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Building Urban Climate Resilience: Assessing Awareness, Perception, and Willingness regarding Nature-Based Solutions and Climate Change among Stakeholders in Iligan City, Philippines

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Abstract: Iligan City has been the heart of major industries in steel, cement, and hydropower and is one of the highly urbanized coastal cities in Mindanao, Philippines. Due to its geological state, environmental challenges like flooding, natural disasters, and environmental degradation have been experienced by the city. With the climate crisis, these risks are being magnified. Recently, nature-based solutions (NBS) have gained significant attention worldwide, viewed as a key solution to the consequences of climate change. Yet implementation of strategies and policies regarding NBS, especially in developing countries, has received poor attention. Hence, this study aims to assess the awareness and perceptions of stakeholders in Iligan City regarding climate change, NBS, and willingness to engage in actions involving NBS. Stakeholder mapping and surveys were conducted through purposive sampling. A total of 187 respondents were interviewed from different sectors (LGUs, NGOs, the private sector, and academia) in Iligan City. Results revealed significant differences in awareness and perceptions across the distinct socio-economic backgrounds of stakeholders, where respondents with higher education and income have greater levels of awareness, perception, and willingness. The study recommends future targeted approaches and increased campaigns for climate change and sustainable solutions such as integrating NBS in adaptation strategies and mitigation plans to foster multi-level stakeholder collaboration.

Keywords: nature-based solutions; climate change; stakeholders; Iligan City; awareness; perception



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1. Introduction

Climate change has been studied and predicted extensively, particularly in light of its negative consequences for human survival. Regarded as one of the largest global concerns at present, climate change has continued to progress over time due to various destructive anthropogenic activities brought by global industrialization, on top of its natural causes such as volcanic emissions and the shifts in carbon dioxide in the planet's atmosphere [1]. These major economic and industrial events have led to dwindling carbon sinks, while greenhouse gases continue to amass greatly in the atmosphere, placing the planet at a critical point [2–4]. While urbanization continues to expand in most countries, it has also exacerbated the risks that are already present in most cities, such as air pollution, sea level rise, flooding, urban heat, and health hazards, especially for individuals who are members of the most vulnerable populations [5,6]. Studies have shown that while climate change effects have been negatively affecting the entire planet, particularly in countries with megacities and highly urbanized areas, this long-term threatening phenomenon has been more felt in developing nations due to heightened vulnerability, which is more

likely attributed to their topographical state and poverty. For instance, limited adaptive capacity, infrastructure, and resources to cope with climate change impacts and their geographical exposure are observed in developing nations located in areas with heightened environmental hazards that are more susceptible to disasters, which then can be further exacerbated by the effects of climate change [7,8].

The Philippines is an archipelagic country with over 7000 islands stretching along the Pacific Ocean's rim and has one of the world's longest coastlines [9–11]. Given the country's geographical location and the frequency of tropical cyclones that bring with them heavy rains, flooding, and rising sea levels that increase the risk of storm surges, the Philippines is one of the most vulnerable countries to extreme weather events related to climate change worldwide, especially in urban areas [12,13]. With climate change effects and the country's economic state, these environmental risks and hazards of the country are magnified despite the country being one of the least contributors to global emissions of greenhouse gases, with a 0.48% global share of greenhouse gas while ranking 121st for climate vulnerability in the year 2021 [14,15]. In addition to this, various risks are faced by local communities from poor households as they are more vulnerable to climate change impacts than those that are from moderate and high-income households. Specifically, studies have been conducted in Vietnam and in the Philippines, where household characteristics such as types of livelihood, income, and exposure to hazards are found to be determining factors in their vulnerability and in which low adaptive capacity was found to be an antecedent to vulnerability [13].

On the island of Mindanao, Iligan City has been regarded as an industrial city of the south known for various domains in steel, cement, ferroalloy plants, and crude coconut oil, with the city's power harnessed from the Maria Cristina Falls hydropower plants located within the city's boundaries [16–18]. Iligan City is classified as a highly urbanized coastal city; with the city's geological state, it has been prone to various environmental disasters such as typhoons, landslides, earthquakes, and especially flooding, which are more likely to be intensified due to the threat of climate change impacts such as increased sea levels in coastal areas [19,20]. Iligan has gone through several instances of natural disasters, including the devastating case of the tropical cyclone "Sendong". In response, the government of Iligan City has made efforts and taken actions to enhance disaster risk reduction plans, policy, and management, as well as mitigation strategies as prevention and readiness for future disaster events. For instance, 'Project Climate Twin Phoenix', supported by the United Nations Development Program (UNDP), aims to formulate contingency plans for cities in Mindanao, including Iligan City, to cope with the challenges posed by climate change. The flood contingency plan in 2012, focusing on the residents of Iligan City, aims to provide warning communication systems and flood drills for future disasters [21]. Aside from this, stakeholders from Iligan City have recently aimed at being a climate-disaster-resilient city, with projects and partnerships from private entities, academic communities, and the National Resilience Council (NRC) for the accomplishment of the "Adopt-a-City" plan, which aims to empower Iligan City through developing scientific-based solutions and policies. Through this, Iligan City eyes future meaningful partnerships, especially among the private sector [22,23].

