
ASSESSING HUMAN POPULATION DYNAMICS AND CLIMATE CHANGE IN VULNERABLE COMMUNITIES IN BARANGAY IBO, LAPU-LAPU, CEBU

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Abstract

This study focused on the relevance of the population count, average household size, and the change of climate within the given years. The research aimed to assess whether climate change has a significant impact on the human population and household size in the community of Brgy. Ibo, Lapu-Lapu City. The researchers used the qualitative data method to gain insight and analyse trends over time; data were mined through the census of PhilAtlas and data from Weather Underground. The researchers examined the data over five years. The researchers found that there was a gradual increase in population from the year 2000 to 2020, and the highest population count was in 2020. On average, the household size decreased from 1995 to 2015, with 2015 having the lowest number of people per household. The highest temperature recorded in 2010 was the lowest in 2000. The researchers projected forecasts in terms of year and temperature, and there was a decrease in temperature for the year 2025 compared to the year 2024. After 2025, there was a gradual rise in temperature in 2030. The projected data revealed an increase in the population, indicating that there is a significant relationship between year and population.

Keywords: household size, temperature, resource utilisation, urbanisation, growth rate.

1. INTRODUCTION

Climate change is causing temperatures to rise globally. In coastal areas like Barangay Ibo, increasing temperatures can lead to more frequent and severe weather events, such as typhoons and heat waves. Higher temperatures also affect local agriculture, Water resources, and health, which are critical for maintaining the population. Climate change can reduce the availability of these resources by damaging crops, depleting water supplies, and disrupting fisheries if the population continues to grow without adequate planning and adaptation measures.

The effect of temperature increases due to climate change is expected to have a negative impact on a range of outcomes (Churchill et al., 2022) ^[1]. The effect of temperature increases on the incidence of poverty-stricken families depends on the climate. In cold climates, typically associated with the inability to heat one's home adequately, one might expect temperature increases to lower the incidence of energy poverty, holding other factors constant. However, in warm climate countries, in which energy poverty is primarily due to the cost of cooling, rising temperatures might

heighten energy poverty. This is because in countries or regions with hot climates, spikes in energy consumption, contributing to energy poverty, are mainly due to extremely hot days (Chai et al., 2021) ^[2].

The Philippines is one of the world's most climate-vulnerable countries. It is confronted with at least 20 typhoons every year, which lead to the destruction of houses and livelihoods, the displacement of thousands, and hundreds of deaths. It also experiences extreme droughts and rising sea levels. These not only lead to the forced displacement of communities but also threaten food security. Given the negative effects of these adverse social and environmental conditions on mental health, climate-related anxiety has affected the Philippine population. In 2022, a global survey showed that the Philippines has the highest number of young people experiencing high levels of anxiety and negative emotions associated with the climate crisis. Thus, there is an ever-increasing need for a strong and resilient mental health system (Albudbud et al., 2023) ^[3]. Ibo is a barangay in the city of Lapu-Lapu. Its population, as determined by the 2020 Census, was 8,318. This represented 1.67% of the total population of Lapu-Lapu. The household population of Ibo in the 2015 Census was 8,126, broken down into 2,521 households or an average of 3.22 members per household. The population of Ibo grew from 1,453 in 1990 to 8,318 in 2020, an increase of 6,865 people over 30 years. The latest census figures in 2020 denote a positive growth rate of 0.49%, or an increase of 192 people, from the previous population of 8,126 in 2015.

Barangay Ibo is a coastal community that is particularly vulnerable to the impacts of climate change due to its location. Rising sea levels and extreme weather events can lead to flooding and erosion, threatening homes and livelihoods. The higher temperatures can impact the health of residents, especially the elderly and children, and reduce the productivity of local fisheries and agriculture. Barangay Ibo, like many communities, is experiencing population growth. As more people move to the area, the demand for resources such as food, water, and shelter increases. This growth can strain the local environment and infrastructure, making it harder to support everyone, especially in the face of climate change. The purpose of this study is to assess the human dynamics of Brgy. Ibo and its relation to climate change. Specifically, it aimed to establish an understanding of population growth that helps predict the increased human dynamics in the community and analyze the projected temperature rise that can indicate relation to climate change.

2. METHODOLOGY

This study used qualitative data to gain in-depth insights and analyse trends over time. Census data for Brgy. Ibo was collected every five years from PhitAtlas, specifically for the years 2000, 2007, 2010, 2015, and 2020. Average household sizes were similarly recorded from PhitAtlas census data for the years 1995, 2000, 2007, 2010, and 2015 to analyse trends over time. Maximum temperature data for Lapu-Lapu were obtained from Weather Underground for the years 2000, 2007, 2010, 2015, and 2020 to examine temperature trends. This systematic collection of data from reliable

sources facilitated a comprehensive analysis of population growth, household size trends, and temperature changes in the Brgy. Ibo Lapu-Lapu City.

The researchers also used the forecasting method to predict future trends. For projection and forecasting, Simple Linear Regression Analysis was employed to project population growth from 2025 to 2030 and to forecast temperature trends from 2025 to 2030.

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

This method goes beyond correlation by establishing a mathematical model that describes the linear relationship between population (dependent variable) and year (independent variable). This model allows the researchers to predict year population and year temperature and assess the strength of this prediction through the coefficient of determination (R^2). R^2 tells how many predictions of the year population and year temperature would explain. The formula to be used is $y=a+bx$.

3. RESULTS AND DISCUSSION

The Population of Brgy. Ibo

Table 1

The Population of Brgy. Ibo every five years

Year	Population
2000	4,382
2007	6,775
2010	7,055
2015	8,126
2020	8,318

Table 1 shows the population of Brgy. Ibo every five years, based on the 2020 Census (PhitAtlas, 2020) ^[4], Baranga Ibo of Lapu-Lapu had a total population of 8,318 in 2020, which increased by 192 from 8,126 in 2010 with a population growth rate of 1.47%. According to the World Population Prospects (2022), as cited by Zarocostas (2022) ^[5], the population is growing at the slowest rate; the global population is expected to reach 8 billion people in 2023. It is projected to grow to approximately 9.7 billion by 2050 and peak at around 10.4 billion in the 2080s. The population is then expected to remain at that level until the end of the century. The analysis of the anticipated growth of the world population by 2050 will be mostly seen in eight nations with low to middle incomes. These countries include the Democratic Republic of Congo, Egypt, Ethiopia, India, Nigeria, Pakistan, Tanzania, and the Philippines.

In the Philippines, the challenges encompassing the result of population growth are that rural areas are undergoing a gradual process of urbanisation as a result of population growth and demand. The changing climate conditions potentially caused by climate change are seen as threats (Yamagishi, 2024) ^[6]. Traffic congestion and

overpopulation in highly urbanised cities are linked to the spread of population in rural areas. Furthermore, Cebu experiences a consistent increase in population and a rise in per capita consumption, which contributes to the growing demand (Galolo, 2016) ^[7]. Overall, amidst the global downshift of economic development, the Philippines, as a developing country, needs help effectively handling the rise of its population and its effects on urbanisation, climate change, and resource utilisation.

Household Size in Brgy. Ibo

Table 2

Average Household Size in Brgy.Ibo every five years

Year	Average Household Size
1995	5.13
2000	4.21
2007	3.86
2010	3.54
2015	3.22

Table 2 indicates the average household size in Brgy. Ibo every five years, based on PhitAtlas (2020) ^[4], the highest average household size was in 1995, with 5.13 members per household, followed by 4.21 members per household in 2000. In the 2015 Census, the recorded population was 8,126; on average, each household had 3.22 individuals. Othman and Motlak (2023) ^[8] elucidate that the household is a crucial economic and social institution in human civilisation; this will provide a reality for society. Household size is a significant demographic factor that impacts the financial decisions made by individuals (Curtis et al., 2017) ^[9]. Additionally, Wu et al. (2021) ^[10] assert that household size was determined by the total number of individuals residing in a house, excluding family members who did not live in the same residence.

According to Gu et al. (2021) ^[11], the average household size across all countries was approximately four individuals per home. Based on estimates, if the average household size worldwide had been 2.5 persons, the total number of households globally would have been 2.7 billion. This is 0.8 billion higher than the actual figure of 1.9 billion households, representing a 41% increase. In the Philippines, households in highly urbanised areas like Metro Manila and the urban centres of Cebu and Davao del Sur are often classified into two categories: small families consisting of two members and larger families consisting of five members, including three children (Magno-Ballesteros et al., 2022) ^[12]. Overall, household size and composition trends have significant implications for sustainable development, particularly when they are linked to consumption and capacity.

*Temperature in Lapu-Lapu City***Table 3***Maximum Temperature in Lapu-Lapu last five years*

Year	Maximum Temperature
2020	35°C
2021	33.8 °C
2022	32.7°C
2023	35 °C
2024	37.7 °C

Table 3 shows the maximum temperature in Lapu-Lapu in the last five years. The year with the highest maximum temperature was 2024, with 37.7 C, and in the 2023 census done by Weather Underground ^[13], the maximum temperature was 35 C, denoting an increase in temperature. According to Wang (2024) ^[14], the upward trends in monthly maximum temperature are significantly more noticeable than those in minimum temperature. Significant fluctuations are observed in the time series of monthly, seasonal, and annual maximum and lowest temperatures. More precisely, there was a sudden and considerable increase in the maximum temperature recorded each year since the 1980s. According to the IPCC Sixth Assessment Report (AR6), the average temperature of the Earth's surface has risen by one °C from 1850 to the present (Wang, 2024) ^[14].

On the other hand, Ombao (2024) ^[15] asserts that the Meteorology, Climatology, and Geophysics Agency (BMKG) has verified that this occurrence is not a heatwave like those seen in various Asian nations, where the recorded temperatures have surpassed 40 degrees Celsius. Meanwhile, the Philippines, as a developing country, exhibits a high susceptibility to climate change and ranks as the fourth most impacted nation from 2000 to 2019, denoted a notable temperature increase of 1.5 °C in its maximum temperature each month (Raihan, 2023) ^[16]. Raihan (2023) ^[15] asserts that evaluating existing environmental policies and developing new environmental rules will enhance the Philippines' preparedness for the sudden rise of global temperature. Overall, Samborska and Roser (2024) ^[17] state that climate change has geographical variability, meaning that its impacts are not distributed evenly throughout all regions of the world. Different locations are experiencing varying rates of temperature increase, which has significant implications for local ecosystems, weather patterns, and human activities.

Projected Population Growth in Brgy. Ibo

Using the Simple Linear Regression Analysis establishes a time frame from 2025 to 2030. Prior to inputting the data of certain variables into the model for population growth prediction, data need to be analysed. The analysis of the model yields the regression equation for population growth:

Table 4

Projected Population Growth in Brgy. Ibo

Year	Population
2025	9799
2026	9995
2027	10191
2028	10387
2029	10584
2030	10781

$y = a + bx$ $a = -387931.46$ $b = 196.41$ $x = \text{year}$ *2026-2029 is prorated

The data predicted population growth in Brgy. Ibo over five years from 2025 to 2030. The table shows that in 2025, the population will grow by 9799, while in 2030; the population will increase by 10781. Moreover, the data for the years 2026 to 2029 are prorated. Furthermore, since the computed r value of 0.95 is beyond the critical value of -0.87, so the null hypothesis is rejected. This means that there is a significant relationship between the year and the population of Brgy. Ibo, denoting there is a growing population in Brgy. Ibo in 5 years.

Projected Maximum Temperature in Brgy. Ibo

Using the Simple Linear Regression Analysis establishes a time frame from 2025 to 2030. Prior to inputting the data of certain variables into the model to predict temperature, data need to be analysed. The analysis of the model yields the regression equation for temperature:

Table 5

Projected Temperature in Lapu-Lapu

Year	Temperature
2025	36.82 °C
2026	37.48 °C
2027	38.14 °C
2028	38.8 °C
2029	39.46 °C
2030	40.12 °C

$y = a + bx$ $a = -387931.46$ $b = 196.41$ $x = \text{year}$

The data predicted the temperature in Lapu-Lapu City over five years from 2025 to 2030. The table shows that by 2025, the temperature will decrease by 36.82 C, while in 2030; the temperature will increase by 40.12 C. Moreover, the data for the years 2026 and 2027 are 37.48 C and 38.14 C, respectively. From 2028 to 2029, the temperature will increase gradually, indicating that there will be an increasing trend in the temperatures over the next five years. However, since the years cannot determine the actual temperature trend, researchers opt not to correlate the variables.

4. CONCLUSION

The population growth of Brgy. Ibo, Lapulapu, Cebu had a slight increase from the year 2025, with a 9799 population, it is projected that there will be 10781 in the year 2030, with an increase of 9.12%. There was a slight increase of temperature from year 2024 at 37.7°C, to the year 2030, at 40.12°C. Overall, the forecasted temperature had a gradual increase over time. So, if nothing was done to stop the gradual increase, this place will be too hot in the future.

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