Trends in Perception of Global Warming in Coastal States Vs. Interior States

in the United State of America

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Abstract:

While studies have been done in other countries comparing the perceptions of coastal versus interior area residents regarding climate change, there are few studies of this issue based on data collected in the U.S. This study addresses that gap by conducting a comparison of perceptions of climate change between coastal and interior states. Specifically, this research compares opinions from respondents in coastal states with those of interior states, both cross sectionally at three time periods 2014, 2016 and 2018, and longitudinally, to see if the patterns of beliefs and concerns remain consistent. The data used for this analysis came from questions that were replicated on the 2014, 2016 and 2018 surveys that presented in The Yale Climate Opinion Maps. Descriptive statistics and paired t-tests revealed that compared to interior states the respondents in the coastal states reported higher levels of concern about climate change for all 6 questions used for comparison. There was also a slight decrease in the concern and belief in global warming reported by respondents in the interior states between 2016 and 2018. Our research suggests that further study needs to be done to better understand these trends.

Introduction:

According to the Yale Climate Opinion maps, in 2019, 67% of American adults report believing in global warming, while only 42% believe that global warming will cause them personal harm. This leads to the question, if people believe that global warming is happening, why do they believe that it will not harm them personally? Numerous studies have been done, both in the United States and globally, on the factors that influence perceptions of climate change. A study done in 2014 showed that hurricanes are most accurately experienced by people as indicators of climate change (Howe et al., 2014). Coastal populations are the most at risk for hurricanes, as well as damage due to sea level rise and flooding. In 2014, a study was

done in New Zealand linking proximity to coastline with increased belief in climate change (Milton et al., 2014) but to date there have been no studies done in the United States testing if proximity to the coast influences perception of climate change, despite population growth in these areas. The current study utilizes data taken from the Yale Project for Climate Change Communication to see if there is a relationship between concerns about climate change and the geographic location of the state. Specifically, this research compares opinions from respondents in coastal states with those of interior states, both cross sectionally at three time periods 2014, 2016 and 2018, and to see if the patterns of beliefs and concerns remain consistent across time.

Methods.

The data is taken from a model built by Yale Project on Climate Change Communication and George Mason Center for Climate Change Communication using a nationally representative survey. The model is presented as maps called "Yale Climate Opinion Maps". The maps present estimates of geolocated responses from a national survey data set called the Climate Change in American Minds, also run by Yale Project on Climate Change Communication and the George Mason Center for Climate Change. The estimates are derived from a statistical model using multilevel regression with post-stratification (MRP) on a large national survey dataset with a sample size greater than 2200 (Howe et al. 2015). Yale Climate Opinion Maps have been released for 2014, 2016, 2018 and 2019. We took the data used for the 2014, 2016 and 2018 maps for our analysis. The responses to the survey were collapsed, so that the percent that answered, "strongly agree" and "agree" are combined, the same for responses "disagree" and "strongly disagree". Neutral responses such as "not sure" were not included (Howe et al. 2015). Only questions that appeared on each iteration of the survey from each year were used for the analysis. We looked at the change in the mean estimated percentage of each state population over time for six survey questions that were repeated over different iterations of the survey.

In order to analyze the data, it needed to be formatted so that the counties matched across the time samples. This was done by matching county codes and county names across

the samples. By using this approach, some counties (2) that were included in the 2014 data set did not appear in the 2016 and 2018 data sets and had to be removed. And one county only appeared in the 2018 sample, and it was also removed. Once the data was in the correct format it was entered into SPSS statistical software. We then coded the counties by states based on whether the state was "coastal" or "non-coastal" (interior). This allowed us to look at the differences in the percentage of responses that fell into the agree category for each county in the sample and to calculate a state mean. Table 1 lists the states by coastal code.

Table 1. Coastal and Interior States

Coastal		Interior	
Hawaii	Washington	Arizona	Missouri
Massachusetts	New York	Arkansas	Montana
New Jersey	Delaware	Colorado	Nebraska
California	Oregon	Idaho	Nevada
Rhode Island	Virgina	Illinois	New Mexico
Connecticut	Forida	Indiana	North Dakota
Alaska	North Carolina	Iowa	Ohio
Maine	South Carolina	Kansas	Oklahoma
Maryland	Mississippi	Kentucky	Pennyslvania
Texas	Georgia	Michigan	South Dakota
Louisana		Minnesota	Utah
		West Virginia	Tennessee
		Wisconsin	Vermont
		Wyoming	

Figure 1 States Coded Coastal vs. States Coded Non-Coastal (Interior)

Once coded, a graph of the aggregated mean for all coastal states was compared to the aggregated mean for all interior states for the variables "Estimate percentage who think that global warming is happening" "Estimate percentage who are somewhat/very worried about global warming" and "Estimate percentage who think that global warming is caused mostly by human activities," and "Estimate percentage who think global warming will harm people in the US a moderate amount/a great deal" and "Estimate percentage who think global warming will

harm them personally a moderate amount/a great deal". For each of these questions, graphs were made that plot the averages across all the coastal and interior states for the years 2014, 2016 and 2018, shown in figure 2.

