



# Land-use change and socio-ecological drivers of wetland conversion in Ha Tien Plain, Mekong Delta, Vietnam



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## ABSTRACT

The loss and degradation of wetlands in the Mekong Delta has been caused by a combination of human activities (social systems) and natural events (ecological systems). However, the complexity and interaction of these socio-ecological factors are poorly understood. This study provides a better understanding of the complex social-ecological factors affecting land-cover change in the Phu My Lepironia grassland conservation area, part of Kien Giang Biosphere Reserve, Vietnam. A systems thinking approach was used to determine the interaction between the social system and land-use and land-cover changes. Results indicate that ensuring food supply and improving income are the key endogenous drivers of wetland degradation in the study area. Over-exploitation of wetland resources and inappropriate agricultural practices are accelerating wetland conversion and degradation. The conflict and unclear land tenure, coupled with a desire for higher income, has driven the community to convert and reclaim large parts of the wetland. This process is also driven exogenously by wetland access and the fluctuation of commodity prices, which in-turn results in transition from traditional to extensive cropping systems and expansion of cultivated land into the protected wetland. The relationship between people and wetlands must be central to the development of wetland policies and wetland management approaches. This will improve how land use policy supports sustainable sources of food and income for the local community and concurrently reduce pressures on wetland degradation. Any efforts made to protect the remnant wetland grassland and its diverse ecosystem by regulation should be supplemented by developing and sustaining the relationship between social systems and ecological systems.

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## 1. Introduction

Wetlands are exceptionally important to many rare and endangered wildlife species. They are also important to people, but many wetlands are now so degraded that the communities who rely directly on them for their livelihoods have become more vulnerable to, or have fallen deeper into, poverty. The link between conservation and poverty reduction is a very broad and complex topic (Agrawal and Redford, 2006). Biodiversity conservation scientists are often faced with a dilemma because early management approaches have been ineffective due to the incomplete understanding of the complexity of this relationship (Agrawal and Redford, 2006). Some argue that it is a “double-edged sword”,

because poverty is either an obstacle to conservation (Sanderson and Redford, 2003; Kiss, 2004; Sanderson and Redford, 2004; Terborgh, 2004; Oates, 2006; Salafsky, 2011) or conservation fails to reduce the poverty of the wetland dependent communities (Roe and Elliott, 2004; Sandker et al., 2009; Romero et al., 2012).

According to Adams et al. (2004), poverty reduction and associated livelihood security of resource-dependent populations and biodiversity conservation are two distinct objectives, and different societal goals. However, the two have common drivers (Roe et al., 2013) and in a particular context they may interact in a mutually supportive or conflicting way (Walpole and Wilder, 2008). Several recent publications reveal a link between biodiversity and livelihoods, and between conservation and poverty reduction (Sunderland et al., 2007; Roe, 2008; Miller et al., 2011). These linkages are dynamic (Billé, 2006) and locally specific (Kepe et al., 2004; Sanderson and Redford, 2004) and they can rarely be resolved using simple cause-and-effect analyses (Billé et al., 2012). Additionally, conservation and poverty are related to both ecosys-

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tems and human social systems, many parts of which are highly interconnected and interdependent (Morse et al., 2013).

Although there has been increasing interest in trying to link the livelihoods of people living near natural resources to the conservation of those resources, there has been little attempt to systematically assess or measure this linkage (Salafsky and Wollenberg, 2000). Thus, complementary approaches and methods are required, including those addressing causal links and feedback loops between independent and dependent variables and how these interactions are reflected in the patterns of behavior among people and institutions and resources (Sterman, 2000; Folke, 2006; Liu et al., 2007).

This empirical study explores and describe the interactions and feedback relationships between the livelihood activities of local communities and the threats from change in land use and land cover of grassland wetland ecosystems within the “Phu My *Lepironia* grassland conservation and sustainable use” area (hereafter referred as the Phu My project – PMP established in 2004). The study also analyses the feedback relationships between the livelihood activities of local communities to determine the drivers of wetland grassland degradation and discusses feasible policy interventions. This is the first study using a systems thinking approach to explore and describe the socio-ecological drivers of wetland conversion influencing the biodiversity conservation, based on which recommendation could be proposed.

## 2. Research method

### 2.1. Study area

#### 2.1.1. The Phu my grassland

The study area is part of Kien Giang Biosphere Reserve, Vietnam, which was recognized by UNESCO in 2006. The Phu My grassland is the last remnant of wetland area which features seasonally inundated grassland in the Mekong Delta (MD) that supports a high diversity of flora and a rich avifauna. Buckton et al. (1999, p.10) stated that “the Mekong Delta seasonally inundated grasslands provide habitat for globally threatened birds, including Bengal Florican *Houbaropsis bengalensis* and White-shouldered Ibis *Pseudibis davisoni*. The habitat also supports at least 60% of the population of the eastern subspecies of Sarus Crane *Grus Antigone sharpii* in the dry season. These grasslands also contain unique vegetation communities, some of which are not likely to be found elsewhere in Indochina”. Unfortunately, the Mekong Delta’s remaining natural wetlands are also under pressure of land conversion and encroachment, particularly from large-scale commercial agriculture and land concessions. This occurs as a result of poor planning and management, and conflict between wetland resource users and government management conservation and protection plans (Triet and Caines, 2007).

#### 2.1.2. The community

The Phu My Project is located in the north-western section of the Ha Tien Plain (HTP), was once considered to be the last remaining extensive wetland area of seasonally inundated grassland in the Mekong Delta, supporting a high diversity in flora and a rich avifauna. Prior to the 1990s, the status of the delta’s biodiversity was both poorly known and documented. Land-use planners in both provincial and central governments lacked sufficient information on which to base important, and often irreversible, decisions (Triet and Caines, 2007). In addition, under Article 11 of the *Land Law* (1993), grasslands are frequently deemed to be “not-in-use” and therefore seen as “wasteland”. In the Mekong Delta, these areas have been designated to be converted into forest plantations and for the use of agriculture and aquaculture in order to increase the economic value of the region and improve the living standard of the

local people (Decision 773/TTg of the Prime Minister 1994). This has caused the Ha Tien Plain to be the testing ground for several failed economic development projects which include the 22,000 ha of abandoned Eucalyptus plantation, low yielding rice projects and large but inefficient shrimp pond projects (Triet, 2010; p.1). These projects failed to alleviate long-term poverty in the region while simultaneously destroying the most unique and rich biodiversity wetland in the Mekong Delta. Although many efforts have been already undertaken to enhance wetland conservation and management, the establishment of protected areas in Vietnam has for a long time favoured forested land (e.g. mangroves or *Melaleuca* stands), whereas non-forested wetlands, such as the seasonally inundated grassland in the Ha Tien Plain, have been neglected.

#### 2.1.3. The Phu my *Lepironia* wetland conservation project

The entire wetlands in the boundary of the Phu My Project, including the *Lepironia* grassland, play a central role in the culture of local Khmer communities whose livelihoods and incomes are predominantly dependent on harvesting *Lepironia* grass (for making traditional handicraft products) and rice cultivation (Table 1). These two main livelihood activities were subjected to change depending on the rice yield and *Lepironia* grass and mat price. Fishing and collection of fuelwood bring additional incomes for the locals (Buckton et al., 1999; Triet, 2010; Triet et al., 2015). This dependency by the largely low income community has caused an over-exploitation of resources and resulted in declining grass communities and unsustainable livelihoods (Triet et al., 2015). Le (2007) reported that the *Lepironia* grass harvest from 2004 to 2006 by the locals has exponentially increased (from 2382 to 3521 tons) while the estimation of natural supply *Lepironia* grass in the project area was of 6839 tons. In order to meet the growing demand of local communities, the author also suggested implementing plan of restoration *Lepironia* grass from the degraded grassland and the fallow land from failure of rice farming. However, the Khmer community – who rely heavily on the wetland grassland for daily sustenance and income – have limited opportunities to pursue alternative livelihoods due to a lack of capital investment and understanding of farming techniques (Triet et al., 2015). Before the establishment of project, in a strategic scheme of improvement the socio-economic conditions of the local communities in Phu My village, the Kien Giang provincial government had planned to convert the wetlands into rice, shrimp farming and human settlements. However, in confronting the socio-economic issues of the local communities, in September 2004, in partnership with the Kien Giang Provincial Government, the Department of Natural Sciences in HCMC and the International Finance Corporation of the World Bank, the 2,890.5 ha Phu My *Lepironia* Wetland Conservation Project (PMP) was established, allowing the villagers to continue harvesting *Lepironia*. The villagers were trained by the project partners to harvest, process produce high quality *Lepironia* products. They were also given assistance in marketing their products to tourists and higher-value export markets. Therefore, unlike many conventional conservation methods, instead of excluding the local communities out of protected area, the Phu My project created a management strategy based on an “open-access” concept, which enabled community to continue to interact with the protected area and continue with their livelihood activities. However, a community-based management system was put in place to encourage and ensure sustainable use of natural resources. The land was split into four key functional sites (Fig. 1), each serving different purposes. One of which – the Ecological Restoration Zone (core zone) with the dominant sedge species – was strictly protected as a food source for the Sarus Crane. Natural resource exploitation in the core zone (1200 ha) was strictly prohibited. The locals are able to access the rice farms in the Agricultural Zone or Exploitation Zone for harvesting *Lepironia* grass which was allowed to remain in the project area but not be enlarged. The

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