BARRIERS AND MOTIVATIONS TO RESIDENTIAL PRO-ENVIRONMENTAL ACTIONS IN SAN LUIS OBISPO

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ABSTRACT

Barriers and Motivations to Residential Pro-Environmental Actions in San Luis Obispo

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Carbon neutrality has become an important focus for many municipalities, with the inclusion of mitigation measures targeted at the residential sector becoming increasingly prominent for the implementation of climate action plans (CAPs). However, many analyses fall short in identifying the barriers and motivations faced by residents to adopting pro-environmental actions in their daily lives, focusing instead on the available actions themselves. This research aims to identify both the barriers and motivations to adopting pro-environmental behaviors and assess their relationship(s) to key demographic variables, along with climate change perceptions. Using the city of San Luis Obispo (SLO) as a case study, this project used an online residential engagement survey administered to the general public through several mechanisms, including in-person and online platforms. The study reveals that the greatest barrier to SLO residents' implementing pro-environmental behaviors is affordability, with accessibility coming in second, and the most common motivation is climate change concerns. The results further indicate that ranking climate change concerns higher on a scale of 1 to 10 significantly increase the chance of selecting climate change as a primary motivation for adopting pro-environmental behavior. Additionally, we found significant variability among those of differing socioeconomic status (SES) in selection of barriers. These results suggest that SLO should address the most pertinent identified barriers through structural solutions, with an emphasis on their varied distribution across demographic groups, while

continuing to encourage existing motivations. Such efforts would help SLO move toward necessary greenhouse gas emission reductions to achieve carbon neutrality by 2035.

Keywords: Pro-environmental Behavior, Carbon Neutrality, Climate Action Planning, Residential Engagement, Environmental Equity

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

Anthropogenic climate change is a global crisis as the world endures its sixth mass extinction and the human population begins to feel the climate change driven impacts that were long warned about (Ceballos, 2018). Anthropogenic climate change has accelerated the natural rate of global warming due to excessive fossil fuel emissions (Bouwer, 2011). Climate warming correlates with, and is increasingly linked to, occurrences of extreme weather events and natural disasters (Van Aalst, 2006). Climate change induced impacts have created a need for a sustainable shift away from dependency on fossil fuels and have led to the rise of renewable energy transitions (Evans, 2016). The progression of these impacts has also led to formalized commitments from both private and public sector entities to achieving carbon neutrality or carbon zero (Rogelj, 2015).

Although climate change impacts all segments of society, there is a disproportionate effect on underserved communities (Pearson, 2018). Disadvantaged communities are faced with an undue burden of living with the most environmental pollution and experience unjust, increased levels of negative impacts on health, neighborhood blight, and development (Taylor, 2014). This environmental justice issue is gaining greater traction as climate impacts become more severe, making it crucial to ensure that these communities are not left out of plans for mitigation and adaptation (Outka, 2018). In California, racial/ethnic disparities in negative environmental health impacts have been identified; Hispanics, African Americans, Native Americans, Asian/Pacific Islanders, and other multiracial individuals have a 6.2, 5.8, 1.9, 1.8, and 1.6

higher risk, respectively, of living in the top 10% most negatively affected zip codes (Cushing, 2015).

Social justice and environmental justice issues represent inherently systemic issues (Feygina, 2013). There is a need in San Luis Obispo, CA (SLO) to address the issue of its underserved city residents being the most vulnerable and at risk to climate impacts. This need has been identified by Resilient SLO, a flagship program sponsored by the SLO Climate Coalition, with the goal of informing the social justice aspect of the city's Climate Action Plan (CAP) update. SLO County, which is 69.7% White, has an unjust disparity in rates of social issues found amongst its non-white residents, such as 21% and 23% of Hispanic and Black populations living under the poverty line between 2010 and 2014, versus only 13% of the majority White population (Alaniz, 2021). Previous studies regarding the equity of implementing CAPs in the United States recommend that policymakers incorporate local measures to address social inequity and detail the incorporation of environmental, economic, and social objectives in sustainable development efforts (Angelo, 2020; Roseland, 2020).

The emergence of just sustainability highlights issues such as accessibility, affordability, and agency, which can all act as potential barriers to the adoption of pro-environmental actions. To develop relevant local policy that narrows in on the root cause of environmental health inequity and does not simply place a band aid on the symptoms, solutions must be developed that are geographically specific and address the demographics of that area (Baker, 2012). This study was conducted to assess the barriers and motivations to residential implementation of pro-environmental practices, in hopes of increasing pro-environmental behavior in SLO. Although SLO has made efforts to

implicitly investigate its issues in social equity and has adopted a CAP that emphasizes community outreach, engaging and empowering SLO residents to take meaningful climate action remains challenged by an inability to effectively reach all types of community members which can be filled through this research (Alaniz, 2021; City of San Luis Obispo, 2020). This research assesses local resources and infrastructure supporting climate action to contribute towards developing pro-environmental solutions that are appropriate to the SLO community.

1.1 Statement of Problem

In 2009, SLO joined an initiative entitled "Integrating Climate Change Preparation Strategies across Socioeconomic and Natural Resource Sectors," which aimed to develop climate adaptation strategies and ultimately led to the initiation of creating SLO's first CAP in 2010 (Moser, 2011). The purpose of this project, sponsored by the grassroots movement Resilient SLO, is to inform the update of SLO's CAP with regards to community specific barriers and motivations. This effort aims to aid in just sustainable development and policy and provide recommendations for the city to promote proposed pro-environmental actions that address social equity and are accessible to all communities in SLO (McKenzie-Mohr, 2000). The goal of this project is to identify community barriers and motivations in SLO to practicing environmentally responsible behaviors (e.g., sustainable consumption) and pro-environmental actions and provide recommendations to the city to inform local policy. The project goal was accomplished via the administration of an online residential engagement survey, following a survey design drawn from models done in other localities with similar objectives, as well as

larger studies related to climate perceptions (Bekaroo, 2019; Marlon, 2022). The survey collected data on barriers and motivations to environmentally responsible behaviors linked to climate mitigation and analyzed them against available resources in SLO with the intention of creating recommendations focused on social and environmental justice. The research questions and hypotheses of this study are detailed in Table 1.

Table 1. Research questions and hypotheses developed for the project.

Research Question	**Hypotheses**
RQ_1: What pro-environmental actions are being adopted by SLO residents to reduce their carbon emissions and what are their motivations for doing so?	H_1a: Overall actions categorized as lifestyle changes will be most commonly adopted, followed sequentially by transportation and energy sector related actions. H_1b: Personal benefits, such as improved health and monetary savings, will be the most common motivation.
RQ_2: What are the barriers of SLO residents toward adopting pro-environmental actions; and how do these differ among demographic groups?	H_2: Structural barriers (accessibility, affordability, and lack of information) will be the most common barriers faced by low-income SLO residents, while individual barriers (lack of time, not a priority, and personal beliefs) will be the most common barriers among high-income SLO residents.
RQ_3: How do SLO residents' perceptions of climate change influence their motivations?	H_3: Perceptions of climate change being a significant issue will translate to a motivational factor.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews general problem of disproportionate environmental effects on underserved communities and possible solutions. It then synthesizes best practices related to implementing social equity in climate action planning for carbon neutrality, which include placing sustainability in a social justice frame. The chapter concludes by introducing Resilient SLO and its specific needs for identifying community environmentally responsible behaviors and the barriers which impact the value-action gap of climate policy for residents in SLO.

2.2 Environmental Impacts on Disadvantaged Communities

Although climate impacts are being felt by the larger society, disadvantaged, or underserved communities are facing disproportionate environmental effects which are reflected through toxic communities and a lack of resource accessibility resulting from extreme weather events and proliferated natural or anthropogenic disasters (Benevolenza, 2019; Taylor, 2014). "Toxic communities" are characterized as those that are exposed to disproportionate levels of pollution and the resulting health hazards, with patterns typically skewed toward poor and minority neighborhoods (Collins, 2016). The existence of toxic communities reveals a systemic problem inherently resulting from a combination of years of entrenched segregation, zoning ordinances favoring the wealthy, and businesses historically polluting where they face the least resistance all expose poor communities to environmental hazards (Taylor, 2014). One historic example of a toxic community is found in Flint, Michigan, where a water crisis arose from corroded lead

pipes and affected the water supply of primarily African American communities of lower socioeconomic status to the point where it was unsafe to consume the water (Butler, 2016). In Southern California, toxic communities can be found in close proximity to concentrated air pollutant emissions resulting in higher risks of cancer, where one in three people of color reside in such neighborhoods in contrast to one in seven white people (Morello-Frosch, 2001).

Another example of a disproportionate impacts arises from the federal distribution of funds following natural disasters, which has created an effect of unequal recovery among disadvantaged communities. In these cases, inequities in resource distribution or social opportunities that produce recovery outcomes favor well-off groups and limit access to relief resources of those in less fortunate circumstances (Muñoz, 2016). Hurricane Katrina in New Orleans serves as an example of inequities in resource distribution, as the hardest hit areas were vulnerable communities who lived in homes susceptible to storm shock and without flood insurance, leading to an inability to recover from this tragedy and an extensive loss of cultural landmarks within the community (Sze, 2005). Similarly, vulnerability assessments reveal that extreme weather events, such as prolonged droughts, are examples of cases where the most vulnerable communities are hit the hardest during preventable disasters where risks could have been mitigated ahead of time in lieu of inequitable reactive post-disaster responses and needs assessment approaches (King-Okumu, 2020). One example during the ongoing California drought are the residents of Tulare County, home to rural, low-income, and primarily Latino communities who have experienced extreme water shortages, with many not having access to clean water for over a decade (Feinstein, 2017).

Additionally, disadvantaged communities live with the consequences of unequal growth such as the promotion of decentralization, less walkability and dependence on automobiles, and higher rates of pollution and toxicity leading to increased health hazards (Fernandez-Bou, 2021; Hutch, 2011). Other negative effects on underserved communities from development and public investment in new infrastructure include green gentrification, which furthers the class divide by displacing those who cannot afford the luxuries of newfound environmental, health, and economic benefits in their community, thus exacerbating historical neighborhood segregation and destabilization even further (Gould, 2016; Zuk, 2015). For example, in Brooklyn, New York, a toxic industrial canal that was home to low-income residents became the "Venice of Brooklyn" when it was designated a superfund site, triggering the cleanup of the contaminated site and the displacement of the communities that had lived there previously and who were unable to afford the environmental benefits (Gould, 2018).

The creation of legislation such as the National Environmental Protection Act (NEPA) and Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, reflects the need to address these issues on a national level and place federal importance on environmental justice objectives (Hutch, 2002). Beyond the tangible disadvantages faced by underserved communities are those that are not as easily distinguishable and exist as misinformed and preconceived notions that proliferate false beliefs underestimating the environmental concerns of the most vulnerable communities. These prejudices act as an impediment to addressing the environmental inequities they face and negate the urgency of broadening public participation in environmental decision making (Pearson, 2018).

2.3 Just Sustainability and Carbon Neutrality Goals

The disproportionate effects of environmental damages and climate related impacts on socially marginalized populations is one of the most pressing issues facing the world as climate change begins to reinforce and amplify socioeconomic disparities, leaving these groups with increased environmental and health burdens (Shonkoff, 2011). This amplification has shed light on a new concept known as "just sustainability", which focuses on the integration of environmental justice values into wider agendas for sustainability and social inclusion (Agyeman, 2004). For sustainable initiatives to be successful, it is crucial to understand the different roles governments, policymakers, and the public have in the process and that these roles delegate responsibility in a fair and equitable way (Catney, 2014; Summerville, 2008). Discourse on just sustainability has become a hot button topic, as concerns surface regarding the potential pitfalls for communities where sustainability transitions take place (Evans, 2016). It is important to note that sustainability can be used to achieve environmental justice goals when these forces work together to solve the issue of human harm from environmental pollution and degradation. This can be achieved by combining their varied strategies and creating an interdisciplinary approach (Dernbach, 2012). Further, consideration and engagement of environmental justice principles should be applied to policies, such as during the development process of climate action plans, for them to be successful in their goal of achieving carbon neutrality both on paper and throughout implementation (Carley, 2021).

