

PERCEIVED ECOSYSTEM SERVICES TOWARDS THE CONSERVATION OF AGUSAN MARSH WILDLIFE SANCTUARY IN MINDANAO, PHILIPPINES

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Abstract

Ecosystem services refer to the benefits that are derived from the natural environment. Wetlands such as Agusan marsh are a productive ecosystem that provides various goods and services to the ecological, economic, and social wellbeing of the society. Face-to-face household and key informant interview were done to assess the ecosystem services offered by Agusan Marsh Wildlife Sanctuary. Contingent valuation method (CVM) was used to determine the minimum willingness to accept (WTA) compensation per month of land managers should they agree to conserve part of the AMWS. Provisioning services such as food and water resources were seen as the benefits provided by the marsh to the community living within the marsh, but regulating services were more important for people living in the downstream. Flood control services are the regulatory service that has an impact towards the lower stretches of Agusan river, and too much financial effort has been given to flood control projects in low lying areas. The minimum WTA of farmers and fishers for any land conservation agreement were Php2,144.32 and Php3,442.0, respectively. This amount can be the basis of the decision makers and stakeholders if sustainable financing scheme on ecosystem services management program will be implemented in AMWS.

Keywords: Ecosystem services; Flood control; Wetland; Willingness to accept.

Introduction

Ecosystem services refer to the several benefits that are derived from the natural environment. Examples include the supply of food, water and timber (provisioning services); the regulation of air quality, climate and flood risk (regulating services); opportunities for recreation, tourism and education (cultural services); and essential underlying functions such as soil formation and nutrient cycling (supporting services) [1]. The provision of such services might require communities living in the proximity of the ecosystem to undertake or not undertake certain activities.

Wetlands are the most productive ecosystem that provides various goods and services to the ecological, economic, and social wellbeing of the society. Despite their importance to human well-being and biodiversity the world's freshwater ecosystems and the services they provide are continually being degraded [2].

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Agusan Marsh is regarded as one of the most significant marshes in Southeast-Asia and stores more than 15% of the country's freshwater resource in the form of swamp forests. The presence of unique and pristine habitat types like the sago swamp, peat swamp, mixed-swamp forests and the diverse biological and endemic species make Agusan Marsh an ecologically significant wetland in Caraga Region and the Philippines. Since the marshland is home to some of the rare, threatened and endangered flora and fauna of the world, it was declared as a protected area. Officially called the Agusan Marsh Wildlife Sanctuary (AMWS), the goal of its proclamation as a protected area was geared towards sustainable development by protecting and utilizing local biological treasures in ways that do not diminish the variability of genes and species or destroy important habitat and ecosystem [3]. Because of the importance of wetlands such as that of the Agusan Marsh, there is an utmost need to determine its environmental and economic value through the services the marsh ecosystems offer to the people. It is already implied that wetlands have enormous value since it provides as natural flood control and water filtration services to lowland communities, and supports populations of different species of fish and wildlife on which people depend for food, employment, and recreation.

Hence the conduct of ecosystem services perception of different stakeholders, from the local dwellers to people in the downstream communities is deemed necessary. The information generated can be provided to the long-term planning conservation measures of the marsh. The results can be applied to determine the monetary value of different services that will ensure the sustainability of the services. Moreover, it will protect the integrity of AMWS stakeholders but not limited to tourists, Local Government Units, Non-government Organizations, Peoples Organizations, National Government Agencies and Protected Area Management Board which oversees the management of Agusan marsh. The findings from this study would give sustenance for the protection and conservation of ecosystem services. Also, this will provide understanding of the distribution of involved stakeholders and the beneficiaries which is the providers and the direct users. It is also hoped that this paper will serve as a guide for future ecosystem services.

The study aimed to identify the dominant and significant ecosystem services in the protected area as perceived by different stakeholders and determine the minimum Willingness to Accept (WTA) compensation of land managers for the land conservation agreement of water resources in AMWS.

