Exploring the relationship between climate attitudes and extreme weather events - S&DS 625 Final Project

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2021-12-10

Introduction

Contextualizing and motivating

Climate change and environmental degradation is one of the most existential crises of our time, if not the most existential. Unfortunately, many Americans do not agree with this statement and/or do not fully comprehend the implications of our global future if we do not address the causes of climate change. Without recognition of the seriousness of climate change, harmful consumer habits perpetuate, eco-friendly policies falter due to lack of support, and the industries and corporations that negatively impact the environment are not held accountable nor pressured to abandon the status-quo. Climate communication is a field that works with these issues, and in particular, with how to educate and persuade individuals about climate change and the necessity of acting to reduce it. The hope is that the more people there are that recognize climate change as a serious threat, the more likely we are to have politicians and corporations that are pressured to use their positions of power to enact positive change when it comes to the environment.

This contextualizes my goal for this final project - to better understand some aspects of climate change beliefs at the county-level. If we don't understand the beliefs that people currently have about climate change, and what factors might influence those beliefs, then we will be less effective at trying to persuade those people than if we can be understanding and empathetic at the same time as being convincing. In particular I am curious to see how local extreme weather events relate to county-level climate change beliefs. I would expect that personally experiencing one of the widely broadcasted affects of climate change - increased extreme weather events such as drought, hurricanes, wildfires, winter storms, etc - would cause a person to take climate change more seriously, compared to someone who just hears about these things happening on the news. However, there are other cultural and demographic factors that I would expect to have an effect on climate change opinions that also need to be controlled for, such as political leanings and age.

Data sources

To explore the relationship between extreme weather events and climate change opinion with consideration given to the additional impact of political leanings and demographics on climate change beliefs, I gathered information from multiple data sources.

To attempt to understand climate change beliefs, which I will consider to be the response variable, I will use data collected and processed by the Yale Program on Climate Change Communication. This data consists of US county-level estimates of climate change beliefs, i.e. x% of the population in New Haven County believes that climate change is happening. These estimates are calculated from a large-scale nation-wide survey ($n > 25{,}000$) conducted in spring of 2020, and were "derived from a statistical model using multilevel regression with post-stratification (MRP)". Though using individual-level data could be more convincing for arguing existence of a relationship between extreme weather event experiences and climate change beliefs (the unit

"county" does not itself have a climate change belief), actually obtaining the supplementary data at this level was not feasible for this project due to data privacy issues.

I pulled supplementary demographic data at the county level from the Census Bureau's ACS 2019 estimates using the R package `tidycensus`. To understand the political leaning of each county, I used 2020 general election results at the county level. These came from a data set containing general election results from 2000-2020 maintained by the MIT Election Data and Science Lab and accessed via the Harvard Dataverse.

Identifying counties that experienced an extreme weather event around the time of the climate opinion survey is not cut-and-dried. How should one define "extreme weather"? How long does the memory of an extreme weather event impact behavior or beliefs? There may be multiple reasonable responses to these questions. This report defines "extreme weather" as weather events that were declared disasters by FEMA (Federal Emergency Management Agency) in 2019. These events are recorded in the online OpenFEMA Data Sets at the state and county level. I chose to use FEMA disasters as the indicator of extreme weather because it signals a disaster beyond what state governments typically expect and are prepared to handle. This accounts for the fact that independently of climate change, some parts of the country naturally experience - and are used to experiencing - more severe weather than others. I limited the analysis to considering weather events in 2019, which were most recent to when the climate opinion survey was conducted. To use events from any previous years would be to assume that large majorities of individuals stayed in the same counties longer, and also that weather events from 2+ years prior would have a lasting impact on beliefs, which I do not think are safe assumptions.

Data Preparation

Merging these data sources required considerable cleaning and quality assurance checks of each individual source.

Climate change opinion survey data

Because the providers of the climate change opinion survey already processed the individual responses into county-level estimates, this data is very clean to begin with. Data is available for every county reported on by the Census in 2020, there are no duplicate rows, and the response variable `happening` (indicating the proportion of county population that believes climate change is happening) is relatively Normal in distribution.

Election data

This data set required a little more work to clean up. Data was reported for one county that was not recognized as a by the Census, and was dropped. For some reason, San Joaquin County CA had missing data, which I was able to manually find from the county website and replace. Votes were sometimes recorded by the mode in which they were received (ex. "Early Vote", "Absentee", "Election Day" etc.) and sometimes in total, so aggregation to the total county level had to be standardized between counties.

Analysis

Remember to discuss ideas inspired by Causal Inference but not actually valid in that framework Furthermore, it is difficult to guarantee that an individual experienced an extreme weather event, even if they are recorded as living in the county where one occurred, and "treatment" of experiencing a weather event is not randomized.

Try repeating analysis with just hurricanes, fires

Results

Conclusion

References

Contextualizing the problem of climate change and climate change communication

- https://www.theguardian.com/environment/ng-interactive/2021/oct/14/climate-change-happening-now-stats-graphs-maps-cop26
- https://climate-xchange.org/communicating-the-climate-crisis/

Data sources (Use hyperlinks with text describing which data set this is)

- https://climatecommunication.yale.edu/
- https://climatecommunication.yale.edu/visualizations-data/ycom-us/
- MIT Election Data and Science Lab, 2018, "County Presidential Election Returns 2000-2020", https://doi.org/10.7910/DVN/VOQCHQ, Harvard Dataverse, V9, UNF:6:qSwUYo7FKxI6vd/3Xev2Ng== [fileUNF]

Analysis documentation

- https://kosukeimai.github.io/MatchIt/reference/method_optimal.html
- https://cran.r-project.org/web/packages/tidycensus/tidycensus.pdf