Due to the increasing relevance and media spotlight on environmental justice there has been a subsequent increase in greenwashing, often described as deceptive communication or manipulation regarding environmental performance, which can occur in both private and public entities and acts as the gap between symbolic gestures and real action (Siano, 2017). Climate action and/or emissions reduction plans are not immune to these irresponsible behaviors, with examples such as recent climate strikes seeking justice against the Ontario, Canada government demonstrating the harmful effects of broken promises (Saxe, 2019). The rising popularity in the adoption of carbon neutrality goals unfortunately leads to a potential increase in the risk of greenwashing and misuse of goals intended to reliably communicate sustainability (Lashitew, 2021).

Carbon neutrality goals, communicated through climate action plans, have become prominent in cities across the U.S. as they attempt to counteract air pollution, noise, heat island, and other negative environmental effects exacerbated by urban areas that exhibit suboptimal regional planning (Nieuwenhuijsen, 2020). These goals require a transformation of current built environments through the combined efforts of implementing new technologies, innovative urban design, enabling policies and regulations, management strategies, and changes in consumer attitudes toward more sustainable energy and water use (Newton, 2020). As the importance of carbon neutrality goals increase in municipalities and planning efforts, the inclusion of social equity must also be regarded as a crucial component of climate action planning and long-term resiliency strategies should be expected to address these issues (Meerow, 2019).

2.4 Climate Action Planning in California with regard to Social Equity

California is known for having some of the most progressive environmental legislation in the nation and is often seen as a leader in the climate movement, as it remains at the forefront of new policies (Vogel, 2018). In 2000, California adopted Senate Bill 1771 (SB 1771) establishing the California Climate Action Registry, a non-profit agency that spearheaded emissions reporting protocols (Mazurek, 2008). Assembly Bill 1493 (AB 1493) was then passed in 2002, regulating carbon dioxide emissions from vehicles and setting reduction standards for states that followed (Johnson, 2007). These pieces of legislation laid the groundwork for what would become the Global Warming Solutions Act, or Assembly Bill 32 (AB 32), which in 2006 was the first of its kind in the U.S. to set greenhouse gas emission reduction targets and strive for increased energy efficiency (Wheeler, 2017).

Similar to its pioneering role in environmental policy, California has also been a forerunner in the development of climate action plans (CAP), with 482 cities and 58 counties adopting one in recent years (Boswell, 2019). Municipal climate action planning in California has been used as a strategy to aid the state in reaching its carbon neutrality goal and reduction targets set by AB 32, while attempting to encompass social equity within these frameworks (Wheeler, 2017). However, out of a study done covering 170 California CAPs, 39% had no equity language, while the majority of the others that did include it failed to discuss socio-economic disparities in substantive policy terms (Angelo, 2022). Going beyond California, research has shown that there has generally been a lack of inclusion or operationalization of equity goals in CAPs; however, the rise in equity language can act as a catalyst for broadening the scope of these plans to include

greater emphasis on the socio-economic aspects of sustainability beyond greenhouse gas reduction (Angelo, 2020). Overall, sustainability planning efforts offer strategic opportunities for cities to pursue equity goals and can act as a platform for community-based actors to intervene and participate in climate action planning through community initiatives (Schrock, 2015).

2.5 The Residential Sector

One of the largest contributors to the carbon footprint of a city is the residential sector, which accounts for 17% of greenhouse gas emissions globally, and exemplifies why an emphasis on public participation is a crucial component in reaching carbon neutrality at this scale (Hoornweg, 2011; Nejat, 2015). Residential sector emissions can be broken down into general top contributors, which typically fall on the energy and transportation sectors that present many challenges for planners (Newell, 2018).

An important aspect of achieving carbon neutrality in localities is energy literacy, which describes public awareness and understanding of energy systems and the impacts of the production and consumption of these systems, extending to their application of these ideas on personal energy-related decisions and conservation (Dewaters, 2007). It is difficult to develop a scale by which to measure levels of energy literacy, however, doing so can be a necessary step toward developing better tools to teach energy literacy and establish greater levels of community involvement in reduction efforts (Dwyer, 2011). The study of energy literacy is done to analyze behaviors of residential households and consumer attitudes, which often are found to have low levels of energy literacy reflected by the lack of investment decisions in energy efficient equipment (Brounen,

2013). Additionally, financial barriers are cited as the number one constraint in the adoption of energy efficiency measures in households, despite residents often expressing a desire to do so (Reames, 2016).

The importance of energy efficiency in the residential market has made its way over to CAPs, acting as the driving force in these pursuits by promoting renovation of households to meet energy targets set forth by the locality (Gkonis, 2020). Energy efficiency strategies are a common denominator in CAPs and are often expressed in buildings as efficient light fixtures, appliances, and insulation. Renewable energy programs are typically categorized as a separate management strategy with the intention of reducing greenhouse gas emissions or waste heat production (Stone, 2012).

As for transportation, reduction strategies often target decreasing vehicle-miles-traveled and focus on increasing alternative forms of transportation, including electric vehicles and public transit options, to work toward carbon neutrality (Deakin, 2011). In addition to these strategies there are many programs that encourage sustainable commuting such as ride sharing and carpool services (Alberto, 2020). Implementing these reduction strategies and services is in large part a personal choice reflecting on social drivers, however, increases in infrastructure supporting neighborhood walkability and improving public transit systems can significantly influence personal choices to adopt them by increasing accessibility (Marshall, 2009; Tang, 2018).

2.6 Environmentally Responsible Behavior vs. California's Social Ecology

To engage resident involvement in reaching carbon neutrality goals there must be effective literacy and action tools in place to encourage "environmentally responsible

behaviors" or "pro-environmental behaviors" (De Young, 2000; Jenson, 2002). These behaviors, although occurring across different domains, can be considered unidimensional due to the link that exists between their shared common goal of protecting the environment (Gatersleben, 2014). Extensive research has been done on how environmental quality depends on human behavior patterns and corresponding pro-environmental actions, which could contribute significantly to achieving long-term sustainability in a locality (Steg, 2009). These behaviors are often the aim of environmental education and are essential to producing actions among individual consumers that reflect conservation values and knowledge of topics such as energy efficiency (Jensen, 2002). Many strategies have been explored to try to increase practices in behavior changes, such as turning attention toward collective organization of practices that result from societal influence, or others that examine the influence of values and identities on individual behavioral changes (Gatersleben, 2014; Hargreaves, 2011).

To understand what might elicit changes within environmentally responsible behavior, it is important to assess the influence of social ecology, which is a concept describing the reciprocal relationship between mind and behavior and natural and social habitats to influence one another (Oishi, 2010). California's social ecology proliferates a lifestyle founded on high-consumption and motor-vehicle-orientation, making it especially difficult to reach carbon neutrality (Wheeler, 2017). California's car dependency and insufficient walkable infrastructure are therefore an extension of these natural and social habitats and can influence the minds and behaviors of its residents (Mitra, 2017). This impacts the decision-making process of California residents and can in turn impact decisions to partake in environmentally responsible behaviors. However, it

is important to note that many California residents have no choice but to conform to societal accepted levels of car ownership due to the structural proliferation of suburban neighborhoods and poorly designed public transportation systems (Quinn, 2006).

Although it is important for cities and counties to advocate for environmentally responsible behaviors from their residents, it is also critical to identify and understand the barriers that prevent the adoption of these behaviors and determine the actions to mitigate these barriers. For example, a study in the United Kingdom found that there should be greater emphasis placed on the 'value-action' gap present in environmental policies, which describes the value an individual places on changing a behavior versus that individual taking action to change said behavior (Blake, 1999). There are many factors that might influence environmentally responsible behaviors, and these factors culminate in two non-exclusive categories: situational and individual. Individual factors involve concepts such as an individual's perception of norms or their personal values, whereas situational factors pertain to the convenience of a behavioral change or overcoming obstacles to the change in question (Von Borgstede, 2002). Focusing on the presence of obstacles within situational factors reveals issues such as affordability, accessibility, informational gaps, and time constraints, which serve as examples of what one would more typically describe as a structural barrier. Addressing these areas of concern within a municipality such as SLO is crucial if there is any hope of increasing public engagement in achieving greenhouse gas reduction targets for the city.

2.7 Climate Mitigation in San Luis Obispo

SLO has retained its presence as a historically environmentally progressive city, being awarded an "A" grade in 2021 due to its implementation of a CAP, development of a city-wide emissions inventory, and adoption of emission reduction targets (Carbon Disclosure Project, 2021). With the hiring of their first city sustainability manager in 2018, SLO continues to strive toward effective environmental action (Wilson, 2018). SLO's Office of Sustainability has set focus areas that include climate action, developed major city goals that encompass equity, diversity, and inclusion, and acknowledged the inequitable nature of climate change impacts (Office of Sustainability, 2021). The SLO Climate Coalition is a non-profit organization working in partnership with the Office of Sustainability, assisting them in achieving their carbon neutrality goal through an emphasis on environmental justice, high impact solutions, and economic viability. This organization contains within it the working group Resilient SLO, a grassroots people's movement that encourages community collaboration and the development of resilient, sustainable neighborhoods by providing programming and resources ("Resilient SLO", 2021). These efforts exemplify SLO's significant presence within the climate movement and its willingness as a city to elicit change within pre-existing frameworks that no longer serve its residents.

In SLO, residential buildings and transportation account for over 25% of community greenhouse gas emissions, which reflects the potential residents have to impact the outcomes of the updated climate action plan and its policies (City of San Luis Obispo, 2020). The residents of SLO, however, continue to face different barriers to implementing environmentally responsible behaviors. Thus, it is vital to the success of

the CAP for these barriers, along with motivations such as personal benefits and climate change concerns, to be identified and addressed. Further, the barriers faced by underserved and minority populations must be understood so that suggestions can be made that include social equity dimensions.

2.8 Conclusion

Pioneering efforts by SLO, such as the adoption of their first CAP in 2010, continue today as the city aims to achieve carbon neutrality by 2035. The non-profit Resilient SLO has identified a need for greater public involvement and engagement to reach this goal. This project aims to not only identify barriers and motivations to residents in SLO adopting pro-environmental actions, but also to suggest pro-environmental actions, policies, and community programs that are accessible to all demographics and allow for public engagement of a variety of socio-economic groups.

Chapter 3

METHODOLOGY

The purpose of this section is to report on the development and selection of the variables used to evaluate socioeconomic status (SES) and other demographic characteristics, barriers and motivations to pro-environmental actions, and perceptions on climate change developed to obtain information about the factors influencing a resident of SLO's adoption of pro-environmental actions in their life (Iliescu, 2008).

3.1 Study Area

The city of SLO is located on the central coast of California halfway between Los Angeles and San Francisco, within the greater SLO County that is best known for farming, viticulture, and tourism (Discover Sustainable Travel and Healthy Living in San Luis Obispo, 2022). At the time of this study the city of SLO has a population of 47,545 consisting of 48.6% female and 51.4% male, with racial demographics of 70.1% White, 18.8% Hispanic or Latino, 5.1% Asian, and 2.3% Black or African American (U.S. Census Bureau, 2021). The survey was conducted among the residents of the city of SLO, California. The study area includes solely the boundaries of the city, and not the greater SLO County. This is due to the intention of the survey to inform the update of the city of SLO's CAP to incorporate social equity values and language based on the lived experiences of its residents.

3.2 Permission from Institutional Review Board (IRB)

The survey was approved by the IRB under project title 'A Master's Project Examining the Barriers and Motivations to Residential Pro-Environmental Action in San Luis Obispo, CA' and letter reference number Ref. # 2022-094. The study was sent to the IRB on April 8th, 2022 and approved on May 10th, 2022. Materials were sent to and approved by the IRB in both English and Spanish, as the survey was offered in both languages.

3.3 Design

Surveys have historically been used as a tool in the policy-making process with the intention of capturing the views of the community (Watson, 1991). This study, with the same overarching goal, employed a study design of a cross-sectional Microsoft Forms online survey, administered in-person through provided QR codes or a paper option, which was conducted from May 18th, 2022, through June 4th, 2022, at various locations, including grocery storefronts such as Lassen's, Target, and Food 4 Less as well as local community events such as Pridefest. The online survey was also posted on the platform Reddit within the 'San Luis Obispo' and 'Cal Poly SLO' subreddits from June 26th, 2022, to July 1st, 2022. Collection dates and locations are shown in Table 2.

