

Perception of Post-Secondary Students on Environmental Practices in Selected Communities in the Philippines: Implications to Climate Change Action

Maridel Z. Viernes, Jocelyn P. Gabriel, Ma. Germina E. Santos, Mary Chris A. Austria, Olive Chester C. Antonio, Arneil G. Gabriel 

Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines

Email: gabrielarneil77@gmail.com

How to cite this paper: Viernes, M.Z., Gabriel, J.P., Santos, M.G.E., Austria, M.C.A., Antonio, O.C.C. and Gabriel, A.G. (2022) Perception of Post-Secondary Students on Environmental Practices in Selected Communities in the Philippines: Implications to Climate Change Action. *Open Journal of Ecology*, 12, 537-557. <https://doi.org/10.4236/oje.2022.128030>

Received: January 22, 2022

Accepted: March 15, 2022

Published: August 16, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Climate change contributes to disasters in the Philippines. Most human activities have had negative consequences on the environment, exacerbating global warming. Humans contribute to climate change and global warming by burning fossil fuels, cutting down trees, engaging in improper waste disposal, using electricity, and driving a car. This study assessed the environmental practices of communities in Nueva Ecija, Philippines, and their implications for climate change. Respondents were selected using convenient sampling. A questionnaire delivered online was used to elicit their responses then analyzed the data using SPSS. This study revealed that most post-secondary students do not litter but sometimes burn their trash in an open dump. Most of them used LPG as their primary source of fuel for cooking. Rice production is always the same as producing food waste in food production. Garden waste was sometimes produced. Plastic containers are commonly produced as recyclable wastes. They often dispose of wastes in controlled and regulated open dumpsites by their municipality or city. Due to the pandemic, special wastes like face masks and face shields are disposed of daily. Generally, despite no littering behavior, the respondents never burned their trash or threw it on any body of water. They perceived to disagree that these daily community activities contribute to climate change. Lastly, less than half of them affirmed that there are initiative programs at the barangay level to lessen and eliminate community activities that cause climate change.

Keywords

Community Practices, Climate Change, Local Climate Action, Nueva

Ecija, Philippines

1. Introduction

Most disasters in the Philippines, such as typhoons, flash floods, drought, and landslides, are caused by climate change. Most human activities produce inimical effects on the environment that aggravate global warming; Humans increase the influence on climate change and the earth's temperature by burning fossil fuels, cutting down trees, and livestock farming [1] [2]. Human daily activities such as improper waste disposal, excessive use of electricity and water, transportation using private vehicles, the popularity of fast food, animal rearing, and others increase the earth's temperature [3].

The community's activities contribute to climate change, from food production to waste disposal. The daily actions of the community support growing concern about climate change, ranging from essential requirements such as food (livestock production) to habitual activities such as cigarette smoking [4]. Greenhouse gases from livestock production generate methane and nitrous oxide, accounting for 80% of greenhouse gas emissions. Cigarette smoking contributes to the greenhouse effect due to fuel, energy, water, and land from the beginning to the end of the process [5].

Many greenhouse gases occur naturally but are increased in concentration by human activities. The carbon dioxide from burning coal, oil, and gas served as the most significant contributor to climate change, followed by methane, nitrous oxide, and fluorinated gases since the industrial revolution [6]. Climate change is the cause of diminishing agricultural productivity (yield in rice and corn) due to changes in temperature and rainfall patterns that affect the agricultural ecosystem, associated with decreased livelihood and food security [7]. Earth warming affects humans and disrupts the life cycles of plants and animals, posing an extinction risk at various levels of warming [8]. Human activities intensify the release of greenhouse gases into the atmosphere. People have emitted around 450 billion tonnes of carbon since the industrial revolution, adding to the world's present global catastrophe [9].

The development of the community and their daily activities contribute to climate change. Society is a natural product of human interaction. As Aristotle once said, humans are political animals because they are social creatures. Humans as political beings are the same as gregarious animals described as "for whom the work of all is something and common [10]. Therefore, the natural tendency of humans to mingle with fellowmen creates a community where needs and wants increase over time. To meet social needs, human activities are more intense and towards greater economic productivity, which goes beyond the environment's carrying capacity, from households to more complex cities and large villages [11].

People tend to litter anywhere and dump those wastes by the road, on any bodies of water, and many others. Hence, improper waste disposal can harm the environment and human health. Part of human life carries out various activities such as planting, processing food, building houses, and many others. In carrying out these activities, different kinds of waste are being generated. Some of the wastes are biodegradable, and others are not. Some of the wastes are appropriately disposed of, and some are not [12].

The littering of cigarette butts and plastics, burning of waste, and even agricultural activity impacts climate change. A cigarette butt is the common litter trash that pollutes the air [13]. Cigarettes pollute the air even after it is extinguished. It continues damaging the environment from millions of non-biodegradable butts discarded every year. In 2013, a study focusing on the personal and environmental predictors of littering behavior in 130 outdoor public spaces in the United States revealed that cigarette butts account for 65% of the littering rate [14]. Littering is the incorrect disposal of solid waste from carelessly discarded small items such as cigarette butts or candy wrappers from abandoned automobiles, appliances, and even spacecraft [15]. Beacons of the litter as a social experiment suggest that the presence of large, salient items increases the occurrence of different litter dropped. In contrast, the littering rate is reduced on the ground if litter items are lesser [16].

Plastic, like tobacco, is a significant component of litter [17] because people may intentionally or unintentionally dump it in the surroundings after using it [18]. Plastic emits greenhouse gases (GHG) at every stage of its life cycle because it is derived from fossil fuels. Plastic pollution impacts climate change during extreme tropical storms that can disperse mismanaged waste between terrestrial, freshwater, and marine environments. Inputs of terrestrial plastics into the aquatic environment are intensified by strong winds and frequent rains that further worsen the flood risk areas due to high plastic mobilization [19]. According to [20], around 12% of the plastic in Municipal Solid Waste gets burned in an open field. Like plastic waste incineration, this activity emits hazardous substances such as dioxins, furans, mercury, and polychlorinated biphenyls, which contribute to climate change.

Slash and burn agriculture is also a common method for growing food in forested areas. The forest land is cleared, then cut, and burned the remaining vegetation to fertilize the land as preparation for crop production. However, this farm method has inimical effects such as deforestation, releasing carbon dioxide, and increasing the occurrence of an accidental fire that contributes to climate change [21]. The Department of Environment and Natural Resources (DENR) forbids the burning of waste under the Ecological Solid Management Act (RA 9003) and the Clean Air Act (RA 8749) to limit burning operations [22].

