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# An analysis of the influences on household-level adaptations to environmental hazards

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# AN ANALYSIS OF THE INFLUENCES ON HOUSEHOLD-LEVEL ADAPTATIONS TO ENVIRONMENTAL HAZARDS

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## ABSTRACT

Utilizing a randomized phone survey of coastal Louisiana residents, this study will focus on identifying which influences from a resident's exposure, socio-economic vulnerability and adaptive capacity are the best indicators of an individual's resilience. Two binary logistic regression models were developed to test the associations of resident response to: 1) acute hazards via household emergency plan adoption and 2) chronic hazards represented by behavior modification in response to daily air quality reporting where adoption of these two risk-reducing behaviors are viewed as increased individual resilience. Bivariate correlation analysis found that a north – south grouping of coastal Louisiana was significantly correlated with 26 of the survey predictor variables. Findings of the two regression models include: 1) as an individual's current level of environmental hazard knowledge increases by 1-increment they are 53% more likely to engage in the risk-reducing behavior, adoption of an emergency plan and 2) almost 5 in 10 residents of the southern region reported altering their behavior on poor air quality days. This self-reported mitigation effort is associated with an increase in their personal level of concern for overall environmental pollution. Overall the results indicate when residents are provided with relevant environmental hazard information and, more importantly, when residents understand and have confidence in the hazard information, they are more likely to take anticipatory and pre-emptive measures to reduce their risk. While this study found less optimal risk-reducing adoption rates, the finding suggests immediate opportunities for government agencies and public-interest organizations to increase public education efforts to target audiences who are willing and receptive to increased environmental hazard information. Future research improvements should include increased survey questions, new survey administering methods, broadening the geographical scope of the research project, and, thus, increasing the sampling population size.

# CHAPTER 1: INTRODUCTION

## 1.1 Problem Statement

There is increasing evidence that indicates climate change is enhancing the risk of environmental hazards and understanding the indicators of more resilient individuals, households, and communities to these disruptions will benefit society in the long-term (Staudinger et al. 2012; Hanson et al. 2010; IPCC 2012). This study will gain insight into the resiliency of south Louisiana residents by analyzing their use and perceptions of a household emergency plan and the daily air quality index. The need for more household-level emergency plan development is highlighted by the increasing risk of more frequent flooding in coastal areas due to rising rivers and sea level rise (Bronstert 2003; IPCC 2012; Staudinger et al. 2012). Similarly, in the public draft report of the 2013 National Climate Assessment, a key message reported with 'high confidence' for the southeastern United States, is that "rising temperatures and the associated increase in frequency, intensity, and duration of extreme heat events are already and will continue to affect public health, the natural and urban environments, energy, agriculture, and forestry (NCADAC, 2013)." Holding all other factors constant, an increase in temperature is expected to increase surface level ozone (EPA, 2006). This increasing ozone-temperature relationship emphasizes the greater need for individuals to have more personal responsibility towards risk-reducing behaviors, such as daily review of the local air quality and ozone indices.

This study of southeast coastal Louisiana, primarily the parishes of Orleans and St. Tammany, will focus on identifying influences on household or individual level resilience by asking the following questions:

**Resilience**: What factors explain variation in adoption of behaviors to reduce exposure risks associated with chronic and acute environmental hazards? Specifically, how may exposure to hazards, socioeconomic vulnerability, and capacity to adapt to changing risk levels affect the choices of individuals?

**Exposure**: Will individuals who have experienced environmental emergencies or live in communities with reduced environmental quality demonstrate greater adaptive capacity when faced with new acute or chronic hazards?

**Socioeconomic vulnerability**: Do lower socio-economic groups demonstrate lower rates of adaptive behavior?

**Adaptive capacity**: Does level of knowledge and utilization of publicly available information regarding environmental hazards influence an individual's behavior? How may individuals' risk perceptions of environmental hazards, ranging from diminished soil, air, water quality to climate change, affect their adaptive behavior? Also, do residents' attitudes toward government institutions appear to influence the extent to which residents take steps to make themselves safer?

### 1.1.1 Climate Change and Louisiana

Louisiana is exceptionally vulnerable to several chronic hazards such as "sea level rise, extreme heat events, and decreased water availability" (NCADAC, 2013) and acute hazards such as hurricanes, flooding, and toxic substance spills. According to the Coastal Protection and Restoration Authority of Louisiana (CPRA), Louisiana has a coastal zone population of approximately 2 million individuals, almost 47% of the state's population. With Louisiana's coastal zone experiencing some of the worst land loss in the world, a net loss of 1,883 square miles of land between 1932 and 2010 (CPRA, 2011), the state published a final draft of their

coastal master plan, officially named Louisiana's Comprehensive Master Plan for a Sustainable Coast (Master Plan), on May 22, 2012.

Due to these circumstances in Louisiana's coastal zone, researchers, emergency professionals, and policy makers are striving to understand the extent of resident, commercial, and municipality exposure and vulnerability to SLR and associated SLR hazards such as increased flooding and storm surges extending further inland. Lam et al. (2009), Figure 1, estimated exposure in south Louisiana to 3 meters or 6 meters of absolute sea level rise would impact 1,184,386 residents, 18% of state population, or 1,714,392 residents, 27.6% of state population, respectively.

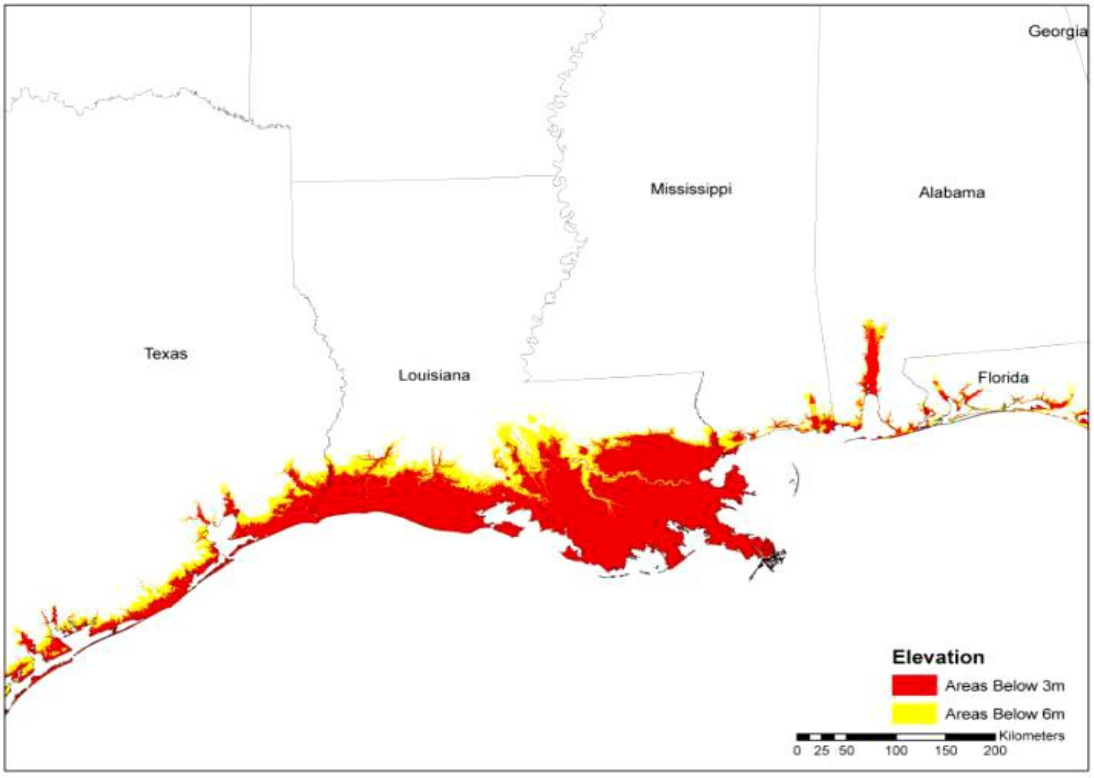


Figure 1: Areas & population within 1-km and below 3m/6m along the U.S. Coast. Adapted from Lam et. al 2009.

Of the 287 energy facilities in the U.S., Figure 2, that are located at or below 4 feet (approximately 1.22 meters) from the current high water mark, 51.5% (n = 148 of 287) are located in southern Louisiana. On April 19, 2012, in a rare U.S. Senate Energy and Natural Resources Committee[1] hearing on climate sciences, testimony by Ben Strauss of Climate Central highlighted that SLR of 4 feet above the current high tide mark poses an increasing threat to these energy infrastructures, which includes oil and gas refineries and nuclear power plants, as soon as 2030.

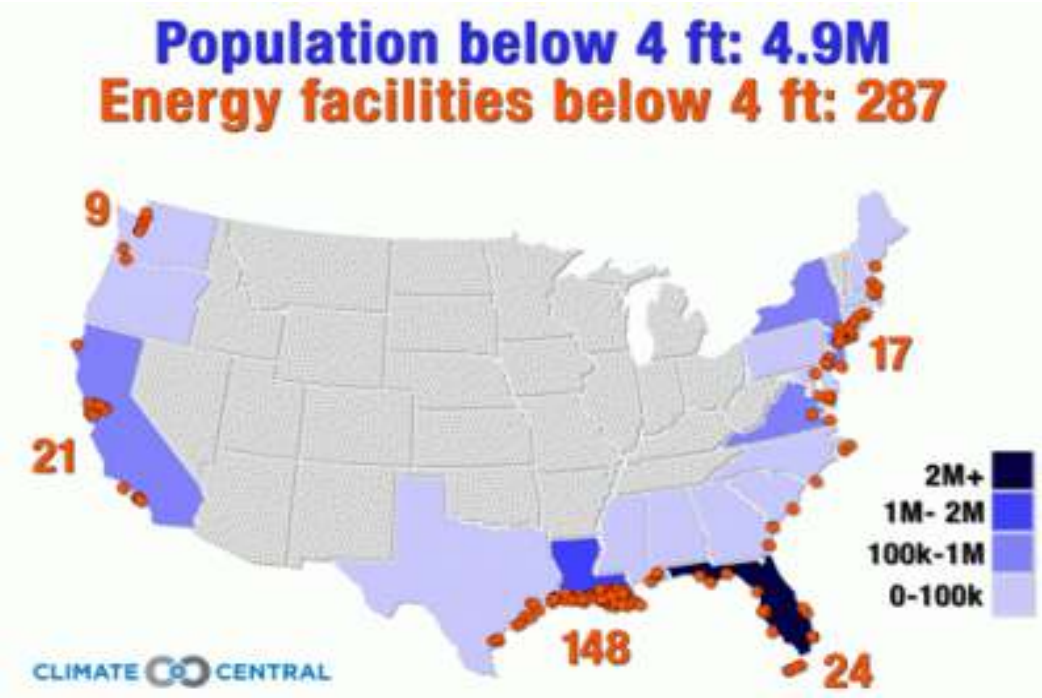


Figure 2: U.S. energy infrastructure at risk from sea level rise.
Adapted from ClimateCentral.org.

Additionally, specific to our study area of Orleans and St. Tammany parishes, the exposure to SLR and storm surges in this region includes the following environmental hazard

[1] Freedman, Andrew, "Senate hearing focuses on threat of sea level rise," Climate Central, viewed May 2013, http://www.climatecentral.org/news/senate-climate-change-hearing-focuses-on-sea-level-rise/.

sites: 3 Superfund sites, 10 Toxic Release Inventory (TRI) facilities[2], and 50 Brownfield sites[3] (Figure 3 locates TRI and Superfund sites). Superfund sites are federally designated due the hazardous waste contained at the site being abandoned and uncontrolled. TRI sites have been required by the federal government to report their release of certain toxic chemicals that may pose a threat to human health and the environment. A Brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant[4]. Figure 3 shows for our study area a higher density of TRI facilities south of Lake Pontchartrain (n = 8 of 10). Also, all Brownfield sites

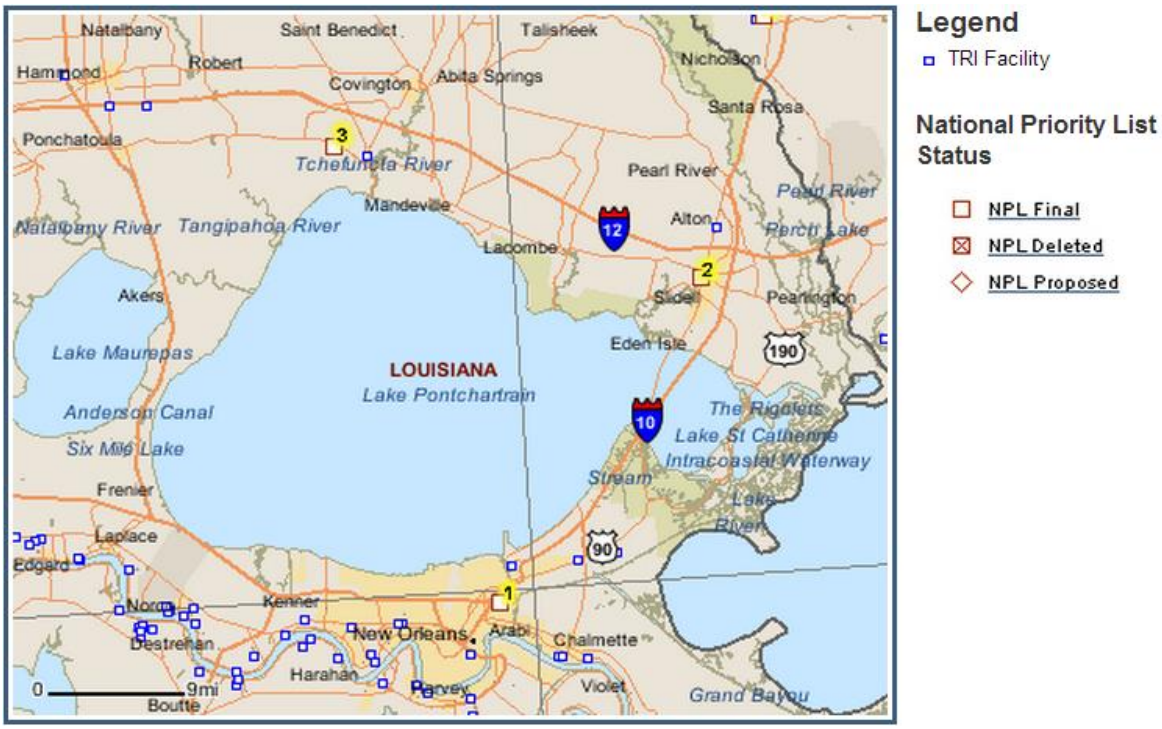


Figure 3: TRI facilities and Superfund Sites located in the parishes around Lake Pontchartrain. Adapted from TOXMAP, environmental health e-maps, http://toxmap.nlm.nih.gov/toxmap/main/index.jsp

[2] TRI facilities and Superfund site information obtained per US zip code from the EPA TRI Explorer website, viewed April 2013, http://iaspub.epa.gov/triexplorer/tri_factsheet_search.searchfactsheet.

[3] LDEQ, Brownfield and Voluntary Remediation Program, retrieved March 2013, http://www.deq.louisiana.gov/portal/PROGRAMS/BrownfieldsandVoluntaryRemediationProgram.aspx.

[4] http://www.epa.gov/brownfields/basic_info.htm

(n=50) associated with this study are located south of Lake Pontchartrain. Additionally, this coastal region was also impacted by the Deepwater Horizon/BP Oil Spill on April 20, 2010.

While free information is available to the public regarding each of these hazardous sites from multiple sources, it is only a powerful public tool when citizens take heed of the data and apply the information to their daily actions and choices. Individuals in this region live with chronic pollution from these facilities because each releases substances that cumulatively deteriorate the air, water, and soil quality, and, thus, produces a negative impact on their health. See Section 1.2 for a thorough study of the air quality regulations, monitoring, and reporting guidelines. In this study, southeast Louisiana respondent's usage of daily reported air quality data and resulting behavior modifications are viewed as resilient behaviors and provide insights into how the public, in similar locations, will utilize other freely available chronic hazard information such as poor soil quality, water quality, and high food chemical contamination levels (i.e. mercury). The rationale behind using this region's household emergency plan adoption is that this region has historically experienced multiple environmental (i.e. toxic substance releases) and natural hazards (i.e. hurricanes and floods) where prior emergency planning results in municipalities and citizens that are more agile in their adjustment after the disturbance. Of note, since 2002 in Louisiana there have been 7 hurricane landfalls[5]: Lili (2002), Katrina and Rita (2005), Humberto (2007), Gustav and Ike (2008), and Isaac (2012), and these hurricanes have caused major storm surges and flooding throughout the region. Figure 4 below (Li, 2013) shows the zip code level natural hazard exposure of the state of Louisiana over the ten year period of 2000 to 2010. The following types of natural hazard events were included in the analysis: hurricane/tropical storm, severe storm/thunderstorm, coastal (flooding and storm surge), tornado,

[5] NOAA Hurricane Research Division, Chronological List of All Hurricanes: 1851 – 2012, viewed May 31, 2013, http://www.aoml.noaa.gov/hrd/hurdat/All_U.S._Hurricanes.html.

and flooding. As you can see, the area south of Lake Pontchartrain has had more natural hazard exposure over this time-frame. As shown in Figure 4, as an indirect result of geography residents living below the southern shores of Lake Pontchartrain are exposed to more natural hazards.

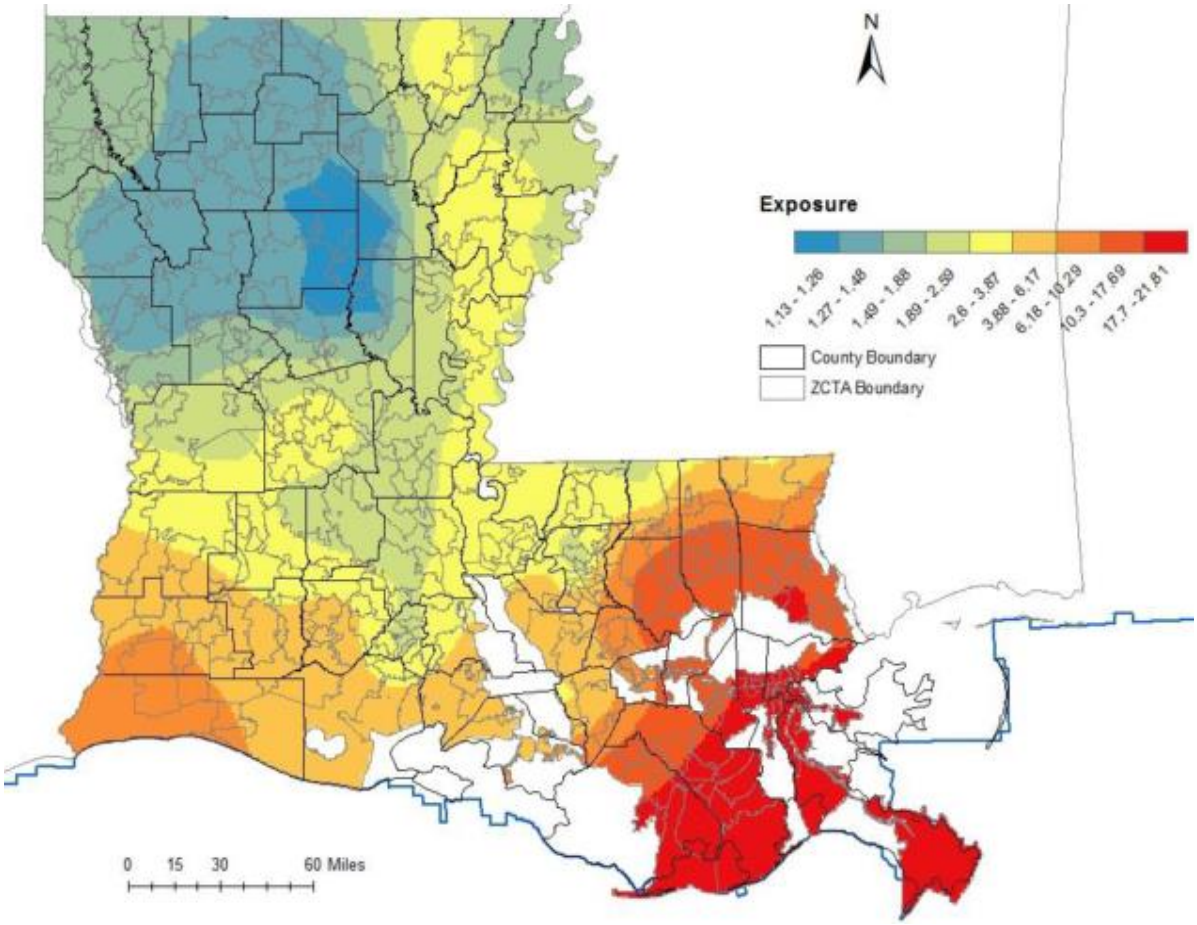


Figure 4: Natural hazard exposure at the zip code level. Adapted from Li (2013).

1.2 Research Objectives

The intent of this study is to enhance the body of research at the micro-level with regards to the influences on individual or household-level resilience. Two main risk-reducing behaviors are the focus of this study: 1) the adoption of household emergency plans and 2) residents who alter their behavior to avoid poor air quality. In this study, individuals or households who adopt these two risk-reducing behaviors are seen as more resilient. Ultimately, we are attempting to identify which variables among a resident's exposure, socio-economic vulnerability and adaptive

capacity are the best indicators of a resident that will adopt these behaviors. Research that provides relevant exposure, vulnerability, and adaptive capacity analysis is pertinent to facilitating the development of plans and policies that will be future-focused on preparing for, mitigating, avoiding, and responding to these types of environmental hazards.

During the course of this research the following will be completed: 1) application of the theoretical framework tested by Reams et al. (2013) in a previous pilot study of Baton Rouge, Louisiana residents that considers resilience as a function of three factors: Resilience = *f*(exposure, vulnerability, adaptive capacity), 2) compilation of data from a large (n = 536) randomized telephone survey of coastal Louisiana residents to create a baseline of household and community level resiliency data for future research 3) use of correlation analysis to determine if relationships exist between selected independent variables (risk-reducing behaviors) and the dependent variables, and 4) use of binary regression analysis to establish the relative influence of independent variables found to be associated with the risk-reducing behaviors. By completing these objectives the following research hypothesis will be tested:

*Exposure and Geographical Regions:* As previously discussed, as an indirect result of the Louisiana coastal geography there are variations in the quantity and types of environmental hazard exposures across the study area. With higher levels of environmental hazard exposure both chronic and acute impacting residents who live below or southward of Lake Pontchartrain, specifically Orleans Parish, for our study, and less environmental hazard impacts both chronic and acute impacting residents who live northward of Lake Pontchartrain, St. Tammany parish for our study. This variation in environmental hazard exposure may manifest as differences among the two geographical regions ranking across the three influencing factor groups of exposure, socio-economic vulnerability and adaptive capacity.

**H1**: There are differences in our study area trending in a north - south direction, with the southern region more likely to have higher adoption patterns of risk-reducing behaviors.

*Socio-economic vulnerability*: Magnan (2010) states and labels as a false, yet generally accepted idea, that, "it is generally maintained that a low level of development systematically induces a low level of adaptive capacity."

**H2**: A decrease in a socio-economic variable will not be a significant predictor or have a strong relationship with decreases in risk-reducing behaviors.

*Adaptive Capacity*: The findings of Reams et al., 2013, suggest that "residents who believed that they are well-informed about risk-reducing strategies, regardless of education or income, were found to be more likely to have adopted these measures [adoption of an emergency plan and behavior modification to poor air quality reporting]." In addition, recent research states there is a need for more detailed understanding of household-level perceptions of environmental and natural hazards, because, historically, personal action or household-level mitigation behaviors are slow even in high risk zones unless the community has recently experienced a hazard event (Harvatt, Petts, & Chilvers, 2011).

**H3**: An increase in an adaptive capacity variables will be a significant predictor variable and have a strong relationship with increases in risk-reducing behaviors.

## 1.3 Air Quality Information, Monitoring, and Reporting

> It is ironic to think that man might determine his own future by something so seemingly trivial as the choice of an insect spray.
> — Rachel Carson, Silent Spring

> How it is we have so much information, but know so little?
> — Noam Chomsky

This section will discuss in more detail the regulations that manage and require reporting on our nation's air quality and standards that have been established regarding emergency plan development.

The EPA's Greenhouse Gas (GHG) Emission and Sinks Glossary[6], defines air pollution as:

> One or more chemicals or substances in high enough concentrations in the air to harm humans, other animals, vegetation, or materials; such chemicals or physical conditions (such as excess heat or noise) are called air pollutants.

The chemicals and substances described in the EPA's air pollution definition do occur naturally via events such as fires and volcanic eruptions. However, most air pollution is caused by anthropogenic factors, or by human activity, and its generation of greenhouse gases and particulate matter. According to the Inventory of U.S. Greenhouse Gas Emissions and Sinks[7] (see Figure 5 below), which tracks the national trend in GHG emissions and removals back to 1990, the largest percentage of GHG emissions is carbon dioxide at 84% then methane (9%), nitrous oxide (5%), and fluorinated gas (2%). As shown in Figure 5, the major sources of GHG emissions are: electric generation (33%), transportation (28%), industry (20%), commercial and residential (11%), and agriculture (8%). Another way to categorize the sources of GHG emissions are as stationary sources such as electricity generation plants or mobile sources such as vehicles, ships, aircraft, or other motorized devices. In the United States, the largest contribution to GHG emissions is the burning of fossil fuels to 1) generate electricity (70% of electricity is generated by burning mostly coal and natural gas) and 2) provide transportation (90% of fuel used is petroleum based).

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[6]EPA Terminology Services, viewed May 2013, http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do.

[7] EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks annual report published online April 2013, viewed May 2013, http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html.