Table 2. Data collection dates, times, and locations of residential engagement survey.

Location	**Dates and Times**		
Lassen's	05/18/22 6-8pm	05/20/22 12-2pm	05/21/22 8-10am
Pride Fest	05/21/22-05/22/22 All day event		
Target	05/25/22 6-8pm	05/27/22 12-2pm	05/28/22 8-10am
Food 4 Less	06/01/22 6-8pm	06/03/22 12-2pm	06/04/22 8-10am
Reddit	06/26/22-07/01/22 All day (online)		

Cross-sectional studies encompass a selected subset of a certain population and represent only the situation at the point in time the data was collected (Olsen, 2004). For this study, this means that the data collection surrounding barriers is only representative of a subset of residents of the city of SLO during the point in time that the surveys were completed. The style of survey used is a self-reported survey, where participants in the study voluntarily respond to questions which are read and answered without interference. The survey was offered in English and in Spanish, both in the online and paper options. Translations were conducted by the researcher, who is bilingual in English and Spanish. Survey completion was incentivized through a $25 Vanilla Visa e-gift card raffle which included a total of 5 gift cards. The gift card raffle winners were chosen by assigning each submitted e-mail address a number and using the in the Rand function in Microsoft Excel Version 16.62.

3.4 Sampling

Study participants (N=135 completed surveys) were recruited with a focus on obtaining a varied pool of participants that would accurately represent or closely resemble the demographics of the city of SLO. This was done by conducting the survey at numerous locations throughout the city to capture a variety of demographics, as well as posting the survey online to increase the sample size and capture a broader range of participants.

3.5 Inclusion/Exclusion Criteria

Participants were eligible for the study, subject to the geographic constraints of the study area described above, if they were a SLO resident over the age of 18, had access to either the grocery store, community event, or a Reddit account, were either a homeowner or renter, and had sufficient proficiency in English or Spanish to complete the survey (Rissel, 2018). Residents who responded that lived in the greater SLO County but not within the city of SLO were excluded. The electronic nature of the online survey places additional constraints on participants who wished to take it on their own time, as they must have access to an electronic device, however a paper option was provided for completion on-site at the surveyed grocery stores.

3.6 Survey Composition

The questionnaire was developed focusing on collecting demographic data and data on individual and/or structural barriers to pro-environmental actions, as well as climate perceptions (Actions, 2022).

The self-reported questionnaire included 21 questions consisting of information related to the following:

- demographics (age, race and/or ethnicity, gender identity)
- employment status and annual income
- education level (including current)
- living arrangements (own or rent)
- individual barriers to pro-environmental actions (e.g., accessibility, lack of information, affordability)
- structural barriers to pro-environmental actions (e.g., lack of time, not a priority, personal beliefs)
- motivations for adopting pro-environmental actions
- community resources

The questions were answered through multiple response mechanisms including multiple choice, grid, agree/disagree statements, and text box entry. Participants who completed the survey on-site were able to seek assistance and ask questions throughout the course of taking the survey to clarify any confusion on question structure or content. The survey would take an estimated 10 minutes to complete. The full survey can be found in Appendix A.

3.7 Data Analysis

The collected data were entered into a Microsoft Excel spreadsheet (Afzal, 2020). The data was then disaggregated to better understand responses from various groupings of demographic characteristics. To identify socioeconomic groups, falling generally

within the bounds of lower, middle, and upper class, data was obtained on the average annual median income in the city of SLO of $56,071, and grouping was conducted within Microsoft Excel to place responses within these three categories (U.S. Census Bureau, 2021). Survey participants that did not live within the study area of the city of SLO, did not consent to participate, and/or did not complete the survey were not included and their responses were removed from the database.

Descriptive statistics, univariate, and multivariate models were performed using R Studio Version 4.2.1 and used to analyze relationships between demographic characteristics and engagement in environmental activities. Chi-Squared tests were run to analyze the variance between demographic groups for statistical significance and determine the comparative barriers they faced to implementing pro-environmental actions against those actions they chose to implement (Afzal, 2020). A one-way ANOVA was performed to investigate the significance of ranking climate change concerns higher, regarding its translation as a primary motivation for residents for adoption of pro-environmental actions. Finally, a qualitative frequency analysis was conducted on free responses covering improvements to resources in the city of SLO. Descriptive statistics were performed beyond measures of frequency and included measures of central tendency, used to calculate the mean for average or most indicated responses. All graphs were generated in Excel Version 16.64.

3.8 Limitations

One of the limitations of utilizing a survey in data collection research is the potential for numerous forms of biases, in researchers and in survey respondents. When

dealing with surveys with environmental related content, it is expected that those who have a more positive attitude toward such matters are more likely to respond than those who do not, hence only garnering a subset of the population that may already be inclined toward caring for the environment. For this reason, members of the population who are unwilling to participate are underrepresented in the survey responses. This phenomenon is known as non-response bias, which warns of the average characteristics of respondents and the average characteristics of the population not being equal (Spekle, 2018). Another potential form of bias is acquiescence bias, defined as the preference of survey participants to lean to the positive or agreeable side of the scale when responding to questions concerning attitudes or feelings (Mandić, 2021). Although survey questions for this study were designed to be as neutral as possible, it is important to note these biases in the framework of their construction.

Chapter 4

RESULTS

The following section presents the main results of this study, which aimed to address three central research questions:

1. RQ1 asks: What pro-environmental actions are being adopted by SLO residents to reduce their carbon emissions and what are their motivations for doing so?
2. RQ2 asks: What are the barriers of SLO residents toward adopting pro-environmental actions; and how do these differ among demographic groups?
3. RQ3 asks: How do SLO residents' perceptions of climate change influence their motivations?

Adoption of pro-environmental actions was measured through a provided list for respondents to select from and therefore does not act as a carbon footprint assessment, rather a general baseline assessment of a focused set of actions (Table 3). This is an important distinction to carry on through analysis and the conveying of findings surrounding those actions.

Table 3. Pro-environmental actions and their original formatting as described within the survey questions.

Categories	Action	Survey Description
Lifestyle Changes	Waste Reduction/Recycling	You try to reduce your waste and you regularly separate it for recycling
	Minimize Disposables	You try to cut down on your consumption of disposable items whenever possible (e.g., plastic bags from the supermarket, excessive packaging, plastic water bottles, etc.)
	Food Conscious	You consider the carbon footprint of your food purchases and sometimes adapt your shopping accordingly
	Alternative Transportation	You regularly use eco-friendly alternatives to a private vehicle (e.g., walking, cycling, taking public transportation, ride sharing, carpool, etc.)
Energy	Household Appliances	When buying a new household appliance (e.g., washing machine, fridge, TV, etc.), lower energy consumption is an important factor in your choice
	Home Insulation	You have insulated your home better to reduce your energy consumption
	Home Energy	You have installed equipment in your home to control your energy consumption (e.g., smart meter, smart lighting controls, etc.)
	Energy Supplier	You switched to an energy supplier which offers a greater share of energy from renewable sources than your previous one
	Solar Panels	You have installed solar panels on your home
Transportation	Fuel Consumption	You have bought a new vehicle and its fuel consumption was an important factor in your choice
	Travel	You consider your carbon footprint of your transport when planning your holiday and other longer distance travel and adapt your plans accordingly
	Electric/Hybrid Vehicle	You have bought an electric or hybrid vehicle
	Alternative Transportation	You regularly use eco-friendly alternatives to a private vehicle (e.g., walking, cycling, taking public transportation, ride sharing, carpool, etc.)

4.1 Sample Demographics

Demographic information was collected in the survey, noting that respondents had a 'Prefer not to say' option available if they did not wish to disclose that information. The survey collected data on the participants' (N = 135 completed surveys) gender identity, age, highest level of education, income level, employment status, home ownership, and residency in the city of San Luis Obispo. Sample characteristics and totals are outlined in Table 4. The demographics of the survey reflect a greater number of male respondents versus females, as well as more renters than owners. Of the sample, 67% of participants were White, which is representative of the dominant population distribution in the city of SLO. Other demographic characteristics, such as highest level of education and employment status, were collected but were not analyzed due to the disaggregated groups yielding sample sizes too small to draw conclusions about the greater sample population. These categories demonstrated that respondents generally held a bachelor's degree or attended some college, and a majority are employed full-time. Age distributions were skewed toward the younger age, with most participants being between the ages of 18 and 44 (85%). Racial/ethnic group was analyzed using two categories of White (67%) and Non-White or Mixed (30%) due to the response distribution, while SES was broken into the standard three categories of low (24%), middle (mid) (54%), and high (22%). Home ownership was left the same as upon collection, simply split between renters (62%) and owners (38%). All responses from the sample came from the English survey, as no surveys were completed in Spanish.

Table 4. Sample demographics of survey respondents in the city of SLO.

Characteristics	Level	Respondent # (%)
Gender Identity	Female Male Non-binary Prefer not to say	59 (44%) 69 (51%) 6 (4%) 1 (1%)
Age Category	18-24 25-34 35-44 45-54 55-64 65-74 Prefer not to say	35 (26%) 42 (31%) 37 (28%) 11 (8%) 6 (4%) 3 (2%) 1 (1%)
Race/Ethnicity	White or Caucasian Hispanic or Latino Asian Black or African American Native Hawaiian or Other Pacific Islander Two or more races/ethnicities Prefer not to say	90 (67%) 11 (8%) 9 (7%) 7 (5%) 1 (1%) 12 (9%) 5 (3%)
Highest Level of Education	Less than or some high school Completed high school, GED, or equivalent Some college Trade, technical, or vocational school Associate degree Bachelor's degree Master's degree Doctorate degree Prefer not to say	1(1%) 9 (7%) 29 (22%) 7 (5%) 10 (7%) 48 (36%) 20 (15%) 7 (5%) 3 (2%)
Annual Income Category = Low SES = Mid SES = High SES	Less than $20,000 $20,000 - $34,999 $35,000 - $49,999 $50,000 - $74,999 $75,000 - $99,999 $100,000 - $124,999 $125,000 - $149,999 $150,000 and over Prefer not to say	19 (14%) 13 (10%) 15 (11%) 30 (22%) 13 (10%) 15 (11%) 8 (6%) 15 (11%) 7 (5%)
Employment Status	Full-time employment Part-time employment Self-employed Two or more jobs Retired Student Employed student Home-maker Unemployed Prefer not to say	74 (55%) 16 (12%) 9 (7%) 6 (4%) 3 (2%) 12 (9%) 9 (7%) 2 (1.5%) 1 (1%) 2 (1.5%)
Home Ownership	Own Rent	51 (38%) 84 (62%)

4.2 Pro-Environmental Actions and Barriers

To assess the barriers and motivations that residents of SLO face to implementing pro-environmental actions in their daily lives, it is important to understand current levels of participation in such actions (Figure 1). Actions (Table 3) were split into the following three categories based on similarities in carbon emission sectors: lifestyle changes, energy, and transportation. From RQ_1, H_1a hypothesizes that individual actions related to the lifestyle changes category will be most adopted among the sample population. The greatest level of current involvement in an action is found in waste reduction and recycling (56%), with minimizing the use of disposables (50%) following close behind, failing to disprove H_1a. The least common climate change mitigation action undertaken among the sample population was switching to a more renewable energy supplier (17%), followed by carbon footprint considerations in travel (21%), further supporting H_1a which hypothesized that energy sector related actions will be the least adopted after those falling under transportation. Those that did not partake in one of the described pro-environmental actions at the time of the survey had the option of selecting a perceived barrier for the total of the twelve actions (Table 3), if any, that they face to implementing that particular action. Identified barriers (Figure 2) available for selection included affordability, accountability, lack of information, lack of time, not a priority, and personal beliefs. The most common barrier selected overall was “affordability” (N=408), while the least common was “personal beliefs” (N=25).

