CURRENT STATUS OF LIVELIHOOD ACTIVITIES, PRESSURES AND CHALLENGES TO ECOSYSTEM SERVICES IN THE BUFFER ZONE AT THANH PHU WETLAND NATURE RESERVE, BEN TRE PROVINCE

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Abstract

Wetlands play an important role in many different ways for the lives of many people in Vietnam. One of the challenges that the Wetlands are facing is the livelihood activities of local people in the buffer zone. This paper examines the current situation of people's livelihood activities and the pressures on biodiversity conservation in Thanh Phu Wetland Nature Reserve (NR), Vietnam. The study was conducted in 3 communes in the buffer zone. 249 households were selected for interviewing, 03 group discussions, 10 in-depth interviews were conducted to collect both qualitative and quantitative data. The results show that, people living in the buffer zone of Thanh Phu Nature Reserve do not have diversity in livelihoods, they mainly work in aquaculture, agriculture and fishing in mangrove forests. 4 provisioning services, 5 regulating services and 3 supporting services are mainly ecosystem services that are highly appreciated by the people. In addition, the NR is also facing challenges in conserving biodiversity from both human and natural impacts, especially forest encroachment activities for aquaculture and fisheries activities. The harmony of interests between local people and the conservation. Therefore, the sustainable livelihood development for the community and biodiversity conservation requires integrated and multi-methodical efforts in addressing constraints in different areas such as aquaculture, contracting and forest protection policy.

Key words: *Ecosystem Services, Natural Resources, Thanh Phu, Wetland*

1. Introduction

Wetlands cover 5–10% of the Earth's land surface (Mitsch and Gosselink, 2007). As a transitional ecosystem between terrestrial and aquatic ecosystems, wetlands support high biodiversity (Keddy, 2009; Cohen-Shacham, 2015) and are essential to the health of both lower life forms water and land (Mitsch and Gosselink, 2007).

Wetlands are very important to human society (Mitsch and Gosselink, 2000; Ricaurte et al., 2014) because they provide a wide range of ecosystem services (RCS, 2007). In particular, the provision of food, drinking water and ensuring livelihoods for people living

in and around them is widely recognized (Ricaurte et al, 2014; Schuyt, 2005; Rebelo et al., 2009). Their global economic value is estimated to be about 70 billion USD per year (Schuyt and Brander, 2004). However, wetlands are continuously degraded in many countries (Mitsch and Gosselink, 2007; Wei, 2015) although understanding of their values has been enhanced (MEA, 2005). Global wetland loss has been estimated to be around 50% since 1900 (OECD/ IUCN, 1992), leading to a significant impact on ecosystem services, biodiversity and human livelihoods (ICSU-UNESCO-UNU, 2008). In Asia alone, about 5,000 km^2 of wetlands are lost annually (McAllister et al., 2001).

The Millennium Ecosystem Assessment (MEA, 2005) demonstrated a strong link between ecosystem services and people's livelihoods and the decline of ecosystem services across biomas, leading to changes to people's livelihoods. On the contrary, people's livelihood activities are also reversed to put pressure on the ecosystem. We use the MEA framework as the basis for our research, where we look at changes in wetlands and consequential impacts on people. Specifically, we use the separation of ecosystem services into provision (products obtained from the ecosystem), moderation (benefits obtained from modifying ecosystem processes), (the non-material benefits people gain from the ecosystem through spiritual fostering, cognitive development, reflection, recreational and aesthetic experiences), and support (experiences required for the production of all other ecosystem services) (MEA, 2005).

Information on individual wetlands and their exploitation at the local level is very limited (Gopal, 2013). Accurate information is needed on the values and drivers of change for the conservation and sustainable use of wetlands (Balmford et al., 2011). Knowledge of wetland ecosystem services, dynamics of change and subsequent impacts specific to regions or areas of interest is essential to ensure proper, safe use, conservation and sustainable development (Mmopelwa, 2006; Ostrom, 2007; Adekola, 2011). Assessing wetland ecosystems at a time scale and particularly at the local level helps to track changes, providing important information for natural resource planning and management (Prasad, 2002). For conservation planning and management, there is a clear need for a more detailed understanding of the ecosystem services provided by wetlands and the threats they face (MEA, 2005).

The objective of the paper is to analyze livelihood activities of people in Thanh Phu Nature Reserve buffer zone and the pressures on biodiversity conservation activities.

