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Participatory Wetland Conservation in Yok Don National Park, Vietnam

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Abstract

Protected areas are the 'backbone' of conservation, essential to supporting a diverse, healthy and resilient environment. They also play an important role in contributing to the culture and livelihoods of Indigenous communities, often leading to conflict between conservation and the needs of local communities. Collaborative management has been found to be an effective strategy to decrease this. However, a lack of communication and shared understanding can be an impediment to developing co-management arrangements. I examined levels of natural resource use in Indigenous communities in Yok Don National Park, Vietnam. I identified the most important cultural keystone species and examined the effectiveness of using a conceptual social-ecological modelling approach to enhance mutual understanding and the potential for more collaborative management through a case study of wetland use in the park. A semi-structured interview process with multiple choices and open-ended questions together with quantitative data, focus group discussions and a collaborative workshop were used to collect information on the views of 259 members of Indigenous communities in nine villages surrounding the park and 12 park managers. After the workshop, through semi-structured, open ended questions and semantic differential scales, the effectiveness of this modelling procedure on communication and shared understanding between Indigenous communities and park managers was evaluated. The results have elicited the patterns of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park. Types of local community users of the park could be classified as Wetland specialists, Mixed resource users, Crop-focused mixed resource users and a Low income group. These groups were divided based on group characteristics comprising the amount of income sources, the frequency of park visitation and the strategies of each group. Understanding the impact on park resources and managing resource use by villagers can be informed by this understanding of the different strategies employed by community members. This understanding provided a starting point for identifying the important wetland species which have been used by Indigenous communities. The most important cultural keystone wetland species of Indigenous communities are elephants, cogon grass, Indian mulberry, turtles, snakes, lizards, fishes, frogs, crabs, shrimps, sweet leaf, rice paddy herb and sticky adenosma. The first four most important cultural keystone species were unpacked by multiple dimensions of relationship between these cultural keystone species and Indigenous communities. The results illustrate the complexity of cultural keystone species and how people value them differently. These differences were rooted in the attributes of those animals and plants and the way they are used by people. A conceptual social-ecological systems model was developed in a workshop of community representatives and managers to gain an understanding of the social and environmental relationship between Indigenous communities and the protected area. The accuracy of this conceptual model was examined by developing individual conceptual social-ecological systems models for the most important cultural

keystone species. After the workshop all participants from the communities reported an increased awareness of the importance of wetland resources and the need to maintain these, as well as a better understanding of the functions of important species in terms of their conservation. Managers reported their understanding of local people's desires to ensure local livelihoods through investment in cultivation, planting perennial plants and breeding some species around their villages. They saw a role for the park management through employing local people as guides and providing permission, funding, training and source animals for rearing and breeding instead of concentrating just on the management and conservation of the forest. All representatives from the Indigenous communities felt more comfortable initiating discussion with park managers, who had previously been reluctant to share their knowledge. Identifying potential areas where collaborative management might be improved will allow managers and local communities to move toward negotiations for more formal collaborative management agreements.

Declaration by author

This thesis *is composed of my original work, and contains* no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

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Contributions by others to the thesis

Overall intellectual guidance of this thesis was provided by Prof Marc Hockings (University of Queensland), Dr Catherine Robinson (CSIRO) and Dr Rebecca Laws (CSIRO) and edited by Ms Judith Millington.

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In memory of my Grandparents, Ông Bà Nội và Ông Bà Ngoại.

You are really missed and will never be forgotten!

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Chapter 1 INTRODUCTION

This dissertation aims to contribute to the field of protected area management. It does this by examining levels of natural resource use of Indigenous communities living in and adjacent to a protected area to identify different strategies in relation to resource use being employed by Indigenous communities for managing protected areas at a local level. It also examines the effectiveness of a conceptual social-ecological systems model in increasing understanding and expanding opportunities for collaboration amongst park managers and Indigenous communities.

1.1 Interactions between protected areas and local and Indigenous communities

Protected areas play a key role in conserving biodiversity and in ensuring diverse and resilient environments for current and future generations (Cumming et al., 2015). Protected areas management models vary from strict nature reserves with limited local community visitation and no harvesting of fauna or flora to protected areas with sustainable use of natural resources that explicitly allow sustainable harvesting by local and Indigenous communities (Dudley, 2008). The perception of protected areas as ecological islands is no longer feasible (Janzen, 1983). Instead, there is increased understanding of the protected areas which influence regional processes in the arrangement of ecological communities and the dynamics of their spatial and temporal population; the intricate influences, politically and economically, that support the formation and maintenance of protected area; the function of protected areas as the source of benefits both for the local communities and the society in a wider sense of context; as well as the potential costs, including opportunity costs, that could be incurred for protected areas (Cumming et al., 2015). Therefore, protected areas have been considered as social-ecological systems that respond to as well as affect a wide range of social, political and ecological processes (Liu et al., 2007).

The effectiveness of protected areas is often threatened by the increasing land use in surrounding areas, segregating the protected areas and causing their ecological function to be damaged in direct and indirect ways (Hansen and DeFries, 2007). Some of these challenges lie in the reality that protected areas lie on Indigenous people's traditional estates and Indigenous people wish to continue to use resources to sustain their livelihoods and exercise their human and Indigenous rights to make decisions on how these areas are managed (Roe et al., 2013, Walker et al., 2013, Zander et al., 2014). Protected areas can be damaged directly by the increase in timber extraction, hunting and land clearing for agricultural purposes which can impact negatively on wildlife populations (Brashares et al., 2001, Fritz et al., 2003, Metzger et al., 2010, Estes et al., 2012). The massive reduction of wildlife habitat by the global trend of conserving the natural ecosystems into areas for

human use has led into “extinction crises” (Hoekstra et al., 2005). As the wildlife and their habitats disappear, the involved life-sustaining ecosystem services such as the availability of medicinal plants, pest and disease controls, and clean water and air supply experience a decline (De Groot et al., 2002). The loss of wildlife and their habitats reduces the quality of life for humans due to the high value placed on maintaining nature in many peoples’ points of view (e.g. aesthetic, cultural, religious, economic, educational (Manfredo et al., 2009, Carter et al., 2012). The change in land use around the protected areas can also cause indirect damage that can change the wider ecosystem (Hansen and DeFries, 2007). This has led to conflicts between biodiversity conservation and the needs and demands of local and Indigenous communities and the conflicts are predicted to increase (Joppa et al., 2008, McDonald et al., 2008). The interactions between people and wildlife have been studied with increasing focus on the social and the ecological dimensions of Indigenous-protected areas interactions and systems (Constantino et al., 2008, Fitzsimons et al., 2012, Robinson and Wallington, 2012). Therefore, there have been multi-faceted approaches to addressing local and Indigenous communities and protected area related issues.

1.2 Management and governance strategies affecting Indigenous people in protected areas

Some active management strategies are employed to mitigate the impacts of local and Indigenous people using natural resources from, or residing within, the protected areas; as well as building co-operation and improve livelihoods and improving sustainable use.

1.2.1 Preventing or limiting local impacts

The use of buffer zones is aimed at the sustainable use of natural resources achieved through using traditional activities that can improve not only the Indigenous communities’ livelihoods by supplying income from natural resources but also protected areas by reducing poaching and local opposition (Songorwa, 1999, Nelson et al., 2007). However, the difficulties of buffer zone programs include the fact that the Indigenous communities have inadequate empowerment for decision making and there is a lack of transparency and benefit-sharing systems (Budhathoki, 2004).

The law enforcement strategy used to prevent the breaking of government-established rules on natural resources management is punishment in the form of fines (Gibson et al., 2005), however this has been found to have considerable negative impacts on rural livelihoods (Kaimowitz, 2003). The rule enforcement strategy incorporates anti-poaching activities which prevent the removal or destruction of assets within protected areas through vigilance and turning rule breakers over to law enforcement (Knapp et al., 2010).

1.2.2 Building co-operation

Co-management is based on sustainable principles and traditional knowledge, and uses economic incentives and developing rights to encourage sustainable use of protected areas (Hill et al., 2015). Collaborative or cooperative management involves the interaction between the government and civil society. While there is no single appropriate definition of co-management, co-management can be understood as "a partnership in which government agencies, Indigenous communities and resource users, NGOs and other stakeholders share ... the authority and responsibility for the management of a specific territory or a set of resources" (IUCN, 1996). Indeed, countries such as the United States, Canada, Australia and New Zealand have codified co-management as a formalised management strategy in various Indigenous lands and resource rights cases (Armitage et al., 2010). Protected areas that are co-managed with Indigenous communities highlight the richness and complexity of conservation within a social-ecological system (Plummer and Armitage, 2007). Indigenous co-management has emerged as a popular approach to protected area governance, particularly for enabling Indigenous communities to participate in environmental management decisions. Different aspects of collaborative management comprise power sharing, institution building, trust and social capital, process for sharing management rights and responsibilities, problem solving and governance (Berkes, 2009). Co-management regimes are now diverse across the globe but are all focused on the relationship between Indigenous communities and conservation agencies which seek to reconcile the conservation system of the state with community efforts to promote recognition of their rights to use, manage and sustain ecosystems using their own governance system (Hill et al., 2012).

Participation approaches to natural resource management have emerged as an effective strategy in which compensate conservation payments and encourage local and Indigenous communities in conservation integration (Archabald and Naughton-Treves, 2001, Scherl, 2004) through coordinating their actions and management strategies with conservation goals (Borrini-Feyerabend, 1999, Hulme and Murphree, 2001, Scherl, 2004) in order to achieve win-win outcomes in environmental management and economic development (Benjaminsen and Svarstad, 2010). However, the success of participatory approaches depends on the level of involvement and the scale of benefits accumulated (Child, 2003), protected area goals, management strategies and missions (Mannigel, 2008) and the features of protected areas in which managers can harmonise biodiversity conservation objectives and social and economic issues (Andrade and Rhodes, 2012).

1.2.3 Improving livelihoods and promoting sustainable use

Integrated Conservation and Development Projects aim to reduce external threat to parks through developing sustainability in surrounding areas. This strategy goes beyond the conflict between development and the objectives of biodiversity conservation (Brooks, 2010) by flexibly controlling the local community demands and biodiversity conservation achievements (Kellert et al., 2000, Salafsky and Wollenberg, 2000, MacKinnon and Wardojo, 2001, Berkes, 2004). In practice, programs that integrate stakeholders at all levels and the combination between conservation and national and regional development are key aspects of Integrated Conservation and Development Projects (Batisse, 2001, Mackinnon, 2001, Brechin et al., 2002, Wells and McShane, 2004). Nevertheless, lack of sustainable use raising biodiversity conservation concerns from local people, high-level corruption and resource piracy, and designing conservation projects by using an inappropriate model are three main weaknesses that make this strategy often ineffective in park management (Schaik and Rijksen, 2002).