Cooking and heating activities rely solely on firewood, especially in rural dwellers in developing countries. This releases a hazardous pollutant that includes carbon monoxide, sulfur, nitrogen oxides that affect human health (espe-

cially women and children), and climate-warming emissions [23]. The type of cooking is classified based on the source of energy. Fuelwood, agricultural waste, animal dung, coal, solar, and natural gas are the primary energy sources for cooking. Petroleum products, biogas, and renewable energy sources are secondary cooking energy sources. Educated females in Kenya and India prefer to use clean cooking fuels, while other research identifies socioeconomic characteristics, such as education, influencing cooking fuel preferences [24].

Transportation and waste disposal practices in the community contribute to global warming. Transportation through the burning of fossil fuels releases carbon dioxide (CO₂) and other greenhouse gases (GHGs) into the atmosphere [25]. According to [26], there is a significant positive relationship between electric use and net income (the national electric consumption rate rises annually by 5.8%). One factor in the increase in energy consumption is the net growth in net income per capita.

Food wastes are products of human consumption. Unlike other commodity flows, food is biological material subject to degradation. Food waste is considered food losses or spoilage that results in a decrease in the quantity and quality of consumable goods but an increase in the amount of waste products [27].

In terms of garbage disposal, food waste or garden waste accounts for more than half (52.3%) of municipal waste. Garden waste accounts for only 13.8% of other sources. Food scraps account for 2% of the total [28]. Recyclable waste accounts for 27.78% of total waste (paper and cardboard waste, metals, glass, textile, leather, and rubber). Household health care waste and electrical and electronic equipment (WEEE) account for 1.93% of particular waste [29]. The majority of waste practices are not environmentally friendly. Still, the community is eager to play an essential part in garbage management if local authorities provide technical assistance and support.

The Philippines is confronted with several environmental concerns, such as waste management. Solid waste is a well-known issue since, despite legislation, people tend to dispose of waste improperly. Scheduled garbage collection by city/municipal garbage collectors, open dumping, open burning, tossing waste into bodies of water, burying, composting, and recycling are all common waste treatment and disposal options. The absence of a system leads to environmental pollution, which has become a significant concern [30]. Also in upland communities in the Philippines early signs of climate change have been felt resulting to community organizing and stakeholders framework for forest protection [31].

Global warming can cause long-term effects with irreversible consequences if mitigating measures and programs are taken for granted [32]. Incorporating climate change into the curriculum raises student awareness of the causes and impacts and potential solutions that can help reduce global warming [33]. Education is critical in increasing student knowledge and motivating them to mitigate and adapt to climate change [34].

Because of their educational background, students may be able to lead the action in disaster preparedness as members of a community [35]. Understanding

risk perceptions and responses to climate change and natural disasters (from social, economic, political, and cultural perspectives) ensures community engagement in building resilience and greater adaptive capacity [36]. Eventually, the effort may lead to attaining Sustainable Development Goal 13 on climate action.

Some research on climate change looks into the respondents' perception of natural disasters, responses and readiness to climate change and disasters, and the causes, consequences, and desire to act on climate change. Meanwhile, the study examines perceived community activities in Nueva Ecija, Philippines, and their implications for climate change. Specifically, this study has the following objectives:

- 1) Describe the perceived practices of the community that contribute to climate change, such as:
 - a) littering;
 - b) burning;
 - c) cooking; and
 - d) food production.
- 2) Describe waste products generated in the communities;
- 3) Describe the methods and frequency of garbage disposal in the communities in Nueva Ecija in the Philippines;
- 4) Determine the programs or activities undertaken in the communities to mitigate climate change;
- 5) Provide recommendation/s to improve community environmental practices.

1.1. Research Paradigm

The Input-Process-Output (IPO) paradigm was used in this study that was delineated on **Figure 1**. The input describes the demographics of the respondents as well as their perceptions of community activities that contribute to climate change (type of waste produced, method, and frequency of garbage disposal).

Likert-type questionnaires are used to collect data. Then, it was examined using mean and percentage through Statistical Package for the Social Sciences (SPSS).

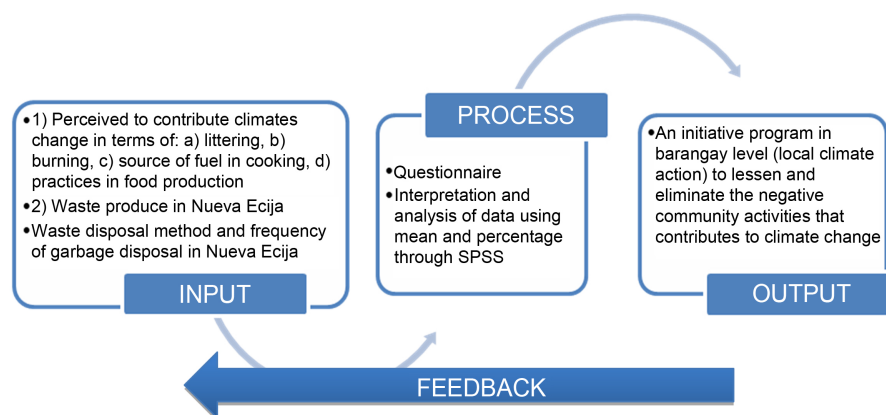


Figure 1. Research paradigm.

The outcome determines the barangay-level initiative program to decrease and eliminate harmful environmental practices contributing to climate change.

1.2. Theoretical Framework

In the face of climate change, the community needs to be proactive. This study adopts the theory of change (TOC), a valuable tool to monitor, evaluate, and plan adaptation. This theory is suited to complex, multifaceted, and long-term issues to identify how to implement changes in a given location, sector, or social group. This will determine the barriers to implementation to achieve the project's long-term goals [37]. Decreasing the effect of climate change is a complex and long-term issue. This study assesses the perception of post-secondary students of activities in the communities that cause climate change. After determining their perceptions, it can analyze their perceived community activities that contribute to climate change. The perceived community activities may be the barrier to minimizing climate change's effect. The TOC begins by identifying a clear ultimate goal that can work backward to establish a precondition to reach the goals [38]. The ultimate goal is to lessen and eliminate the community activities that cause climate change. Working backward is the identification of the initiative program at the barangay level.

1.3. Significance of the Study

This research will aid Nueva Ecija Local Government Units (LGUs) in examining community practices that contribute to climate change from the perspective of post-secondary students. The findings could form the basis of a local climate action initiative program.

2. Materials and Methods

2.1. Study Area

The research was conducted in Central Luzon's largest province, in Nueva Ecija (see **Figure 2**). This province has a land area of 5,689,69 square kilometers with warm climate and little rain from January to June and August to December. It has a highest average temperature of 32°C in May.