2. Method

Study areas

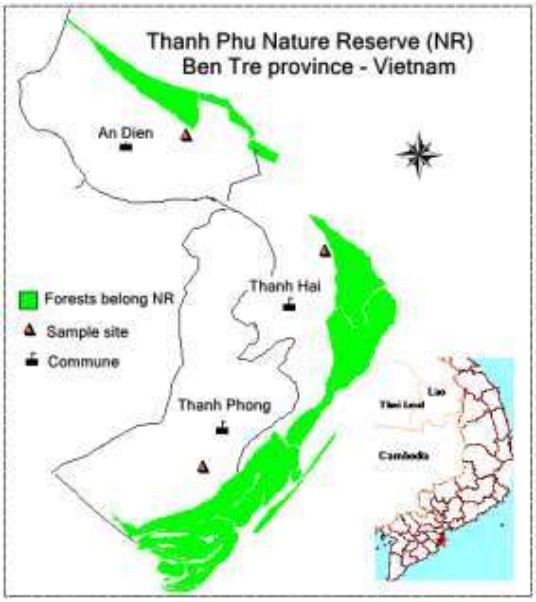

Fig.1. Location of Sampling

Thanh Phu Wetland Nature Reserve, Ben Tre Province: Ben Tre was established under Decision No. 1026 / QD-TTg dated November 13, 1998 of the Prime Minister with an area of 4,510 ha. Since the establishment of the Reserve, the area covered all forest and production forest land managed by Thanh Phu Forest Enterprise (971 ha), a state-owned enterprise assigned by the Provincial People's Committee. Many land areas of the Nature Reserve belongs to local people who have lived and cultivated before the NR was established. There are over 407 households with 1,385 people living and cultivating interwoven in the forest, but the locality has no land fund and financial resources to relocate. Therefore, under the pressure of production development, people always violate deforestation and illegal encroachment on forest land for aquaculture and agricultural production, thus creating a conflict between economic development and forest protection.

The study was conducted in three communes in the buffer zone of Thanh Phu NR: An Dien, Thanh Phong, and Thanh Hai (Figure 1).

Data collection

We used both qualitative and quantitative research methods to identify the livelihoods of people dependent on ecosystem services.

Household survey

Before conducting interviews with the households, the research team had a meeting with the Nature Reserve Management Board, local authorities in the district to find out an overview of the socio-economic background of the people living around the NR. In which, the research team has selected three communes in the buffer zone of Thanh Phu NR to be study sites to determine the household's dependence on wetland resources. Initial assessment

shows that about 85% of all households directly depend on wetland resources. Of these households, about 10% were randomly selected for household survey. Using semi-structured questionnaires, a total of 249 households dependent on wetlands were surveyed in Thanh Phu NR. The questions focused on the ecosystem services, people's dependence on them, the dynamics of change and people's impact on ecosystem services.

Group discussion

The list of ecosystem services obtained from the household survey was confirmed during focus group discussions. Three focus group discussions were conducted at the commune level, with an average of 8–10 participants per group during the study. Group members were selected based on their livelihood strategy and dependence on wetlands. The different dynamics of change and people's dependence on wetlands have also been thoroughly discussed among the groups. The listed ecosystem services have also been ranked in discussions.

In-depth interview with key informants

Representatives of the NR Management Board, Thanh Phu Agriculture Department, Natural Resources Department, the leaders of the People's Committees of 3 communes, the heads of the hamlets, from October 2020 to January 2021. The main questions in interviews focused on livelihood strategies and the dynamics of change in wetlands. A total of 10 staff members were consulted as key informants during the study to help us understand change patterns and dynamics. The main criteria for selecting informants were their knowledge of wetland resources, and people's dependence on and participation in wetland management. The main topics of the in-depth interview were focused on the following areas: (a) what is the status of wetlands and the availability of ecosystem services, (b) ecosystem services. What are the key drivers of change that local communities are gaining, (c) changing trends in existing ecosystem services, (d) what are the main drivers of change, and (e) What management decisions are needed to manage well wetlands?

Data analysis

Quantitative data were analyzed using software (SPSS) 20.0 to determine the extent of local people's dependence and the impacts of different factors on wetland ecosystems. Qualitative data obtained from first-time interviews were coded and categorized into topics according to research questions (i.e. ecosystem services; dynamics of change, livelihood strategies, etc.) and similar coded topics are grouped together. Ecosystem service ratings are performed using participatory tools. Focus group discussion participants were asked to identify key ecosystems available from wetlands. After key ecosystem services were listed, participants were asked to rate the listed ecosystem services on a scale of 1 to 10 (1 with least priority and 10 with highest level). The overall rating is based on the total score for each ecosystem service divided by the number of respondents. Drivers of ecosystem change

are identified through both qualitative analysis (focus group discussions) and also from the household questionnaire.