Meanwhile, nature-based solutions to climate change continue to garner attention as a key solution in addressing climate change, especially in urban cities. Nature-based solutions (NBSs) are sustainable interventions or actions that are highly effective and efficient, inspired or heavily influenced by nature, providing various benefits and services that address environmental challenges such as biodiversity loss and particularly climate change [24]. Examples of these NBS are natural water reservoirs, constructed wetlands, urban greening, reforestation, green infrastructure, and other green landscapes or management that help mitigate climate change impacts and other threats posed by the growing mass emissions of greenhouse gases in the atmosphere [25,26]. Adapting NBS to climate change strategies has been viewed to have greater potential in terms of achieving sustainable development in most countries [27,28]. The assistant director of the Department of Environment and Natural Resources/Ecosystem Research and Development Bureau of the

Philippines has recently shared NBS for its best practices for ecosystem restoration and conservation, resiliency to disasters, and also towards climate change impact mitigation for communities in the Philippines. In addition to this, the need for accountability, adaptability, and the willingness of stakeholders was also addressed in consideration of integrating NBS as an approach to addressing various environmental issues in localities [29]. Despite this, the adoption of NBS has been sparse [30]. Various studies have looked into potential barriers that may hinder the adoption and implementation of NBS and have found political factors and institutional and knowledge barriers are the most dominant [30,31]

On the other hand, localized efforts to mitigate climate change have been viewed as a means of successfully resolving environmental challenges. Thus, collaboration among multiple levels of stakeholders, particularly those in the local government sectors, is deemed vital for successful implementations of policies, for instance, NBS. Aside from this, the need to increase awareness and initiatives between institutions and sectors is important, especially in ASEAN countries for the effective enactment of NBS policies [26,32,33]. Previous studies in the Philippines involving NBS have mainly focused on the varieties of types of NBS implemented, their effectiveness, and their challenges [34,35]. However, awareness and perception studies on NBS, particularly in the domain of governance and stakeholders in the Philippines, have been limited.

Thus, the goal of this study is to assess the awareness and perceptions of stakeholders in Iligan City on climate change and NBS and their willingness to engage in actions involving NBS. This study specifically aims (1) to assess the relationship between stakeholders' level of awareness and perception toward climate change and NBS and willingness to engage and (2) to determine differences among stakeholders' levels of awareness and perception of climate change and NBS and willingness to engage across their socio-demographic backgrounds.

2. Materials and Methods

2.1. Theoretical Framework

The conceptual framework of this study is based on the theory of reasoned action (TRA) by Fishbein and Ajzen (1977), which proposes that the behavioral intentions of an individual are predicted by their attitudes and subjective norms. According to Fishbein and Ajzen (1977), the way an individual perceives positively or negatively a certain concern or action would lead to them likely intending to engage in a certain behavior [36]. In this study, behavioral intent is the stakeholder's willingness to engage in NBS implementations, while attitudes or perceptions are the stakeholder's perceptions of climate change and NBS. Furthermore, this study is also guided by the social identity theory (SIT) by Tajfel (1979), where an individual's social belonging to certain groups with distinct shared characteristics influences their self-concept. In this study context, awareness and perceptions of climate change and NBS may likely align according to the norms and values shared among different groups of stakeholders such as sectors, educational backgrounds, and income groups.

2.2. Research Design and Study Area

This study followed a cross-sectional descriptive/quantitative design to assess stakeholder awareness and perception of climate change and NBS, as well as their willingness to engage with different sectors of stakeholders in Iligan City. Interviews with stakeholders were carried out to produce and collect information from a population over a specified period. In the northern region of Mindanao, Iligan City is categorized as a highly urbanized and lone-district city in the province of Lanao del Norte (Figure 1). It has an estimated population of 363,115 and a population density of 446 people per per square kilometer, with an average household size of 4.2. Iligan City a coastal city with a total land area of 813.37 km² and is approximately 6 m above sea level [18].

