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Understanding Community Perceptions on Watershed Sustainability: Socioeconomic and Environmental Insights from the Sambunotan Watershed

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Abstract: The Sambunotan Watershed is critical to water security and ecological stability of Tubajon and Loreto, Dinagat Islands, Philippines. This study assessed the sociodemographic and economic profile of the residents and their level of awareness regarding key environmental concerns, including water quality, climate change, illegal logging, and mining activities. A mixed-method approach was employed, incorporating household surveys, focus group discussions, and key informant interviews. Data was analyzed using descriptive statistics and multiple regression analysis. Results indicate that most respondents rely on farming and daily wage jobs for income, with varying levels of education and access to water resources. Higher educational attainment positively correlates with awareness of rainwater harvesting and water quality monitoring. These findings highlight the need for targeted environmental education campaigns and integrated watershed management strategies to enhance public participation in conservation efforts. The study provides a valuable framework for developing sustainable solutions for the Sambunotan Watershed.

Keywords: Sambunotan Watershed, environmental awareness, sociodemographic profile, water consumption, watershed management, Dinagat Islands

1. INTRODUCTION

Watersheds play a critical role in sustaining ecosystems, providing water resources, and supporting livelihoods, particularly in rural and agricultural communities[1]. In the Philippines, watershed degradation due to deforestation, unsustainable land use, and pollution has led to declining water quality and availability, exacerbating environmental vulnerabilities in many regions[2]. Effective watershed management requires not only scientific and technical assessments but also an understanding of the socioeconomic factors influencing residents' behaviors and perceptions[3]. The success of conservation programs depends on community awareness and participation, as local populations directly impact and rely on the watershed's resources[4].

The Sambunotan Watershed, shown in Fig. 1, spanning the municipalities of Tubajon and Loreto in the Dinagat Islands, is an essential freshwater source for local communities.[5] However, environmental concerns such as illegal logging, kaingin (slash-and-burn farming), and mining activities pose threats to its sustainability. In addition, climate variability has influenced water availability, causing seasonal fluctuations that affect household water consumption patterns. Understanding the sociodemographic and economic characteristics of watershed residents, along with their level of environmental awareness, is crucial for developing targeted conservation strategies and improving water resource management [6,7].

Despite the watershed's significance, there is limited empirical data on the sociodemographic and economic profile of its residents and how these factors influence environmental awareness. Prior research indicates that

education, economic status, and employment shape environmental attitudes and behaviors[8,9].

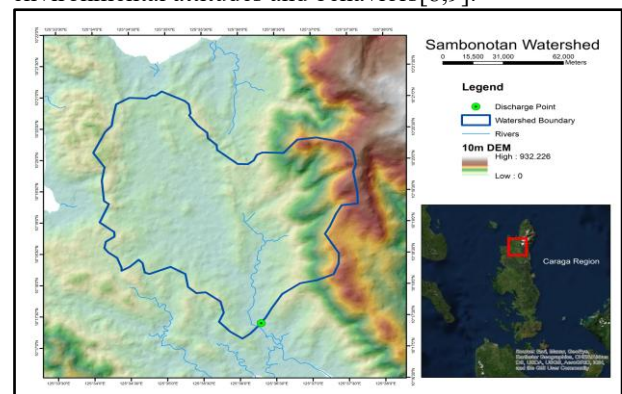


Fig. 1. Location map of Sambunotan watershed (boundary file used is from DENR Caraga)

However, specific insights into how these variables correlate with watershed-related concerns in the Philippine context, especially in Mindanao, remain understudied. Furthermore, studies from other regions of the country highlight the importance of public perception in determining the success of water conservation and watershed management efforts [10,11].

This study seeks to bridge this knowledge gap by investigating the relationship between the residents' sociodemographic and economic characteristics and their awareness of environmental issues within the Sambunotan Watershed. The findings will provide insights for local policymakers, environmental managers, and community stakeholders in formulating evidence-based interventions.