Multiple-use forest management is defined by Nix (2012) as "the management of land or forest for more than one purpose, such as wood production, water quality, wildlife, recreation, aesthetics or clean air". It is "a concept of forest management that combines two or more objectives, such as production of wood or wood-derivative products, forage and browse for domestic livestock, proper environmental conditions for wildlife, landscape effects, protection against floods and erosion, recreation, and protection of water supplies". The benefits of multiple-use forest management are fivefold: 1) diversifying natural resource use, 2) developing forest productivity, 3) supplying incentives for forest maintenance, 3) integrating stakeholders in obtaining natural resource benefits, 5) contributing opportunities for diminishing social conflicts and forest resource degradation (Sabogal et al., 2013). However, during implementing multiple-use forest management, constraints were identified in countries that have inappropriate legislation, lack natural resource use and profitability (Sabogal et al., 2013).

1.3 Understanding the social-ecological systems and the interactions between the social-ecological systems and Indigenous communities

There is now growing recognition that protected areas are complex social-ecological systems comprised of ecological, social and economic factors and the interactions between them (Liu et al., 2007) instead of being considered as entirely ecological islands (Janzen, 1983). A social-ecological system consists of all of the social and ecological components of a particular geographical area, including social actors and institutions (Schluter et al., 2012). Humans play a key role in

constructing protected areas in which institutions are for accomplishing natural and social objectives. However, because human activities in protected areas are still limited, recognitions of natural, ecological, cultural values of societal actors are needed (Cumming et al., 2015). The concept of social-ecological systems helps manage protected areas because it brings ecological and social sciences to understand the complex social-ecological systems (Turner et al., 2003, Walker et al., 2004, Liu et al., 2007, Ostrom, 2009) in order to mitigate the conflicts between the social and ecological components (Schluter et al., 2012) and to better understand processes influencing the sustainability of protected areas and integrate managers, local communities, other stakeholders and related institutions together (Cumming et al., 2015). The approach of social-ecological systems has led to a wide range of focus such as resilience (Resilience Alliance, 2007a, Resilience Alliance, 2007b), robustness (Anderies et al., 2004), vulnerability (Turner et al., 2003, Adger, 2006), and sustainability science (Kates et al., 2001) for better understanding the dynamics of protected areas. A social-ecological systems approach is useful for understanding the relationships between humans and nature in which accounting for patterns and processes, identifying key interactions and feedbacks and understanding cross-scale between local communities and wildlife are key factors (Carter et al., 2014).

There have been several case studies that have showcased how social-ecological models can be used for assisting in management issues. For example, social-ecological systems models have been applied to oil palm expansion in Indonesia (Sandker et al., 2007). The government officials of Malinau district supported the building of a system of dynamic modelling in order to harmonise two main issues: the development of the Indonesian economy and the conservation of primary forest ecosystems. Consequently, the understanding of these issues was included and the modelling also provided a framework for the debate and decision-making to take place. Also, the condition of livelihoods in the district and how different lands are used can be found through the data in the model (Collier et al., 2011).

Similarly in Cameroon a scoping model was constructed in order to appraise how governance, conservation and livelihoods interacted and to find a positive solution for both biodiversity and livelihood outcomes (Sandker et al., 2009). Yet, despite its importance in terms of determining policies and funding allocations in the landscape, changes cannot be attributed exclusively to the modelling because it is just one facet of a rich set of processes. Still, the modelling is indispensable to decision-makers in terms of their awareness and engagement with it (Collier et al., 2011) .

In Ethiopia, the trade-off between biodiversity conservation and enhancement of Indigenous communities' livelihoods was investigated using participatory modelling (Kassa et al., 2009). During the modelling process, the importance of the role of shared management of Chilimo forest between Ethiopian authorities and the Indigenous communities was identified and Indigenous communities played an active part in decision-making.

All three of the case studies were in developing countries that have uncertain institutional systems and ineffective governments. The use of the models proved to be not only a strategic method for improving both conservation and development but the models also provided guidance for policy. In addition, the essential role of different stakeholder groups was identified and the stakeholders were able to better understand trade-offs and feasible benefits. In the case study in Indonesia, power is not shared between the government and Indigenous communities, and the former controls all the decision-making process (Collier et al., 2011) and the participation of the Indigenous communities in making decisions was not evaluated completely (Boedhihartono et al., 2007).

However, it is impossible to model everything so the choice of what to include is critical. One of the ways that social and ecological information can be linked and examined for ecosystem conservation and restoration is through using cultural keystone species. Cultural keystone species can be defined as "the culturally salient species that shape in a major way the cultural identity of a people, as reflected in the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices" (Garibaldi and Turner, 2004). Cultural keystone species can be used as a lens to understand the cultural dimensions of the social-ecological system (Berkes, 2002, Garibaldi and Turner, 2004) and to build consensus between different knowledge systems and values held by partners in protected areas (Hill et al., 2010, Robinson et al., 2014). The cultural keystone species play an integral role in the ethnosphere as they are implicit in understanding conservation and restoration of social and ecological system. The consideration of impacts of economic and environmental change on local and Indigenous communities is the major concept of cultural keystone species (Garibaldi and Turner, 2004).

The cultural keystone model has four contributions to conservation and restoration efforts (Garibaldi and Turner, 2004), including (1) the complex relationships of cultural keystone species to each other and to other species are identified and appreciated based on the approach of cultural keystone species, (2) a starting point for identification and analysis of cultural keystone species may be supported for further research on environment change and community resilience, (3) the way

cultural keystone species interact with other species may achieve a better understanding and (4) a partnership between researchers and Indigenous communities may be gained.

Cultural keystone species have been applied in many case studies to unpack the attributes of species in order to understand the reasons why these species have value to Indigenous communities. One case study has looked at the relationship between culture and species and their habitat in terms of the nature of those species and whether they are invasive species (Nuñez and Simberloff, 2005) or are species of conservation value or cultural value (Garibaldi, 2009). More recently, attention has been paid to the complexity of culture, and a wide range of different services that species and their habitats provide to Indigenous communities instead of a "single biological species" (Platten and Henfrey, 2009). Cultural keystone species also play a key role in triggering adaptive, cross-cultural and cross-scale resource governance by integrating Indigenous knowledge and science and management knowledge (Butler et al., 2012).

1.4 Overview of case-study – Conservation issues in Vietnam

The World Bank recognised Vietnam in 2005 as one of most biologically diverse countries in the world (World Bank, 2005). National parks and nature reserves are two types of protected areas in Vietnam that are strictly protected and managed in a top-down fashion. At the national level, the State has prohibited unsanctioned new settlements within protected areas through legislation (Phan, 2007). People who already live within strictly protected areas must ensure the success of conservation while still maintaining economic and social development for themselves. At the local level, the land always belongs to the State to be administered by the managers, and Indigenous communities are under the administrative management of local government. Thus, relevant policies need to be re-interpreted by the protected areas' managers to suit local conditions.

Collaborative management in Vietnam is actually administrative collaborative management in which property rights of natural resources belong to the State and local communities rights to use the resources are still limited (KimDung et al., 2013). Administrative collaborative management is based on a forestry land contract between local communities and a park management agency in which local community members are employed by the managers to patrol for protecting the forest (Government of Vietnam, 2010b). While the strength of this collaborative management is not as strong as other areas around the world such as United States, Canada, Australia and New Zealand, there are some important opportunities for local communities in Vietnam to influence park decisions.

1.5 Overall research aim

My research will examine levels of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park to identify different strategies in relation to resource use being employed by Indigenous communities for managing protected areas at a local level. It will also examine the effectiveness of a conceptual social-ecological model in increasing understanding and expanding opportunities for collaboration amongst stakeholders.

1.6 Study site: Yok Don National Park

1.6.1 Overall

Yok Don National Park is a complex system with both high conservation and social values. Spanning two provinces including Dak Lak and Dak Nong in the central highland of Vietnam, the buffer zone of Yok Don National Park also encompasses seven communes (Ea Bung, Cu M'Lan, Krong Na, Ea Huar, Ea Wer, Ea Po and Dak Wil) with a total area of approximately 134,000 ha.

Yok Don National Park contains the largest area of dry-Dipterocarp forest in Vietnam (113,000 hectares), representing over two-thirds of this type of forest under protection in Vietnam. The distinct deciduous forest habitat of Yok Don is of global, regional, and local conservation importance because it supports substantial populations of many rare, endangered, and endemic birds most of the native birds and mammal species (Phan, 2010). The majority of natural wetland habitat patches in Yok Don are small seasonal streams that contract to small pools and scattered stagnant standing waterholes up to a few hectares in size, during the dry season. These scattered wetlands also play an important role in contributing to the necessary water and food sources of local tribal people (mainly Ede, Laos, M'nong). Up to 42,000 people (approximately 23,000 working-age people) reside in the buffer zone of the park and some households from specific communities are able to enter the park to collect plants and animals under the system of resource management agreements between park managers and Indigenous communities. It is common local knowledge that some community members overexploit the ecological system through hunting, fishing, collecting non-timber forest products, grazing cattle and engaging in other unlawful activities. Their presence in the park also contributes to higher levels of disturbance, especially during the dry seasons when disturbance of wetland habitats is a major problem for large waterbirds and mammals. This disturbance not only changes the ecological characteristics of the wetland habitats but also results in disruption of animal feeding and distribution.

Many surveys encompassing minority ethnic communities in the central highlands of Vietnam have been undertaken; however, almost all of them have concentrated on community-based rehabilitation

(Erskine et al., 2003), community development (Steeman, 2003) and community-based forest management (Bao, 2005, Bao, 2006, Bao, 2007a, Bao, 2007b). In Yok Don National Park, wetland inventory studies have been performed (Nguyen, 2004, Nguyen, 2006) but the extent and nature of human uses and the impacts of Indigenous communities on the wetland ecosystem have not been investigated. Until now, there has been little detailed reliable information on the roles of wetland resources in Dipterocarp forest and no quantitative assessment of the nature or scale of human utilisation of such wetlands. The standard of living of the Indigenous communities in the core and buffer areas is still poor and is likely to continue to decline significantly. Without information on human use of the park, it is impossible to develop solutions to mitigate impacts and to share the responsibilities and benefits of conservation between national park managers and communities. Collecting and sharing this information with all of the stakeholders are therefore the first steps in improving understanding of park management and community needs and impacts.

1.6.2 Management system

Yok Don National Park is managed by centrally and locally administered agencies and the management board (Figure 1.1).