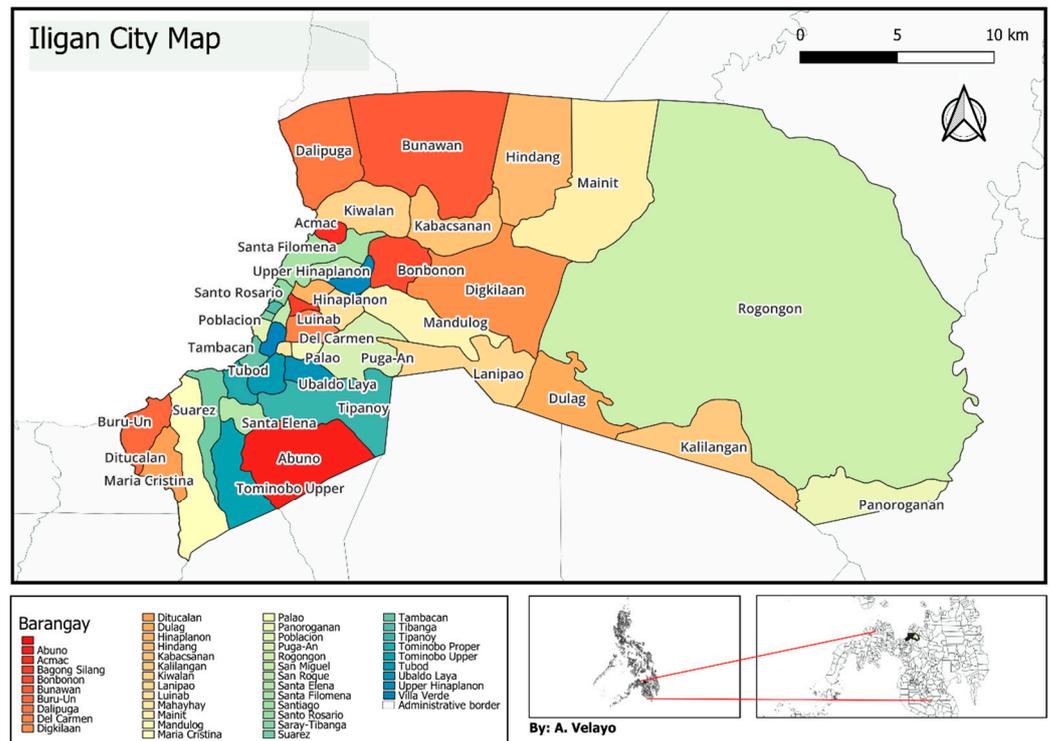


Figure 1. Map of Iligan City, Philippines, showing its 44 barangays. The barangay is the smallest political unit in the Philippines.

2.3. Research Instruments and Data Gathering

This study utilized an adapted survey questionnaire to measure the stakeholders' level of perception and awareness toward climate change and nature-based solutions, as well as their level of willingness to engage. To gather the respondent's sociodemographic background data, a demographic profile sheet, consisting of the participant's name (optional), address, age, sex, affiliation, income, job/employment, civil status, educational attainment, and years of residency was provided. As for the second part of the questionnaire, a questionnaire developed by [37,38] was adapted and localized to fit the study's context to measure the level of perception and awareness of the respondents in Iligan City, Philippines in Table S1 (please see Supplementary Materials). The adapted questionnaire consists of the following sub-domains: the awareness and perceptions of NBS and climate change and, lastly, the level of willingness to engage. The first domain of the questionnaire is a five-point Likert scale that aims to measure the level of awareness of the respondents to climate change and NBS. The awareness questionnaire consists of 12 items with two sub-domains, with statements such as "I am well aware of global warming or climate change and its impacts", "There are nature-based solution initiatives present in this city" and, "Climate change will be more severe in the future". In this study, the awareness questionnaire has an acceptable Cronbach alpha value of 0.8712.

The second domain is the perception questionnaire, which uses a five-point Likert scale that aims to measure the level of perception of the respondents toward climate change and nature-based solutions. It consists of 10 statements such as "Climate change is real and is a significant threat to this city", "I support increased funding for environmental planning such as green spaces, constructed wetlands, and eco parks", "Climate change impacts (e.g., urban heat, sea level rise, intensified flooding, etc.) are noticeable in this city", with responses ranging from "strongly disagree" to "strongly agree". For this study, the perception scale has an acceptable Cronbach alpha value of 0.8326.

Lastly, the third domain is the five-point Likert willingness scale that aims to measure the respondent's level of willingness to engage in actions or activities related to nature-based solutions. It consists of items with statements such as "I will be willing to participate

in the drafting of NBS projects and the implementation of these interventions” and “I will be willing to participate in activities related to these interventions and the funding of them”, with responses ranging from “very unwilling” to “very willing”. For this study, the willingness questionnaire has an acceptable Cronbach alpha value of 0.7528. The research questionnaires used in this study were reviewed and assessed for validity by the panel of experts of the Department of Biological Science at Mindanao State University/Iligan Institute of Technology. Before the data collection proper, pilot testing was conducted to ensure the validity of the research questionnaires used in the study. Furthermore, the questionnaires went through several revisions before submission to the ethical board of conduct. After obtaining the ethical approval, the proper data gathering process then followed. Furthermore, the reliability of each subdomain in the questionnaire was tested and scored for its Cronbach alpha value with Jamovi ver. 2.3.28 statistical software.

Using a non-probability sampling method through Key-informant Interviews (KIIs), this study has gathered a total sample of 187 responses from stakeholders in Iligan City, Philippines. Before the actual gathering of data, the researcher identified and selected potential participants of the study through the stakeholder mapping approach used in a study by [39]. First, an initial stakeholder identification took place which involved reviewing the existing database for a preliminary list of organizations, groups, institutions, and other agencies within Iligan City. After this, the second process was a consultation wherein all relevant stakeholder sectors from different private and government units were identified in the city and contacted for consultation with authorities and other relevant organizations to identify more potential participants for the study. Once identified, a third process involving which is a criterion for selection was established. They were narrowed down only to those agencies or organizations that are involved in the environmental planning, development, implementation, and decision-making processes in Iligan City. The criteria were limited to expertise, influence, and organizational mandate. The selected sectors of stakeholders that were identified were approached and given intent letters to survey their offices. Before the survey started, an informed consent sheet including the title and main purpose of the study was handed out to the respondents. All the collected responses that were gathered and sorted were treated with utmost confidentiality as mandated by the Philippine Data Privacy Act of 2012.

The inclusion criteria for determining the participants for this study are as follows: (1) bonafide residents of the city; (2) 18 years of age and above; (3) employees and experts from the local and national government or non-governmental organizations, academia, and the private sector involved in city environmental planning, development, implementation, and resilience; and (4) all genders. The gathering of the respondents for this study was conducted on-site at the target location of the study.

Furthermore, while this study has gathered data across various sector groups, this study may not fully represent each sector group equally, which may cause bias. Also, the study is cross-sectional in that data were gathered in a specific time period. Future studies may focus on establishing a longitudinal study approach to capture the causal direction of the study’s focus.

2.4. Data Analysis

The collected data were tabulated and analyzed using Jamovi ver. 2.3.28, which is open-source statistical software. The reliability of the questionnaires was calculated by determining their internal consistency through the Cronbach alpha. Furthermore, the frequency and distribution of the sociodemographic profile of the respondents, such as gender, educational attainment, sector, income, years of residence, and civil status, together with the level of awareness, perception, and willingness, were analyzed and calculated using descriptive statistics (frequency, mean, median, and percentage) through Microsoft Excel 2022.

The process also includes running a Pearson correlation to analyze the strength of the relationship between awareness of climate change, awareness of NBS, perceptions of climate change, perceptions of NBS, and willingness to engage. Subsequently, the relationships

between the respondents' level of perceptions, awareness, and willingness to engage in actions related to climate change and NBS and also their sociodemographic background were calculated using one-way ANOVA/Kruskal–Wallis analysis and Dwass–Steel–Critchlow–Fligner pairwise comparisons to analyze differences among variables further.

3. Results

3.1. Respondent Profile, Level of Awareness, Perception, and Willingness

This study has utilized a sample of 187 participants across the different sectors of stakeholders in Iligan City that were involved in city environmental planning, development, implementation, and resilience (Table 1). Most of the gathered respondents were women (62.6%), while the rest were men (37.4%). In addition, the majority of the respondents were married (48.7%), followed by those who were single (44.4%), and the least were those who were widowed (4.8%). Moreover, the majority of the educational backgrounds of the stakeholders were college graduates (81.8%), followed by master's graduates (8%), while only a few of them were college undergraduates (1.6%). Furthermore, approximately 42.8% of the participants have an estimated monthly income of PHP 10,000–PHP 20,000, followed by those whose income is below PHP 10,000 (20.9%), while only 2.1% of the sample population's income was PHP 40,000–PHP 50,000.

Table 1. Frequency distribution of respondents' sociodemographic backgrounds.

Demographic Variables		Count	% of Total	Cumulative %
Gender	Male	70	37.4%	37%
	Female	117	62.6%	100%
Civil status	Single	83	44.4%	44.4%
	Married	91	48.7%	93.0%
	Separated	4	2.1%	95.2%
	Widowed	9	4.8%	100.0%
Educational background	Master's graduate	15	8.0%	8.0%
	College graduate	153	81.8%	89.8%
	Ph.D. graduate	4	2.1%	92.0%
	College undergraduate	3	1.6%	93.6%
	Vocational graduate	6	3.2%	96.8%
Income	High school graduate	6	3.2%	100.0%
	PHP 20,000–PHP 30,000	36	19.3%	19.3%
	PHP 10,000–PHP 20,000	80	42.8%	62.0%
	PHP 30,000–PHP 40,000	18	9.6%	71.1%
	Below PHP 10,000	39	20.9%	92.5%
	PHP 50,000 and above	10	5.3%	97.9%
Sector	PHP 40,000–PHP 50,000	4	2.1%	100.0%
	Academia	63	33.7%	33.7%
	Private sector	23	12.3%	46.0%
	LGU	76	40.6%	86.6%
	NGOs	25	13.4%	100.0%
Years of residency	More than 10 years	148	79.1%	79.1%
	1–2 years	16	8.6%	87.7%
	5–10 years	14	7.5%	95.2%
	3–4 years	9	4.8%	100.0%

A total of four different sectors of stakeholders were sampled in this study, with 40% of the respondents coming from the local government unit (LGU), which makes up most of the population, followed by 33.7% from the academic sector and then by 13.4% from non-governmental organizations (NGOs). Meanwhile, only 12.3% of the sample population are from the private sector.

Shown below in Table 2 are the data for the respondents’ level of awareness on topics covering climate change and nature-based solutions (NBS). The top four topics in which the respondents have high levels of awareness are areas related to climate change, with median scores of 4.32 and above. Meanwhile, the areas of topics covering NBS and related policies have only moderate awareness among respondents.

Table 2. Awareness of climate change and NBS among respondents. Range of scoring: Not Aware (1.00–1.80), Slightly Aware (1.81–2.60), Moderately Aware (2.61–3.40), Aware (3.41–4.20), Fully Aware (4.21–5).

