Moving to the Country
Understanding the Effects of Covid-19 on Property Values and Farmland Development Risk

Project Team: Kelsey Johnson[1], Lee Parton[1], Christoph Nolte[2], Matt Williamson[1], Theresa Nogeire-McRae[3], Jayash Paudel[4], Jodi Brandt[1]

1. Boise State University
2. Boston University
3. American Farmland Trust
4. University of Oklahoma

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BOISE STATE UNIVERSITY

USDA National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

Motivation

- An important margin of land use change is at the urban-agricultural interface
  - Competition between housing and food production
  - Highest quality farmland
  - Ecosystem service provision
    - Open space
    - Natural hazard buffer
    - Carbon sequestration

Motivation

- Land use projections are important tools for policy makers
  - Facilitate proactive land use planning and policies
  - Understanding of the full benefits and costs of land use decisions

Motivation

- While land use change projections rely on historical patterns of land use, broadscale socio-economic shocks can shift housing preferences and land prices.
  - Political instability: He et al. 1998; Chau 1997; Lai et al. 2006
  - Natural disasters: Eves 2002; Bin and Polasky 2004; McCoy and Walsh 2018

- Socio-economic shocks can also affect land use patterns
  - Alix Garcia et al. 2016; Hostert et al. 2011; Baumann et al. 2015

Motivation

The Covid-19 pandemic is one such shock

- Prior to pandemic, development rates were slowing on ag land
  - Bigelow et al 2021

- Preferences have shifted away from dense urban living
  - D'Lima et al 2022,
  - Liu and Su 2021

- Housing prices in city centers have fallen while prices have risen towards city edges
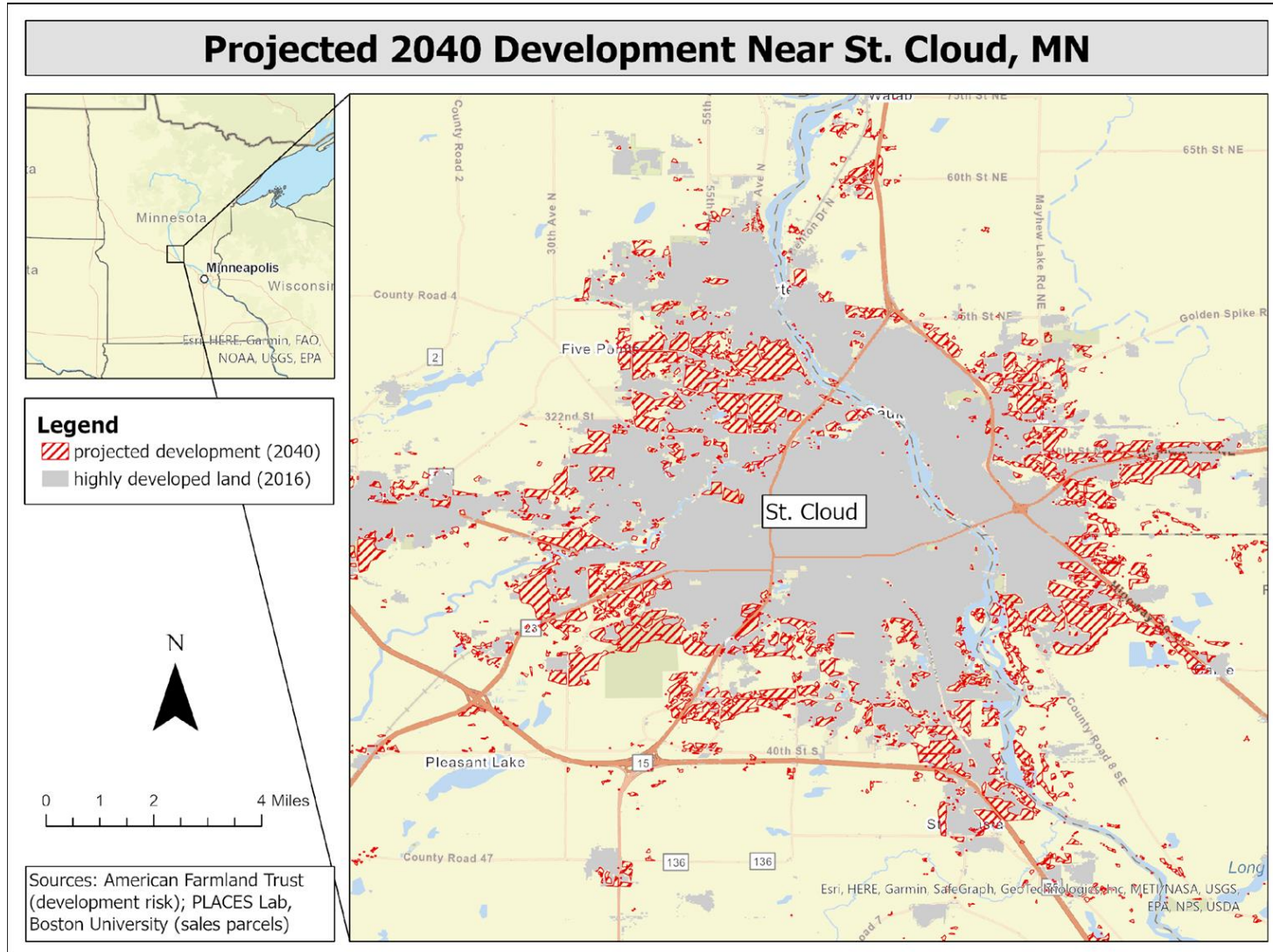 - Gupta et al 2021

Research questions

- How has the pandemic affected development pressure on parcels at high risk of being developed compared to low-risk parcels at the agricultural-urban margin?