3. Results

Background information established from the survey of local household

Among 249 respondents, the number of respondents is male is 160, accounting for 64.3%, the rest are female. Women in the three communes participated in the interview very boldly, they not only take care of housework in the family but also know very well the business and economic situation in the family, they are the key people lock, keep money and take care of household payments, so the data is very reliable. The age of the interviewees ranged from 24 to 89 years with the median age, 48.5 years (Table 1). The largest age group represented was 41-50 years with 28.5% of the respondents. This implies that the respondents had experience on various issues relating to livelihood activities by themselves and in the community. Small family size (smaller than 4 people in the family) is dominant (66.3%). Most of the respondents are owners, therefore, they have a good understanding of their house livelihood as well as the disadvantage that their family is facing.

Table 7. Summary of socio-economic respondents based on the survey

Social-economic situation	Categories	Frequency (n)	Proportion (%)
Gender	Male	160	64.3
	Female	89	35.7
	21 – 30	16	6.4
	31 – 40	53	21.3
	41-50	71	28.5
	51-60	69	27.7
	Above 60	40	16.1
Number of persons in the	≤ 4	165	66.3
family	5 – 7	72	28.9
	≥ 8	12	4.8
Relationship of the respondent to family owner	Owner	167	67.1
	Wife	46	18.5

	Husband	5	2.0
	Other	31	12.4
Years of stay in the commune	Under 20	25	10.0
	21-30	31	12.4
	31-40	43	17.3
	41-50	47	18.9
	51-60	58	23.3
	Above 60	45	18.1

Ecosystem services, their uses and ratings

A total of 12 major ecosystem services have been identified through household surveys, in-depth interviews, focus group discussions, of which, 4 providing services, 5 regulating services and 3 supporting services (Table 2). Cultural services in Thanh Phu NR have not yet been available, a number of historical relics for tourism development have been removed from the NR, some spontaneous tourism activities such as restaurants, swimming by a number of private sectors, not belong to NR.

Table 2. List of ecosystem services at study site

Ecosystem service criteria	Ecosystem services were recorded at the study site	Note
Providing Services (4)	1. Wood 2. Firewood 3. Seafood (fish, ba khia, clam, shrimp) 4. Water for aquaculture	- Timber: More than 10 years ago, people lived in Thanh Phu used timber to build houses, however, now, the government prohibits them, they cannot cut the trees and they also use solid houses, however, there are still a few households living in the core zone of the NR that still need to take wood for house construction, the government suspended the construction of the house, but they do not agree. - Firewood: Previously, people went to the mangrove forest to get firewood to cook, now they use gas, no more firewood. - Seafood: In Thanh Phu NR, people go to the forest to

Ecosystem service criteria	Ecosystem services were recorded at the study site	Note
		catch fish and Ba Khia (*Sesarma mederi)*, which is a significant source of income for a part of the people dependent on the mangrove forest. - Water supply services, according to the people in the study site, water mainly for aquaculture.
Regulating Services (5)	1. Air regulating 2. Air purification 3. The cycle of nutrition 4. Carbon sequestration and storage 5. Control of floods, breakwaters	1. "The mangroves make the climate cool, too wonderful, the green lungs, especially in the summer, coming here (mangrove forest) is too cool. 2. "Mangrove forest" the air too good, making the air fresh" 3. The crab living in the forest make the soil soft. 4. "If you have trees, you will definitely absorb carbon, but we don't know if we can store them" 5. There are mangroves that support waves very much, if there is no forest, the inner dyke cannot support the waves at sea, this service is very clear.
Support services (3)	1. Regenerate soil nutrition 2. Agricultural production support 3. Spawning grounds, food supply, and breeding animals	1. Alluvial soil and deciduous branches contribute to soil nutrient regeneration (soils in mangrove forests). 2. Thanks to mangroves that prevent waves and saltwater, people can do agriculture. 3. "The Ba Khia, fish and shrimp live in it"

In focus group discussions with local communities, and household interviews, the top ranked services are aquaculture, fishing services, agricultural production (growing rice). These services were ranked based on their household use and / or the ability to sell them in the marketplace for an economic profit. The top 8 services with detailed information on local people's usage are given in Table 3

Table 3. Ecosystem services, local community uses and ratings (Lower number indicates higher preference)