Methodology

Study Area

The study was conducted in the municipality of Talacogon, Agusan del Sur, Caraga Region, the Philippines which is considered as the heart of Agusan valley and is situated along Agusan River within the geopolitical boundary of Agusan marsh. Five villages in the municipality of Talacogon namely: San Nicolas, Marbon, La Flora, Desamparados and Sabang Gibong (Fig. 1) were chosen because they have the greatest number of fishermen and farmers based on the secondary data gathered. Talacogon was also reported to have the highest number of marsh inhabitants.

Additionally, downstream communities including five municipalities and two cities were included to gather information on their perception of the ecosystem services offered by AMWS thru its key informants. The municipality of Las Nieves, Esperanza, Magallanes, Butuan City, and Bayugan City are part of the Agusan River Basin (ARB) and are the communities located further down of Agusan marsh.

Household Survey

Purposive sampling method and stratified random sampling technique were used to select and determine the target number of respondents in the study area. The sample size was determined using the formula (1):

$$n = \frac{NZ^2pq}{(N - 1)d^2 + z^2pq} \tag{1}$$

where n is the sample size, N is the population size, p is equivalent to 0, q is equal to 0.5, and z is 1.96 at 95% level of confidence.

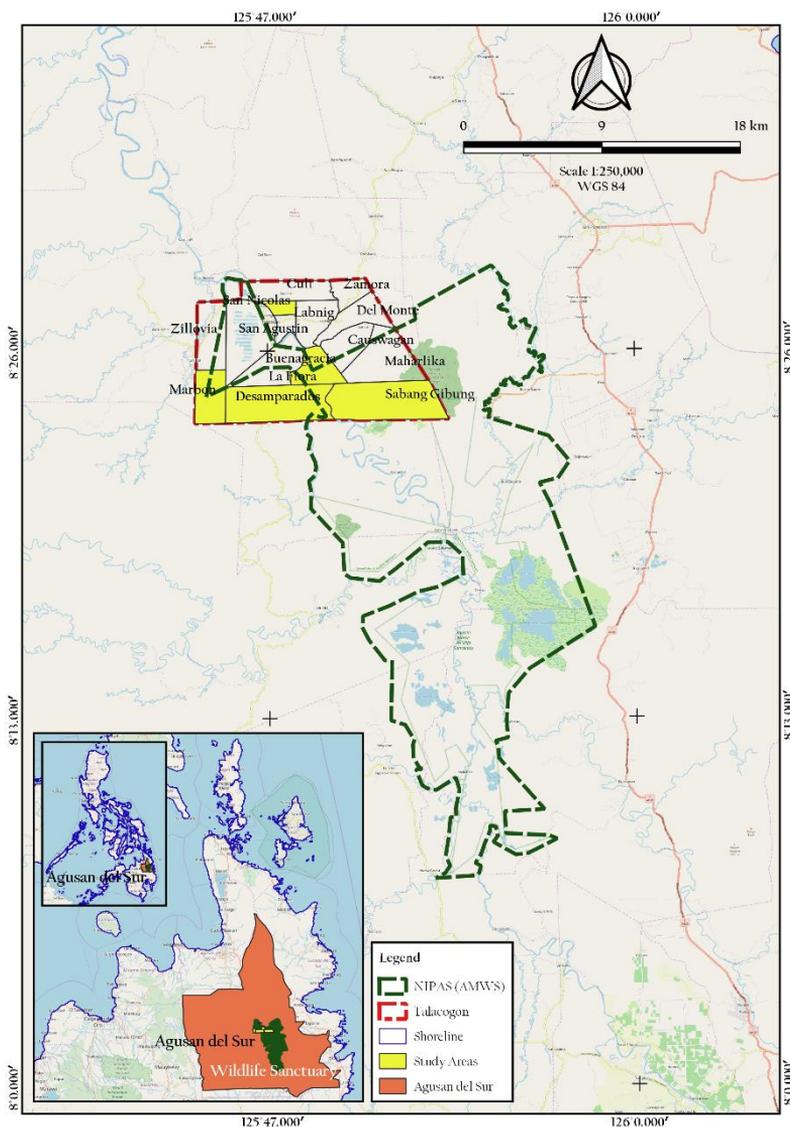


Figure 1. Map of Agusan Marsh Wildlife Sanctuary and the five villages in Talacogon, Agusan del Sur

Before the conduct of the survey, a reconnaissance visit and secondary data gathering were done in Talacogon, Agusan del Sur to determine the significant resources or services of the marsh. A pilot survey was also conducted to improve the survey instruments/questionnaires

and identify some errors. Additional information was gained that served as the basis for comparison of the primary data collected.

Face-to-face household interview with the farmers, fishers, and residents were undertaken to assess the ecosystem services of AMWS. Survey instrument intended for farmers and fisherfolks included land conservation agreement and willingness to accept cash or non-cash compensation for the conservation of water resources in AMWS. Residents were asked of their source for drinking and domestic water, payment for this water. Focus group discussion was also conducted to enhance data collection. The dialogue included local leaders and other concerned stakeholders who are actively involved in the conservation management of the marsh.

A total of 603 respondents were interviewed in five chosen villages in the municipality of Talacogon consisting of 99 (16%) fishers, 217 (36%) farmers and 287 (48%) residents for the assessment of the vital ecosystem services of AMWS (Table 1).

Table 1. Number of Respondents Interviewed in Talacogon, Agusan del Sur

Village	No. of Respondents Interviewed		
	Fisherfolks (Managers)	Farmers (Managers)	Local Residents (Users/Beneficiaries)
Marbon	14	41	59
La Flora	27	77	51
San Nicolas	19	37	63
Sabang Gibung	22	27	53
Desamparados	17	35	61
Total	99	217	287
Grand Total			603

Key Informant Interview (KII)

Key informant interview of leaders on the downstream community of the marsh was conducted to assess the importance of the wetland ecosystem to their municipality. Key informants in every Local Government Units include the Environment and Natural Resources Officer, Disaster Risk Reduction Officer, Planning and Development Officer and the Agricultural Officer. They were from two cities and five municipalities of the downstream areas namely; Butuan City, Bayugan City, Municipality of Las Nieves, Esperanza, and Magallanes. The city and municipalities were chosen considering the route of Agusan river.

Contingent Valuation Method (CVM)

The contingent valuation method (CVM) was used to determine the minimum WTA of land managers for land conservation agreement of water resources in AMWS and to determine the maximum willingness to pay (WTP) of residents for the conservation and protection of water resources in AMWS. Multiple linear regression analysis through Statistical Package for the Social Science (SPSS) software was used to calculate WTA and WTP.

Results And Discussion

Perception of Local Dwellers of the Ecosystem Services of AMWS

Provision of resources such as fish as a source of food was the most important ecosystem service according to most of the respondents while water provisioning was the most important according to farm resources consumers (Table 2). Many wetlands are used for food production, such as pond aquaculture aiming to increase fish production to provide economic support to the locality as well as a source of food nutrition. Most respondents harvests fish from the marsh and fish are used for both small-scale commercial and subsistence purposes. Chen and Wong [4] said that there exists great potential for integrating different food production systems into

wetlands, to enhance sustainable food production, taking advantage of its ecological multifunction. Some wetlands are used for or linked to different types of food production, based on their unique characteristics. Additionally, they also mentioned that wetlands integrated with other systems for food production processes could achieve more sustainable food production. Furthermore, farmers cultivate the swamp for two main reasons, first is to sell harvest for income generation and second is to satisfy household food requirements [5]. Most farmers are engaged in farming by planting rice, corn, cassava, and peanuts. During dry season (April - July) farming is done in large part of the marsh where there is no water while fishing is the dominant activity during the wet season (November to February). Agusan Marsh and its adjacent surrounding catchments support rural livelihood through the provision of an extensive range of natural resources such as fresh water that are used to feed several farming systems within and around the marsh.

