

Water Security Challenges in Households in Tuba, Benguet, Philippines

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Abstract. Water is a basic need and right of people. Yet there are water security issues, even in the Philippines. These are linked to global and national security and overall well-being. This study, therefore, describes the domestic water security issues of the households of the Twin Peaks National High School, Tuba, Benguet catchment areas, as represented in 2023 by the school's students and personnel who reside in the locale. A sample of them voluntarily answered the researcher-prepared online survey questionnaire; 226 response sets were valid. Where appropriate, the researchers checked the Cronbach alpha to be acceptable. They summarized the responses in percentage and mean. As reported by the respondents, their households' non-drinking waters are, from the most to least frequent source, via hosepipes from springs, streams, and waterfalls; private deep wells; commercial water delivery trucks; and rainwater harvesting. Most households experienced domestic water shortages and interruptions, mitigated by sufficient water storage containers and buying their drinking water. The households experienced problems with their non-drinking domestic water quality at the second highest level of "often"; 40% found their water supply generally unacceptable (odor, color, flavor, and dirt particles). Around 15% of them find their domestic water supply costly. Thirty-eight percent of them "often" or "very often" experienced the four adverse effects of the issues on their domestic waters' properties. However, the households practice ecologically responsible water-related behaviors only at the second least ideal level of "sometimes true." The findings add to the data-based information that domestic water security issues negatively affect households and individuals like those in the school's catchment areas. They and everyone need to practice ecologically responsible behaviors to help arrest the said issues. The local government units also need to take appropriate actions.

Keywords: Domestic water security issues; Water supply; Benguet; Philippines.

1.0 Introduction

Water is a fundamental human right and a critical resource for health, development, and security. Despite global efforts to ensure water access, billions of people still face water insecurity, including those in the Philippines (ADB, 2020; UN-Water, 2023). While the country has abundant water sources, access to clean and sufficient domestic water remains challenging, particularly in rural and urban communities with inadequate water infrastructure (WHO, 2021; Mendoza et al., 2020). This issue is evident in the Baguio-Benguet area, where water shortages, supply inconsistencies, and quality concerns continue to affect households (Mason, 2013).

Water security is part of the national security agenda (The President of the Philippines, 2023). However, studies highlight persistent issues, particularly in areas reliant on groundwater and alternative water sources. Households in Baguio City and Benguet, including those in Tuba, face difficulty securing reliable and safe water for daily needs (Mendoza et al., 2020; Malteser International, 2019). Some households lack direct access to water utilities, while others experience rationed or intermittent supply. Families often depend on springs, creeks, and rainwater in rural areas, raising concerns about sustainability and health risks (ICLEI, 2017).

Existing research explores water security at national and urban levels but lacks localized studies on domestic water issues in specific communities like Tuba and Benguet. The Twin Peaks National High School (TPNHS) catchment area, home to several barangays along Kennon Road, lacks a substantive local water utility system. This is despite the fact that other parts of the municipality of Tuba, Benguet are a water source for Baguio City. This gap in literature leaves a critical need for data-driven insights into the domestic water security challenges households face in these areas.

This study aims to describe the domestic water security issues of households in the TPNHS catchment area in Tuba, Benguet, during 2023. By examining household experiences, the study provides valuable insights into water access, availability, quality, and coping strategies. The findings can support local governments, policymakers, and water providers in designing sustainable solutions to improve regional domestic water security. Additionally, this research contributes to the broader discourse on water security, offering a localized perspective that may inform similar studies in other underserved communities.

2.0 Methodology

2.1 Research Design

This is a quantitative-descriptive, exploratory survey study. It is conducted due to the substantive lack of literature on the water security issues in the TPNHS catchment areas. Moreover, the researchers had limited capability and resources and faced considerable constraints in navigating the locale. The researchers used a survey questionnaire to gather data. They then subjected the data to descriptive statistical analysis to arrive at descriptions of the population's DWSI.

2.2 Research Locale

The study essentially covers the TPNHS catchment areas, namely, five of the barangays of Tuba in the province of Benguet. As shown in Table 1, the barangays are along or near Kennon Road, an around 34-kilometer-long road whose lowland end is at the municipality of Rosario, La Union, while its highland end is at Baguio City.

2.3 Research Participants

The research covers the DWSI of the households in the TPNHS catchment areas (see Table 1). The households are represented by the TPNHS students and personnel who reside in the locale. The school's teachers, administrators, and supervisors are teaching personnel; the rest are non-teaching.

