



Wildfire Smoke and Voting Behavior in the United States

Preliminary Results

February 14, 2026

Motivation

- Wildfire smoke is **the most** widespread *experiential* consequence of climate change in the U.S.
- Does smoke exposure change **how people vote**?
- Prior work:
 - **Fire proximity** → pro-environment voting in CA, but only among Democrats (Hazlett and Mildenberger, 2020)
 - **Air pollution (PM₁₀)** → anti-incumbent voting in Germany (Bellani et al., 2024)
 - **Rain on election day** → lower turnout (Gomez et al., 2007)
- **Gap:** **Nobody has linked** wildfire-specific smoke PM_{2.5} to U.S. election outcomes

Why Smoke > Fire Proximity

Fire perimeters

- Treatment: ~1,  block groups near fire lines
- California only
- Confounded by property destruction, displacement, insurance
- Endogenous to land use

Wildfire smoke

- Treatment: *every county in the U.S.*
- National scope
- Isolates experiential/health channel
- Plausibly exogenous (wind-driven)

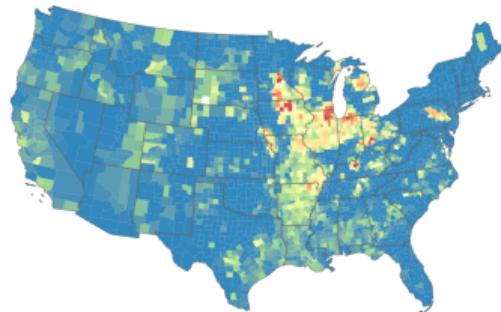
Data

1. **Wildfire smoke PM_{2.5}** — Stanford Echo Lab (Childs et al., 2022)
 - Daily, county-level, 2006–2020
 - ML separation of wildfire smoke from background PM_{2.5}
2. **Presidential election returns** — MIT Election Data Lab (MIT Election Data + Science Lab, 2024)
 - County-level, 2000–2024
3. **Analysis sample:** 12,429 county × election observations
3,108 counties × 4 elections (2008, 2012, 2016, 2020)

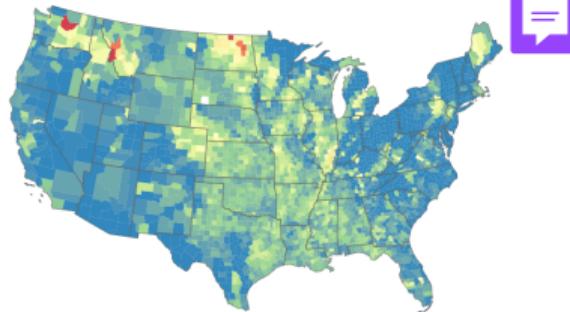
Smoke Exposure Varies Dramatically Across Elections

Pre-Election Wildfire Smoke Exposure by County
Mean wildfire-attributed PM_{2.5} in the 30 days before election day

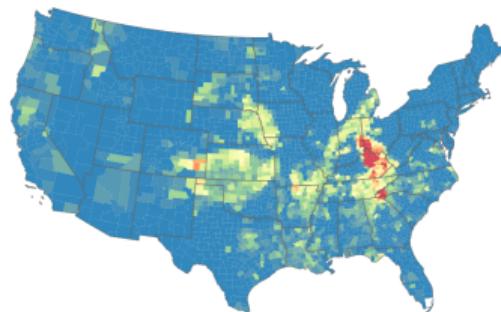
2008



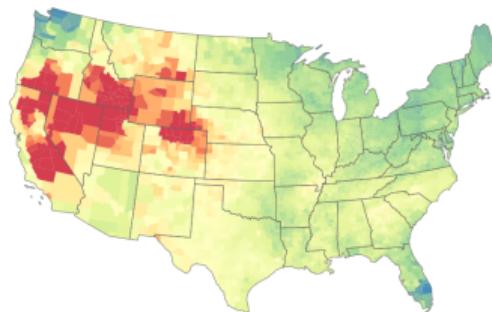
2012



2016



2020



Empirical Strategy

Two-way fixed effects:

$$Y_{ct} = \alpha_c + \gamma_t + \beta \cdot \text{SmokePM}_{ct} + \varepsilon_{ct}$$

- α_c : County FE — absorb all time-invariant confounders
- γ_t : Election year FE — absorb national swings
- SEs clustered by county
- Treatment: mean smoke PM_{2.5} in the 60 days before election

Identification: Smoke plume direction is determined by wind, not by county politics or demographics.

