

## INTRODUCTION

As one of the fastest growing economies of all metropolitan areas in the US, Phoenix Metropolitan Area is extremely vulnerable to climate change due to its geographical location in the Southwestern US. Critiques have shown that Phoenix Metropolitan Area could witness 42.2 extreme heat days per summer in the periods of 2041 to 2070 compared to 10.6 days for the periods of 1971-2000 (Grossman-Clarke, Schubert, Clarke & Narlan, 2014). Increased heat levels and greater incidence of heat-related illness are observed in the Phoenix Metropolitan Area. This in turn raises concerns about the future wellbeing of the 4,8 million people who live there.

## PURPOSE

Given the city's increasing population and drastically changing climate, we aim to understand the locals' perception about climate change considering various factors such as their experience of heat-related illnesses, socio-demographic factors (e.g. gender, income, ethnicity), and other factors including political belief, sense of belonging, and trust in scientists.

## METHODOLOGY

The study used the 2011 Phoenix Area Social Survey (PASS-2011) dataset, available at the CAP LTER data portal (Harlan et al., 2017). The PASS-2011 dataset contains records from a total of 806 respondents, drawn from the population of residents in the Phoenix area using a random-probability sampling design.

The dataset contains a wide range of items, which explore several aspects of the experience of living in the Phoenix area. Selected variables from this dataset were analysed using two-level logistic regression models with a random intercept at city level. The analysis for this study was conducted within the R environment for statistical analysis.

## THE DATA AND THE ANALYSES

Table 1: Distribution properties of PASS-2011 variables considered by this study

| Variable   | Distribution description  |
|--|---|
| Respondent's extent of agreement with the statement "the effects of global warming and climate change are already occurring" | Strongly agree: 362 respondents; Somewhat agree, somewhat disagree, strongly disagree: 408 respondents  |
| Respondent had symptoms related to heat or high temperatures   | Yes: 203 respondents; No: 535 respondents   |
| Someone else in respondent's household had symptoms related to heat or high temperatures                                     | Yes: 158 respondents; No: 566 respondents   |
| Respondent called 911 or visited the hospital for heat-related illness   | Yes: 32 respondents; No: 765 respondents  |
| Survey completion mode   | Online: 629 respondents; Telephone: 95 respondents; Face-to-face: 82 respondents  |
| Respondent gender  | Female: 453 respondents; Male: 345 respondents  |
| Respondent age   | 18-40 years of age: 269 respondents; 41-56 years of age: 265 respondents; 57 years of age or older: 252 respondents                                     |
| Respondent employment status   | In full-time work: 371 respondents; Other than full-time work: 421 respondents  |
| Respondent highest level of school completed   | College, bachelor's degree, graduate, professional school: 371 respondents; Grades 1-11, high school, community, vocational, technical: 424 respondents |
| Where respondent was born  | In the U.S.A: 699 respondents; Outside of the U.S.A.: 97 respondents  |
| Respondent has children under 6 years of age   | Yes: 115 respondents; No: 691 respondents   |
| Respondent ethnic background   | White: 530 respondents; Other than White: 260 respondents   |
| Respondent political ideology  | Very liberal: 60 respondents; Other than very liberal: 648 respondents  |
| Respondent's trust in scientists as a source of information about global warming and climate change                          | Strongly trust: 198 respondents; Other than strongly trust: 569 respondents   |
| Extent to which respondent feels a sense of belonging to the Valley  | Count of responses: 793; Minimum response: 1; Maximum response: 10; Mean response: 7.8; Median response: 8; Standard deviation of responses: 2.212      |

Table 2: Two-level logistic regression models with random intercept at city level predicting strong agreement with the statement "the effects of global warming and climate change are already occurring" [vs. moderate agreement, moderate disagreement, or strong disagreement]