This study provides a critical examination of how sociodemographic and economic factors shape environmental awareness in the Sambunotan Watershed. Understanding these relationships is essential for improving watershed management strategies, as prior research indicates that education, economic status, and employment significantly influence public perceptions of environmental concerns [8,9]. Findings from this study contribute to the growing body of literature on environmental attitudes and community participation, particularly in rural and developing areas where resource management heavily depends on local engagement [6,7]. By identifying key predictors of awareness, this research offers practical insights into how demographic attributes affect pro-environmental behavior within watershed communities. Additionally, results will provide empirical evidence for local governments in Tubajon and Loreto to develop community-centered environmental education programs. The study will also offer a foundation for integrating household water consumption data into watershed management plans, ensuring more sustainable water resource allocation. Finally, by identifying key gaps in awareness, policymakers and conservation practitioners can design targeted interventions that align with the specific needs and behaviors of the watershed's residents [4].

2. METHODOLOGY

2.1 Research Design

This study employed a mixed-method approach, integrating both quantitative and qualitative research techniques to assess the sociodemographic and economic profile of the residents of the Sambunotan Watershed and their level of awareness regarding environmental concerns. The quantitative component involved structured household surveys to gather demographic and economic data, as well as responses on environmental awareness. The qualitative component consisted of focus group discussions (FGDs) and key informant interviews (KIIs) to provide deeper insights into community perceptions and challenges related to watershed management. This combined approach ensured a comprehensive understanding of the factors influencing environmental awareness and water resource utilization in the watershed [4,7].

2.2 Study Area and Population

The study was conducted in the Sambunotan Watershed, which spans approximately 28 square kilometers within the municipalities of Tubajon and Loreto in the Province of Dinagat Islands, Philippines. The watershed covers multiple barangays, including Carmen, Sta. Cruz, Santiago (Loreto), and Mabini, Diaz, San Vicente, San Roque, and Roxas (Tubajon). These areas were selected due to their dependence on the watershed for water supply, agriculture, and other livelihoods. The target population included household heads, barangay officials, local government representatives, and environmental stakeholders directly involved in or affected by watershed management policies.

The study utilized stratified random sampling to ensure representation from different socio-economic backgrounds. The latest household census data from the

local government was used as a basis for calculating the sample size. The respondents were selected proportionally from each barangay, considering factors such as population size and accessibility.

2.3 Data Collection Methods

Household Survey

A structured survey questionnaire was administered through door-to-door interviews with randomly selected households. The survey was designed to collect information on:

1. Demographic profile (age, gender, marital status, educational attainment)
2. Economic profile (employment, income sources, household income levels)
3. Water consumption patterns (sources, quantity, and quality of water)

Level of environmental awareness in the following areas: knowledge of water pollution, deforestation, mining activities, climate change, and conservation practices. The survey instrument was pre-tested in a pilot study before full implementation to ensure clarity, reliability, and validity. Enumerators were trained in proper data collection procedures to minimize biases and errors.

Focus Group Discussions (FGDs)

FGDs were conducted to explore community perceptions and attitudes toward watershed management. Participants included

- Representatives from the Barangay council
- Concerned citizens and residents
- Stakeholders such as farmers, fisherfolk, and water resource users

The FGDs provided an open discussion platform to understand community concerns, beliefs, and traditional knowledge related to watershed sustainability. Topics included water conservation, climate change adaptation, and challenges in accessing safe water [6,11].

Key Informant Interviews (KIIs)

KII gathered expert opinions on water resource management challenges, policy gaps, and the impacts of deforestation and mining on water [2,12]. KIIs were conducted with selected experts and government officials, including:

- Municipal Environment and Natural Resources Office (MENRO) representatives
- Rural Health Unit (RHU) officials
- Municipal Engineering and Planning Officers
- Local water district personnel

Geographic Mapping of Water Sources

The study also involved mapping water sources using a handheld Global Navigation Satellite System (GNSS) receiver. This provided precise geographic coordinates of dug wells, springs, rivers, and other water sources, ensuring an accurate assessment of water availability and distribution across the watershed. [5,13] The GIS approach used in this study is aligned with methodologies from Yeh et al. (2016) [12] and Rondinel-Oviedo &

Sarmiento-Pastor, (2020) [14] which emphasizes spatial analysis for water resource planning.

2.4 Data Analysis

Descriptive Statistics

Survey data were analyzed using descriptive statistics to summarize the demographic and economic characteristics of the respondents. Frequency distribution, mean, and percentage values were used to describe key variables, such as education levels, household income, and water consumption patterns.