Topic	Median Score	Level of Awareness
General awareness of climate change	4.35	Fully Aware
Impact on health and well-being	4.48	Fully Aware
Climate change causes	4.43	Fully Aware
Climate change risks	4.32	Fully Aware
Nature-based solutions and their benefits	3.21	Moderately Aware
Policies on climate change and nature-based solutions	3.59	Moderately Aware

On the other hand, the respondents’ levels of perceptions in Table 3 shows that the respondents have high levels of perceptions, and they perceive climate change as a significant threat and that there is a need to address it. Furthermore, they also strongly agree on topics surrounding NBS and its effectiveness in combating climate change, especially in Iligan City.

Table 3. Perception on climate change and NBS.

Topic	Median Score	Level of Awareness
Climate change is real and is a significant threat to this city.	4.46	Strongly Agree
There is a need to address climate change in this city.	4.43	Strongly Agree
Nature-based solutions help in mitigating climate change risks and impacts.	4.12	Agree
Nature-based solutions effectively combat climate change in this city.	4.14	Agree

Similarly, the respondents also have high levels of willingness to engage in positive actions related to NBS and climate change (Figure 2).

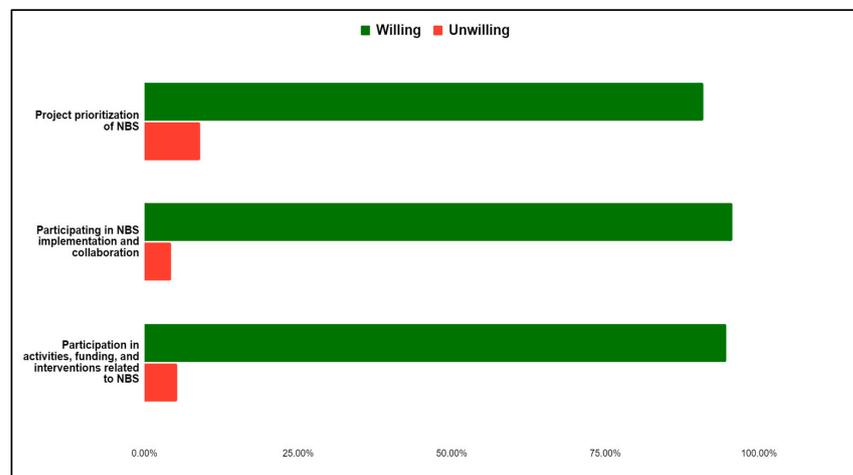


Figure 2. Level of willingness among stakeholders. N = 187.

3.2. Intercorrelations between Awareness of Climate Change, Awareness of Nature-Based Solutions, Perceptions of Climate Change, Perceptions of Nature-Based Solutions, and Willingness to Engage

The respondents' awareness of climate change in Figure 3 below has a strong positive correlation with awareness of NBS ($r = 0.565$), perceptions of nature-based solutions ($r = 0.671$), and willingness to engage ($r = 0.267$) (Figure 3). Also, there is a positive correlation of awareness of nature-based solutions toward perceptions of NBS ($r = 0.569$) and willingness to engage ($r = 0.153$). In the same way, willingness to engage also demonstrates positive correlations between awareness of climate change ($r = 0.267$) and NBS ($r = 0.153$) and perceptions of climate change ($r = 0.236$) and NBS ($r = 0.165$).