2.2. Methods

Type of Study and Sampling Techniques

This study is descriptive-quantitative research. The numerical data were described through frequency distribution. The level of agreement was determined, and a binary instrument weighed mean and frequency. The numeric findings were computed using SPSS software and triangulated through data mining. The respondents are 134 post-secondary students from the province of Nueva Ecija enrolled in the Bachelor of Public Administration (BPA) program during the first semester of Academic Year 2021-2022. Using a convenience sampling technique, the respondents were picked depending on the availability of their internet

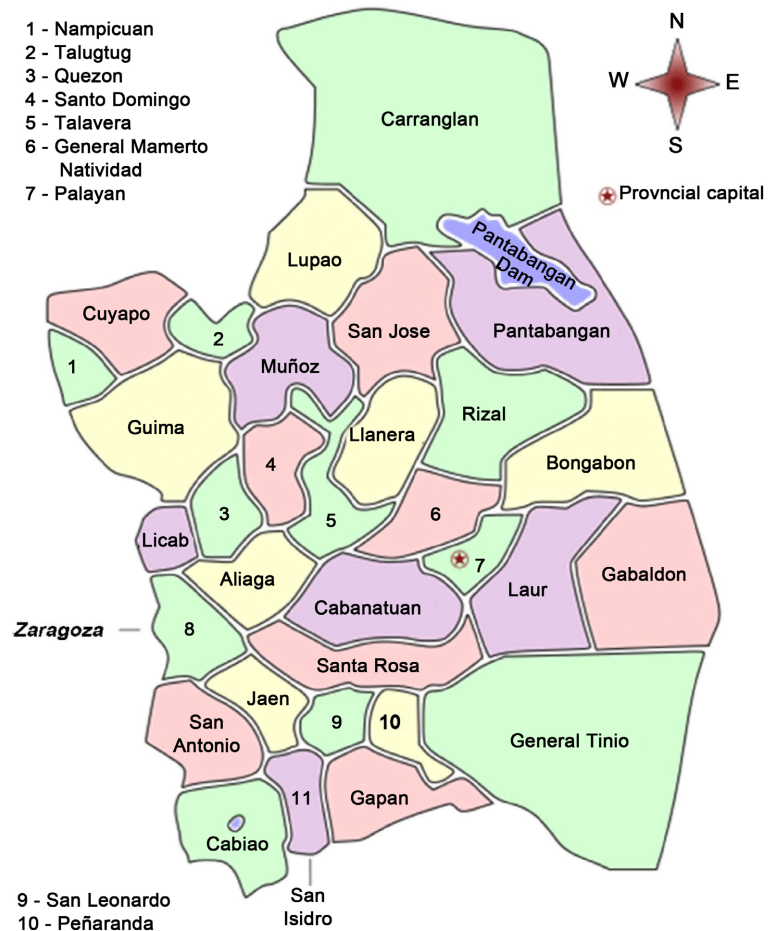


Figure 2. Map of the study area [39].

connection. A checklist type of questionnaire on a 5-point Likert scale was used to elicit their responses to the majority of the statement on the problem (such as community activities that are perceived to contribute to climate change, waste produced in Nueva Ecija, and waste disposal method). While on initiative programs in barangay level to lessen and eliminate the community activities that cause climate change as the basis for local climate action, a yes or no questions (5 items) are used. Then it was accompanied by an open-ended question asking them to identify the program if their answer is “yes”. The questionnaire contains 61 items. To confirm its validity, the questionnaire was pre-tested among respondents from various sectors, including nurses, government officials, and community residents. As a precautionary measure and to reduce the risk of COVID 19 transmission, the pre-test and data collection were conducted using Google Forms.

3. Results

3.1. Climate Change-Inducing Community Activities

3.1.1. Littering

The inappropriate disposal of waste materials is referred to as littering. Littering

can occur either purposefully or unintentionally, although both have negative environmental consequences [40]. The community practices that contribute to littering as perceived by the post-secondary students are listed in **Table 1**.

With a grand mean of 1.74, it can be deduced from the table that most respondents *never* abandoned litter by the roadside (mean = 1.76), dumped garbage on vacant areas (mean = 1.61), or threw trash on any body of water or in moving vehicles (mean = 2.40). This implies that students are aware to disposed waste in appropriate bin.

3.1.2. Burning

Natural and human-induced changes to the environment create environmental consequences that can be favorable or bad. Recent studies have identified the harm caused by the earth's continuous warming due to industrialization and waste-burning, which depletes the ozone layer [41]. Unsustainable activities are profoundly ingrained in the fabric of modern society [42]. The common burning practices of different communities in Nueva Ecija are shown in **Table 2**.

The burning of waste, particularly in open fields, is a significant cause of pollution. Burning emits poisonous chemicals into the atmosphere, endangering vegetation and human and animal health [43]. According to the findings, the majority of respondents *seldom* burn trash piles (mean = 2.07), dry grass, leaves, and tree branches (mean = 2.15), or use kerosene as a light source (mean = 2.12). While they do not engage in slash and burn or tobacco smoking with mean of 1.45 and 1.10 respectively, students *often* use household electric appliances that emit greenhouse gases (mean = 3.60). This demonstrates that, despite students' best efforts to avoid burning waste in open spaces, they *seldom* and unknowingly contribute to greenhouse gas emissions in the environment due to their reliance on electrical devices.

3.1.3. Source of Fuel Used in Cooking

[24] asserts that socioeconomic characteristics, such as education, influence

Table 1. Littering.

| | Mean | Verbal Description |
|--|------|--------------------|
| Throws candy wrappers, cigarette butts, or small items near the trash bin. | 2.40 | Seldom |
| Abandons items or wrappers by the roadside. | 1.76 | Never |
| Dumps garbage on vacant areas or lot. | 1.61 | Never |
| Throws trash on rivers, canals, oceans, and anybody of water. | 1.32 | Never |
| Throws trash when in a moving vehicle. | 1.59 | Never |
| Grand Mean. | 1.74 | Never |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

cooking fuel preferences. **Table 3** presents the respondents' preferred fuel source for cooking and their neighborhoods.

Despite knowledge of the harmful effects of petroleum-based products on the environment, the respondents *often* use liquefied petroleum gas (LPG) in cooking (mean = 3.51). However, this is because LPG is the most accessible and practical form of fuel compared to other options on the market. Respondents also seldom utilize fuelwood (mean = 2.15) and coal (mean = 2.03) for cooking, although this is confined to people who live in rural areas and when their family or neighbors are cooking for a large group. The findings suggest that simply being aware of harmful compounds is insufficient to reduce greenhouse gas emissions because industries continue to support fuel-based products and greener energy sources are either prohibitively expensive or not within reach. Furthermore, some respondents believed that it is difficult to change the thinking of community members who are accustomed to using firewood or LPG for cooking because they have been a part of their everyday lives for many years.