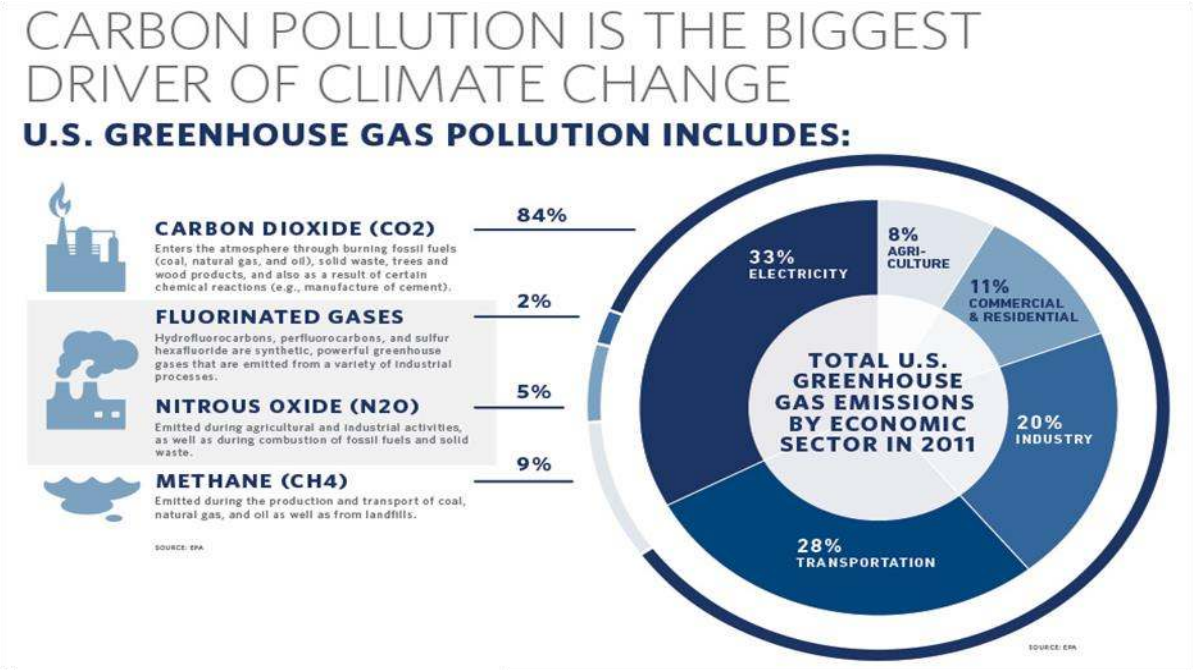


Figure 5: Sources of carbon pollution graphic. Adapted from EPA, www.whitehouse.gov/share/climate-action-plan.

A summary is provided below of other important actions in air quality monitoring and policy that U.S. citizens should be aware of because it affects their air pollution exposure, health, and welfare:

- Cross-State Air Pollution Rule (CSAPR): a federal rule to make the separate state-by-state regulations of air quality more cohesive for the shared air resource and to regulate how much air pollution states would be required to clean-up to avoid violations in downwind states. This ruling was finalized in June 2011, but the United States Court of Appeals overturned the CSAPR in August 2012 in a 2 to 1 ruling. The U.S. Court of Appeals stated that the EPA "overstepped" its legal authority and issued standards that were too strict[8].
- Mercury and Air Toxic Standards (MATS): first-ever federal standards that require power plants to limit their emissions of toxic air pollutants like mercury, arsenic and metals were

[8] Wald, Matthew L., "Court Blocks E.P.A. Rule on Cross-state Pollution." The New York Times, published August 21, 2012, http://www.nytimes.com/2012/08/22/science/earth/appeals-court-strikes-down-epa-rule-on-cross-state-pollution.html?smid=pl-share.

finalized in December 2011. The EPA anticipates the new rules will avert an estimated 11,000 premature deaths, 4,700 heart attacks, and 130,000 asthma attacks every year. The financial benefits that all U.S. citizens will receive per $1 of cost spent in implementing the new rule are valued at $3 to $9 and the EPA estimates that up to 540,000 "sick" days, or missed work days, will be avoided each year[9].

- Massachusetts v. Environmental Protection Agency (EPA): The EPA originally denied a petition from private organizations requesting that the EPA issue rules to begin regulating four greenhouse gases, including carbon dioxide, emitted from new motor vehicles by stating they did not have authority under the Clean Air Act. On April 2, 2007, the U.S. Supreme Court ruled that the EPA can regulate greenhouse gases, such as carbon dioxide, as "air pollutants" under the Clean Air Act and the court held that EPA must determine whether or not emissions of greenhouse gases from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision[10].
- EPA's Endangerment Finding: in response to the April 2007 Massachusetts v. EPA Supreme Court decision the EPA's Administrator issued two findings that were final on December 7, 2009. These two findings regarding regulation of greenhouse gases under the section 202(a) of the Clean Air Act are provided here, in their entirety, per the EPA's Frequently Asked Questions document[11]:

[9]EPA Mercury & Air Toxics Standards, viewed May 2013, http://www.epa.gov/airquality/powerplanttoxics/health.html.

[10] The United States Department of Justice, Massachusetts v. Environmental Protection Agency, 549 U.S. 497 (2007), viewed May 2013, http://www.justice.gov/enrd/3589.htm.

[11] EPA Climate Change, Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, retrieved May 2013, http://www.epa.gov/climatechange/Downloads/endangerment/EndangermentFinding_FAQs.pdf.

1) The "Endangerment Finding," in which the Administrator finds that the mix of atmospheric concentrations of six key, well-mixed greenhouse gases threatens both the public health and the public welfare of current and future generations. These six greenhouse gases are: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). These greenhouse gases in the atmosphere constitute the "air pollution" that threatens both public health and welfare.

2) The "Cause or Contribute Finding," in which the Administrator finds that the combined greenhouse gas emissions from new motor vehicles and motor vehicle engines contribute to the atmospheric concentrations of these key GHG and hence to the threat of climate change.

- Renewable Fuel Standard (RFS): established by the Energy Policy Act (EPAct) of 2005, and became the first renewable fuel volume mandate in the United States. The RFS, under the Energy Independence and Security Act (EISA) of 2007, was expanded to include a requirement for the EPA to apply lifecycle GHG performance threshold standards to ensure that each category of renewable fuel emits fewer GHG than the petroleum fuel it replaces[12].

As set forth in the CAA, the National Ambient Air Quality Standards (NAAQS) require the EPA to establish federal standards on air pollutants, also known as criteria pollutants, for pollutants considered harmful to the public's health and welfare. Under the CAA, the EPA defined six criteria pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution (i.e. $PM_{2.5}$ and $PM_{10}$), and sulfur dioxide. These NAAQS have two standards: "*primary standards* that provide public health protection, including protecting the health of "sensitive"

[12] EPA Transportation and Air Quality, viewed May 2013, http://www.epa.gov/otaq/fuels/renewablefuels/.

populations such as asthmatics, children, and the elderly, and *secondary standards* that provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings[13]".

Building upon the momentum of the Massachusetts v. EPA ruling and the published EPA Endangerment Findings, the EPA and the National Highway Traffic and Safety Administration (NHTSA) have created an aggressive program to target and reduce transportation emissions, the largest source of GHG emissions, in three phases based on the model year of the vehicle:

- Model year 2012 – 2016[14]: raised average fuel efficiency for light-duty vehicles to 35.5 miles per gallon by model year 2016.
- Model year 2014 – 2018[15]: carbon dioxide emissions reduction by approximately 270 million metric tons for heavy-duty vehicles and buses.
- Model year 2017 – 2025[16]: extension of the light-duty vehicle GHG Nation Program for model years 2017 to 2025 to increase fuel economy standards to 54.5mpg by 2025.

The cumulative emissions in your area, thus the air quality, are monitored under the CAA regulations for State Implementation Plan (SIP) and areas may be designated as Attainment or Non-attainment Areas. Under Section 110(a)(2)(B) of the CAA, each SIP must provide for the ambient air quality monitoring and reporting in a data system[17]. To meet this requirement and the Code of Federal Regulations (CFR), Title 40, Part 58, the Louisiana Department of

[13] EPA Air and Radiation, NAAQS, viewed May 2013, http://epa.gov/air/criteria.html.

[14]National Highway Traffic and Safety Administration, "Consumer Savings Comparable to lowering price of gasoline by $1 per gallon by 2025," viewed May 2013, http://www.nhtsa.gov/About+NHTSA/Press+Releases/2012/Obama+Administration+Finalizes+Historic+54.5+mpg+Fuel+Efficiency+Standards.

[15] EPA Transportation and Air Quality, viewed May 2013, http://www.epa.gov/otaq/climate/regs-heavy-duty.html.

[16]Schario, Tracy, The Pew Charitable Trusts, Environmental Initiatives, "Driving to 54.5 mpg by 2025," viewed May 2013, http://www.pewenvironment.org/news-room/data-visualizations/infographic-driving-to-545-mpg-by-2025-85899431047.

[17] EPA Infrastructure SIP Element Reports, viewed May 2013, http://www.epa.gov/air/urbanair/sipstatus/infrastructure.html.

Environmental Quality's (LDEQ) Air Field Services section is responsible for operating and providing publicly available air quality data from the following monitoring stations: State and local Ambient Monitoring Stations (SLAMS), Photochemical Assessment Monitoring Stations (PAMS), Special Purpose Monitoring Stations (SPMS), and National Core Network (NCore) Ambient Air Monitoring Stations[18]. As you can see in the Ambient Air Monitoring Stations map below (Figure 6), the stations are concentrated in two regions: 1) the industrial corridor that runs from the New Orleans metropolitan area northwest to the Baton Rouge metropolitan area and 2) in the western part of the state around the industrial complexes surrounding Lake Charles. LDEQ publishes the air quality data online under the title 'Ozone and $PM_{2.5}$ Air Quality Index (AQI) Forecast' and may be found at this link: http://airquality.deq.louisiana.gov/. Currently Louisiana is in attainment for all six criteria pollutants except ground-level ozone in the parishes of Ascension, East Baton Rouge, Iberville, Livingston, and West Baton Rouge (marginal)[19]. However, in a Tuesday, March 19, 2013 press release from the Louisiana Department of Environmental Quality (LDEQ), the public was asked to provide input (via this online survey: http://www.surveymonkey.com/s/cleanairforlouisiana) on methods to reduce ozone formation and maintain attainment with NAAQS. The LDEQ was motivated by the fact that the New Orleans metropolitan area is "very close to becoming nonattainment and has joined the Environmental Protection Agency's Ozone Advance Program to take measures to reduce ozone.[20]"

[18] LDEQ Office of Environmental Compliance and Assessment, "2012 Louisiana Annual Network Assessment," published June 1, 2012 and retrieved May 2013, www.deq.louisiana.gov/portal/Portals/0/AirQualityAssessment/Analysis/LANA%202012%20final.pdf.

[19] LDEQ Ambient Air Monitoring Operations, viewed May 2013, www.deq.louisiana.gov/portal/DIVISIONS/Assessment/AirFieldServices/AmbientAirMonitoringProgram.aspx.

[20] LDEQ, "DEQ and Regional Planning Commission seeking input on ozone reduction strategies," retrieved May 2013, http://www.deq.louisiana.gov/portal/portals/0/news/pdf/OzoneAdvancePRNOLA.pdf.

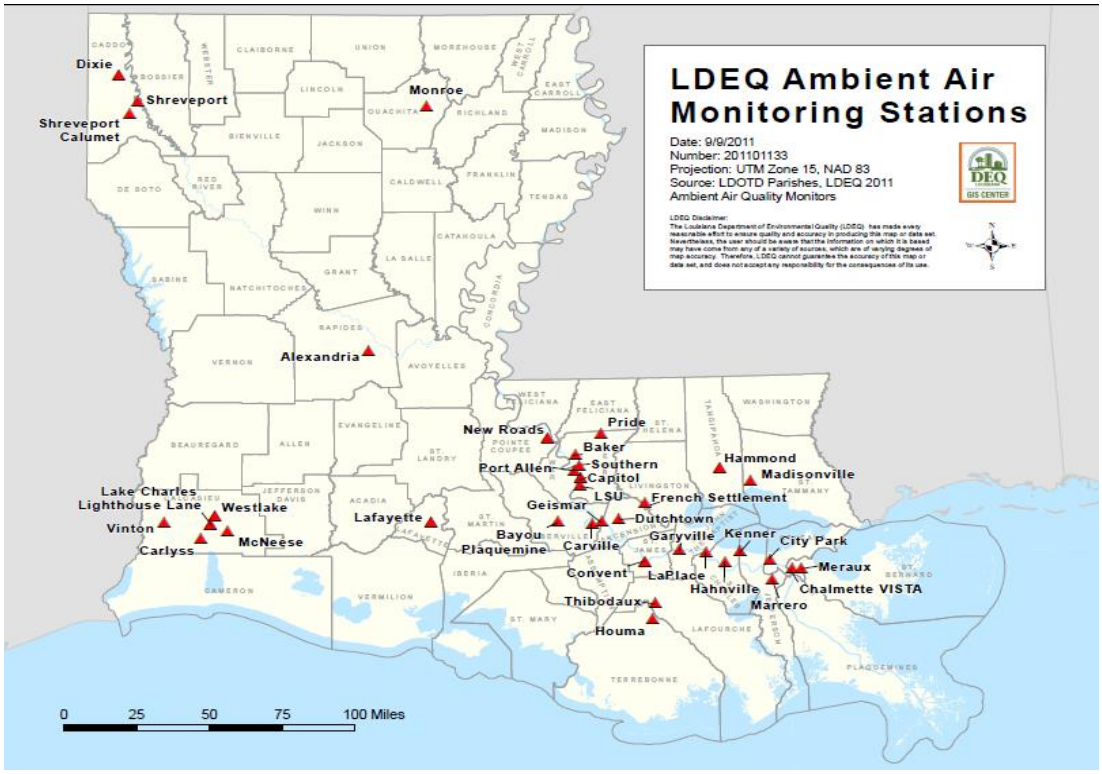


Figure 6: Ambient Air Monitoring Stations. Adapted from LDEQ.

The New Orleans metropolitan area is comprised of regions within the following parishes: Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. John, and St. Tammany. The LDEQ noted that residents may help to control the amount of ozone created by reducing both "road and non-road emissions." The LDEQ stated that non-road emissions in the New Orleans metropolitan area are comprised of 35 percent nitrous oxide emissions and 25 percent volatile organic compound emissions. Some of the sources of these types of non-road emissions, and thus areas for control and reduction, include lawn and garden equipment, four wheelers, boats and other off road vehicles. There has also been discussion at the federal level of making the ozone attainment numbers even more stringent by dropping the acceptable ppb line down to as low as 55, according to DEQ Senior Scientist Mike Vince[21]. This change, slated to be voted on later in 2013, would mean the entirety of the state could possibly fall into nonattainment.

[21] McGaughy, Lauren, "New Orleans ozone pollution requires public response, DEQ says," The Times-Picayune, viewed May 2013, http://www.nola.com/environment/index.ssf/2013/03/new_orleans_ozone_pollution_re.html.

Residents may access the daily Air Quality Index using various methods ranging from internet, phone, email subscription, to mobile phone application. With regards to the daily Air Quality Index, it was divided, by the EPA, into six categories that each correspond to a specific level of health concern (see Figure 7). To facilitate quick understanding of the index each level has been color-coded ranging from 'Maroon' for worst to 'Green' for best. On poor air quality days the EPA suggests the best action to take is to reduce exposure by reducing prolonged or heavy exertion outdoors. See Table 1 (at the end of Chapter 1) for a complete listing of environmentally focused websites and applications ranging from corporation support of innovative climate change policy to household emergency plans and each are publicly and freely available.

| Air Quality Index Levels of Health Concern | Numerical Value | Meaning |
|---|---|---|
| Good | 0 to 50 | Air quality is considered satisfactory, and air pollution poses little or no risk |
| Moderate | 51 to 100 | Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution. |
| Unhealthy for Sensitive Groups | 101 to 150 | Members of sensitive groups may experience health effects. The general public is not likely to be affected. |
| Unhealthy | 151 to 200 | Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. |
| Very Unhealthy | 201 to 300 | Health warnings of emergency conditions. The entire population is more likely to be affected. |
| Hazardous | 301 to 500 | Health alert: everyone may experience more serious health effects |

| Air Quality Index (AQI) Values | Levels of Health Concern | Colors |
|---|---|---|
| *When the AQI is in this range:* | *..air quality conditions are:* | *...as symbolized by this color:* |
| 0-50 | Good | Green |
| 51-100 | Moderate | Yellow |
| 101-150 | Unhealthy for Sensitive Groups | Orange |
| 151 to 200 | Unhealthy | Red |
| 201 to 300 | Very Unhealthy | Purple |
| 301 to 500 | Hazardous | Maroon |

Figure 7: EPA's Air Quality Index six levels of health concern. Adapted from www.airnow.gov.

Environmental quality reporting of this type is a successful development that originated from the passage, in 1986, of the Emergency Planning and Community Right-to-Know Act (EPCRA). The EPCRA requirements also established the following reporting requirements for industries and made the collected data publicly available "so that any citizen may become informed about potentially dangerous chemicals in their community[22]": Emergency planning notification (EPCRA §302), Emergency release notification (EPCRA §304), Hazardous chemical inventory reporting (EPCRA §§311/312), and the Toxics Release Inventory (TRI) reporting (EPCRA §313).

The EPA describes the passage of EPCRA, as "providing an infrastructure at the state and local levels to plan for chemical emergencies," and "[under] EPCRA chemical reporting requirements, facilities must report the storage, use, and release of certain hazardous chemicals.[23]" However, between April and July 2013, there have been three major industrial plant explosions in the states of Louisiana and Texas. Each explosion is summarized below:

- April 17, 2013:
  Company: West Fertilizer Company, a fertilizer blending facility in West, Texas;
  Hazardous Material: reported up to 270 tons of ammonium nitrate on site; 30 tons are estimated to have initiated the plant explosion;
  Fatalities and injuries: 14 fatalities: 12 emergency response personnel and 2 West, TX residents and over 200 injuries of residents in the surrounding area[24].

- June 13, 2013:
  Company: Williams Partners, an olefins chemical facility in Geismer, LA;
  Hazardous Material: 31,000 lbs of toxic chemicals released; plant produces ethylene and propylene;
  Fatalities and injuries: 2 fatalities and over 105 injuries of plant employees[25].

[22] EPA Emergency Management, viewed May 2013, http://www.epa.gov/oem/content/epcra/.

[23] EPA Emergency Management, viewed May 2013, http://www.epa.gov/oem/content/epcra/.

[24] Chemical Safety Board, Testimony of Rafael Moure-Eraso, Ph.D., Chairperson, U.S. Chemical Safety Board before the U.S. Senate Committee on Environment and Public Works on June 27, 2013, retrieved July 10, 2013, http://www.csb.gov/assets/1/19/CSB_Written_Senate_Testimony_6.27.13.pdf.

- June 14, 2013:
  Company: CF Industries, a nitrogen complex in Donaldsonville, LA;
  Hazardous Material: capable of producing and shipping approximately 5 million tons of nitrogen for agricultural and industrial uses each year[26]; also one of the suppliers to West Fertilizer Company;
  Fatalities and injuries: 1employee fatality and 5 injuries of plant employees[27].

The Chemical Safety Board (CSB) is investigating both the West and Williams Partners plant explosions and has presented findings before the US Senate Committee on Environment and Public Works. The CSB reported, with regards to the EPCRA, that while West Fertilizer Company had reported approximately 270 tons of ammonium nitrate as on site to the Local Emergency Planning Committee (LPEC), a committee required by the EPCRA, that afterwards there was no documented community emergency plan developed for an ammonium nitrate explosion by the LPEC or the local volunteer fire department. The CSB also points out that while the EPCRA requires the creation of a LPEC the law does not provide for funding of this committee nor does the LPEC have any regulatory authority over chemical facilities. Lack of funding and adequate resources is not isolated to the LPEC, CSB's report highlights that specifically the CSB is overtaxed with its current investigations and, if any future hazardous incidents were to happen, it lacks adequate resources for future investigations. Similarly, the CSB report documents that in the past the EPA has lacked adequate resources to effectively enforce environmental hazard programs, like its Risk Management Program (RMP). The RMP is designed to prevent catastrophic offsite and environmental damage from extremely hazardous substances. Funding or the lack of funding and having adequate resources is a major hurdle to

[25] ibid.

[26] CFIndustries, Plants, Donaldsonville, Louisiana Nitrogen Complex, viewed July 9, 2013, .

[27] Mitchell, David J. and Stewart, Robert, "Rupture at Donaldsonville plant kills one, injures seven," The Advocate, viewed July 10, 2013, http://theadvocate.com/home/6255031-125/second-plant-explosion-reported-in.

overcome for any organization, group, or agency that has as its mission to pursue scientific, environmentally sound and safe practices. These plant explosions and the examples of agency-wide lack of funding and resources should serve as a call to arms for each of us to become more active in determining our own well being and to not expect or assume that someone else: our neighbor, city leader, congressman, or a governmental agency will take, or have the adequate resources, to be fully responsible for complete community-wide awareness and reporting of the hazards, and enforcement of standards in our communities.

### 1.3.1 Household Emergency Plans

Prepared families and households are paramount when environmental and natural emergency hazard events can occur at anytime of the day and at any location. The American Red Cross lists these first steps as the '*Be Red Cross Ready Checklist*' for families to take to be as prepared as possible for any potential disasters and other emergencies: 1) know what emergencies or disasters are most likely to occur in my community; 2) have a family disaster plan and have practiced it; 3) have an emergency preparedness kit; 4) at least one member of my household is trained in first aid and CPR/AED; 5) have taken action to help my community prepare[28].

The New Orleans Office of Homeland Security website[29] provides thorough and detailed information for citizens to prepare for emergencies. They stress that building a more resilient city can be accomplished by neighbors helping neighbors from the preparation stage of shared development of emergency preparedness to helping neighbors during a disaster event. Additionally, they promote Citizen Corp, FEMA's grassroots strategy to bring together

[28] American Red Cross, Prepare Your Home and Family, viewed July 11, 2013, http://www.redcross.org/prepare/location/home-family.

[29] New Orleans Office of Homeland Security and Emergency Preparedness viewed July 20, 2013, http://www.nola.gov/homeland-security/.

government and community leaders to involve citizens in all-hazards emergency preparedness and resilience. Their household emergency plan that is specific to hurricane preparedness lists these steps to take:

1. **Designate an out-of-town contact;** household members can call if separated during an emergency. Ensure all family members memorize it.
2. **Choose a pre-determined place to reunite** if separated during an emergency. Have one near home and one outside your neighborhood. Your predetermined contact will help you decide and communicate which is best.
3. **Stock Up.** Disasters can strike at any time and in many forms which do not require citizens to evacuate, but do require them to be ready to be stuck inside, without power or running water, or access to groceries. Gather Supplies for what you'll need to weather events from boil advisories to chemical spills to Category 1 or 2 hurricanes.
4. **Practice alternate routes out.** In a disaster roads may be blocked, buses and city transportation shut down or re-routed, or streets be impassable. Each family member should know all possible exit routes from home and neighborhood.
5. **Know how you will evacuate** in the case of a man-made or natural disaster, whether it be through contraflow in your own car, or locating the closest evacuspot, where you can get transportation assistance out of town.
6. **Coordinate your emergency plan** with those of places in your lives, including work, daycare, school, and other families.

Another more generalized family emergency plan may be found on the Baton Rouge Mayor's Office of Homeland Security and Emergency Preparedness and lists the following steps:

- Have a meeting with the members of your household to discuss the possible emergencies that exist and how to respond to each.
- Identify the safe areas in your home for each type of emergency.
- Explain what to do about power outages and personal injuries.
- Draw a floor plan of your home and identify two escape routes from each room.
- Show household members how to turn off the electricity, water, and gas at the main switches when necessary.
- Identify emergency phone numbers and post near telephones.
- Teach your children how and when to call 911.
- Identify one out-of-state and one local contact (relative or friend) for family members to call if separated during an emergency.
- Teach your children the phone numbers for your contacts.
- Identify two emergency meeting places: near your home in case of a fire & outside your neighborhood in case you cannot return home after an emergency.
- Take course for CPR and First Aid.
- Family records should be kept in a water and fireproof container.
- Instruct family members to monitor local radio and television stations for emergency information.

In summary and as additional reference material, Table 1 below list several different types of resiliency building information that Louisiana residents, and residents across the nation, may utilize to prepare for and mitigate against environmental hazards. This list is a good place start. However, there is a plethora of information that is becoming freely published on the web and provides accurate environmental quality, climate change adaptation, and household emergency planning information.

Table 1: List of data freely available online for building and developing resilience.

| Geographical Focus | Information Type / Source | Where to Access & Description |
|---|---|---|
| National | Real-time air quality data<br>EPA | http://m.epa.gov/apps/airnow.html<br>Mobile phone application. |
| National | Real-time air quality data<br>EPA & state air quality agencies | http://www.enviroflash.info/<br>Subscription for air quality data via email or cell phone |
| New Orleans Metropolitan | NAAQS attainment<br>LDEQ | http://www.surveymonkey.com/s/cleanairforlouisiana<br>Public comment on air quality strategies to reduce ozone formation and maintain attainment. |
| National | Real-time water quality data<br>EPA | http://watersgeo.epa.gov/mywaterway/<br>Mobile phone application to learn the condition of local streams, lakes and other waters anywhere in the US. |
| National | Soil survey data<br>UC-Davis & USDA-NRCS | http://casoilresource.lawr.ucdavis.edu/soilweb/<br>SoilWeb app is a portable version of the UC Davis California Soil Resource Lab's Web-based interface to digital soil survey data from USDA's Natural Resources Conservation Service (NRCS). |
| International | City Resilience<br>International Council for Local Governments Initiative | http://www.icleiusa.org/<br>Households should speak-up to influence their local leaders to join the ICLEI-Local Governments for Sustainability. |
| National | Corporation Climate Declaration<br>Businesses for Innovative Climate and Energy Policy | http://www.ceres.org/bicep/climate-declaration<br>Listing of corporations that have declared public support for climate change adaptation and innovative policies. Individuals may also sign the Climate Declaration. |
| National | Vote with your dollars<br>ClimateCounts.org | https://itunes.apple.com/us/app/climatecounts/id342541675?mt=8<br>We analyze companies, and our ranking scale tells you how well the company is addressing climate change. |
| National | Household Emergency Guide<br>American Red Cross | http://www.redcross.org/prepare/location/home-family<br>Family preparation for various emergencies |
| Louisiana | Household Evacuation Plan<br>Governor's Office of Homeland Security & Emergency Preparedness | http://www.getagameplan.org/<br>Mobile phone application that provides critical information and checklists to help you create a personal evacuation plan. |
| Louisiana | LA Emergency Preparedness Guide<br>Governor's Office of Homeland Security & Emergency Preparedness | http://gohsep.la.gov/evacinfo/Emergency_Guide_v38_5_30_3p.pdf<br>Straightforward family emergency planning that provides critical information and checklists specific Louisiana. |
| National | Family Emergency Plan<br>FEMA | http://www.ready.gov/make-a-plan<br>Simple and step-by-step family emergency plan. |

# CHAPTER 2: LITERATURE REVIEW

This project is intended to build upon the findings of Reams, Lam, Cale, and Hinton (2013) in their study of Baton Rouge residents' risk-reducing behaviors. Their Baton Rouge survey design built upon the theoretical framework of resilience (r) as a function of three factors: exposure (e), socio-economic vulnerability (v), and adaptive capacity (ac) and written as r = f(e, v, ac). Their results indicated that residents who believe they are well informed or have adequate information regarding environmental hazards are more likely to adopt mitigating measures for those hazards. Additionally, their findings highlighted that adaptive capacity variables are pertinent to understanding and motivating risk-reducing behaviors. Here, related research is reviewed that further supports these concepts and the use of these concepts in designing the current household survey and analysis.