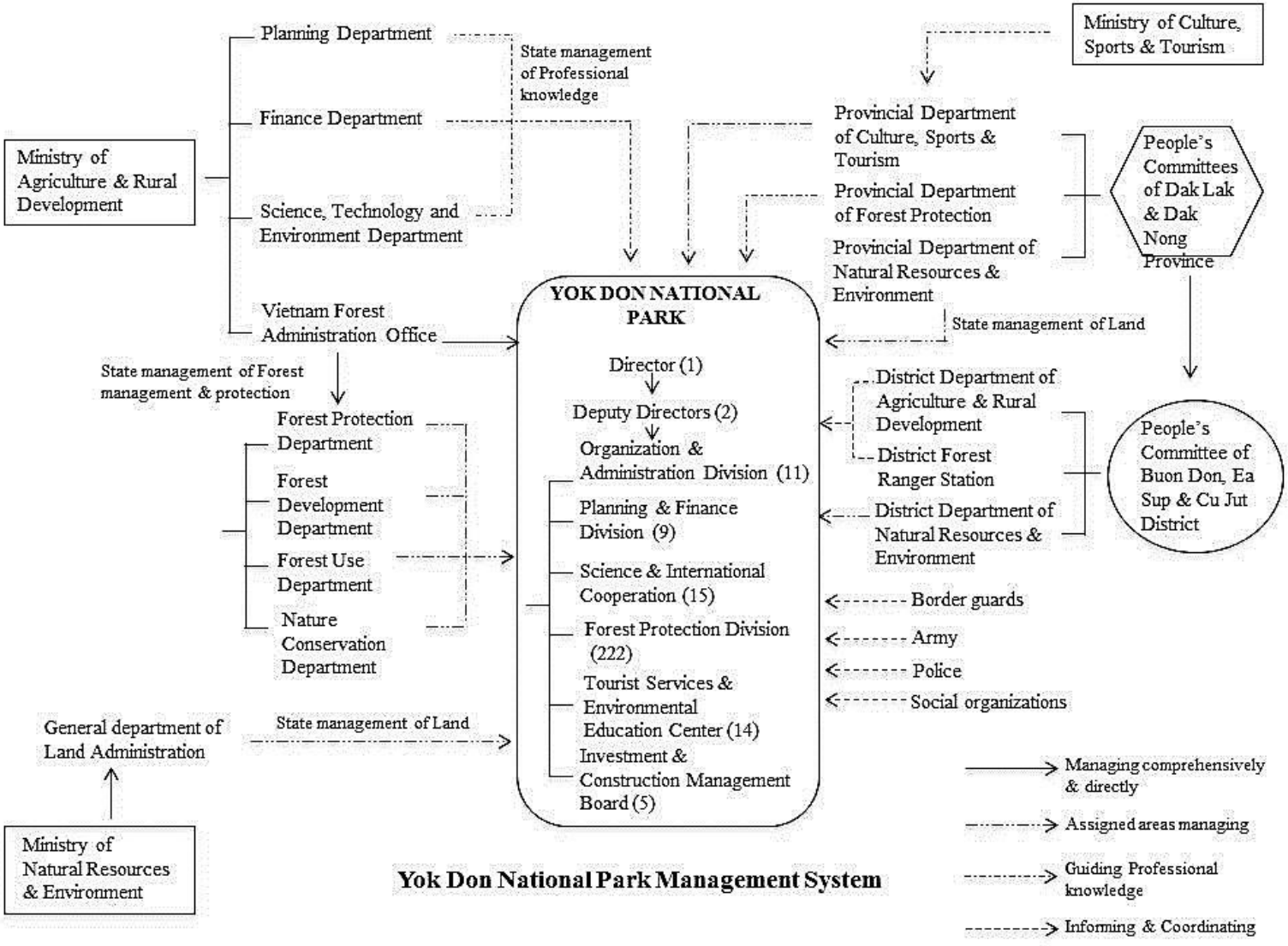

Figure 1.1 **Yok Don National Park Management System**

1.6.2.1 Centrally administered agencies

- Ministry of Agriculture and Rural Development (MARD)

MARD is a governmental agency performing state management functions in the fields of agriculture, forestry, salt production, fisheries, irrigation/water services, and rural development nationwide. One of the main responsibilities of MARD is to manage the entire special-use forest system in Vietnam. MARD has four specialised departments that assist Yok Don National Park management in their respective areas, including:

- The Planning Department, Finance Department and Science, Technology and Environment Department collaborate in order to provide professional knowledge for managing Yok Don National Park.
- The Forestry Development Department is a State level department that manages forest restoration and construction.
- Vietnam Forest Administration Office is also at the State level and has the role of State Forest management and protection. This Office has four Departments that are related to Yok Don National Park management. While the Forest Protection Department manages Yok Don National Park comprehensively and directly, three other Departments including the Forest Development Department, Forest Use Department and Nature Conservation Department contribute in managing Yok Don National Park through providing professional knowledge.

- Ministry of Natural Resources and Environment (MONRE)

MONRE is a State agency that manages land, water resources, geological and mineral resources, environment, hydrometeorology, surveying and mapping, and marine resources nationwide. The General Department of Land Administration belongs to MONRE and plays the State Land management role in managing the lands of Yok Don National Park.

1.6.2.2 Locally administered agencies

- People's Committees of Dak Lak and Dak Nong Province

People's Committees of Dak Lak and Dak Nong Province, are government agencies of the People's Councils of Dak Lak and Dak Nong Province. The People's Committees are responsible for management of all State resources including forestry. The Committee consists of two Departments related directly in managing Yok Don National Park, including

- The Provincial Department of Forest Protection which provides professional knowledge for Yok Don National Park's Forest Ranger Station in managing and protecting the Park.
- The Provincial Department of Natural Resources and Environment plays the State Land management role.

- People's Committees of Buon Don, Ea Sup and Cu Jut District

People's Committees for the People's Councils of Buon Don, Ea Sup, and Cu Jut district, are responsible for all areas of State management including forestry. This Committee consists of three Departments directly involved in managing Yok Don National Park, including

- District Department of Agriculture and Rural Development and District Forest Ranger Station which collaborate in order to inform and coordinate the management of Yok Don National Park.
- District Department of Natural Resources and Environment plays the State Land management role.

1.6.2.3 Yok Don National Park managers

Yok Don National Park managers consist of a Management Board including one Director who will report directly to the Minister of MARD and two Deputy Directors and several other divisional, centre and board staff, with the following roles.

- The director is responsible for managing and operating all activities of the park. This role includes budgeting and planning, and setting the foundation of managing biodiversity and sustainable ecotourism.

- Deputy Directors (two members) assist the Director in managing the Park programs and all the divisions, centre and board, they have an especially strong role in the Science and International Cooperation Division.

- The Organisation and Administration Division (13 members: 11 permanent staff and 2 temporary staff) assist the Director in managing the organisation and personnel, and administration.

- The Planning and Finance Division (5 members) assist the Management Board in implementing and operating the annual work schedule.

- The Science and International Cooperation Division (13 members) implements programs in silvicultural, scientific research, and undertakes monitoring and evaluation of biodiversity, human impacts, and socio-economic situations, and oversees database construction and management of Yok Don National Park.

- The Forest Ranger Station (222 members: 174 permanent staff and 48 temporary staff) belongs to the Management Board and is operated under the professional knowledge provided by the Provincial Department of Forest Protection. This Station allocates time and resources to Yok Don National Park forest management based on legal documents and current policies of the State and Ministry of Agriculture and Rural Development.

- The Tourist Services and Environmental Education Centre (14 members: 13 permanent staff and a temporary staff member) develops tourism programs for Yok Don National Park and provides services to tourists based on the regulations for special-use forests.

- The Investment and Construction Management Board (5 members) manages and plays an executive role for basic construction investments.

1.6.3 Socio-economic and cultural characteristics of Yok Don Indigenous communities

Highlands Indigenous communities including Ede, M'nong, JRai and Laos have long been settled within the area that is now the buffer zone of Yok Don National Park, while the Kinh community (the most populous community in Vietnam) and other ethnic minorities including Cham, Dao, HRe, H'mong, Kho me, Mong, Mien, Muong, Nung, San Diu, Tay and Tho are immigrants to Yok Don National Park over the past few decades. The majority of Indigenous communities who interact with and impact on Yok Don National Park live in the buffer zone of the park. The 134,000 ha buffer zone encompasses seven communes within three districts and two provinces (Figure 1.2). In this area, there are 42,907 people comprising 9494 households, living in 85 villages, with an average population density of about 32people/km^2. In addition to the people in the buffer zone, the expansion of Yok Don National Park in 2002 resulted in one village of 302 people becoming an enclave within the core area of the park (Bao et al., 2003).

The traditional Indigenous communities still retain many cultural characteristics of the Central Highland communities (Cao, 2008), including activities such as community meetings and festivals, housing structures, costumes, gongs and other cultural features. However, free migration policies adopted in Vietnam have fundamentally changed the ethnic structure of the buffer zone. Different

communities living together are increasingly common, with people in these communities having more opportunities to learn and share each other's culture and experiences.

The Vietnamese economy is undeveloped, and this is especially true for communities based in remote areas which are still largely based on self-sufficiency (Cao, 2008, Phan, 2010). Recent national programs have invested money to develop rural infrastructure and support poverty reduction and agricultural production in the buffer zone; however, transportation of goods and cultural, educational and medical exchanges with the greater district are still limited (Cao, 2008, Phan, 2010). The local markets are undeveloped and the communities are mostly self-sustaining with limited commodities bartered at commune or district markets or sold to traders.

Basic needs of the inhabitants are met by cultivating annual food crops, particularly paddy rice near Sre Pok River and other wetland areas in Yok Don National Park. Some households graze cattle freely in the park. These activities are considered legal by local law enforcement authorities but are regarded as illegal by the government. Households of ethnic highland minorities that have recently moved to Yok Don National Park usually grow commercial plant cultivars including cashew, coffee, fruit trees but on a small-non-intensive scale with low productivity. The expansion of intensive farming and focuses on commercial plant cultivars are still sporadic, unplanned, and affected by market prices. Communes vary in socio-economic situation, from poor to moderately better-off. The income of most households comes mainly from agriculture, forestry, wetland resources and livestock. These products are used for the daily needs of the family and any excess is sold at the market.

Communes in the core and buffer areas are all equipped with basic infrastructure. Provincial roads have been constructed between districts and the inter-communal road has been upgraded. An electricity system provides power for domestic and industrial use. A water reticulation system is also provided at N'Drech B village; the other villages use water mostly from wells, streams and the river. Each commune has its own health station staffed by nurses who are locals of that village. All villages have an elementary school, every commune has a junior high school and every district has a high school. Communes also have post-offices where residents can exchange information, communication and refer to documents, books and newspapers.

Overall the wetlands play an important role in Indigenous communities' lives including not only the cultural places for Indigenous communities to gather and relax but also sources of food, household goods and income. However, the extent of the people's reliance on and impact upon the wetlands has remained unquantified.

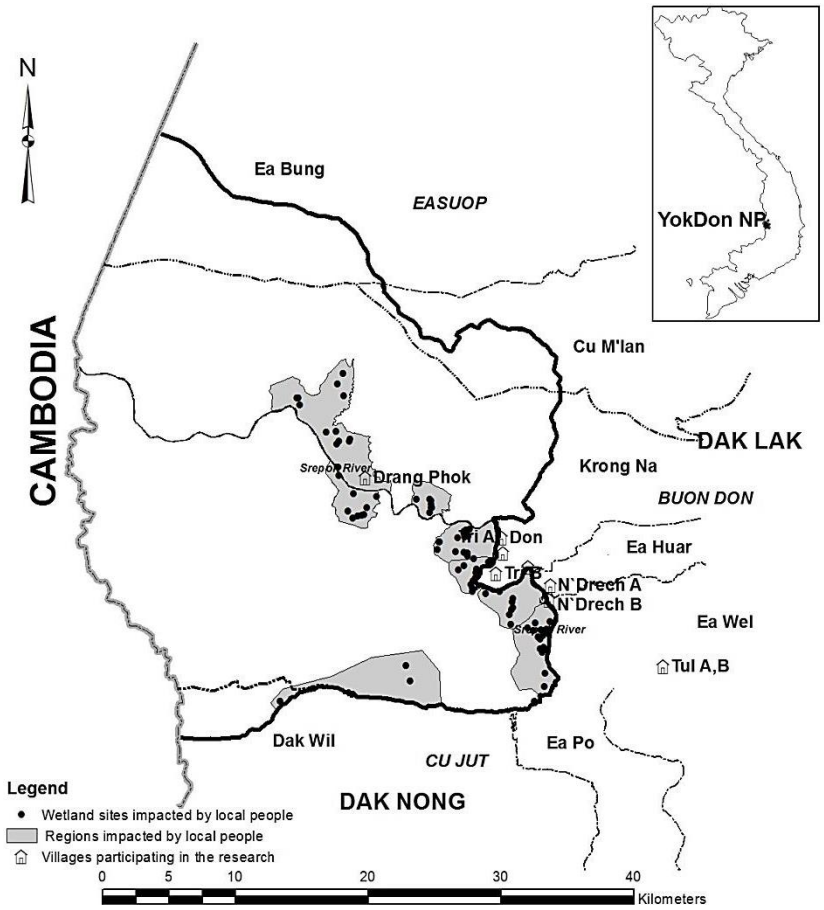

Figure 1.2 Yok Don National Park map and the locations of nine researched villages and the regions impacted by Indigenous communities in the park. The buffer zone of Yok Don National Park encompasses seven communes within three districts and two provinces: Cu M'lan and Ea Bung communes of Ea Suop district; Krong Na, Ea Huar and Ea Wer communes of Buon Don district, all within Dak Lak province; Ea Po and Dak Wil communes of Cu Jut district, all within Dak Nong province.

1.7 Research objectives and questions

1.7.1 Research objectives

The overall aim of this study is to assess the potential for improving a collaborative management strategy for managing Yok Don National Park. In assessing this potential, the benefits of enhanced and shared understanding of the social and ecological attributes and processes of the region through development of social-ecological models and the role of shared understanding will be examined.

1.7.2 Research questions

This thesis will address the following research questions:

RQ1: What are the impacts on park resources of Indigenous communities?

→ **Chapter 2: Natural resource use patterns and conservation: A case study in Yok Don National Park, Vietnam**. This chapter examines levels of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park to identify different strategies in relation to resource use being employed by Indigenous communities.

RQ2: What are the cultural keystone species of Yok Don National Park? What roles do they play in maintaining cultural identity and integrity?

→ **Chapter 3: Considering cultural values to co-manage wetland species in protected areas.** This chapter identifies cultural keystone species to show different areas of consensus and conflict that arise with each cultural keystone species.

RQ3: Does collaborative development of a conceptual social-ecological systems model for Yok Don National Park improve understanding of park management and community needs and the impacts amongst both managers and Indigenous communities?

→ **Chapter 4**: **Translating community views into conservation action**. This chapter investigates 1) whether collaborative development of a conceptual social-ecological systems model improves understanding of park management and community needs and impacts amongst both managers and Indigenous communities 2) how the extent of understanding and the recognition of each other's viewpoints, interests and needs might underpin not only a specific communication about an issue but also the relationships between managers and communities.

1.8 Methods

1.8.1 Introduction

My research in Yok Don National Park was conducted at the villages in the buffer, core zone and in the wetland ecosystem. It comprised of three main stages (Table 1.1). Firstly, the levels of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park were examined. Wetland sites inside the park and general land use in the buffer zone around the villages were determined using information provided by Indigenous residents at each chosen village. The impacts on park resources of Indigenous communities provide an understanding of different strategies in relation to resource use being employed by Indigenous communities. This step provided information required for answering research question 1 (What are the impacts on park resources of Indigenous communities?).

The second stage involved determining cultural keystone species. An index of the identified cultural influence of species adapted from Garibaldi and Turner (2004) was used to identify cultural keystone species of Yok Don National Park. This list was compared to the list ranked by selected Indigenous communities based on their villages' needs and demands. This step provided information required for answering research question 2 (What are the cultural keystone species of Yok Don National Park? What roles do they play in maintaining cultural identity and integrity?).

Finally, the overall conceptual social-ecological systems model was developed through participation of park managers and selected representatives of Indigenous communities and combined with information collected on wetland ecosystems derived from utilisations surveys, semi-structured interviews and observations. In order to evaluate how well the overall social-ecological systems model matched the detailed information about individual keystone species, conceptual social-ecological systems models for the four most important cultural keystone species were developed through observations, focus group discussions with Indigenous communities and information from modelling workshop. The shared understanding between the park managers and the Indigenous communities gained through the modelling workshop was examined to determine its influence on communication and negotiation between park management and community needs. These steps provided the information required for answering research question 3 (Does collaborative development of a conceptual social-ecological systems model for Yok Don National Park improve understanding of the park management and community needs and impacts?)

Table 1.1 **Research Methods**

Research question	**Research component**	**Methods**	**Participants**
What are impacts on park resources of Indigenous communities?	Identifying the natural resources use patterns of Indigenous communities	Qualitative semi-structured interviews with quantitative data	Indigenous communities
What are the cultural keystone species of Yok Don National Park? What roles do they play in maintaining cultural identity and integrity?	Identifying cultural keystone species	Focus group interviews Workshops	Park managers Indigenous communities
Does collaborative development of a conceptual social-ecological systems model for Yok Don National Park improve understanding of park management and community needs and impacts amongst both managers and Indigenous communities?	Developing a conceptual social-ecological systems model	Qualitative semi-structured interviews Focus group interviews Workshops	Park managers Indigenous communities

1.8.2 Data collection

There are 41,652 people living in 85 villages in the core and buffer areas of Yok Don National Park. This project included surveys at the main office of the Park, the houses of Indigenous communities and wetland sites in the park. Thirty households per village in nine key villages were chosen based on the human-use level. The households were selected randomly and the person in that household who usually uses the natural resources of the park was then interviewed. The participation of the local farmers in the research was to understand the farmers' own wetlands management practices and to determine their values and demands on the wetland for the future negotiation with park managers in terms of approaching the natural resources inside the park. Questionnaires were administered in the Vietnamese language.

1.8.2.1 *What are the impacts on park resources of Indigenous communities?*

The first stage of the project involved the production of a series of wetlands maps, each map focusing on a village and the wetlands that they were associated with. GPS and mapping techniques were used to draw a wetlands map of Yok Don National Park and surrounding land use covering the buffer zone around the villages. The map was constructed with local farmers based on the locational data from satellite images and previous studies (Nguyen, 2004, Nguyen, 2006). The use of GPS and mapping techniques is preferable to using blank maps and asking participants to draw the terrain (Kindon et al., 2007) because the Indigenous communities have a chance to observe boundaries and landmarks in a new context which may assist in the understanding of the local area (Wood, 2005). Thirty key farmers of each village discussed together and drew wetlands sites on this blank map in a focus group discussion. The location of these sites was then verified in the field with three key farmers using a handheld Global Positioning System.

When the wetlands and general land use maps at each village were completed, a focus group interview was organised at the public house or the house of the head of that village. During the interview, their activities at these wetland sites and the surrounding land use were discussed. Diversity of species and use of those species, what type and how much of the wetland products they were using were the main topics that would be examined. Thirty heads of households of every village who had knowledge about the village and the park, and had been living in that village for more than ten years were chosen prior to the interview to be participants in a focus group interview. The advantages of focus group interviews is that they are not only cost efficient in collecting data but they also contribute to data quality improvement through the interplay among participants (Patton, 2002).

1.8.2.2 What are the cultural keystone species of Yok Don National Park? What roles do they play in maintaining cultural identity and integrity?

Focus group discussions with villagers participating in the research and representatives of the Indigenous communities were organised at the villages. Thirty representatives of Indigenous communities of each village were selected based on their understanding of the park. Stakeholders were asked to quantitatively and qualitatively evaluate each species in terms of the following criteria.

- intensity, type, and multiplicity of use;
- naming and terminology in a language, including the use as seasonal or phonological indicators;
- role in narratives, ceremonies, or symbolism;
- persistence and memory of use in relation to cultural change;
- level of unique position in culture, e.g., it is difficult to replace with other available native species; and
- extent to which it provides opportunities for resource acquisition from beyond the territory

Adapted from Garibaldi and Turner (2004)

Responses for each criterion were then used to create an index value for each species. This process was comprised of three steps. Firstly, some of the most dominant species were listed by asking Indigenous communities which species they thought were indispensable to their daily lives. Asking people directly is preferable to undertaking field experiments to gauge the off take of species as it is less expensive and less time-consuming and more ethical (Garibaldi and Turner, 2004). Secondly, species were ranked based on their index value on a scale of 0 to 5, with 0 representing the answer "no, not used"; 1, "yes, although low or infrequent"; 2, "yes, low"; 3, "yes, moderate"; 4, "yes, high"; and 5, "yes, very high". Finally, the highest ranking species were identified as cultural keystone species. The production of the index value was undertaken in a similar method as used by Garibaldi and Turner (2004). During the ranking process, in-depth discussion and qualitative semi-structured interviews were used to capture Indigenous knowledge of the cultural keystone species.

1.8.2.3 Does collaborative development of a social-ecological systems model for Yok Don National Park improve understanding of park management and community needs and impacts amongst both managers and Indigenous communities?

- Developing a conceptual social-ecological systems model

A conceptual model was built to capture how biological and social systems in Yok Don National Park currently interact to capture and to examine the possibility for changes in these interactions to attain a better balance between wetland's biodiversity conservation and sustainable community livelihoods.

The model was constructed at the landscape level; development occurred in two main steps and engaged the local users throughout the process. Engaging stakeholders in the procedure of recognising key socio-ecological processes and thresholds plays an integral role in participatory modelling (Salerno et al., 2010, Whitfield et al., 2011). The first stage focused on the current understanding of the impacts and needs of Indigenous communities in Yok Don National Park by holding a workshop. The workshop was held at the park's main office between two park managers and seven selected representatives of the Indigenous communities. The current understanding of all participants about the relationship between the park's management and Indigenous communities' needs and impacts was mapped out. This step was essential to create a strong and practical stakeholder group (Collier et al., 2011). Twelve topics were provided for discussion during the workshop. First, Indigenous residents were asked to list all the flora and fauna species that are the most important and most used by them. This ranking list was then compared to the list from the village interviews adapted from Garibaldi and Turner (2004).

Second, semi-structured interviews with open-ended questions were used to determine and evaluate the roles of cultural keystone species in both ecosystems functions and processes and Indigenous communities' life (e.g. how they maintain cultural identity and integrity, the needs of community for cultural keystone species, the interactions between cultural keystone species, the ecological impacts of gathering and using of these species and the impacts of all participants on cultural species). At this stage, a model was established to construct a qualitative system design that consisted of high-level participation of stakeholder groups. This model was built, explored and refined through all the information being shared during the workshop.

- Developing social-ecological systems models for four most important cultural keystone species

Social-ecological systems models for the four most important cultural keystone species were developed for examining how well the overall conceptual social-ecological systems model matched the detailed information of individual keystone species through observations, focus group discussions with three key Indigenous communities of each village and information shared by the park managers and Indigenous communities during the modelling workshop.

- Evaluating the effect on understanding of park management and community needs amongst both managers and Indigenous communities of the development of a conceptual social-ecological systems model process

The shared understanding between two park managers and seven Indigenous residents gained through the modelling workshop was examined to determine its influence on communication and negotiation between park management and community needs. To investigate this issue, a questionnaire survey was used as a data collection tool combined with open-ended interview questions using a semi-structured and semantic differential method. Survey research not only allows the accurate step-by-step development and testing of such logical explanations but also benefits from the experience of participants (Babbie, 1990). Park managers and Indigenous communities were interviewed individually. The interview questions covered three major topics: benefits of the workshop process, learning that occurred from the workshop and likelihood of changing their initially stated intentions after the workshop.

1.9 Dissertation structure

This dissertation comprises five chapters, including this, the Introduction chapter (Figure 1.3)

Chapter 1 reviews the relationships between protected areas and Indigenous communities and their impacts on each other and the management strategies being applied. This chapter also provides an understanding of social-ecological systems and how the social-ecological systems interact with Indigenous communities and an overview of the focus for the study, Yok Don National Park, Vietnam.

Chapter 2 focuses on impacts on natural resources of Indigenous communities through examining levels of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park. This has led to the unpacking of different strategies in relation to resource use being employed by Indigenous communities through examining impacts on park resources of Indigenous communities. Details of the most important wetland species Indigenous communities have used and how they interact with these species are provided.

In Chapter 3, these most important wetland species were used to identify cultural wetland keystone species of Yok Don National Park. This understanding was used to explore the complexity of the roles these species have played for Indigenous communities and different areas of consensus and conflict that arise with each cultural keystone species.

In Chapter 4, these most important cultural keystone species were used at a modelling workshop through a collaborative effort between the representatives of park managers and Indigenous communities to develop a conceptual overall social-ecological systems model. The aim of this conceptual model was to examine whether collaborative development of a conceptual social-ecological systems model improves understanding of park management and community needs amongst both park managers and Indigenous communities. The accuracy of this conceptual model is examined by developing detailed individual conceptual social-ecological systems models for the four most important cultural keystone species. The shared understanding and the recognition of each other's viewpoints, interests and needs between park managers and Indigenous communities gained through the modelling workshop is examined to determine its influence on not only a specific communication about issues but also the relationships between managers and Indigenous communities.

Chapter 5 concludes the dissertation. A broad discussion of the research with key findings and contributions to conservation practice is presented.

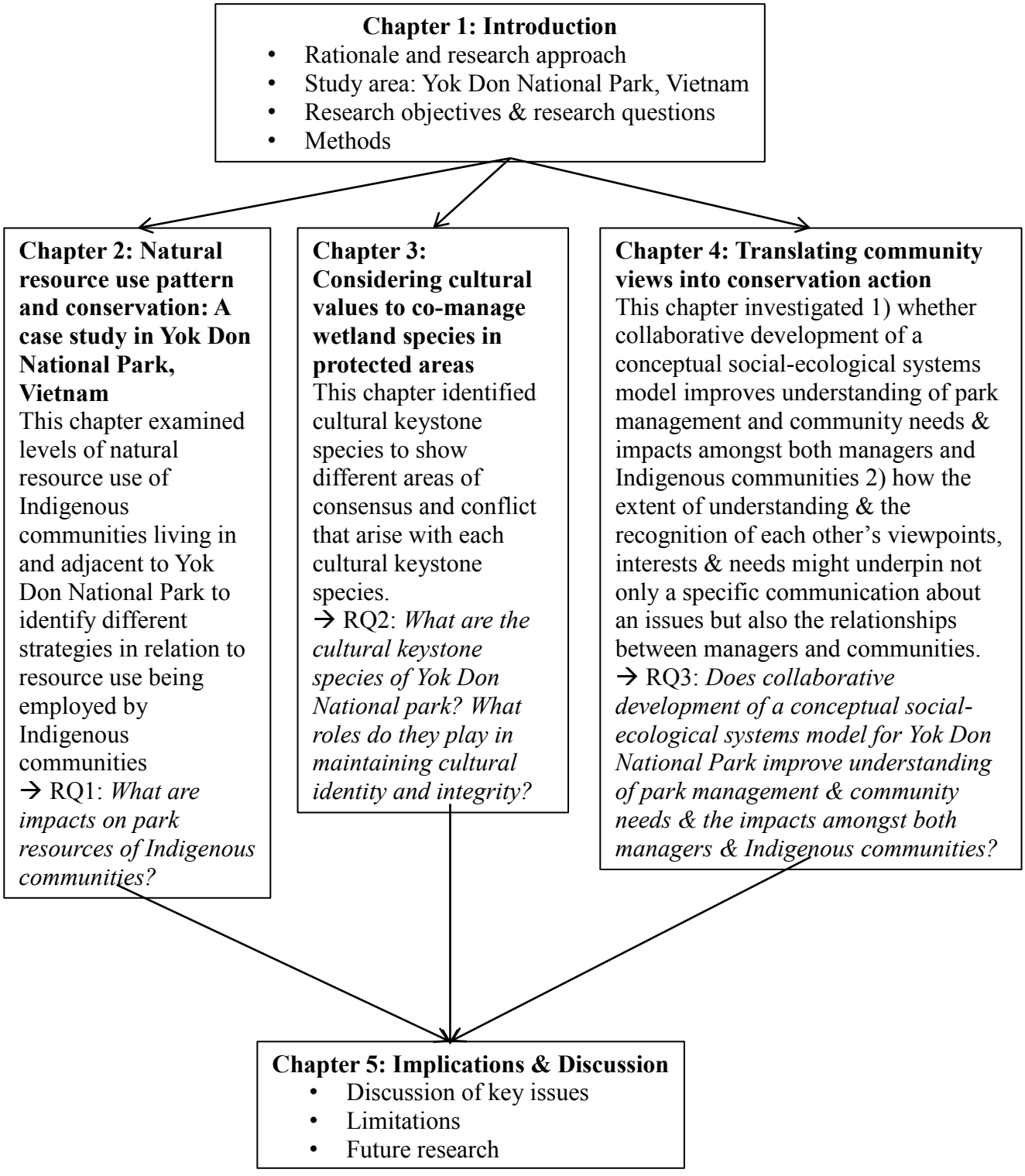

Figure 1.3 **Dissertation structure**

Chapter 2 NATURAL RESOURCE USE PATTERNS AND CONSERVATION: A CASE STUDY IN YOK DON NATIONAL PARK, VIETNAM

This chapter examines impacts of Indigenous communities living in and adjacent to Yok Don National Park in Vietnam on natural resources and identifies their current natural resource use strategies. This understanding provides a foundation for identifying the most important wetland cultural keystone species Indigenous community use.

2.1 Introduction

The conflict between conservation and the demand for natural resources has been an issue for over half a century as natural resources supply the food and income sources to support local livelihoods, especially in most developing countries (Reardon and Vosti, 1995, Reddy and Chakravarty, 1999, Cavendish, 2000, Mamo et al., 2007). The increasing demand for resources can have profound effects on protected areas, which are central to the conservation of biodiversity (Stoner et al., 2007, Gaston et al., 2008). A growing concern is that Indigenous and local community use of natural resources in protected areas has intensified to a point which poses a threat to biodiversity conservation. Threats to protected areas can be divided into two main categories; the first encompasses habitat loss and degradation as a result of conversion of forest to pastureland and agriculture while the second relates to overexploitation of natural resources including collection of non-timber forest products (NTFPs), overfishing, logging and overgrazing by livestock (Brashares et al., 2001, Fritz et al., 2003, Alers et al., 2007, Metzger et al., 2010, Estes et al., 2012).

In order to reduce the threats, the relationship between protected area conservation and natural resource use has been discussed, particularly when local and Indigenous communities rely on park natural resources for their cultural identity and livelihoods. One conservation strategy has been to find collaborative ways to enable Indigenous communities to participate in conservation management goals and decisions (Castro and Nielsen, 2001, Sah and Heinen, 2001). Another effective way that communities can play a role in natural resource conservation is to build collaborative or co-management partnerships to reduce destructive activities in protected areas (Mutoko et al., 2015). When instigating co-management, one approach has focused on the importance of incorporating into management local and traditional knowledge to improve partnerships and efforts (Freeman, 1991, Bockstael et al., 2000, Hassan, 2003, Kala, 2005, Glenday, 2006, Wunder, 2007, Ansink et al., 2008, Benhin and Hassan, 2008, McGregor et al., 2010, Hein, 2011).

In order to understand what environmental problems might arise from local community resource use, the impacts of societies and individuals, particularly the patterns of consumption need to be examined (Mee et al., 2015). Natural resources use patterns and dependence differences between Indigenous and non-Indigenous communities of two national Parks in Nepal were compared and it was found that people from the national park in which a buffer zone had been declared earlier had general resource use patterns and were more dependent on natural resources than people from the national park for which a buffer zone had not been declared (Baral and Heinen, 2007). However, there was a lack of information on resource use patterns among community groups in each park. In Biringou, Wake, Ivindo and Monts de Cristal National Parks in Gabon, West Africa, the identifications of park households and control households that did and did not use natural resources of the park was determined by comparing livelihood indicators (Foerster et al., 2011). They argued that there was a variation in forest coverage around park households and control households and park households depended more on forest resources and on the proximity to the park resources. In general, understanding the patterns of natural resource use of each group of people using the park can help park managers focus on the groups having the highest impact on the park and identify strategies to mitigate their impacts on natural resources (Senaratna Sellamuttu et al., 2011) and can be a foundation for accessing the local-level institutions governing resource use (Mitra and Mishra, 2011).

Vietnam was recognised by the World Bank in 2005 as one of most biologically diverse countries in the world (World Bank, 2005). National parks are one of the types of protected areas in Vietnam that are strictly conserved and managed in a top-down fashion. However, there is little knowledge of the impact on natural resources by Indigenous communities in Vietnam. Without this knowledge, it is impossible to develop solutions to mitigate impacts and to share the responsibilities and benefits of conservation between national park managers and communities. The objective of this study was to examine the levels of the use of natural resources by Indigenous communities living in and adjacent to Yok Don National Park, Vietnam to identify the natural resource use patterns of Indigenous communities. Understanding these patterns is a crucial step in minimising the trade-offs between conservation and natural resources use by local and Indigenous communities and creating win-win scenarios between conserving species and sustaining human populations (Crawhall, 2015).

2.2 Methods

A study of natural resource use by Indigenous communities was carried out in the Central Highland of Vietnam in the area in and around Yok Don National Park. Firstly, data on demographics, incomes, frequency of park use, activities undertaken and interactions with park managers were collected using semi-structured interviews. Then, wetland sites being impacted by Indigenous communities were drawn on maps through a focus group discussion with representatives of each selected village. Location of these sites was verified in the field with the participation of key Indigenous community members.

2.2.1 Household surveys

Surveys of 259 people in nine villages surrounding the park were undertaken between 25 November and 30 December, 2013. Based on advice from the park managers on the extent to which various villages made use of park resources, I surveyed five high use villages (all within 1km of the park), two medium use villages (3-8 km from the park) and two low use villages (more than 8km from the park) (Figure 1.2). I aimed to undertake 30 interviews (>18 years old) per village; however, I fell short of this in six villages due to Indigenous communities not having time or wishing to be involved in the study (four had 29 respondents, one had 28 respondents and one had 25 respondents). The survey was conducted in Vietnamese which all participants spoke fluently. The survey used a semi-structured approach with multiple choice and open-ended questions together with quantitative data on the amounts of various species harvested from the wetlands in order to gain an understanding of how Indigenous communities use the park's resources. The survey comprised five main parts: (1) demographic information (ethnicity, household characteristics including age, gender, education and occupation of all members of that household); (2) sources of income (annual crops, perennial plants, livestock, wetland resources, forest resources and other); (3) frequency of visiting the park; (4) activities undertaken in the park and their importance level (harvesting plants, hunting animals, grazing livestock, cultivation and spiritual practices) and (5) any amounts they had been fined for illegal activities in the park or other reprimands and punishments. Duration of each individual interview was thirty to forty minutes. Indigenous community members chose location of the interview between the main public house of that village or their houses.

2.2.2 Locating impacted wetland sites by Indigenous communities

First, thirty Indigenous participants of each village drew their most used wetland sites on blank map through a focus group discussion. This blank map was constructed based on the locational data from

satellite images. Later, Global Positioning System and mapping techniques were used to locate these wetland sites of Indigenous communities in Yok Don National Park with three key participants of each village.

2.2.3 Data analyses

- Characteristics of individuals in the ethnic minority community living in and adjacent to Yok Don National Park were used to sort them into groups based on their use patterns. The software PATN version 3.11 with Gower metric was used to group respondents based on their amount of income from annual crops, perennial plants, livestock, wetland and forest resources and other sources; park visitation frequency and importance level of natural resource products and activities. The socio-economic characteristics of members of these groups were then compared. Amount of income from different sources was calculated by taking total volume of agricultural production (household consumption and volume sold) minus investments in agriculture (seeds for planting, fertilizer, food for grazing cattle, hiring labors, preventive medicine, pesticides). The labors provided by this household were not included.
- This information was then analyzed by using Map Info software and presented in Figure 1.2. In this map, locations of nine villages participating in the research and impacted wetland sites and the regions impacted by Indigenous communities in the park were provided.

2.3 Results

Interviews with the Indigenous communities provided information on the use of natural resources and socio-economic characteristics of users. I first outline the socio-economic characteristics of individuals of nine villages, then the community natural resource use undertaken in the park is examined and finally the groups of natural resource users based on their pattern of resource use of the park are compared.

2.3.1 Socio-economics of villages participating in the research

Nine villages were chosen from three different communes of Buon Don District, Dak lak province (Table 2.1). The size of each village differed; however, there was little variation in the average number of people in a household (4-5 persons/household). The number of wetland sites impacted by Indigenous communities varied from village to village (Appendices A2.1, A2.2, A2.3, A2.4, A2.5, A2.6, and A2.7). Most villages visited from 5 to 14 wetland sites with the exception of one village inside the park which impacted on 31 wetland sites. Indigenous communities had a wide range of income from annual crops, perennial plants, livestock and other sources. Some households also

gained their income from the park including wetland resources, forest resources, cultivation and grazing livestock within park boundaries. Tri A was the only village that offered tourism opportunities which explains the high level of income from sources other than natural resource use.

Table 2.1 **Socio-economics of surveyed villages.** (DRP – Drang Phok, DON – Don, JAL – Jang Lanh, TRA – Tri A, TRB – Tri B, DRA – N'Drech A, DRB – N'Drech B, TUA – Tul A and TUB – Tul B)

Village characteristics	**DRP**	**DON**	**JAL**	**TRA**	**TRB**	**DRA**	**DRB**	**TUA**	**TUB**
Commune	Krong Na	Krong Na	Krong Na	Krong Na	Krong Na	Ea Huar	Ea Huar	Ea Wer	Ea Wer
Population	431	467	766	395	671	635	245	1135	1055
Number of households	104	137	185	80	160	172	57	232	222
Poor households	43	56	56	31	94	75	33	115	134
Ethnicity	7	9	7	5	5	4	3	3	5
Number of respondents	29	29	30	25	28	30	29	29	30
Distance to forest (km)	0	0.5	1	0.5	0.5	1	1	3.5	3.5
Distance to the closest wetland site (km)	0.7	6	2.6	2.5	0.7	1.5	1.5	5	5
Average distance to the wetland sites (km)	4	6.5	3.3	3	1.8	3	3	6.5	6.5
Distance to the furthest wetland site (km)	9	7.4	4.6	5	3	6	6	9	9
Grazing place	Park	Park	Park	Park	Park	½ Park ½Village	½ Park ½Village	Village	Village

2.3.2 Wetland sites impacted in Yok Don National Park

There were eighty-four wetland sites impacted by Indigenous community members of the nine villages participating in the research (Table 2.2). The total area of these wetland sites was over 42 hectares, accounted for 0.36% of total area of impacted regions by Indigenous communities in Yok Don National Park. These sites were small areas with the average area was only 0.07 hectares distributed around the forest. Average distance from villages to these sites was around 5 km. Most of them had their own Indigenous names. This showed that Indigenous communities have used the natural resources of these wetland sites for a long time.

Table 2.2 **Wetland sites impacted by Indigenous communities of nine villages participating in the research**

No	Villages	Wetland sites' name	Total area of wetland sites (ha)	Total area of region impacted by Indigenous communities (ha)	Percentage of total area of wetland sites compared to region impacted (%)	Distance to wetland sites (km)
1	**Drang Phok**	Nglao Tu Nam Har	0.710			9.2
2		Nglao Loc	0.690			8.6
3		Wetland site 1	0.280			7.5
4		Jang Krak 3	0.430			9.0
5		Jang Krak 2	2.030			8.4
6		Jang Krak 1	0.520			5.5
7		Rlom Bung Anang	3.980			5.3
8		Thung lung gan suoi Ket	1.620			4.5
9		Dak So 2	0.150			4.4
10		Nglao 1	0.580			2.6
11		Dak So 1	1.480			3.0
12		Orso	1.190			0.7
13		Nglao Dam 1	0.550			1.2
14		Nglao Dam 2	0.090			1.2
15		Nglao Chong	0.290			2.2
16		Nglao Kbung	0.390			2.3
17		Nglao Min	0.430			2.0
18		Tu Bom	0.320			1.9
19		Sre Tu Bum	1.350			2.6
20		Nglao Nam	0.670			4.1
21		Nao Nam	0.820			3.9
22		Sre Bom	0.080			1.8
		Total/Average	**18.650**	**4245**	**0.44**	**4.2**

23	**Don**	Wetland site 2	0.016			6.1
24		Nglao Sre Cro 1	0.208			6.1
25		Wetland site 3	0.024			6.1
26		Nglao Sre Cro 2	1.070			6.3
27		Nglao Rsam	0.274			6.4
28		Nglao Tom Creng	0.077			6.5
29		Nglao Nor	0.111			7.4
		Total/Average	**1.779**	**592**	**0.30**	**6.4**
30	**Jang Lanh**	Noong Coc Khao	0.071			2.9
31		Noang Phac Ven	0.062			3.8
32		Noong Da Le 1	0.533			2.7
33		Noong Dạ Lo 2	0.887			2.9
34		Noong Nam Sao 1	0.054			3.3
35		Noong Nam Sao 2	0.017			3.5
36		Noong Nang Phet	0.046			3.9
37		Wetland site 4	0.777			4.5
		Total/Average	**1.671**	**1088**	**0.15**	**3.4**
38	**Tri A**	Noong Do	0.185			2.4
39		Noong Den	0.160			2.9
40		Noong Ay Keo	0.204			3.1
41		Noong Me Lon	1.639			3.3
42		Noong Thom	0.041			3.3
43		Noong Po Rut	0.491			3.2
44		Noong Hin Hen	0.102			3.1
45		Noong Pho Blo	0.219			3.5
46		Noong Thong Va	0.099			4.7
47		Noong Hang	0.043			4.7
48		Noong Tjoong Tj'ch	0.189			4.7
49		Noong Lay	0.310			3.3
50		Noong Po Kne	0.067			2.7
51		Noong Me Muom	0.135			2.5
		Total/Average	**3.884**	**483**	**0.80**	**3.4**
52	Tri B	Nao Sre Jong	0.220			0.7
53		Sre Chong	0.330			0.6
54		Non Khoai Po Ngut Tai	0.140			2.2
55		Non Na/Thung Na	1.730			3.1
56		Ho Sen	0.320			2.7
57		Wetland site 5	0.690			1.4
58		Wetland site 6	0.170			1.6
59		Wetland site 7	0.180			1.8
60		Wetland site 8	0.760			2.2
61		Wetland site 9	1.260			2.5
62		Wetland site 10	1.060			2.5
63		Wetland site 11	0.610			2.7

		Total/Average	**7.470**	**1010**	**0.74**	**2.0**
64	**N'Drech A**	Nglao Dam	0.272			4.9
65		Nglao Ngol	0.265			4.8
66		Nglao Y Srom	0.662			4.2
67		Nglao Y Ngoan	0.222			4.0
68		Nglao Drech 1	0.860			3.6
69		Nglao Ndah	0.195			3.5
70		Nglao Co Kreo	0.624			3.7
71		Nglao Thang	0.186			3.1
72	**N'Drech B**	Nglao Pe	0.710			2.0
73		Nglao Kreo	0.650			3.1
74		Nglao Da	0.190			2.6
75		Nglao Drach	0.730			2.9
76		Nglao Ngo	0.210			4.2
77		Nglao Tam	0.270			4.3
78		Nglao Tang	0.190			6.8
79		Nglao Nang	0.190			5.7
		Total/Average	**6.427**	**1557**	**0.41**	**4.0**
80	Buôn Tul	Nglao Ke Phu	0.523			21.8
81	A & B	Nglao Ngar	0.298			13.3
82		Nglao Prech	0.385			12.7
83		Nglao Nong	0.296			8.2
84		Nglao Drech 2	0.939			6.3
		Total/Average	**2.441**	**2760**	**0.09**	**12.5**
Total/Average of 9 villages			**42.322**	**11736**	**0.36**	**5.1**

2.3.3 Community natural resource use undertaken in the park

Three patterns of park use were evident with the majority of people interviewed going to the park daily or at least weekly (49%), one third going to the park 1-3 times a month while 18% of Indigenous communities said that they seldom or never went to the park. Five types of use were evident: harvesting plants, hunting animals, cultivation, grazing livestock and spiritual practices (Figure 2.1). Direct gathering of natural resources (native plants and animals) was overwhelmingly the most important use of the park, followed by use of the park to support agriculture (cultivation and grazing), which was important for only a minority of people.

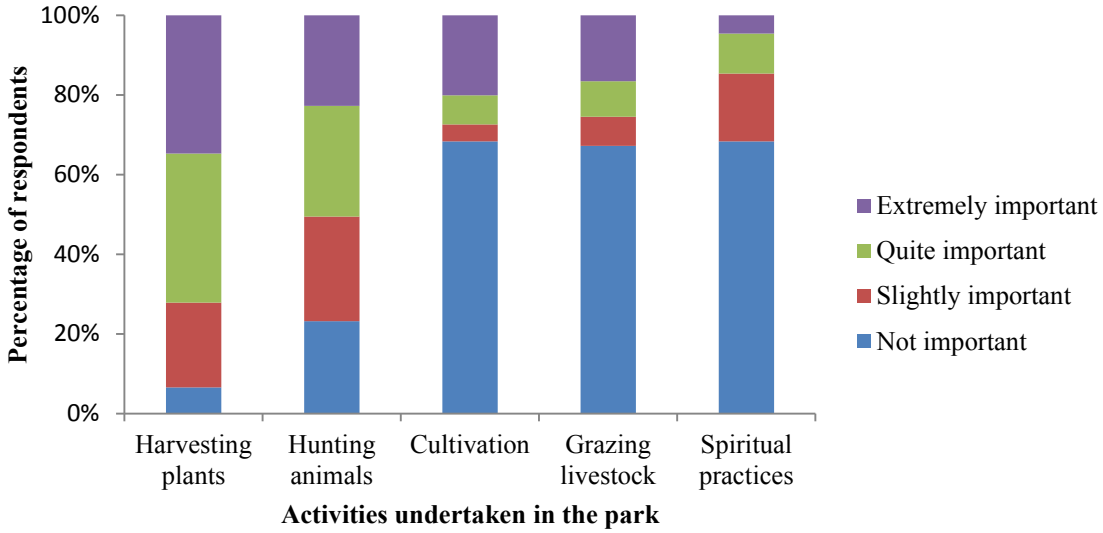

Figure 2.1 **Percentage of members of Indigenous communities reporting importance to daily life of different activities they undertake in Yok Don National Park** (N = 259)

2.3.4 Main groups of community wetland use characteristics

Dendrograms based on PATN cluster analysis were created for four, five and six groups. Based on the levels of differentiation between the groups (branch length), four groups were chosen as the most appropriate number of groups. Four groups of Indigenous communities were distinguished using cluster analysis. Relationships between individuals and groups can be seen in the dendrogram (Figure 2.2).

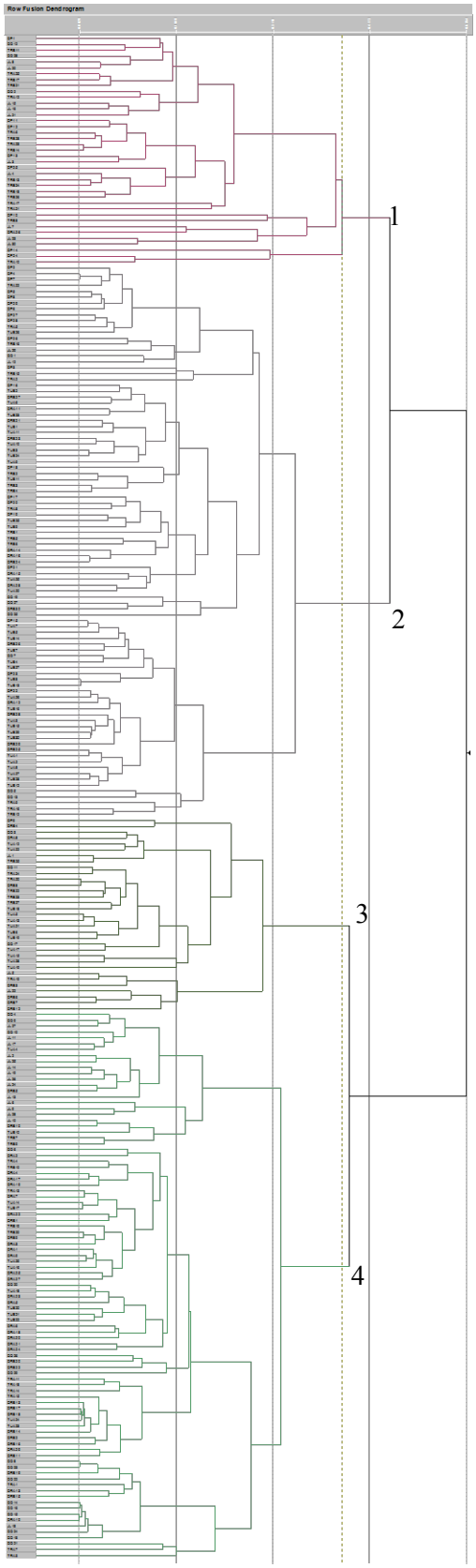

Figure 2.2 **Dendrogram classification of respondents** (Gower Metric; clustering-intensity coefficient beta = -0.10; ordination stress of 0.1446)

The income of Indigenous communities mainly came from park resources, livestock, farming, forestry contracts with park managers and income from waged or salaried jobs (Figure 2.3 and Table 2.2). The income from park resources, comprising a third of total income, was one of the most important sources of income for the Indigenous communities. Of 259 Indigenous community members participating in the research, 88% had a yearly income resulting from park use of less than $500/person in a year, 9% of Indigenous communities had an income from $501 to $1,000 and 3% of Indigenous communities had an income of over $1,000. The 3% of people with incomes over $1,000 all came from the 3 villages closest to the park. The 88% of Indigenous communities who were in the lowest income bracket had approximately the same total income derived from the park in a year as the total for the remaining 12% of Indigenous communities. Livestock was also one of the most important income sources of Indigenous communities (consisting of 32% of total income). There was a lot of variation in the amount of livestock income, with some individuals from all communities having livestock income over $500/person/year. Crop income from paddy rice, corn and cassava constituted a small proportion of income (15%) but paddy rice was the main source of daily food for the Indigenous communities. Only five households from the two furthest villages had a crop income over $500/person/year and their strategy was to focus on growing corn and cassava instead of paddy rice. Income from forestry contracts and perennial plants accounted for a small amount (5%) of the total income. Other income of Indigenous communities usually came from tourism and other waged or salaried jobs.

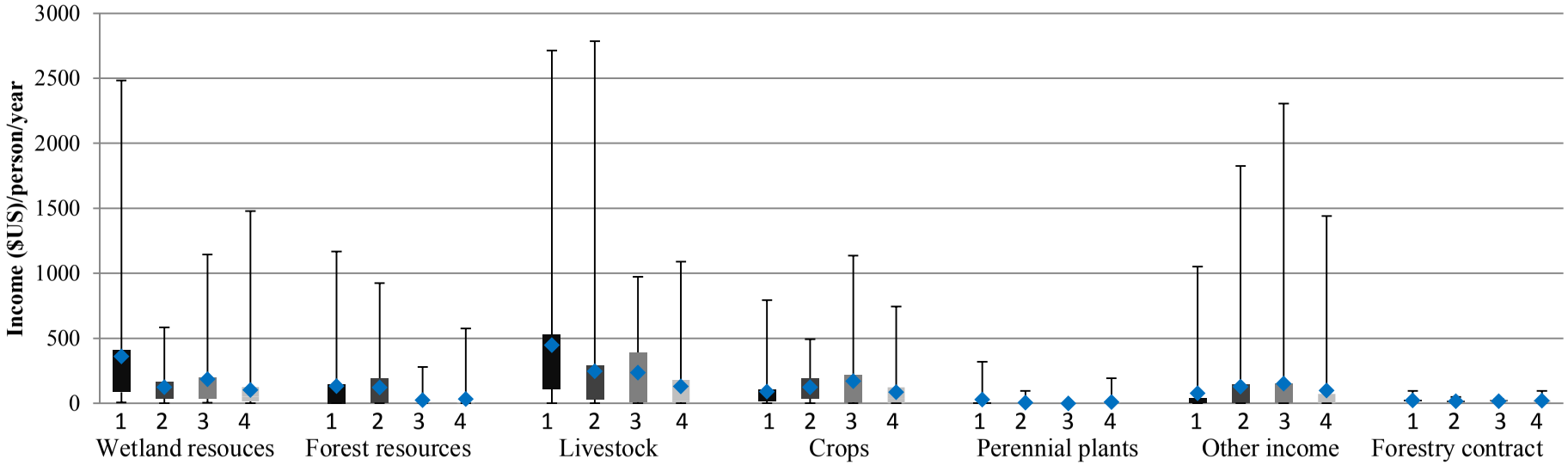

Figure 2.3 **Different income sources of each group in a year**. Blue diamonds represent average and error bars show range. First and third quartiles depicted using box. Numbers 1, 2, 3 and 4 presumedly refer to the PATN groupings.