- Do changes in development pressure differ near large vs small communities?

Methods: Data

- Zillow Transactions and Assessment Database (ZTRAX)
  - 3.7 million detailed transactions
  - January 2012 – October 2021
  - 34 states

- PLACES Lab (Boston University) remote sensing data
  - Spatial locations of property sales
  - Parcel boundaries
  - Building footprints

- AFT Farmland Conversion Risk (Farms Under Threat: 2040)
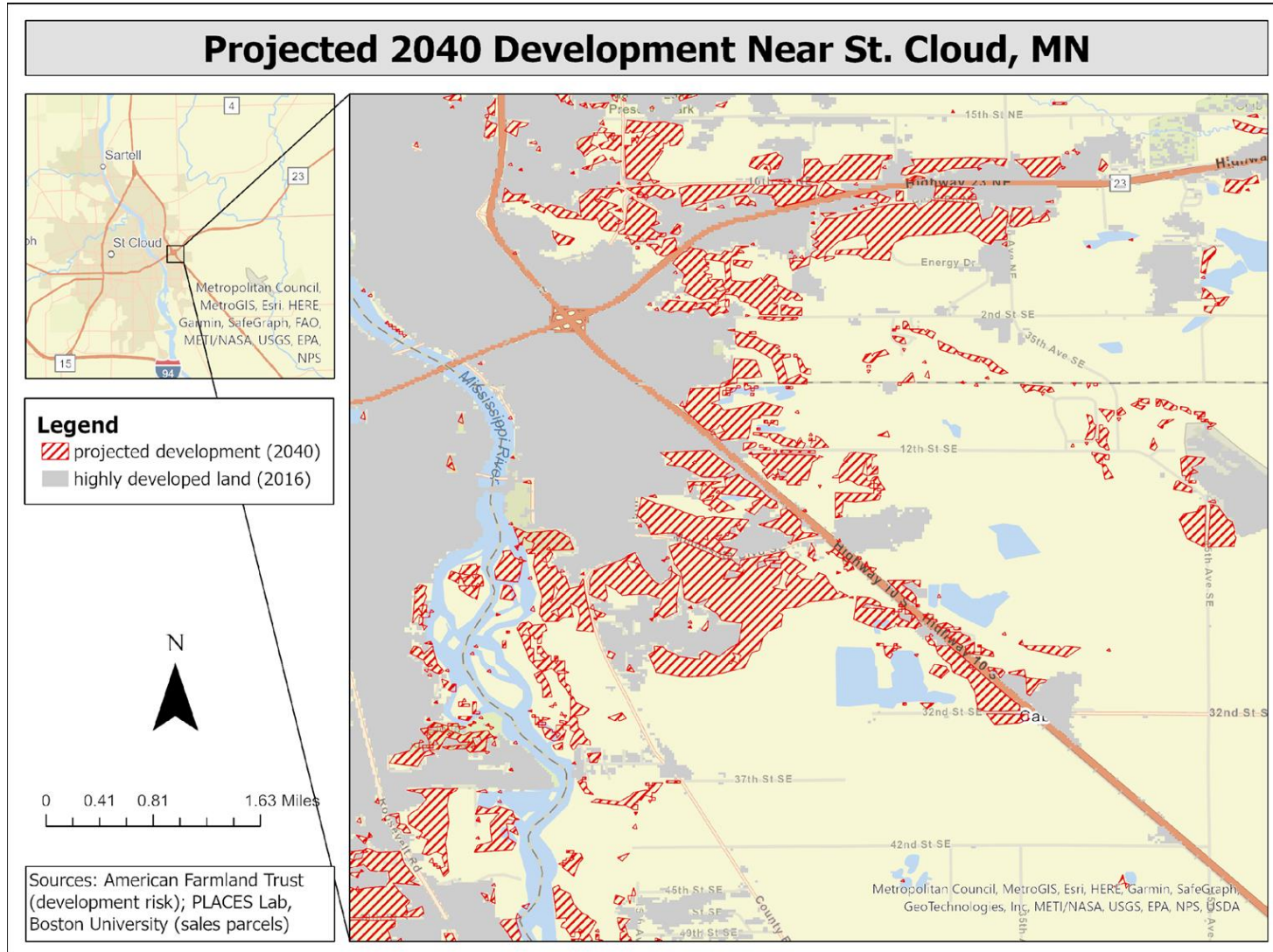 - 2016 land cover & farmland development projections at 30m resolution