## 2.1 Factors that Shape Resilience

Recently, multiple U.S. Congressional Committees and The National Academies[30] asserted that building disaster resilience capacity in our communities should be a national imperative (National Academies, 2012) . The IPCC notes that "limits to resilience are faced when thresholds or tipping points associated with social and/or natural systems are exceeded, posing severe challenges for adaptation (IPCC, 2012)." Common challenges or hurdles involved in building more resilient communities include the communities' socioeconomic attributes, fostering membership in a local environmental group, and developing resident's knowledge of risks, perception of risks, and their confidence in the effectiveness of risk-reducing actions.

The academic study of resilience began in 1973 with C.S. Holling's study of ecological systems. In 1973, he defined resilience as "a measure of the persistence of systems and of their

[30] Authors include: Committee on Increasing National Resilience to Hazards and Disasters; Committee on Science, Engineering, and Public Policy (COSEPUP); Policy and Global Affairs (PGA); and The National Academies.

ability to absorb change and disturbance and still maintain the same relationships between populations or state variables (Holling, 1973)." Over time, since Holling's 1973 definition, the study of socio-ecological system resilience has developed and we now understand that several other attitudes are key variables to overall system dynamic. For instance, the IPCC stated in its 2012 Summary for Policy Makers with confidence levels of 'high agreement and robust evidence,' that "integration of local knowledge with additional scientific and technical knowledge can improve disaster risk reduction and climate change adaptation." Other key variables include the capacity of systems to self-organize as a critical source of resilience (Abel, Cumming, & Anderies, 2006) and that prior environmental hazard experience encourages adaptations for future similar risk (Nelson, Adger, & Brown, 2007). In addition, a current resiliency study of the counties along the Gulf of Mexico summarized that higher resilience rankings were documented in counties that tended to have *increased adaptive capacity* through higher rates of voter participation, *decreased vulnerability* through more investment in education, higher per capita incomes, more children and more women in the workforce, and *decreased exposure* due to higher mean land elevation (Reams et. al. 2012). In the Annual Review of Environment and Resources, Nelson et al., (2007) defined resilience as "the amount of change a system can undergo and still retain the same function and structure while maintaining options to develop."

### 2.1.1 Environmental Hazard Exposure and Awareness

After releasing the results of a recent Stanford University national poll, Jon Krosnick, the survey director and senior fellow at the Stanford Woods Institute for the Environment stated that the survey findings highlighted that, "People are least supportive of policies that try to hold back

Mother Nature and they think it makes more sense to recognize risk and reduce exposure[31]." Exposure, in this study, considers the past and present extent of community or household-level impact from natural hazards and / or human-induced hazards such as chemical and toxic spills and poor air, water, or soil quality. Exposure may be reduced by modifying and mitigating behaviors, for example, when environmental hazard information is made publicly available, such as the EPA's Toxic Release Inventory (TRI) or a locally updated air quality index. Understanding the environmental conditions from the global scale to the local scale provides the context or background to frame a resident response, or lack thereof, to reduce their risk exposure. Study of behavior under uncertainty, in the hazards literature, highlights the probability that individuals "systematically underestimate the likelihood of the hazard affecting them, with dire consequences" (Freeman & Kunreuther, 2002).

2.1.2 Should Louisiana Have Concern for Climate Change?

"Carbon pollution ($CO_2$ or air pollution) is the biggest driver of climate change," states the current federal administrations Climate Action Plan (2013). In the past three decades, U.S. asthma rates have doubled and residents will continue to feel these effects if air pollution is not significantly reduced. The World Meteorological Organization reported in July 2013, based on data provided by the Centre for Research on the Epidemiology of Disasters, that from 2001 to 2010, more than 370,000 people died, an increase of 20% of the previous decade, as a result of extreme weather and climate. In 2009, Lam et al. estimated that in the contiguous United States there were approximately "19 million people living within 1 kilometer of the shoreline, whereas, 11.6 million people are living below 3-meter elevation." They also estimated that there were 6.3 million residents who met both criteria: below 3-meter elevation and within 1 km of the

[31] Stanford Woods Institute for the Environment, 2013 Stanford Poll on Climate Adaptation, http://woods.stanford.edu/research/public-opinion-research/2013-Stanford-Poll-Climate-Adaptation.

shoreline. In addition, according to Strauss et al. (2012), flooding to four feet above high tide (approximately 1.22 meters) would reach dry land that currently encompasses almost 3 million acres of roads, bridges, jetties, breakwaters, docks, piers, commercial buildings, military bases, agricultural lands, toxic waste dumps, schools, hospitals, and more across the nations coastal areas.

More focused on our study area, Lam et al. (2009) found that Louisiana was ranked second for the highest percentage of population potentially affected by 3-meters of SLR (Florida rank 1$^{st}$ = 32.5% and Louisiana = 27.6%). Additionally, Louisiana ranks first for land area (13,510 km$^2$) that is less than 1 meter above the local mean high water (Strauss et al. 2012). Regarding housing units (413,900 units) and population (888,679 residents) that are also estimated to be less than 1 meter above the local mean high water, Louisiana ranks second for both categories (Strauss et al. 2012).

If we consider the Master Plan SLR scenarios[32] (Table 2 below) combined with the Strauss et al. (2012) estimates of land, housing, and population potentially impacted by 1 meter of SLR, then considering all four of the plausible ranges the time frame for southern Louisiana residents to either mitigate or relocate is at a maximum of 416.67 years to a minimum of 76.92 years. As discussed in the United States and specifically in southern Louisiana, an individual's concern for climate change and SLR is legitimate and could range from: curbing the production and emission of greenhouse gases (thus reducing air pollution); to property damage resulting from SLR increasing coastal erosion, storm damage, and flooding; to the potential of SLR causing groundwater aquifer contamination due to intruding saltwater; and ultimately, under the least optimistic Master Plan scenario to relocation within the next 77 years.

[32] Master Plan seal level rise scenarios, viewed July 15, 2013, http://www.lacpra.org/assets/docs/2012MP/Appendix_C_Environmental_Scenarios-011912.pdf

Table 2: LA Master Plan scenarios combined with Strauss et al. (2012) population and land data.

| Master Plan SLR: (meters /50 years) | Dividing 1meter SLR by rate / 50 years | Factor Multiplier per 50 years | Combining Master Plan scenarios with ClimateCentral.org data |
|---|---|---|---|
| Plausible low end: 0.12 m / 50 yrs | 1m/0.12m = 8.333 | 8.333*50yrs = 416.67 years | In ***416.67 years***, current estimates of 13,510 $km^2$ of land, 413,900 housing units, and 888,679 residents will be ***below sea level***. |
| Moderate value: 0.27 m / 50 yrs | 1m/0.27m = 3.703 | 3.703*50yrs = 185.19 years | In ***185.19 years***, current estimates of 13,510 $km^2$ of land, 413,900 housing units, and 888,679 residents will be ***below sea level***. |
| Less optimistic: 0.45 m / 50 yrs | 1m/0.45m = 2.222 | 2.222*50yrs = 111.11 years | In ***111.11 years***, current estimates of 13,510 $km^2$ of land, 413,900 housing units, and 888,679 residents will be below sea level. |
| Plausible high end: 0.65 m / 50 yrs | 1m/0.65m = 1.538 | 1.538*50yrs = 76.92 years | In ***76.92 years***, current estimates of 13,510 $km^2$ of land, 413,900 housing units, and 888,679 residents will be ***below sea level***. |

Our study will consider two specific risk-reducing behaviors: altering behavior to poor air quality data and the household adoption of an emergency plan, and a resident's concern for climate change is a potential explanatory factor for both of these dependent variables. Consideration must be given to the broad range of impacts that climate change may have on resident's risk perceptions and potential adaptive capacity.

2.1.3 Adaptation and Adaptive Capacity

Adaptation is the process or the action(s) taken by an individual or household in order to better cope with or adjust to changing condition, stress, hazard, risk or opportunity (Smit & Wandel, 2006). For community and management practices formulating longer term adaptation and resilience strategies to more frequent ecological discontinuities will be unavoidable. Some argue that at the micro-scale adaptation to climate change is related to an individual's access

to resources and information (Phillips, 2003; Adger, N. Arnell, N., Tompkins, 2005). Adaptive capacity can be thought of as the prior risk perceptions and concerns, knowledge level regarding various hazards, and the prior ability to implement a response, or adaptation, to the trigger event that may be a stress, environmental hazard or risk.

Societal adaptations have a dynamic relationship with climate processes and human risk perceptions thus continued research at various scales (micro to macro) is warranted (Combest-Friedman, Christie, & Miles, 2012). At the climate change impact scale on individuals, if residents believe they have adequate risk information and adaptive strategy information to plan and prepare for potential extreme weather events then they are more likely to adopt an emergency plan and maintain a first-aid kit (Semenza, Ploubidis, & George, 2011). Table 3 below is an excellent summary by Langlois (2012) of the Hance et al. (1998) seven variables for understanding the public's risk perceptions. This summary is of the risk communication, Improving Dialogue with Communities: A Risk Communication Manual for Government (1998), a document describing how variations of influential risk perceptions result in different individual adaptations.

Previous scientific studies at the micro-scale or household-level by Wakefield et. al (2001), Reams et. al. (2013), and Wen et al. 2009 present evidence that residents in communities with lower air quality will tend to alter or modify their behavior to reduce risk related to air pollution. Wakefield, et. al (2001) found that residents chose to modify their behavior in various ways including: altered their lifestyle by staying indoors and not hanging laundry outside; changed personal habits such as recycling and use of alternative transit such as bicycling or bus; civic action such as complaints to industry, government or media; group civic action such as attending public meetings and/or protest.

| | |
|---|---|
| Voluntary vs. Involuntary Risks | People view voluntary risks (e.g., health risks due to smoking) as more acceptable than involuntary risks (e.g., industry polluting the air) even if engaging in the voluntary behavior carries a greater risk of harm |
| Familiar vs. Unfamiliar Risks | Familiarity with a risk tends to make it more acceptable than a risk considered exotic or unfamiliar |
| Individually Controlled vs. Controlled by the "System" | People feel safer when they are in control. Risks out of a person's control seem more threatening and therefore less acceptable, regardless of the hazard |
| Certain vs. Uncertain Risks | People are more cautious about uncertain risks and less likely to find them acceptable |
| Fair vs. Unfair Risks | A risk is considered fair if the benefits associated with exposure are going to the same people. |
| Natural vs. Man-made Risks | Acts of nature are more acceptable than ones created by people |
| Morally Irrelevant vs. Morally Objectionable Risks | Risks from exposures or circumstances considered objectionable (or unethical) are considered less acceptable compared to risks that do not have strong moral relevance to the public. |

Table 3: Variables in understanding public's risk perception. Adapted from Langlois (2012).

Reams et al. (2013) found that residents "who believe that they are well informed about risk reducing strategies, regardless of their own level of educational attainment, were found to be more likely adopted one or both measures [limited outdoor activity or adopted household emergency plan]." Another study of 33,888 adults across six U.S. states found that residents demonstrated a strong trend towards behavior modification when the media broadcast poor air quality alerts (Wen, Balluz, & Mokdad, 2009).

2.1.4 Socio-economic Vulnerability

The scientific variable of vulnerability has been used as a method for discussing "states of susceptibility to harm, powerlessness, and marginality of both physical and social systems, and for guiding normative analysis of actions to enhance well-being through reduction of risk" (Adger, 2006). Vulnerability of an individual or household, in this context, is constantly in a

state of flux due to its many links to both the ecological and social states within the system (Leichenko and O'Brien, 2002). While we have separated hazard and vulnerability in this discussion, it is beneficial to point out that a resident is not vulnerable if a resident is not threatened. Thus, vulnerability and hazards are intrinsically linked. Here, when we are discussing a resident's vulnerability we are considering their "potential vulnerability."

Cutter, Boruff, and Shirley (2003) stated that at the most basic level vulnerability to environmental and natural hazards means the potential for loss. The individuals, or household, who are at risk and the degree of harm they may face, are the focus of socio-economic vulnerability study (Cutter & Emrich, 2009). Socio-economic vulnerability is honed in on contributing factors of both demographic and socioeconomic nature that "increase or attenuate the impacts of hazard events on local populations" (Tierney, Lindell, & Perry, 2001). Most often this vulnerability is described using the individual or household demographic characteristics, such as: age, race, health, income, type of dwelling unit, and employment. In addition, Cutter et al. (2003), states that "social vulnerability is influenced by the combination of social inequalities — social factors that influence or shape the susceptibility of various groups to harm and that also govern their ability to respond, and place inequalities —those characteristics of communities and the built environment, such as the level of urbanization, growth rates, and economic vitality, that contribute to the social vulnerability of places."

In summary, the related research has established that individual or household resilience may include: exposure variables, socioeconomic and demographic attributes, and adaptive capacity variables ranging from knowledge of and access to more hazard and risk related information, individual perceptions and confidence in risk-reducing behaviors and governmental agencies to communities where hazard information is shared among more individuals.

# CHAPTER 3: STUDY AREA AND DATA SUMMARY

## 3.1 Study Area and Data Summary

As previously mentioned this survey was intended to build upon the findings of the Reams et al. (2013) pilot study of Baton Rouge by increasing the sample size and sampling region. A total of 553 surveys were documented from this enlarged survey sampling region focused on St. Tammany Parish and Orleans Parish (Figure 8[33]). A total of 50 questions were asked with 27 questions related to perceptions of various environmental hazards and 13 questions relating to socio-demographic data. Based on a zip code review a total of 5 responses were removed from the results due to invalid zip code entries and 12 responses were removed due to their location being outside the intended geographical focus of the study.

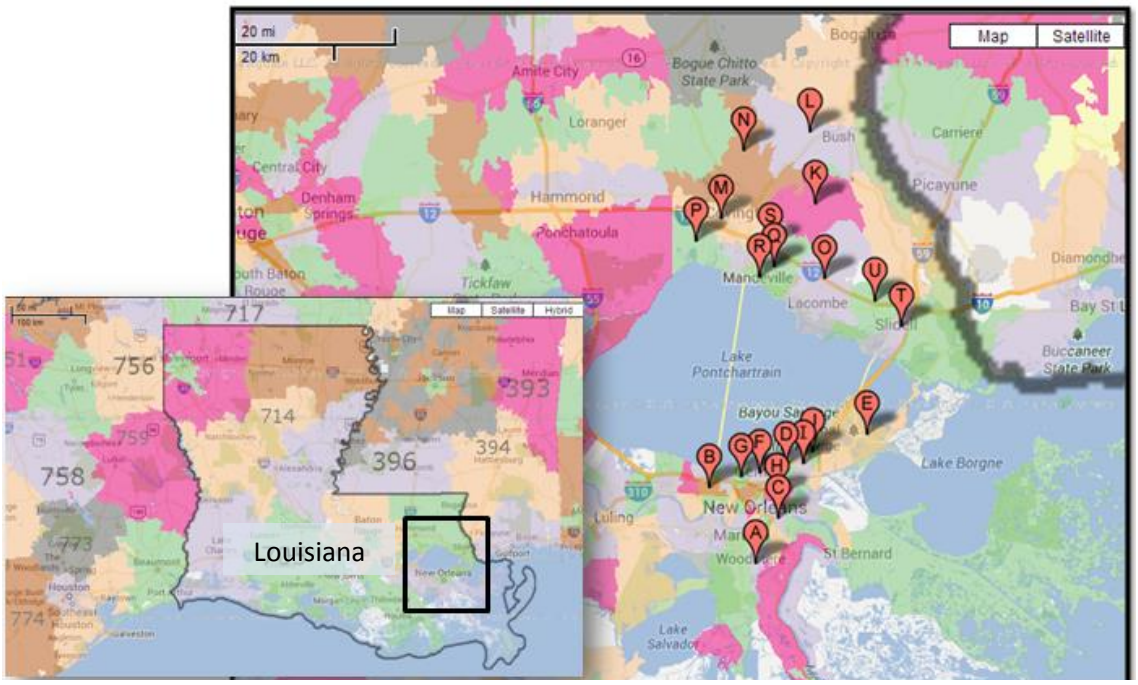


Figure 8: Study area with zip-code detail.

[33] Figure 8 Note: This figure is adapted from USNaviguide LLC and displays a Google Map with an overlay of Louisiana zip codes. The black rectangle over the state of Louisiana indicates study focus area that has been enlarged. Lettered balloons indicate general zip code regions that have been included in this study. See Table 4 for a description of each lettered balloon.

Cell phones were included in the survey and this factor may have allowed for the responses that were outside of the intended focus area. This reduced the dataset to a total of 536 responses distributed over a total of 21 zip codes within 3 southeast Louisiana parishes. The list of survey questions is included in Appendix A. As shown in Table 4 below, the zip code responses were grouped into two geographical regions the 'north' and the 'south'. This breakdown highlights, based on US 2000 and 2010 census data, the mass exodus that occurred in the southern region, Orleans Parish, after Hurricane Katrina, and that the population of the northern region, St. Tammany Parish, increased. In addition, the Madisonville area (zip code, 70447) grew significantly by 61%. It also documents the number of responses per zip code.

Table 4: Study area summary of zip codes, parishes, & US census data.

| Map ID | USPS Zip Code | Survey Response | Associated City / Neighborhood | Parish | Study Region | 2000 Census Population | 2010 Census Population | % Change (+/-) |
|---|---|---|---|---|---|---|---|---|
| A | 70058 | 1 | Harvey | Jefferson | South | 42582 | 39887 | -6% |
| B | 70001 | 1 | Metairie | Jefferson | South | 39774 | 37996 | -4% |
| C | 70114 | 16 | Algiers | Orleans | South | 28385 | 22870 | -19% |
| D | 70126 | 42 | Chef Menteur | Orleans | South | 40677 | 23958 | -41% |
| E | 70129 | 13 | East New Orleans | Orleans | South | 14963 | 9064 | -39% |
| F | 70122 | 56 | Gentilly | Orleans | South | 46533 | 28564 | -39% |
| G | 70124 | 29 | Lakeview | Orleans | South | 22951 | 16824 | -27% |
| H | 70117 | 20 | Lower Ninth Ward | Orleans | South | 51252 | 23389 | -54% |
| I | 70127 | 45 | New Orleans | Orleans | South | 31635 | 20471 | -35% |
| J | 70128 | 56 | New Orleans | Orleans | South | 20556 | 17113 | -17% |
| K | 70420 | 4 | Abita Springs | St. Tammany | North | 5143 | 7345 | +30% |
| L | 70431 | 4 | Bush | St. Tammany | North | 4625 | 5366 | +14% |
| M | 70433 | 89 | Covington | St. Tammany | North | 23824 | 31133 | +23% |
| N | 70435 | 41 | Covington | St. Tammany | North | 10763 | 16603 | +35% |
| O | 70445 | 3 | Lacombe | St. Tammany | North | 9165 | 10840 | +15% |
| P | 70447 | 5 | Madisonville | St. Tammany | North | 3916 | 10150 | +61% |
| Q | 70448 | 60 | Mandeville | St. Tammany | North | 19975 | 24851 | +20% |
| R | 70470 | 1 | Mandeville | St. Tammany | North | n/a | n/a | n/a |
| S | 70471 | 48 | Mandeville | St. Tammany | North | 19950 | 21383 | +7% |
| T | 70458 | 1 | Slidell | St. Tammany | North | 32837 | 35077 | +6% |
| U | 70460 | 1 | Slidell | St. Tammany | North | 20107 | 22096 | +9% |
| | Total | 536 | | | | | | |

As shown in Table 5 below, the demographic profile of the survey sample was representative of the US 2010 Census population statistics for the state of Louisiana, with respect to race (white: Census 59.9%, survey 54.3%; black: Census 32.4%, survey 37.7%), employment (in labor force: Census 61.7%, survey 58.0%; not in force: Census 38.3%, survey 40.5%) and home ownership. Due to the phone surveys reflecting populations that are more likely to be home during the day, our results showed a sampling bias towards gender, age, and educational attainment.

Table 5: Study sample compared to 2010 US Census for Louisiana.

| Demographic | Study Sample N = 536 | Louisiana Sample |
|---|---|---|
| Gender (female) | 64.4% | 51.1% |
| Age | | |
| Younger than 50 | 33.5% | 41.0% |
| 51 or older | 61.5% | 31.4% |
| Race/Ethnicity | | |
| White | 54.3% | 59.9% |
| Black or African American | 37.7% | 32.4% |
| Other | 5.0% | 7.0% |
| Educational attainment | | |
| High School Graduate | 16.0% | 34.6% |
| Bachelors | 25.4% | 14.2% |
| Graduate or professional degree | 16.8% | 7.0% |
| Employment | | |
| In labor force | 58.0% | 61.7% |
| Not in labor force | 40.5% | 38.3% |
| Own Home | 76.5% | 67.9% |

3.2 Additional Study Area Variables

TRI information, both the number of facilities and total releases (lbs), and Superfund site information was obtained per US zip code from the Environmental Protection Agency's TRI

Explorer website[34]. The Brownfield's data was downloaded from the Louisiana Department of Environmental Quality (LDEQ) website.

The EPA's 'My Health for My Environment' website provides the 2005 National Scale Air Toxics Assessment that was released in 2011. The EPA utilizes this assessment to provide a ranking of cancer risk by zip code. This information was incorporated into our study at the zip code level under the variable, *EPA_Cancer*. The EPA defines their ranking as follows:

> **Cancer Risk**: Toxic air pollutants, or air toxics, are those pollutants known or suspected of causing cancer or other serious health problems, such as birth defects. Cancer risk is expressed as a number in a million, e.g., 16 in a million chance of getting cancer due to air pollution. Not all air pollutants are considered. Our data set also incorporated the final Louisiana zip code level coastal hazard data

Our data set also incorporated the final Louisiana zip code level coastal hazard data developed by Chi Li and Dr. Nina Lam in her thesis, *Community Resilience to Coastal Hazards: An Analysis of Two Geographical Scales in Louisiana* (2013) (see Chapter 1, Figure 4). The coastal hazards data were obtained from the Spatial Hazard Events and Losses Database for the United States (SHELDUS), operated by the University of South Carolina. Li (2013) indicated that the study used five major types of hazards including: hurricane/tropical storm, severe storm/thunderstorm, coastal (flooding and storm surge), tornado, and flooding. Please reference their published work for a thorough explanation of their mapping methodology.

[34] http://iaspub.epa.gov/triexplorer/tri_factsheet_search.searchfactsheet

# CHAPTER 4: RESEARCH METHODOLOGY

## 4.1 Survey Methods

The LSU Public Policy Research Lab[35] completed the phone survey in the fall of 2011 utilizing their 52 state-of the-art computer-assisted telephone interviewing (CATI) workstations. The survey was administered in a controlled centralized facility that monitored the interviews. The interviewer administered each interview by reading to the interviewee a pre-set list of questions which appeared on a monitor. The survey design included contingency patterns of questions, where sub-questions automatically branched off to produce skip patterns. In addition, subsequent data entry was omitted since the data were typed directly into the database. The telephone numbers were selected based on random digit dialing and focused on southeast Louisiana parishes. Participants were screened for age (>= 18 years), location safety, and zip codes (to assure geographic specificity of respondents).

## 4.2 Statistical Methods and Model Development

This section discusses the plan for statistical data analysis of the household survey responses. All data analysis will be conducted with the IBM Statistical Package for Social Sciences (SPSS) Version 19 software. An initial review using descriptive statistics has been completed to identify significant differences between groups and the results are summarized in the next section. Bivariate correlations analysis using Spearman's correlation coefficient will be used to identify patterns of significant relationships among the variables. Since the dependent variables derived from the survey are dichotomous ("Yes" or "No") and the independent variables are either categorical (i.e. nominal or ordinal) or scale, binary logistic regression will be used to further establish the types of relationships that may exist. The stepwise backward

[35] LSU Public Policy Lab, Manship School Research Facility, South Stadium Road, Baton Rouge, Louisiana 70803.

method of binary logistic regression will be used to model the relationship between the dependent variables and the predictor variables identified in the bivariate correlation analysis. The stepwise backward method was chosen because it starts with all predictor variables included in the model then test whether any of these predictors can be removed from the model without having a substantial effect on how well the model fits the observed data. To be one of the final predictor variables in the last step of the stepwise regression analysis the p-value or significance value must be less than 0.100.

### 4.2.1 Assumptions of Logistic Regression

As with ordinary or normal regression there are assumptions regarding the state of your data that must be addressed when using logistic regression. These assumptions are: linearity, independence of errors, and multicollinearity. Linearity in logistic regression is violated due to the categorical nature of the variables. If any of the predictor variables are continuous then each would need to be tested for linearity. Independence of errors addresses the assumption that each case in the study should be random and unrelated. Finally, the assumption of multicollinearity is that no two predictor variables should be too highly correlated with each other (Field, 2009).