Regression Analysis

To examine the relationship between sociodemographic variables (education, income, employment) and environmental awareness, multiple regression analysis was conducted using STATA version 13.1. The model tested whether sociodemographic factors significantly influenced awareness levels on issues such as water quality, climate change, and illegal logging [15] Before running the regression, a multicollinearity test (Variance Inflation Factor, VIF) was performed to remove redundant variables, ensuring a robust analysis.

Qualitative Data Analysis

Data from FGDs and KIIs were analyzed using thematic analysis to identify patterns in perceptions and experiences related to watershed conservation. Common themes, such as barriers to water conservation, local knowledge of environmental risks, and community-led initiatives, were categorized and interpreted in the context of existing literature [3,4].

Mapping and Spatial Analysis

The geographic data collected from GNSS mapping was analyzed using GIS tools to visualize the distribution of community water sources. This helped in assessing spatial disparities in water access, which is crucial for designing localized water management interventions [12].

2.5 Ethical Considerations

Ethical guidelines were strictly followed to ensure informed consent, data confidentiality, and respondent anonymity. Each participant was informed about the purpose of the study, and their voluntary participation was emphasized. A consent form was provided before conducting surveys and interviews. The study adhered to ethical research standards set by local institutions and followed best practices in social science research.

3. RESULTS AND DISCUSSION

3.1 Sociodemographic and Economic Profile of Residents

The study revealed that the majority of the respondents were female, largely due to male household members being engaged in external work. Married individuals constituted the largest portion of the population, followed by those in common-law relationships. Shown in Fig. 2 is the mean age of respondents was between 48 and 49 years old, indicating that most are within their working and reproductive years. Educational attainment averaged nine years, suggesting that the majority had only completed some level of high school education.

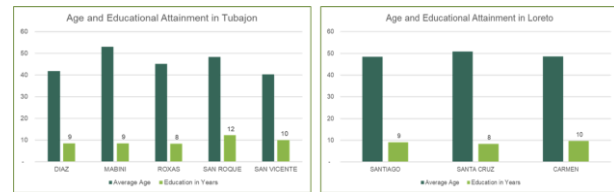


Fig. 2. Age and Educational Attainment in the Municipality of Tubajon and Loreto

In Figure 3, the family source of income for both municipalities is shown. Economically, residents of Tubajon relied primarily on farming, while daily wage jobs were the dominant source of income in Loreto. This difference reflects Loreto's more developed business and infrastructure sector, allowing for greater employment opportunities. However, despite more job opportunities, the overall household income remained low, with most families earning less than PHP 10,000 per month. Households in Tubajon had an average of two working members, yet their total gross income was slightly lower than that of Loreto, where typically only one household member worked. This suggests that farming as a primary livelihood generates lower earnings than employment in more urbanized areas. These findings align with previous studies that highlight economic disparities in rural communities and their impact on resource dependency[2,3] .

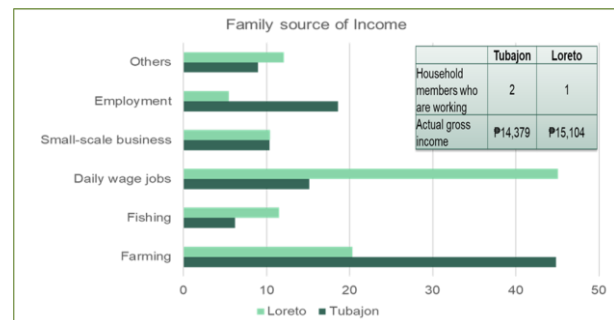


Fig. 3. Family Source of Income

3.2 Level of Awareness Regarding Environmental Concerns

The respondents exhibited moderate to high awareness levels regarding environmental issues affecting the Sambunotan Watershed. In Figure 4, the level of awareness was highest for rainy seasons, climate change, and water quality monitoring, while knowledge about water contamination, kaingin (slash-and-burn farming), and illegal logging was comparatively lower.

- Rainy season (72.98%) and climate change (72.41%) had the highest awareness levels, likely due to direct experience with extreme weather patterns affecting the watershed.
- Moderate awareness was observed for rainwater harvesting (60.72%), water quality (56.13%), and mining activities near the watershed (64.23%).
- Illegal logging (64.38%) and kaingin (62.19%) had relatively lower awareness levels, despite their significant impact on watershed sustainability.