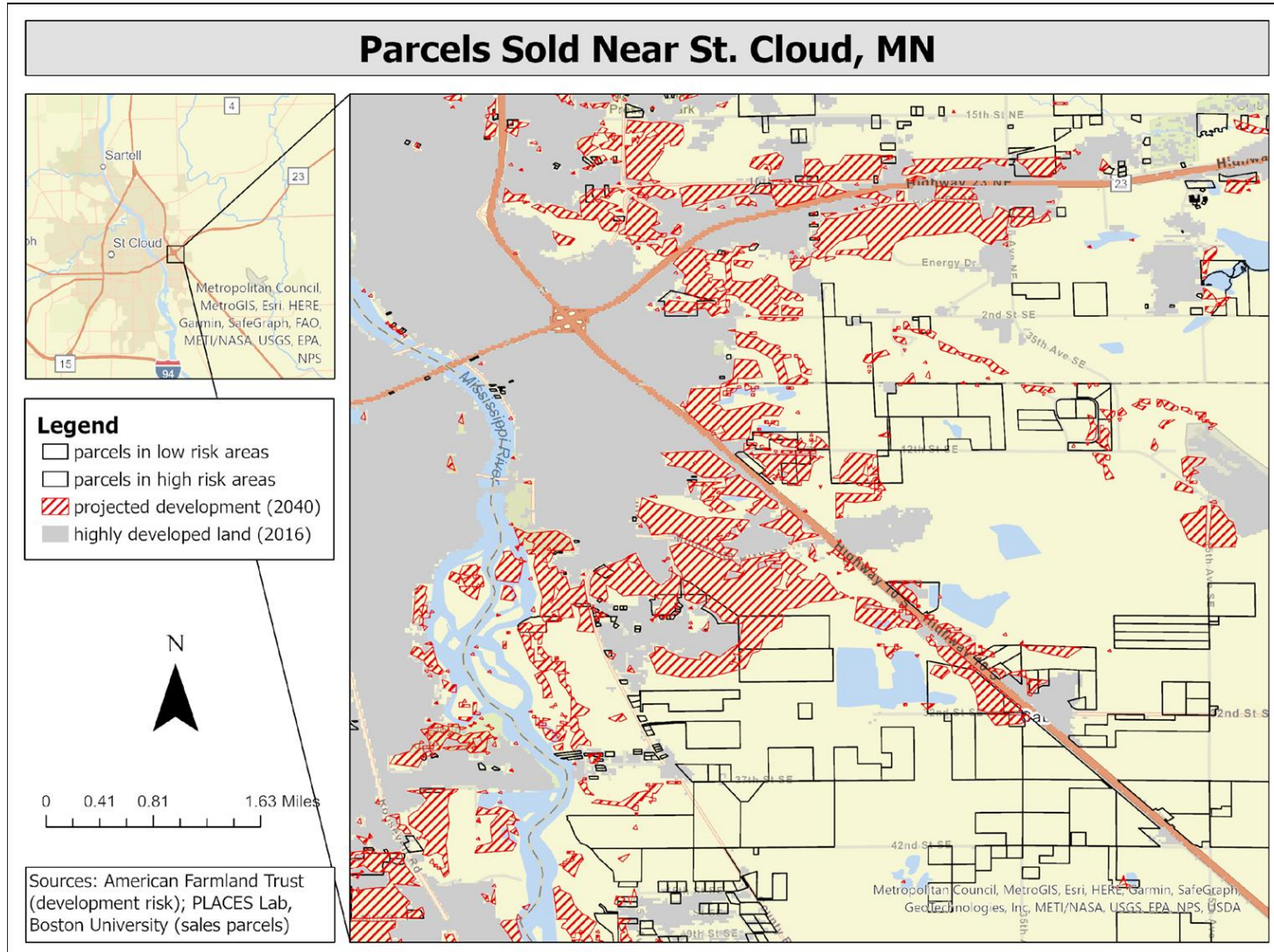# AFT Development Projections

Projected 2040 Development Near St. Cloud, MN

Legend
- projected development (2040)
- highly developed land (2016)

Sources: American Farmland Trust (development risk); PLACES Lab, Boston University (sales parcels)

Projected development is determined by
- Development probability
- Development demand
(Xie et al 2023, *Land)*

Study Design

Projected 2040 Development Near St. Cloud, MN

Legend
- projected development (2040)
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Sources: American Farmland Trust (development risk); PLACES Lab, Boston University (sales parcels)

How has development pressure changed at the <u>urban-rural margin</u> in high-risk vs low-risk areas?

Study Design

Parcels Sold Near St. Cloud, MN

Legend
- ☐ parcels in low risk areas
- ☐ parcels in high risk areas
- ▨ projected development (2040)
- ▨ highly developed land (2016)

N

0   0.41   0.81   1.63 Miles

Sources: American Farmland Trust
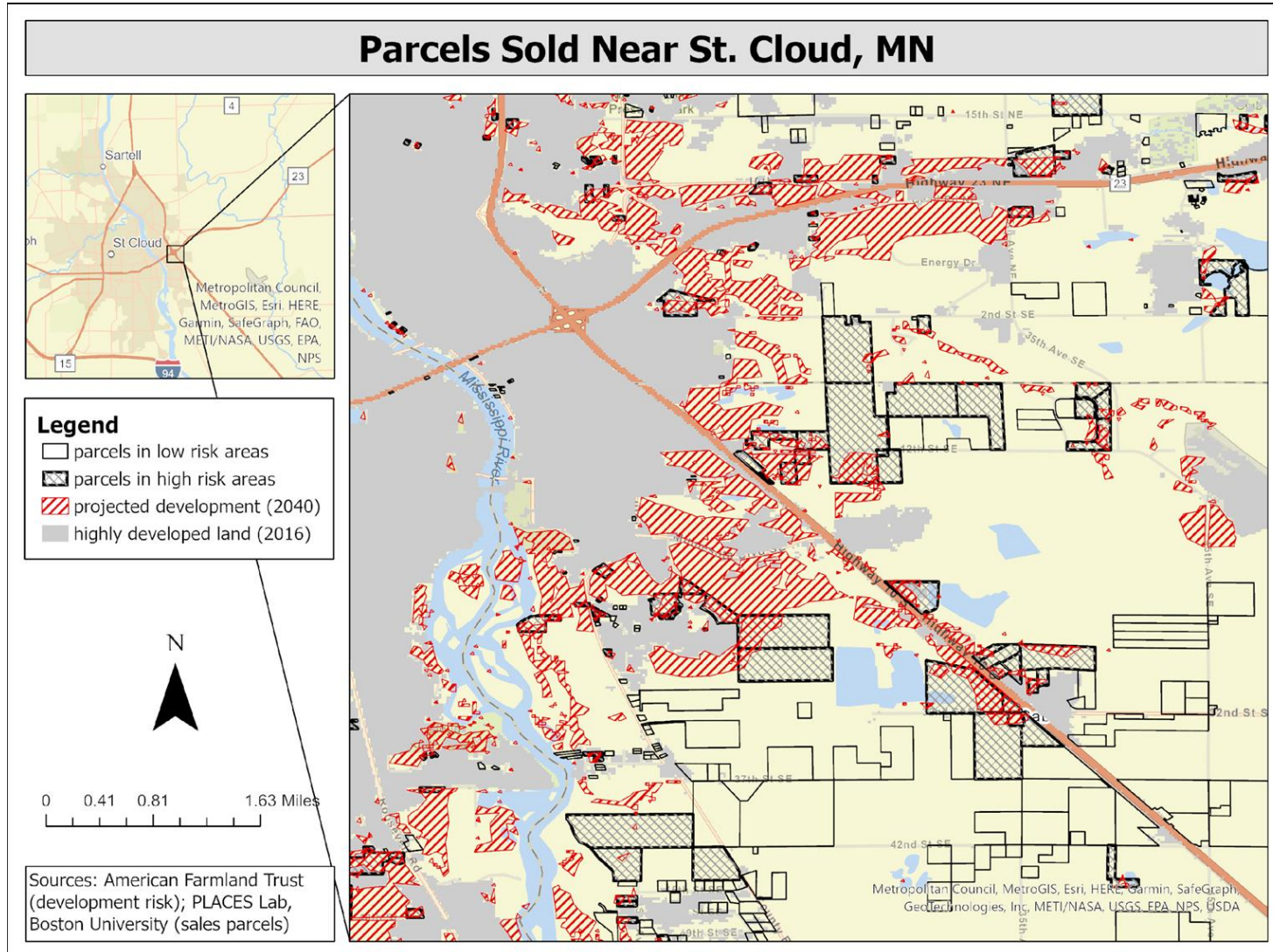(development risk); PLACES Lab,
Boston University (sales parcels)