| Variable  | Category [vs. reference category, if predictor is categorical]  | Coefficient (standard error) |                       |                     |                     |                     |                     |
|---|---|------------------------------|-----------------------|---------------------|---------------------|---------------------|---------------------|
|   |   | Model 1                      | Model 2               | Model 3             | Model 4             | Model 5             | Model 6             |
| Intercept   | -   | 1.59336*** (0.40803)         | 1.28436 *** (0.43725) | 0.4677 (0.3044)     | 0.5886* (0.3481)    | 2.0329*** (0.3670)  | 1.0750** (0.45467)  |
| Respondent had symptoms related to heat or high temperatures  | Yes [vs. no]  |                              | 0.53942** (0.24050)   | 0.5377** (0.2271)   | 0.5662** (0.2409)   | 0.4499* (0.2467)    | 0.5004** (0.2291)   |
| Someone else in respondent's household had symptoms related to heat or high temperatures            | Yes [vs. no]  |                              | 0.15619 (0.25844)     | 0.1821 0.2448       | 0.2660 (0.2583)     | 0.2450 (0.2648)     | 0.2163(0.2463)      |
| Respondent called 911 or visited the hospital for heat-related illness                              | Yes [vs. no]  |                              | 0.99105** (0.49692)   | 1.0793** (0.4847)   | 1.1628** (0.5301)   | 0.9982** (0.5081)   | 1.31811** (0.51979) |
| Survey completion mode  | Online [vs. face-to-face]   | -1.01864*** (0.31238)        | -0.97210*** (0.33458) | -1.0743*** (0.2895) | -1.2954*** (0.3246) | -1.1743*** (0.3039) | -1.0940*** (0.2926) |
|   | Telephone [vs. face-to-face]  | -0.42350 (0.36529)           | -0.47797 (0.38887)    | -0.5193 (0.3565)    | -0.7311* (0.3861)   | -0.6886* (0.3792)   | -0.5383(0.3584)     |
| Respondent gender   | Male [vs. female]   | -0.17563 (0.16174)           | -0.16999 (0.17234)    |                     |                     |                     |                     |
| Respondent age  | 41 to 56 years of age [vs. 18 to 40]  | 0.04126 (0.20699)            | 0.04128 (0.22249)     |                     |                     |                     |                     |
|   | 57 years of age or older [vs. 18 to 40]   | -0.14688 (0.22618)           | -0.03248 (0.24571)    |                     |                     |                     |                     |
| Respondent employment status  | In full-time employment [vs. any other employment status]   | -0.11846 (0.17576)           | -0.13062 (0.18776)    |                     |                     |                     |                     |
| Respondent highest level of school completed  | College, graduate / professional school [vs. grades 1 to 11, high school, community college, vocational / technical school] | 0.39155** (0.17014)          | 0.32809* (0.18248)    |                     |                     |                     |                     |
| Where respondent was born   | Outside of the U.S [vs. inside the U.S]   | 0.30578 (0.28045)            | 0.40142 (0.30627)     |                     |                     |                     |                     |
| Respondent has children under 6 years of age  | Yes [vs. no]  | -0.28019 (0.25366)           | -0.18627 (0.27806)    |                     |                     |                     |                     |
| Respondent ethnic background  | White [vs. any other ethnic background]   | -0.80344*** (0.20086)        | -0.72855*** (0.21622) |                     |                     |                     |                     |
| Respondent political ideology   | Very liberal [vs. moderately liberal, moderately conservative, very conservative]   |                              |                       |                     | 1.5709*** (0.3381)  |                     |                     |
| Respondent's trust in scientists as a source of information about global warming and climate change | Strongly trust [vs. moderately trust, moderately distrust, strongly distrust]   |                              |                       |                     |                     | 1.8196*** (0.2122)  |                     |
| Extent to which respondent feels a sense of belonging to the Valley                                 | -   |                              |                       |                     |                     |                     | -0.0708* (0.0380)   |
| Model metrics   |   |                              |                       |                     |                     |                     |                     |
| Sample size   |   | 728                          | 646                   | 680                 | 607                 | 661                 | 674                 |
| Akaike Information Criterion  |   | 963.8                        | 848.6                 | 902.2               | 784.5               | 797.3               | 892.1               |

## RESULTS

Our study for the Phoenix Metropolitan Area indicated that the beliefs in climate change and global warming is highly positively depended on 1) personal damage to heat-related illnesses, 2) highest level of education, 3) liberal political beliefs, 4) trust in scientists as a source of information. Also, our analysis indicated that experiencing personal damage due to symptoms related to heat or high temperatures is a stronger predictor of belief in climate change and global warming than living in a household where others may have had experienced symptoms similar symptoms.

We have found negative relationships between climate change and global warming beliefs and sense of belonging to the local area. The White-male effect has also been observed in our analyses, where white-male individuals were found less likely believe that climate change and global warming is occurring.

We haven't found any positive correlation between belief in climate change and global warming, and socio-demographic indicators such as respondents' gender; their age; their employment status; whether they had children under the age of six; and whether they were born in the United States.

## REFERENCES

Grossman-Clarke, S., Schubert, S., Clarke, T. A., & Harlan, S. L. (2014). Extreme summer heat in Phoenix, Arizona (USA) under global climate change (2041-2070). *DIE ERDE-Journal of the Geographical Society of Berlin*, 145(1-2), 49-61.

Harlan, S. L., R. Aggarwal, D. Childers, J.Declat-Barreto, S. Earl, K. Larson, M.Nation, et al. (2017). *Phoenix Area Social Survey (PASS): 2011*.

## ACKNOWLEDGMENT

This material is based on work supported by the National Science Foundation under Grant Number DEB-1026865 and DEB-1637590, Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER)