Practices, Behaviors, and Action on Climate Change and Environmental Protection and Conservation of Settlers along the Banks of Oro River, Northern Mindanao, Philippines

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ABSTRACT

Rivers are considered to be one of the ecosystems which are sensitive to climate change. It also experiences warming of the earth's atmosphere like any other ecosystems. This study aims to (1). determine the Cagayan de Oro residents' socio-economic activities on the Cagayan de Oro river; (2). determine the values, attitude and beliefs on climate change and environmental protection and conservation; (3). describe the practices, behaviors and action on climate change and environmental protection/conservation. The study used the descriptive survey design involving a purposive sample for 300 household heads living at least 5 years and staying within 100 meters from the river banks and located in the downstream, midstream, upstream sections of the Cagayan de Oro river. The

settlers along the river banks have taken permanent residence in the area. They have limited access to social services like light and safe drinking water, disposal of household and human wastes. Due to their proximity to the river and their lack of access to social services they have contributed to the rivers' contamination through their unhygienic behaviors. A formal River Conservation Education Program should be designed in response to the need for a formal structure to train community residents and further enhance their awareness, and a policy review is needed to evaluate the implementation of national and local policies on river conservation.

INTRODUCTION

Rivers have been very useful to men in all parts of the earth since very early times. They provide water to quench the thirst of men, to fertilize their lands and to provide a means of communication for the goods that transport from place to place.

The state of Philippine rivers is generally not good. Rola and Tabien (2001) cited in the study of local governments involvement in saving rivers that the Philippines has enough water policies only that Local implementation is lacking. It is because local government units do not have the needed ordinances for effective river management. They concluded the inability of local government to implement laws pertaining to national resource management focusing river resources.

The Philippines is one of the places where the freshwater ecosystem is in danger of dying. In Mindanao alone, five (5) river systems have been declared at present as biologically threatened by the Environmental Management Bureau of the Department of Environment and Natural Resources (DENR). One of these is the Cagayan de Oro River, which straddles several geo-political boundaries within the city area, including 17 river barangays.

The river's headwater is found in the Kalatungan Mountain Range, in the central portion of the Province of Bukidnon. It flows northward towards the City of Cagayan de Oro for about 90 kilometers before emptying into the Macajalar Bay. The river drains an area of approximately 1,521 square kilometers. About

80% of the drainage basin is located in the Province of Bukidnon and the rest is in Iligan City and Cagayan de Oro City. The main tributaries of the Cagayan de Oro River are the following: Kalawaig River, Tagite River, Bubunaoan River, Tumalaong River. The river's mouth is located in Cagayan de Oro City. After a 90-kilometer course from the mountains of Bukidnon, the river finally discharges its load to the Macajalar Bay (Alejandrino 1976).

For decades, thousands of families, mostly squatters, have encroached along its bank and a lot of commercial complexes have blossomed within its bank, making the Cagayan de Oro River polluted with domestic sewage, industrial effluents and solid wastes. These resulted in a markedly increased congestion of the river and its arteries. Among the consequences were the loss of clean water supply, the demise of the aquatic system and the overflowing of the river during heavy downpours, which eventually resulted in uncontrolled flooding in the immediate environs.

The Cagayan de Oro River is one such river experiencing various stresses from metal pollution, illegal mining, siltation, bacterial contamination, destructive fishing activities, among others.

Based on the available literature, the Cagayan de Oro River is currently threatened by the presence of *E.coli* (Alvarez et al. 2008; Lubos and Japos 2010), *Salmonella* (Neri 2008), and parasites (Badar 2007). Also, it is chemically polluted due to the effluents coming from commercial establishments, industries, small scale mining, quarrying, animal waste from piggery, poultry, and human settlement (Lubos and Orbe 2004; Lubos and Japos 2010).

The Liceo de Cagayan University has focused its research capabilities for studies that directly impact the well-being of the people. It is the social responsibility of the university to utilize research-based knowledge in informing the public of matters concerning their environment and in formulating schemes as interventions.

For these reasons there is a need to investigate the perceptions, behaviors and activities of people living along the river banks because these affect the current status of health of the river and its sustainability in the future.