How has development
pressure changed at the
<u>urban-rural margin</u> in high-
risk vs low-risk areas?

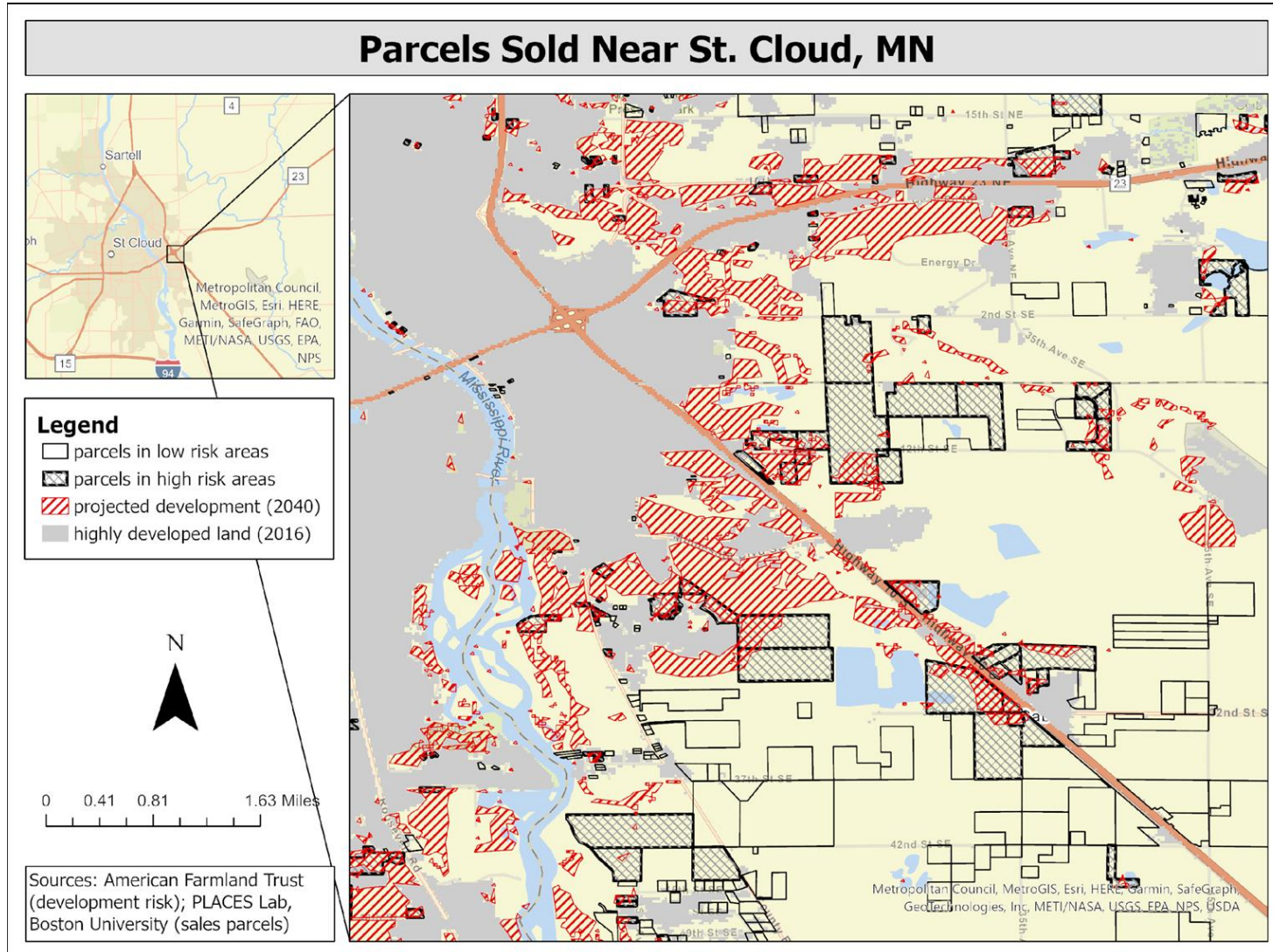- Sample: Residential
  properties *outside*
  developed areas

Study Design

Parcels Sold Near St. Cloud, MN

Legend
- parcels in low risk areas
- parcels in high risk areas
- projected development (2040)
- highly developed land (2016)

Sources: American Farmland Trust (development risk); PLACES Lab, Boston University (sales parcels)

How has development pressure changed at the <u>urban-rural margin</u> for high-risk vs low risk properties?