Table 2. Burning practices.

| | Mean | Verbal Description |
|---|------|--------------------|
| Burn pile of trash | 2.07 | Seldom |
| Burns dry grass, dry leaves, and tree branches | 2.15 | Seldom |
| Slash and burn in farming | 1.45 | Never |
| Use of kerosene lamp or candle as a source of light | 2.12 | Seldom |
| Tobacco smoking | 1.10 | Never |
| Use of appliances such as television, washing, machine, air-condition, electric fan, etc. | 3.60 | Often |
| Grand Mean | 2.08 | Seldom |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

Table 3. Source of fuel used in cooking.

| | Mean | Verbal Description |
|-------------------------------|------|--------------------|
| Liquefied Petroleum Gas (LPG) | 3.51 | Often |
| Burning fuelwood | 2.15 | Seldom |
| Solar | 1.59 | Never |
| Natural gas | 1.85 | Seldom |
| Biogas | 1.37 | Never |
| Coal | 2.03 | Seldom |
| Kerosene | 1.55 | Never |
| Animal Dung | 1.35 | Never |
| Grand Mean | 1.93 | Seldom |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

3.1.4. Practices in Food Production

Daily activities in the community, such as animal raising and cigarette smoking, lead to a growing concern about climate change [4]. Livestock production are responsible for 80% of global greenhouse gas emissions [5], that emits methane and nitrous oxide (Table 4).

Respondents with a mean score of 3.10 stated that they sometimes assist in rice production to support their family's needs. Some have noted that in their community, food production activities include the use of chemical fertilizer and pesticides (mean = 2.31) and harvesting and tilling machinery (mean = 2.02). Others concluded that livestock production (mean = 2.27) and animal grazing (mean = 1.55) are familiar sources of income in their barangay. Still, they are skeptical that the residents who practice them are aware that livestock production emits greenhouse gases because they have not heard of government agencies disseminating information about them.

3.2. Waste Produced

3.2.1. Food and Garden Waste

According to [28] study, food, and garden waste account for more than half of municipal waste (52.3%). The majority of waste disposal practices are environmentally hazardous. Nonetheless, the community is keen to participate in waste management. Table 5 shows the most common food waste and garden waste in the respondent's communities.

Generally, the respondents seldom produced different types of food waste. The highest is vegetable and fruit waste of various kinds (mean score = 2.58), eggshells (mean score = 2.02), and leftover food (mean score = 2.00). Despite ordinances mandating waste segregation, leftover food is sadly transferred to a landfill rather than a compost facility or the household.

Most respondents *seldom* produced garden waste, such as a 2.50 mean score on branches and twigs and 2.58 mean score on soil, dust, rocks, and bricks. Similarly, the respondents *sometimes* produced dry leaves, grass, and flowers with a mean score of 2.93. The responses reveal the most common wastes produced

Table 4. Practices in food production.

| | Mean | Verbal Description |
|--|------|--------------------|
| Rice production | 3.10 | Sometimes |
| Use of chemical fertilizer and pesticide | 2.31 | Seldom |
| Livestock production | 2.27 | Seldom |
| Animal grazing | 1.55 | Never |
| Utilization of machines for harvesting and other farm activities | 2.02 | Seldom |
| Grand Mean | 2.25 | Seldom |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

Table 5. Food and garden waste.

| | Mean | Verbal Description |
|---|------|--------------------|
| A. Food waste | | |
| Vegetable and fruit waste of different types (fruit, vegetable, vegetable and fruit remains and peelings) | 2.58 | Seldom |
| Eggshells | 2.02 | Seldom |
| Food packages like boxes, plastic wrap, etc. | 1.98 | Seldom |
| Meat, fish, chicken by-products, etc. | 1.50 | Seldom |
| Left over foods | 2.00 | Seldom |
| Mean | 2.02 | Seldom |
| B. Garden waste | | |
| Dry leaves, grass, and flowers | 2.93 | Sometimes |
| Branches and twigs | 2.50 | Seldom |
| Soil, dust, rocks, and bricks | 2.58 | Seldom |
| Mean | 2.26 | Seldom |
| Grand Mean | 2.14 | Seldom |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

in a household. Conversely, respondents believe that simple acts can make a substantial difference in resolving this problem, starting with composting and proper planning. Food waste reduction benefits the economy, communities, and the environment. Food waste prevention can also save energy and labor expenses.

3.2.2. Recyclables and Special Waste

Soiled objects that cannot be composted are often recycled, such as bottles and plastic containers. The significance of recycling in meeting the statutory waste reduction targets is recognized by Republic Act 9003. This law provides guidelines for establishing and managing buy-back centers and Material Recovery facilities (MRFs) that encourage recycling.

Meanwhile, special wastes such as household healthcare waste and waste electrical and electronic equipment (WEEE) make for a small percentage of waste generated in each barangay. **Table 6** lists the respondents' recyclables and special wastes, along with the percentages for each.

Most BPA students dispose of plastic containers (34%), followed by paper (27%). Because of the pandemic, face masks, a special waste, account for 7.5% of the waste generated in communities. When asked about their understanding of recycling, respondents unanimously replied that scrap metals and plastics are usually sold in junkyards.

3.3. Waste Disposal Methods

Consumerism, rising pollution levels, and unclear waste disposal systems with

Table 6. Recyclables and special waste.

| | f | % |
|--|-----|-----|
| 1) Paper | 15 | 11 |
| 2) Glass container | 8 | 6 |
| 3) Electrical and Electronic equipment | 7 | 5.2 |
| 4) Cardboard materials | 6 | 4.5 |
| 5) Leather | 2 | 1.5 |
| 6) Plastic container | 45 | 34 |
| 7) Paper | 36 | 27 |
| 8) Special waste | | |
| a) Face mask | 10 | 7.5 |
| b) Face shield | 5 | 3.7 |
| Total | 134 | 100 |

little environmental impact are the most serious concerns we face today. As a result, proper waste management for various household and community wastes must be devised. The waste disposal methods implemented in the communities of Nueva Ecija are listed in **Table 7**.

The majority (mean score = 3.18) of the respondents are *sometimes* burying their waste. This suggests that some respondents are currently composting their household wastes. It is also consistent with the study of [44] in Cabanatuan City, where 72% of those surveyed occasionally used compost pits.