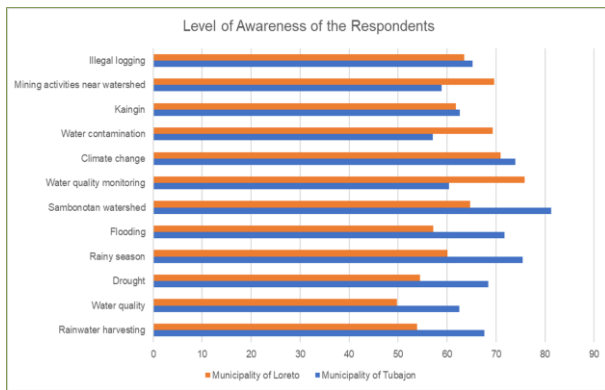


Fig. 4. Level of Awareness of the Respondents

3.3 Correlation Between Sociodemographic Factors and Environmental Awareness

Statistical analysis revealed significant relationships between sociodemographic characteristics and environmental awareness levels.

- Education was positively correlated with awareness of rainwater harvesting and water quality monitoring, confirming previous findings that higher educational attainment enhances environmental understanding[7,8].
- Employment and economic status influenced perceptions of environmental risks—for instance, those engaged in daily wage jobs exhibited higher awareness levels than those solely dependent on farming.
- Longer residency in the area was negatively correlated with awareness of water contamination and mining-related impacts. This suggests that long-term residents may become desensitized to environmental degradation over time [4].
- Gender and ethnicity also played a role, with male respondents and Cebuano speakers demonstrating higher awareness levels on specific environmental concerns, such as watershed conservation.

These results highlight the need for targeted awareness programs that address knowledge gaps based on demographic differences. Community-based education initiatives could be particularly effective in engaging older residents and those with lower educational backgrounds[11].

3.4 Household Water Consumption Patterns and Water Resource Availability

The study found that most households relied on water districts for their daily needs, particularly for cooking, washing, and bathing. However, for drinking water, the sources varied:

- In Tubajon, the majority relied on water refilling stations.
- In Loreto, most residents depended on the water district for drinking water.
- Seasonal fluctuations in water supply were also observed
- A significant number of households reported irregular water availability, particularly during drought seasons.
- Some communities experienced water supply disruptions lasting several days, forcing them to rely on alternative sources such as deep wells and rivers.

Regarding water quality, most households rated their drinking water as "not so safe," highlighting concerns over contamination. These perceptions align with previous studies showing that many rural communities in developing countries lack access to consistently safe drinking water[12,14].

3.5 Location of Community Water Resources

Geographic mapping revealed that community water sources, such as dug wells, springs, and hand pumps, were unevenly distributed across the watershed. The primary sources of water in Tubajon were dug wells, while in Loreto, residents relied on both dug wells and rivers. Springs were found in some areas but were not the primary water source, likely due to accessibility issues or contamination concerns.

In Tubajon, the primary sources of water are groundwater and surface water. Most of the households in Tubajon were using water from dug wells. Some water sources from a hand pump, river and spring. On the other hand, in Loreto the source of water is from dug wells, rivers and springs. Dug wells were one of the most common types of wells for individual water supply in both municipalities. There was a total of 15 dug wells, 5 hand pump, 7 springs and 1 surface water as shown in Figure 5.

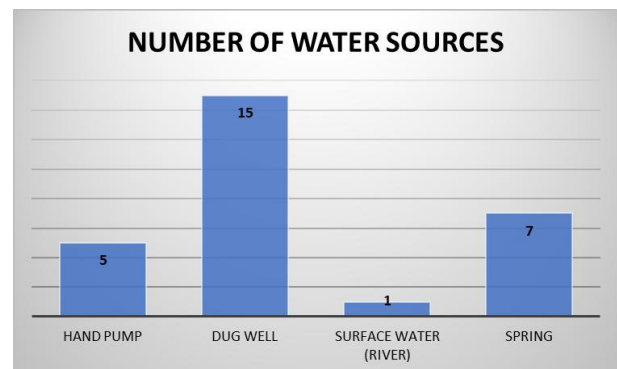


Fig. 5. Number of Water Sources

The study confirmed that most water sources were located outside the Sambunotan Watershed, raising concerns about the sustainability of the watershed as a primary water resource. These findings underscore the importance of integrating spatial analysis into water resource planning, as demonstrated in GIS-based studies on groundwater management [12].