- <u>High-risk</u>: >10% of parcel on land projected to be developed

Study Design

Parcels Sold Near St. Cloud, MN

Legend
- ☐ parcels in low risk areas
- ▨ parcels in high risk areas
- ▨ projected development (2040)
- ▧ highly developed land (2016)

Sources: American Farmland Trust (development risk); PLACES Lab, Boston University (sales parcels)

How has development pressure changed at the <u>urban-rural margin</u> for high-risk vs low risk properties?

- <u>High-risk</u>: >10% of parcel on land projected to be developed
- <u>Low-risk</u>: all other parcels

Methods: Study Design

- Pandemic onset: April 1, 2020

- Estimate change in prices post-pandemic onset for parcels in high-risk areas relative to parcels in low-risk areas
  - Difference-in-differences econometric model
  - Control for property characteristics
    - # of rooms
    - Sqft
    - Parcel size
    - Distance to nearest city
    - County characteristics

- National and state-level analysis
 - 34 states across the U.S.
    - Exclude non-disclosure states

Hypothesis 1

Development pressure (as measured by relative changes in prices) in high-risk areas has changed relative to areas of low development risk

Results: National Analysis

- Property prices in high-risk areas rose _slower_ than in low-risk areas
  - 3% slower
- Indicates a decrease in development pressure in high risk areas

Results: State-level analysis

- Development pressure dropped in areas of high development risk

- 13 states with significant results
  - Exception: OR
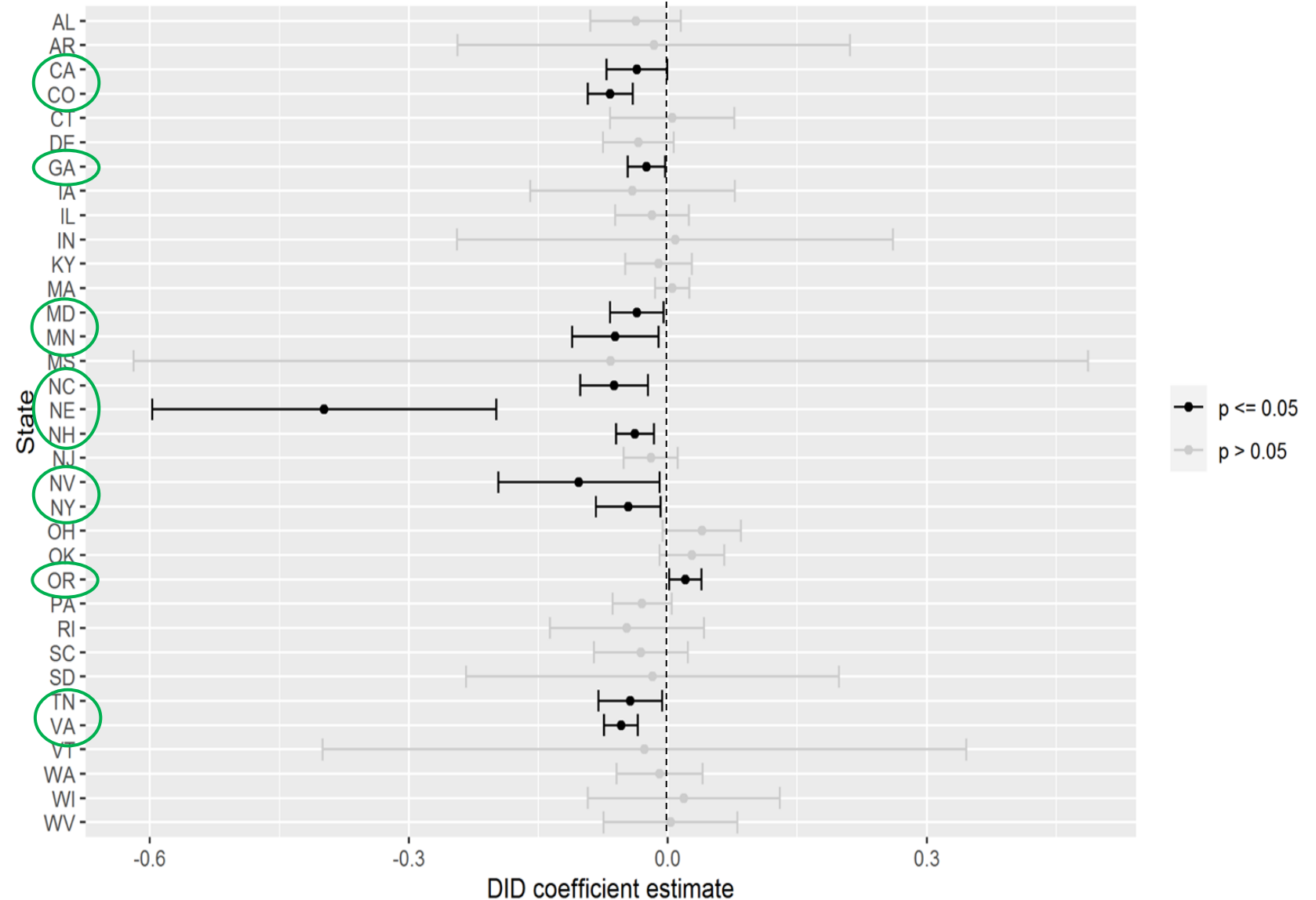
Results:

- Decrease in development pressure around large cities
  - Prices in high risk areas near large cities rose <u>slower</u> than low risk areas

- Increase in development pressure around small cities
  - Prices in high risk areas near small cities rose <u>faster</u> than low risk areas

Small City: ≤ 50,000 people   Large City: >50,000 people

Hypothesis 2

The change in development pressure in high-risk areas (post-pandemic) is different near large communities versus small communities

- Census definition of urban areas and urban clusters:
  - Large communities: urban areas with ≥ 50,000 population
 - Small communities: urban areas with population < 50,000

Results: National Analysis

- Prices in high risk areas near large cities <u>fell</u> by 4.2%, and prices in high risk areas near small cities <u>rose</u> by 3.3%
  - Decrease in development pressure around large cities
  - Increase in development pressure around small cities

Results: State-level analysis

Treatment effect for parcels near large cities

Near large cities:

- Development pressure in high risk areas drops near large cities
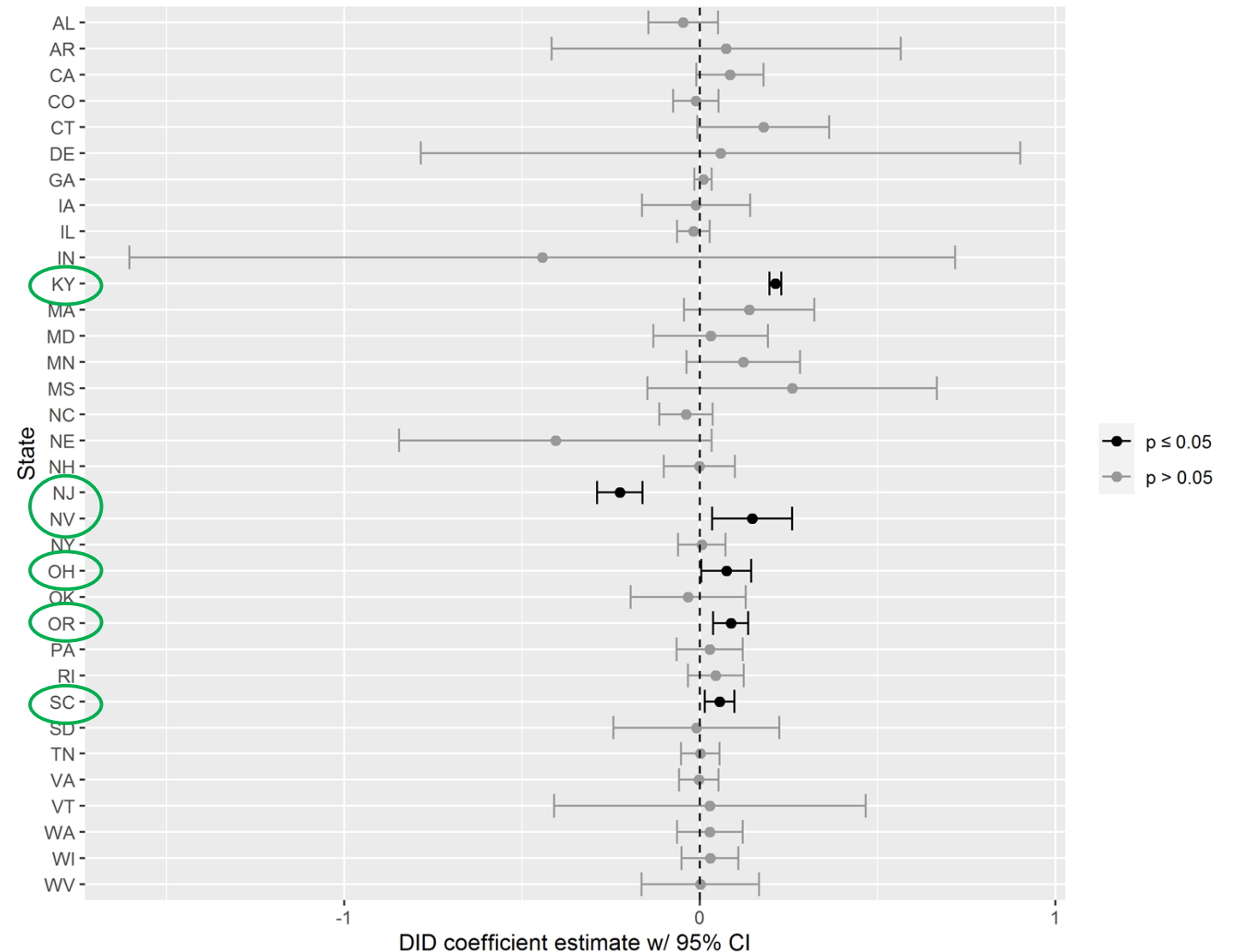
- 11 states with significant results
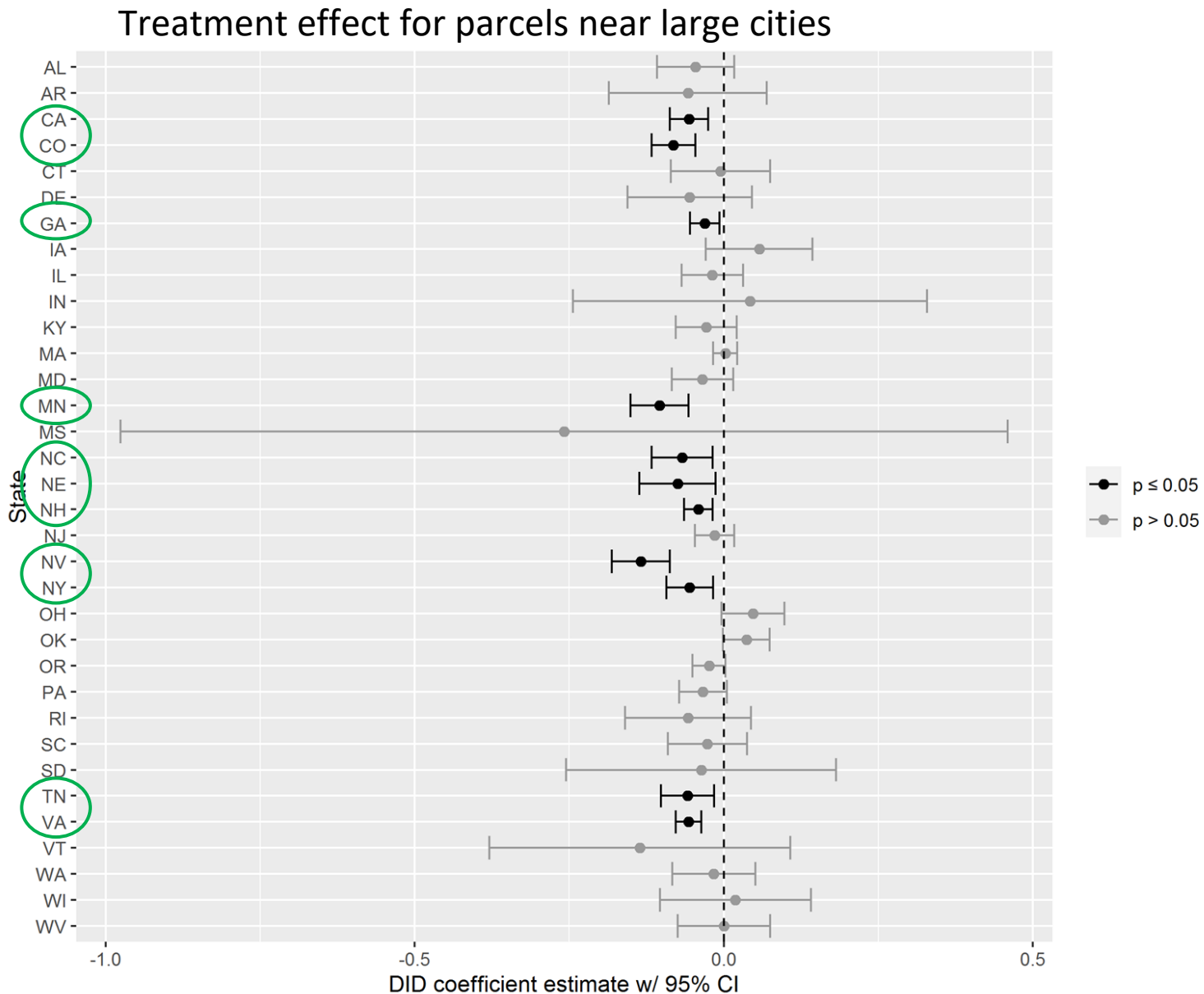
Results: State-level analysis