In this study, we have nine predictor variables that are continuous. Eight of these variables were added to the data set from external publicly available sources and include the following: *TRI_lbs*, *TRI_Facility*, *EPA_Cancer*, *Superfund*, *Brownfield, PerCapDamage, Damage,* and *ZipHazardExp*. The variables *Age, LengthResidence,* and *NumChildren,* are also continuous and were derived from the survey responses. However, to test if these variables meet the linearity assumption, we must run a regression model to assess if there is significant interaction between the predictor variable and its log transformation by using the SPSS interaction term (Field, 2009). When the regression model has been developed the linearity of

these continuous variables will be tested if they are part of the final regression model. If needed, the linearity test results will be included in the Results chapter.

The independence of errors assumption has been met due to the design of the household survey. Each response in the household survey was randomly selected and each individual case was identified as a unique household phone number or cell phone number.

The full dataset will have an initial assessment of multicollinearity via the bivariate correlation analysis. As the first checkpoint to reduce multicollinearity, or when the relationship between two independent variables is too strongly correlated, only one of two reviewed independent variables will be selected for regression analysis if their correlation coefficient is a magnitude of greater than 0.80 (Field, 2009). The second level of multicollinearity testing will be on the regression model itself and will utilize the SPSS Collinearity diagnostics: tolerance and variance inflation factor (VIF) values. Menard (1995) suggests that a tolerance value of less than 0.1 is a signal of a serious collinearity issue and Myers (1990) also suggest that a VIF value of greater than 10 is an indication of multicollinearity.

4.2.2 Variable Determination

To understand the influences and possible motivational triggers for individuals to adopt risk-reducing behaviors we first need to review the relationship between the exposure, socio-economic vulnerability, and adaptive capacity variables with our two risk-reducing actions *ChangeActivity* and *AdoptEmergPlan*. Bivariate correlation will be used in this study to identify patterns of significant relationships, or to test the degree of association between these variables. Spearman's Correlation Coefficient was chosen due to the variables having a categorical nature from the survey responses (Field, 2009) . If the correlation coefficient, or Spearman's "rho" value, is positive then a relationship exist where one variable increases the corresponding

variable also increases; there can also be a negative relationship where one variable increases the other variable decreases (Field, 2009). As previously discussed, this step will also be used to test all of the variables identified as significant predictor variables for high degrees of correlation or multicollinearity.

4.2.3 Model Development: Binary Logistic Regression

As Table 6 below lists, we have derived two dependent variables from the construction of the survey questionnaire: 1) *AdoptEmergPlan* is derived from the question regarding household adoption of an emergency plan and 2) *ChangeActivity* is derived from the question asking if respondent's altered or modified their behavior in response to checking the local air quality index. Since these two dependent variables are dichotomous ("Yes" or "No") and the independent variables are either categorical (i.e. nominal or ordinal) or scale, normal or ordinary regression is not suitable for this type of data, because the assumption of linearity is no longer valid when one or more of the variables is not continuous. The method that will be used for regression analysis in this study is binary logistic regression and it uses a log transformation of data to express non-linear relationships in a linear way (Field, 2009). The Stepwise method of binary logistic regression was chosen because it develops a model by adding and removing variables to determine the most influential and important indicators in explaining the dependent variable (Fields, 2009).

Table 6: List of thesis variables.

| | **Variables derived from survey questions** | **Survey** | **Rank Direction** |
|---|---|---|---|
| A | *AdoptEmergPlan* : Adoption of household emergency plan | Y/N | 1-Y, 2-N |
| A | *ChangeActivity*: Behavior change in response to AQI | Y/N | 1-Y, 2-N |
| Exp | *NorthSouth*: North coast vs. South coast | n/a | 1-S, 2-N |
| Exp | *TRI_lbs*: 2011 Total TRI Releases (lbs) | n/a | Increasing = more release per zip |
| Exp | *TRI_Facility*: 2011 # of TRI Facilities | facility /zip | Increasing = more facility per zip |
| Exp | *EPA_Cancer*: 2005 Cancer Risk Estimates within zip code | rank/zip | Increasing = worse |

(Table 6 continued)

| Variables derived from survey questions | | Survey | Rank Direction |
|---|---|---|---|
| Exp | *Superfund*: # of Superfund Sites | sites/zip | Increasing = more facility per zip |
| Exp | *Brownfield*: # of LA-DEQ Voluntary Brownfield Sites | sites/zip | Increasing = more facility per zip |
| Exp | *Emergency_5yrs*: environmental emergency within 5 years | Y/N | 1-Y, 2-N |
| Exp | *Damage*: | n/a | Increasing = more damage |
| Exp | *PerCapDamage*: | n/a | Increasing = more damage per capita |
| Exp | *ZipHazardExp*: | n/a | Increasing = more exposure |
| V | *DOB*: entered as year of birth | n/a | Decreasing = Older |
| V | *LengthResidence:* # years living in current zip code | #yrs | Increasing = more yrs in zip code |
| V | *Education*: Educational attainment | 1 to 7 | Increasing = more education |
| V | *Income*: Household income | 1 to 8 | Increasing = more income |
| V | *Own_Rent*: Own (1), Rent (2), Other (3) | 1 to 3 | n/a |
| V | *Employment*: Full-time (1) to Volunteer/Disability (6) | 1 to 6 | n/a |
| V | *Race*: White (1), Black (2), Asian American (3), Native American (4), Other (5) | 1 to 5 | n/a |
| V | *Marital*: Married (1) to Widowed (5) | 1 to 5 | n/a |
| V | *NumChildren:* # children under age of 18 living in household | n/a | Increasing = more children |
| V | *Gender*: Male (1) and Female (2) | 1 to 2 | n/a |
| AC | *WhomContact*: Know which agencies to contact in emergency | Y/N | 1-Y, 2-N |
| AC | *HazardKnowledge*: Feel informed to respond to emergency hazard event | 1 to 5 | Increasing = more knowledgeable |
| AC | *AQI*: Knowledge of Air Quality Index | Y/N | n/a |
| AC | *FreqAQI*: Frequency of checking Air Quality Index | 1 to 5 | Increasing = more checking |
| AC | *IfAware*: If aware of AQI likeliness of changing behavior | 1 to 4 | Increasing = more likely alter behavior |
| AC | *DemRep:* 1-Democrat 2-Republican 3-Independent | 1 to 3 | n/a |
| AC | *Concern_Air*: Concern for air quality | 1 to 5 | Increasing = greater concern |
| AC | *Concern_Water*: Concern for water quality | 1 to 5 | Increasing = greater concern |
| AC | *Concern_Soil*: Concern for soil quality | 1 to 5 | Increasing = greater concern |
| AC | *Concern_EnvPoll*: Concern for overall environmental pollution | 1 to 5 | Increasing = greater concern |
| AC | *Concern_CC*: Concern for climate change | 1 to 5 | Increasing = greater concern |
| AC | *Concern_Nature*: Concern for natural disasters | 1 to 5 | Increasing = greater concern |
| AC | *Concern_Biggest*: Concern for biggest environmental threat facing community | 1 to 5 | Increasing = greater concern |
| AC | *Confidence_FEMA*: Confidence in FEMA | 1 to 5 | Increasing = greater confidence |
| AC | *Confidence_EPA*: Confidence in EPA | 1 to 5 | Increasing = greater confidence |
| AC | *Confidence_Fed*: Confidence in Federal Government | 1 to 5 | Increasing = greater confidence |
| AC | *Confidence_State*: Confidence in State Government | 1 to 5 | Increasing = greater confidence |
| AC | *Confidence_Local*: Confidence in Local Government | 1 to 5 | Increasing = greater confidence |
| Note: A =adaptation, Exp =exposure; V = vulnerability; AC = adaptive capacity and *italic* = SPSS variable name. | | | |

# CHAPTER 5: RESULTS

## 5.1 Survey Descriptive Statistics and Frequencies

Of the 536 residents surveyed 36% of the residents have lived within their current zip code for at least 20 or more years, as shown in Figure 9 below. Additionally, 10% of those surveyed have lived within their current zip code for 60 or more years. The age range of survey respondents was from 18 to 93. Within this range 35.6% were age 50 or younger, 61.5% were at least 51 years of age or older, and 2.9% of the respondents refused to provide their age. This age range reflected the survey's minimum age requirement of at least 18 years of age. Similarly, 50% of the respondents are employed at least part-time and 41% are either: retired, not employed (and not looking for work), or on disability.

The majority of those surveyed, 72% of the respondents, have attained at least a high school diploma and up to a 4-year college degree. As shown in Table 8 below, 44% (n = 113/257) of the northern region of the study area self-reported as Republicans, while 65% (n = 181/279) of the southern region self-reported as Democrats. This randomized survey sample of

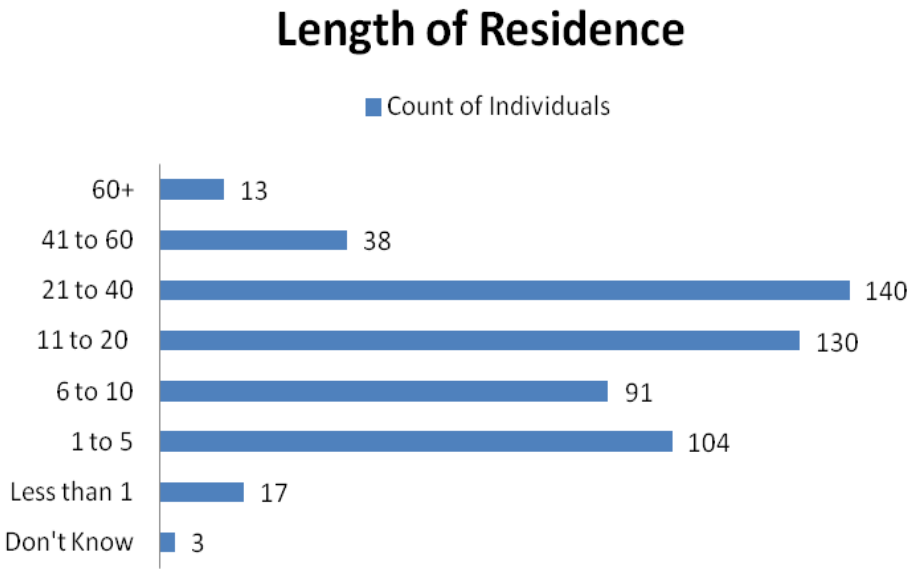


Figure 9: Survey reported length of residence within current zip code.

536 residents of south Louisiana returned socio-demographic statistics similar to the 2010 census for Louisiana, as shown in Chapter 3.

As shown in Figure 10, the two best methods to rapidly and widely broadcast environmental emergency information, as indicated by the residents, in the event of an environmental hazard were via television broadcast (38%) or text message (28%). However, in the southern region the rate of respondents that would like to be informed via television broadcast was even greater at 41% (n=114:279). Interestingly, the much broader use of mobile phones is evident here and ranks higher than being informed via home phone.

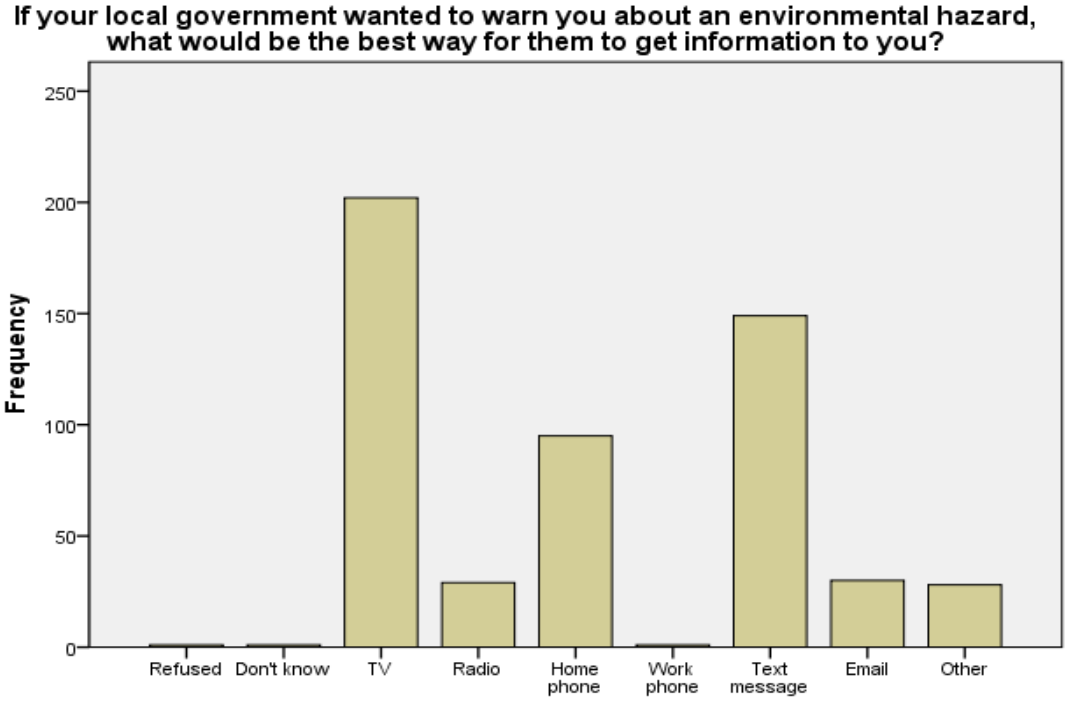


Figure 10: Best methods to provide environmental hazard information.

When individuals and households have greater confidence in governmental agencies and scientific policies, their support of government intervention to address a hazard will increase (Gerber & Neeley, 2005). As shown in Figures 11 through 15 below, by summing the percentages of residents that are at least 'Somewhat confident' to 'Very Confident', south Louisiana residents are most confident in their local government (39.4%) and least confident in

the federal government (27.6%). Greater confidence in south Louisiana local governments will lead to greater support of local government actions and policies, over federal government actions, to address and mitigate environmental hazards.

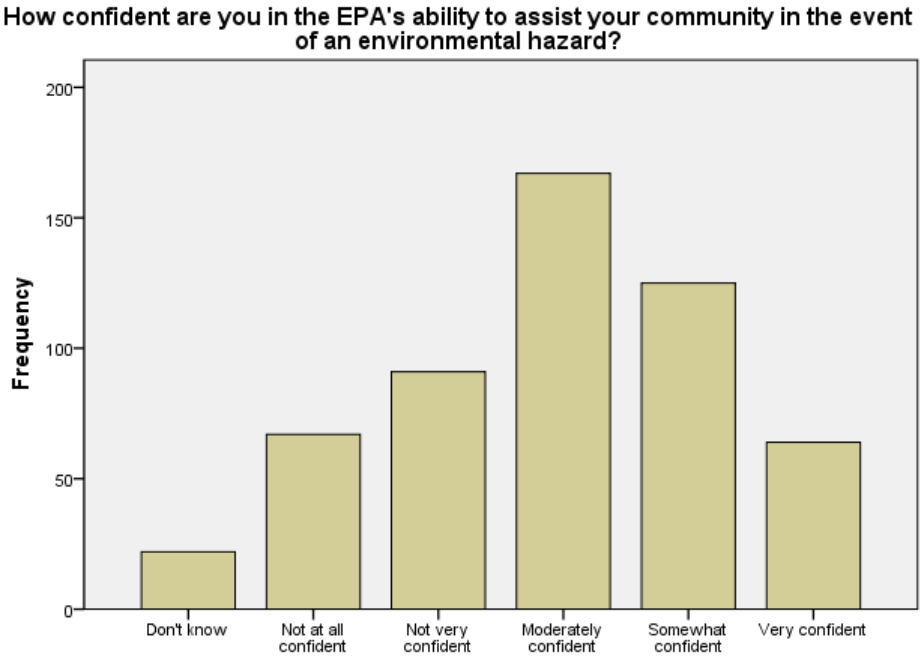


Figure 11: Resident confidence in the EPA.

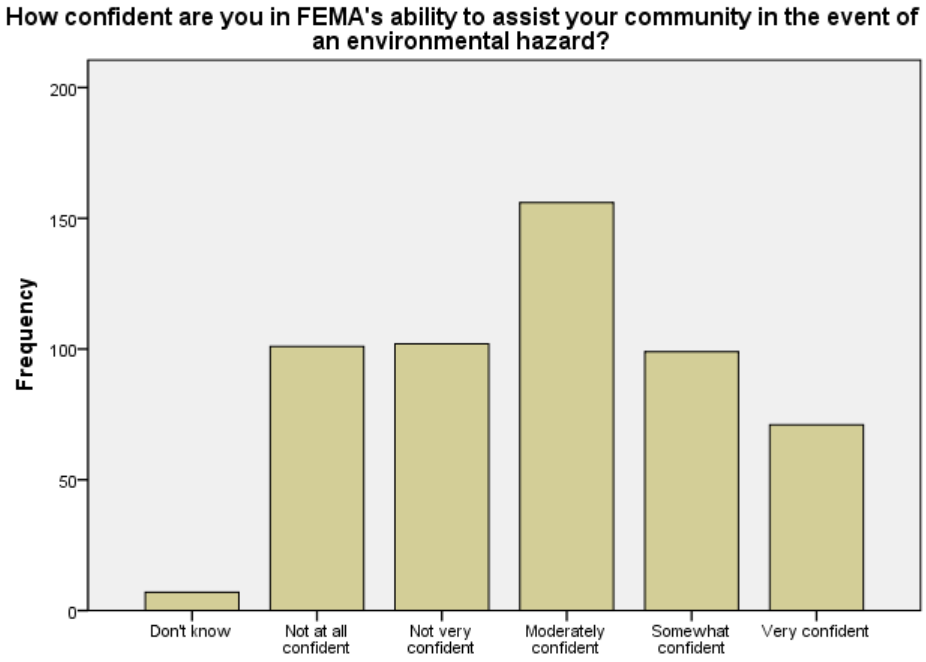


Figure 12: Resident confidence in FEMA.

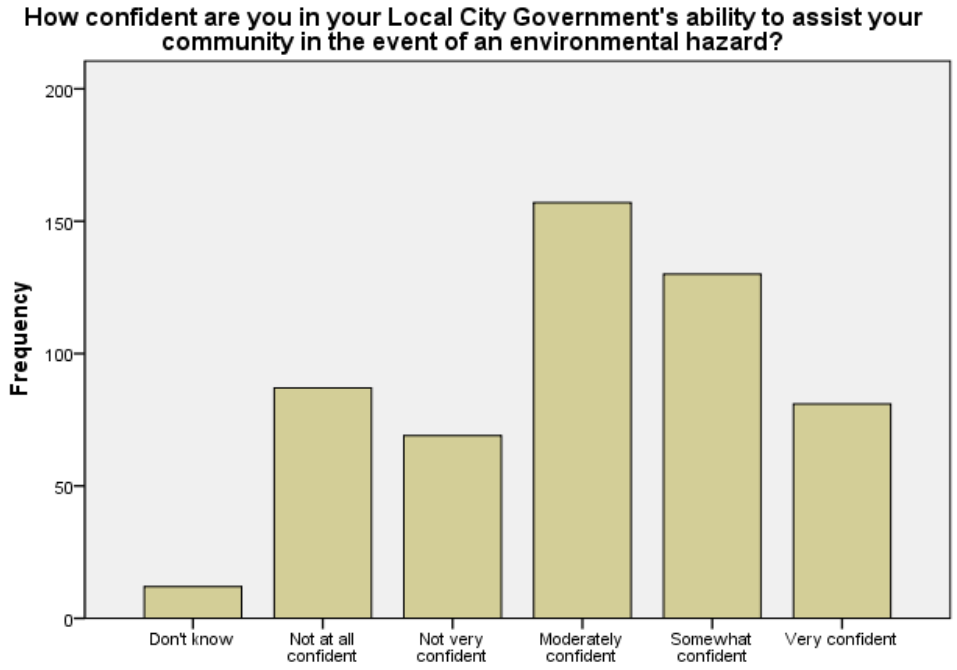


Figure 13: Resident confidence in the State Government.

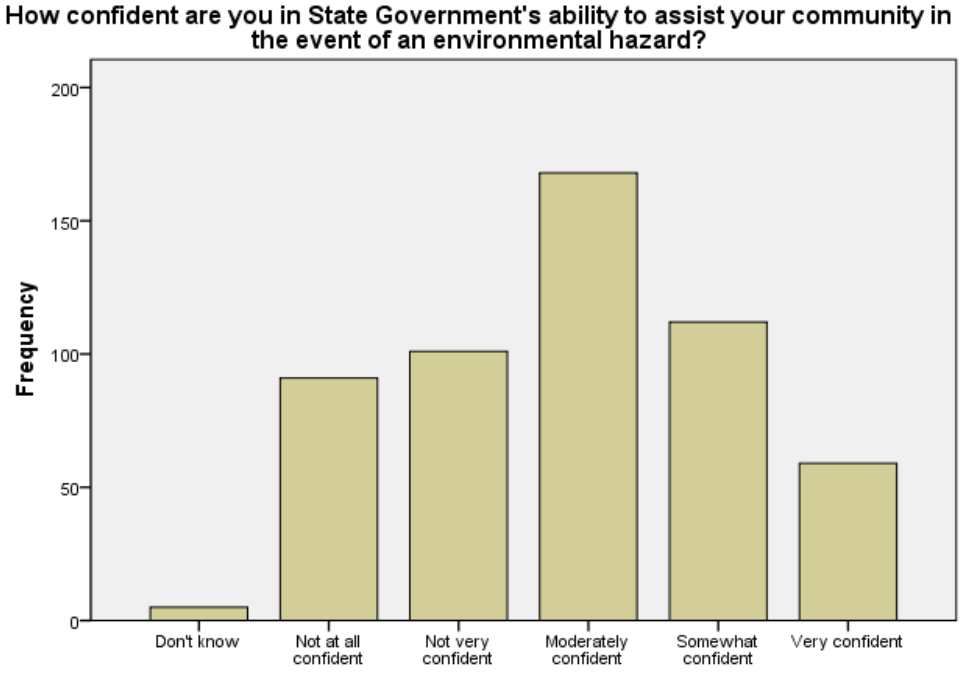


Figure 14: Resident confidence in the Local City Government.

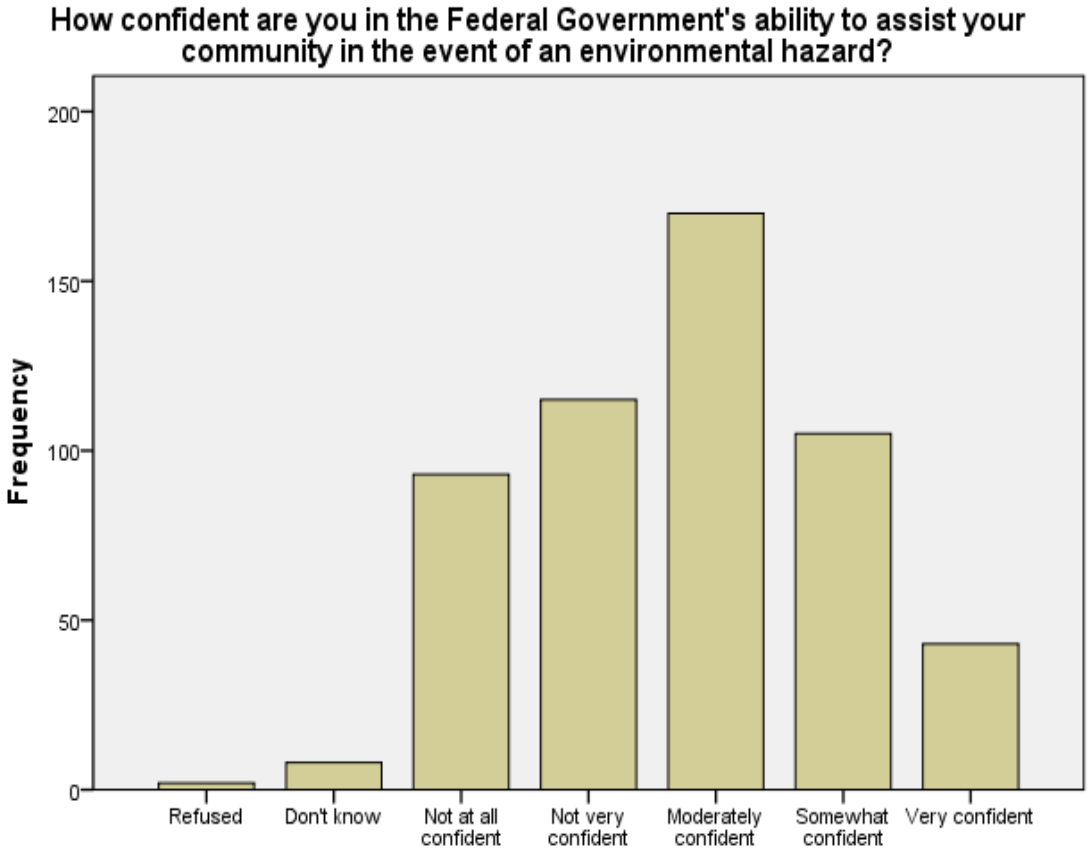


Figure 15: Resident confidence in the Federal Government.

5.2. Bivariate Correlation Analysis

The purpose of the bivariate correlation analysis is two-fold: 1) to identify which variables may be multicollinear or highly correlated with each other, and 2) determination of the significant variables derived from the survey with the two dependent variables: *ChangeActivity* and *AdoptEmergPlan*. Please see Appendix B to view the complete bivariate correlation results table.

5.2.1. Multicollinearity

Multicollinearity was assessed by entering all 40 variables into the SPSS bivariate analysis function. Any pair of variables that returned a correlation coefficient of 0.8 or greater is

considered to be multicollinear. As shown in Table 7 below, only the exposure group returned variables that are multicollinear. The remaining groups: adaptive capacity, vulnerability, and adaptation did not contain variables that were multicollinear.

