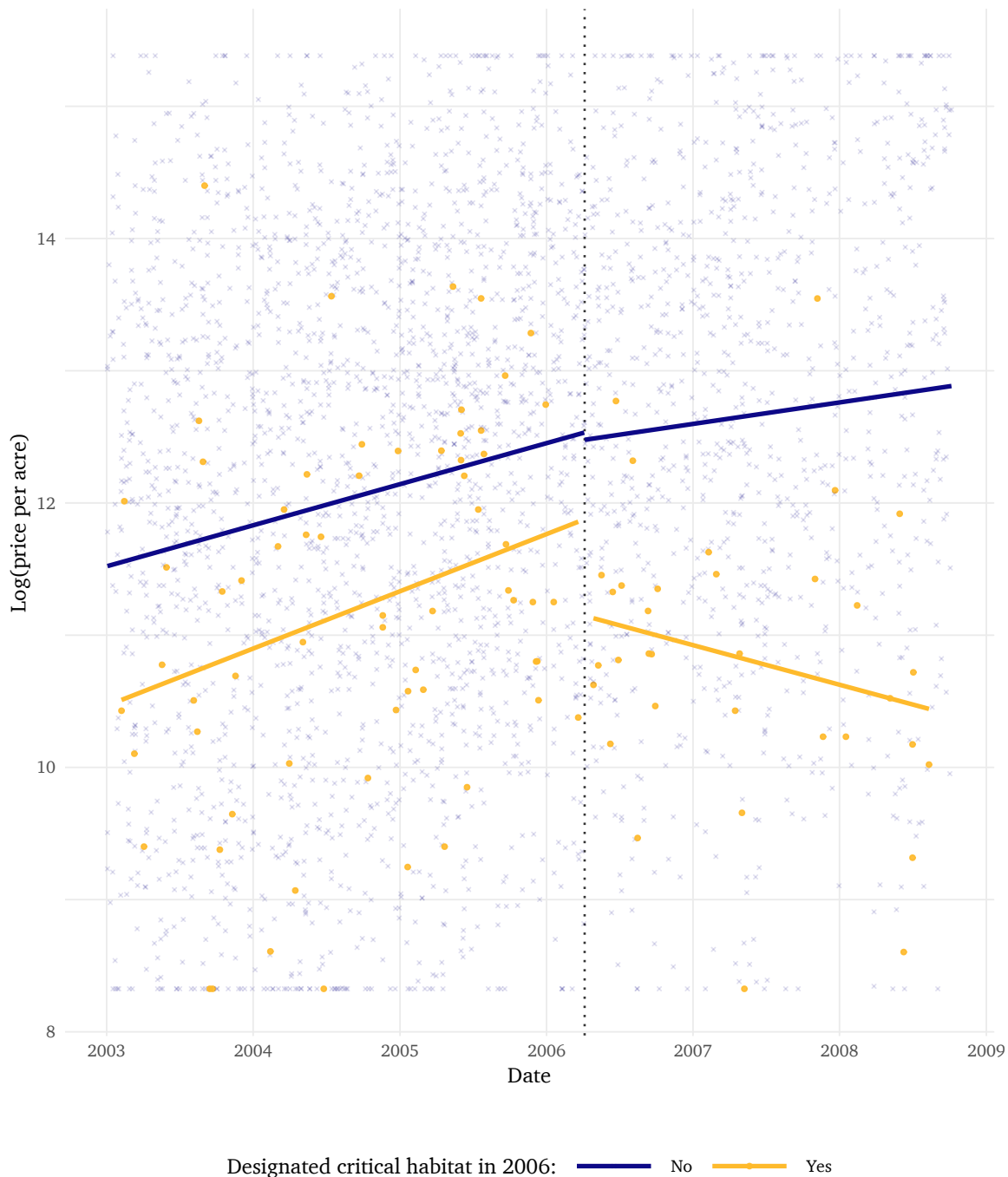
Figures

Figure A1: Land-sale prices by RLF designation status, 2001 announcement (1993–2005) Log(Price (USD) per acre), Winsorized data