Table 1. *The Population of the TPNHS Catchment Areas in Tuba, Benguet*

Barangay	Percentage of Tuba's Population (2020)	Population (2020)	Population (2015)	Number of Households 2015 Aug 1
1. Camp One	3.35	1,619	1,773	354
2. Twin Peaks	2.20	1,061	1,184	274
3. Camp 3	16.33	7,890	10,033	2,190
4. Camp 4	14.15	6,836	7,136	1,675
5. Tabaan Sur	2.85	1,375	1,315	323

Source: PhilAtlas, 2024.

As of October 2023, there are around 543 students and personnel. A sample of them participated in the study. The total number of valid respondents is 226, distributed as shown in Table 2. The school's students and personnel who voluntarily answered the online survey questionnaire comprise the sample population. Fifty-one percent (51%) of them are females; the rest are males. The youngest respondent is a 12-year-old student, while the oldest is a 57-year-old teaching personnel. The least number of respondents are from Camp One (7.96%), followed by those from Tabaan Sur (19.47%). The rest, in nearly equal proportions, reside in the three other barangays. The

sample is sufficient in the context of the study that utilizes descriptive statistics. For studies utilizing the mean in statistical analysis, a percentage of the population can be a good enough representative (Israel, 2012).

Table 2. *The Respondents' Profile*

Property	Count	Percentage	Property	Count	Percentage
Occupation:			Residence Barangay:		
Junior high school	67	29.65	Camp One	18	7.96
Senior high school	142	62.83	Twin Peaks	56	24.78
Student (Unspecified level)	3	1.33	Camp 3	51	22.57
Teaching	13	5.75	Camp 4	57	25.22
Utility	1	0.44	Tabaan Sur	44	19.47
Residence Ownership:			Total, n	226	100
Own house	202	89.38			
Renting	24	10.62			

2.4 Research Instrument

The researchers utilized the survey questionnaire they designed based on the references, their experiences, and the recommendations of their research guides, who are experts in research or on the topic. They checked the study, including the questionnaire. The questionnaire's solicitation letter informs the target participants about the study, that participation is voluntary, that answering the questionnaire indicates consent to participate, that the respondent will remain confidential, that the responses will be for research purposes, and how the data will be protected and archived. Part I of the questionnaire properly deals with the respondent's demographic profile. The other parts consist of items that lead to the answers to the study questions.

The alpha coefficients of the final responses are 0.753 for the perceived quality of the domestic water supply, 0.691 for the four items on the effects of the DWSI, and 0.671 for the seven items on the countermeasures taken against the DWSI. These values are considered acceptable. Goforth (2015) states that "although the standards for what makes a "good" coefficient alpha are entirely arbitrary and depend on your theoretical knowledge of the scale in question, many methodologists recommend a minimum coefficient alpha between 0.65 and 0.8 (or higher)."

2.5 Data Gathering Procedure

The research students first had their study topic and site approved by the research professor, concerned department, and adviser. They then contacted the TPNHS school principal for permission to conduct the study. The research professor and panel eventually approved the research proposal. The school principal and teachers selflessly, without remuneration, took charge of the data gathering in the school last October 2023. The respondents answered the online survey questionnaire without remuneration. The researchers coded the raw responses to ensure that the respondents remained confidential. They calculated the frequency counts, percentages, and means of the responses to arrive at the answers to the study questions. They will keep the electronic files of the coded responses for five years for any necessary verification.

2.6 Ethical Considerations

The researchers followed ethical guidelines, as indicated in the preceding sections. It did not harm any participant.

3.0 Results and Discussion

3.1 Experiences in Domestic Water Supply Properties

Domestic Water Source

The respondents' households primarily pipe in their non-drinking water via hosepipes from nearby unprotected/open waterfalls, streams, or protected/improved "ubbog" (or springs). The second most frequent non-drinking domestic water source is the private deep well category, followed by commercial water delivery trucks and rainwater harvesting. Most respondents (57.96%) indicated that their households primarily buy their drinking water from commercial water filtering and refilling stations and stores that sell this resource in typical 5-gallon containers. Water from protected or improved "ubbog," whose waters are known to be potable, is

primarily used by the rest of the households for drinking or intake. A few do some home filtration. For example, they filter the water using a clean cloth when necessary.

Domestic Water Sufficiency

Water shortage is the insufficiency of the water supply. Table 3 shows that most of the study respondents' households experienced piped-in domestic water shortages during the first three quarters of 2023. However, the frequency is generally at the lower levels of 1 to 3 days per week (50.88%). Around 60% of the respondents indicated that their households experienced water shortages every week of each month. The highest relative percentage (36.28%) experienced water shortages at the frequency level of "1 day per week."

Table 3. *Piped-in Domestic Water Shortage and Interruption (n = 226)*

Frequency of Water Shortage and Interruption	Count	Percentage
Frequency of Piped-in Water Shortage		
Never	91	40.27
1 day/week	82	36.28
2 to 3 days/week	33	14.60
4 to 5 days/week	9	3.980
6 to 7days/week	11	4.870
Frequency of Piped-in Water Interruption		
1 week/month	155	68.58
±2 weeks/month	28	12.39
±3 weeks/month	16	7.080
Every week of the month	27	11.95

There is a water supply interruption when the piped-in water supply flow does not come for the scheduled, or at least for the expected, time. Most respondents indicated that they experienced piped-in water interruption for about one week per month. This is the lowest per-month frequency. A respondent noted that water shortages and interruptions are widespread during summer when the water flow weakens. Table 3 thus indicates that most of the respondents experienced piped-in water supply shortages and interruptions, though at the lowest frequency levels. This explains why the respondents summarily indicated that "sometimes" (weighted mean = 2.41) they do not have enough water for hygiene. This set of findings becomes more meaningful with the information in Table 4.

Table 4 shows the schedule and duration of piped-in water flow and the sufficiency of water storage containers in the respondents' households. The ideal schedule for piped-in water flow is "more than 6 hours"; its ideal duration is "6 to 7 days per week." Nevertheless, nearly half (44.69%) of the respondents indicated that their piped-in water flows for one day per week. Only 32.74% of the respondents indicated that their household's piped-in water flows for four to seven days a week.

Table 4. *Piped-in Domestic Water Flow and Storage (n = 226)*

Property of Domestic Water Supplying	Count	Percentage
Schedule of Piped-In Water Flow		
1 day/week	101	44.69
2 to 3 days/week	51	22.57
4 to 5 days/week	19	8.410
6 to 7 days/week	55	24.33
Duration of Piped-In Water Flow		
Less than an hour	93	41.15
1 to 3 Hours	60	26.55
4 to 6 Hours	16	7.080
More than 6 Hours	57	25.22
Water Storage		
Sufficient/Enough	140	61.95
Insufficient/Inadequate	86	38.05

Table 4 also shows the duration of the flow of piped-in water. Many (41.15%) of the respondents indicated that their households' domestic water flows for less than an hour on the water supply days. These findings show that

most of the respondents' households have a problem with the number of days and hours of actual flow of piped-in water supply. A once-a-week schedule of actual water supply flow would not be enough to support the household's water needs for the week.

The households acquired water supply storage containers to compensate for the problem with the piped-in water supply flow schedule and duration. Most (61.95%) respondents indicated that their households' water supply storage containers are sufficient. A respondent wrote that "*we should always be alert if there is a water shortage*"; the respondents' households collect and store water whenever the water comes. Another respondent added that this is true even "*on rainy days..., sometimes no water is coming out from the faucet.*" Some households, therefore, buy additional water supply from water delivery trucks. The finding in Table 3 that 40.27% of the respondents never had a piped-in water supply shortage supports these thoughts based on Table 4.

Domestic Water Cost Level/Affordability

Table 5 shows that a significant percentage (85.40%) of the respondents answered that the cost of their drinking and non-drinking water supplies is affordable. This finding may imply that these respondents' households are financially stable enough or have sufficient financial resources for their basic needs, including domestic water supplies. Table 5 also tells us that 14.60% of the respondents' households may not be financially stable or have sufficient financial resources for their basic needs. The cost of their drinking and non-drinking water supplies is high. These may be the households, also shown in Table 5, who utilize approximately 10% to 15% of their average monthly income for their domestic water supply.

Table 5. *Self-Reported Cost Levels of Water Supply (n = 226)*

Cost Level	Frequency Count	Percentage
How do you find the cost of your piped-in water supply?		
Affordable/Within our means	193	85.40
Costly/Expensive	33	14.60
How do you find the cost of your drinking water supply?		
Affordable/Within our means	193	85.40
Costly/Expensive	33	14.60
Approximate percent of water supply cost based on average monthly income		
1 to 4%	108	47.79
5 to 9%	83	36.72
10 to 15%	35	15.49

Domestic Water Quality

The ideal response to Table 6 items is "always," which signifies that the respondents find their domestic water to be of the most acceptable quality. However, the overall mean of the items is "often true," the second most ideal response. This finding is not suitable because water is a basic human need and is indispensable for survival, health, and overall well-being. Moreover, Table 6 tells us that the quality of the domestic water supply of the respondents' households is not of the most acceptable quality since less than 50% of the respondents answered "always" to each of the five items.

Table 6. *Self-Reported Quality of Domestic Water Supply*

Water Quality Criterion	Frequency Count				Percentage				Weighted Mean	Interpretation
	N	S	O	A	N	S	O	A		
1. How acceptable is the water quality from your local water district/supplier?	28	39	44	108	13	18	20	49	3.06	Often
2. The water does not contain visible dirt particles.	27	54	110	28	12	25	50	13	2.63	Often
3. How acceptable is the quality of the color	30	67	62	60	14	31	28	27	2.69	Often
4. How acceptable is the quality of the odor	59	53	48	59	27	24	22	27	2.49	Sometimes
5. How acceptable is the quality of the flavor	31	48	64	76	14	22	29	35	2.84	Often
Mean	35	52	66	66	16	24	30	30	2.74	Often

Note: n = 219; Seven respondents left some items blank; their responses for this set were, therefore, not considered. Response Levels: N = Never; S = Sometimes; O = Often; A = Always. Cronbach's alpha = 0.753.

The sum of the averages of the “often” and “always” responses tells us that the majority (60%) found their domestic water supply quality to be generally acceptable. However, 40% found their domestic water supply quality to be typically unacceptable, which signifies that their domestic water supplies were polluted.

Table 6 also shows that the least often acceptable water property is odor, followed by visible dirt particles, color, and flavor. A respondent noted that *“on rainy days, water supply is slow with a brownish color...”*. The color indicates the presence of dirt particles that may provide an additional dirty scent to the water. Odorous and dirty domestic water is polluted and can cause diseases (like diarrhea).

The findings in this section are not entirely ideal because water is a basic human need and right (Omarova et al., 2019; UNDESA, n.d.) critical for people's survival and overall well-being. They signify that the TPNHS respondents' households have issues with their domestic water supply's source, sufficiency, affordability, and quality. Those findings are, however, not unique to the TPNHS catchment areas, as discussed in the Introduction section of this paper. It is undeniable that for many people in the world, including the Philippines, sufficient water is not ensured and is increasingly becoming scarce (ADB, 2020; Aquino et al., 2023; Dinka, 2018; Kummur et al., 2016; Lee et al., 2020; Mason, 2013; Omarova et al., 2019; UN-Water, 2023; WHO, 2021). Nevertheless, the findings in this section partly do not support the ADB's AWDO, which categorized the Philippines at the “Engaged” level, the second to the lowest of five levels under the rural household category. The more extensive population and set of variables covered by the AWDO probably explain the difference in the findings of this study from those of the AWDO.

Indeed, even the areas near the TPNHS catchment areas have frequent water shortages and interruptions (Malteser International, 2019; Mendoza et al., 2020). That is why private water suppliers make up a significant portion of the household water supply market in Baguio City (Mendoza et al., 2020). That is also why the city's poor households rely on free water sources, such as springs and rainwaters, despite being uncertain of those waters' quality (ICLEI, 2017). Most TPNHS respondents' households mitigate the water sufficiency problem by having adequate water storage containers. This finding parallels Mendoza et al. (2020), who found that two-thirds of their respondents' families have containers for storing water from planned BWD distributions, rainwater collection, or water deliveries.

The finding that the properties of the domestic water supplies of the TPNHS respondents' households are not entirely ideal has various implications. Domestic water supplies with non-ideal properties imply the causes of the DWSI. Some of the many reasons for water scarcity issues are rapid population growth, economic development, accumulated disaster risk, and climate change (Lee et al., 2020). Other causes are pollution, overconsumption, and water mismanagement (Lai, 2022). In the case of the TPNHS catchment areas, rapid population growth may be excluded as a cause, as supported by Table 1. For the catchment areas, the management of water resources is a more influential cause. The catchment areas have no extensive, localized, improved/protected domestic water supply system.