Table 7: Multicollinear thesis variables.

| Variables | | Correlation Coefficient |
|---|---|---|
| NorthSouth | Damage | .997 |
| | Brownfield | -.998 |
| | EPA Cancer Risk | -.894 |
| TRI Facilities | TRI_lbs | .820 |
| | Superfund | .986 |
| EPA Cancer Risk | Brownfield | .895 |
| | Damage | -.895 |
| Damage | Brownfield | -.995 |

5.2.2 North and South Regional Variations

As summarized in Table 8, the bivariate correlation analysis confirms Hypothesis 1, that there are important differences between the north (St. Tammany Parish) and south (Orleans Parish) coastal regions in our study area. The *NorthSouth* variable is significantly correlated with 65% (n = 26/40) of the variables (see Appendix B for complete bivariate correlation). Note that in this study North is coded as '2' and South is coded as '1. All nine of the exposure variables are significantly correlated with *NorthSouth*: *TRI_lbs*, *TRI_Facility*, *EPA_Cancer*, *Superfund*, *Brownfield*, *Emergency_5yrs*, *PerCapDamage*, *Damage,* and *ZipHazardExp*. Of these significant correlations for exposure three of the relationships are multicollinear, or highly correlated with a correlation coefficient of 0.8 or greater: *EPA_Cancer* (-.894), *Brownfield* (-.998), and *Damage* (.998). For instance, the *EPA_Cancer* variable's correlation coefficient is -.894 and this represents an inverse relationship with the *NorthSouth* variable. This relationship

may be described as the higher incidents of cancer are significantly correlated to the southern coastal region of this study area.

With regards to the two dependent variables *AdoptEmergPlan* and *ChangeActivity*, only *ChangeActivity* (+.009) was significantly correlated with variations between the north and south regions. As this is a positive correlation relationship, more residents in the southern region are correlated with altering their behavior on days when poor air quality is reported.

The vulnerability variables captured socio-demographics such as gender, age, home ownership, race, and number of children under 18 living in the home. Of these socio-demographic vulnerability variables, four had significant variations between the north and south regions: *Own_Rent*, *Race*, *Marital*, and *NumChildren*. Home ownership is greater in the northern region, while more children under the age of 18 are living at home in the southern region. Additionally, more residents in the northern region self-reported as Caucasian and as households that are married.

Interestingly, the adaptive capacity variables representing level of hazard knowledge, knowing who to contact during an environmental hazard event and frequency of checking the AQI do not have significant variations between the north and south regions. However, there are significant differences in the ranking of environmental hazard concerns and confidence in governmental agencies between the north and south regions. More southern residents indicated higher levels of concern across all hazards in the survey including 'Very Concerned' for the following: air quality (49%), water quality (70%), soil quality (44%), general environmental pollution (57%), climate change (44%), and natural hazards such as hurricanes and flooding (84%).

Table 8: North - South summary of bivariate correlation and cross-tabulation data.

| Variable / Bivariate Significance to NorthSouth Variable | | North(2) / South (1) | N | Cross Tabulation as % of N | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Don't Know | Yes (1) | No (2) | Total | Less - 1 | 2 | 3 | 4 | 5 | 6 | More - 7 | Total |
| A | *AdoptEmergPlan* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (+) 0.621 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A | *Change_Activity* | *N* | 82 | - | 0.26 | 0.74 | 1.00 | - | - | - | - | - | - | - | - |
| | (+) 0.009 ** | *S* | 87 | - | 0.45 | 0.55 | 1.00 | - | - | - | - | - | - | - | - |
| Exp | *NorthSouth* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | n/a | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Exp | *TRI_lbs* | *N* | 257 | - | - | - | - | 0.96 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.80 | 0.15 | 0.00 | 0.00 | 0.05 | 0.00 | - | 1.00 |
| Exp | *TRI_Facility* | *N* | 257 | - | - | - | - | 0.96 | 0.04 | 0.00 | - | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.80 | 0.00 | 0.20 | - | - | - | - | 1.00 |
| Exp | *EPA_Cancer* | *N* | 257 | - | - | - | - | 0.00 | 1.00 | 0.00 | 0.00 | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.05 | 0.00 | 0.01 | 0.95 | - | - | - | 1.00 |
| Exp | *Superfund* | *N* | 257 | - | - | - | - | 0.98 | 0.02 | - | - | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.85 | 0.15 | - | - | - | - | - | 1.00 |
| Exp | *Brownfield* | *N* | 257 | - | - | - | - | 1.00 | 0.00 | 0.00 | - | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.00 | 0.01 | 0.99 | - | - | - | - | 1.00 |
| Exp | *Emergency_5yr* | *N* | 257 | 0.02 | 0.07 | 0.91 | 1.00 | - | - | - | - | - | - | - | - |
| | (+) 0.002 ** | *S* | 279 | 0.03 | 0.16 | 0.81 | 1.00 | - | - | - | - | - | - | - | - |
| Exp | *Damage* | *N* | 257 | - | - | - | - | 0.00 | 0.00 | 1.00 | 0.00 | - | - | - | 1.00 |
| | (+) 0.000 ** | *S* | 279 | - | - | - | - | 0.99 | 0.01 | 0.00 | 0.00 | - | - | - | 1.00 |
| Exp | *PerCapDamage* | *N* | n/a | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.000 ** | *S* | n/a | - | - | - | - | - | - | - | - | - | - | - | - |
| Exp | *ZipHazardExp* | *N* | 257 | - | - | - | - | 0.54 | 0.22 | 0.24 | 0.00 | 0.00 | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | - | - | - | - | 0.00 | 0.00 | 0.36 | 0.40 | 0.24 | - | - | 1.00 |
| V | *Age* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.993 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| V | *LengthResidence* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.821 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| V | *Education* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (+) 0.130 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| V | *Income* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (+) 0.694 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| V | *Own_Rent* | *N* | 257 | 1-Own 2-Rent 3-Other | | | | 0.82 | 0.08 | 0.10 | - | - | - | - | 1.00 |
| | (-) 0.003 ** | *S* | 279 | | | | | 0.71 | 0.18 | 0.11 | - | - | - | - | 1.00 |
| V | *Employment* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.517 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| V | *Race* | *N* | 257 | 1-white 2-black 3-asian | | | | 0.88 | 0.05 | 0.01 | 0.06 | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | 4-other | | | | 0.24 | 0.67 | 0.02 | 0.07 | - | - | - | 1.00 |
| V | *Marital* | *N* | 257 | 1-married 2-single | | | | 0.63 | 0.18 | 0.10 | 0.09 | - | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | 3-divorced 4-other | | | | 0.42 | 0.30 | 0.10 | 0.18 | - | - | - | 1.00 |
| V | *NumChildren* | *N* | 257 | Count starts at zero. | | | | 0.61 | 0.17 | 0.14 | 0.05 | 0.01 | 0.00 | 0.00 | 0.98 |
| | (+) 0.049 * | *S* | 279 | Refused: 6 | | | | 0.72 | 0.12 | 0.08 | 0.06 | 0.01 | 0.02 | 0.00 | 1.00 |
| V | *Gender* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.181 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| AC | *WhomContact* | *N* | 257 | 0.00 | 0.50 | 0.49 | 1.00 | - | - | - | - | - | - | - | - |
| | (-) 0.001 ** | *S* | 279 | 0.01 | 0.35 | 0.64 | 1.00 | - | - | - | - | - | - | - | - |
| AC | *HazardKnowledge* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (-) 0.543 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| AC | *AQI* | *N* | 257 | 0.25 | 0.32 | 0.43 | 1.00 | - | - | - | - | - | - | - | - |
| | (-) 0.047 * | *S* | 279 | 0.18 | 0.31 | 0.51 | 1.00 | - | - | - | - | - | - | - | - |
| AC | *FreqAQI* | *N* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | (+) 0.623 | *S* | - | - | - | - | - | - | - | - | - | - | - | - | - |
| AC | *If_Aware* | *N* | 244 | 1-Don't know | | | | 0.02 | 0.16 | 0.14 | 0.43 | 0.25 | - | - | 1.00 |
| | (-) 0.000 ** | *S* | 258 | | | | | 0.03 | 0.09 | 0.09 | 0.36 | 0.43 | - | - | 1.00 |
| AC | *DemRep* | *N* | 257 | 1-Dem 2-Rep 3-Ind | | | | 0.18 | 0.44 | 0.23 | 0.15 | - | - | - | 1.00 |
| | (+) 0.000 ** | *S* | 279 | 4-Don't Know / Refuse | | | | 0.65 | 0.08 | 0.18 | 0.09 | - | - | - | 1.00 |

(Table 8 continued)

| Variable / Bivariate Significance to NorthSouth Variable | | North(2) / South (1) | N | Cross Tabulation as % of N | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Don't Know | Yes (1) | No (2) | Total | Less - 1 | 2 | 3 | 4 | 5 | 6 | More - 7 | Total |
| AC | *Concern_Air* | *N* | 257 | 1-Don't know | | | | 0.00 | 0.19 | 0.15 | 0.25 | 0.14 | 0.27 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.00 | 0.09 | 0.09 | 0.17 | 0.16 | 0.49 | - | 1.00 |
| AC | *Concern_Water* | *N* | 257 | | | | | 0.00 | 0.14 | 0.11 | 0.11 | 0.13 | 0.51 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.00 | 0.05 | 0.05 | 0.08 | 0.12 | 0.70 | - | 1.00 |
| AC | *Concern_Soil* | *N* | 257 | | | | | 0.01 | 0.25 | 0.13 | 0.19 | 0.20 | 0.22 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.14 | 0.11 | 0.15 | 0.15 | 0.44 | - | 1.00 |
| AC | *Concern_EnvPoll* | *N* | 257 | | | | | 0.00 | 0.14 | 0.13 | 0.20 | 0.21 | 0.32 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.00 | 0.05 | 0.05 | 0.14 | 0.18 | 0.57 | - | 1.00 |
| AC | *Concern_CC* | *N* | 257 | | | | | 0.01 | 0.25 | 0.12 | 0.18 | 0.17 | 0.27 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.13 | 0.10 | 0.13 | 0.20 | 0.44 | - | 1.00 |
| AC | *Concern_Nature* | *N* | 257 | | | | | 0.00 | 0.04 | 0.04 | 0.10 | 0.16 | 0.67 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.02 | 0.01 | 0.03 | 0.09 | 0.84 | - | 1.00 |
| AC | *Concern_Biggest* | *N* | - | | | | | - | - | - | - | - | - | - | - |
| | (+) 0.916 | *S* | - | | | | | - | - | - | - | - | - | - | - |
| AC | *Confidence_FEMA* | *N* | - | | | | | - | - | - | - | - | - | - | - |
| | (-) 0.099 | *S* | - | | | | | - | - | - | - | - | - | - | - |
| AC | *Confidence_EPA* | *N* | - | | | | | - | - | - | - | - | - | - | - |
| | (-) 0.070 | *S* | - | | | | | - | - | - | - | - | - | - | - |
| AC | *Confidence_Fed* | *N* | 257 | | | | | 0.03 | 0.22 | 0.26 | 0.29 | 0.15 | 0.05 | - | 1.00 |
| | (-) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.13 | 0.17 | 0.34 | 0.24 | 0.11 | - | 1.00 |
| AC | *Confidence State* | *N* | 257 | | | | | 0.01 | 0.09 | 0.17 | 0.35 | 0.24 | 0.14 | - | 1.00 |
| | (+) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.25 | 0.20 | 0.28 | 0.18 | 0.08 | - | 1.00 |
| AC | *Confidence Local* | *N* | 257 | | | | | 0.03 | 0.09 | 0.07 | 0.27 | 0.32 | 0.22 | - | 1.00 |
| | (+) 0.000 ** | *S* | 279 | | | | | 0.01 | 0.23 | 0.18 | 0.31 | 0.18 | 0.09 | - | 1.00 |

Note: A =adaptation; Exp =exposure; V = vulnerability; AC = adaptive capacity and *italic* = SPSS variable name.
italic = high correlation coeffiecent >= 0.800; * p-value < 0.05 and ** p-value < 0.01

5.3 *AdoptEmergPlan*: Stepwise Binary Regression Analysis

Of the 536 individuals surveyed, 34% (n=184) of households indicated adoption of an emergency plan, 65% (n=348) of households indicated no emergency plan adoption, and 1% (n= 4) surveyed responded "don't know". Survey respondents were also asked if they knew whom to contact in the event of an environmental hazard and, if so, who would that contact be? Of the total 536 responses, 57% (n=305) were unaware of whom to contact in the event of an environmental hazard (Table 9 below). The remaining 43% (n = 227) who indicated that they did know whom to contact listed traditional emergency response as the top contact (24%, n = 127).

Table 9: Statistics on whom to contact during an environmental hazard.

| ***Do you know whom to contact in the event of an environmental hazard?*** | | | |
|---|---|---|---|
| | North | South | Total |
| Don't Know | 1% | 1% | 4 |
| Yes | 50% | 35% | 227 |
| No | 49% | 64% | 305 |
| Total | 257 | 279 | 536 |
| ***Whom would you contact in the event of an environmental hazard?*** | | | |
| | | Count | Percentage |
| Emergency Response, responses include: 911, 311, state/local police department, sheriff's office, state troopers, fire department, marine command | | 127 | 24% |
| Governmental Environmental Agencies, responses include: EPA, LDEQ, City Environmental Officer | | 65 | 12% |
| City and Parish Offices, responses include: City or Parish government, City Hall, Council member, Parish President, City Health Dept. | | 24 | 5% |
| Family | | 7 | 1% |
| No Response | | 313 | 58% |
| Total | | 536 | 100% |

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Twelve percent (n = 62) of the survey respondents were aware of an environmental hazard emergency that had occurred in their community in the last 5 years. Of those 62 responses, the vast majority of the respondents who were aware of an environmental hazard emergency were located in the southern region (n = 45). The emergencies that residents listed as occurring in their communities ranged from transportation related chemical spills (i.e. train derailment), the BP oil spill, marsh fires and an underground fire, to water and air pollution.

5.3.1 *AdoptEmergPlan:* Variable Determination

As previously discussed in section 5.2.1, all 40 variables were entered in the bivariate correlation analysis function. Of those 40 variables, the bivariate analysis, Table 10, indicated that only two adaptive capacity variables were significantly correlated to the dependent variable, *AdoptEmergPlan*: *HazardKnowledge* and *WhomContact*.

Table 10: *AdoptEmergPlan* bivariate correlation analysis.

| Independent Variables | Spearman correlation | p-value | N |
|---|---|---|---|
| Adaptive Capacity Variables | | | |
| HazardKnowledge | -0.392** | 0.000 | 536 |
| WhomContact | 0.138** | 0.001 | 536 |
| Note: * = p-value < 0.05 and ** = p-value < 0.01 | | | |

5.3.2 *AdoptEmergPlan:* Binary Regression Model Development

As previously discussed, the stepwise backward method used for regression modeling starts with all predictor variables included then test whether any of these predictors can be removed from the model without having a substantial effect on how well the model fits the observed data. In Table 11 below, this method showed that while the variable *WhomContact* is trending towards significance, p-value of 0.066, the SPSS Odds Ratio and its 95% Confidence Interval must be examined to have a full understanding of the contribution of the independent variable to the regression.

Table 11: *AdoptEmergPlan* stepwise regression analysis.

| Regression Method | Hosmer-Lemeshow | | Cox & Snell | Nagelkerke | Initial -2LL | Model -2LL |
|---|---|---|---|---|---|---|
| | $\chi^2$ | p-value | | | | |
| Stepwise | 6.578 | 0.583 | 0.148 | 0.205 | 686.171 | 600.609 |
| | | Range 0 to 1: 1 indicates the model predicts the outcome perfectly | | | | |

| Independent Variable | B | p-value | Odds Ratio | 95% Confidence Interval |
|---|---|---|---|---|
| HazardKnowledge | -0.624 | 0.000 | 0.536 | (0.458 – 0.627) |
| WhomContact (Yes) | -2.152 | 0.066 | 0.116 | (0.012 – 1.157) |
| WhomContact (No) | -0.260 | 0.198 | 0.771 | (0.519 – 1.145) |

Typically, if the value of the Odds Ratio is greater than 1 then as the predictor value increases, the odds of the outcome occurring increases (Field, 2009). A value of less than 1 indicates that as the predictor increases, the odds of the outcome occurring decreases (Field, 2009). Remember, that for both variables *WhomContact* and *AdoptEmergPlan,* 'Yes = 1' and 'No = 2'. Here, for example, the *WhomContact(Yes)* Odds Ratio is 0.116 and we interpret this to indicate that a 1 increment increase in the *WhomContact* variable, or moving towards 'No or 2', decreases the *AdoptEmergPlan* variable, or moves the response towards 'Yes or 1'. Otherwise stated as, residents are more likely to adopt an emergency plan when they feel less confident regarding whom to contact in the event of an environmental hazard. However, since the upper limit of the Odds Ratio confidence interval is above '1,' we have less confidence in this relationship because when moving towards the upper limit the relationship may be in the opposite, or inverse direction (Field, 2009). Since the stepwise method revealed that while the variable *WhomContact* is trending towards significance but that the confidence in the relationship direction is less than 95%, we have used only the independent variable *HazardKnowledge* in the final regression model and the results are shown below.

The final regression model, shown in Table 12 below, includes the independent variable, *HazardKnowledge*, and does more accurately predict the outcome than the model with only a constant as assessed by the reduction of the log-likelihood statistic value from 686.171 to 605.952 (Field, 2009). When using binary logistic regression, due to the dependent variable being dichotomous, there is not a true $R^2$ value that is traditionally referenced in linear regression as the amount or percentage of variance that is explained by the linear regression model.

Table 12: *AdoptEmergPlan* final regression analysis.

| Independent Variable | B | p-value | Odds Ratio | 95% Confidence Interval |
|---|---|---|---|---|
| HazardKnowledge | -0.636 | 0.000 | 0.530 | (0.454 – 0.618) |

| Regression Method | Hosmer-Lemeshow | | Cox & Snell | Nagelkerke | Initial -2LL | Model -2LL |
|---|---|---|---|---|---|---|
| | $\chi^2$ | p-value | | | | |
| Forced | 5.356 | 0.148 | 0.140 | 0.193 | 686.171 | 605.952 |
| | | Range 0 to 1: 1 indicates the model predicts the outcome perfectly | | | | |

SPSS provides three different calculations that have interpretations similar to $R^2$ for linear regression: Hosmer-Lemeshow, Cox & Snell, and Nagelkerke. The Hosmer-Lemeshow test of goodness of fit indicates the extent to which the model provides a better fit than a null model with no predictors. Here, a p-value of greater than 0.05, the typical cut-off, indicates that the model is predicting values that are *not* significantly different from what was observed suggesting a well fitting model (Field, 2009). The Cox & Snell value is mathematically not able to reach the maximum of 1, thus making interpretation more difficult (Field, 2009). The Nagelkerke calculation was introduced as an adjusted value of Cox & Snell measurement that does have a complete range of 0 to 1.

Here, the Hosmer-Lemeshow statistic, a goodness of fit test, also indicates that the model is predicting values that are *not* significantly different from what was observed with a p-value of 0.148 (greater than 0.05). The Nagelkerke and Cox & Snell measurements may be read as 14% and 19%, respectively, of the variance in *AdoptEmergPlan* may be explained by the *HazardKnowledge* binary logistic model.

In summary, the best fit regression model for the adoption of an emergency plan established residents who feel more knowledgeable regarding actions to take in the event of an environmental hazard are more likely to adopt an emergency plan. The Odds Ratio for

*HazardKnowledge* suggest that as residents have a 1-increment increase in their personal level of hazard knowledge they are 53% more likely to adopt an emergency plan. This relationship is within the 95% confidence interval.

5.3.3 *AdoptEmergPlan*: Testing of Assumptions

There are three assumptions to address when using logistic regression: linearity, independence of errors, and multicollinearity. For the *AdoptEmergPlan* regression model development, testing for linearity is not necessary because the variables *HazardKnowledge* and *WhomContact* are not continuous. The independence of errors assumption was met due to the design of the household survey having one randomized household response per unique phone number. Additionally, the final regression model only included one variable thus testing for multicollinearity among the variables was not needed.

5.4 *ChangeActivity:* Step-wise Binary Regression Analysis

Most notable regarding the community knowledge of an existing air quality rating (Table 13) is that a total of 68% (n = 366) of the residents were either unsure of the existence of an air quality index (n = 115) or responded that a local air quality rating did not exist at all (n = 252). The residents who responded "Yes" (n = 169) to the existence of an air quality index listed the local television broadcast as the top source providing this information (20%, n = 109). These respondents were then asked how often they check the daily air quality rating or if they check the daily air quality rating at all. The responses were Likert scale in format and, of note, a total of 51% of the residents indicated checking the daily air quality rating, at least, "sometimes," and at least 20% reported checking the daily air quality rating "every day."

Table 13: Community knowledge of local air quality index.

| ***To the best of your knowledge is there a daily rating of air quality available for your community?*** | | | |
|---|---|---|---|
| | North | South | Total |
| Don't Know | 25% | 18% | 115 |
| Yes | 32% | 31% | 169 |
| No | 43% | 51% | 252 |
| Total | 257 | 279 | 536 |
| ***Where is this air quality rating available? (Respondent Free Entry)*** | | | |
| | | Count | Percentage |
| No Answer | | 369 | 69% |
| Television news broadcast, including: local weather | | 109 | 20% |
| Computer/internet/website | | 26 | 5% |
| Newspaper | | 10 | 2% |
| Don't know | | 9 | 2% |
| City or State Department | | 8 | 1% |
| Radio or telephone | | 3 | 1% |
| Mobile phone application | | 2 | 0% |
| Total | | 536 | 100% |

Of the residents that responded to the question regarding how they alter their behavior on poor air quality days, 100% (n = 57) indicated that they remain indoors or "stay inside". Health reasons were the major motivation for 55 of the 86 residents to follow the daily air quality index.

Of particular interest to this study is that 73% of those interviewed stated they would be at least "somewhat likely" to alter their behavior if made aware of the daily local air quality. This represents a yet unexplored or nascent opportunity for public policy officials and environmental agencies to recharge air quality educational campaigns and positively influence resident's perception of air quality education and behavior modification.

The dependent variable, *ChangeActivity*, is derived from the survey question in Table 14 below. Of the 169 residents who responded "Yes" to knowing the air quality index was published daily, 64% (n = 109/169) stated they *have not* altered their behavior in response to a poor air quality rating. This 69% represents another tremendous opportunity to expand or grow the current air quality and policy educational programs.

Table 14: Residents who change their behavior due to poor air quality.

| ***Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area?*** | | | |
|---|---|---|---|
| | North | South | Total |
| Don't Know | - | - | - |
| Yes | 26% | 45% | 60 |
| No | 74% | 55% | 109 |
| **Total** | **82** | **87** | **169** |

5.4.1 *ChangeActivity:* Variable Determination

The Table 15 shows the 14 significant predictor variables for the dependent variable *ChangeActivity* identified from the bivariate correlation analysis. Since a significant correlation among these variables has been established the next step will be to run a stepwise binary logistic regression of *ChangeActivity* and including each of the predictor variables listed below. Of the exposure variables, only *NorthSouth* and *ZipHazardExp* will be in further regression modeling, since it was established in the bivariate correlation analysis that both the *Brownfield* and *Damage* variables were highly correlated or multicollinear with the *NorthSouth* variable.

Table 15: *ChangeActivity* bivariate correlation analysis.

| **Independent Variables** | **Spearman correlation** | **p-value** | **N** |
|---|---|---|---|
| Exposure Variables | | | |
| Brownfield | -.201** | 0.009 | 169 |
| Damage | .201** | 0.009 | 169 |
| NorthSouth | .201** | 0.009 | 169 |
| ZipHazardExp | -.189* | 0.014 | 169 |
| Vulnerability Variables | | | |
| Employment | -.232** | 0.002 | 169 |
| Gender | -.163* | 0.034 | 169 |
| Adaptive Capacity Variables | | | |
| Concern_Air | -.397** | 0.000 | 169 |
| Concern_Water | -.224** | 0.003 | 169 |
| Concern_Soil | -.285** | 0.000 | 169 |
| Concern_ CC | -.307** | 0.000 | 169 |
| Concern_EnvPoll | -.337** | 0.000 | 169 |
| Concern_ Natural | -.218** | 0.004 | 169 |
| FreqAQI | .265** | 0.000 | 169 |
| If_Aware | .310** | 0.000 | 169 |
| Note: * = p-value < 0.05 and ** = p-value < 0.01 | | | |

5.4.2 *ChangeActivity:* Binary Regression Model Development

The relationship of the dependent variable, *ChangeActivity,* with the independent variables identified in the variable determination step was modeled using stepwise backward entry method of binary logistic regression in SPSS. This method showed that 11 of the 14 variables were able to be removed from the model without having a substantial effect on how well the model fits the observed data. Table 16 list the remaining 3 variables: *Gender*, *Concern_EnvPoll*, and *FreqAQI* that do contribute to how well the model fits the observed data and are the variables used in our final regression model.

Table 16: *ChangeActivity* stepwise regression analysis.

| Regression Method | Hosmer-Lemeshow | | Cox & Snell | Nagelkerke | Initial -2LL | Model -2LL |
|---|---|---|---|---|---|---|
| | $\chi^2$ | p-value | | | | |
| Stepwise | 15.847 | 0.045 | 0.159 | 0.224 | 165.829 | 142.454 |
| | | Range 0 to 1: 1 indicates the model predicts the outcome perfectly | | | | |

| Independent Variable | B | p-value | Odds Ratio | 95% Confidence Interval |
|---|---|---|---|---|
| Gender (Male) | 0.829 | 0.066 | 2.292 | (0.948 – 5.538) |
| Concern_EnvPoll | -0.586 | 0.001 | 0.557 | (0.396 – 0.782) |
| FreqAQI | 0.326 | 0.062 | 1.386 | (0.983 – 1.954) |

Typically, a decrease (165.829 to 142.454) from the initial value of the log-likelihood statistic indicates an overall improvement of the model with the inclusion of predictor variables when compared to the model with only the constant (Field, 2009). However, another statistic, the Hosmer-Lemeshow, also provides a test of the goodness of fit and, when the p-value is greater than 0.05 indicates that the model is predicting values that are *not* significantly different from what was observed. Here, the Hosmer-Lemeshow is slightly below 0.05 and indicates that the model may produce values that are different from what was observed.