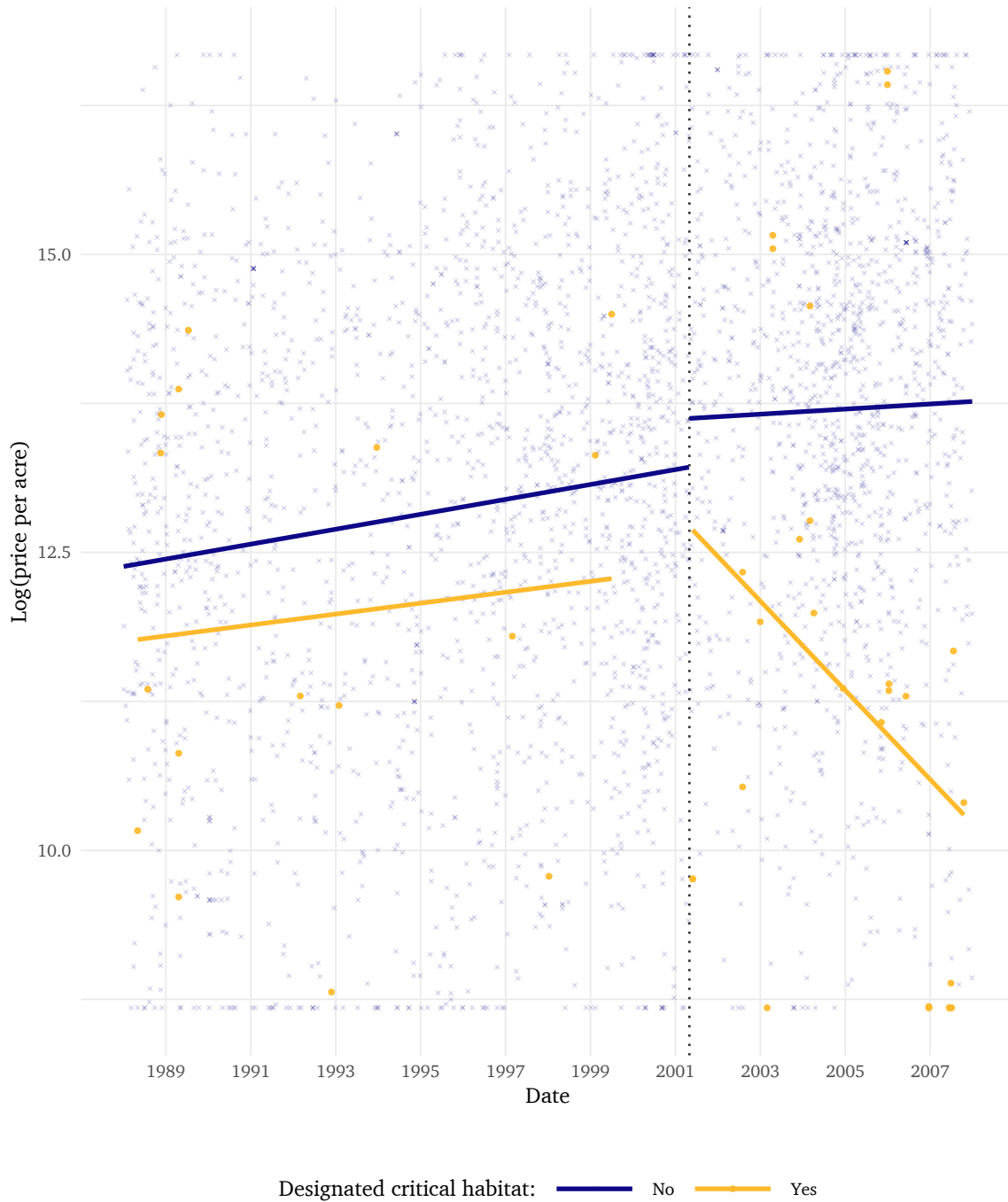
Notes: Prior to the 2001 RLF land designation (left of the dotted vertical line), sales-prices for the eventually protected land (orange dots) and unprotected land (purple crosses) traveled similar trajectories (trends). Following the announcement of the 2001 policy, land values (shown here as USD-price per acre, logged) *may have* briefly declined before returning to trends similar to those in the pre-policy period. The solid lines plot the linear trends for the two groups of properties, before and after the policy. We *Winsorize* the data at the 2.5th and 97.5th percentiles.

Figure A2: Land-sale prices by RLF designation status, 2006 announcement (2003–2008) Log(Price (USD) per acre), Winsorized data



Notes: Prior to the 2006 RLF land designation (left of the dotted vertical line), sales-prices for the eventually protected land (orange dots) and unprotected land (purple crosses) traveled similar trajectories (trends). Following the announcement of the policy, land values (shown here as USD-price per acre, logged) quickly declined for affected (critical-habitat designated) properties. The solid lines plot the linear trends for the two groups of properties, before and after the policy. We Winsorize the data at the 2.5th and 97.5th percentiles.

Figure A3: Land-sale prices by BCB designation status, 2001 announcement (1988–2007) Log(Price (USD) per acre), Winsorized data



Notes: Prior to the 2001 BCB land designation (left of the dotted vertical line), sales-prices for the eventually protected land (orange dots) and unprotected land (purple crosses) traveled similar trajectories (trends). Following the announcement of the 2001 policy, land values (shown here as USD-price per acre, logged) *may have* briefly declined for protected (critical-habitat designated) properties. The solid lines plot the linear trends for the two groups of properties, before and after the policy. We Winsorize the data at the 2.5th and 97.5th percentiles.