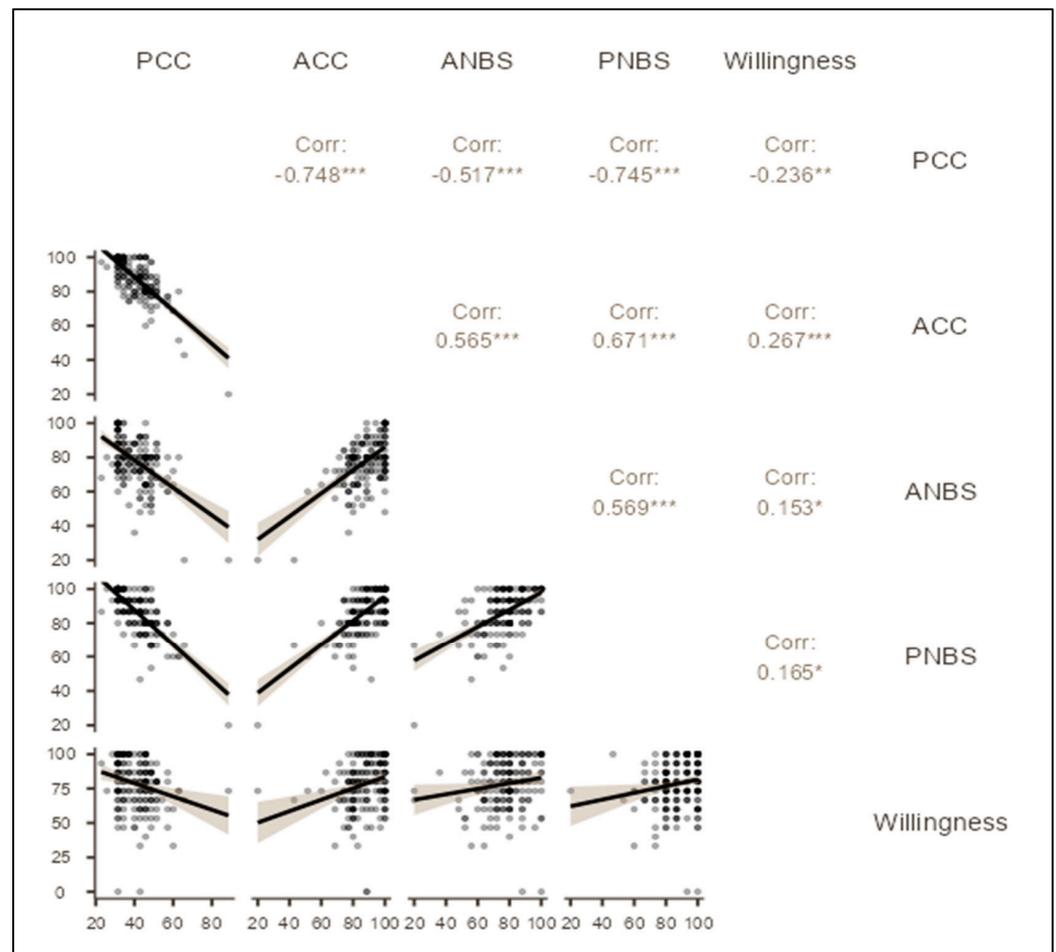


Figure 3. Pearson correlation matrix between the perceptions of climate change (PCC), awareness of climate change (ACC), perceptions of NBS (PNBS), awareness of NBS (ANBS), and willingness among stakeholders. ** Correlation is significant at the 0.05 level (2-tailed). * Correlation is significant at the 0.01 level (1-tailed). *** Correlation is significant at the 0.001 level. $N = 187$.

Meanwhile, perceptions of climate change show a strong negative intercorrelation between awareness of climate change ($r = -0.748$) and NBS ($r = -0.517$), perceptions of NBS ($r = -0.745$), and willingness to engage ($r = -0.236$).

3.3. Differences between Awareness and Perception of Climate Change and Nature-Based Solutions and Willingness to Engage among Stakeholders

The perceptions of climate change have a significant difference among the different groups of sectors, with a p -value of 0.003 (Table 4). Pairwise comparisons show the differences in stakeholders' perceptions of climate change among the different sectors and exhibit that the perceptions of climate change in the academic sector are significantly different from the private sector, LGUs, and NGOs in Table S2 (please see Supplementary Files).

Table 4. One-way ANOVA/Kruskal–Wallis analysis of the relationship between awareness of climate change, awareness of nature-based solutions, perceptions of climate change, perceptions of nature-based solutions, and willingness to engage with sectors as grouping variables. The *p*-value is significant at <0.05. N = 187.

Variable	χ^2	df	<i>p</i> -Value
Awareness of climate change	7.44	3	0.059
Awareness of nature-based solutions	1.39	3	0.708
Perceptions of climate change	14.85	3	0.003
Perceptions of nature-based solutions	14.26	3	0.004
Willingness to engage	1.32	3	0.725

Similarly, perceptions of nature-based solutions have been found to have significant differences at a *p*-value of 0.004 (Table 4). Further analysis through pairwise comparisons also conveyed that the academic sector has significantly greater perceptions of nature-based solutions compared to the private sector and LGUs, as seen in Supplementary Materials Table S2.

The Table 5 results below show that awareness of climate change, perceptions of climate change, perceptions of nature-based solutions, and willingness to engage have significant differences. The pairwise comparison seen in Supplementary Materials Table S3 shows that there is a significant difference between the master's graduate and high school graduate levels, wherein the perceptions of climate change and awareness of climate change are higher in the master's graduate level compared to the high school graduate level.

Table 5. One-way ANOVA/Kruskal–Wallis analysis of the relationship between awareness of climate change, awareness of nature-based solutions, perceptions of climate change, perceptions of nature-based solutions, and willingness to engage with educational background as a grouping variable. The *p*-value is significant at <0.05. N = 187.

Variable	χ^2	df	<i>p</i> -Value
Awareness of climate change	18.71	5	0.002
Awareness of nature-based solutions	3.90	5	0.564
Perceptions of climate change	17.33	5	0.004
Perceptions of nature-based solutions	16.18	5	0.006
Willingness to engage	15.71	5	0.008

Similarly, the pairwise comparisons in Supplementary Materials Table S3 between master's graduates and vocational graduates reveal that there is a significant difference in their level of perceptions of NBS and awareness of climate change. In the same way, pairwise comparisons between master's graduates and college graduates exhibit a significant difference in levels of willingness to engage, wherein master's graduates show a higher level of willingness to engage than college graduates.

Furthermore, the ANOVA results reveal that perceptions of climate change have a significant difference among various income levels of stakeholders (Table 6). Similar to this, perceptions of NBS also have a significant difference among income levels.

The pairwise comparisons in Table 7 below display significant differences in perceptions of climate change and perceptions of NBS between the income groups of PHP 20,000–PHP 30,000 and below PHP 10,000, showing that the income group of PHP 20,000–PHP 30,000 has higher levels of perceptions of climate change and perceptions of NBS in comparison to the income group of below PHP 10,000.