Ecosystem services	Use	Ranking	Note
Aquaculture (Supporting service)	Food serve for their family and sell it	1	131 out of 249 households interviewed in Thanh Phu NR doing aquaclture, with average income (244.73 million VND/ha). Although, in recent years, farmers have lost many shrimp crops from diseases, but aquaculture is still a main sector that brings in significant income, many households raise intensive farming, many households do extensive farming or semi-extensive farming.
Fishing (Providing Service)	Food serve for their family and sell it	2	70/249 households interviewed in Thanh Phu NR participated in fishing in the forest, they went to catch Ba Khia in the forest, earning 70,000 VND/night.
Agricultural production (supporting services)	Mainly for home and sale	3	26/249 households interviewed in Thanh Phu NR cultivates rice. In addition to agricultural production, which is rice cultivation, local people also plant a number of fruit trees of high economic value in Thanh Phu NR (Tu Quy mango, water melon, Jícama) for a significant source of income.
Flood prevention, breakwater, coastal protection (Regulating service)	Protecting people and property for people	4	This service is highly appreciated by the local people. "Without forests, it is dangerous to prevent storms and strong winds to protect people and property for the people". People often give this service a 9-10 score
Habitat for Species (Supporting Service)	Habitat support for species	5	This service was scored by people around 7 points, they said that although some species reproduce in the sea, but then they went to the mangrove forest to live and develop.

Ecosystem services	Use	Ranking	Note
Climate regulation (Regulating service)	Health support for people and disease reduction	6	"It is very cool near the forest. Especially in the summer, I love mangrove forest very much, wherever I go, I want to quickly go back to my hometown, living here, the fresh climate is familiar". This service is also given 9-10 points by people.
Water supply for aquaculture (Supporting Service)	Serve for aquaculture households, especially extensive farming households	7	Now the water source is also polluted from agriculture and other sources, so shrimp and fish also die a lot, aquaculture is no longer the same as before.

(Source: Focus group discussions and household interviews in 2020 and 2021).

People's dependence on ecosystem services

In total, there are three main livelihoods of people in the study site. Approximately 84% of the respondents participated in fishing in the mangrove forest and combined with agriculture in Thanh Phu NR, which is understood as rice cultivation (Figure 3), and fruit crops such as Tu Quy mango, watermelon and Jícama. In addition, they also plant crops for food.

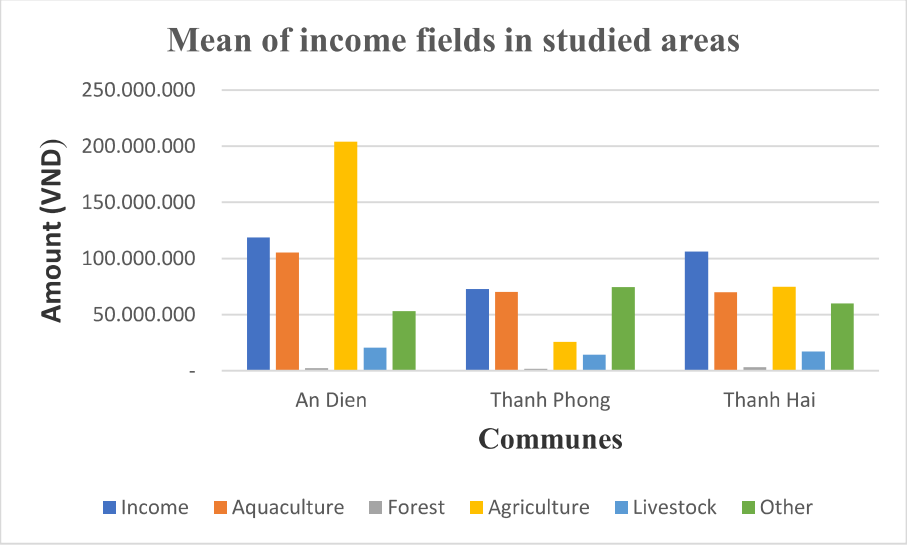

Figure 4. Average income from occupations of people in Thanh Phu NR

The average income per capita / month of the people in Thanh Phu NR is 1,700,000 VND/person/month. Summary of livelihood types associated with ecosystem services in Thanh Phu NR is described in Figure 4.