FRAMEWORK

A number of preliminary cross-sectional studies on the Cagayan de Oro River have already been conducted. These LDCU-funded studies were on river's water

quality and biodiversity as well as on the socio-economic and health status of the people living along the riverbanks.

Petalcorin et al. assessed in 2004 the geo-physical, hydro-ecological and physico-chemical properties of the Cagayan de Oro River. Their study revealed that the Cagayan River ecology was composed of the plant life and the animal life of the plankton community and fisheries to include carp, freshwater shrimp, eel, mudfish, rock creep, and tilapia. Of particular local importance is the goby. This goby species, locally called "anga", "muli" or "hipon", is described as diadromous or migratory from fresh to salt water.

The studies earlier cited identified the following factors associated with the river's fecal and salmonella contamination: 1) disposal of pet/livestock manure in the river (particularly in the upstream portion of the river) 2) number of toilets draining to the river and 3) disposal of human wastes directly into the river.

The study of Lubos (2008) further revealed that almost all of the sampling sites were fecally contaminated as shown by the MPN indices that exceeded the standard allowable fecal coliform values set by the Department of Science and Technology (DOST), which is 1000 fecal coliform MPN/100 mL .

Studies conducted on the Oro river were on fecal contamination, *E. coli* and *Salmonella* detection. The first study was conducted by Alvarez et al. in 2008. The high fecal coliform concentrations obtained, particularly the confirmation of the presence of *E. coli* in the samples taken from the different sites along the Cagayan de Oro River, indicated the presence of warm-blooded animal wastes, especially that of human origin. High concentrations of fecal indicator bacteria like *E. coli* indicated an increased likelihood of pathogens being present. Studies showed that diseases such as typhoid fever, hepatitis, gastroenteritis, dysentery, and ear infections could be contracted in waters with high fecal coliform counts.

According to Alvarez et al. (2008), the Cagayan de Oro River, particularly along the five urban barangays (Macasandig, Puntod, Macabalan, Carmen and Consolacion), had high total fecal coliform values. A gram of human feces has 10 million viruses, one million bacteria, one thousand parasite cysts and 100 parasite eggs, indicating that humans and animals are not safe in this river, which can cause water-borne diseases (DENR 2004).

The study of Lubos (2008) further revealed that almost all of the sampling sites were fecally contaminated as shown by the MPN indices that exceeded the standard allowable fecal coliform values set by the Department of Science and Technology (DOST), which is 1000 fecal coliform MPN/100 mL .

The studies cited identified the following factors associated with the river's fecal and salmonella contamination: 1) disposal of pet/livestock manure in the river (particularly in the upstream portion of the river) 2) number of toilets draining to the river and 3) disposal of human wastes directly into the river.

The impact of climate change on fresh water resources is crucial. The availability of fresh water will be substantially changed in a world affected by global warming (Houghton 1997). The runoff in rivers and streams is what is left from the precipitation that falls on the land after some has been taken by evaporation and by transpiration from plants; it is the major part of what is available for human use.

There are many ways in which the current environment is being degraded due to human activities; global warming will tend to exacerbate these degradations.

For climate change three concepts help in understanding the phenomenon (Houghton 1997).

Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. These encompass all the elements of climate change, including mean climate characteristics, climate

variability, and the frequency and magnitude of extremes. This may be direct (e.g. a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damage caused by an increase in the frequency of coastal flooding due to sea level rise).

Adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities or to cope with the consequences.

Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and also the extent to which a system is exposed, its sensitivity and its adaptive capacity. Both the magnitude and the rate of climate change are important in determining the sensitivity, adaptability and vulnerability of a system.

The river and its tributaries are vital for providing water to people, crops and aquatic life. Water quality determines the suitability of water for these uses. The relative effects of natural and human caused factors are expected to continue because of changing land use that go with urbanization and economic development.

OBJECTIVES OF THE STUDY

The study aimed to determine the Cagayan de Oro residents' socio-economic activities on the Cagayan de Oro river. Specifically it aimed to: (1). determine the knowledge and awareness of climate change and environmental protection/conservation; (2). determine the values, attitude and beliefs on climate change and environmental protection and conservation; (3). describe the practices, behaviors and action on climate change and environmental protection/conservation.