The overall results conveyed that there are significant differences found only in perceptions of climate change and NBS among the different sectors of stakeholders and that there are also significant differences in their perceptions of climate change and NBS in the distinct income groups among stakeholders. Moreover, among the different levels of educational attainment among stakeholders, significant differences are also found in their

awareness of climate change, perceptions of climate change and NBS, and willingness to engage. However, awareness of NBS among the different educational backgrounds of stakeholders found no significant differences.

Table 6. One-way ANOVA/Kruskal–Wallis analysis of the relationship between awareness of climate change, awareness of nature-based solutions, perceptions of climate change, perceptions of nature-based solutions, and willingness to engage with income as a grouping variable. The *p*-value is significant at <0.05. N = 187.

Variable	χ^2	df	<i>p</i> -Value
Awareness of climate change	11.48	5	0.043
Awareness of nature-based solutions	5.52	5	0.356
Perceptions of climate change	20.96	5	0.001
Perceptions of nature-based solutions	16.31	5	0.006
Willingness to engage	6.65	5	0.248

Table 7. Dwass–Steel–Critchlow–Fligner pairwise comparisons across income among stakeholders.

Pairwise Comparisons			
Variable	Income	W	<i>p</i> -Value
Perceptions of climate change	PHP 20,000–30,000/below PHP 10,000	5.024	0.005
Perceptions of nature-based solutions	PHP 20,000–30,000/below PHP 10,000	−4.426	0.022

4. Discussion

This study has found that respondents have an overall high level of awareness in terms of climate change impacts. Stakeholders are fully aware of the significance of the threat that climate change poses. According to them, carbon emissions from vehicles followed by cutting trees are one of the big factors that likely contribute to climate change in the city of Iligan. Carbon emissions (CO₂) have been a major problem in countries belonging to South East Asia, which includes the Philippines. CO₂ emissions from agriculture, manufacturing, and especially transportation have been a determining factor in such CO₂ emissions [40,41]. Likewise, in the city of Iligan, Philippines, various industries and plants are present, such as in cement and food manufacturing, on top of the daily vehicular emissions in the city, and Iligan is regarded as the industrial city of the south [14–16]. Furthermore, respondents also have high levels of awareness in terms of climate change impacts, risks, and causes. Most of them have reported that regardless of age, group, and gender, everyone is at risk of climate change impacts. Meanwhile, despite respondents being fully aware of climate change, their level of awareness regarding NBS and its benefits is only moderate. This implies that while stakeholders are aware of the urgency of climate change, they might not have fully grasped the potentialities of NBS, especially regarding its specific solutions to climate change. In addition to this, the majority of the respondents have reported that they have learned or heard about NBS on social media platforms such as Facebook (FB), Twitter, and TikTok, followed by TV programs and documentaries, as seen in Supplementary Materials Figure S1. This implies that there is a need for further literacy awareness programs regarding NBS for stakeholders in Iligan City.

On the other hand, respondents have high levels of perceptions surrounding climate change and NBS. They perceived climate change as a significant threat to the city and its urgency and highly perceived NBS's role in combating its impacts in Iligan City. Similarly, stakeholders in Iligan City also exhibit high levels of willingness in terms of positive actions such as engagement in NBS implementation, prioritization, and collaboration. These findings indicate that they are receptive to solutions for addressing climate change and understand the significance of the threat of climate change in Iligan City. However,

information surrounding specific applications of NBS and how it can be translated into action is still needed.

The findings of this study indicate a significant positive intercorrelation between awareness of climate change and nature-based solutions (NBS), perceptions of NBS, and willingness to engage. This suggests that increased levels of awareness toward climate change are associated with higher levels of awareness of NBS, greater positive perceptions about NBS, and increased willingness to engage in activities and actions related to climate change and NBS. On the other hand, negative intercorrelations have been found between perceptions of climate change, awareness of climate change and NBS, perceptions of NBS, and willingness to engage. This finding is consistent with the study conducted by [42] in Italy, where they found that individuals who have a higher awareness of climate change are linked with greater positive perceptions towards NBS projects such as green infrastructure and willingness to contribute to its maintenance.

In this study's context, higher awareness among stakeholders on climate change matters and the benefits of NBS is linked with perceiving NBS more positively, which is associated with a greater willingness to engage in support of NBS implementation in the city of Iligan. Following the theory of reasoned action, the awareness of stakeholders on climate change and NBS might shape their evaluation regarding the latter concerns, which could translate to a stronger likelihood of engaging in actions related to NBS implementation for climate action in Iligan City [43,44]. Although this study has found that awareness, perceptions, and willingness to engage with climate change and NBS are significantly associated with one another, it does not establish direction or causation among this study's variables. Furthermore, previous studies have also explored the linkages between the growing climate change awareness and engagement in environmental actions. They have found that increasing awareness among communities and policymakers is one of the key factors in the effective enactment of policies, actions, and implementations for environmental action, especially with NBS [45–47].