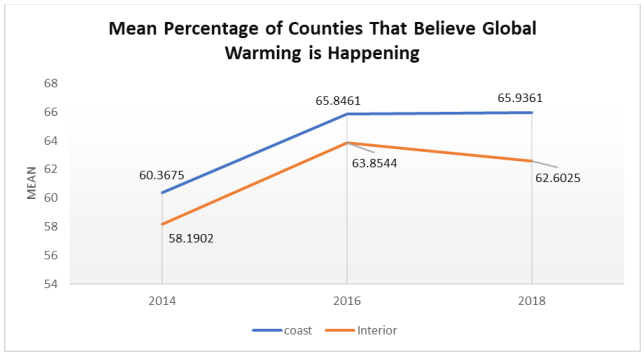
A paired t-test was also run, comparing the mean estimated percentage who think that global warming is happening for 2014 to 2016 and from 2016 to 2018 for the coastal states, and the same was done for the interior states.

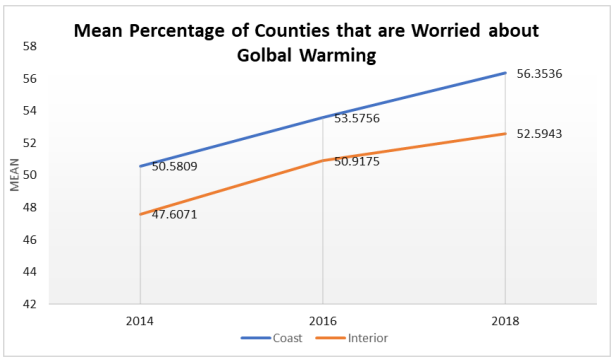
Results

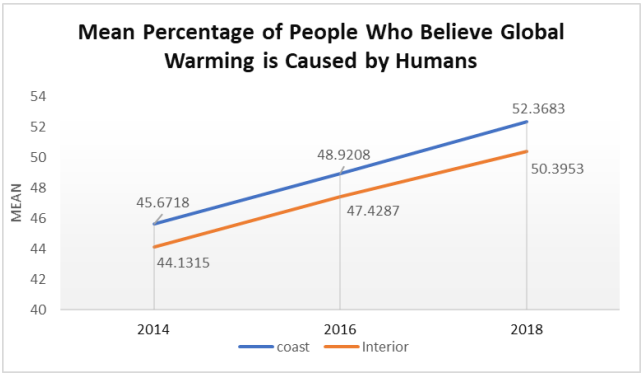
Coastal states evidenced a higher concern than the interior states on all questions at all time points. All the differences were significant based on a series of paired t-tests. Looking at the patterns over time, there seems to be a larger divergence in some questions, such as "is global warming happening," but consistent patterns for the other questions such as "will global warming harm the U.S." From examination of the trend lines shown in the graphs, it seems that the belief that global warming is happening decreased in the interior states between 2016 and 2018. The estimated percentages of counties that are "worried about global warming," that "believe global warming is caused by human activities," and that "believe global warming will harm the U.S." appears to have slowed its rate of change from 2016 to 2018 when compared to the rate of change between 2014 and 2016, where there is a clear increase.

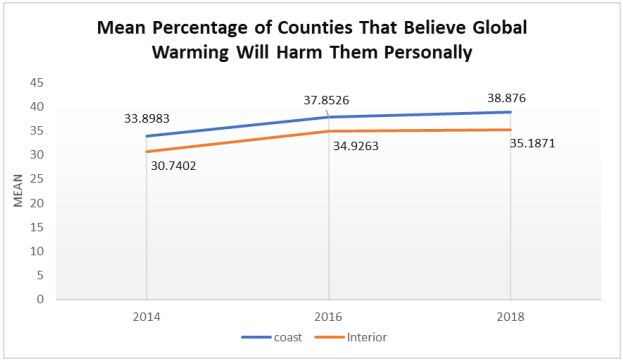
Analysis was also done looking at the states individually within the two groups, coastal versus interior. In examining the results of these graphs it appears that all of the coastal states increased their mean level of concern, except for New Hampshire, which showed a decrease in concern between 2016 and 2018. For the interior states, with the exceptions of Vermont, Colorado and Utah which all showed an increase in level of concern, the rest of the

interior states showed a decrease or remained within one percentage point between 2016 and 2018.









