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## The Consequences of Excessive Vegetable Production

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### ABSTRACT

Using a survey-interview method on 50 randomly selected farmers, the study intends to report the effects of excessive vegetable production in a barangay on farmers' economic conditions, traditional practices, interactions, and the environment. The respondents were composed of 52% middle-aged farmers, 28% young farmers, and 20% elderly farmers; 76% were male and 24% were female. Economically, vegetable cultivation has increased farmers' financial capability, provided a source of income for others, made others reliant on the supply system, and caused others to accumulate debt. Traditional farming methods were abandoned. Furthermore, excessive vegetable farming caused soil loosening, pesticide waste disposal issues, biodiversity loss owing to agricultural expansion, conversion of rice fields to vegetable farms that lead to the endangerment of other species, and the emergence of non-beneficial organisms. In addition, the Amuyo system was enhanced, non-involvement in social functions, and farmer conflicts were linked to excessive vegetable production activities. It is recommended that a study concerning the conditions of soils in all the farms in the barangay should be conducted; a study on the elimination of the insect that causes the rotting of vegetable fruits and fruit trees; carrying out training on sustainable agricultural practices and environmental issues; formation of a farmers' organization and farmers' cooperatives; establishment of a conservation area for indigenous species; creation of vegetable product development facility; and undertake a similar study with a larger research area and respondents.

### INTRODUCTION

Initially, vegetable farming was done to meet immediate consumption needs; however, recognition of its role in a comfortable life results in large-scale vegetable production. Globally, vegetable production has increased by 60% over the last two decades (FAO, 2022). In ASIA, the highest vegetable-producing country is China with an estimated 700 million produced between 2016 and 2020 (Zhu & Yu, 2020). Meanwhile, In the Philippines, vegetable production increased at an annual rate of 2.03% from 2.53 million tonnes in 1971 to 6.62 million tonnes in 2020 (Knoema, 2022). Locally, Benguet was the leading major vegetable-producing province in the Cordillera region, accounting for 72.8% of total major vegetable production at 94,261.6 metric tonnes (PSA, 2020). As a result, it has the potential to improve farmers' access to cash for living expenses while also increasing employment (Mukaila *et al.*, 2022b).

On the other hand, increased vegetable production implies increased demand as a result of the rising human population and agricultural land expansion. Accordingly, the main driver of degradation associated with the loss of forest biodiversity is agricultural expansion (FAO, 2022). Furthermore, the use of chemical fertilizers and pesticides during vegetable production results in the buildup of hazardous compounds (Laurean, 2008) that can damage other forms of life.

Barangay Bila is located in the municipality of Bokod, province of Benguet, country of Philippines. The main source of income of the community is vegetable farming. During the 1970s to 1990s residents of Barangay Bila

relied on their grown rice grains as their main source of carbohydrates. Following the rice harvest, vegetables and root crops were planted. But with the increasing population, the concretization of roads, and the arrival of new farm technologies, the traditional and usual ways of farming and lifestyle gradually change. From the year 2000, the farmers of Barangay Bila shifted to intensive vegetable farming, and dubbed some of the vegetables as the "Green Golds".

Earlier studies on vegetables focused on their profitability, efficiency, marketing, and contribution to household income and livelihood (Holmer, 2011; Isitor *et al.*, 2016; Ngegba *et al.*, 2016; Zhen *et al.*, 2020; Schreinemachers *et al.*, 2016; Timsina & Shivakoti, 2018; Tsiboe *et al.*, 2019; Mukaila *et al.*, 2021, Mukaila *et al.*, 2022), COVID effect (Ridley & Devados, 2021), and vegetable integrated pest management (Yorobe Jr *et al.*, 2011) without evaluating its effects on social interactions, traditional systems, indigenous species, and to rice fields. In addition to income, these factors must be investigated so that policymakers could intervene to further improve well-being and preserve important practices and other forms of life. Owing to this, the purpose of this study was to fill a gap in the research by assessing the consequences of excessive vegetable production on the residents' economic conditions and the ecosystem.

In particular, the current study: described the vegetable farmers' profile, and characterize the effects of vegetable production on the farmers' economic status, farmers' traditional practices, social interactions, and the environment.

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## METHODOLOGY

### Research Design

The study made use of the descriptive survey method of research. Descriptive survey research seeks to shed light on current difficulties or problems by collecting data through surveys, questionnaire, or polls that enables one to explain situations and strives to determine, characterize, or identify what exists (Manjunatha, 2019).

### The Respondents

A total of fifty respondents were chosen at random based on the list of farmers provided by the barangay. The respondents included young farmers (20-35 years old), middle-aged farmers (36-55 years old), elderly farmers (56 and older); single and married farmers; males and females. The participants included were full-time farmers. Farmers that depend on another source of income were excluded.

### Study Area

The research was carried out at Barangay Bila, municipality of Bokod, Benguet Province, Cordillera Region, Philippines. The majority of residents in the barangay rely on land agriculture. The community grew taro, cassava, sweet potatoes, and nearly every form of vegetable. Their vegetable products are sent to different regions in the country.

### The Survey Instrument

A researcher-designed survey questionnaire with six sections was constructed, including respondents' personal information, economic, environmental, social, and suggestion sections. The questionnaire consisted of open-ended questions and was administered to the respondents in the form of an interview. Informed permission forms were presented, explained, and signed by key informants before administering the survey questionnaire.

### Data Analysis

The gathered data were treated with descriptive statistics. Descriptive measures such as frequency count and percentage were used in describing the farmers' personal information. And the specific effects of vegetable production on the different community aspects were interpreted using thematic analysis. Thematic analysis is a versatile method for assessing qualitative data utilized in a wide range of paradigmatic or epistemological contexts. This consists of six steps: becoming acquainted with the data, generating initial codes, searching for themes, reviewing themes, defining and labeling themes, and publishing the report (Kiger & Varpio, 2020).

## RESULTS AND DISCUSSION

### The Respondents Profile

Of the fifty respondents, 52% were middle-aged farmers, 28% were young farmers, and 20% were elderly farmers; 76% were male and 24% were female. This could be one of the reasons for the increase in production, as

most farmers are of productive age. They are open to changes in agricultural technology. Meanwhile, 20% of the respondents did not complete elementary school, 20% did not complete high school, 12% graduated high school, 26% did not complete college, and 22% graduated college. All of the farmers had no official agricultural training or schooling; instead, their years of experience improved their farming talents. Furthermore, 20% of the farmers were unmarried and had completed elementary to high school. On the other hand, married respondents had 2-6 children.

### Economic Effects of Vegetable Farming

All of the participants depend solely on vegetable farming. Based on the survey interview, the following are the thematized effect of vegetable production:

#### Financial Capability Enhancement

According to the farmers, vegetable farming increased their financial capability when compared to solely planting rice. With their improved income, 14% of participants were able to buy an elf truck, 14% a motorcycle, and 18% a truck van, and the rest were able to send their children to city universities or schools, build their residences, and finance everyday necessities. One farmer even said, "*tonaka panpedeta ni kamatis ja unbaknang* (tomato production compels me to become wealthy)". This utterance was due to his tripled investment in planting tomatoes. Furthermore, they claimed that expanding their farm size, as was also proven in the study of Mukaila *et al*, (2022) and fine climate enhances their income.

#### Source of Income

Women who rely on daily earnings typically have a regular income for 4-6 months because barangay farmers usually plant at the same time. Planting, weeding, harvesting, hauling, or crop maintenance costs between Php250.00 and Php350.00 per individual. In addition, some students can support themselves by working on the farm during the holidays and weekends. Furthermore, growing leafy vegetables became a source of revenue for them.

#### Supplier Dependency

Meanwhile, 34% percent of farmers were under the "supply system". This method is an unwritten agreement between a farmer and a businessman, or both farmers, in which one of them provides all of the necessary farming necessities such as seeds, fertilizer, pesticides, farm equipment and tools, farm rental if not owned, and labor fees for other workers. The other party will work on the land and maintain it. When harvest time comes, all expenses will be subtracted from the gross income, and the net income will be split in two; 60% for the supplier and 40% for the farmer, or 50% each. According to a female farmer, the arrangement advantages the supplier the most. Because if their monetary portion is insufficient to sustain their family expenses until the following harvest season, they will be unable to support their next crop and will be

forced to return to the system. This frequently happens when the wholesale buying price is low and they do not own the land. Fortunately, several suppliers were kind enough not to deduct the expenses.

### **Succumb to Debt**

On the other hand, 6% of the respondents incurred debts. This was either due to low vegetable prices, farm damage due to typhoons and pests, or reckless farm worker (supply system). In terms of low prices, the interview revealed that they encountered vegetable prices ranging from Php2.00 to Php10.00. And, to mitigate losses, some farmers took the risk of borrowing from cooperatives and other individuals. Farmers, on the other hand, typically dump tons of crops such as carrots, tomatoes, cabbage, and others into vacant lots due to extremely cheap prices. This resulted in a significant loss for the farmer, resulting in debt.

### **Effects of Vegetable Production on Farm Practices**

#### **Replacement of old farm practices**

With the emergence of development, the old ways of farming in Bila, Bokod, Benguet were gradually replaced. The use of traditional soil-tilling, land irrigation systems, and watering plants with the aid of centrally located water pits, was gradually abandoned starting in the year of 1990s.

Carabao to tractors. Of the 50 respondents, 14% of them still use carabao, while 86% of them do not use carabao in plowing and tilling their farms; instead, they used tractors (rented or owned). This resulted in the unavailability of the animal when someone needed it for important ritual purposes.

#### **Land Irrigation to Pipelines**

Ten percent of the participants continued to utilize the land irrigation system, while 40% switched to using a hose to irrigate their vegetables (from the water source to the farm). However, switching to a more efficient irrigation method caused conflict among farmers. Numerous rolls of hose were laid straight from the main source to each farmer's farm by farmers with the means to do so. Water was distributed unevenly as a result, and other farmers were unable to access water, which led to lawsuits among farmers.

#### **Limited Crop Rotation**

Additionally, all of the respondents said that they practiced crop rotation. However, 10% of respondents stated they had grown tomatoes continuously on the same plot of land for eight years. The others do crop rotation but their rotation was only between two types of vegetables. Meanwhile, 38 of the respondents do not practice intercropping because according to them, intercropping may limit the growth or may transfer disease to their main crop.

#### **Use of Commercialized Vegetable Seeds**

Besides that, farmers typically saved mature seeds of

their current veggies for future use. Nonetheless, none of the farmers interviewed do this anymore because of previous experiences in which the seeds they generated did not produce the same quality and yielded fewer crops. As a result, they had to buy commercialized seeds for each crop adding to their expenses. Respondents also stated that commercial seeds are more resilient to weather fluctuations.

#### **Use of Herbicides**

Moreover, the farmers used to do a manual removal of weeds, now it is replaced with several types of herbicides. Ninety percent (90%) of respondents used herbicides twice or three times during one crop. In terms of biopesticide use, such as ground chili pepper, there was a complete transition to the use of chemical pesticides and fungicides. During the rainy season, they may apply 4-12 times every month, or every three days, depending on the severity of the condition. Fortunately, they had been trained to utilize protective gear to protect themselves from the toxic compounds.

#### **Use of Chemical Stickers or Surfactants**

Aside from spraying herbicides and pesticides, one farmer indicated that during the rainy season, some farmers add "chemical stickers" to insecticides. The chemical sticker or surfactant enhances pesticide or herbicide adherence to the leaf and reduces chemical loss due to rain (Pataky, 2002). However, failure to follow sticker usage guidelines may result in plant phytotoxicity (plant harm) or unanticipated troubles (Pataky, 2002). Furthermore, including stickers in herbicides may endanger off-targeted plants and aquatic organisms (Pacanoski, 2015).