Main Results

| | (1) | (2) | (3) |
|-------------------------------|-------------------------|--------------------------|-------------------------|
| | DEM Vote Share | Incumbent Share | Log Turnout |
| Smoke PM _{2.5} (60d) | 0.00087*** (0.00009) | -0.00399*** (0.00044) | 0.00242*** (0.00018) |
| County FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| N | 12,429 | 12,429 | 12,429 |

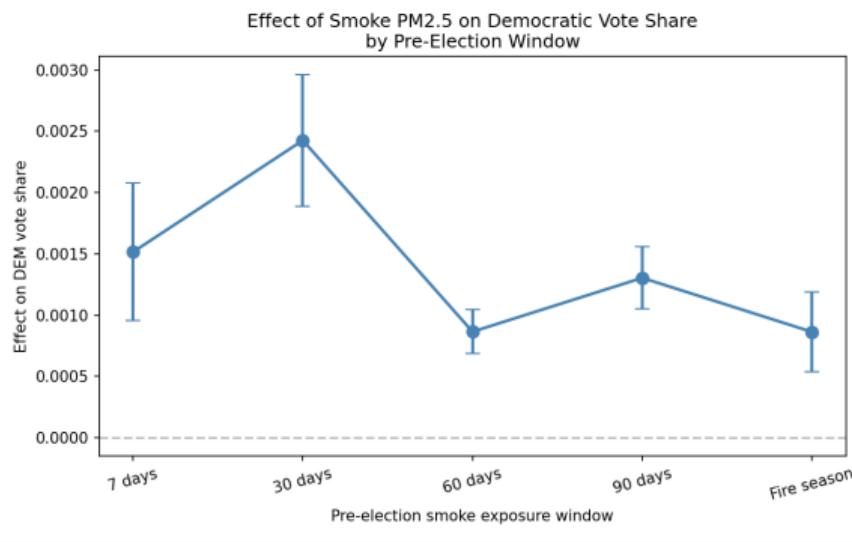
- +10 $\mu\text{g}/\text{m}^3$ smoke \rightarrow +0.9 pp DEM vote share
- Anti-incumbent effect is $\sim 4x$ larger than pro-DEM effect
- No evidence of turnout suppression

Effect Across the Partisan Spectrum

| | R-Leaning | Swing | D-Leaning |
|-------------------------------|-------------------------|-------------------------|-------------------------|
| Smoke PM _{2.5} (60d) | 0.00066*** (0.00021) | 0.00049*** (0.00014) | 0.00082*** (0.00013) |
| N | 4,144 | 4,141 | 4,143 |

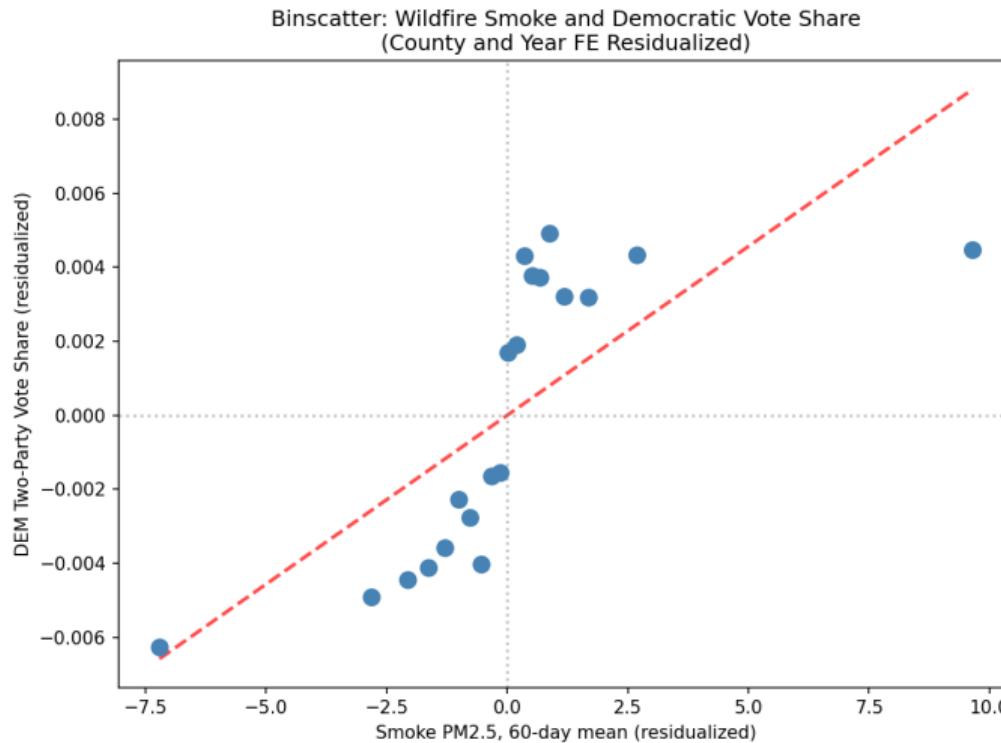
- Effect is **present in all terciles** of prior partisanship
- Somewhat larger in D-leaning counties
- Contrast with Hazlett and Mildenberger (2020): fire proximity affects *only* Democratic areas
- Smoke is a broader, less politically sorted treatment