Conservation of biodiversity, flood control, carbon sequestration storage, and scenic beauty for recreation are indirect use values of the wetland, and with less income derived from these services, it could be the reason why respondents perceived it with least importance. However, *Pedersen et al.* [6] said that wetland area located in an urban setting contributed to several quality-of-life aspects, such as encountering nature and experiencing beauty, support well-being, and have high restorative qualities. Though respondents do not directly get income from the mentioned ecosystem services, they also see its importance for the sustainability of the marsh and its downstream communities. Determining other ecosystem services aside from the provisioning and regulating services could increase the total value attributed to wetlands.

Table 2. Important ecosystem services in the locality as perceived and ranked by farmers, fishers, and resource consumers.

Ecosystems Services	Farmers	Fishermen	Farm Resources Consumers	Fish Consumers
	Rank			
Fish Production	1	1	2	1
Flood Control	4	4	4	3
Carbon Sequestration and Storage	5	5	5	5
Water Provisioning	2	2	1	2
Scenic Beauty for Recreation	6	6	6	6
Conservation of Biodiversity	3	3	3	4

Most farmers perceived flooding as their main problem during the rainy days. A pronounced maximum period of rain occurs from December to February with rainfall that is more or less evenly distributed throughout the year. Flooding feature of wetlands is a fundamental element of wetlands, and seasonal flood plays a crucial role to the healthy marsh habitat [7], but the disadvantage of this affects the socioeconomic status of farmers because agricultural production decreases. Flooding has severe implication on lowering productivity in terms of losses in crops, livestock and other agricultural assets. Some areas within the marsh assigned as multiple use zone have been reclaimed as agricultural land specifically rice farms. Rice is the main cash crop and is heavily impacted when flooding happens. Due to floods, market places are unable to conduct normal marketing function because farmers carry their goods to the market places with the help of boats which become costly [8]. Contrarywise, fishers also perceive flooding as an opportunity rather than as a problem since the presence of water means occurrence of fishes. Fishers in the marsh claimed that fishes caught are abundant during flooding season. Residents within the marsh are mostly indigenous people and have coping mechanisms to deal with problems caused by natural disasters. One is that they tend to have a dynamic livelihood which is dependent on the season. They are fishers during the wet season and becomes farmers during the dry season.

Perception of Downstream Communities of the Ecosystem Services of AMWS

Key informants interviewed mentioned flood control, conservation of biodiversity, and water provisioning as the perceived benefits and essential ecosystem services that AMWS provides in their locality (Table 3). Respondents are well aware of the regulating and provisioning services provided by Agusan marsh. Floods occur during rainy months in the region which is from December to February. Rainfall is sometimes intense during wet periods, and flooding events would happen. Respondents are aware that the peatlands in the marsh control flood waters by absorbing and retaining them in the peat. During the dry season, the waters will be slowly released.

Respondents are also conscious of the complex network of ecosystems which is a habitat to diverse flora and fauna where some are endemic to the place. Many kinds of researches have been done to account the freshwater fauna species present in the marsh [9-12].

Common problems the key informants observed occurring in the downstream areas are flooding, water pollution, riverbank erosion, and improper waste disposal. Seasonal flooding becomes a problem due to its risk to inhabitants and damage to properties incurred. Water pollution is said to be mostly caused by mining activities (large-scale or small-scale). Riverbank erosion or scouring is also seen as a problem because it reduces the area utilized for any other purpose. Riverbanks of Agusan river are mostly utilized as agricultural land, and with continuous erosion, the land area decreases, thereby decreasing food production as well. Improper solid waste management has been a "battle" of every local government unit in the Philippines and no matter the effort in the implementation of waste management programs, and problems continue to exist. Most recurring problems on solid waste are the following; no segregation of solid waste at source, burning of solid wastes, the presence of plastics in water bodies, and unregulated dumping of wastes by households located near riverbanks.

Table 3. Ecosystem services of Agusan Marsh as perceived by key informants from communities situated further down of Agusan marsh.