Results revealed that both perceptions towards climate change and NBS have been found to have significant differences among the groups of stakeholder sectors. This indicates that stakeholders' perceptions regarding climate change are significantly different among the various sectors such as academia, local government units (LGUs), non-governmental organizations (NGOs), and the private sector. Further analysis and comparison reveal significant differences in perceptions of climate change and NBS among the different sectors and exhibit that the perceptions of climate change in the academic sector are significantly different from the private sector, LGU, and NGO stakeholders. This implies that the academic sector has more positive perceptions regarding NBS and more negative perceptions towards climate change than those stakeholders from the private sector, LGUs, and NGOs. These findings align with the studies by [48,49] who have determined that climate change and nature-based solutions (NBS) are perceived differently by different stakeholders such as academia, governmental personnel, non-governmental organizations, institutions, and other key responsible entities related to policy and decision-making. From this study's viewpoint, distinct group identities such as the different sectors of stakeholders likely shape an individual's perceptions and understanding of climate change and NBS according to shared characteristics, similarities, and values within their affiliation, thus leading to different levels of perception toward climate change and NBS [50]. Most of the respondents from the academic sector in this study are those who are involved in or related to environmental programs, projects, and teaching within the university or schools, such as the personnel from the Mindanao Center for Resiliency, the Department of Sustainable Studies, and other related departments. The collective experiences and views attributed to their respective occupation may have linkages concerning their more positive perceptions toward NBS and negative views of climate change compared to other stakeholder sectors.

In addition to this, the present study also found that only the awareness of NBS has no significant differences among the different educational backgrounds of the stakeholders, indicating that regardless of educational background, stakeholders are equally aware of

NBS. This suggests that initiatives or campaigns regarding NBS may have reached various stakeholders in Iligan City from distinct educational backgrounds. Recent actions by the government of the Philippines regarding climate change have been mobilizing a national adaptation plan that includes integrating NBS as a key element of the action plan [51,52]. These actions by the government, together with other bureaus and national government units, may have been a contributing factor in the present awareness among stakeholders regarding NBS in Iligan City.

Moreover, further analysis has found significant differences in perceptions of climate change and NBS among the distinct income groups among stakeholders. This indicates that climate change and NBS are perceived differently by the different social classes. Pairwise comparisons revealed that stakeholders from the lower/middle-income class (PHP 20,000–PHP 30,000) perceive NBS positively and climate change negatively more than the stakeholders coming from the poor-income class (below PHP 10,000). Consistent with the social identity theory, socio-economic factors such as social class by income may influence their perceptions of climate change and NBS, likely due to values, characteristics, and norms shared within the social group, resulting in distinct perceptions among stakeholders. Thus, stakeholders from lower-income groups in Iligan City may often prioritize their well-being as they focus on meeting their daily needs for necessary survival, leading to short-term outlooks on environmental issues [53]. In-work poverty has been a problem in the Philippines due to a lack of productive job opportunities as most jobs common among the poor are casual or job-order positions with no access to basic benefits. This may have been a contributing factor to the present perceptions of those stakeholders belonging to the lower-income groups in this study's context [54]. Previous studies have also determined that economic inequalities play a role in shaping individual attitudes, responses, and individual perceptions [50,55].

5. Conclusions

This study examined the associations between stakeholders' awareness and perceptions of climate change and NBS and their willingness to engage in actions related to NBS implementations. Stakeholders who have higher awareness of NBS and climate change tend to perceive NBS more positively and were linked with having higher levels of willingness to engage in actions related to the latter and vice versa. Initiatives and campaigns for climate action and sustainable solutions are needed even more, especially in Iligan City, Philippines, more specifically with conducting NBS awareness literacy programs and capacity building in specific NBS solutions among sectors to raise awareness and foster willingness among key stakeholders from different sectors to engage in a collaborative effort to combat the impact of climate change, particularly in urban areas. It is recommended that the lead governmental agency responsible for environmental sustainability and disaster risk reduction should lead in disseminating information and integrate human awareness and perception into strategies and policy formulation and also in leading multi-stakeholder dialogues through forums for climate action plans that integrate sustainable solutions such as NBS.

Furthermore, significant differences in awareness and perceptions of NBS and climate change, as well as the willingness to engage, have been found in distinct sociodemographic groups among stakeholders, especially among sectors and income groups. It is highly recommended that entities responsible for awareness campaigns with climate change and sustainable solutions should conduct targeted outreach programs (e.g., informational workshops and infographics) and enrichment activities regarding climate mitigation, integrating sustainable solutions such as NB for sectors with lower awareness or engagement willingness. Aside from this, the study has also found that perceptions of climate change and NBS of those belonging to the poor-income group of stakeholders are significantly different from those of other higher-income groups. However, this study has only focused on stakeholder awareness and perception, and the investigation of potential barriers to NBS was not accounted for in this study. Future directions in research may explore the

barriers and the management aspect of stakeholders with regard to climate resilience and NBS in Iligan City. It is also highly recommended to address possible in-work poverty among sectors as it could be a determining factor for barriers in perceptions of climate change and NBS, ultimately affecting future engagement.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/urbansci8020053/s1>, Figure S1: Summary of respondents' source of information regarding the topic surrounding NBS; Table S1: Adapted questionnaires from Salem et al. (2022) and Ferreira et al. (2021), consent form, and demographic profile sheet; Table S2: Dwass-Steel-Critchlow-Fligner pairwise comparisons among sectors. Results of pairwise comparisons among sectors are statistically significant at <0.05 ; N: 187; Table S3: Dwass-Steel-Critchlow-Fligner pairwise comparisons across the educational background of respondents.

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