METHODOLOGY

The study used the descriptive survey design involving a purposive sample for 300 household heads living at least 5 years and staying within 100 meters from the river banks and located in the downstream, midstream, upstream sections of the Cagayan de Oro river. They were contacted from November 18 to 30 2011 by a team of interviewers (Table 1). Data gathering was done from November 18 to 30 2011 involving 300 households.
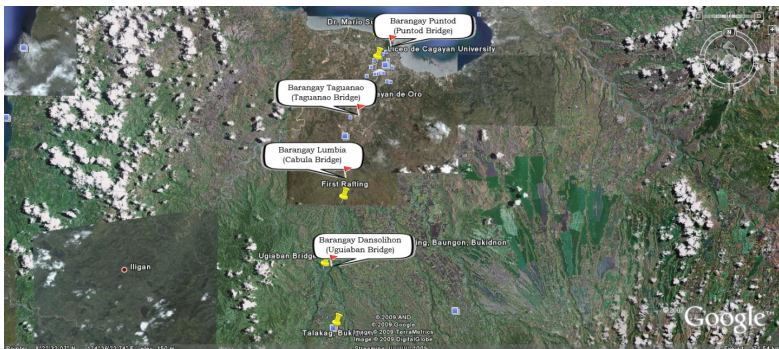

Figure 1. Map showing the four sampling stations in Cagayan de Oro River

Cagayan River, often called as Cagayan de Oro River, is one of the rivers draining the northern central part of Mindanao. The river has its headwaters in the Kalatungan Mountain Range found in the central part of the province of Bukidnon. It traverses the municipalities of Talakag, Baungon and Libona, picking up tributaries along the way. It finally empties into the Macajalar Bay at Cagayan de Oro City in the province of Misamis Oriental.

The river serves as the natural boundary between the province of Bukidnon and Lanao del Norte and between Bukidnon and Cagayan de Oro City, based on the administrative order issued by the defunct Department of Mindanao and Sulu during the American occupation of the Philippines. In Cagayan de Oro, it is the dividing line between its two congressional districts.

Table 1. Distribution of respondents by community interviewed
and sampling statum

A		
Community	**Frequency**	**Percentage**
Dansolihon	75	25.00
Lumbia	75	25.00
Taguanao	75	25.00
Puntod	75	25.00
Total	**300**	**100.00**
B		
Sampling Stratum	**Frequency**	**Percentage**
Upstream	**150**	**50.00**
Midstream	**75**	**25.00**
Downstream	**75**	**25.00**
Total	**300**	**100.00**

Four communities (Dansolihon - Plate 1, Lumbia - Plate 2, Taguanao - Plate 3 and Puntod - Plate 4) representing the downstream, midstream, upstream sections of the Cagayan de Oro river consisted the research sites.

Half the respondents came from the upstream section while the other half were from the midstream and downstream sections (Table 1). The study observed research ethics. An informed consent form was signed by the respondents in the

first page of the interview schedule. The instrument contained eight blocks (Table 2) and was tried out to a group of 30 residents by professional data enumerators.

Table 2. Sections of the Instrument

BLOCK	INDICATORS	ITEMS
BLOCK A	Sociodemographic Characteristics	A1 – A4
BLOCK B	General Household Characteristics	B1 – B17
BLOCK C	Treatment/Usage of River	C1 – C4
BLOCK D	Knowledge, Attitude and Practices	D1 – D36
BLOCK E	Knowledge and Awareness of Climate change and Environmental Protection/ conservation	E1 – E12
BLOCK F	Values/ Attitudes/ Beliefs on Climate Change and Environmental Protection/Conservstion	F1 – F12
BLOCK G	Practices/Behaviors/Actions on Climate change and Environmental Protection/Conservation	G1 – G13
BLOCK H	Health and Illnesses of Respondents	

The instrument went through the processes of item construction and content validation by the social science research experts in Cagayan de Oro City.

The statistical techniques included frequency count and percentage and mean.

RESULTS AND DISCUSSION

I. Knowledge awareness of Climate Change and Environmental protection/ conservation

Table 3. Awareness of climate change/global warming

	Frequency	Percentage
Very hot, rains easily, low pressure	102	34.0
No information about climate change	75	25.0
Different kind of heat	60	20.0
Easily gets sick	10	3.33

Frequent storm and flood	6	2.00
Styrofoam, cellophane burning	5	1.67
Others	22	7.33
don't know	20	6.67
Total	300	100.00

The respondents indicated awareness of climate change /global warming (Table 3). They observed that the environment is very hot (36%), rains easily (25%), and has low pressure in some areas (20%). People easily get sick (3.33%), and there is occurrence of frequent storm and flood (2.00%).

Table 4. Means of acquiring knowledge on climate change

	Frequency	Percentage
Based on observation	46	15.33
By experience	43	14.33
I felt it	35	11.67
I saw it	32	10.67
News from TV/my children told me	19	6.33
News over the radio	5	1.67
No trees	4	1.33
don't know	3	1.00
Others	10	3.33
No response	103	34.33
Total	300	100.00

Respondents derive their knowledge on climate change (Table 4) through direct observation (15.33%), experience (14.33%), feelings (11.67%), seeing (10.67%) and news from tv (6.33%).

Table 5. Awareness of changes in the recent years in the environment, the weather, the river, soil, water, and forest

	Frequency	Percentage
No	48	16.00
Yes	252	84.00
Total	300	100.00

Table 6 . Type of changes noticed in the recent years

	Frequency	Percentage
Bald Mountains	88	29.33
Scorching heat that causes skin rashes	54	18.00
Landslide	28	9.33
Big and strong flood	23	7.67
Flash floods	12	4.00
If it rains, flood is fast	9	3.00
Water is murky and polluted	5	1.67
Unpredictable weather	5	1.67
Water not clear	4	1.33
Very dirty water	4	1.33
Others	17	5.67
No response	51	17.00
Total	300	100.00

The respondents noticed these changes in the form of bald mountains (29.33%), scorching heat that causes skin rashes (18%), landslide during rainy season (9.33%), floods that are big and strong (7.67%) and flash floods (4%). They noted the water in the river as murky and dirty indicating siltation and pollution (Table 6).

The majority of respondents (84%) indicated their awareness of changes in the ecology particularly in their immediate environment. Few (16%) did not notice such changes (Table 5). The respondents noticed these changes in the form of bald mountains (29.33%), scorching heat that causes skin rashes (18%), landslide during rainy season (9.33%), floods that are big and strong (7.67%)

and flash floods (4%). They noted the water in the river as murky and dirty indicating siltation and pollution (Table 6).

Table 7. Perception on Causes of Climate Changes

	Frequency	Percentage
Illegal logging/due to cutting of trees	125	41.67
Lack of involvement of people	35	11.67
Murky river water is due to quarrying	15	5.00
Ozone layer depletion	11	3.67
Improper waste disposal	10	3.33
Abuse of the environment	5	1.67
Always raining	5	1.67
Industrial plants produce fumes that pollute the air	4	1.33
don't know	16	5.33
Others	13	4.33
No response	61	20.33
Total	300	100.00

They attribute climate change to illegal logging (41.67%) and a lack of people's concerted efforts to mitigate climate change (11.67%). Some respondents have knowledge on ozone layer depletion (1.33%) and how it affects climate change. Others perceive the industrial plants pollute the air through their fumes (1.33%). Most respondents (82.67%) are aware of environment- friendly practices (Table 7).

Table 8. Environmentally -Friendly Practices

	Frequency	Percentage
Cleanliness in the environment	89	29.66
Reforestation	69	23.00
Correct waste disposal	28	9.33
Planting and non-cutting of trees	16	5.33
Cutting among the branches	14	4.67
Segregation of garbage	9	3.00

Non burning of wood and plastic	7	2.33
Others	11	3.67
No response	57	19.00
Total	300	100.00

The top three environment- friendly practices include cleanliness in the environment (29.66%), reforestation (23%) and correct waste disposal (9.33%. These are supported by tree planting (5.33%), segregation of garbage and non-burning of wood and plastic (Table 8).

Table 9. Reason for environment-friendly practices

	Frequency	Percentage
To clean surroundings to make the mosquito free	50	16.67
Prevent soil erosion and landslide	32	10.67
So there will be no dengue outbreak	27	9.00
Prevent flash flood; control of water current	25	8.33
Plant trees to produce oxygen	18	6.00
Planting trees to prevent flood	14	4.67
Orderly environment that is disease-free	12	4.00
Add beauty to nature	8	2.67
To make the surroundings cool and protected from storm	8	2.67
Cool environment due to trees	5	1.67
To protect from heat	5	1.67
Flood prevention	4	1.33
No mosquito to cause dengue	4	1.33
Others	26	8.67
No response	62	20.67
Total	300	100.00

Outbreak of dengue is the top reason for cleaning the surroundings (16.67%). Another practice which is good for the environment is prevention of soil erosion and landslide (10.67%). Flood control (8.33) is another to keep people safe and to free them from the hassles of evacuation. Replenishing the environment can take place by planting trees and not cutting them (Table 9)

Table 10. Knowledge of technologies/activities that nurture the environment

	Frequency	Percentage
No	160	53.33
Yes	140	46.67
Total	300	100.00

More than half (53.33%) of the respondents did not know of technologies that nurture the environment. A smaller percentage (46.67%) claimed they know (Table 10).

Table 11. Perception of Technologies/activities that nurture the environment

	Frequency	Percentage
Reforestation	65	21.67
Cleaning the surroundings	43	14.33
Proper waste disposal	8	2.67
Not burning plastic and cellophane	6	2.00
Clean environment	4	1.33
Garbage collector/segregation	4	1.33
Others	8	2.67
No response	162	54.00
Total	300	100.00

Respondents consider reforestation as a technology (21.67%) to nurture the environment. Cleaning surroundings (14.33%) and proper waste disposal (2.67%) are also identified (Table 11).

Values/Attitudes/Beliefs on Climate Change and Environmental Protection/ Conservation

Table 12. Awareness of technologies/activities inimical/bad
to the environment

	Frequency	Percentage
No	121	40.33
Yes	179	59.67
Total	300	100.00

Most respondents know about technologies that harm the environment (59.67%) than those that protect the environment (Table 12).

Table 13. Perception of technologies/activities that is bad/inimical
to the environment

	Frequency	Percentage
Illegal cutting of trees/illegal logging	59	19.67
Burning of rubber/plastic	56	18.67
Throwing of garbage anywhere	23	7.67
Pollutive behaviors	9	3.00
Factory waste-pollution	6	2.00
Illegal mining/quarrying	5	1.67
Presence of stagnant canal	4	1.33
Making environment dirty	4	1.33
Others	12	4.00
No response	122	40.67
Total	300	100.00

Cutting trees (19.67%), burning plastic (18.67%), throwing garbage anywhere (7.67%) and pollutive behaviors (3%) are identified as bad for the environment. Others mentioned waste pollution from factories, quarrying and mining as inimical to the environment (Table 13).

Table 14. Desire to know more about climate change/global warming

	Frequency	Percentage
No	23	7.67
Yes	277	92.33
Total	300	100.00

Despite limited knowledge, most respondents (92.33%) desire to know more about climate change (Table 14).

Table 15. Reason for wanting to know more about
climate change/global warming

	Frequency	Percentage
For awareness leading to action	87	29.00
To read trends of the environment	34	11.33
For disaster preparedness	27	9.00
To warn others of disasters	26	8.67
To understand global warming	21	7.00
To know how to protect nature	13	4.33
To experience changes of nature	11	3.67
To prepare for future disasters	8	2.67
To become prepared of climate impact	8	2.67
To answer if others ask about global warming	7	2.33
Others	25	8.33
No response	33	11.00
Total	300	100.00

They want to know more about climate change so they will know what actions to take (29%) to mitigate climate change. They want to read trends (11.33%) to better prepare themselves for disasters (8.67%). They want to find answers why the world is getting hotter and why disasters occur (Table 15).

Table 16. Perception on experiencing the effects
of climate change/global warming

	Frequency	Percentage
No	82	27.33
Yes	218	72.67
Total	300	100.00

Most respondents indicated they are experiencing effects of climate change (72.67%). Few are not experiencing (27.33%) (Table 16).