Similarly, most respondents *never* threw waste into bodies of water (mean score = 1.65) but *seldom* burned their waste (mean score = 2.11). They are, in specific ways, in compliance with the mandates of RA 9003 or the Ecological Solid Waste Management Act, but not with RA 8749, often called the Clean Air Act, which restricts and penalizes open burning.

Frequency of Garbage Disposal

It is apparent that during the pandemic, the special waste (household health care waste/face mask, face shield, electrical and electronic equipment) is daily disposed of in garbage with a mean score of 2.30, followed by food waste and garden waste every other day (mean score = 2.46) as shown in **Table 8**.

In terms of recycling waste (paper, plastic containers, glass containers, cardboard materials, textile, leather, and rubber) is being done weekly with a mean score of 2.69. Recycling, the least expensive waste disposal technique is good for the environment; it also has significant economic benefits for both individuals and the economy. Recycling is beneficial since it minimizes the work required to generate something fit for human use. Recycling necessitates the participation of all stakeholders. Responsible waste disposal will always strive to promote recycling to the greatest extent feasible, but unfortunately, not everything can be recycled.

Table 7. Waste disposal methods.

| | Mean | Verbal Description |
|---|------|--------------------|
| Municipality or city dump garbage in the controlled and regulated open dumpsite | 2.80 | Sometimes |
| Municipality or cities place trash in sanitary landfills | 2.81 | Sometimes |
| Municipality or cities transfer garbage to Common Waste Treatment and Disposal Facilities | 2.89 | Sometimes |
| Open burning of waste | 2.11 | Seldom |
| Burying of waste | 3.18 | Sometimes |
| Composting | 2.72 | Sometimes |
| Recycling and reusing | 3.24 | Sometimes |
| Waste materials are thrown into bodies of water like rivers, oceans, and drainage. | 1.65 | Never |
| Grand Mean | 2.68 | Sometimes |

Verbal Description: 1.0 - 1.80 (Never, N), 1.81 - 2.60 (Seldom, S), 2.61 - 3.40 (Sometimes, SM), 3.41 - 4.20 (Often, O), 4.21 - 5.00 (Always, A).

Table 8. Frequency of garbage disposal.

| | Mean | Verbal Description |
|---|------|--------------------|
| Food waste or garden waste | 2.46 | EOD |
| Recyclable waste (paper, plastic container, glass container, cardboard materials, textile, leather, rubber) | 2.69 | TAW |
| Special waste (household health care waste/face mask, face shield, electrical and electronic equipment) | 2.30 | EOD |
| Grand Mean | 2.48 | EOD |

Verbal Description: 1.0 - 1.80 (Daily, D), 1.81 - 2.60 (Every other day, EOD), 2.61 - 3.40 (Twice a week, TAW), 3.41 - 4.20 (Weekly, W), 4.21 - 5.00 (Monthly, M).

3.4. Barangay Initiatives to Reduce and Curb Harmful Community Practices

Pollution, fossil fuels, and deforestation are all examples of human activities that have a wide range of effects on the physical environment [45] [46], because they cause the emission of greenhouse gases, which contribute to climate change.

In general, responses vary on whether or not there are community initiatives to reduce climate change. Of the respondents, 48.5% said their barangay had an initiative program to reduce litter, while 51.5% said there was none. This is the same as every other criterion. However, some respondents recognized some programs such as waste management programs, the separation of biodegradable and non-biodegradable waste, clean and green initiatives, and the prohibition of

littering and burning. “They enforced Barangay rules about the proper garbage disposal, and each ordinance has a corresponding sanction, either money or community service”, one of the interviewees said. The findings demonstrate the continued efforts of local government units to curtail actions contradictory to existing environmental legislation and residents’ understanding that they play a critical part in the success of environmental policies and programs.

4. Discussion

4.1. Community Activities that Cause Climate Change

4.1.1. Littering

The findings in **Table 9** indicate the students’ awareness and mindfulness of appropriately disposing of their waste in the designated bin. Properly placed waste prevents the occurrence of flooding by blocking littered trash on drainage systems and any body of water.

4.1.2. Burning

Burning is the simplest way to dispose of trash and dry leaves, but individuals do it when necessary, especially when the LGUs fail to collect household waste. Students seldom used a kerosene lamp or candles as a light source, because some municipalities in Nueva Ecija appear to have a limited source of electrical supply still. Most students occasionally used tobacco but never practiced slash and burn to farm. These somehow prevent the release of carbon dioxide. In Cuyapo, Nueva Ecija has an existing Municipal Environmental Code [47]. Section 26 of which prohibits slash and burn on the farm. Finally, respondents often used appliances as part of their daily needs whereas, majority of them appear to be dependent on appliances. That raised the demand for fossil fuels in the generation of power.

4.1.3. Source of Fuel Used in Cooking

The municipal environmental code of Cuyapo, Nueva Ecija, approved in 2007 for one, forbids the unauthorized cutting, harvesting, or removing of trees for firewood, charcoal production, and other reasons within the municipality’s territorial jurisdiction. It is notable that they rarely employed alternative or natural sources of cooking fuel, such as natural gas and biogas, and never solar. The

Table 9. Barangay initiatives to reduce and curb harmful community practices.

| | Yes | | No | | Total | |
|---|-----|------|----|------|-------|-----|
| | f | % | f | % | f | % |
| 1) Littering | 65 | 48.5 | 69 | 51.5 | 134 | 100 |
| 2) Burning of waste | 63 | 47 | 71 | 53 | 134 | 100 |
| 3) Use of chemical fertilizer and pesticide | 57 | 42.5 | 77 | 57.5 | 134 | 100 |
| 4) Use of chemical pesticide | 53 | 39.6 | 81 | 60.4 | 134 | 100 |
| 5) Food waste or garden waste | 74 | 55.2 | 60 | 44.8 | 134 | 100 |

limited natural fuel sources for cooking, environmental constraints, and socio-cultural considerations are all impediments to using them for cooking [48].

4.1.4. Practices in Food Production

Food production may greatly be affected by climate change due to its decrease in community practices. Similarly, there was decreased by 19.5% in palay cropping area in 1991 [49].

4.1.5. Food Waste and Garden Waste

Food and vegetables that are wasted may result from poor quality, overbuying, or being left to be consumed and cooked. Eggshell is a solid waste that generates many tons every day [50]. The majority of leftover items are rice, with an average of 3.39 kg wasted per year [51].

For garden waste, most municipalities in Nueva Ecija have a scarcity of trees and plants that can mitigate the effects of climate change. Only 5 million hectares of forest areas remained in 1995, with only 800,000 hectares classified as old-growth forest [30]. In Nueva Ecija, ornamental and flower farming declined by 54% compared to the 2.9 thousand farms used in 1991 [49].