4. CONCLUSION

This study assessed the sociodemographic and economic profile of the residents of the Sambunotan Watershed and evaluated their level of awareness regarding environmental concerns. The findings highlight the interplay between demographic characteristics, livelihood sources, and environmental consciousness, providing valuable insights for sustainable watershed management.

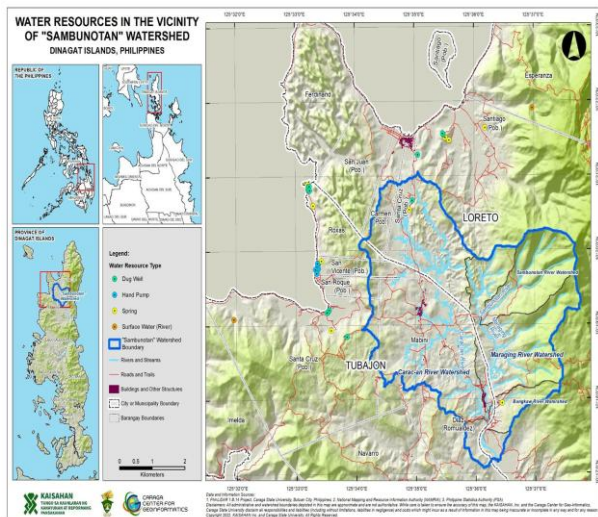


Fig. 6. Water Resources in the Vicinity of Sambunotan Watershed

The study revealed that the majority of residents are middle-aged, married individuals with moderate education levels and are primarily engaged in farming and daily wage jobs. Economic opportunities in Loreto provided slightly higher incomes compared to Tubajon, though overall household income remained low. These economic constraints limit access to safe drinking water and proper sanitation, further emphasizing the need for improved water management strategies.

The level of environmental awareness among residents varied, with higher awareness of climate change, the rainy season, and water quality monitoring, but lower awareness of water contamination, illegal logging, and mining impacts. Statistical analysis confirmed that education, employment type, and length of residency significantly influence awareness levels. This aligns with global studies indicating that higher education enhances environmental consciousness, while economic pressures may divert attention from long-term environmental concerns[6,8].

Water consumption patterns showed a heavy reliance on water districts and water refilling stations yet supply shortages during drought seasons remain a significant issue. The perception of drinking water safety was low, with most respondents considering their water “not so safe.” Geographic mapping revealed that community water sources, including dug wells and springs, are not evenly distributed, and many are located outside the watershed, raising concerns about the watershed’s sustainability as a primary water resource.

Overall, the study underscores the need for integrated watershed management, combining community education, infrastructure improvements, and policy interventions to ensure sustainable water resource utilization. Without proactive measures, socioeconomic vulnerabilities, environmental degradation, and water security challenges in the Sambunotan Watershed may worsen.