Additionally, the final *ChangeActivity* stepwise model included two variables: *Gender* and *FreqAQI* with confidence intervals that crossed 1 indicating that we lack confidence in the results. For both of these variables the Odds Ratio is greater than 1 and would typically indicate that as the predictor value increases, the odds of the outcome occurring increases (Field, 2009). However, since the lower limit of the Odds Ratio confidence interval is less than '1,' we have less confidence in this relationship because when moving towards the lower limit (and crossing '1') the relationship may be in the opposite, or inverse direction (Field, 2009). Since the stepwise method revealed that while the both variables: *Gender* and *FreqAQI* are trending towards significance but that the confidence in the relationship direction is less than 95%, we have used only the independent variable *Concern_EnvPoll* in the final regression model and the results are shown below.

The final regression model, Table 17 below, includes the independent variable *Concern_EnvPoll*, and does more accurately predict the outcome than the model with only a constant as assessed by the reduction of the log-likelihood statistic value from 200.904 to 197.804 (Field, 2009). Similarly, the Hosmer-Lemeshow statistic, a goodness of fit test, also indicates that the model is predicting values that are *not* significantly different from what was observed with a p-value of 0.867 (greater than 0.05).

Table 17: *ChangeActivity* final regression analysis.

| Independent Variable | B | p-value | Odds Ratio | 95% Confidence Interval |
|---|---|---|---|---|
| Concern_EnvPoll | -0.597 | 0.000 | 0.551 | (0.415 – 0.730) |

| Regression Method | Hosmer-Lemeshow | | Cox & Snell | Nagelkerke | Initial -2LL | Model -2LL |
|---|---|---|---|---|---|---|
| | $\chi^2$ | p-value | | | | |
| Forced | 0.728 | 0.867 | 0.122 | 0.168 | 200.904 | 197.804 |
| | | Range 0 to 1: 1 indicates the model predicts the outcome perfectly | | | | |

The Nagelkerke and Cox & Snell measurements may be read as 12% and 17%, respectively, of the variance in *ChangeActivity* may be explained by the *Concern_EnvPoll* binary logistic model.

Remember, that the variable *Concern_EnvPoll* represents the survey question, "How concerned are you with overall environmental pollution in your community?" This may broadly include the quality of the air, water, and soil. In summary, the best fit regression model for the change in a resident's behavior on poor air quality days established residents who are more concerned with overall environmental pollution are more likely to alter their behavior on poor air quality days. The Odds Ratio for *Concern_EnvPoll* suggest that as residents have a 1-increment increase in their personal level of concern for overall environmental pollution they are 55% more likely to alter their behavior on poor air quality days. This relationship is within the 95% confidence interval.

5.4.3 *ChangeActivity*: Testing of Assumptions

There are three assumptions to address when using logistic regression: linearity, independence of errors, and multicollinearity. Since the *ChangeActivity* regression model did not utilize continuous variables it was not necessary to test the linearity assumption. The independence of errors assumption was met due to the design of the household survey having one randomized household response per unique phone number. Additionally, the final regression model only included one variable thus testing for multicollinearity among the variables was not needed.

# CHAPTER 6: DISCUSSION, CONCLUSIONS, & FUTURE RESEARCH

## 6.1 Discussion

In the present study we explored indicators of individual or household resilience. Based on an earlier pilot study by Reams et al. (2013) that examined the influences on resilience among residents of Baton Rouge, Louisiana, three hypotheses were posed to examine micro-scale or household-level resilience in southern Louisiana. First, we hypothesized that there are differences in our study area trending in a north - south direction, with the southern region more likely to have higher adoption patterns of risk-reducing behaviors. Second, a decrease in a socio-economic variable will not be a significant predictor or have a strong relationship with decreases in risk-reducing behaviors. Third, an increase in an adaptive capacity variables will be a significant predictor variable and have a strong relationship with increases in risk-reducing behaviors. The theoretical framework applied to this study considers resilience to be a function of three sets of influences: exposure to hazards, vulnerability to that exposure, and an ability or capacity to adapt to avoid or reduce damages from disturbances (Cutter et al., 2003; Nelson et al., 2007; Semenza et al., 2011).

Two parallel binary logistic regression statistical models were developed to test associations with two dependent variables derived from the household-level survey. The two dependent variables are reported behavior modifications in the face of chronic and more acute exposure risks. The first dependent variable is a resident changing their behavior to reduce exposure risk to poor air quality, a chronic environmental exposure risk. The second dependent variable is adoption of a household emergency plan in response to more acute natural hazard exposure risk. In the broad sense, rates of behavior modification to poor air quality data were higher than rates of household emergency plan adoption. In addition, both best-fit regression

models established that when considering indicators of resilience one should use current *adaptive capacity variables* including resident environmental hazard awareness, perceptions of hazards and personal hazard knowledge.

### 6.1.1 Exposure and Geographical Regions

Our findings support Hypotheses 1 that there are significant differences in our study area trending in a north - south direction. Of note, our dataset utilized both external data sources and survey derived variables to include nine independent variables that addressed different types of exposure from chronic anthropogenic environmental hazards to acute natural hazard events. These nine exposure variables captured data spanning acute, chronic, anthropogenic and natural hazards were found to be significantly correlated with the *NorthSouth* variable and three of the exposure variables (*Brownfield*, *EPA_Cancer*, and *Damage*) were highly correlated or multicollinear with the *NorthSouth* variable.

Providing further support for the findings of Reams et al. (2013), Nelson et al. (2007), and Wakefield et. al (2001) where a resident's exposure to a hazard is a significant component to understanding the micro-scale adaptive measures to becoming more resilient, our results document that the southern region's increased rankings of exposure and socio-economic vulnerability, are matched with greater concern regarding acute and chronic environmental hazards including air, water, and soil quality, climate change, overall environmental pollution, and natural hazards events.

The delineation of coastal Louisiana into a northern and southern section is supported by the bivariate correlation analysis. This analysis found that the north – south grouping significantly correlated with 65% (n = 26/40) of the predictor variables. Ultimately the north-

south grouping represents the accumulation of the multiple single explanatory variables that are increased in the southern region (Orleans Parish).

### 6.1.2 Socio-economic Vulnerability

Vulnerability, according to the resilience framework, is an important factor for understanding overall community resilience to hazards. Two socio-economic variables were found to be significantly correlated with residents who are more likely to alter their behavior on poor air quality days: *Employment* (p-value = 0.002) and *Gender* (p-value = 0.034). Those who self-reported that their form of employment was retired, disabled, or volunteer were more likely to modify their plans in response to air quality forecast and reports. This finding suggests that those who have more leisure time and, thus, who potentially spend more time outdoors are cognizant of their health-related risk and, as reported, stay indoors on poor air quality days. With regards to gender, women are more likely to alter their behavior on poor air quality days.

While a significant correlation was found for these two socio-economic variables in the bivariate correlation analysis, neither were included as predictor variables in our two parallel regression analyses addressing both the adoption of an emergency plan and altered behavior on poor air quality days. This finding supports Hypothesis 2 and the Baton Rouge, Louisiana pilot study by Reams et al. (2013), that socio-economic variables, specifically decreases in socio-economic variables (lower rankings in educational attainment, income, and types of employment), are not significantly related to decreases in risk-reducing behaviors. This provides evidence that residents of south Louisiana who have had extraordinary prior environmental hazard exposure are not fatalistic in the face of future potential anthropogenic and natural hazards. Instead, when provided with relevant hazard information and, more importantly, when residents understand the hazard information, they are more likely to take anticipatory and pre-

emptive measures to reduce their risk. This is further confirmed by the 73% of respondents who indicated they would be 'somewhat likely' to 'very likely' to alter their behavior to poor air quality if made aware of the AQI every single day.

6.1.3 Adaptive Capacity

A resident's ability or capacity to understand and perceive changing threat levels then to respond in a manner as to avoid or mitigate hazard events is supported by this study as indicators of individual or household resilience. As discussed in Hypothesis 3 and demonstrated across the development of the two parallel regression models, in the bivariate analysis step, 10 adaptive capacity predictor variables are significantly correlated with the two dependent variables that represented risk-reducing behaviors and this sets the stage for future potential behavior modification in the face of an environmental hazard. Summarized in Figure 13 below, is further support for Hypothesis 3, and documented in the *AdoptEmergPlan* (p-value = 0.00) and the *ChangeActivity* (p-value = 0.00) final regression models, an increase in an individual's adaptive capacity measures is likely to increase their overall risk-reducing behaviors. Figure 16 shows

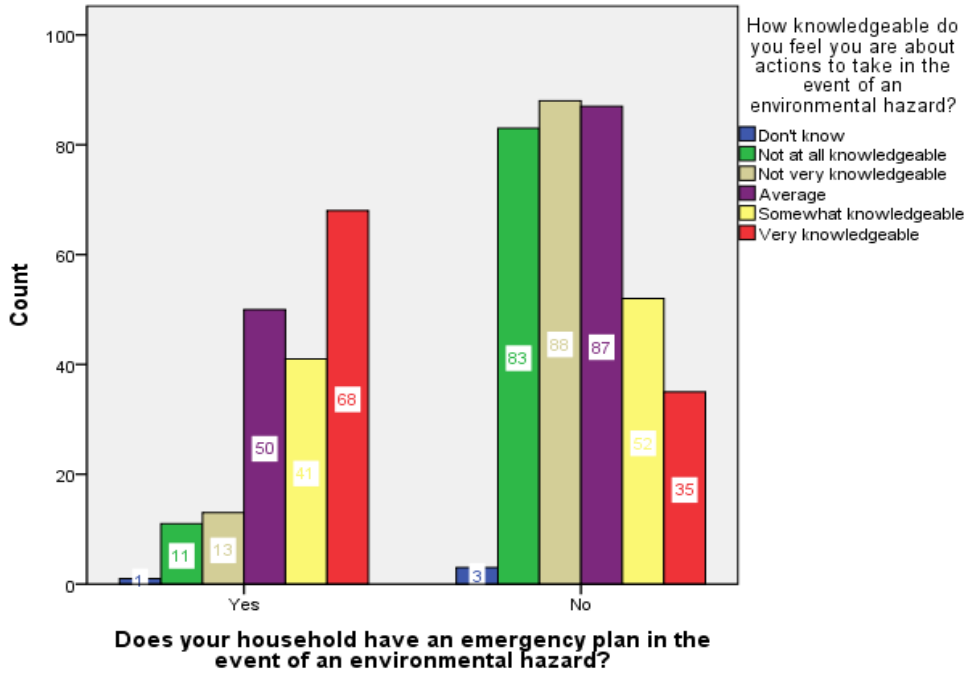


Figure 16: Cross-tabulation of *HazardKnowledge* and *AdoptEmergPlan*.

that as an individual's current level of environmental hazard knowledge increases by 1-increment they are 53% more likely to engage in the risk-reducing behavior, adoption of an emergency plan. Similarly, as summarized in Figure 17 below, almost 5 in 10 residents of the southern region reported altering their behavior on poor air quality days and this self-reported mitigation effort is associated with an increase in their personal level of concern for overall environmental pollution.

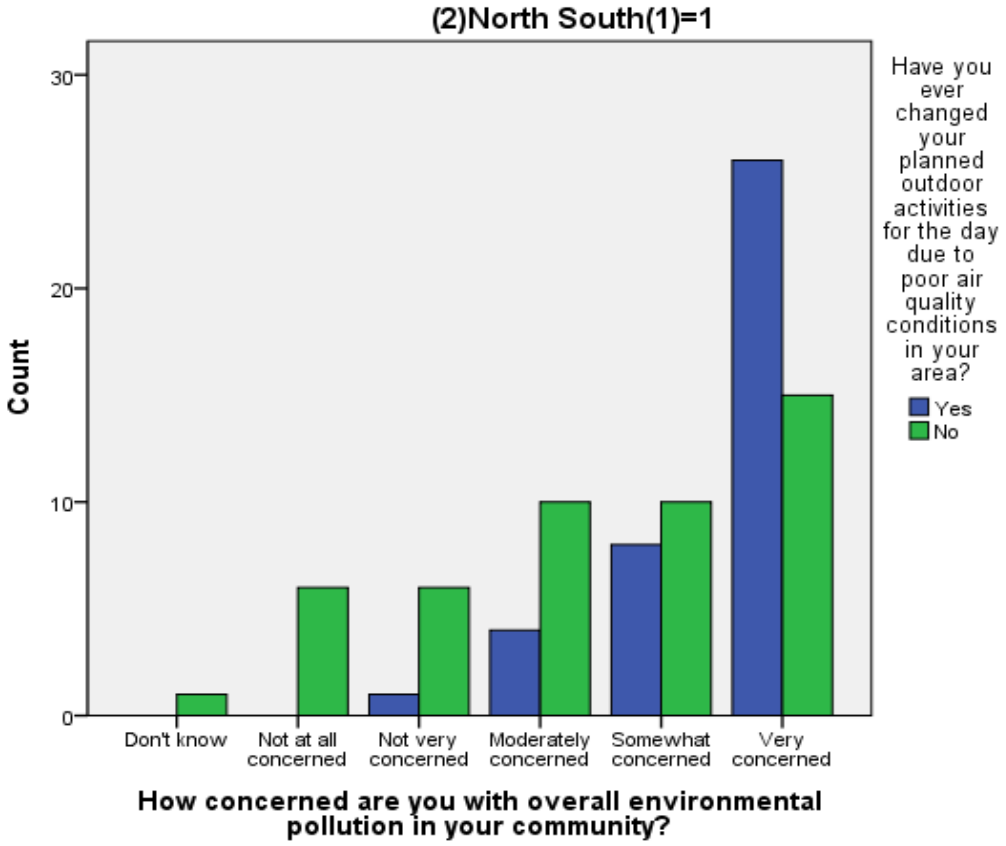


Figure 17: Cross-tabulation of *ChangeActivity* and *Concern_EnvPoll*.

## 6.2 Conclusions

The focus of this study was to better understand the influences on resident's risk-reducing behaviors that live with both chronic and acute environmental hazards. This region is at risk to both environmental and natural hazard exposures and on-going hazards associated with a range

of industrial activities. Additionally, as documented from the Louisiana Master Plan and Strauss et. al (2012), within this century up to 1 million south Louisiana residents will be facing up to 1 meter of sea level rise that could potentially increase the effects of future hurricanes, storm surges, and flooding and our study has yielded useful insights into the pattern of adoption of household-level adaptations to these potential hazards. Our findings that attitudes and knowledge about risks are significant predictors of household-level adaptations offer encouragement both because it demonstrates that residents, in this region, have not become fatalistic and that these are skills that can be improved by effective educational outreach. Also, while this study found that adoption of these risk-reducing actions is not as wide spread as one may hope, the finding suggests immediate opportunities for government agencies and public-interest organizations to increase efforts for public education. These actions need to encourage and support broader public engagement, as seen in Citizen Corp from FEMA. This citizen engagement should start from initial policy development to policy implementation, to expanded dissemination of technical information concerning changing threat levels, modernization of those dissemination techniques to include cell phone text messages and applications, along with specific strategies for reducing potential exposure. Efforts such as these should enhance the adaptive capacity of residents to understand risks more clearly, and to have more confidence in their abilities to reduce their exposure risks, thereby increasing their overall resilience to a range of future acute and chronic environmental disturbances.

### 6.3 Future Research

There are several considerations for future research that would benefit future analysis of this study area. These research improvements should include increased and focused survey

questions and methods, broadening the geographical scope of the research project, and, thus, increasing the sampling population size.

Utilizing newer technologies such as online surveying and mobile phone accessible surveys may not only increase rate of survey response but also decrease the total number of days needed to administer the survey. Additionally, administering the survey via multiple survey sampling methods such as by both land-line and mobile phone calls and by online and mobile phone applications may broadened the demographic profile of those interviewed and decrease the likelihood of survey response bias towards any one group.

Future survey questionnaires may be broadened to include or address other individual risk-reducing actions. For example, if the concern for climate change question was expanded to include carbon footprint reducing actions such as: reduced gasoline and household energy consumption, increased recycling, and water conservation, then this would provide insight to additional steps residents are taking towards mitigation. Other survey question structures may include allowing for self-reporting of obstacles to adoption of risk-reducing behaviors such as: perceived barriers or benefits, cues to take risk-reducing action, and perceived severity.

Expanding the geographical scope to include the full extent of coastal Louisiana will enhance the profile obtained of coastal Louisiana residents' and shed more light on the indirect affects geography may have on residents' exposure, socio-economic vulnerability and adaptive capacity measures. The increased geographical area and population sample size will ultimately provide a more complete representation of the residents' resiliency factors and increase the confidence levels for any future statistical analysis.

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# APPENDIX A: SURVEY QUESTIONNAIRE

We are conducting a very short survey which includes research on health hazards, media, and the effect of hazards on the local community. Data collected via this study may be used to improve your local community. This study has been approved by the LSU IRB. For questions concerning participant rights, please contact the IRB Chair, Dr. Robert C. Mathews, 578-8692, or irb@lsu.edu.

QA: AGE;
Are you 18 years of age or older?
1.Yes
2.No
QB:PhoneType;
Have I reached you on a cell phone or a regular landline phone?
1. Cell Phone
2. Landline Phone
QC: SAFE1
Are you in a safe place to talk?
1.Yes
2.No (THANKS---SCHEDULE CALL BACK)
QD: ZIP1
What is your zipcode?
[INTERIVEWER - DO NOT READ - ALLOW RESPONDENT TO SAY ZIP]
1. 70114
2. 70117
3. 70122
4. 70124
5. 70126
6. 70127
7. 70128
8. 70129
9. Other
Q: Q1: And for how long have you lived within this zip code?
-8. Don't Know / -9. Refused
Q: Q2: Do you know whom to contact in the event of an environmental hazard? [Environmental hazard is the risk of damage to the environment
eg air pollution, water pollution, toxins, radioactivity ]
1. YES
2. NO
-8. Don't Know / -9. Refused
Q: Q3: Whom would you contact in the event of an environmental hazard?
[ENTER RESPONSE]
Q: Q4: Does your household have an emergency plan in the event of an environmental hazard?
1. YES
2. NO
-8. Don't Know / -9. Refused
Q: Q5: On a scale of 1 to 5 where 5 is "very knowledgeable" and 1 is "not at all knowledgeable" how knowledgeable do you feel you are about actions to take in the event of an environmental hazard?
5 - very knowledgeable
4 - somewhat knowledgeable
3 - average
2 - not very knowledgeable
1 - not at all knowledgeable
-8. Don't Know / -9. Refused
Q: Q6: If your local government wanted to warn you about an environmental hazard, what would be the best way for them to get information to you?

[CHOOSE ONE]

1. Television
2. Radio
3. Home phone
4. Work phone
5. Text message
6. Email
7. Other (please specify)_____

-8. Don't Know / -9. Refused

Q: Q7: Has there been an emergency event involving hazardous materials in your community within the past 5 years?

1. YES
2. NO

-8. Don't Know / -9. Refused

Q: Q8: What was the cause of the emergency?

[ENTER RESPONSE]

Q: Q9: To the best of your knowledge is there a daily rating of air quality available for your community?

1. YES
2. NO

-8. Don't Know / -9. Refused

Q: Q10: Where is this air quality rating available?

[ENTER RESPONSE]

Q: Q11: And how often do you check the air quality rating of your community? Do you check it..

1. - Everyday
2. - Occasionally
3. - Sometimes
4. - Seldom
5. - Never

-8. Don't Know / -9. Refused

Q: Q12: Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area?

1. YES
2. NO

-8. Don't Know / -9. Refused

Q: Q13: And how did you alter your outdoor activities due to poor air quality conditions?

[ENTER RESPONSE]

Q: Q14: And, in your own words, why do you follow the air-quality rating?

[ENTER RESPONSE]

Q: Q15: If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating?

1. - Very likely
2. - Somewhat likely
3. - Not very likely
4. - Not at all likely

-8. Don't Know / -9. Refused

Q: Q16: I'm going to read you a list of environmental factors within your community. Please rate your concern about each on a scale of 1-5 with 5 being 'very concerned' and 1 being 'not at all concerned'. How concerned are you with air quality in your community?

5 - very concerned
4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned

-8. Don't Know / -9. Refused

Q: Q17: How concerned are you with water quality in your community?

5 - very concerned

4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned
-8. Don't Know / -9. Refused

Q: Q18: How concerned are you with soil quality in your community?
5 - very concerned
4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned
-8. Don't Know / -9. Refused

Q: Q19: How concerned are you with overall environmental pollution in your community?
5 - very concerned
4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned
-8. Don't Know / -9. Refused

Q: Q20: How concerned are you with climate change affecting your community?
5 - very concerned
4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned
-8. Don't Know / -9. Refused

Q: Q21: How concerned are you with natural disasters such as hurricanes and floods affecting your community?
5 - very concerned
4 - somewhat concerned
3 - moderately concerned
2 - not very concerned
1 - not at all concerned
-8. Don't Know / -9. Refused

Q: Q22:Which of the following do you think is the biggest environmental threat facing your community right now?
1. - Residual effects from the BP oil spill
2. - The threat of future hurricanes
3. - Environmental pollution
4. - Climate change
-8. Don't Know / -9. Refused

Q: Q23
I'm going to read you a list of state and government entities that may assist your community in the event of an environmental hazard. Please rate your confidence in each of these groups to successfully assist your community on a scale of 1 to 5 with 5 being "very confident" and 1 being "not at all confident". How confident are you in FEMA's ability to assist your community in the event of an environmental hazard?
5 - very confident
4 - somewhat confident
3 - moderately confident
2 - not very confident
1 - not at all confident
-8. Don't Know / -9. Refused

Q: Q24
How confident are you in the EPA's ability to assist your community in the event of an environmental hazard?
5 - very confident
4 - somewhat confident
3 - moderately confident
2 - not very confident

1 - not at all confident
-8. Don't Know / -9. Refused

Q: Q25
How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard?
5 - very confident
4 - somewhat confident
3 - moderately confident
2 - not very confident
1 - not at all confident
-8. Don't Know -9. Refused

Q: Q26
How confident are you in State Government's ability to assist your community in the event of an environmental hazard?
5 - very confident
4 - somewhat confident
3 - moderately confident
2 - not very confident
1 - not at all confident
-8. Don't Know / -9. Refused

Q: Q27
How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard?
5 - very confident
4 - somewhat confident
3 - moderately confident
2 - not very confident
1 - not at all confident
-8. Don't Know / -9. Refused

Q: QF1
Generally speaking do you consider yourself a Democrat, Republican, Independent, or what?
1. Democrat
2. Republican
3. Independent
4. Other
-8. Don't Know / -9. Refused

Q: QF2
Would you consider yourself a strong or not so strong?
1. Strong
2. Not so Strong
-8. Don't Know / -9. Refused

Q: QF3
Would you say, you lean to the Democratic Party or Republican Party, or would you say you don't lean to either party?
1. Democratic Party
2. Republican Party
3. Independent
-8. Don't Know / -9. Refused

Q: QF4
In what year were you born?
-8. Don't Know / -9. Refused

Q: QF5
Which of the following categories best describes your level of education?
Please stop me when I get to that category.
1. Less than 9th grade
2. 9th through 11th grade

3. High school diploma
4. Some college or vocational school
5. A 4-year college degree
6. Some graduate work
7. Advanced degree (M.A., M.S., J.D., Ph.D., M.D., etc.)
-8. Don't Know / -9. Refused

Q: QF6
Do you own your own home, pay rent, or something else?
1.Own home
2.Pay Rent
3.Something else
-8. Don't Know / -9. Refused

Q: QF7
Are you of Hispanic, Latino, or Spanish origin, such as Mexican, Puerto Rican, or Cuban?
1. Yes
2. No
-8. Don't Know / -9. Refused

Q: QF8
Which of the following best describes your race?
1. White/Caucasian
2. Black/African-American
3. Asian/Asian American
4. American Indian or Native American
5. Other
-8. Don't Know / -9. Refused

Q: QF9
What is your current marital status?
1. Married
2. Single
3. Divorced
4. Separated
5. Widowed
-8. Don't Know / -9. Refused

Q: QF10
And how many children under the age of 18 do you have living in your household?
[Enter # between 0 & 10]
-8. Don't Know / -9. Refused

Q: QF11
Are you currently employed full-time, employed part-time, retired, unemployed and looking for work, or not employed and not looking for work?
1. Employed Full-time
2. Employed Part-time
3. Retired
4. Unemployed and looking for work
5. Not employed and not looking for work
6. On Disablitiy [volunteered]
-8. Don't Know / -9. Refused

Q: QF12
We would like to know what your family income was last year before taxes. This information will remain strictly confidential and will only be used for statistical purposes. Please stop me when I get to the category that includes your family income.
1.Under $10,000
2.$10,000 - $19,999
3.$20,000 - $29,999

4.$30,000 - $39,999
5.$40,000- $49,999
6.$50,000 - $74,999
7.$75,000 - $99,999
8.$100,000 or more
-8. Don't Know / -9. Refused

Q: QF13
Record Gender [DO NOT ASK]
1.Male
2.Female

Q: THANKYOU
That is the end of the survey. I'd like to thank you for participating.
Thank you for your time. Have a good day.