When the plant disease persists, accordingly, they occasionally employ cyanide to eliminate harmful insects and fungi. The degree of cyanide use was not specified. Furthermore, some of them employ chemicals such as cumectin and cyamectin to make vegetable fruit shiny, such as tomatoes. In addition, the participants also said they occasionally combine all of the chemicals in one application.

#### **Dependent on Synthetic Fertilizers**

Finally, the farmers reported that they became dependent on synthetic fertilizers for the maintenance of their vegetables. The use of carabao and cow manure in the 1990s as fertilizer was abandoned. According to the interview, a 1,000-square-meter vegetable farm used 10 to 20 sacks of synthetic fertilizer per crop, as well as 15 to 50 sacks of chicken excrement. While one farmer said that on her 2,000 square meter vegetable plot, she used 20 bags of synthetic fertilizer and 300 sacks of chicken excrement in one year. Another claimed to have used 17 cavans of commercially produced fertilizer and 40 cavans of chicken manure. On the other hand, one farmer used 10 sacks of synthetic fertilizer and 15 sacks of chicken excrement on his 2500 square-meter vegetable farm for a single crop. Farmers claim that their regular usage of

chicken manure has increased the population of non-beneficial insects that may spread diseases. In addition, farmers who have been continuously planting vegetables on the same ground for more than five years use more fertilizer. Consequently, the farmers noticed that even if they kept on applying fertilizer, their plants were not robust as before.

According to Savci (2012), intensive use of nitrogenous fertilizers may cause water contamination via leaching and flow, air pollution through emission of nitrogen oxides, and soil degradation through the decline of current element balance, decrease in pH, soil fertility, and restrictions on nitrifying bacteria.

Based on the respondents' demographics, the majority (52%) were married middle-aged farmers, and 28% were young. This could be one of the explanations for their willingness to accept the adjustments to earn an immediate income and cut labor inputs to meet their household expenses.

### Environmental Effects of Vegetable Farming

#### Soil Loosening

According to the farmers, their regular application of herbicide for every crop observably promotes soil loosening, which causes erosion of vegetable farm embankments. This could be related to Rose *et al.* (2016)'s results that herbicides can change the soil environment by disrupting soil earthworm ecology and nitrogen cycle inhibition.

#### Pesticide Waste Disposal Problems

With the severity of chemical pesticide use, chemical container disposal became a problem. Farmers either burn the plastics, bury the bottles and plastics on the farm, throw them on riverbanks, or just stack them in bags and store them on the farm. It was also discovered that some of the pesticide plastic bags were being repurposed as taro pots, which might be dangerous if not properly cleansed. As a result, one pesticide business agreed to collect the containers and set up a collection schedule but never showed up to collect the pesticide containers.

#### Expansion of Farm Lands

Farmers expand their agricultural farms by converting forest lands. This is due to the need for more income, less

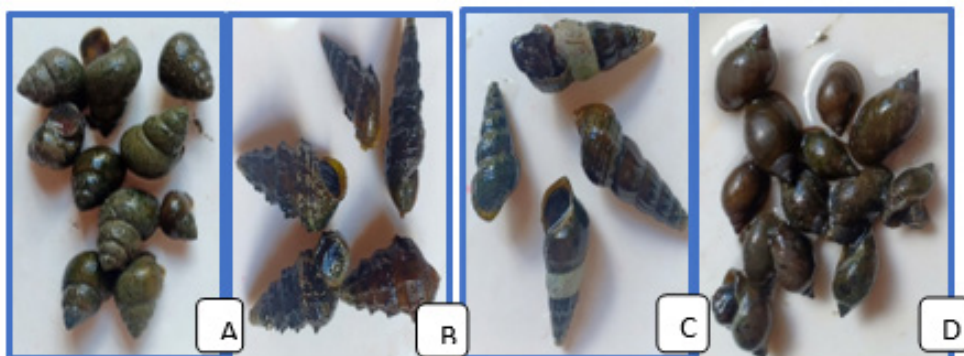
fruitful old farms, and the "supply system." The amount of vegetable product produced increases as the farm area expands, as does the income. While insufficient crop rotation and excessive use of pesticides and synthetic fertilizers may contribute to the declining fertility of vegetable plots, prompting farmers to seek new farm grounds. The supply system, on the other hand, is becoming more common. Sixty-six of those who took part were suppliers. They tend to invite individuals from other places to till their lands, increasing the number of arriving employees and; thus the need for expansion. Meanwhile, it has been proven that agricultural expansion endangers biodiversity (Dudley & Alexander, 2017). As was observed, pine trees were toppled, as were valuable shrubs such as "shuminay" or hop bush (traditionally used as a stick broom and as an anti-arthritis herbal tea).