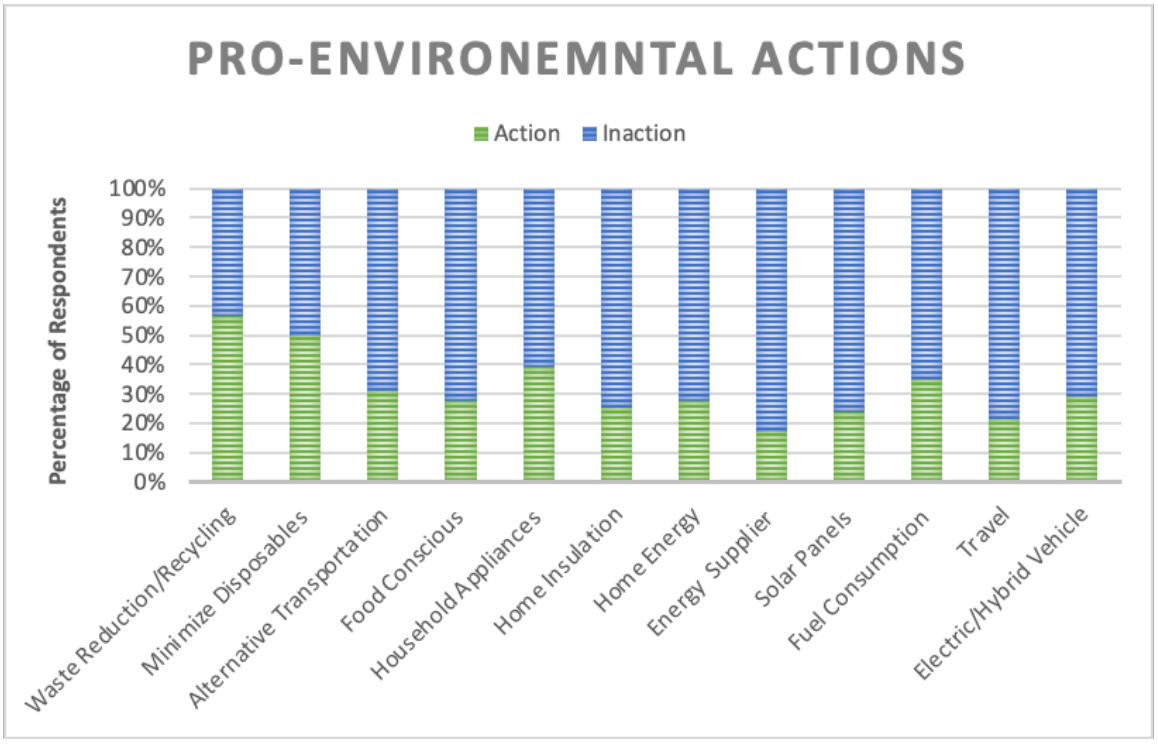

Figure 1. SLO residential participation in pre-selected list of pro-environmental actions.

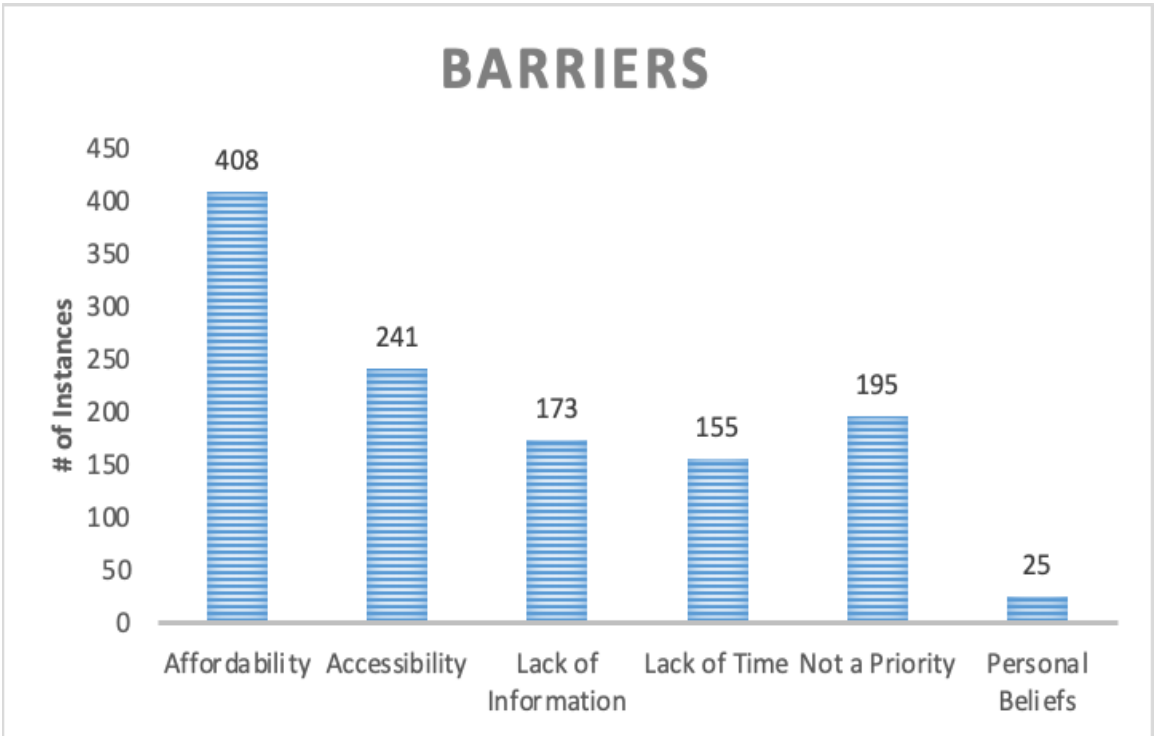

Figure 2. Frequency of barriers to pro-environmental actions selected by SLO residents.

4.3 Impact of Key Demographics on Barriers to Pro-Environmental Actions

The categories of race/ethnicity, SES, and home ownership were chosen to be disaggregated to communicate the results to the city of SLO and provide insights on potential future policy interventions targeted at demographics.

4.3.1 Statistical Significance

Chi-Squared tests were performed to analyze demographic group comparisons among the three pro-environmental action categories (Table 5). Adoption of actions by race/ethnicity groups varied significantly among lifestyle changes, $X^2(5, N=313) = 11.9$, $p=.03$, while differences in energy, $X^2(5, N=496) = 13$, $p=.02$, and transportation, $X^2(5, N=383) = 12.5$, $p=.03$, sector related actions proved significant among home ownership groups. For SES, all three action categories of lifestyle changes, $X^2(10, N=300) = 27.4$, $p=.002$, energy, $X^2(10, N=473) = 22.3$, $p=.01$, and transportation, $X^2(10, N=362) = 38.3$, $p=.00003$, yielded statistically significant results.

Table 5. Chi-Squared results for p-values for demographic group comparisons of SLO residents.

P-values			
Treatment	Race/Ethnicity	Socioeconomic Status (SES)	Home Ownership
Lifestyle Changes	*.03**	*.002**	*.2*
Energy	*.5*	*.01**	*.02**
Transportation	*.9*	*.00003**	*.03**

*P-value < *.05*.

4.3.2 Race/Ethnicity

Race/ethnicity was chosen to be analyzed to determine if it is a contributing factor leading to variance of selected barriers. The percentage of participants who identify as White make up a majority of the pool of responses at 67% (N=90), with the remaining 30% (N=40) and 3% (N=5) being attributed to Non-White or Mixed respondents and those who preferred not to answer, respectively.

White and Non-White or Mixed groups significantly differed in their adoption of pro-environmental lifestyle changes, $X^2(5, N=313) = 11.9$, $p=.03$ (Figure 3). Barriers of "accessibility" and "not a priority" were identified as reasons for not adopting lifestyle changes at higher percentages for the Non-White or Mixed groups than White-identifying participants. White respondents selected "lack of time" as a barrier much more often than their Non-White or Mixed counterparts, whereas "affordability" was only selected at a slightly increased percentage. Lack of information and personal beliefs were also selected at only slightly increased percentages but among Non-White or Mixed residents.

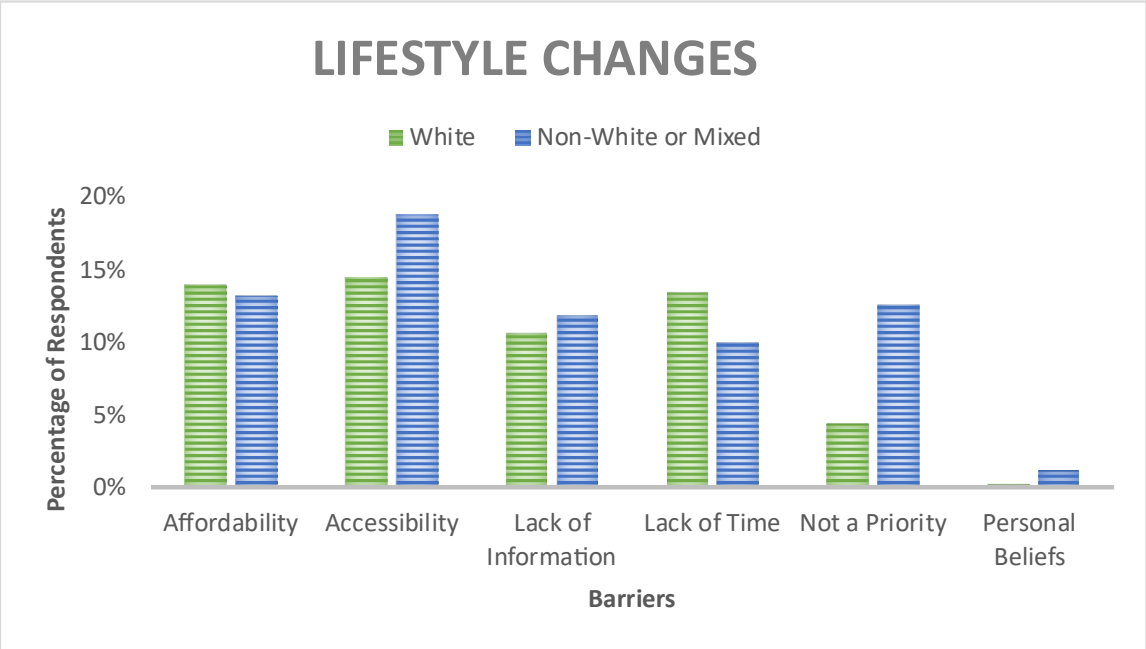

Figure 3. Barriers faced by White versus Non-White or Mixed residents to the implementation of pro-environmental actions falling under the lifestyle changes category.

As for energy sector related pro-environmental actions, there was not statistical significance among race/ethnicity groups, $X^2(5, N=469) = 4.4$, $p=.5$ (Figure 4). Non-White or Mixed group perceived "affordability", "accessibility", and "not a priority" as primary barriers to energy sector related pro-environmental actions at a greater percentage than their White counterparts. The barriers of "lack of information" and "personal beliefs" were experienced at relatively similar percentages among both groups. The lack of significant variance within the lifestyle changes category suggests that race/ethnicity is not a key contributing factor in the barriers selected, suggesting that other demographic factors are more strongly correlated with pro-environmental behaviors.

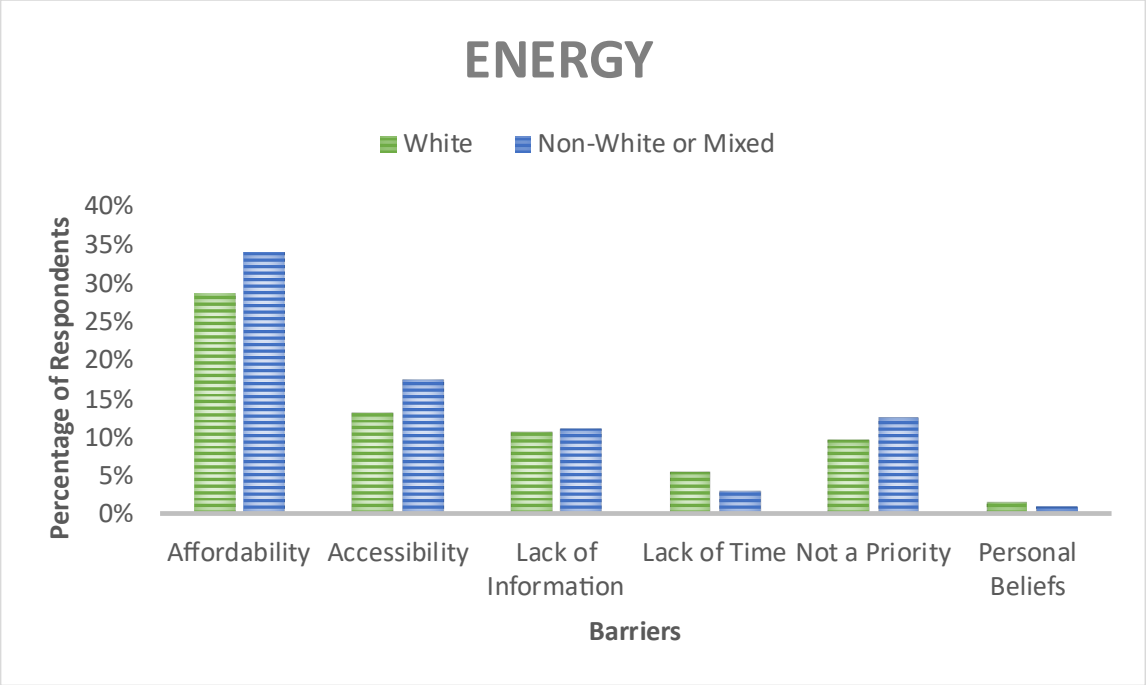

Figure 4. Barriers faced by White versus Non-White or Mixed residents to the implementation of pro-environmental actions falling under the energy category.

Barriers selected within the transportation sector were experienced at similar percentages across all race/ethnicity groups and did not prove to be statistically significant, $X^2(5, N=367) = 2$, $p=.9$ (Figure 5). White presenting residents identified "lack of time" more often than Non-White or Mixed presenting residents. "Accessibility," "lack of time," and "not a priority" were selected at slightly higher percentages among Non-White or Mixed respondents. "Affordability" and "personal beliefs" presented little noticeable variation in percentage of responses among these groups.

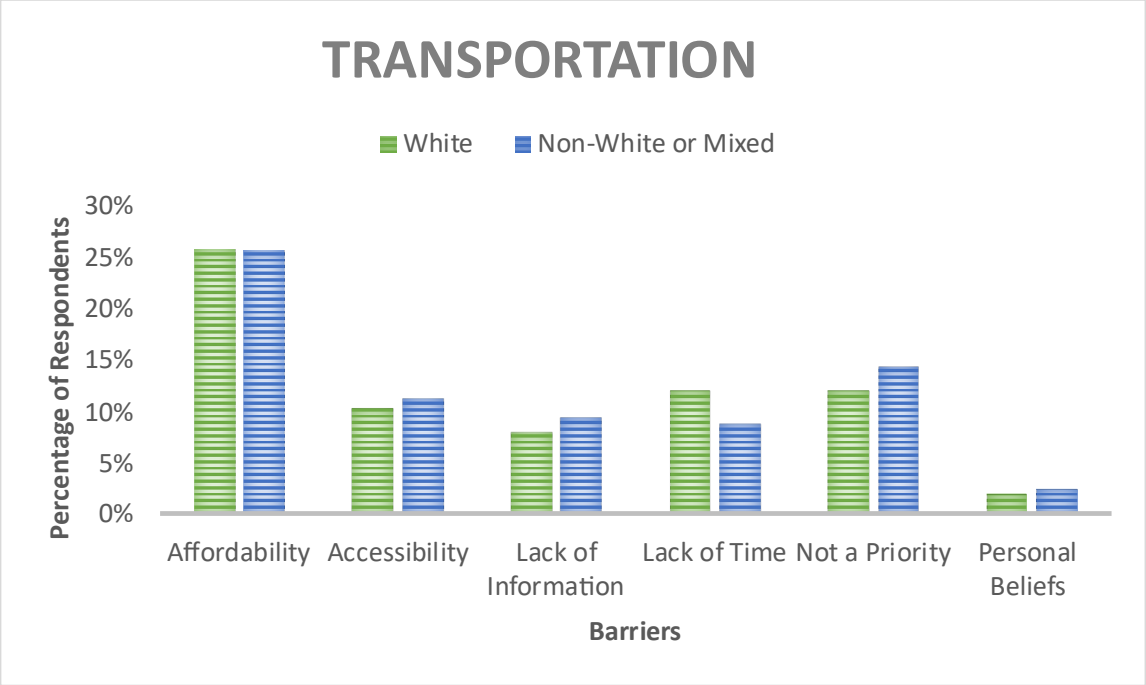

Figure 5. Barriers faced by White versus Non-White or Mixed residents to the implementation of pro-environmental actions falling under the transportation category.

4.3.3 Socioeconomic (SES) Status

One of the most important demographics to understand for policy implementation purposes is that of the various SES groups and the impact of annual income categories on perception of barriers to adopting pro-environmental actions. From RQ_2, H_2 hypothesizes that "affordability", "accessibility", and "lack of information" will be barriers to pro-environmental actions that would be more commonly faced by low SES groups, while "lack of time", "not a priority", and "personal beliefs" would be more commonly faced by high SES groups.

Variance in lifestyle changes to adopt pro-environmental behavior was statistically significant among survey participants of differing SES status, $X^2(10, N=300) = 27.4$, $p=.002$ (Figure 6). Low SES identifying individuals identified "accessibility" challenges at a higher percentage than high SES individuals. "Affordability" was

identified as a barrier among low and mid SES status groups at a much higher percentage than among those of high SES. “Lack of time” and “not a priority” were more commonly selected by those of high SES, reflecting that they experience greater individual barriers versus structural as opposed to low and mid SES participants. “Lack of information” was shown to be a perceived barrier in large part to those of mid SES and personal beliefs was simply not a significant barrier among any group.

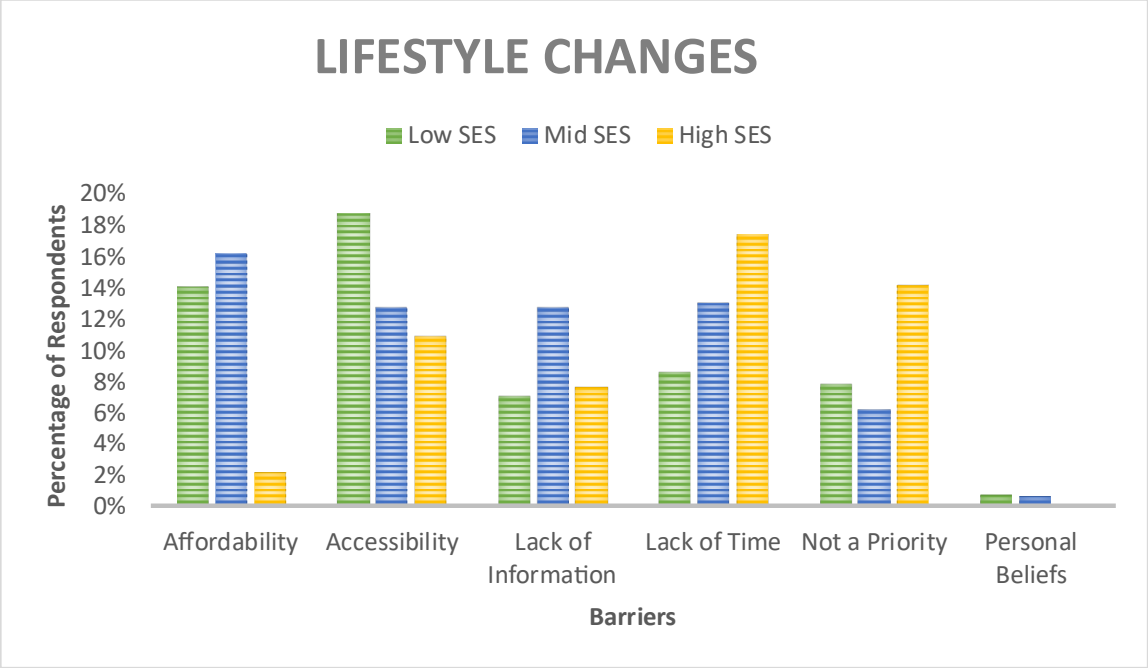

Figure 6. Barriers faced by low, mid, and high SES residents to the implementation of pro-environmental actions falling under the lifestyle changes category.

Within the energy sector, results were statistically significant for comparison of barriers between SES groups, $X^2(10, N=473) = 22.3$, $p=.01$ (Figure 7). “Affordability” is a highly identified barrier for both low SES and mid SES groups, while it is not for those of high SES. Both low and mid SES groups experienced higher percentages of “accessibility” as a barrier to energy related actions than the high SES group. Those of

mid SES selected “lack of information” and “lack of time” at slightly elevated percentages than their low and high counterparts. “Not a priority” was perceived to be a barrier at the highest percentage among low SES residents, followed by those of high SES. “Personal beliefs” was once again not a significant contributor.

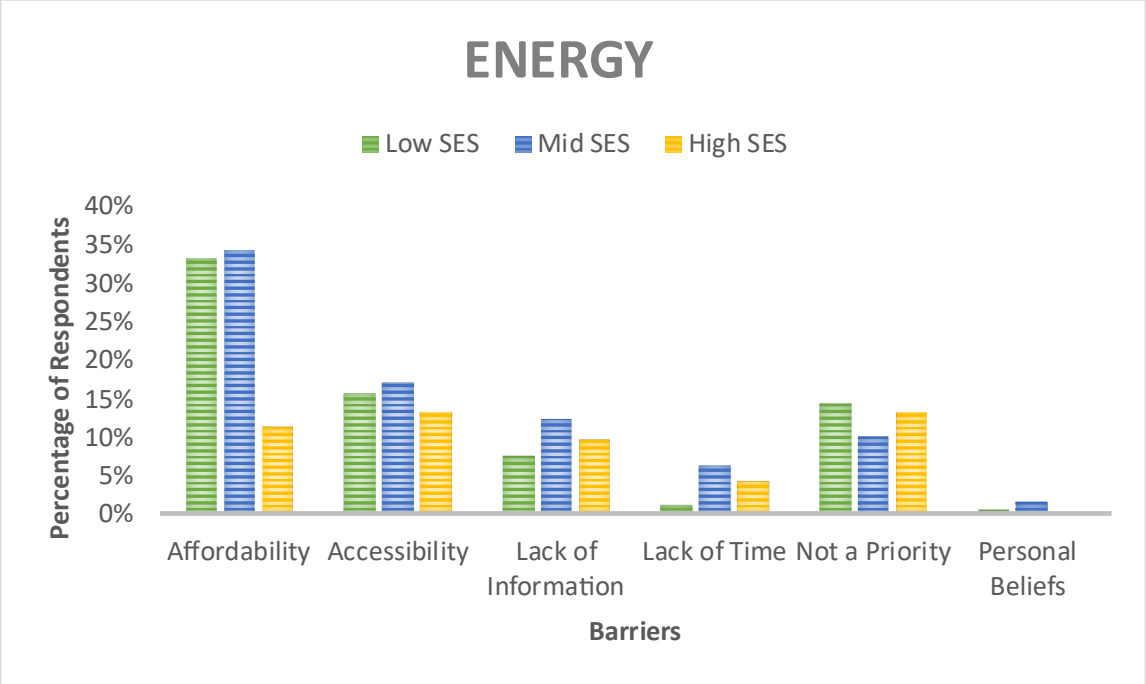

Figure 7. Barriers faced by low, mid, and high SES residents to the implementation of pro-environmental actions falling under the energy category.

Actions falling under the transportation sector exhibited statistically significant response rates for perceived barriers of SES groups, $X^2(10, N=362) = 38.3$, $p=.00003$. Transportation related action groupings present “not a priority” as a greater barrier to residents falling into the high SES group (Figure 8). “Affordability” was selected as a perceived barrier at a much higher percentage among low and mid SES groups, while “accessibility” was only slightly higher for them than for respondents of high SES. “Lack of information” and “lack of time” were shown to be more common among mid and high

SES groups than those respondents identifying as low SES. “Personal beliefs” was only selected by low and mid SES groups, however at extremely low percentages.

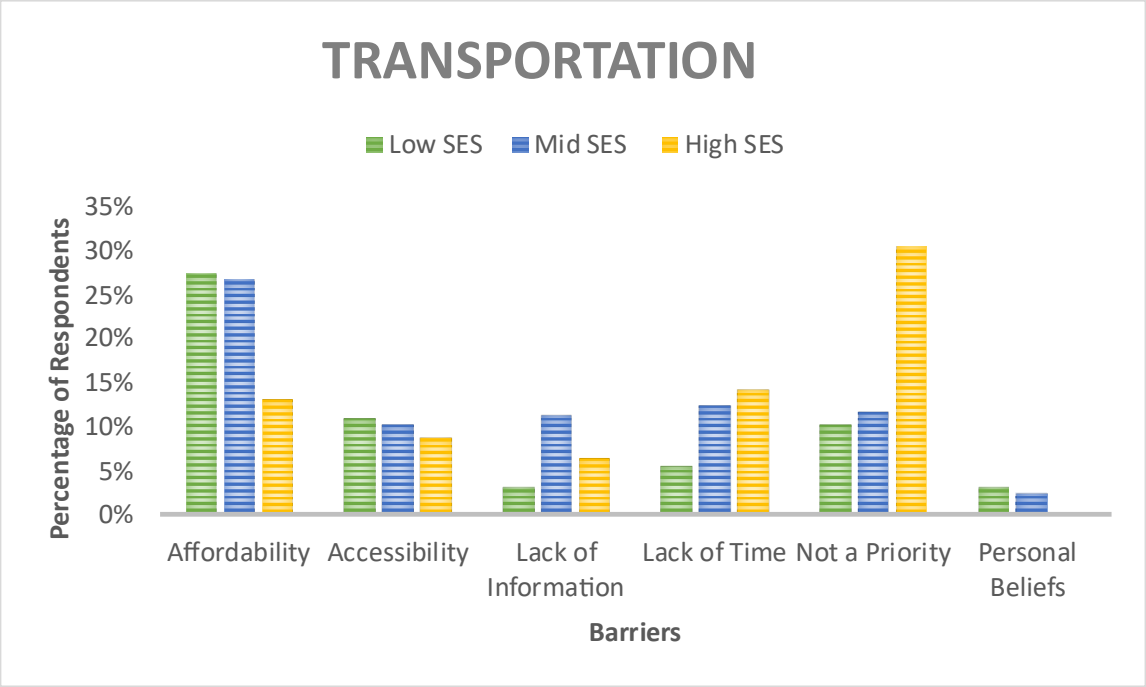

Figure 8. Barriers faced by low, mid, and high SES residents to the implementation of pro-environmental actions falling under the transportation category.

The proportion of respondents that reported barriers in all three action categories differed significantly based on SES, revealing areas where the city of SLO can provide support to increase adoption of such actions. These results validate H_2 for the following barriers; affordability and accessibility in all cases and lack of time and not a priority in the cases of lifestyle changes and transportation, while disproving all other cases.

4.3.4 Home Ownership

Another significant demographic is the renting versus owning populations. As SLO has a rather large turnover rate within its renter population, due to it being a college

town, it is crucial to analyze the barriers renters face if there is hope of significantly lowering emissions to meet carbon neutrality goals (Shockley, 2018).

Lifestyle changes did not prove to be statistically significant for differences in the selection of barriers between renters and owners, $X^2(5, N=318) = 7.5$, $p=.2$. Renters experience "affordability," "not a priority," and "personal beliefs" as barriers to implementing pro-environmental lifestyle changes at a higher percentage than owners, whereas owners identify "accessibility," "lack of information," and "lack of time" as more pertinent to them (Figure 9). These differences, however, did not produce statistically significant results, suggesting that home ownership is not an indicator of variance among adoption of pro-environmental actions falling under the lifestyle changes category.

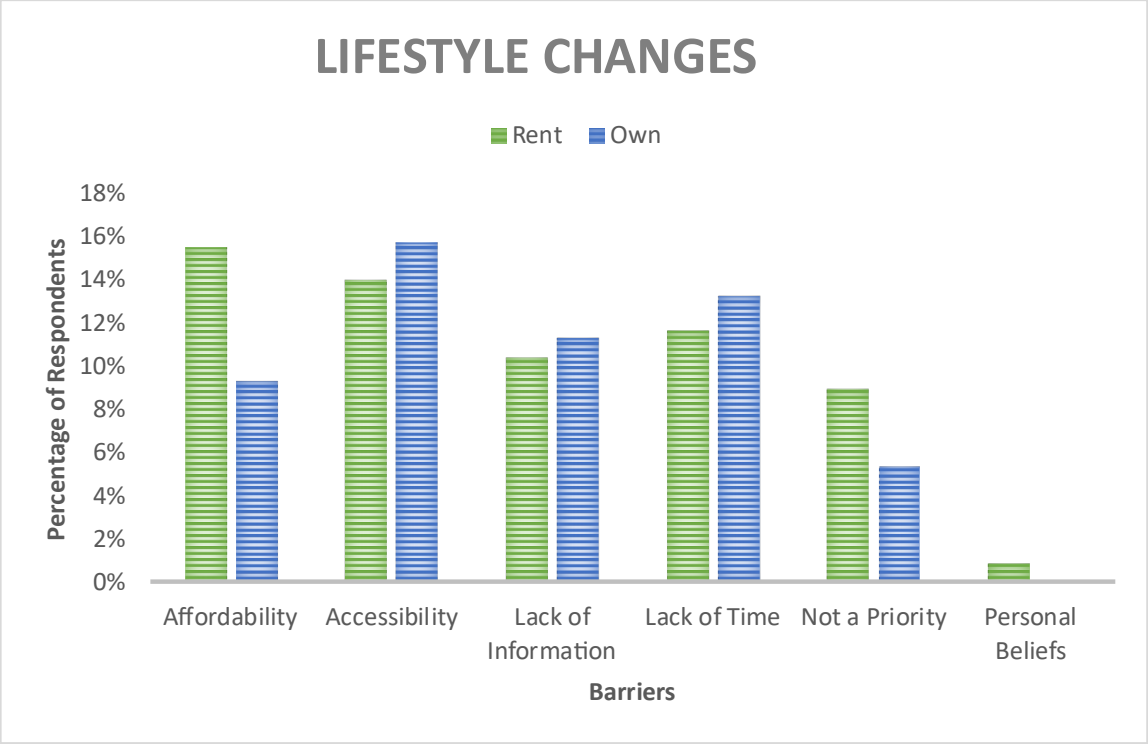

Figure 9. Barriers faced by renters versus owners to the implementation of pro-environmental actions falling under the lifestyle changes category.

Variance between perceived barriers among renters and owners across energy sector categorized actions proved to be statistically significant, $X^2(5, N=496) = 13$, $p=.02$ (Figure 10). Results from the energy sector reveal "lack of information" as a greater barrier to owners, which is telling when looking into the provided actions being geared toward home improvements and retrofitting. "Affordability," "accessibility," and "not a priority" were selected at higher percentages among renters, demonstrating a potential inability to implement such actions. "Lack of time" and "personal beliefs" were least commonly selected.

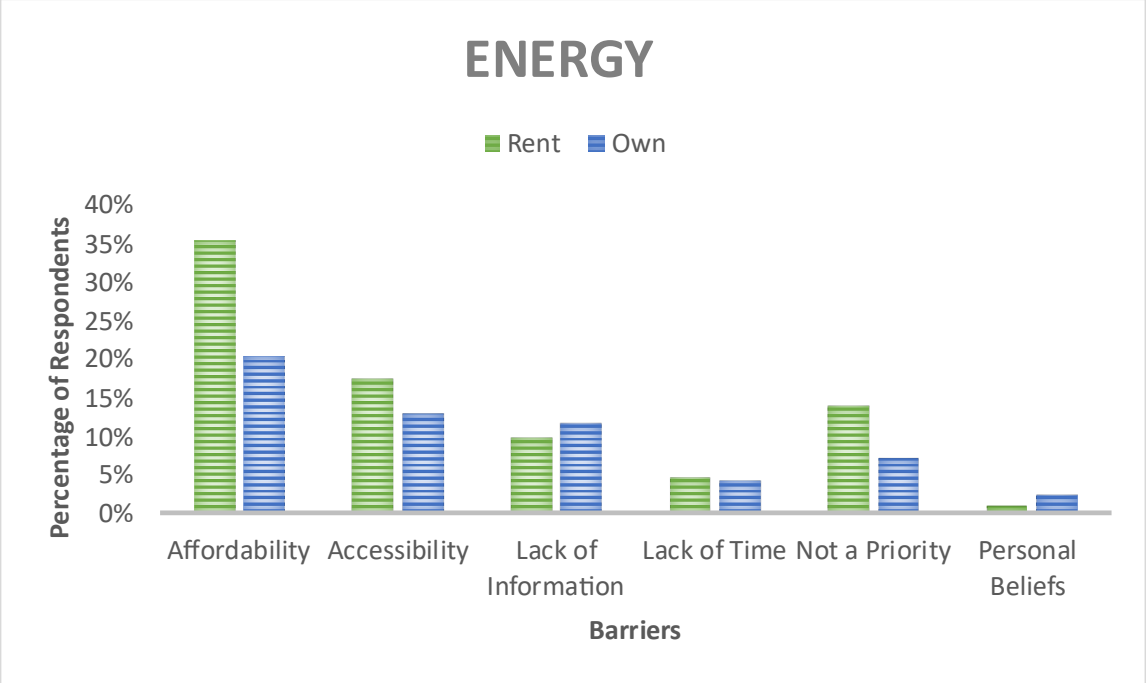

Figure 10. Barriers faced by renters versus owners to the implementation of pro-environmental actions falling under the energy category.

Within transportation, statistically significant variability was calculated among barriers selected by renters and owners, $X^2(5, N=383) = 12.5$, $p=.03$ (Figure 11). Renters perceive "affordability" as a significant barrier to these actions whereas homeowners

most disproportionately experience "lack of time" and "accessibility." "Lack of information," "not a priority," and "personal beliefs" were chosen as barriers at similar percentages among the two groups.

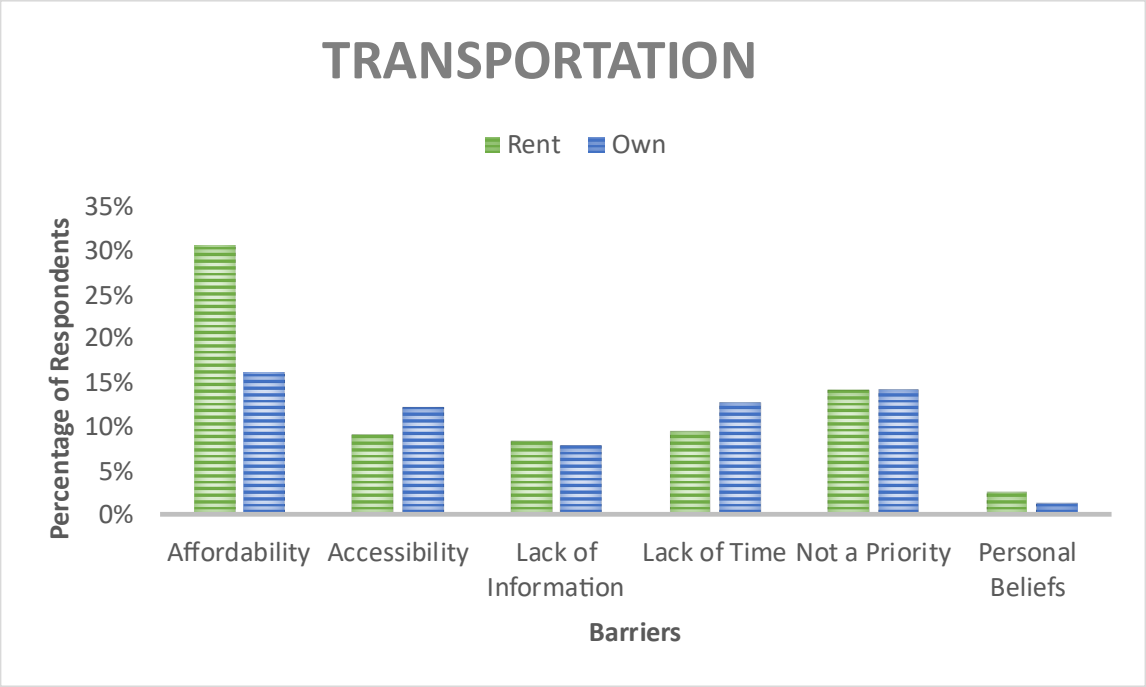

Figure 11. Barriers faced by renters versus owners to the implementation of pro-environmental actions falling under the transportation category.

4.4 Impact of Climate Change Perceptions on Motivations

To better understand the drivers and barriers to pro-environmental behaviors, we assessed participants' perceptions of climate change in addition to actions. From RQ_1, H_1b hypothesizes that personal benefits will be the most commonly selected motivation. "Climate change concerns" (65%) was selected as the most frequent motivation for implementing such actions, with personal benefits following in second (56%) (Figure 11), thus disproving H_1b. When respondents were asked to rank their perception of climate change on a scale from 1 to 10, with '1' meaning "not at all a serious problem" and '10' meaning "an extremely serious problem," level of climate change concern

positively correlated with selecting "climate change concerns" as a motivation ($p<0.01$, Table 6).

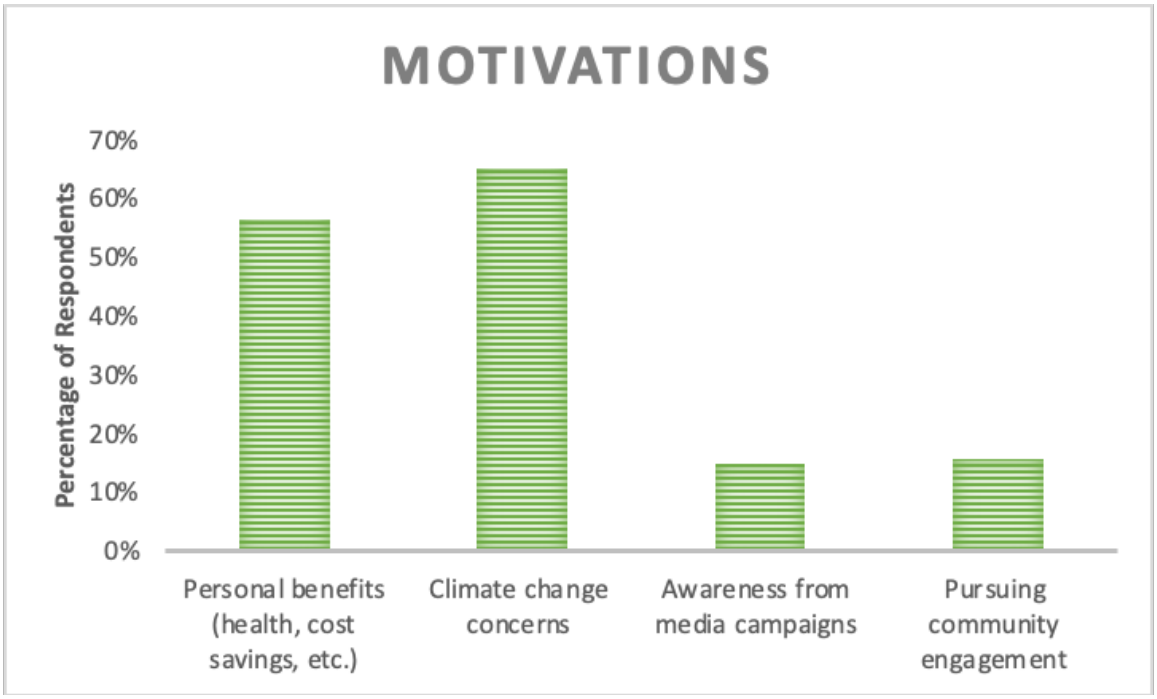

Figure 12. Motivations held by SLO residents to adopt pro-environmental actions (multiple could be selected).

Table 6. One-way ANOVA results, measuring average concern for climate change on a scale of 1-10 (with '1' meaning "not at all a serious problem" and '10' meaning "an extremely serious problem") (N=133, df=1).

Treatments	Mean	Standard Deviation	P-value
"Climate change concerns" not selected as a motivation	7.1	2.9	*.00002< .05*
"Climate change concerns" selected as a motivation	8.8	1.5	

4.5 Community Resources

Survey respondents were asked the following singular free response question: "Please tell us about any community resources you wish existed in San Luis Obispo, CA." Qualitative analysis was used to investigate responses to this question and shed light on consistent sentiments held by the sample population. A word frequency analysis was conducted, which looked for the words in these free responses that appeared the most frequently (Table 7). Commonalities in participant responses suggest areas that require improvement in the city of SLO by the sample population and may have potential general applications. Although the question was directed toward community resources that do not presently exist, many respondents also identified areas where resources exist but could be improved to increase use. Specifically, recycling, public transit/transportation, and homeless related resources were reported by SLO residents to be most lacking in supportive infrastructure. Considering that recycling and use of public transit/transportation are pro-environmental actions that were analyzed in this study, it is very important that they be addressed to encourage participation. Other pro-environmental actions identified in the free responses include biking, compost, and solar, suggesting that *structural* rather than *individual* barriers may be critical limiting factors to engaging in pro-environmental behaviors.

Table 7. Qualitative frequency analysis of free responses from survey participants regarding perceived lacking community resources in SLO.

Term	Frequency (N=58)
Recycling	12 (20%)
Public Transit/Transportation	11 (19%)
Homeless	11 (19%)
Housing	9 (16%)
Bike	7 (12%)
Compost	5 (9%)
Incentives	5 (9%)
Solar	5 (9%)
Zoning	5 (9%)

Chapter 5

DISCUSSION

5.1 Overview of Findings

The results of this study contribute to the existing body of research pertaining to pro-environmental behaviors by providing insight into the barriers and motivations faced within a specific locality by its residents, highlighting the implications of demographics and behaviors, and offering a framework for other areas to investigate residential carbon neutrality goals (Table 8).

Table 8. Overview of findings based on the initial set of hypotheses.

Hypothesis	**Findings**	**Conclusion**
RQ_1 - H_1a	Actions categorized as lifestyle changes (i.e., waste reduction/recycling, minimize disposables, food conscious, and alternative transportation) were the most commonly adopted, followed by transportation (i.e., fuel consumption, travel, electric/hybrid vehicle, and alternative transportation) and then energy sector (i.e., household appliances, home insulation, home energy, energy supplier, and solar panels) related actions.	*Failure to Reject*
RQ_1 - H_1b	The most common motivation for adopting pro-environmental actions was climate change concerns.	*Rejected*
RQ_2 - H_2	Affordability and accessibility are the most common barriers faced by low-income SLO residents across all action categories, while lack of time and not a priority are only most common for high-income SLO residents in the cases of lifestyle changes and transportation. Lack of information and personal beliefs did not follow a clear trend.	*Partially Rejected*
RQ_3 - H_3	Perceptions in climate change as a more significant issue resulted in a greater probability of selecting it as a motivation for implementing pro-environmental actions.	*Failure to Reject*

The study reveals that barriers to pro-environmental actions are perceived differently by groups that differ in race/ethnicity, SES, and home ownership. These findings suggest that sound implementation of policies targeted at increasing participation in pro-environmental behaviors at the city level will require an awareness about variability in lived experiences within SLO. The city of SLO should aim to address structural barriers, such as affordability, accessibility, and lack of information (Baker, 2012). Focus should also be placed on increasing environmental literacy, as the *perception* of climate change as a pressing issue was identified to be a main motivational factor behind pro-environmental action. Understanding the actions that SLO residents are already adopting provides insight into areas where implementation may easily be increased through minor support as well as those that may require greater involvement from the city.

5.2 Adoption of Pro-Environmental Actions

The adoption of pro-environmental actions from within the residential sector is a topic that is gaining importance as more municipalities make the commitment to reach carbon neutrality. This commitment involves finding innovative ways to address emissions from the residential sector and encourage residents to champion environmental behaviors in their daily lives (Cheng, 2022). However, this is a difficult feat to take on as understanding why people may or may not act requires recognition that behavior is influenced by many internal and external forces and the local government's role as an external force could likely not elicit change on its own (Gleim, 2019). This study asked its respondents to identify current pro-environmental actions that they perform from a

generated list of twelve actions to help the city of SLO to better comprehend the motivations and barriers to widespread adoption of pro-environmental behaviors among residents. Although not a comprehensive carbon footprint assessment, the twelve actions surveyed serve to address many of the areas that the city is most interested in, including those related to infrastructure and possible incentive programs (e.g., alternative transportation and solar panels) in SLO or more broadly offered throughout the state of California. Overall, study respondents had higher rates of participation among actions falling under lifestyle changes, which generally do not require as extensive infrastructural support, with the exception of alternative transportation. As for those falling under transportation, actions were adopted that were more economically feasible, while others, such as purchasing an electric/hybrid vehicle remain out of reach for many despite a willingness to make the switch.

Pro-environmental behaviors, particularly in the energy sector, are often limited by existing infrastructure and attitudes alone are not enough of a driver (Jakučionytė-Skodienė, 2020). Actions categorized under the energy sector were the least commonly adopted by survey respondents despite being the largest contributing sector to carbon emissions. This demonstrates that residents of SLO's attitudes toward climate change may be enough to influence changes in categories such as lifestyle changes, but not enough to overcome the structural barriers present within home energy (Jakučionytė-Skodienė, 2020).

5.2.1 Implications of Motivations

Survey respondents identified their greatest motivations for implementing pro-environmental actions as "climate change concerns," followed closely by "personal

benefits," with few selecting pursuing community engagement and awareness from media campaigns. One of the most difficult aspects of addressing motivations is the understanding of the value-action gap, defined earlier as the gap between an individual wanting to make a change and taking necessary action to change their behavior (Blake, 1999). These motivations have been identified as those behind the respondents' adoption of pro-environmental actions, suggesting that they could have significant influence when paired with structural support from the city of SLO, hence acting as a bridge between value and action.

Motivation-driven activities are offset by structural issues, once again stressing the importance of motivations and structural support working in tandem (Tabi, 2013). The study found that a large percentage of residents of SLO, based on the sample population, are generally concerned about climate change, noting that it is a significant issue. Thus, climate change perceptions are an important variable when analyzing motivations for adopting pro-environmental actions and encouraging community members to pursue these types of actions. It is crucial to place residents in positions where they have agency to make changes to lower their carbon emissions, especially when motivations to do so exist and are being reflected by the survey responses collected in this study. Additionally, climate change education and increasing environmental awareness may be beneficial for increasing implementation of actions. "Personal benefits" is also a useful motivation and should be highlighted during discussion of solutions to carbon emission reductions (Jakučionytė-Skodienė, 2020). As "personal benefits" can be considered a more universally recognized norm, whereas climate change

concerns tend to rely on eco-centric world views, this can be a good motivation for the city of SLO to target to increase participation.

5.3 Barriers to Pro-Environmental Actions

Previous research has focused on identifying barriers to pro-environmental action on a broad scale, citing the differences between individual barriers and those that are social or institutional. Social or institutional barriers, classified as practicality, restrict people from adopting pro-environmental behaviors despite their attitudes or intentions, citing some examples of these as lack of money and lack of information (Kollmuss, 2002). Much like those barriers identified in previous research, this study identified similar and additional barriers being faced by SLO residents including "affordability," "accessibility," "lack of information," "lack of time," "not a priority," and "personal beliefs." The barrier of "affordability" (N=408) was selected the most, followed by "accessibility" (N=241), revealing that these social and institutional barriers are the most restrictive for SLO residents and must be addressed on a structural level.

Many pro-environmental actions can only occur when necessary external factors, such as proper infrastructure, are in place, supporting the notion that the city of SLO must take action to improve and invest in public resources as discussed in the results (Li, 2019). These barriers reflect potential areas for growth in terms of supporting carbon neutrality and lowering the associated carbon emissions. Although individual barriers must be overcome through the internal motivations of the public, those structural barriers that are strongly influenced by external forces present the opportunity to be addressed within the city's capabilities.

5.3.1 Implications of Key Demographic Groups

The key demographic analyzed in this study include ethnicity, SES, and home ownership. Significant relationships between all three key demographics and pro-environmental actions/barriers were found, demonstrating that consideration of these factors is a crucial component to understanding the interconnected nature between environmental and social justices as well as structural solutions. Differences in SES was correlated variation in all pro-environmental action categories, which is in line with "affordability" being the most common barrier selected by respondents. Characteristics such as income impact an individual's ability to implement certain actions and goes on to describe this as the behavior-impact gap (Tabi, 2013). This gap extends past the previously discussed value-action gap, classifying the gap between a person adopting an action and the actual impact on their carbon footprint from consumption (Blake, 1999). An individual's SES often translates in turn to their experience of certain barriers, much like the other demographic characteristics, such as the comparison of renting versus owning a property and its impact on having agency to make environmental changes. Renting versus owning has a direct influence on energy-saving behavior (Jakučionytė-Skodienė, 2020), which can be seen in the energy category of this research. Previous research has also focused largely on ethnicity as an important demographic variable in analyzing pro-environmental behaviors (Ghazali, 2019); and this study exhibits that among actions categorized under lifestyle changes there is statistically significant variability. This finding can be useful in analyzing the impacts that social and cultural norms have on pro-environmental behaviors, particularly in the city of SLO.

5.4 Implications of Additional Findings

This study placed special importance on community resources and offered up a platform for feedback from residents on areas where the city of SLO can improve. This aspect allowed for the researchers to see not only what could be improved, but also provided insight on resources that do exist but that the public are not aware of, showing a lack of information in this regard. Results reflected the main three areas that are lacking proper resources in the city as recycling programs, public transportation options, and addressing homelessness, which can all be categorized as structural issues. Although recycling programs and public transportation exist, many identified them as insufficient for community needs as they currently stand. Adequate infrastructure will encourage greater adoption of pro-environmental actions (Kollmuss, 2002). Simply put, people will not take public transit if it has poor and infrequent routes and will not recycle if it is not convenient for them to do so or receive accurate education about. It should be a point for these improvements to be addressed in the city of SLO's CAP update, as they could generate significant reductions in carbon emissions associated with waste and personal vehicle usage.

Chapter 6

CONCLUSION

The findings of this study illustrate that barriers exist to the adoption of specified pro-environmental actions by residents of the city of SLO. This information is pertinent to the city of SLO, particularly the Office of Sustainability, that has committed to the goal of achieving carbon neutrality by 2035, noting that the residential sector is one of the top contributors to carbon emissions in a municipality. To achieve this goal, it is of great importance to address those barriers that are being faced by the public and create infrastructure that supports implementation on individual and community levels. "Affordability" was the most selected barrier among survey participants, followed by "accessibility," while "personal beliefs" was the least selected. This study also distinguished among pro-environmental action barriers that are primarily individual versus those that are inherently structural. Structural barriers have the potential to then be addressed by the city of SLO and constitute grounds for improvement.

Analysis of barriers was conducted through disaggregation into the following key demographic groups: ethnicity, SES, and home ownership. Barriers selected under lifestyle changes varied by race/ethnicity and SES groups, while barriers related to the transportation and energy sector varied by SES and home ownership groups. Information from this study provides insight for policy mechanisms targeted at certain demographics and allows for a clearer lens on equity in the city of SLO.

This research highlighted that respondents were most motivated by "climate change concerns" and "personal benefits" to implement pro-environmental behaviors into their daily lives. Additionally, the perception of climate change as a significant issue was

positively correlated with the likelihood of selecting "climate change concerns" as a motivational factor. This result demonstrates the importance of environmental awareness and education for the public, noting that fostering an understanding of climate change related issues may motivate individual action. Future research should focus on examining if climate change concerns are able to overcome either or both individual and structural barriers. This study serves as a general baseline for the levels of adoption of pro-environmental actions among SLO residents at the time of this study. Though not a comprehensive carbon footprint assessment, the survey outlined action and inaction among twelve pre-selected pro-environmental actions, emphasizing barriers faced when inaction occurred.

This study supported previous research on the identification of barriers to pro-environmental behavior and challenged perceptions of the influences of internal and external factors against key demographics. The overall recommendation to address structural barriers and their impact on differing demographics within the city of SLO's CAP update, is considered best practice as it is crucial to include actionable discussions on equity when presenting mitigation measures. Future research should aim to continue development of understanding of all factors influencing pro-environmental behaviors and emphasize approaches that focus on the root of environmental and social issues. As subsequent adoption of municipal CAPs makes apparent, targeting residential pro-environmental behaviors remains a viable option for significantly reducing carbon emissions. Doing so places communities at the forefront of environmental change, paving a sustainable path for future generations to follow.

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APPENDICES

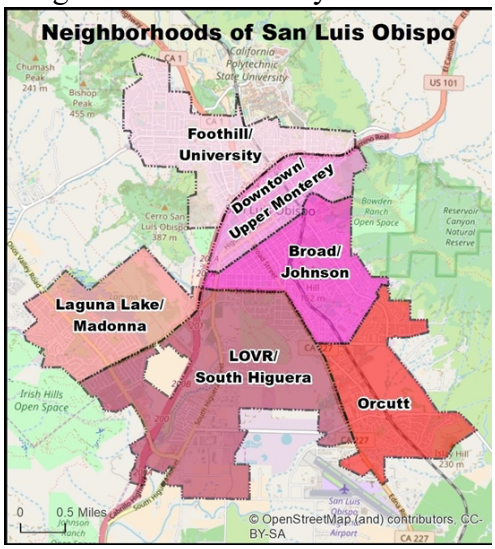
A. Survey

1. Please navigate to the link below to review the survey consent form. https://docs.google.com/document/d/15yEjwpa5pADM8Mmm9e6EaeTh78K20uoMXqP3U86VSRk/edit?usp=sharing • I have read the consent form and consent to participate in research. • I do not consent to participate in research.
2. Please select your gender identity. • Female • Male • Non-binary • Prefer not to say • Other
3. Please select your age category. • 18-24 • 25-34 • 35-44 • 45-54 • 55-64 • 65-74 • 75+ • Prefer not to say
4. Please select your race and/or ethnicity. Select all that apply. o White or Caucasian o Asian o Black or African American o Hispanic or Latino o Native American or Alaska Native o Native Hawaiian or Other Pacific Islander o Prefer not to say
5. Please select your highest level of education. • Less than or some high school • Completed high school, GED, or equivalent • Some college • Trade, technical, or vocational school • Associate degree • Bachelor's degree • Master's degree • Doctorate degree • Prefer not to say • Other
6. Please select your income level category. • Less than $20,000 • $20,000 - $34,999

- $35,000 - $49,999
- $50,000 - $74,999
- $75,000 - $99,999
- $100,000 - $124,999
- $125,000 - $149,999
- $150,000 and over
- Prefer not to say

7. Please select your employment status.
   - Full-time employment
   - Part-time employment
   - Unemployed
   - Self-employed
   - Home-maker
   - Student
   - Retired
   - Prefer not to say

8. Please select which neighborhood of the city of San Luis Obispo you live in.



- Foothill/University
- Downtown/Upper Monterey
- Broad/Johnson
- Orcutt
- LOVR/South Higuera
- Laguna Lake/Madonna
- None. I am not a resident of the city of San Luis Obispo
- Prefer not to say

9. Do you rent or own?
   - Rent
   - Own
   - Prefer not to say

10. Which of the following do you consider to be the single most serious problem facing the world as a whole?
- Poverty, hunger, and lack of drinking water
- Climate change
- International terrorism
- The economic situation
- Armed conflicts
- The increasing global population
- Proliferation of nuclear weapons
- Spread of infectious diseases
- Other

11. Please select the barrier(s) you face to implementing the following actions.
- None. I already do this
- Accessibility
- Lack of information
- Affordability
- Lack of time
- Not a priority
- Personal beliefs

Actions:
You try to reduce your waste and regularly separate it for recycling.
You try to cut down on your consumption of disposable items whenever possible (e.g., plastic bags from the supermarket, excessive packaging, plastic water bottles, etc.).
When buying a new household appliance (e.g., washing machine, fridge, TV, etc.), lower energy consumption is an important factor in your choice.
You regularly use eco-friendly alternatives to a private vehicle (e.g., walking, cycling, taking public transportation, ride sharing, carpool, etc.).
You have insulated your home better to reduce your energy consumption.
You consider the carbon footprint of your food purchases and sometimes adapt your shopping accordingly.
You have installed equipment in your home to control your energy consumption (e.g., smart meter, smart lighting controls, etc).
You have bought a new vehicle and its fuel consumption was an important factor in your choice.
You switched to an energy supplier which offers a greater share of energy from renewable sources than your previous one.
You consider your carbon footprint of your transport when planning your holiday and other longer distance travel and adapt your plans accordingly.
You have bought an electric or hybrid vehicle.
You have installed solar panels on your home.

12. Of the barrier(s) you selected, which is the most important?
If the most important barrier you face is not listed, please tell us about it in 'Other.'
- Accessibility

- Lack of information
- Affordability
- Lack of time
- Not a priority
- Personal beliefs
- No barriers were selected
- Other

13. Please select which action(s) you feel would overcome the barriers you selected.
If there is an action that is not listed, please tell us about it in 'Other.'
  - Awareness campaigns
  - Educational community programs
  - Governmental initiatives and/or assistance
  - More eco-friendly initiatives
  - I don't believe action is needed
  - Other

14. Please select your motivation(s) for implementing the previously identified actions.
If you have a motivation that is not listed, please tell us about it in 'Other.'
If you are not motivated to implement eco-friendly actions, please tell us why in 'Other.'
  - Personal benefits (health, cost savings, etc.)
  - Climate change concerns
  - Awareness from media campaigns
  - Pursuing community engagement
  - I am not motivated to implement eco-friendly actions
  - Other

15. How much, if anything, would you be willing to change about how you live and work to help reduce the effects of global climate change?
- A lot of changes
- Some changes
- A few changes
- No changes at all

16. How confident are you that actions you take to reduce your environmental impact will significantly reduce the effects of global climate change?
- Very confident
- Somewhat confident
- Not too confident
- Not at all confident

17. How serious a problem do you think climate change is at the moment? Please use a scale of 1 to 10, with '1' meaning it is "not at all a serious problem" and '10' meaning it is "an extremely serious problem".
- 1
- 2

- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

18. In your opinion, who within the United States is responsible for tackling climate change?
    - National Government
    - Business and Industry
    - State of California
    - Individuals like yourself
    - Regional and Local Authorities
    - Environmental Groups
    - All of them
    - Other

19. Please indicate if you agree or disagree with each of the following statements.
    - Agree
    - Disagree
    - Neutral
    - I don't understand the statement

Statements:
I know about the causes of climate change.
I know about the consequences of climate change.
I know about potential solutions to climate change.
There is conflicting information on climate change to know whether it is actually happening.
The media is alarmist about environmental issues.
Pollution from industry is the main cause of climate change.
We have technology that can save us from problems associated with climate change.
Climate change is a bigger threat in other parts of the world.
I will be personally affected by climate change in my lifetime.
There are many other things besides climate change that I can focus on right now.
Making changes to be more environmentally sustainable are too costly at this time.
It is already too late and there is nothing we can do at this point to affect climate change.
Climate change is a global problem so changes that I make wouldn't make a difference.
The government is not doing enough to tackle climate change.
Industry and business should be doing more to tackle climate change.
People are too selfish to do anything about climate change.
Radical changes to society are needed to tackle climate change.
Cars are not the big polluting evil that some people say they are.

The government should provide incentives for people to look after the environment.
20. Please tell us about any community resources you wish existed in San Luis Obispo, CA.
21. Please select if you would like to provide your e-mail address for any of the following. Provide your e-mail address in 'Other.' o If you wish to enter the e-gift card raffle. o If you would like to actively participate in reducing your carbon footprint. o If you would like more information about community resources. o Other