The finding that the properties of the domestic water supplies of the TPNHS respondents' households are not entirely ideal also hints at human rights. They signify that the respondents' human right to access safe drinking water and adequate sanitation, necessary for achieving all human rights, is not entirely ideal (Omarova et al., 2019; UNDESA, n.d.). They indicate possible health risks. They also point to human security conditions. Human security refers to a person's general well-being. It is interlinked and complementary to national security, which is influenced by water insecurity (Pobre, 2013). Therefore, the findings in this section indirectly imply the country's well-being (Coronel, 2022). They likewise imply the attainment of national security goals in relation to communities like the TPNHS catchment areas. The same findings also suggest their consequences and countermeasures. These may be considered two other DWSI categories.

3.2 Effects of Domestic Water Supply Issues

Items 1 to 4 in Table 7 are negatively stated, so “very rarely true” is the best response, and “very often true” is the worst response. Only 38.16% of the respondents reported that their households “often” or “very often” experienced the said effects during the period. The trend of the responses for items 1 to 4 in Table 7 is somewhat good since “very rarely true” got the highest percentage (32.41%) and “very often true” got the lowest rate (14.38%). Similarly, the “sometimes true” overall result for those items is quite good since it is just a step below the best level. Nevertheless, the result for item 5 is not good since “very often true” is the best response for it. The statistics suggest that 50% of respondents do not consciously conserve water.

Table 7. Self-Reported Effects of Domestic Water Supply Issues

Effect of DWSI	Frequency Count				Percentage				WM	Interpretation
	VRT	ST	OT	VOT	VRT	ST	OT	VOT		
1. Some of our illnesses come from the water we drink.	73	80	48	25	32	36	21	11	2.11	Sometimes
2. I get mad, irritated, and/or easily angry due to our household water issues.	59	77	60	30	26	34	27	13	2.27	Sometimes
3. The water challenge of limited piped-in water supply leads to conflict with our neighbor, with whom we share the same main pipe.	71	59	60	36	31	26	27	16	2.27	Sometimes
4. The costs for our water supply are a headache for the family, as they are one reason for limited allowance and budget for other necessities.	90	50	47	39	40	22	21	17	2.15	Sometimes
Mean of Items 1 to 4	73	66.5	54	32.5	32.41	29.43	23.78	14.38	2.20	Sometimes
5. The challenges to our water supply make us more consciously conserve/not waste water	51	61	68	46	23	27	30	20	2.48	Sometimes

Note: n = 226; Response Levels: VRT = Very Rarely True; ST = Sometimes True; OT = Often True; VOT = Very Often True.

WM = Weighted Mean. Cronbach's alpha for items 1 to 4 = 0.691.

There are physical, social, and psychological/mental health consequences of costly, insufficient, and polluted domestic water (Dinka, 2018; Omarova, 2019; Rhue et al., 2023; UN-Water, 2023). We may perceive not consciously conserving water (item 5) as a psycho-ecological effect. Getting sick is a physical health effect also reportedly experienced by the TPNHS respondents and their households. We may categorize “more quickly getting irritated and/or angry” and “having conflict with neighbors due to problems with the water supply” as psychosocial effects. A respondent wrote, “the other house comes to our house to get water”; another wrote, “We should always be alert if there's a water shortage.” These situations may sometimes be stressful, leading to negative emotions that can lead to conflict. Further, recall from section 3.1 that the respondents summarily indicated that “sometimes” (weighted mean = 2.41) they do not have enough water to use for hygiene purposes, like bathing. For example, not being able to bathe when needed can also trigger negative emotions.

The Table 7 findings also support water insecurity's health impacts on children and adolescents. Evidence shows that the impacts include communicable diseases, physical and cognitive health, adverse social effects, and non-communicable diseases (Rhue et al., 2023). These impacts can negatively affect mental health (Rhue et al., 2023; Vuong et al., 2022). The overall finding for item 4 supports the conclusion that “water insecurity can also exacerbate financial issues (UN-Water, 2023).”. For example, a financially needy family in the site with insufficient domestic water supply may be forced to buy water from delivery trucks using money that can be used for the children's school supplies. A financially needy family may also use funds for food supplies to buy domestic water.