#### Conversion of Rice fields to Vegetable Farms

The barangay's first farmers primarily planted rice all year, but with the growth of vegetable farming, the rice fields have been transformed into vegetable farms. The discontinuation of conventional rice agriculture resulted in the unavailability of rice heirlooms. Furthermore, because the bulk of rice fields had been turned into vegetable farms, older people who wished to plant rice were cautious because if they were the only ones who planted rice, rice-eating birds and rodents would flock to their fields. In addition, the traditional cuisine known as "shenamel" which was made from 70% ripe rice grains, was becoming rare.

#### Threatened Population of Native Freshwater Snails and Loaches

The native freshwater snail population (figure 1) is threatened by the conversion of rice fields to vegetable farms because rice fields are their habitat. Some of them can still be found in small fishponds, but their numbers are notably declining. This was linked to the golden apple snail, pesticide-intensive use, and the conversion of rice fields. Consuming the bitter soup of the boiled native snail, according to one of the senior farmers, relieves recurrent coughing. Similarly, loaches were now seen only in small fish ponds, which were previously abundant in rice fields and land irrigation systems.

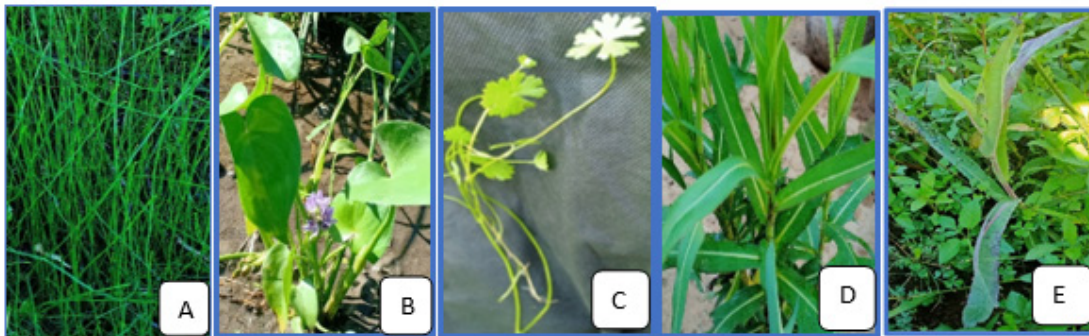


**Figure 1:** Threatened native freshwater snails found in Barangay Bila: (A) *Vivipara* sp., (B) *Thiara* sp., (C) *Melanioides* sp., (D) *Lymnaea* sp.

### Threats Indigenous Edible Plants

Indigenous food plants (figure 2) are currently uncommon on most farms in the barangay. According to the interview, the plants were threatened by the use of

herbicides and the conversion of rice fields to vegetable farms. These food plants (B-E) grow naturally on farms but are becoming rare.



**Figure 2:** Threatened indigenous edible plants in Bila, Bokod, Benguet: (A) *Equisetum* (consumed as tea), (B) *Lactuca* sp, (C) *Pontederia* sp, (D) *Oenanthe* sp, and (E) *Sonchus* sp.