Temporal Dynamics



- Effect significant at all windows
- Strongest at 30 days
- Consistent with recency / salience mechanism
- Not just election-day disruption

Binscatter: Smoke and Democratic Vote Share



County and year FE residualized. 20 equal-sized bins of smoke exposure.

House Elections: County-Level Analysis

| | (1) County House | (2) District House | (3) Presidential |
|------------------------|--------------------------|-------------------------|--------------------------|
| <i>DEM Vote Share</i> | 0.00038*** (0.00013) | -0.00027 (0.00045) | 0.00087*** (0.00009) |
| <i>Incumbent Share</i> | -0.00153*** (0.00045) | -0.00186** (0.00089) | -0.00399*** (0.00044) |
| Unit | County | District | County |
| <i>N</i> (contested) | 8,391 | 3,014 | 12,429 |
| Elections | 2016–2020 | 2006–2020 | 2008–2020 |

- County-level House confirms both pro-DEM and anti-incumbent effects
- Avoids crosswalk measurement error → sharper estimates than district-level
- Magnitudes smaller than presidential, consistent with candidate-driven races

What Mechanism?

| Mechanism | Turnout? | Partisan pattern | Our evidence |
|------------------------|-------------|------------------|----------------------|
| Salience | No | Pro-environment | ✓ DEM shift |
| Negative affect | No | Anti-incumbent | ✓ Large anti-incumb. |
| Disruption | Suppression | Differential | ✗ No suppression |

Evidence is most consistent with **both** salience and negative affect channels operating simultaneously.

Limitations and Next Steps

Current limitations:

- Only 4 presidential elections; 3 House elections (smoke data: 2006–2020)
- County-level aggregation; no individual-level variation
- Turnout measure is crude (no population denominator)

Planned extensions:

- NOAA HMS smoke plumes for extended coverage through 2024
- State legislative elections
- Wind direction as instrument for smoke exposure
- State \times year FE; Conley spatial SEs

Summary

1. Wildfire smoke **increases Democratic vote share and punishes incumbents**
2. Effects are **nationally representative** and **cross the partisan spectrum**
3. Smoke is **plausibly exogenous** (wind-driven) and affects **far more people** than fire proximity
4. Consistent with both climate salience and negative affect mechanisms

References

- Bellani, L., Ceolotto, S., Elsner, B., and Pestel, N. (2024). The effect of air pollution on voting behavior. *Proceedings of the National Academy of Sciences*, 121(18):e2309868121.
- Childs, M. L., Li, J. S., Wen, J., Heft-Neal, S., Drber, A., and Burke, M. (2022). Daily local-level estimates of ambient wildfire smoke PM2.5 for the contiguous US. *Environmental Science & Technology*, 56(19):13607–13621.
- Gomez, B. T., Hansford, T. G., and Krause, G. A. (2007). Weather, turnout, and voting: Is weather a natural experiment? *The Journal of Politics*, 69(3):649–663.

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- Hazlett, C. and Mildnerger, M. (2020). Wildfire exposure increases pro-environment voting within Democratic but not Republican areas. *American Political Science Review*, 114(4):1359–1365.
- MIT Election Data + Science Lab (2024). County presidential election returns 2000–2024. Harvard Dataverse.