3.3 Households' Solutions to Domestic Water Issues

The findings in Table 8 specify actions, behaviors, or practices that can be done to solve (or at least mitigate) domestic water insecurity and its consequences. For the Table 8 items, “very often true” is the best response, while “very rarely true” is the worst. However, “very often true” got the lowest percentage (16.18%), and “often true” got the second lowest percentage (26.11%) of the responses. The sum of the two percentages is less than 50%. The rate of households who rarely and sometimes practice the specified countermeasures against the water shortage problem is higher than those who often and very often practice the same countermeasures.

Likewise, note that “we conserve water in our household” (item 4) is the most often performed behavior. It suggests that the households practice other water conservation behaviors. Examples of such behaviors are using a cup when brushing teeth, using the pail & dipper/“tabo” when bathing, and promptly closing the faucet. However, those are still at the second least desired “sometimes true” level. Therefore, the relatively low findings for item 4 still support the low findings for item 5 (on conscious water conservation) in Table 7. “Our household sees to it that there are no leaks/dripping in faucets and pipes” is the second most often performed countermeasure. It is another specific way of not wasting water. The least usually practiced DWSI mitigating strategy is rainwater harvesting (item 1). Moreover, the overall “sometimes true” result is the second least desired response for the items in Table 8. The trend of the responses is, therefore, not desired about the domestic water shortage problem.

Table 8. *Solutions to Domestic Water Supply Issues*

Solution/Practice/Countermeasure to DWSI	Frequency Count				Percentage				WM	Interpretation
	VRT	ST	OT	VOT	VRT	ST	OT	VOT		
1. Our household collects rainwater.	91	59	48	28	40	26	21	12	2.06	Sometimes
2. Our household sees to it that there are no leaks/dripping in faucets and pipes.	45	81	67	33	20	36	30	15	2.39	Sometimes
3. We reuse water in our household.	80	57	44	45	35	25	19	20	2.24	Sometimes
4. We conserve water in our household.	50	66	78	32	22	29	35	14	2.41	Sometimes
5. Our family uses the minimum amount of water for hygiene.	70	53	60	43	31	23	27	19	2.34	Sometimes
6. To avoid conflict with our neighbors, our family follows the schedule and rules regarding the water supply flow.	65	65	59	37	29	29	26	16	2.30	Sometimes
7. To avoid conflict with our neighbors, our family follows the schedule of opening our water valves and does not unnecessarily close our neighbor's water valves (which is against the rules).	57	74	57	38	25	33	25	17	2.34	Sometimes
Mean	65	65	59	37	28.95	28.76	26.11	16.18	2.30	Sometimes

Note: n = 226; Response Levels: VRT = Very Rarely True; ST = Sometimes True; OT = Often True; VOT = Very Often True.

WM = Weighted Mean. Cronbach's alpha = 0.671.

The findings in Table 8 suggest that most of the respondents' households do not significantly practice those behaviors to help arrest (or at least mitigate) the issues of the cost, quantity, and quality of their domestic water supplies. This connotation is not ideal since behavioral practices 1 to 5 are environmentally or ecologically responsible behaviors, which should be encouraged in all persons and households. Environmental problems and climate change are not slowing down. They contribute to water insecurity. Those resource-friendly behaviors contribute to water security and help mitigate other ecological issues that affect environmental health. A healthy environment is necessary for human well-being. A respondent's note that "*we reuse water from washing dishes*" is but one way to mitigate domestic water issues that should then be encouraged for all households.

The Table 8 findings indicate that the respondents' households probably give more weight to the other aspects of their daily living. They also connote the reasons for water shortage. For instance, not frequently practicing water-friendly behaviors can contribute to the "accumulated disaster risk and climate change (Lee et al., 2020)" reasons for water scarcity. The findings likewise insinuate that, in the TPNHS catchment areas, there is a lack of water infrastructure or water supply systems and integrated water resource management. The latter "leads to the failure of institutions to balance everyone's needs (UN-Water, 2023)" for the households there. The finding that rainwater harvesting is the least often performed mitigating action is probably because there would be more water from other sources during the rainy season. Only 33% of the TPNHS respondents' households "often" or "very often" do rainwater harvesting. This finding is comparable to Mendoza et al.'s (2020) finding that "rainwater harvesting has had some success in implementation" in Baguio City.