### Endangerment of Beneficial Organisms

Farmers have seen a decrease in the number of dragonflies compared to previous years, which they attribute to the conversion of grasslands and rice fields into vegetable farms. Dragonflies help to remove troublesome insects like mosquitoes by devouring their larvae (May, 2019). Similarly, birds and frogs were occasionally observed on farms. This is most likely one of the factors contributing to the significant increase in the mosquito population and an increase in dengue cases.

### Emergence of Undesirable Worms and Insects

There was an emergence of large earthworms and insects such as several varieties of whiteflies, fruitworm, thrips, cutworm, and army worms. As a result, because the destructible insects were difficult to exterminate, they resorted to the use of cyanide. They also attempted to remove these insects by combining various pesticides. On the contrary, one of the farmers stated that he was able to exterminate army worms using powerful pesticides, but that more hardly eliminated insects resurfaced. One participant also remarked that some insects had become more aggressive in harming farms than they had been previously. Moreover, the large earthworms observed were destructible to farm embankments.



**Figure 3:** The image above depicts a farmer-identified insect (Genus *Bactrocera*) that infects vegetable fruits and is difficult to eradicate.

According to the farmers, the above insect (figure 3) is one of their major concerns. This insect mainly infects vegetable fruits, causing them to deteriorate. They are difficult to eradicate since they spread to surrounding fruit trees and other farms during insecticide application, earning them the label “behaviorally wise.” Furthermore, the appearance of this insect impacted fruit trees and backyard coffee plantations.

Dudley and Alexander (2017) argued that agriculture is the leading cause of biodiversity loss, with escalating consequences due to shifting consumer habits and a rising population. Farmers were well aware of the environmental consequences of excessive chemical use, as well as the consequences of removing pine trees. However, their primary focus was on increasing their family’s income. Furthermore, while all respondents were aware of what a genetically modified organism is, they were unfamiliar with the process of bioaccumulation and its potential consequences. This may be attributed to the respondents’ educational background.

### Social Effects of Intensive Vegetable Production

#### Enhancement of Amuyo System

Amuyo is an Ibaloi term that means helping each other. When one of the farmers harvests their crop or prepares their farms for the next crop, the other farmers will come and assist such as in harvesting, carrying, or packing without being paid. In exchange, the farmer must assist the other when it is time to harvest.

#### Not Attending Social Gatherings and Meetings

Farmers in Barangay Bila often plant crops simultaneously. A farmer with more than one hectare of tomato-planted land needed to hire 5-15 people for weeding, leaf pruning, knotting, and harvesting. Individuals who rely on daily revenue were all incredibly busy during this season. There were also times when other farmers needed to hire employees from nearby barangays since there were no available laborers in the community. As a result, they do not attend social gatherings.

Eighteen percent of respondents claimed that vegetable production had an impact on their social relationships. They do not attend events such as cañao (traditional practice), Sunday masses, or school meetings. This is most likely one of the reasons why the majority of churchgoers are women. One of the farmers even claimed that he had neglected his wife because he had to start working in the field from 6 a.m. to 7 p.m. In terms of the cañao, families who engaged in this practice were obliged to perform all of the preparation and work because the majority of the community members were on their farms. Previously, the elders obligated the younger generations to help the family concerned. Working in the field is also prohibited on the day of burial if someone has died. However, these methods were no longer followed. Meanwhile, 80% of farmers do not attend environmental or new agricultural technology seminars or training. On the contrary, 82% stated their social interactions were unaffected. They enjoyed what they were doing and were able to manage their time effectively.

### Conflicts among Farmers

In the issue of water resources, misunderstandings amongst farmers led to the filing of a case in the barangay. In addition, as agricultural fields expanded, problems emerged between farmers over farm boundaries and legitimate property ownership, resulting in the filing of a complaint. According to the barangay's records, there were two property dispute cases filed in 2019 and one water system deviation case filed. While some farmers simply tolerate illegal conduct by other farmers. These misunderstandings influenced farmers' cooperative behavior in some way.