4.1.6. Recyclables and Special Waste

In the Philippines, there is a firm reliance on plastic. The Philippines generates 2.7 million tons of plastic waste, with an estimated 20% in the ocean [52]. Plastics emit greenhouse gases (GHG) at every stage of their life cycle since they are derived from fossil fuels [19]. Overall, 17% of recyclable waste is plastic, and 19% is paper [53]. Paper production and recycling require power, which accounts for 1.3% of world greenhouse gas emissions [54]. The average waste generation in Region III is estimated to be 0.5 kilos per person per day or around 3500 tons per day. 70% is domestic, while the remaining 30% is ascribed to industries [55]. Face masks are the most prevalent special waste generated due to the pandemic.

Some of the respondents implemented waste segregation in terms of waste disposal methods. The majority of them never threw waste into bodies of water, seldom burnt their wastes but have a limited understanding of the daily communal activities that can exacerbate climate change. While some residents dispose of their waste daily, some collection schedules, such as Cabanatuan City, are only done twice a week.

4.2. Initiative Program in Barangay to Lessen and Eliminate Community Activities that Contribute to Climate Change

This demonstrates that the grassroots level is taking steps to mitigate the negative consequences of communal activities that contribute to climate change. In this regard, the province of Nueva Ecija has established a solid waste management strategy [56].

5. Conclusions

Many market failures are inherent in environmental issues, which can only be

solved through public policy or other collective initiatives, particularly at the grassroots level. The study results revealed that most respondents do not litter and practice segregation of waste due to the no segregation no collection policy implemented in the locality.

Waste disposal and manner of garbage collection must be made more systematic. When it comes to waste generation in Nueva Ecija, most respondents produce very little food waste and garden waste. They recycle and dispose off 34% of the plastic container, 27% of paper, and 7.5% of facemask, which became in demand due to the pandemic.

Lastly, most students opposed community activities that contribute to climate change. Aside from non-littering and non-waste burning, the grassroots level is taking steps to mitigate the negative consequences of communal actions that contribute to climate change.

6. Recommendation

Although most respondents do not litter, other municipalities in Nueva Ecija can create, propose, and adopt an anti-littering and anti-garbage-burning code. Garden and agricultural waste are included. In response to inadequate power supply, the LGU can develop a project proposal for an alternative source of electricity that can be supported by national or private Government Organizations (GO), Non-Government Organizations (NGOs), and others. To promote the natural supply of fuel for cooking to the community, the LGU must be made more accessible.

House Bill No. 2031, also known as An Act Providing for a System of Redistributing and Recycling Food Waste to Promote Food Security, should be enacted and implemented to address food waste. Local governments may initiate novel programs such as converting chicken feathers into bedding, decorative goods, sporting equipment, manure as plant fertilizer, and animal intestines in livestock production into fish meal, which may be used on a small scale for personal use or sold in the market as an additional source of income.

The implementation of RA 9003 and Material Recovery Facilities (MRFs) for recyclable wastes must be enhanced. Maintaining the community's adherence to proper waste disposal by burying their waste rather than burning it or throwing it into any body of water strengthens the implementation of RA 9003 and the Mandamus ruling to clean up, restore, and safeguard Manila Bay. As a result, the volume and frequency of waste disposals will be reduced.

To transform the community's attitude from rejecting to consenting to community activities that can contribute to climate change, an intensive educational effort using social media must be conducted to raise awareness among respondents and the community. There is a crucial component in the effectiveness of social media in raising climate protection knowledge among youths and providing a visible link to change public opinion in order to influence political decision-making.

Acknowledgements

The authors would like to recognize the support of the University administration and faculty of the College of Public Administration and Disaster Management namely; Arneil G. Gabriel, Corinthian Obispo, Vilma Ramos, Rose Casimiro and Olive Chester Antonio without their support this piece cannot be completed.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Herring, D. (2020) Are Humans Causing or Contributing to Global Warming. <https://www.climate.gov/news-features/climate-qa/are-humans-causing-or-contributing-global-warming>
- [2] Jayathilakan, K., Sultana, K., Radhakrishna, K. and Bawa, A.S. (2012) Utilization of By-Products and Waste Materials from Meat, Poultry and Fish Processing Industries: A Review. *Journal of Food Science and Technology*, **49**, 278-293. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614052/>
- [3] Driga, A.M. and Drigas Athanasios, S. (2019) Climate Change 101: How Everyday Activities Contribute to the Ever-Growing Issue. *International Journal of Recent Contributions from Engineering, Science, and IT*, **7**, 22-31. <https://online-journals.org/index.php/i-jes/article/view/10031>
- [4] Juranić, B., Mikšić, Š., Rakošec, Ž. and Vuletić, S. (2018) Smoking Habit and Nicotine Effects. In: Rajer, M. (Ed.), *Smoking Prevention and Cessation*. IntechOpen, London, 49-60. <https://doi.org/10.5772/intechopen.77390>
- [5] Moran, D. and Wall, E. (2011) Livestock Production and Greenhouse Gas Emissions: Defining the Problem and Specifying Solutions. *Animal Frontiers*, **1**, 19-25. <https://doi.org/10.2527/af.2011-0012>
- [6] Mann, M.E. (2011) Greenhouse Gas: Atmospheric Science. <https://www.britannica.com/science/greenhouse-gas>
- [7] Environmental Protection Agency (2017) Climate Impacts on Agriculture and Food Supply. https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply_.html
- [8] Tandon, A. (2021) Climate Change Will Hit “Endemic” Plants and Animals the Hardest, Study Warns. <https://www.weforum.org/agenda/2021/04/climate-change-will-hit-endemic-plants-and-animals-the-hardest-study-warns>
- [9] Sanderman, J., Hengl, T., Gregory, J. and Fiske, G. (2017) Soil Carbon Debt of 12,000 Years of Human Land Use. *Proceedings of the National Academy of Sciences of the United States of America*, **114**, 9575-9580. <https://doi.org/10.1073/pnas.1706103114>
- [10] Guremen, R. (2018) In What Sense Exactly Are Human Beings More Political According to Aristotle. *Filozofija*, **29**, 170-181. https://www.researchgate.net/publication/325990495_In_what_sense_exactly_are_human_beings_more_political_according_to_Aristotle