Some findings on the actions practiced by the TPNHS respondents' households against the problems of their domestic water supply cost, source, quantity, and quality are parallel with those cited by Venkataramanan et al.'s (2020) literature review. In particular, the parallel practices are the coping mechanisms of water storing, purchasing, sharing, skipping hygiene practices, and changing household routines. This study's findings also imply the other development sectors; they point to the need for more investment in water to meet the people's right to water, which will also lead to economic, technical, environmental, and political gains (Dinka, 2018 UNDESA, n.d.; UN-Water, 2023; Zabala, 2017). This implication has a bearing on government units. They are in the best position to motivate and carry out more investment in water in their jurisdictions.

This study's findings also indicate that, for the locale of this study, the attainment of the United Nations Sustainable Development Goal (SDG) 6 (to ensure the availability and sustainable management of water and sanitation for all by 2030) is a long way off. SDG 6 will likely not be attained by 2030 for this study's population. Thus, there is also a need to strengthen the people's and the local government's water-responsible practices. The behavioral and environmental theories that explain how people behave when faced with ecological problems can

guide the design and implementation of water-responsible programs. Two models are the Value-Belief-Norm (VBN) Theory of Environmentalism and the Behavioral Change Model (Akintunde, 2017). The latter theory proposes that knowledge influences awareness or attitude that can influence or lead to behavior. For instance, schools, government units, organizations, institutions, and even individuals should unfailingly educate and prod people about water resource-related concerns to the point that the people value and consistently perform water-responsible practices. The theories tell us that any water-responsible program should consider the many variables that indirectly and directly lead to actual behavior. These variables are knowledge, awareness, attitudes, beliefs, norms, and intentions. The water-friendly practices of this study's respondents are at different levels, influenced by many variables, like their domestic water supply issues, values, beliefs, and norms.

4.0 Conclusions

The descriptive statistics of the data from the TPNHS students and personnel support the following information and propositions. Many households experience issues with their domestic water supplies' source, cost, quantity, and quality. Specifically, households nowadays generally buy their drinking water in five-gallon jugs. They get their non-drinking domestic water from various sources, with the mix and degree varying with the particular conditions in the area. For the TPNHS households, the mix, in order from the most to the least frequent source, is (i) piped in from the nearby waterfalls, streams, or springs; (ii) private deep well; (iii) water delivery truck; and (iv) rainwater harvesting. Furthermore, some households find their domestic water supply costly. The findings also support the proposition that in many parts of the country, such as in the TPNHS catchment areas, most households experience piped-in water shortages and interruptions. Households can effectively mitigate these with sufficient water storage containers. In addition, a large percentage of households frequently experience generally non-acceptable domestic water supply qualities of odor, color, flavor, and visible dirt particles.

The issues with the properties of domestic water supplies can negatively affect, up to a high level, households and their members. However, experiencing the said issues does not necessarily lead to enhanced ecologically responsible water-related behaviors, as signified by the finding that the TPNHS households' water conservation behaviors are at the second least desired level of "sometimes true." Overall, the descriptive statistics of the data from the TPNHS students and personnel support the information on various categories of domestic water security issues, which should be addressed because they adversely affect households and their members. To help arrest, mitigate, and manage the DWSI, the residents of the TPNHS catchment areas in Tuba in the province of Benguet need to maintain sufficient water storage, maximize (or at least optimize) rainwater harvesting, coordinate with the local government units regarding the DWSI, and consciously take appropriate countermeasures against its adverse effects. They and everyone else are encouraged to truly, actually, habitually practice ecologically responsible water-related practices.

The concerned individuals, schools, and government officials of the TPNHS catchment barangays also need to optimize their efforts to make everyone truly and consistently practice water-friendly behaviors. The government officials of the TPNHS catchment barangays are also encouraged to coordinate with the people regarding the DWSI. This includes looking into any probability of creating extensive local quasi-government water systems in their jurisdictions. Considering this study's limitations, researchers are encouraged to conduct further studies on DWSI, water conservation, and water conservation programs to strengthen support or validate this study's findings and conclusions. Said studies may utilize inferential statistics and qualitative approaches.

5.0 Contributions of Authors

JP Tayaban: conceptualization, advising, data analysis, writing, editing. The rest of the researchers conceptualize, write, revise, encode, analyze data, and interact with the TPNHS.

6.0 Funding

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7.0 Conflict of Interests

No conflict of interest, financial or non-financial, has been identified.

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