Cutting trees (19.67%), burning plastic (18.67%), throwing garbage anywhere (7.67%) and pollutive behaviors (3%) are identified as bad for the environment. Others mentioned waste pollution from factories, quarrying and mining as inimical to the environment (Table 13). Despite limited knowledge, most respondents (92.33%) desire to know more about climate change (Table 14). They want to know more about climate change so they will know what actions to take (29%) to mitigate climate change. They want to read trends (11.33%) to better prepare themselves for disasters (8.67%). They want to find answers why the world is getting hotter and why disasters occur (Table 15). Most respondents indicated they are experiencing effects of climate change (72.67%). Few are not experiencing (27.33%) (Table 16).

Table 17. Ways of knowing the effects of climate change

	Frequency	Percentage
Heat is scorching; can't cope with it	101	33.67
Heavy rains that cause flood in a short time	29	9.67
Quick rain then flash flood	22	7.33
People get sick easily	17	5.67
Occurrence of heat stroke	10	3.33
Experience temperatures changes	9	3.00
By experience	9	3.00
Others	14	4.67
No response	89	29.67
Total	300	100.00

Their experience of climate change is in feeling the scorching heat that gives them skin rashes (33.67%) and sudden change from hot temperature to cold brought about by heavy rains (9.67%) that result to flash floods. People get sick easily, some have heat stroke (Table 17).

Table 18. Practices/activities that contribute to climate changes/global warming

	Frequency	Percentage
No	244	81.33
Yes	56	18.67
Total	300	100.00

Generally, respondents did not have practices/activities that contribute to climate change/global warming (81.33%). Few had (18.67%) (Table 18).

Table 19. Practices and activities that contribute to Climate Change

	Frequency	Percentage
Tree planting	37	12.33
Cleanliness	9	3.00
Throwing garbage into the River	6	2.00
No response	248	82.67
Total	300	100.00

Tree planting (12.33%), cleanliness (3%), and throwing garbage in the river (2%) are the practices that contribute to climate change (Table 19).

Table 20. Involvement in environmental groups/NGO activities that advocate environmental protection and rehabilitation

	Frequency	Percentage
No	202	67.33
Yes	98	32.67
Total	300	100.00

Basically, NGO's have limited involvement (67.33%) Others are involved (32.67%) (Table 20).

Table 21. Activities of environmental groups that
protect and rehabilitate the environment

	Frequency	Percentage
Clean the surroundings	51	17.00
Tree planting	32	10.67
Not cutting trees	5	1.67
Women's organization	4	1.33
No response	208	69.33
Total	300	100.00

Cleanliness (17%) is the top choice for activities that protect and rehabilitate the river followed by tree planting (10.67%) (Table 21).

Table 22. Practices/activities which are environment-friendly

	Frequency	Percentage
No	83	27.67
Yes	217	72.33
Total	300	100.00

Majority of the respondents (72.83%) are involved in activities that are environment friendly. Only few (27.67%) are not involved (Table 22).

Table 23 . Practices/activities that are environment friendly

	Frequency	Percentage
Cleaning the surroundings	111	37.00
Tree planting	55	18.33
Proper waste disposal	12	4.00
Waste segregation	7	2.33
Not burning plastic	6	2.00

Not throwing garbage into the River	6	2.00
Planting flowers	5	1.67
Others	11	3.67
No response	87	29.00
Total	300	100.00

In particular terms, cleaning the surroundings (37%) is their top environment – friendly activity followed by tree planting (18.33%), waste disposal (4%) and waste segregation (2.33%), among others (Table 23).

Table 24. Involvement of family in protecting and rehabilitating rivers, riverbanks, slopes and watersheds

	Frequency	Percentage
No	90	30.0
Yes	210	70.0
Total	300	100.00

Family involvement in protecting and rehabilitating rivers, riverbanks, slopes and watersheds is pronounced (70%). Few do not have involvement (30%) (Table 24).