# APPENDIX B: BIVARIATE CORRELATION ANALYSIS

| | | Does your household have an emergency plan in the event of an environmental hazard? | Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area? | (2)North South(1) | 2011 Total TRI Releases (lbs) | # TRI Facilites (2011) | EPA Cancer Risk (Inhalation1 in Million) | #Superfund Sites | #Brownfields (combined Zip entered sum) | Has there been an emergency event involving hazardous materials in your community within the past 5 years? | PerCapDamage | Damage | ZipHazardExp | In what year were you born? | And for how long have you lived within this zip code? | Which of the following categories best describes your level of education? | Income before taxes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Does your household have an emergency plan in the | Correlation Coefficient | 1.000 | .054 | .021 | -.010 | -.022 | -.022 | -.028 | -.016 | .039 | .038 | .014 | -.028 | -.066 | .036 | -.050 | .032 |
| | Sig. (2-tailed) | . | .484 | .621 | .822 | .615 | .603 | .523 | .708 | .372 | .383 | .750 | .512 | .125 | .406 | .250 | .598 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Have you ever changed your planned outdoor activities for | Correlation Coefficient | .054 | 1.000 | .201** | .007 | .014 | -.136 | .096 | -.201** | .137 | -.032 | .201** | -.189* | .083 | .030 | .055 | .051 |
| | Sig. (2-tailed) | .484 | . | .009 | .926 | .855 | .077 | .217 | .009 | .076 | .676 | .009 | .014 | .285 | .698 | .474 | .640 |
| | N | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 88 |
| (2)North South(1) | Correlation Coefficient | .021 | .201** | 1.000 | -.245** | -.268** | -.894** | -.223** | -.998** | .136** | -.248** | .997** | -.787** | -.004 | -.010 | .065 | .024 |
| | Sig. (2-tailed) | .621 | .009 | . | .000 | .000 | .000 | .000 | .000 | .002 | .000 | .000 | .000 | .933 | .821 | .130 | .694 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| 2011 Total TRI Releases (lbs) | Correlation Coefficient | -.010 | .007 | -.245** | 1.000 | .986** | .024 | .798** | .240** | -.064 | .156** | -.240** | .180** | -.041 | .043 | -.039 | .004 |
| | Sig. (2-tailed) | .822 | .926 | .000 | . | .000 | .578 | .000 | .000 | .140 | .000 | .000 | .000 | .340 | .320 | .366 | .950 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| # TRI Facilites (2011) | Correlation Coefficient | -.022 | .014 | -.268** | .986** | 1.000 | .056 | .820** | .258** | -.058 | .119** | -.258** | .202** | -.031 | .047 | -.048 | .006 |
| | Sig. (2-tailed) | .615 | .855 | .000 | .000 | . | .196 | .000 | .000 | .179 | .006 | .000 | .000 | .470 | .282 | .264 | .927 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| EPA Cancer Risk (Inhalation1 in Million) | Correlation Coefficient | -.022 | -.136 | -.894** | .024 | .056 | 1.000 | .238** | .895** | -.100* | .129** | -.895** | .711** | .021 | .019 | -.048 | -.033 |
| | Sig. (2-tailed) | .603 | .077 | .000 | .578 | .196 | . | .000 | .000 | .020 | .003 | .000 | .000 | .627 | .656 | .272 | .593 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| #Superfund Sites | Correlation Coefficient | -.028 | .096 | -.223** | .798** | .820** | .238** | 1.000 | .224** | -.023 | -.027 | -.224** | .193** | -.037 | .073 | -.048 | .014 |
| | Sig. (2-tailed) | .523 | .217 | .000 | .000 | .000 | .000 | . | .000 | .593 | .531 | .000 | .000 | .392 | .092 | .269 | .820 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| #Brownfields (combined Zip entered sum) | Correlation Coefficient | -.016 | -.201** | -.998** | .240** | .258** | .895** | .224** | 1.000 | -.138** | .255** | -.999** | .784** | -.001 | .015 | -.064 | -.025 |
| | Sig. (2-tailed) | .708 | .009 | .000 | .000 | .000 | .000 | .000 | . | .001 | .000 | .000 | .000 | .974 | .723 | .138 | .684 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Has there been an emergency event involving | Correlation Coefficient | .039 | .137 | .136** | -.064 | -.058 | -.100* | -.023 | -.138** | 1.000 | -.071 | .138** | -.050 | .022 | .056 | -.050 | -.007 |
| | Sig. (2-tailed) | .372 | .076 | .002 | .140 | .179 | .020 | .593 | .001 | . | .102 | .001 | .249 | .610 | .195 | .247 | .908 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |

| | | Does your household have an emergency plan in the event of an environmental hazard? | Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area? | (2)North South(1) | 2011 Total TRI Releases (lbs) | # TRI Facilites (2011) | EPA Cancer Risk (Inhalation1 in Million) | #Superfund Sites | #Brownfields (combined Zip entered sum) | Has there been an emergency event involving hazardous materials in your community within the past 5 years? | PerCapDamage | Damage | ZipHazardExp | In what year were you born? | And for how long have you lived within this zip code? | Which of the following categories best describes your level of education? | Income before taxes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PerCapDamage | Correlation Coefficient | .038 | -.032 | -.248** | .156** | .119** | .129** | -.027 | .255** | -.071 | 1.000 | -.255** | -.006 | .032 | -.041 | .007 | -.041 |
| | Sig. (2-tailed) | .383 | .676 | .000 | .000 | .006 | .003 | .531 | .000 | .102 | . | .000 | .883 | .460 | .345 | .865 | .506 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Damage | Correlation Coefficient | .014 | .201** | .997** | -.240** | -.258** | -.895** | -.224** | -.999** | .138** | -.255** | 1.000 | -.782** | -.001 | -.015 | .067 | .030 |
| | Sig. (2-tailed) | .750 | .009 | .000 | .000 | .000 | .000 | .000 | .000 | .001 | .000 | . | .000 | .986 | .736 | .124 | .626 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| ZipHazardExp | Correlation Coefficient | -.028 | -.189* | -.787** | .180** | .202** | .711** | .193** | .784** | -.050 | -.006 | -.782** | 1.000 | .031 | .006 | -.005 | -.002 |
| | Sig. (2-tailed) | .512 | .014 | .000 | .000 | .000 | .000 | .000 | .000 | .249 | .883 | .000 | . | .469 | .889 | .907 | .973 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| In what year were you born? | Correlation Coefficient | -.066 | .083 | -.004 | -.041 | -.031 | .021 | -.037 | -.001 | .022 | .032 | -.001 | .031 | 1.000 | -.365** | .045 | -.081 |
| | Sig. (2-tailed) | .125 | .285 | .933 | .340 | .470 | .627 | .392 | .974 | .610 | .460 | .986 | .469 | . | .000 | .295 | .186 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| And for how long have you lived within this zip code? | Correlation Coefficient | .036 | .030 | -.010 | .043 | .047 | .019 | .073 | .015 | .056 | -.041 | -.015 | .006 | -.365** | 1.000 | -.010 | -.074 |
| | Sig. (2-tailed) | .406 | .698 | .821 | .320 | .282 | .656 | .092 | .723 | .195 | .345 | .736 | .889 | .000 | . | .822 | .227 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Which of the following categories best describes | Correlation Coefficient | -.050 | .055 | .065 | -.039 | -.048 | -.048 | -.048 | -.064 | -.050 | .007 | .067 | -.005 | .045 | -.010 | 1.000 | .288** |
| | Sig. (2-tailed) | .250 | .474 | .130 | .366 | .264 | .272 | .269 | .138 | .247 | .865 | .124 | .907 | .295 | .822 | . | .000 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Income before taxes | Correlation Coefficient | .032 | .051 | .024 | .004 | .006 | -.033 | .014 | -.025 | -.007 | -.041 | .030 | -.002 | -.081 | -.074 | .288** | 1.000 |
| | Sig. (2-tailed) | .598 | .640 | .694 | .950 | .927 | .593 | .820 | .684 | .908 | .506 | .626 | .973 | .186 | .227 | .000 | . |
| | N | 269 | 88 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 |
| Do you own your own home, pay rent, or something | Correlation Coefficient | .016 | -.092 | -.126** | .010 | .022 | .090* | -.011 | .124** | .065 | .000 | -.125** | .136** | .361** | -.301** | -.242** | -.173** |
| | Sig. (2-tailed) | .707 | .234 | .003 | .825 | .609 | .037 | .792 | .004 | .133 | .994 | .004 | .002 | .000 | .000 | .000 | .004 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Employment | Correlation Coefficient | .062 | -.232** | -.028 | .104* | .109* | -.023 | .066 | .027 | .040 | -.035 | -.027 | .008 | -.246** | .029 | -.273** | -.159** |
| | Sig. (2-tailed) | .150 | .002 | .517 | .017 | .012 | .593 | .126 | .531 | .360 | .425 | .528 | .848 | .000 | .505 | .000 | .009 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |

| | | Does your household have an emergency plan in the event of an environmental hazard? | Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area? | (2)North South(1) | 2011 Total TRI Releases (lbs) | # TRI Facilites (2011) | EPA Cancer Risk (Inhalation1 in Million) | #Superfund Sites | #Brownfields (combined Zip entered sum) | Has there been an emergency event involving hazardous materials in your community within the past 5 years? | PerCapDamage | Damage | ZipHazardExp | In what year were you born? | And for how long have you lived within this zip code? | Which of the following categories best describes your level of education? | Income before taxes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Which of the following best describes your race? | Correlation Coefficient | -.004 | -.125 | -.558** | .225** | .236** | .484** | .218** | .562** | -.084 | .057 | -.562** | .370** | .100* | -.021 | -.190** | -.118 |
| | Sig. (2-tailed) | .923 | .104 | .000 | .000 | .000 | .000 | .000 | .000 | .051 | .185 | .000 | .000 | .021 | .620 | .000 | .053 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| What is your current marital status? | Correlation Coefficient | .023 | -.097 | -.196** | .036 | .047 | .157** | .005 | .193** | -.004 | .029 | -.190** | .182** | .017 | -.054 | -.210** | -.162** |
| | Sig. (2-tailed) | .597 | .209 | .000 | .410 | .279 | .000 | .901 | .000 | .920 | .504 | .000 | .000 | .696 | .210 | .000 | .008 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| And how many children under the age of 18 do | Correlation Coefficient | -.010 | .103 | .085* | -.056 | -.044 | -.065 | -.052 | -.088* | -.030 | .049 | .090* | -.036 | .493** | -.219** | .050 | .044 |
| | Sig. (2-tailed) | .820 | .181 | .049 | .197 | .309 | .130 | .231 | .042 | .487 | .261 | .037 | .402 | .000 | .000 | .248 | .468 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Gender | Correlation Coefficient | .031 | -.163* | -.058 | .075 | .077 | .035 | .056 | .055 | .046 | -.048 | -.054 | .054 | -.015 | -.031 | -.062 | -.010 |
| | Sig. (2-tailed) | .471 | .034 | .181 | .083 | .076 | .425 | .196 | .203 | .290 | .263 | .215 | .212 | .732 | .476 | .154 | .873 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Do you know whom to contact in the event of an | Correlation Coefficient | .138** | .077 | -.141** | -.008 | .000 | .126** | .013 | .138** | .057 | -.020 | -.136** | .152** | .106* | -.093* | -.119** | -.005 |
| | Sig. (2-tailed) | .001 | .320 | .001 | .861 | .991 | .004 | .769 | .001 | .184 | .649 | .002 | .000 | .015 | .031 | .006 | .935 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How knowledgeable do you feel you are about actions | Correlation Coefficient | -.392** | .038 | -.026 | .062 | .068 | .035 | .076 | .024 | .003 | -.023 | -.025 | -.011 | -.033 | .013 | .031 | -.053 |
| | Sig. (2-tailed) | .000 | .626 | .543 | .151 | .115 | .424 | .078 | .586 | .943 | .600 | .565 | .791 | .443 | .756 | .467 | .383 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| To the best of your knowledge is there a daily rating of air | Correlation Coefficient | .042 | . | -.086* | .003 | .013 | .046 | -.036 | .087* | -.097* | .056 | -.089* | .024 | .021 | .079 | -.041 | -.077 |
| | Sig. (2-tailed) | .330 | . | .047 | .950 | .764 | .292 | .411 | .044 | .025 | .192 | .038 | .576 | .627 | .068 | .341 | .209 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| And how often do you check the air quality rating of your | Correlation Coefficient | .067 | .265** | .038 | .052 | .056 | -.038 | .026 | -.038 | .035 | .002 | .038 | -.017 | .099 | .004 | .048 | -.045 |
| | Sig. (2-tailed) | .390 | .000 | .623 | .501 | .473 | .626 | .733 | .623 | .649 | .980 | .623 | .822 | .202 | .957 | .536 | .676 |
| | N | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 88 |
| If you were made aware of the air quality rating every single | Correlation Coefficient | .026 | .310** | .198** | -.069 | -.079 | -.159** | -.087 | -.202** | -.001 | -.048 | .202** | -.150** | .084 | -.063 | .155** | -.026 |
| | Sig. (2-tailed) | .563 | .000 | .000 | .122 | .076 | .000 | .052 | .000 | .983 | .279 | .000 | .001 | .060 | .160 | .000 | .676 |
| | N | 502 | 135 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 252 |

| | | Does your household have an emergency plan in the event of an environmental hazard? | Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area? | (2)North South(1) | 2011 Total TRI Releases (lbs) | # TRI Facilites (2011) | EPA Cancer Risk (Inhalation1 in Million) | #Superfund Sites | #Brownfields (combined Zip entered sum) | Has there been an emergency event involving hazardous materials in your community within the past 5 years? | PerCapDamage | Damage | ZipHazardExp | In what year were you born? | And for how long have you lived within this zip code? | Which of the following categories best describes your level of education? | Income before taxes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Generally speaking do you consider yourself a Democrat, | Correlation Coefficient | .012 | .059 | .352** | -.161** | -.167** | -.319** | -.181** | -.353** | .044 | -.049 | .350** | -.252** | .114** | -.073 | .095* | .037 |
| | Sig. (2-tailed) | .791 | .442 | .000 | .000 | .000 | .000 | .000 | .000 | .304 | .255 | .000 | .000 | .008 | .091 | .028 | .544 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with air quality in your | Correlation Coefficient | -.047 | -.397** | -.251** | .071 | .086* | .221** | .094* | .252** | -.058 | .080 | -.253** | .122** | -.158** | .055 | -.125** | -.068 |
| | Sig. (2-tailed) | .281 | .000 | .000 | .101 | .045 | .000 | .029 | .000 | .180 | .063 | .000 | .005 | .000 | .206 | .004 | .268 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with water quality in your | Correlation Coefficient | .012 | -.224** | -.216** | .074 | .088* | .201** | .125** | .218** | -.107* | .065 | -.220** | .097* | -.027 | -.012 | -.023 | -.105 |
| | Sig. (2-tailed) | .789 | .003 | .000 | .089 | .042 | .000 | .004 | .000 | .014 | .132 | .000 | .024 | .540 | .787 | .599 | .085 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with soil quality in your | Correlation Coefficient | -.014 | -.285** | -.218** | .128** | .130** | .205** | .167** | .223** | -.104* | .074 | -.224** | .112** | -.065 | .025 | -.052 | -.093 |
| | Sig. (2-tailed) | .754 | .000 | .000 | .003 | .003 | .000 | .000 | .000 | .016 | .088 | .000 | .010 | .131 | .566 | .233 | .129 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with overall environment | Correlation Coefficient | -.032 | -.337** | -.280** | .136** | .153** | .252** | .189** | .282** | -.066 | .081 | -.283** | .146** | -.041 | .082 | -.118** | -.107 |
| | Sig. (2-tailed) | .463 | .000 | .000 | .002 | .000 | .000 | .000 | .000 | .128 | .060 | .000 | .001 | .348 | .058 | .006 | .081 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with climate change | Correlation Coefficient | -.050 | -.307** | -.206** | .058 | .065 | .210** | .118** | .210** | -.042 | .027 | -.208** | .117** | .004 | .013 | -.120** | -.006 |
| | Sig. (2-tailed) | .251 | .000 | .000 | .181 | .134 | .000 | .006 | .000 | .331 | .533 | .000 | .007 | .920 | .764 | .005 | .927 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How concerned are you with natural disasters | Correlation Coefficient | -.023 | -.218** | -.201** | .049 | .062 | .217** | .115** | .199** | -.008 | -.020 | -.198** | .190** | -.085* | .025 | -.021 | -.054 |
| | Sig. (2-tailed) | .596 | .004 | .000 | .253 | .153 | .000 | .008 | .000 | .851 | .638 | .000 | .000 | .050 | .565 | .636 | .374 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| Which of the following do you think is the biggest environment | Correlation Coefficient | .027 | -.075 | .005 | -.021 | -.018 | .027 | .018 | -.004 | .070 | -.006 | .004 | -.084 | .049 | .031 | -.008 | -.002 |
| | Sig. (2-tailed) | .536 | .331 | .916 | .622 | .676 | .536 | .686 | .918 | .104 | .892 | .919 | .051 | .259 | .469 | .859 | .972 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |

| | | Does your household have an emergency plan in the event of an environmental hazard? | Have you ever changed your planned outdoor activities for the day due to poor air quality conditions in your area? | (2)North South(1) | 2011 Total TRI Releases (lbs) | # TRI Facilites (2011) | EPA Cancer Risk (Inhalation1 in Million) | #Superfund Sites | #Brownfields (combined Zip entered sum) | Has there been an emergency event involving hazardous materials in your community within the past 5 years? | PerCapDamage | Damage | ZipHazardExp | In what year were you born? | And for how long have you lived within this zip code? | Which of the following categories best describes your level of education? | Income before taxes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| How confident are you in FEMA's ability to | Correlation Coefficient | .075 | .011 | -.071 | .062 | .071 | .032 | .037 | .071 | .042 | .009 | -.071 | .023 | -.027 | .008 | -.093* | -.038 |
| | Sig. (2-tailed) | .083 | .892 | .099 | .151 | .102 | .455 | .390 | .100 | .330 | .835 | .102 | .600 | .536 | .860 | .031 | .532 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How confident are you in the EPA's ability to assist your | Correlation Coefficient | -.043 | -.120 | -.078 | .013 | .012 | .083 | .039 | .085* | .031 | .026 | -.083 | .066 | .102* | -.012 | -.039 | .073 |
| | Sig. (2-tailed) | .317 | .119 | .070 | .756 | .785 | .056 | .364 | .049 | .470 | .548 | .055 | .125 | .018 | .777 | .365 | .233 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How confident are you in your Local City Government' | Correlation Coefficient | .058 | .114 | .296** | -.085 | -.088* | -.267** | -.039 | -.292** | .097* | -.111** | .292** | -.202** | .010 | .041 | -.001 | .025 |
| | Sig. (2-tailed) | .183 | .140 | .000 | .050 | .041 | .000 | .365 | .000 | .025 | .010 | .000 | .000 | .818 | .347 | .982 | .685 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How confident are you in State Government's ability to | Correlation Coefficient | .068 | .011 | .206** | -.070 | -.078 | -.209** | -.059 | -.203** | .068 | -.026 | .200** | -.116** | .000 | .015 | -.100* | -.011 |
| | Sig. (2-tailed) | .117 | .887 | .000 | .106 | .071 | .000 | .175 | .000 | .116 | .547 | .000 | .007 | .997 | .723 | .021 | .859 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |
| How confident are you in the Federal Government' | Correlation Coefficient | .056 | -.105 | -.225** | .046 | .047 | .184** | .041 | .230** | -.037 | .056 | -.229** | .158** | .032 | .040 | -.120** | -.044 |
| | Sig. (2-tailed) | .192 | .176 | .000 | .287 | .278 | .000 | .339 | .000 | .395 | .198 | .000 | .000 | .461 | .351 | .005 | .473 |
| | N | 536 | 169 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 269 |

| | | Do you own your own home, pay rent, or something else? | Employment | Which of the following best describes your race? | What is your current marital status? | And how many children under the age of 18 do you have living in your household? | Gender | Do you know whom to contact in the event of an environmental hazard | How knowledgeable do you feel you are about actions to take in the event of an environmental hazard? | To the best of your knowledge is there a daily rating of air quality available for your community? | And how often do you check the air quality rating of your community? Do you check it | If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating? | Generally speaking do you consider yourself a Democrat, Republican, Independent, or what? | How concerned are you with air quality in your community? | How concerned are you with water quality in your community? | How concerned are you with soil quality in your community? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Does your household have an emergency plan in the | Correlation Coefficient | .016 | .062 | -.004 | .023 | -.010 | .031 | .138** | -.392** | .042 | .067 | .026 | .012 | -.047 | .012 | -.014 |
| | Sig. (2-tailed) | .707 | .150 | .923 | .597 | .820 | .471 | .001 | .000 | .330 | .390 | .563 | .791 | .281 | .789 | .754 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Have you ever changed your planned outdoor activities for | Correlation Coefficient | -.092 | -.232** | -.125 | -.097 | .103 | -.163* | .077 | .038 | . | .265** | .310** | .059 | -.397** | -.224** | -.285** |
| | Sig. (2-tailed) | .234 | .002 | .104 | .209 | .181 | .034 | .320 | .626 | . | .000 | .000 | .442 | .000 | .003 | .000 |
| | N | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 135 | 169 | 169 | 169 | 169 |
| (2)North South(1) | Correlation Coefficient | -.126** | -.028 | -.558** | -.196** | .085* | -.058 | -.141** | -.026 | -.086* | .038 | .198** | .352** | -.251** | -.216** | -.218** |
| | Sig. (2-tailed) | .003 | .517 | .000 | .000 | .049 | .181 | .001 | .543 | .047 | .623 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| 2011 Total TRI Releases (lbs) | Correlation Coefficient | .010 | .104* | .225** | .036 | -.056 | .075 | -.008 | .062 | .003 | .052 | -.069 | -.161** | .071 | .074 | .128** |
| | Sig. (2-tailed) | .825 | .017 | .000 | .410 | .197 | .083 | .861 | .151 | .950 | .501 | .122 | .000 | .101 | .089 | .003 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| # TRI Facilites (2011) | Correlation Coefficient | .022 | .109* | .236** | .047 | -.044 | .077 | .000 | .068 | .013 | .056 | -.079 | -.167** | .086* | .088* | .130** |
| | Sig. (2-tailed) | .609 | .012 | .000 | .279 | .309 | .076 | .991 | .115 | .764 | .473 | .076 | .000 | .045 | .042 | .003 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| EPA Cancer Risk (Inhalation1 in Million) | Correlation Coefficient | .090* | -.023 | .484** | .157** | -.065 | .035 | .126** | .035 | .046 | -.038 | -.159** | -.319** | .221** | .201** | .205** |
| | Sig. (2-tailed) | .037 | .593 | .000 | .000 | .130 | .425 | .004 | .424 | .292 | .626 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| #Superfund Sites | Correlation Coefficient | -.011 | .066 | .218** | .005 | -.052 | .056 | .013 | .076 | -.036 | .026 | -.087 | -.181** | .094* | .125** | .167** |
| | Sig. (2-tailed) | .792 | .126 | .000 | .901 | .231 | .196 | .769 | .078 | .411 | .733 | .052 | .000 | .029 | .004 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| #Brownfields (combined Zip entered sum) | Correlation Coefficient | .124** | .027 | .562** | .193** | -.088* | .055 | .138** | .024 | .087* | -.038 | -.202** | -.353** | .252** | .218** | .223** |
| | Sig. (2-tailed) | .004 | .531 | .000 | .000 | .042 | .203 | .001 | .586 | .044 | .623 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Has there been an emergency event involving | Correlation Coefficient | .065 | .040 | -.084 | -.004 | -.030 | .046 | .057 | .003 | -.097* | .035 | -.001 | .044 | -.058 | -.107* | -.104* |
| | Sig. (2-tailed) | .133 | .360 | .051 | .920 | .487 | .290 | .184 | .943 | .025 | .649 | .983 | .304 | .180 | .014 | .016 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |

| | | Do you own your own home, pay rent, or something else? | Employment | Which of the following best describes your race? | What is your current marital status? | And how many children under the age of 18 do you have living in your household? | Gender | Do you know whom to contact in the event of an environmental hazard | How knowledgeable do you feel you are about actions to take in the event of an environmental hazard? | To the best of your knowledge is there a daily rating of air quality available for your community? | And how often do you check the air quality rating of your community? Do you check it | If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating? | Generally speaking do you consider yourself a Democrat, Republican, Independent, or what? | How concerned are you with air quality in your community? | How concerned are you with water quality in your community? | How concerned are you with soil quality in your community? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PerCapDamage | Correlation Coefficient | .000 | -.035 | .057 | .029 | .049 | -.048 | -.020 | -.023 | .056 | .002 | -.048 | -.049 | .080 | .065 | .074 |
| | Sig. (2-tailed) | .994 | .425 | .185 | .504 | .261 | .263 | .649 | .600 | .192 | .980 | .279 | .255 | .063 | .132 | .088 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Damage | Correlation Coefficient | -.125** | -.027 | -.562** | -.190** | .090* | -.054 | -.136** | -.025 | -.089* | .038 | .202** | .350** | -.253** | -.220** | -.224** |
| | Sig. (2-tailed) | .004 | .528 | .000 | .000 | .037 | .215 | .002 | .565 | .038 | .623 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| ZipHazardExp | Correlation Coefficient | .136** | .008 | .370** | .182** | -.036 | .054 | .152** | -.011 | .024 | -.017 | -.150** | -.252** | .122** | .097* | .112** |
| | Sig. (2-tailed) | .002 | .848 | .000 | .000 | .402 | .212 | .000 | .791 | .576 | .822 | .001 | .000 | .005 | .024 | .010 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| In what year were you born? | Correlation Coefficient | .361** | -.246** | .100* | .017 | .493** | -.015 | .106* | -.033 | .021 | .099 | .084 | .114** | -.158** | -.027 | -.065 |
| | Sig. (2-tailed) | .000 | .000 | .021 | .696 | .000 | .732 | .015 | .443 | .627 | .202 | .060 | .008 | .000 | .540 | .131 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| And for how long have you lived within this zip code? | Correlation Coefficient | -.301** | .029 | -.021 | -.054 | -.219** | -.031 | -.093* | .013 | .079 | .004 | -.063 | -.073 | .055 | -.012 | .025 |
| | Sig. (2-tailed) | .000 | .505 | .620 | .210 | .000 | .476 | .031 | .756 | .068 | .957 | .160 | .091 | .206 | .787 | .566 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Which of the following categories best describes | Correlation Coefficient | -.242** | -.273** | -.190** | -.210** | .050 | -.062 | -.119** | .031 | -.041 | .048 | .155** | .095* | -.125** | -.023 | -.052 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .248 | .154 | .006 | .467 | .341 | .536 | .000 | .028 | .004 | .599 | .233 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Income before taxes | Correlation Coefficient | -.173** | -.159** | -.118 | -.162** | .044 | -.010 | -.005 | -.053 | -.077 | -.045 | -.026 | .037 | -.068 | -.105 | -.093 |
| | Sig. (2-tailed) | .004 | .009 | .053 | .008 | .468 | .873 | .935 | .383 | .209 | .676 | .676 | .544 | .268 | .085 | .129 |
| | N | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 88 | 252 | 269 | 269 | 269 | 269 |
| Do you own your own home, pay rent, or something | Correlation Coefficient | 1.000 | .166** | .207** | .348** | .117** | -.023 | .165** | -.093* | -.006 | .129 | -.014 | .004 | -.014 | -.041 | -.038 |
| | Sig. (2-tailed) | . | .000 | .000 | .000 | .007 | .588 | .000 | .032 | .894 | .094 | .763 | .925 | .744 | .343 | .377 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Employment | Correlation Coefficient | .166** | 1.000 | .131** | .195** | -.145** | .077 | .044 | .007 | -.022 | -.064 | -.118** | -.076 | .093* | .020 | .037 |
| | Sig. (2-tailed) | .000 | . | .002 | .000 | .001 | .077 | .304 | .872 | .615 | .407 | .008 | .081 | .032 | .647 | .388 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |

| | | Do you own your own home, pay rent, or something else? | Employment | Which of the following best describes your race? | What is your current marital status? | And how many children under the age of 18 do you have living in your household? | Gender | Do you know whom to contact in the event of an environmental hazard | How knowledgeable do you feel you are about actions to take in the event of an environmental hazard? | To the best of your knowledge is there a daily rating of air quality available for your community? | And how often do you check the air quality rating of your community? Do you check it | If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating? | Generally speaking do you consider yourself a Democrat, Republican, Independent, or what? | How concerned are you with air quality in your community? | How concerned are you with water quality in your community? | How concerned are you with soil quality in your community? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Which of the following best describes your race? | Correlation Coefficient | .207** | .131** | 1.000 | .273** | .021 | .072 | .170** | -.011 | .082 | -.036 | -.211** | -.306** | .262** | .219** | .242** |
| | Sig. (2-tailed) | .000 | .002 | . | .000 | .633 | .095 | .000 | .799 | .056 | .643 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| What is your current marital status? | Correlation Coefficient | .348** | .195** | .273** | 1.000 | -.063 | .106* | .117** | -.113** | .016 | .018 | -.101* | -.091* | .127** | .013 | .043 |
| | Sig. (2-tailed) | .000 | .000 | .000 | . | .145 | .014 | .007 | .009 | .709 | .813 | .024 | .035 | .003 | .758 | .322 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| And how many children under the age of 18 do | Correlation Coefficient | .117** | -.145** | .021 | -.063 | 1.000 | -.014 | .033 | .035 | -.080 | .051 | .030 | .135** | -.118** | -.005 | -.002 |
| | Sig. (2-tailed) | .007 | .001 | .633 | .145 | . | .747 | .451 | .424 | .065 | .510 | .508 | .002 | .006 | .905 | .955 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Gender | Correlation Coefficient | -.023 | .077 | .072 | .106* | -.014 | 1.000 | .094* | -.124** | .016 | -.002 | -.189** | -.196** | .130** | .088* | .095* |
| | Sig. (2-tailed) | .588 | .077 | .095 | .014 | .747 | . | .030 | .004 | .719 | .983 | .000 | .000 | .003 | .041 | .027 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Do you know whom to contact in the event of an | Correlation Coefficient | .165** | .044 | .170** | .117** | .033 | .094* | 1.000 | -.203** | -.009 | .169* | -.031 | -.103* | .013 | .016 | -.016 |
| | Sig. (2-tailed) | .000 | .304 | .000 | .007 | .451 | .030 | . | .000 | .833 | .028 | .488 | .017 | .770 | .713 | .716 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How knowledgeable do you feel you are about actions | Correlation Coefficient | -.093* | .007 | -.011 | -.113** | .035 | -.124** | -.203** | 1.000 | -.048 | -.275** | -.041 | .037 | .029 | -.029 | .027 |
| | Sig. (2-tailed) | .032 | .872 | .799 | .009 | .424 | .004 | .000 | . | .270 | .000 | .359 | .390 | .497 | .504 | .529 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| To the best of your knowledge is there a daily rating of air | Correlation Coefficient | -.006 | -.022 | .082 | .016 | -.080 | .016 | -.009 | -.048 | 1.000 | . | -.093* | -.061 | .104* | .093* | .068 |
| | Sig. (2-tailed) | .894 | .615 | .056 | .709 | .065 | .719 | .833 | .270 | . | . | .037 | .157 | .016 | .031 | .114 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| And how often do you check the air quality rating of your | Correlation Coefficient | .129 | -.064 | -.036 | .018 | .051 | -.002 | .169* | -.275** | . | 1.000 | .221** | .021 | -.265** | -.040 | -.159* |
| | Sig. (2-tailed) | .094 | .407 | .643 | .813 | .510 | .983 | .028 | .000 | . | . | .010 | .790 | .001 | .610 | .039 |
| | N | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 135 | 169 | 169 | 169 | 169 |
| If you were made aware of the air quality rating every single | Correlation Coefficient | -.014 | -.118** | -.211** | -.101* | .030 | -.189** | -.031 | -.041 | -.093* | .221** | 1.000 | .226** | -.308** | -.184** | -.270** |
| | Sig. (2-tailed) | .763 | .008 | .000 | .024 | .508 | .000 | .488 | .359 | .037 | .010 | . | .000 | .000 | .000 | .000 |
| | N | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 135 | 502 | 502 | 502 | 502 | 502 |

| | | Do you own your own home, pay rent, or something else? | Employment | Which of the following best describes your race? | What is your current marital status? | And how many children under the age of 18 do you have living in your household? | Gender | Do you know whom to contact in the event of an environmental hazard | How knowledgeable do you feel you are about actions to take in the event of an environmental hazard? | To the best of your knowledge is there a daily rating of air quality available for your community? | And how often do you check the air quality rating of your community? Do you check it | If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating? | Generally speaking do you consider yourself a Democrat, Republican, Independent, or what? | How concerned are you with air quality in your community? | How concerned are you with water quality in your community? | How concerned are you with soil quality in your community? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Generally speaking do you consider yourself a Democrat, | Correlation Coefficient | .004 | -.076 | -.306** | -.091* | .135** | -.196** | -.103* | .037 | -.061 | .021 | .226** | 1.000 | -.139** | -.062 | -.119** |
| | Sig. (2-tailed) | .925 | .081 | .000 | .035 | .002 | .000 | .017 | .390 | .157 | .790 | .000 | . | .001 | .153 | .006 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with air quality in your | Correlation Coefficient | -.014 | .093* | .262** | .127** | -.118** | .130** | .013 | .029 | .104* | -.265** | -.308** | -.139** | 1.000 | .529** | .576** |
| | Sig. (2-tailed) | .744 | .032 | .000 | .003 | .006 | .003 | .770 | .497 | .016 | .001 | .000 | .001 | . | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with water quality in your | Correlation Coefficient | -.041 | .020 | .219** | .013 | -.005 | .088* | .016 | -.029 | .093* | -.040 | -.184** | -.062 | .529** | 1.000 | .607** |
| | Sig. (2-tailed) | .343 | .647 | .000 | .758 | .905 | .041 | .713 | .504 | .031 | .610 | .000 | .153 | .000 | . | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with soil quality in your | Correlation Coefficient | -.038 | .037 | .242** | .043 | -.002 | .095* | -.016 | .027 | .068 | -.159* | -.270** | -.119** | .576** | .607** | 1.000 |
| | Sig. (2-tailed) | .377 | .388 | .000 | .322 | .955 | .027 | .716 | .529 | .114 | .039 | .000 | .006 | .000 | .000 | . |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with overall environment | Correlation Coefficient | .021 | .077 | .313** | .124** | -.006 | .103* | .008 | .022 | .108* | -.153* | -.309** | -.183** | .646** | .605** | .687** |
| | Sig. (2-tailed) | .631 | .075 | .000 | .004 | .897 | .017 | .851 | .609 | .012 | .047 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with climate change | Correlation Coefficient | .076 | .078 | .262** | .126** | .019 | .088* | .045 | -.006 | .055 | -.161* | -.299** | -.165** | .506** | .356** | .446** |
| | Sig. (2-tailed) | .078 | .071 | .000 | .004 | .659 | .042 | .296 | .893 | .206 | .037 | .000 | .000 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How concerned are you with natural disasters | Correlation Coefficient | -.035 | .013 | .166** | .059 | -.066 | .040 | .026 | -.065 | -.018 | -.071 | -.158** | -.137** | .366** | .348** | .338** |
| | Sig. (2-tailed) | .416 | .770 | .000 | .171 | .130 | .355 | .552 | .132 | .670 | .358 | .000 | .001 | .000 | .000 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| Which of the following do you think is the biggest environment | Correlation Coefficient | .010 | .038 | .064 | .065 | -.041 | .020 | .038 | -.026 | -.023 | .118 | .043 | -.027 | .000 | .049 | .073 |
| | Sig. (2-tailed) | .821 | .380 | .138 | .132 | .340 | .637 | .383 | .551 | .600 | .126 | .336 | .535 | .997 | .258 | .092 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |

| | | Do you own your own home, pay rent, or something else? | Employment | Which of the following best describes your race? | What is your current marital status? | And how many children under the age of 18 do you have living in your household? | Gender | Do you know whom to contact in the event of an environmental hazard | How knowledgeable do you feel you are about actions to take in the event of an environmental hazard? | To the best of your knowledge is there a daily rating of air quality available for your community? | And how often do you check the air quality rating of your community? Do you check it | If you were made aware of the air quality rating every single day - how likely do you think you would be to alter your behavior based on the rating? | Generally speaking do you consider yourself a Democrat, Republican, Independent, or what? | How concerned are you with air quality in your community? | How concerned are you with water quality in your community? | How concerned are you with soil quality in your community? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| How confident are you in FEMA's ability to | Correlation Coefficient | .034 | .096* | .151** | .022 | .019 | .026 | .048 | .080 | -.001 | -.075 | -.038 | -.055 | .105* | .007 | .091* |
| | Sig. (2-tailed) | .435 | .027 | .000 | .608 | .669 | .553 | .263 | .063 | .986 | .332 | .401 | .206 | .015 | .877 | .035 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How confident are you in the EPA's ability to assist your | Correlation Coefficient | .003 | -.010 | .132** | .031 | .062 | .072 | -.037 | .091* | .006 | -.178* | -.083 | -.045 | .127** | .081 | .147** |
| | Sig. (2-tailed) | .938 | .816 | .002 | .473 | .155 | .096 | .390 | .036 | .884 | .021 | .064 | .296 | .003 | .060 | .001 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How confident are you in your Local City Government' | Correlation Coefficient | -.024 | -.032 | -.134** | -.031 | .030 | .032 | -.015 | .003 | -.104* | .019 | .123** | .118** | .017 | -.030 | -.013 |
| | Sig. (2-tailed) | .583 | .464 | .002 | .469 | .487 | .458 | .733 | .937 | .016 | .804 | .006 | .006 | .701 | .482 | .767 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How confident are you in State Government's ability to | Correlation Coefficient | .035 | .027 | -.113** | -.036 | .110* | -.001 | -.010 | -.004 | -.055 | -.098 | .089* | .118** | .043 | .019 | .011 |
| | Sig. (2-tailed) | .412 | .527 | .009 | .403 | .011 | .978 | .817 | .919 | .205 | .203 | .047 | .006 | .321 | .660 | .795 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |
| How confident are you in the Federal Government' | Correlation Coefficient | .078 | .068 | .264** | .152** | .076 | .084 | .098* | .025 | .048 | -.074 | -.083 | -.124** | .146** | .132** | .195** |
| | Sig. (2-tailed) | .071 | .117 | .000 | .000 | .080 | .052 | .023 | .564 | .268 | .341 | .064 | .004 | .001 | .002 | .000 |
| | N | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 169 | 502 | 536 | 536 | 536 | 536 |

| | | How concerned are you with overall environmental pollution in your community? | How concerned are you with climate change affecting your community? | How concerned are you with natural disasters such as hurricanes and floods affecting your community? | Which of the following do you think is the biggest environmental threat facing your community right now? | How confident are you in FEMA's ability to assist your community in the event of an environmental hazard? | How confident are you in the EPA's ability to assist your community in the event of an environmental hazard? | How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard? | How confident are you in State Government's ability to assist your community in the event of an environmental hazard? | How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Does your household have an emergency plan in the | Correlation Coefficient | -.032 | -0.05 | -.023 | .027 | .075 | -.043 | .058 | .068 | .056 |
| | Sig. (2-tailed) | .463 | 0.25 | .596 | .536 | .083 | .317 | .183 | .117 | .192 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Have you ever changed your planned outdoor activities for | Correlation Coefficient | -.337** | -.307** | -.218** | -.075 | .011 | -.120 | .114 | .011 | -.105 |
| | Sig. (2-tailed) | .000 | 0.00 | .004 | .331 | .892 | .119 | .140 | .887 | .176 |
| | N | 169 | 169.00 | 169 | 169 | 169 | 169 | 169 | 169 | 169 |
| (2)North South(1) | Correlation Coefficient | -.280** | -.206** | -.201** | .005 | -.071 | -.078 | .296** | .206** | -.225** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .916 | .099 | .070 | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| 2011 Total TRI Releases (lbs) | Correlation Coefficient | .136** | 0.06 | .049 | -.021 | .062 | .013 | -.085 | -.070 | .046 |
| | Sig. (2-tailed) | .002 | 0.18 | .253 | .622 | .151 | .756 | .050 | .106 | .287 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| # TRI Facilites (2011) | Correlation Coefficient | .153** | 0.06 | .062 | -.018 | .071 | .012 | -.088* | -.078 | .047 |
| | Sig. (2-tailed) | .000 | 0.13 | .153 | .676 | .102 | .785 | .041 | .071 | .278 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| EPA Cancer Risk (Inhalation1 in Million) | Correlation Coefficient | .252** | .210** | .217** | .027 | .032 | .083 | -.267** | -.209** | .184** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .536 | .455 | .056 | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| #Superfund Sites | Correlation Coefficient | .189** | .118** | .115** | .018 | .037 | .039 | -.039 | -.059 | .041 |
| | Sig. (2-tailed) | .000 | 0.01 | .008 | .686 | .390 | .364 | .365 | .175 | .339 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| #Brownfields (combined Zip entered sum) | Correlation Coefficient | .282** | .210** | .199** | -.004 | .071 | .085* | -.292** | -.203** | .230** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .918 | .100 | .049 | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Has there been an emergency event involving | Correlation Coefficient | -.066 | -0.04 | -.008 | .070 | .042 | .031 | .097* | .068 | -.037 |
| | Sig. (2-tailed) | .128 | 0.33 | .851 | .104 | .330 | .470 | .025 | .116 | .395 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |

| | | How concerned are you with overall environmental pollution in your community? | How concerned are you with climate change affecting your community? | How concerned are you with natural disasters such as hurricanes and floods affecting your community? | Which of the following do you think is the biggest environmental threat facing your community right now? | How confident are you in FEMA's ability to assist your community in the event of an environmental hazard? | How confident are you in the EPA's ability to assist your community in the event of an environmental hazard? | How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard? | How confident are you in State Government's ability to assist your community in the event of an environmental hazard? | How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard? |
|---|---|---|---|---|---|---|---|---|---|---|
| PerCapDamage | Correlation Coefficient | .081 | 0.03 | -.020 | -.006 | .009 | .026 | -.111** | -.026 | .056 |
| | Sig. (2-tailed) | .060 | 0.53 | .638 | .892 | .835 | .548 | .010 | .547 | .198 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Damage | Correlation Coefficient | -.283** | -.208** | -.198** | .004 | -.071 | -.083 | .292** | .200** | -.229** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .919 | .102 | .055 | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| ZipHazardExp | Correlation Coefficient | .146** | .117** | .190** | -.084 | .023 | .066 | -.202** | -.116** | .158** |
| | Sig. (2-tailed) | .001 | 0.01 | .000 | .051 | .600 | .125 | .000 | .007 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| In what year were you born? | Correlation Coefficient | -.041 | 0.00 | -.085* | .049 | -.027 | .102* | .010 | .000 | .032 |
| | Sig. (2-tailed) | .348 | 0.92 | .050 | .259 | .536 | .018 | .818 | .997 | .461 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| And for how long have you lived within this zip code? | Correlation Coefficient | .082 | 0.01 | .025 | .031 | .008 | -.012 | .041 | .015 | .040 |
| | Sig. (2-tailed) | .058 | 0.76 | .565 | .469 | .860 | .777 | .347 | .723 | .351 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Which of the following categories best describes | Correlation Coefficient | -.118** | -.120** | -.021 | -.008 | -.093* | -.039 | -.001 | -.100* | -.120** |
| | Sig. (2-tailed) | .006 | 0.01 | .636 | .859 | .031 | .365 | .982 | .021 | .005 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Income before taxes | Correlation Coefficient | -.107 | -0.01 | -.054 | -.002 | -.038 | .073 | .025 | -.011 | -.044 |
| | Sig. (2-tailed) | .081 | 0.93 | .374 | .972 | .532 | .233 | .685 | .859 | .473 |
| | N | 269 | 269.00 | 269 | 269 | 269 | 269 | 269 | 269 | 269 |
| Do you own your own home, pay rent, or something | Correlation Coefficient | .021 | 0.08 | -.035 | .010 | .034 | .003 | -.024 | .035 | .078 |
| | Sig. (2-tailed) | .631 | 0.08 | .416 | .821 | .435 | .938 | .583 | .412 | .071 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Employment | Correlation Coefficient | .077 | 0.08 | .013 | .038 | .096* | -.010 | -.032 | .027 | .068 |
| | Sig. (2-tailed) | .075 | 0.07 | .770 | .380 | .027 | .816 | .464 | .527 | .117 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |

| | | How concerned are you with overall environmental pollution in your community? | How concerned are you with climate change affecting your community? | How concerned are you with natural disasters such as hurricanes and floods affecting your community? | Which of the following do you think is the biggest environmental threat facing your community right now? | How confident are you in FEMA's ability to assist your community in the event of an environmental hazard? | How confident are you in the EPA's ability to assist your community in the event of an environmental hazard? | How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard? | How confident are you in State Government's ability to assist your community in the event of an environmental hazard? | How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Which of the following best describes your race? | Correlation Coefficient | .313** | .262** | .166** | .064 | .151** | .132** | -.134** | -.113** | .264** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .138 | .000 | .002 | .002 | .009 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| What is your current marital status? | Correlation Coefficient | .124** | .126** | .059 | .065 | .022 | .031 | -.031 | -.036 | .152** |
| | Sig. (2-tailed) | .004 | 0.00 | .171 | .132 | .608 | .473 | .469 | .403 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| And how many children under the age of 18 do | Correlation Coefficient | -.006 | 0.02 | -.066 | -.041 | .019 | .062 | .030 | .110* | .076 |
| | Sig. (2-tailed) | .897 | 0.66 | .130 | .340 | .669 | .155 | .487 | .011 | .080 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Gender | Correlation Coefficient | .103* | .088* | .040 | .020 | .026 | .072 | .032 | -.001 | .084 |
| | Sig. (2-tailed) | .017 | 0.04 | .355 | .637 | .553 | .096 | .458 | .978 | .052 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Do you know whom to contact in the event of an | Correlation Coefficient | .008 | 0.05 | .026 | .038 | .048 | -.037 | -.015 | -.010 | .098* |
| | Sig. (2-tailed) | .851 | 0.30 | .552 | .383 | .263 | .390 | .733 | .817 | .023 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How knowledgeable do you feel you are about actions | Correlation Coefficient | .022 | -0.01 | -.065 | -.026 | .080 | .091* | .003 | -.004 | .025 |
| | Sig. (2-tailed) | .609 | 0.89 | .132 | .551 | .063 | .036 | .937 | .919 | .564 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| To the best of your knowledge is there a daily rating of air | Correlation Coefficient | .108* | 0.05 | -.018 | -.023 | -.001 | .006 | -.104* | -.055 | .048 |
| | Sig. (2-tailed) | .012 | 0.21 | .670 | .600 | .986 | .884 | .016 | .205 | .268 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| And how often do you check the air quality rating of your | Correlation Coefficient | -.153* | -.161* | -.071 | .118 | -.075 | -.178* | .019 | -.098 | -.074 |
| | Sig. (2-tailed) | .047 | 0.04 | .358 | .126 | .332 | .021 | .804 | .203 | .341 |
| | N | 169 | 169.00 | 169 | 169 | 169 | 169 | 169 | 169 | 169 |
| If you were made aware of the air quality rating every single | Correlation Coefficient | -.309** | -.299** | -.158** | .043 | -.038 | -.083 | .123** | .089* | -.083 |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .336 | .401 | .064 | .006 | .047 | .064 |
| | N | 502 | 502.00 | 502 | 502 | 502 | 502 | 502 | 502 | 502 |

| | | How concerned are you with overall environmental pollution in your community? | How concerned are you with climate change affecting your community? | How concerned are you with natural disasters such as hurricanes and floods affecting your community? | Which of the following do you think is the biggest environmental threat facing your community right now? | How confident are you in FEMA's ability to assist your community in the event of an environmental hazard? | How confident are you in the EPA's ability to assist your community in the event of an environmental hazard? | How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard? | How confident are you in State Government's ability to assist your community in the event of an environmental hazard? | How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Generally speaking do you consider yourself a Democrat, | Correlation Coefficient | -.183** | -.165** | -.137** | -.027 | -.055 | -.045 | .118** | .118** | -.124** |
| | Sig. (2-tailed) | .000 | 0.00 | .001 | .535 | .206 | .296 | .006 | .006 | .004 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with air quality in your | Correlation Coefficient | .646** | .506** | .366** | .000 | .105* | .127** | .017 | .043 | .146** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .997 | .015 | .003 | .701 | .321 | .001 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with water quality in your | Correlation Coefficient | .605** | .356** | .348** | .049 | .007 | .081 | -.030 | .019 | .132** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .258 | .877 | .060 | .482 | .660 | .002 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with soil quality in your | Correlation Coefficient | .687** | .446** | .338** | .073 | .091* | .147** | -.013 | .011 | .195** |
| | Sig. (2-tailed) | .000 | 0.00 | .000 | .092 | .035 | .001 | .767 | .795 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with overall environment | Correlation Coefficient | 1.000 | .529** | .420** | .045 | .091* | .121** | -.073 | -.029 | .244** |
| | Sig. (2-tailed) | . | 0.00 | .000 | .304 | .034 | .005 | .091 | .499 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with climate change | Correlation Coefficient | .529** | 1.00 | .375** | .031 | .085 | .110* | -.040 | -.130** | .142** |
| | Sig. (2-tailed) | .000 | . | .000 | .481 | .050 | .011 | .355 | .003 | .001 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How concerned are you with natural disasters | Correlation Coefficient | .420** | .375** | 1.000 | -.037 | .010 | .107* | -.030 | -.124** | .072 |
| | Sig. (2-tailed) | .000 | 0.00 | . | .390 | .818 | .014 | .488 | .004 | .096 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| Which of the following do you think is the biggest environment | Correlation Coefficient | .045 | 0.03 | -.037 | 1.000 | -.040 | -.010 | .006 | -.011 | -.037 |
| | Sig. (2-tailed) | .304 | 0.48 | .390 | . | .361 | .816 | .899 | .799 | .387 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |

| | | How concerned are you with overall environmental pollution in your community? | How concerned are you with climate change affecting your community? | How concerned are you with natural disasters such as hurricanes and floods affecting your community? | Which of the following do you think is the biggest environmental threat facing your community right now? | How confident are you in FEMA's ability to assist your community in the event of an environmental hazard? | How confident are you in the EPA's ability to assist your community in the event of an environmental hazard? | How confident are you in your Local City Government's ability to assist your community in the event of an environmental hazard? | How confident are you in State Government's ability to assist your community in the event of an environmental hazard? | How confident are you in the Federal Government's ability to assist your community in the event of an environmental hazard? |
|---|---|---|---|---|---|---|---|---|---|---|
| How confident are you in FEMA's ability to | Correlation Coefficient | .091* | 0.08 | .010 | -.040 | 1.000 | .467** | .261** | .300** | .493** |
| | Sig. (2-tailed) | .034 | 0.05 | .818 | .361 | . | .000 | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How confident are you in the EPA's ability to assist your | Correlation Coefficient | .121** | .110* | .107* | -.010 | .467** | 1.000 | .377** | .349** | .496** |
| | Sig. (2-tailed) | .005 | 0.01 | .014 | .816 | .000 | . | .000 | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How confident are you in your Local City Government' | Correlation Coefficient | -.073 | -0.04 | -.030 | .006 | .261** | .377** | 1.000 | .634** | .293** |
| | Sig. (2-tailed) | .091 | 0.36 | .488 | .899 | .000 | .000 | . | .000 | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How confident are you in State Government' s ability to | Correlation Coefficient | -.029 | -.130** | -.124** | -.011 | .300** | .349** | .634** | 1.000 | .410** |
| | Sig. (2-tailed) | .499 | 0.00 | .004 | .799 | .000 | .000 | .000 | . | .000 |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |
| How confident are you in the Federal Government' | Correlation Coefficient | .244** | .142** | .072 | -.037 | .493** | .496** | .293** | .410** | 1.000 |
| | Sig. (2-tailed) | .000 | 0.00 | .096 | .387 | .000 | .000 | .000 | .000 | . |
| | N | 536 | 536.00 | 536 | 536 | 536 | 536 | 536 | 536 | 536 |

# VITA

Tiia Maria Carraway was born in Montgomery, Alabama and she spent most of her childhood living in the city of Mobile, Alabama. In 2009, with a Bachelor's of Finance from University of Alabama at Tuscaloosa, ten years of industry experience, and a trusty hound dog by her side she embarked on a new career path. The turbulent and uncertain economy of previous years had stirred her passion for finding a niche where she could make a daily impact on how our nation moves forward by developing science-based environmental policies. She set out to obtain a science background and an advance degree that focused on environmental policy. After graduating in May of 2011 from the University of South Alabama with a Bachelors of Science in Geology, Tiia moved to Baton Rouge, Louisiana and began attending Louisiana State University to pursue a Master's of Environmental Science. As a graduate student in the Department of Environmental Sciences, Tiia was a graduate research assistant with Dr. Margaret Reams. She will graduate from Louisiana State University in December of 2013.