- [11] Miller, F. (2017) Political Naturalism. Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/entries/aristotle-politics/supplement3.html>
- [12] Oluwafemi, J., Olukanni, D. and Justin, L. D. (2021) Improper Waste Disposal in Ota, Ogun State—A Proposed Waste Segregation Approach. *Journal of Physics: Conference Series*, **1734**, Article ID: 012038. <https://doi.org/10.1088/1742-6596/1734/1/012038>
- [13] Slaughter, E., Gersberg, R.M., Watanabe, K., Rudolph, J., Stransky, C. and Novotny, T.E. (2011) Toxicity of Cigarette Butts, and Their Chemical Components, to Marine and Fresh Water Fish. *Tobacco Control*, **20**, i25-i29. https://tobaccocontrol.bmj.com/content/20/Suppl_1/i25
- [14] Schultz, P.W., Bator, R.J., Large, L.B., Bruni, C.M. and Tabanico, J.J. (2013) Littering in Context: Personal and Environmental Predictors of Littering Behavior. *Environment and Behavior*, **45**, 35-59. <https://doi.org/10.1177/0013916511412179>
- [15] Geller, E., Brasted, W.W. and Mann, M. (1979) Waste Receptacle Design as Intervention for Litter Control. *Journal of Environmental Systems*, **9**, 145-160.
- [16] Tehan, R., Jackson, L., Jeffers, H. and Burns, T. (2017) Beacons of Litter: A Social Experiment to Understand How the Presence of Certain Littered Items Influences Rates of Littering. *Journal of Litter and Environmental Quality*, **1**, 5-25. https://www.researchgate.net/publication/341071504_Beacons_of_litter_A_social_experiment_to_understand_how_the_presence_of_certain_littered_items_influences_rates_of_littering
- [17] Galgani, F., Hanke, G. and Maes, T. (2015) Global Distribution, Composition, and Abundance of Marine Litter. In: Bergmann, M., Gutow, L. and Klages, M., Eds., *Marine Anthropogenic Litter*, Springer, Cham, 29-56. https://link.springer.com/chapter/10.1007/978-3-319-16510-3_2
- [18] Bauman, B. (2019) How Plastics Contribute to Climate Change. <https://yaleclimateconnections.org/2019/08/how-plastics-contribute-to-climate-change/>
- [19] Ford, H.V., Jones, N.H., Davies, A.J., Godley, B.J., Jambeck, J.R., Napper, I.E., et al. (2021) The Fundamental Links Between Climate Change and Marine Plastic Pollution. *Science of the Total Environment*, **806**, Article ID: 150392. <https://reader.elsevier.com/reader/sd/pii/S0048969721054693?token=702A1530C3A68EB0CA48601C77F4DA298FB9CDAEE238818AC8011B393A5A286377B6FB58854E2206F1AF7B1B59374C10&originRegion=us-east-1&originCreation=20211029061951>
- [20] Verma, R., Vinoda, K.S., Papireddy, M. and Gowda, A.N.S. (2016) Toxic Pollutants from Plastic Waste—A Review. *Procedia Environmental Sciences*, **35**, 701-708. <https://reader.elsevier.com/reader/sd/pii/S187802961630158X?token=486531D582280398BEB66063F8872F230AB0B46B4B5D8A9B2D9DB329397B7AFBD06EF04931B3E38E77734DFB7408A7A5&originRegion=us-east-1&originCreation=20211029081948>
- [21] Stief, C. (2019) Slash and Burn Agriculture Explained. How this Agricultural Practice can Contribute to Environmental Problems. <https://www.thoughtco.com/slash-and-burn-agriculture-p2-1435798>
- [22] DENR Region 8 Eastern Visayas (2020) Denr Reminds the Public against Burning of Their Garbage. <https://r8.denr.gov.ph/index.php/news-events/press-releases/1359-denr-reminds-the-public-against-burning-of-their-garbage>
- [23] Global Alliance for Clean CookStoves (2015) Assessing the Climate and Health

- Co-Benefits of Clean Cooking. Workshop Report, Global Alliance for Clean Cookstoves, Washington DC.
<https://cleancooking.org/binary-data/RESOURCE/file/000/000/481-1.pdf>
- [24] Malla, S. and Timilsina, G.R. (2014) Household Cooking Fuel Choice and Adaptation of Improved Cookstoves in Developing Countries. The World Bank Research Group Environment and Energy Team 2014. Policy Research Working Paper No. 6903, World Bank, Washington DC.
<https://openknowledge.worldbank.org/bitstream/handle/10986/18775/WPS6903.pdf?sequence=1&isAllowed=y>
- [25] Yevdokimov, Y. (2018) Climate Change and Transportation. Department of Civil Engineering and Economics, University of New Brunswick Fredericton, Canada.
- [26] Zhang, C., Liao, H. and Mi, Z. (2019) Climate Impacts: Temperature and Electricity Consumption. *Natural Hazards*, **99**, 1259-1275.
<https://discovery.ucl.ac.uk/id/eprint/10080040/1/Climate%20Impacts%20Temperature%20and%20Electricity%20Consumption.pdf>
- [27] Parfitt, J., Barthel, M. and Macnaughton, S. (2010) Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, **365**, 3065-3081.
<https://doi.org/10.1098/rstb.2010.0126>
- [28] Limon, M.R., Vallente, J.P.C. and Corales, N.C.T. (2020) Solid Waste Management Beliefs and Practices in Rural Households towards Sustainable Development and Pro-Environmental Citizenship. *Global Journal of Environmental Science and Management (GJESM)*, **6**, 441-456. <https://doi.org/10.22034/gjesm.2020.04.02>
- [29] Environmental Management Bureau, Department of Environment and Natural Resources (2018) National Solid Waste Management Status Report 2008-2018. Department of Environment and Natural Resources, Quezon City.
http://eeid.emb.gov.ph/wp-content/uploads/2020/07/SOLIDWASTE-LAYOUT_final.pdf
- [30] Ferronta, N. and Torretta, V. (2019) Waste Mismanagement in Developing Countries: A Review Global Issues. *International Journal of Environmental Research and Public Health*, **16**, Article No. 1060.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6466021/>
- [31] Gabriel, A., Claudio, E. and Bolisay, F. (2017) Saving Dupinga Watershed in Galdon, Nueva Ecija Philippines: Insights from Community Based Forest Management Model. *Open Journal of Ecology*, **7**, 140-157.
<https://doi.org/10.4236/oje.2017.72011>
- [32] Gabriel, A.G., Santiago, P.N.M. and Casimiro, R.R. (2021) Mainstreaming Disaster Risk Reduction and Climate Change Adaptation in Comprehensive Development Planning of the Cities in Nueva Ecija in the Philippines. *International Journal of Disaster Risk Science*, **12**, 367-380. <https://doi.org/10.1007/s13753-021-00351-9>
- [33] Ogunsola, O.E, Araromi, O.I. and Adeshina, O.A. (2018) Studies on Students' Awareness on Climate Change Education in Nigeria: A Case Study of the University of Ibadan. *Journal of Emerging Trends in Educational Research and Policy Studies*, **9**, 251-257. <https://journals.co.za/doi/10.10520/EJC-14017e2164>
- [34] Reid, A. (2019) Climate Change Education and Research: Possibilities and Potentials versus Problems and Perils? *Environmental Education Research*, **25**, 767-790.
<https://doi.org/10.1080/13504622.2019.1664075>
<https://www.tandfonline.com/doi/full/10.1080/13504622.2019.1664075>
- [35] Bollettino, V., Alcayna-Stevens, T., Sharma, M., Dy, P., Pham, P. and Vinck, P.