Near small cities:

- Development pressure in high risk areas *increases* near small cities

- 6 states with significant results
  - Exception: NJ

Treatment effect for parcels near small cities

Conclusions

- Development pressure decreases in high-risk areas

  - Near large cities ↓
  - Near small cities↑

- State-level analysis:

  - Knowing where these effects are happening and can be helpful for policy makers

- Knowledge gaps

  - Analysis of farmland loss rates

Conclusions

Implications for policy and science

- Revisit land use patterns

- Implications for ecological systems/biodiversity

- Implications for small rural areas with limited planning resources

Conclusions

Implications for policy and science

- Revisit land use patterns

- Implications for ecological systems/biodiversity

- Implications for small rural areas with limited planning resources

As development pressure spreads, small towns struggle to plan for the future

Rural towns are being tasked with weighing plans for substantial development, but are unprepared to properly plan for the growth.
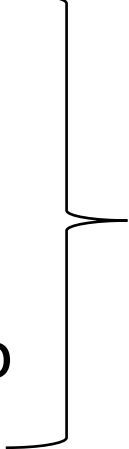
Thank You!

kelseyjohnson428@boisestate.edu

AFT Farms Under Threat 2040: Land use change projections

Probability of conversion is product of:

- Suitability for urban high density development (UHD)
  - Distance to roads, urban areas, water
  - Topography
  - Land values

- County-level rate of land conversion from non-urban to urban (2001-2016)

Probability of development

- Projected conversion is determined by
  - Development probability
  - Development demand
    - Historical conversion rates + population growth rate adjustment

Empirical Specification

Model 1 (One Treatment Arm)

$$log(p_{ist}) = \beta_0 + \beta_1 hirisk_i + \boxed{\beta_2 hirisk_i * post_t} + \beta_3 beds_i + \beta_4 baths_i + \beta_5 FP_i + \beta_6 ha_i +$$

$$\beta_7 ha_i{}^2 + \beta_8 age_i + \beta_9 age_i{}^2 + \beta_{10} distance_i + \alpha_s + \gamma_t + \delta_t$$

Model 2 (Two Treatment Arms)

$$log(p_{ist}) = \beta_0 + \beta_1 hirisk\_sm_i + \boxed{\beta_2 hirisk\_sm_i * post_t} + \beta_3 hirisk\_lg_i + \boxed{\beta_4 hirisk\_lg_i * post_t} + \beta_5 beds_i +$$

$$\beta_6 baths_i + \beta_7 FP_i + \beta_8 ha_i + \beta_9 ha_i^2 + \beta_{10} age_i + \beta_{11} age_i^2 + \beta_{12} distance_i + \alpha_s + \gamma_t + \delta_t$$
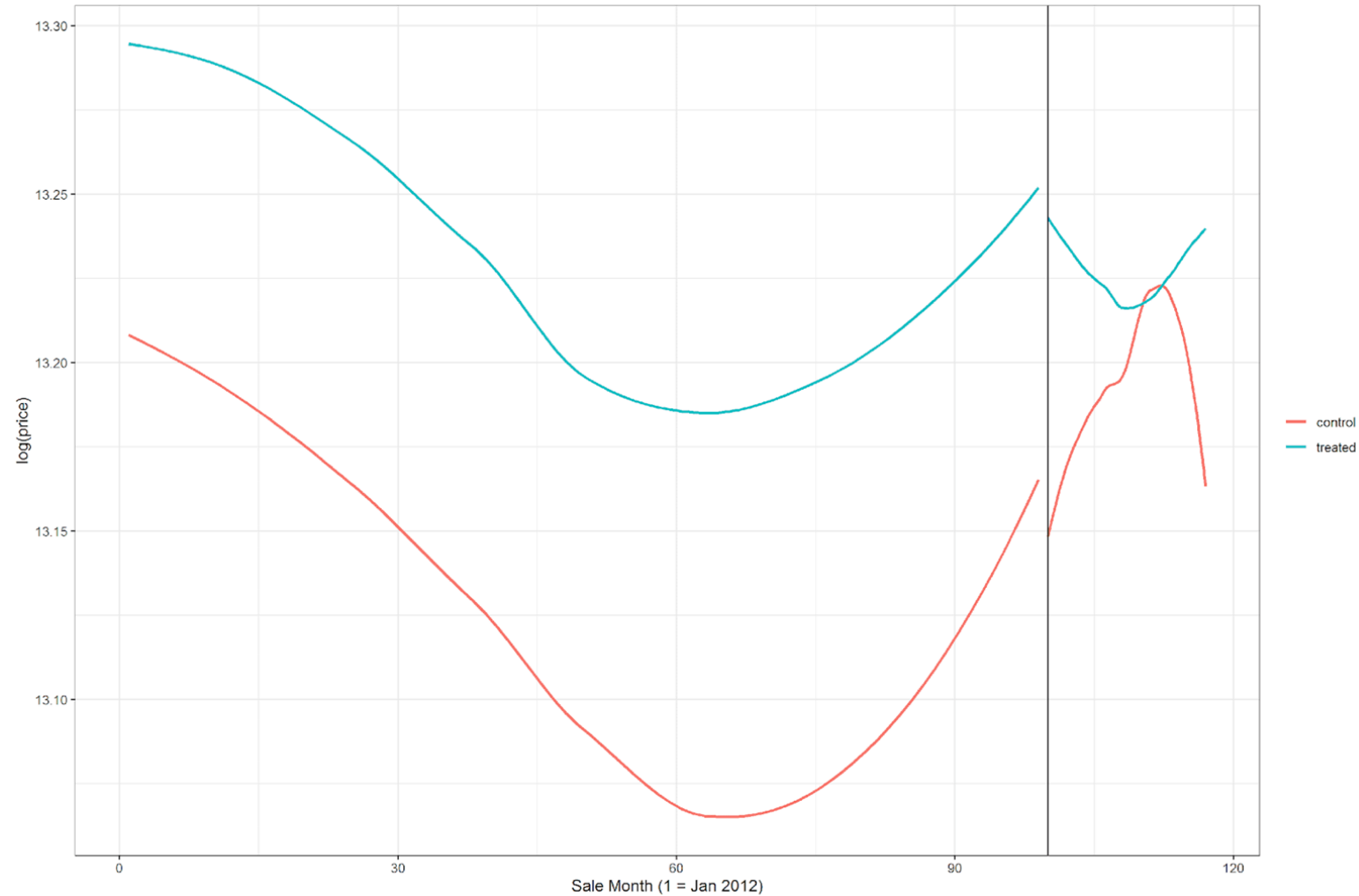
Summary Statistics

Variable	High-Risk Parcels			Low-Risk (Control) Parcels		
	Mean	Min	Max	Mean	Min	Max
age	22.13	0	1817	32.07	0	2021
baths	2.173	0	356.5	1.899	0	396
beds	2.961	0	411	2.669	0	432
distance	0.472	0	83.35	2.144	0	93.94
fp	159.3	0	20127	195.1	0	26763
ha	0.579	0.01	962.2	1.043	0.01	9274
price	$321,805	$1,800	$3,495,000	$284,173	$1,750	$3,499,750

Summary Statistics

variable	Pre-Pandemic			Post-pandemic		
	Mean	Min	Max	Mean	Min	Max
age	29.27	0	2020	37.05	0	2021
baths	1.968	0	396	1.755	0	75
beds	2.739	0	432	2.603	0	72
distance	1.837	0	93.94	2.125	0	93.83
fp	186.2	0	26763	199.7	0	18284
ha	0.948	0.01	9274	0.981	0.01	1996
price	$275,917	$1,750	$3,499,750	$367,512	$1,750	$3,499,000

Parallel Trends

Colorado

Parallel Trends

Minnesota