Rank	Ecosystem Services
1	Flood Control
2	Conservation of Biodiversity
3	Provision of Water Resources
4	Fish Production
5	Scenic Beauty for Recreation
6	Carbon Sequestration and Storage

Flood Mitigating Measures of Downstream Communities

Water from Agusan marsh flows to Agusan River and drains to Butuan bay traversing several municipalities including Butuan City. Along the watercourse of Agusan River are many flood mitigating measures mainly located in Butuan city. Most, if not all flood control projects are implemented in the city because it is low lying and prone to flooding. Butuan city is also the regional capital of Caraga; hence economic activities are mostly concentrated in the area and without any measures against flood, trade, and industry in the region might be jeopardized. Dikes are often the final means of flood defense in times when territories situated beyond dikes have avoided flooding as a result of other events such as drainage system overflow or runoff [13]. Several flood control projects had been implemented by the Department of Public Works and Highways-Caraga Region from 2014-2018 amounting to around 1.4 billion PhP. The projects were done to lessen the impacts of a flood in the city. However, even with these developments, in the advent of heavy and prolonged rains in the entire region, the city is still flooded.

On the other hand, the amount spent on greening programs surrounding Agusan Marsh by DENR is roughly around 3.5 million PhP allotted for 100 hectares. This amount is only 0.2% of the total budget allocated to flood control projects in Butuan city. If half of the multiple use zone within the Agusan marsh which would be around 4,000 hectares will be subjected for conservation and enhanced environmental protection programs the government will be spending around 138,400,000.00 PhP. This amount is only 9.6 % of the total amount of flood control projects in downstream communities. Flood control projects are expensive and require intensive diagnosis, monitoring, and maintenance in the long run. The study of *Williams et al.* [14] emphasized that retention of existing wetlands provides the highest social return of investment and that government policy should focus on preventing further loss of wetlands as a strategic investment opportunity. They further added that wetland retention is an economically viable solution to limit the financial, social and environmental damages of flooding. This shows that policy-makers and environmental planners must somehow realize that grey infrastructures may not be the most suitable solution to reduce flood risk. A shift from grey solutions to nature-based solutions can be pondered.

Willingness to Accept of Farmers and Fishermen

Farmers and fishers decided whether they would potentially enter into a land conservation agreement for AMWS like reforestation, conservation training, adopt sustainable land use practices and sustainable management of wetlands. Eventually, 294 out of 316 resource users were willing to potentially enter into an agreement since they are considered as land managers and they can acquire benefits in helping conserve AMWS that would compensate for their livelihood. Example of land conservation agreements is community-based forest management. Community forestry approach is expected to 'alleviate poverty among forest users, empower them and improve the condition of the forests' [15]. Community-based forest management in the Philippines is forest management 100% fully owned by the community for 25 years and renewable for another 25 years. Through CBFM the land is managed by a group (Peoples' Organization) that provisions are given to land managers such as training, development plans, financial assistance, and an individual certificate of stewardship to stakeholders as assurance that they are the owner of their tilled land. Example of programs and projects that have made a difference in people's lives includes the National Greening Program and Upland Development Program. According to *Zanella et al.* [16] in certain situations, providing economic incentives can prove more effective and efficient than taking regulatory measures in supporting the provision of ecosystem services for land users. Most respondents emphasized that conservation of the marsh will ensure their future consumption for their source of foods and livelihood. It will also provide them countless ecosystem services such as flood control and water supply.

In this study, WTA represented the amount of money a respondent was willing to accept to adopt sustainable land use practices and land conservation agreement for improvement of the environmental quality such as conservation and protection of watershed within AMWS. Table 4 shows the minimum WTA of farmers and fishers per month in exchange for conservation practices in AMWS. The estimated WTA were calculated using the regression model. All variables that have a significant effect on the value of WTA were determined. These factors were important in evaluating WTA since these factors have a substantial relationship with WTA.

Table 4. Willingness to accept of farmers and fishers for an agreement for the conservation of Agusan marsh.