- (2020) Public Perception of Climate Change and Disaster Preparedness: Evidence from the Philippines. *Climate Risk Management*, **30**, Article ID: 100250. <https://doi.org/10.1016/j.crm.2020.100250>
- [36] Mercado, R.M. (2016) People's Risk Perceptions and Responses to Climate Change and Natural Disaster in BASECO Compound, Manila, Philippines. *Procedia Environmental Sciences*, **34**, 190-505. <https://doi.org/10.1016/j.proenv.2016.04.043>
- [37] Pringle, P. and Thomas A. (2019) Climate Adaptation and Theory of Change: Making it Work for You. A Practical Guide for Small Island Developing States (SIDS). Climate Analytics, Berlin. https://climateanalytics.org/media/theory_of_change_briefing_note.pdf
- [38] Allen, W. (2016) Using a Theory of Change (TOC) to Better Understand your program. <https://learningforsustainability.net/post/theory-of-change/>
- [39] Eduardo, J. and Gabriel, A. (2017) Assessing the Leadership Skills of the Chiefs of Police in the Towns of Nueva Ecija, Philippines: A Dichotomy between Managerial Competence and Decision Making Ability. *Open Journal of Leadership*, **6**, 142-159. <https://doi.org/10.4236/ojl.2017.64011>
- [40] Khawaja, F.S. and Shah, A. (2013) Determinants of Littering: An Experimental Analysis. The Pakistan Development Review. *The Pakistan Development Review*, **52**, 157-168. <https://doi.org/10.30541/v52i2pp.157-168>
- [41] Akanwa, A.O., Mba, H.C., Jiburum, U. and Ogboi, K.C. (2019) Strategies for Combating Climate Change. In: Jhariya, M.K., Banerjee, A., Meena, R. and Yadav, D., Eds., *Sustainable Agriculture Forest and Environmental Management, International Standard Book*, Springer, Singapore, 393-435. https://doi.org/10.1007/978-981-13-6830-1_12
- [42] Odjugo, A.O. (2010) General Overview of Climate Change Impacts in Nigeria. *Journal of Human Ecology*, **29**, 47-55. <https://doi.org/10.1080/09709274.2010.11906248>
- [43] United Nations Environment Programme (2019) Plastic Bag Bans Can Help Reduce Toxic Fumes. <https://www.unep.org/news-and-stories/story/plastic-bag-bans-can-help-reduce-toxic-fumes#:~:text=In%20March%202019%2C%20the%20United,plastics%20across%20their%20life%20cycle%E2%80%9D>
- [44] Pastorfide, D.M. and Pastorfide, D.D. (2021) Environmental Preservation: A “No Plastic” Ordinance Implementation in Urban Area. *International Journal of Innovative Science and Research Technology*, **6**, 133-139. <https://www.ijisrt.com/assets/upload/files/IJISRT21JAN096.pdf>
- [45] Ramzan, M., Shehzadi, R., Khawaja, N. and Adeeb, H. (2019) Climate Changes Awareness among Young Social Media Users. *Library Philosophy and Practice (E-Journal)*, Article No. 3796. <https://digitalcommons.unl.edu/libphilprac/3796/>
- [46] Marvodieva, A.V., Rachman, O.K., Harahap, V.B. and Shaw, R. (2019) Role of Social Media as a Soft Power Tool in Raising Public Awareness and Engagement in Addressing Climate Change. *Climate*, **7**, Article 122. <https://doi.org/10.3390/cli7100122>
- [47] Resolution No. 61 s-2007 (2007) Resolution Approving the Municipal Environmental Code of Cuyapo, Nueva Ecija. <http://www.sbcuyapo.com/wp-content/uploads/2017/05/RESOLUTION-NO.-61-s-2007.pdf>
- [48] Vigolo, V., Sallaku, R. and Testa, F. (2018) Drivers and Barriers to Clean Cooking:

- A Systematic Literature Review from a Consumer Behavior Perspective. *Sustainability*, **10**, Article 4322. <https://doi.org/10.3390/su10114322>
- [49] Philippine Statistics Authority (2004) A Review of the Agricultural Sector in Central Luzon. <https://psa.gov.ph/content/review-agriculture-sector-central-luzon>
- [50] Faridi, H. and Arabhosseini, A. (2018) Application of Eggshell Wastes as Valuable and Utilizable Products: A Review. *Research in Agriculture Engineering*, **64**, 104-114. https://www.researchgate.net/publication/319464095_Application_of_eggshell_wastes_as_valuable_and_utilizable_products_A_review
- [51] Food and Research Institute—DOST (2016) The Philippine Nutrition Facts and Figures 2015. Food and Research Institute, Taguig. http://enutrition.fnri.dost.gov.ph/site/uploads/2015_DIETARY_SURVEY.pdf
- [52] World Bank Group (2021) Market Study for the Philippines: Plastics Circularity Opportunities and Barriers. East Asia and Pacific Region Marine Plastics Series. World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/35295>
- [53] Parayno, P.P. and Bustamante, M.G. (2006) Project Integration of Solid Waste Management Tools in Specific European and Asian Communities (ISTEAC). Environmental Studies Institute, Quezon City. http://www.wadef.com/projects/isteac/StudyReport_Paper_Recycling_Research_Philippines.Work_Results.pdf
- [54] Patel, P. (2020) Paper Recycling Isn't Necessarily Good for the Climate. *Anthropocene*. <https://www.anthropocenemagazine.org/2020/10/paper-recycling-isnt-necessarily-good-for-the-climate/>
- [55] Environmental Management Bureau (EMB) and ICETT (2008) Green Framework of Innovative Strategy (GFIS) for Sustainable Consumption and Production. Environmental Management Bureau (EMB), Quezon City; ICETT.
- [56] Department of Environment and Natural Resources (2021) NSWMC Approves Solid Waste Management Plans for 21 LGUS. <https://denr.gov.ph/index.php/news-events/press-releases/3057-nswmc-approves-solid-waste-management-plans-of-21-lgus>