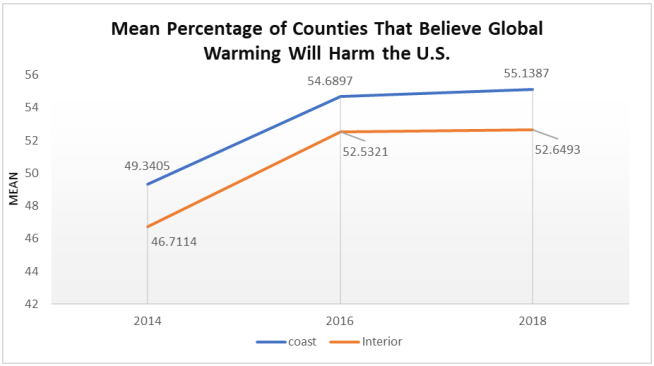


Figure 2 Plots of the mean estimated percentages for Coastal vs. Interior states across time.

Discussion:

For each estimated percentage (percentage who think that global warming is caused mostly by human activities, percentage who are somewhat/very worried about global warming, percentage who think that global warming is happening, percentage who think global warming will harm them personally a moderate amount/a great deal) the coastal states showed

a higher mean at each time point than the interior states. This indicates that there is a positive relationship between presence of coastline within a state's border, and belief in global warming.

The trends for the graphs showing mean estimates of percentage of belief in global warming for the Coastal states over time showed almost all coastal states increased across all time points, with only New Hampshire showing a decrease in estimated percentage who believe in climate change between 2016 and 2018.

For the Interior states, all states showed an increase in concern, though at a level less than the coastal states between 2014 and 2016, and then a decrease or no change in concern between 2016 and 2018, except for Vermont, Colorado and Utah. These states showed an increasing level of concern based on estimated percentages from 2016 to 2018.

In conducting a statistical analysis on the between group differences of the coastal versus the non-coastal averages over time using a repeated measures linear analysis, there appears to be not only a cross sectional difference at each time point, but also a difference in change over time. For instance, there was a statistical significance in the increase in belief in global warming between 2014 and 2016, but not between 2016 and 2018. Indicating that there was a significant increase in mean percentage from 2014 to 2016, but there was not significant increase between 2016 and 2018. Why did the increase plateau? In the methodology section of the Yale website, the researchers caution against using this data to measure change over time. However, it is important to conduct further research to examine this possibility. Further research into the cause for this should be performed to increase understanding

However, it should be noted that because the data in the Yale Climate map is reported to come from a multiple regression model which is constantly improving, change over time may not be accurately represented. As such observations of change in belief over time may not be significant, though looking at the trends there is some indication that there may be a national trend of decreasing growth in the belief in climate change.

Many studies have shown that political alignment has a pervasive effect on belief in climate change (Shao, 2016), however our analysis compares interior and coastal states across

the county and so encompass states that are both traditionally Republican and Democratic. The results were consistent despite political leanings.

Caveats and Further Research Recommendations

The results of the statistical analysis indicate that there is a stronger belief in climate change in all coastal states and that across the nation, except for a few outliers, there is an increase in the belief in climate change. Further research should be conducted to determine what is causing the variance we see in a few states that leads them to break form the trends of the rest of their peers. Further study into whether coastal states also have higher perception of risk could be enlightening towards people's perceptions of living on the coasts. Also, a finer grained study of counties within coastal states could show if proximity to the coast is related to an increasing belief in climate change. Further research should also be done one the accuracy of the decrease in growth of belief in climate change. Is there actually this sort of trend? And if so what is causing it. For instance, in recent years there has been less attention given to climate change by political leaders on the national level. This change in national attention could be a source of further investigation

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Works Cited

Milfont, T. L., Evans, L., Sibley, C. G., Ries, J., & Cunningham, A. (2014). Proximity to Coast Is Linked to Climate Change Belief. *PLoS ONE*, *9*(7). doi: 10.1371/journal.pone.0103180

Hornsey, Matthew J., et al. "Meta-Analyses of the Determinants and Outcomes of Belief in Climate Change." *Nature Climate Change*, vol. 6, no. 6, 2016, pp. 622–626., doi:10.1038/nclimate2943.

Howe, Peter D., Matto Mildenberger, Jennifer R. Marlon, and Anthony Leiserowitz (2015). "Geographic variation in opinions on climate change at state and local scales in the USA." Nature Climate Change, doi:10.1038/nclimate2583.

Howe, Peter D., et al. "Mapping the Shadow of Experience of Extreme Weather Events." *Climatic Change*, vol. 127, no. 2, 2014, pp. 381–389., doi:10.1007/s10584-014-1253-6.

Shao, Wanyun, and Kirby Goidel. "Seeing Is Believing? An Examination of Perceptions of Local Weather Conditions and Climate Change Among Residents in the U.S. Gulf Coast." *Risk Analysis*, vol. 36, no. 11, 2016, pp. 2136–2157., doi:10.1111/risa.12571.

Zhang, Baobao, et al. "Experimental Effects of Climate Messages Vary Geographically." *Nature Climate Change*, vol. 8, no. 5, 2018, pp. 370–374., doi:10.1038/s41558-018-0122-0.