Land Managers	Willingness to Accept (WTA)
Farmers	Php2,144.32
Fishermen	Php3,442.01

Estimated WTA of farmers was calculated using the regression model below:

$$\text{WTA (Php)} = -834.707 + 1072.358 [\text{sex}] + 496.045 [\text{age}] + -128.067 [\text{civil status}] + 19.898 [\text{religion}] + 37.917 [\text{ethnic origin}] + -231.626 [\text{monthly income}] + 510.512 [\text{educational attainment}] + -462.399 [\text{length of residency in years}] + 44.074 [\text{household size}] + -49.071 [\text{cost incurred in farming}] + 33.095 [\text{total annual net revenue in farming}] + 1636.294 [\text{land conservation agreement}] = \text{Php}2,144.32.$$

Estimated WTA of fishers was calculated using the regression model below:

$$\text{WTA (Php)} = -1050.87 + 198.491 [\text{sex}] + 745.921 [\text{age}] + -187.689 [\text{civil status}] + -889.56 [\text{religion}] + -881.637 [\text{ethnic origin}] + 608.675 [\text{monthly income}] + 116.349 [\text{educational attainment}] + 441.383 [\text{household size}] + -887.515 [\text{cost incurred in fishing}] + 20.103 [\text{total annual net revenue in fishing}] + 5208.364 [\text{land conservation agreement}] = \text{Php}3,442.01$$

Table 5 shows the non-cash compensation based on the respondents wherein they would enter into a land conservation agreement. Economic development investments and employment opportunities/livelihood were the non-cash compensations requested by the respondents in exchange for land conservation agreement. Economic development investments pertain to infrastructure developments like road construction, school buildings that are disaster-prone, and river dikes to prevent riverbanks from erosion and scouring. Infrastructure development is essential for a certain locality to improve economically; however, leaders of a different village in the marsh want only minimal access in the strict protection zone. Road networks have been continuously done in the region but are limited within the marsh to limit the access of interested individuals or group from residing or taking out whatever resources they can take. Employment opportunities or livelihood was also identified by respondents to be feasible as non-cash compensation. Though there is already livelihood projects introduced within the area, these are limited and unsustainable with only a few households benefiting from it. Others still resorted to illegal activities within the marsh which include timber poaching, cutting down of lumbia or sago palm stands and electrofishing.

Table 5. Frequency of responses on the non-cash compensation that respondents may agree for the conservation of Agusan Marsh Wildlife Sanctuary

Non-cash compensation	Farmers	Fishers
Economic Development Investments	57	42
Employment Opportunities	30	25
Provision of Farming Equipment	23	8
Provision of Fishing Gears	17	7
Others	33	6

On the other hand, respondents from the downstream communities mentioned employment opportunities or livelihood as the non-cash compensations of the local government units from downstream areas for the land managers of the upstream regions. Through livelihood, this will educate the community for the protection and conservation of AMWS and boost future economic development. Department of Trade and Industry and other agencies can be tapped to sustain a livelihood for compensation based on their responses. Information and education campaign, clean up drive and tree growing helps to mitigate the impact of destructive activities on natural resources. However, some studies suggest that non-economic factors, such

as trust and participation in scheme design, play a crucial role in determining decision by land users on whether to participate environmental and economic schemes in a sustained way [16].

Conclusion

For dwellers within the AMWS, the dominant ecosystem service provided by the marsh is the provisioning of food mainly fish and provision of water for the farm. On the other hand, the downstream community views flood control, conservation of biodiversity, and water provisioning as the perceived benefits and important ecosystem services that AMWS provides in their locality. Flooding control service is the regulatory service that has an impact towards the lower stretches of Agusan River and land managers can invest in enhancing this kind to services to potential buyers. Too much financial effort has been given to flood control projects in low lying areas in the region particularly in Butuan city but less priority to enhance the conservation and environmental development of the marsh.

Contingent valuation method (CVM) was used to determine the minimum WTA compensation per month of land managers. The minimum WTA of farmers and fishers were Php 2,144.32 and Php 3,442.01 per month, respectively. This amount can be the basis of the decision makers and involved stakeholders if sustainable financing scheme on ecosystem services management program will be implemented entirely in AMWS.