5. REFERENCES

- [1] J.C. Salas, Watershed Management Practices in the Philippines: The Tigum-Aganan Watershed Case, in: İ.E. Gönenç, A. Vadineanu, J.P. Wolflin, R.C. Russo (Eds.), *Sustain. Use Dev. Watersheds*, Springer Netherlands, Dordrecht, 2008: pp. 81–98. https://doi.org/10.1007/978-1-4020-8558-1_6.
- [2] J.R.D. Apdohan, N.D. Briones, A.J. Alcantara, M.G. Galang, Effectiveness of Management Strategies Employed in Taguibo River Watershed Forest Reserve for Water Supply in Butuan City, Philippines, 1 (2019).
- [3] L.W. Morton, S. Padgett, Selecting Socio-Economic Metrics for Watershed Management, *Environ. Monit. Assess.* 103 (2005) 83–98. <https://doi.org/10.1007/s10661-005-6855-z>.
- [4] D. Zeng, B. Chen, J. Wang, J.L. Innes, J. Lu, F. Guo, Y. Yan, G. Wang, Evolving environmental awareness and shifts in management priorities: a socioeconomic lens on the min river basin, China, *Front. Environ. Sci.* 11 (2023) 1257089. <https://doi.org/10.3389/fenvs.2023.1257089>.
- [5] Meriam Makinano - Santillan, Arnaldo C. Gagula, Stephanie Mae Salcedo – Albores, Jun Love E. Gesta, Nichole Anthony Pacle, Riva Karyl P. Varela, Jojene R. Santillan, Combined Hydrological and Geologic Assessment for Sustainable Management of the Sambunotan Watershed, Dinagat Islands, Philippines, *Proc. Int. Exch. Innov. Conf. Eng. Sci. IEICES 10* (2024) 956–963. <https://doi.org/10.5109/7323375>.
- [6] M. Belachew, M. Belay, T. Demissie, Socio-Demographic and Psychosocial Factors Influencing Pro-Environmental Behaviours Among Residents in Choke Mountain Watersheds, East Gojjam Zone, Ethiopia, (2024). <https://doi.org/10.2139/ssrn.4809100>.
- [7] S. Dlamini, S.G. Tesfamichael, T. Mokhele, Socio-demographic determinants of environmental attitudes, perceptions, place attachment, and environmentally responsible behaviour in Gauteng province, South Africa, *Sci. Afr.* 12 (2021) e00772. <https://doi.org/10.1016/j.sciaf.2021.e00772>.
- [8] B. Čater, J. Serafimova, The Influence of Socio-Demographic Characteristics on Environmental Concern and Ecologically Conscious Consumer Behaviour among Macedonian Consumers, *Econ. Bus. Rev.* 21 (2019). <https://doi.org/10.15458/ebv.84>.
- [9] U.J. Uba, E.N. Efut, U. Bassey Obeten, E.E. Asuquo, J.C. Uba, Sociodemographic factors and environmental workers’ knowledge of the impact of awareness creation on sustainable disposal of solid wastes, *Heliyon* 9 (2023) e18122. <https://doi.org/10.1016/j.heliyon.2023.e18122>.
- [10] A.I. Almulhim, Y.A. Aina, Understanding Household Water-Use Behavior and Consumption Patterns during COVID-19 Lockdown in Saudi Arabia, *Water* 14 (2022) 314. <https://doi.org/10.3390/w14030314>.
- [11] O. Singh, S. Turkiya, A survey of household domestic water consumption patterns in rural

semi-arid village, India, *GeoJournal* 78 (2013) 777–790. <https://doi.org/10.1007/s10708-012-9465-7>.

- [12] H.-F. Yeh, Y.-S. Cheng, H.-I. Lin, C.-H. Lee, Mapping groundwater recharge potential zone using a GIS approach in Hualian River, Taiwan, *Sustain. Environ. Res.* 26 (2016) 33–43. <https://doi.org/10.1016/j.serj.2015.09.005>.
- [13] Meriam Makinano-Santillan, Michelle V. Japitana, Arnaldo C. Gagula, Stephanie Mae S. Albores, Jahn Rey C. Bautista, Marjunelyn R. Llesis, Jojene R. Santillan, Land-cover Characterization and Water Quality Assessment of the Sambunotan Watershed, Dinagat Islands in Support of the Development of the Watershed Management Plan, *Proc. Int. Exch. Innov. Conf. Eng. Sci. IEICES* 10 (2024) 910–915. <https://doi.org/10.5109/7323368>.
- [14] D.R. Rondinel-Oviedo, J.M. Sarmiento-Pastor, Water: consumption, usage patterns, and residential infrastructure. A comparative analysis of three regions in the Lima metropolitan area, *Water Int.* 45 (2020) 824–846. <https://doi.org/10.1080/02508060.2020.1830360>.
- [15] R.J. Agtong, F.A. Laudino, J. Jumawan, M. Elvira, Knowledge, Attitude, and Practices Towards Utilization, Conservation, and Marketing of Economically Important Fish Species Among the Local Communities of Lake Mainit Watershed, Philippines, *J. Ecosyst. Sci. Eco-Gov.* (2022) 8–19. <https://doi.org/10.54610/jeseg/4.2.2022.002>.