### Farmers' Suggestions

Finally, with rising farm supply costs and fluctuating wholesale buying prices for vegetables, producers proposed the creation of a separate reliable cooperative group for farmers to lend money at lower interest rates. Second, a policy that will stabilize vegetable prices and address the issue of vegetable smuggling. Third, the program to retrieve chemical containers. Fourth, the legitimacy of the supply system, in which profit should be divided equally between the provider and the farmer. Fifth, regulation of farm or labor wages. And fifth, government assistance to low-income farmers. Based on the result of the study, the following are suggested. First, conduct a study concerning the conditions of soils in all the farms in the barangay. This could be used as a piece of evidence to educate and help the farmers. Second, the conduct of the study focuses on the elimination of the insect that causes the rotting of vegetable fruits and fruit trees. Third, carrying out training on sustainable agricultural practices. It could address the emergence of undesirable organisms. Fourth, seminars on environmental issues like bioaccumulation, soil acidity, proper waste disposal, and others caused by intensive vegetable farming. Fourth, the formation of a farmers'

organization that will initiate policies regarding regular labor cost, vegetable fare, supply system, water management, and other issues. Fifth, the formation of farmer cooperatives that can lend cash to farmers at low-interest rates and assist them in acquiring farm equipment. Sixth, the establishment of a conservation area for indigenous species. Seventh, the creation of a facility or factory where they can store their vegetables for product development, particularly when costs are extremely low. This aims to address the issue of farmers dumping vegetable crops such as tomatoes, cabbage, and carrots when prices are extremely low. Even if the prices are cheap, vegetable dealers are unlikely to purchase the aforementioned vegetables. And the barangay has no mitigation practices for such circumstances. Finally, because the current study only includes one area, undertake a similar study with a larger research area and respondents.

### CONCLUSION

Excessive vegetable production had several consequences. Vegetable cultivation has an economic influence including increasing farmers' financial capacity, providing a source of income for others, dependency on the supply system, and debt accumulation. Traditional farming procedures were superseded by new applications that might reduce labor inputs. In terms of the environment, excessive vegetable farming has undermined farm embankments, endangered plant populations, freshwater snails, loaches, indigenous edible plants, and beneficial insects, and led to the emergence of undesirable species. In terms of social consequences, increasing vegetable production boosted the Amuyo system, decreased attendance at social gatherings, and farmer conflicts.

Because vegetable farming is the respondents' only source of income, they had to adjust to changes to raise their revenue and sustain their expenses. Natural resource depletion is directly related to increased economic capabilities. Government mitigations may help to strike a balance between economic advancement and the conservation of natural resources.

### REFERENCES

- Dudley, N., & Alexander, S. (2017). Agriculture and biodiversity: a review. *Biodiversity*, 18(2-3), 45-49.
- Food and Agriculture Organization (FAO). Crop Production-Vegetables. Retrieved from <https://www.fao.org/3/i3138e/i3138e05.pdf> on November 16, 2022.
- Food and Agriculture of the United Nations (FAO). The State of the World's Forest 2020. Retrieved from <http://www.fao.org/state-of-forests/2020/en/on> November 29, 2022.
- Holmer, R. J. (2011). Vegetable gardens benefit the urban poor in the Philippines. *Appropriate Technology*, 38(2), 49.
- Isitor, S. U., Otunaiya, A. O., & Iyanda, J. O. (2016). Efficiency of vegetable marketing in peri-urban areas of Ogun State, Nigeria. *Journal of Agricultural Science*, 8(3), 67-78.

- Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131. *Medical teacher*, 42(8), 846-854.
- Knoema. Philippines-Vegetables primary production quantity. Retrieved from <https://bit.ly/3Ebi2Ze> on November 16, 2022.
- Laurean, C.P. (2008). *Decades of chemical farming in selected municipalities of Benguet (Philippines): assessing its effects on environment and human health*. Retrieved on November 18, 2022. <https://agris.fao.org/agris-search/search.do?recordID=PH2009000083>.
- Manjunatha, N. (2019). Descriptive Research. *Journal of Emerging Technologies and Innovative Research*, 6, 6.
- May, M. L. (2019). Odonata: Who they are and what they have done for us lately: Classification and ecosystem services of dragonflies. *Insects*, 10(3), 62.
- Mukaila, R., Falola, A., Akanbi, S. U. O., Egwue, L., Obetta, A., & Onah, T. L. (2022). Effects of vegetable production on income and livelihood of rural households in Nigeria. *Mustafa Kemal Üniversitesi Tarih Bilimleri Dergisi*, 27(2), 213-223.
- Mukaila, R., Obetta, A. E., Awoyelu, F. E., Chiemela, C. J., & Ugwu, A. O. (2021). Marketing analysis of vegetables: the case of carrot and cucumber marketing in Enugu State, Nigeria. *Turkish Journal of Agriculture-Food Science and Technology*, 9(2), 346-351.
- Ngegbe, M. P., Sesay, M., & Banguru, E. T. (2016). The impact of vegetable farming on the livelihood of small-scale farmers in Koinadugu District Northern Sierra Leone. *Global Journal of Bio-Science and Bio-Technology*, 5(1), 42-49.
- Pacanoski, Z. (2015). Herbicides and adjuvants. *Herbicides, Physiology of Action, and Safety*; Price, A., Kelton, J., Sarunaite, L., Eds, 125-147.
- Pataky, N. (2002). Spreaders-Stickers. *University of Illinois Extension*. Retrieved from <https://hyg.ipm.illinois.edu/pastpest/200220c.html>
- Philippine Statistics Authority (PSA), (2022). Vegetable production at 369 thousand metric tons. Retrieved from [http://rssocar.psa.gov.ph/sites/default/files/Newsletter4Q\\_final.pdf](http://rssocar.psa.gov.ph/sites/default/files/Newsletter4Q_final.pdf)
- Ridley, W., & Devadoss, S. (2021). The effects of COVID-19 on fruit and vegetable production. *Applied Economic Perspectives and Policy*, 43(1), 329-340.
- Rose, M. T., Cavagnaro, T. R., Scanlan, C. A., Rose, T. J., Vancov, T., Kimber, S., ... & Van Zwieten, L. (2016). Impact of herbicides on soil biology and function. *Advances in agronomy*, 136, 133-220.
- Savci, S. (2012). An agricultural pollutant: chemical fertilizer. *International Journal of Environmental Science and Development*, 3(1), 73.
- Schreinemachers, P., Wu, M. H., Uddin, M. N., Ahmad, S., & Hanson, P. (2016). Farmer training in off-season vegetables: Effects on income and pesticide use in Bangladesh. *Food Policy*, 61, 132-140.
- Timsina, K. P., & Shivakoti, G. P. (2018). Vegetables production and marketing: practice and perception of vegetable seed producers and fresh growers in Nepal. *Agriculture & Food Security*, 7(1), 1-9.
- Tsiboe, F., Asravor, J., & Osei, E. (2019). Vegetable production technical efficiency and technology gaps in Ghana. *African Journal of Agricultural and Resource Economics*, 14, 255-278.
- Yorobe Jr, J. M., Rejesus, R. M., & Hammig, M. D. (2011). Insecticide use impacts of integrated pest management (IPM) farmer field schools: Evidence from onion farmers in the Philippines. *Agricultural systems*, 104(7), 580-587.
- Zhen, H., Jia, L., Huang, C., Qiao, Y., Li, J., Li, H., ... & Wan, Y. (2020). Long-term effects of intensive application of manure on heavy metal pollution risk in protected-field vegetable production. *Environmental Pollution*, 263, 114552.
- Zhu, J. and Yu, J. (2020). China's vegetable production brings more sense of contentment to people. *People's Daily*.