Table 25. Ways of protecting or rehabilitating these water bodies and lands

	Frequency	Percentage
Tree planting	86	28.67
Not throwing garbage	27	9.00
Cleaning the surroundings	25	8.33
Stopping people from cutting trees	20	6.67
And those who throw garbage at the River	18	6.00
Imposing penalty for cutting trees	8	2.67
Others	19	6.33
No response	97	32.33
Total	300	100.00

The respondents perceived that tree planting (28.67%), not throwing garbage (9%), and cleaning the surroundings (8.33%) are top three (3) ways to rehabilitate water bodies and lands (Table 25).

Generally, respondents did not have practices/activities that contribute to climate change/global warming (81.33%) and few had (18.67%) (Table 18). Tree planting (12.33%), cleanliness (3%), and throwing garbage in the river (2%) are the practices that contribute to climate change (Table 19). Basically, NGO's have limited involvement (67.33%) Others are involved (32.67%) (Table 20). Cleanliness (17%) is the top choice for activities that protect and rehabilitate the river followed by tree planting (10.67%) (Table 21). Majority of the respondents (72.83%) are involved in activities that are environment friendly. Only few (27.67%) are not involved (Table 22). In particular terms, cleaning the surroundings (37%) is their top environment – friendly activity followed by tree planting (18.33%), waste disposal (4%) and waste segregation (2.33%), among others (Table 23). Family involvement in protecting and rehabilitating rivers, riverbanks, slopes and watersheds is pronounced (70%). Few do not have involvement (30%) (Table 24). The respondents perceived that tree planting (28.67%), not throwing garbage (9%), and cleaning the surroundings (8.33%) are top three (3) ways to rehabilitate water bodies and lands (Table 25).

CONCLUSIONS

The settlers within 100 meters along the river banks have taken permanent residence in the area even under difficult circumstances of unemployment and limited incomes, bigger family sizes, children unable to stay in school. They have limited access to social services like light and safe drinking water, disposal of household and human wastes. Due to their proximity to the river and their lack of access to social services they have contributed to the rivers' contamination through their unhygienic behaviors.

The settlers have manifestations of their awareness of river conservation and protection behaviors and are in fact concerned of keeping the river healthy.

There is dependence of settlers on the river life forms such as fish, snails/shells and plants for livelihood and domestic consumption. They have awareness of river policies and participate in projects on river conservation. However, their need to exploit the rivers' resources to survive a difficult life exacts a toll on the rivers' resource sustainability.

The settlers perceived that their illness such as cough and colds, waterborne

diseases, diarrhea and fever are connected to the rivers' state of well-being. While they use preventive measures against waterborne diseases, their daily activity require frequent contact with the river and pushes them towards contamination.

The settlers have certain awareness of climate change and global warming and are all to see these signs in the environment and experienced them especially the hazards of flash floods that sweep them out into the sea. They traced climate change causes to certain behaviors of people and organizations. However, such environmental awareness do not translate into mitigation measures since they have no power to control human activities like illegal logging and running.

The settler's exposure to natures' elements aggravated by their poverty makes them vulnerable to illness, running nose, hypertension and diarrhea. Due to their limited knowledge and sources, they take self-medications for their illness, consult health workers, or just let their illness take it's natural course.

RECOMMENDATIONS

1. A formal River Conservation Education Program be designed in response to the need for a formal structure to train community residents and to further enhance their awareness.
2. A policy review is needed to evaluate the implementation of national and local policies on river conservation.

ACKNOWLEDGMENTS

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Cagayan de Oro River before and after Tropical Storms
Washi (Sendong) and Bopha (Pablo)

BEFORE

AFTER

Plate 1. Station 1: Dansolihon - Uguiaban Bridge

Cagayan de Oro River before and after Tropical Storms
Washi (Sendong) and Bopha (Pablo)

BEFORE

AFTER

Plate 2. Station 2: Lumbia - Cabula Bridge

Cagayan de Oro River before and after Tropical Storms
Washi (Sendong) and Bopha (Pablo)

BEFORE

AFTER

Plate 3. Station 3: Taguanao - Taguanao Bridge

Cagayan de Oro River before and after Tropical Storms
Washi (Sendong) and Bopha (Pablo)

BEFORE

AFTER

Plate 4. Station 4: Puntod - Puntod Bridge