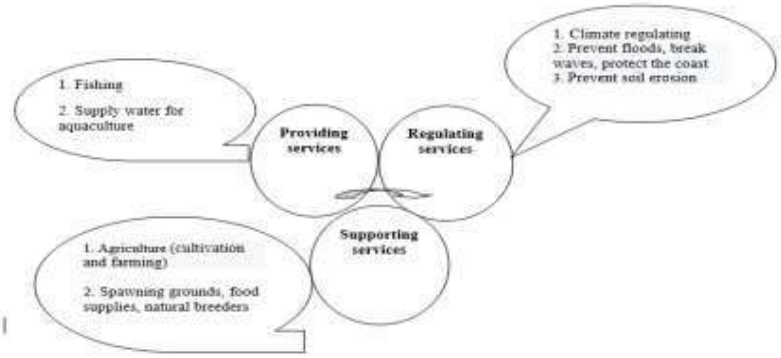

Figure 5. Types of livelihoods and their relationship with the ecosystem services of the study site

The challenges of livelihood activities on the conservation at study sites

Analysis of household surveys, group discussions and in – depth key informant interview, 5 direct drivers and 2 indirect drivers affects on ecosystem services. These forces of change are human and natural (Table 4). The reported market is the indirect driver of the change. The encroachment on forest land to expand aquaculture, the use of chemicals from agricultural production.

Table 4. Factors putting pressure on conservation in Thanh Phu NR

Factors that put pressure on conservation	Direct/ Indirect	Natural / human	Note
Market (purchasing all fish species, Ba Khia, small shrimp)	Indirect	Human	If there is a demand, there is a supply, people will catch everything they catch and sell for money
Management plan is not effective	Indirect	Human	The stakeholders have not yet had truly effective coordination activities.

Factors that put pressure on conservation	Direct/ Indirect	Natural / human	Note
Aquaculture	Direct	Human	The massive development of aquaculture, lack of planning, and lack of strict management and supervision have also lost some areas of mangroves. Not only that, the wastewater from the fins of the aquaculture lagoon has polluted the water sources of the rivers and tidal flats in the area, negatively affecting the food source of wildlife, causing the number and the quality of species has deteriorated.
Wastewater and water pollution. example: Use of pesticides in cultivation (rice)	Direct	Human	The rice farmers said that, at present, to facilitate cultivation, they use too many plant protection chemicals, pollute water sources, and affect the development of mangroves.
Lightning strikes	Direct	Nature	Much of the mangrove area died due to lightning strikes
People's dependence on forest resources	Direct	Human	The dependence of communities in and around the NR has put great pressure on the NR's resources, reducing the quantity and quality of natural resources in the area.
Overexploiting natural resources	Direct	Human	

4. Discuss and conclusion

The research team evaluated the ecosystem services of a wetland by examining the perceptions of communities based on their dependence on those services. We found 12 ecosystem services, reported to be important to the livelihoods of local people. Critical ecosystem services are identified by locals as providing services because they can be immediately profitable in cash or used. Human dependence on services provided is widely recognized, especially in developing countries, as people depend heavily on natural

resources (Van Oort et al., 2015; Bhatta et al. , 2015).

Local people are said to be heavily dependent on the ecosystem services listed, the three main livelihoods in the study from the area are derived from ecosystem services provided by wetlands, suggesting that the high contribution of wetland ecosystem services to their livelihoods. High dependence of some local communities on wetland ecosystem services has been reported elsewhere, for example in the Koshi Tappu Wildlife Sanctuary in eastern Nepal (Chaudhary and et al, 2015; ICIMOD, 2014) and Kratie province of Cambodia (Persson et al., 2010). Declining trends in the availability or provision of these services, as previously reported elsewhere (Bhatta, 2015), threaten the livelihoods of local communities. Further deterioration of ecosystem services can negatively impact the livelihoods of wetland-dependent communities as they limit alternatives for livelihood diversification. The vulnerability of wetland communities to such rapid changes in the provision of ecosystem services is a major concern elsewhere, for example, Bhatta et al. (2015), who pointed out that similarly poor communities in the mountainous regions of Nepal are too poor to adapt their livelihoods to rapid climatic changes in ecosystem service provision. It is worth noting that the factors that cause climate change, climate change in mountainous communities and poor management and overuse of resources in wetlands are completely different. However, poor people are often less able to adapt to their livelihoods in the face of such changes leading to similar results. When interviewing people in Thanh Phu NR, some households said that if they relocate their livelihoods out of the core zone of the NR, they will not go unless the government creates new livelihoods for them, for many generations. They are used to living clinging to work near the forest.

In the assignment of forest protection contracts in Thanh Phu NR, they do not even remember how much money they received per year because that amount was too small, in contrast, they used 3/7 (3 parts of the surface area water, 7 parts of the forest) for extensive aquaculture, fishing (Ba Khia, fish) in the forest area they manage, however, leaves and branches of the forest fall and pollute the water, making it difficult for them to cultivate, their desire to increase the rate of cultured water surface to 4/6 or 5/5. In fact, forest violations at the study site in recent years have decreased significantly, only a few cases of deforestation have been handled, partly because of increased awareness of the people, partly because " there is not much to get in the forest ".

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