References

- [1] S. Smith, P. Rowcroft, M. Everard, L. Couldrick, M. Reed, H. Rogers, T. Quick, C. Eves, C. White, **Payments for Ecosystem Services: A Best Practice Guide**, Defra, London, 2013.
- [2] M.B. Bostian, A.T. Herlihy, *Valuing tradeoffs between agricultural production and wetland condition in the U.S. Mid-Atlantic region*, **Ecological Economics**, **105**, 2014, pp. 284–291.
- [3] * * *, **Agusan Marsh Wildlife Sanctuary Protected Area Report**, DENR- IPAS, Agusan del Sur, Philippines, 2003
- [4] R.Z. Chen, M.H. Wong, *Integrated wetlands for food production*, **Environmental Research**, **148**, 2016, pp. 429–442.
- [5] N.L. Nabahungu, S.M. Visser, *Contribution of wetland agriculture to farmers' livelihood in Rwanda*, **Ecological Economics**, **71**, 2011, pp. 4–12.
- [6] E. Pedersen, S.E.B. Weisner, M. Johansson, *Wetland areas' direct contributions to residents' well-being entitle them to high cultural ecosystem values*. **Science of the Total Environment**, **646**, 2019, pp. 1315–1326.
- [7] Z. Liu, L. Zhao, T. Xu, F. Bu, X. Liu, D. Zhou, *Quantification of potential flood inundation areas in the marsh wetland of Honghe National Natural Reserve, Northeast China*. **Ecohydrology and Hydrobiology**, **18**(4), 2018, pp. 355–364.
- [8] A.Z.M. Haq, *Effects of floods on rice production in Bangladesh*, **Journal of Agricultural Economics and Rural Development**, **3**(3), 2017, pp. 236–240.
- [9] C.M. Talde, A.C. Mamaril, M.L.B. Palomares. *Composition and length-weight relationships of fishes in the three floodplain lakes of Agusan Marsh Wildlife Sanctuary*, **Asian Fishery Science**, **21**, 2008, pp. 55–65.
- [10] M. Hubilla-Travis, F. Kis, J.H. Primavera. *Inventory of aquatic fauna of Agusan Marsh with notes on introduced species and their potential impacts on biodiversity*, (Editor J.H. Primavera). **Proceedings of the 1st Scientific Conference on the Agusan Marsh**, PCAMRD, UNESCO-Jakarta Office, 2008, 123 p.

- [11] R.A. Seronay, J.C. Jumawan, J.A. Vergara, **Agusan Marsh Fish Field Guide**, Caraga State University and Agusan Marsh Wildlife Sanctuary - Protected Area Management Board for GIZ-Coseram, 2018
- [12] M.P. Saculdito-Salibad, O.M. Nuneza, *Significant records of birds in Agusan Marsh, Philippines with notes on the conservation importance of the area*, **AES Bioflux**, **6**(1), 2014, pp. 26-43.
- [13] D. Serre, J. Douvinet, C. Heinzlef, E.D. Lacombe, *Coping Strategies in Dike Protected Areas. In: Floods* by Freddy Vinet, **Risk Management**, **2**, 2017, pp. 45-57.
- [14] J.K.P. Williams, J.W. Pomeroy, P. Badiou, S. Gabor, *Wetlands, Flood Control and Ecosystem Services in the Smith Creek Drainage Basin: A Case Study in Saskatchewan, Canada*, **Ecological Economics**, **147**, 2018, pp. 36-47.
- [15] A. Maryudi, R.R. Devkota, C. Schusser, C. Yufanyi, M. Salla, H. Aurenhammer, R. Rotchanaphatharawit, M. Krott, *Back to basics: considerations in evaluating the outcomes of community forestry*, **Forest Policy Economy**, **14**, 2012, pp. 1–5.
- [16] M.A. Zanella, C. Schleyer, S. Speelmanc, *Why do farmers join Payments for Ecosystem Services (PES) schemes? An Assessment of PES water scheme participation in Brazil*. **Ecological Economics**, **105**, 2014, pp. 166-176.

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