Table 2.3 **Number of households in different income sources from different levels of income**

Income ($US)	**Wetland resources**	**Forest resources**	**Livestock**	**Crops**	**Perennial plants**	**Other**	**Forestry contract**
0	12	156	36	39	208	142	0
1 - 500	232	93	186	215	51	99	259
501 - 1000	10	8	29	4	0	13	0
1001 - 1500	3	2	3	1	0	3	0
1501 - 2000	1	0	3	0	0	1	0
2001 - 2500	1	0	0	0	0	1	0
2501 - 3000	0	0	2	0	0	0	0

Based on group characteristics comprising the amount of income sources, the frequency of park visitation and the strategies of each group (Table 2.3) we labelled them the (1) Wetland specialists, (2) Mixed resource users, (3) Crop-focused mixed resource users and (4) Low income group.

Table 2.4 **Characteristics of clusters of Indigenous communities identified through cluster analysis.** Mean values for sources of income (US$) in a year are provided along with the reported importance of activities to Indigenous communities on a four-point scale from 1, not important to 4, extremely important. A poor household in rural areas has a total income less than US$20 per month per person.

Group characteristics		**1**	**2**	**3**	**4**
Total average income $US (STDEV)		1,168 (769)	775 (608)	789 (613)	491 (470)
Average distance to the park (km)		0.5	1.6	1.7	1.2
Frequency of park visitation	Never	0%	1.07%	0%	8.6%
	1-11 times/year	5.13%	6.38%	18.18%	23.66%
	1-3 times/month	20.51%	30.85%	24.24%	44.09%
	1-3times/week	30.77%	31.91%	36.36%	11.83%
	Every day	43.59%	29.79%	21.22%	11.83%
Activities undertaken in park					
Hunting animals		++++	+++	++++	++
Harvesting plants		++++	+++	++++	++
Grazing livestock		++	++	+	+
Cultivation		++++	++++	+	+
Spiritual practices		++	+	+	+

2.3.4.1 The Wetland specialists

The first group, “the wetland specialists” group, was comprised of 15% of all respondents and had much higher levels of income than the other three groups. Their income mostly came from wetland and forest resources within the park and they visited the park more often than any other group (44% of Indigenous community members in this group visited the park daily). This follows the same pattern seen in other groups in that, the more frequently they reported visiting the park, the higher the income they derived from wetland resources and the higher their overall income. The amount of income from wetland resources of “the wetland specialists” group was five times more than the

poorest group and more than twice as much the second wealthiest group. Therefore, people of this group were having the biggest impact on the park. They reported that harvesting plants, hunting animals and cultivation within the park and grazing livestock were all extremely important to them. Only Indigenous community members from five villages closest to the park belonged to this group.

2.3.4.2 The Mixed resource users

The second group "the mixed resource users" group comprised slightly over a third of the surveyed respondents (36%). Respondents in this group reported mean incomes of US$775/year with relatively little of this income coming from wetland resources. However, this group had the second highest mean income from forest resources, livestock and crops. These users reported that cultivation was extremely important to them but that grazing livestock was not, despite the high levels of income that they derived from this activity. The income from forest resources was reflected in the frequent levels of visitation to the park (over 60% of this group visited the park weekly) and they reported high importance of collecting plants and animals from the park. Many people reported in open ended questions that low levels of mean income from wetland resources were due to the fact that they were only taking enough resources from the wetlands to use for their livelihood, but that these wetland resources were essential to their daily activities. The majority of the respondents from the village inside the park and the village furthest from the park fell into this group. This may be due to large groups of people being required to collect forest resources (many people are required to cut down a tree). People who lived a long way from the forest would travel as groups and make single large trips because of the distance and therefore would be more likely to focus on forestry products because of their higher value. People living inside the park had short distances to travel to the resources and therefore could easily gather a group of people together to collect forest products because they were already in the same area.

2.3.4.3 The Crop-focused mixed resource users

The third group, "the crop-focused mixed resource users" group, also reported a moderate level of income, similar to "the mixed resource users" group and on average visited the park once a week. The "crop-focused mixed resource users" group had slightly higher incomes derived from wetland resources than group two and this was reflected in their reporting that hunting animals and harvesting plants from within the park were more important to them. This group was composed of roughly even numbers of people from each of the villages.

2.3.4.4 The Low income group

The final group "the low income households" which had the lowest mean income of all groups comprised 36% of all people surveyed. The majority of people in this group (over 75%) were visiting the park 1-3 times a month or less and they had the lowest total mean income including lowest mean income from wetland resources and the second lowest mean income from forest resources. The low levels of income coming from the park were also reflected in people reporting that hunting animals and harvesting plants from the park were only slightly important to them and grazing livestock and cultivation within the park had no importance to them. This was the only group that did not contain respondents from the village within the park boundaries which is in line with the respondents saying that they have very little reliance on income from within the park and do not regard resources in the park as important for their daily lives.

2.3.5 Impacts of social characteristics of communities on park use patterns

Examination of social characteristics of group members showed that there was no difference between the four groups in ethnic makeup, career type or the highest level of education attained by a member of the household (Table 2.4). This lack of influence may have been because, although there was diversity in these factors in the community, the diversity came from a very limited number of individuals. The majority of participants' ethnicities (over 80%) were M'nong and Ede. Although there was a diverse range of careers among the Indigenous communities, including soldier, businessman, office worker, teacher, doctor, nurse, tourism worker, police, worker, the vast majority (over 93%) of people were farmers. The average level of education of participants was junior high school (41%), followed by high school (27%) and primary school (19%).

Table 2.5 **Social characteristics of Indigenous communities**

Group characteristics		**Low income**	**Crop-focused mixed resource users**	**Mixed resource users**	**Wetland specialists**
Ethnicity	M'nong	47%	55%	52%	51.52%
	Ede	41%	39%	36%	48.48%
	Gia Rai	0%	1%	3%	9.09%
	Laos	1%	2%	3%	9.09%
	Thai	1%	0%	0%	0%
	Cham	0%	0%	3%	0%
	Kinh	10%	2%	3%	0%

Career type	Farmer	93%	97%	94%	95.15%
	Non-Farmer	7%	3%	6%	4.85%
Highest level of education	Primary or less	25%	21%	27%	27%
	Junior school	38%	45%	33%	55%
	High school	27%	28%	30%	27%
	University	10%	6%	9%	9%

2.3.6 Impacts of deterrents for illegal park use on use patterns

In Yok Don National Park, fines and warnings are a key management instrument used to deter illegal and unsustainable natural resource use. There were 58 (22.4%) Indigenous communities reported that incontrovertible evidence was found of their undertaking illegal activities inside the park. Forest rangers admonished 20 of these, while the other 38 individuals from Indigenous communities were fined or turned over to the police.

The higher the level of forest resource use a group had, the more enforcement of deterrents the Indigenous communities reported receiving from park rangers (with the exception of the Wetland specialists group) (Table 2.5). Despite the fines and warnings, and in some cases prison terms, many people continued to use the park resources. For the poorer groups it may have been due to a need to use the park resources to survive. For example, a member (TUB8) of the Mixed resource users group interviewed stated that "I got warnings and wood confiscated many times but have still impacted on the forest because of daily needs" while another (DRP22) said "I was arrested a few times but did not have enough money to pay the fine so I was released. I needed to continue to use the park which resulted in my vehicle then being confiscated".

For the groups with higher income, it may have been that the income that they received from the forest resources was more than the amount they were fined. This was exemplified by the Wetland specialists group whose natural resource use from the park was the highest of all groups. One member of this group (TRA10) stated that "I have been warned many times and forest products confiscated but I still go to the forest every day". Another member of this group continued to use the park despite having a relatively high proportion of group members reporting being fined or their goods confiscated "First, my motorbike and wood were confiscated and then my bicycle was confiscated" (TRB8).

The crop-focused mixed resource users group had low levels of fines relative to resource use. This may have been due to this group mostly focusing on using non-timber forest products from the

park, as the park managers had exempted the use of these resources from the punishable offences. One member of the group (DRP9) reported "I am an animal hunter and have never been fined because of knowing how to avoid rangers".

Table 2.6 **Fines being applied for illegal park use by different groups**

Group characteristics	**Low income**	**Mixed resource users**	**Crop-focused mixed resource users**	**Wetland specialists**
No fine or warning	85%	62%	85%	74%
Warned	4%	10%	0%	10%
Confiscation of forest products and tools	8%	19%	6%	13%
Confiscation of forest products and tools and a fine	3%	9%	6%	3%
Prison	0%	1%	3%	0%

2.4 Discussion

This study provides information on how Indigenous communities depend on natural resources and identifies the patterns of resource use by ethnic minority communities living in and adjacent to a protected area. Different clusters of Indigenous people are reflected in amount of income from various sources, their park visitation frequency, activities undertaken in the park and the importance of these activities. There are clear groups of villagers that employ different strategies in relation to resource use – these are not based around village of origin but nature of resource exploitation. These are reflected in different patterns of use and very different rewards in terms of income. In the Yok Don National Park case study, the people who were having the biggest impact on the park were characterised by high total income, visiting the park daily or at least weekly for harvesting plants, hunting animals, grazing livestock and cultivation. This showed that a minority of people who visited the park very frequently exploited the majority of the natural resources taken from the park and had the highest natural resource income. I found that these natural resource users were the better-off households. This is in line with Uberhuaga et al. (2012) who argued that better-off households had higher levels of natural resource income. However, I also found that the poor households' livelihoods were more dependent on the forest for their daily life. This supports the work of (Mitra and Mishra, 2011) who reported the better-off used the forest for accumulative

purposes whereas the poor used the resources for daily life and survival. Understanding impacts on park resources and managing resource use by villages can be informed by this understanding of the different strategies employed by Indigenous communities. Park managers can also use this information in planning and finding the most appropriate management strategies to implement for the park. Furthermore, Lamsal et al. (2015) suggested that better-off households who had less dependence on wetland resources were more involved with conservation organisations. A similar contribution of linkages between less direct benefits of wildlife management areas and more direct engagement with policy process was found in northern Tanzania by Salerno et al. (2015). Therefore, if the park managers can reduce the dependence of the better-off households on resources, the better-off will be the first targeted people in conservation.

There are broad geographic patterns in resource dependency of village (villages furthest from park use resources less) in Yok Don National Park. Foerster et al. (2011) provided a similar observation regarding the impact on natural resources of park households and control households in which livelihoods of park households relied to a higher extent on park resources. This suggests that if park agency managers implements restricting the number of times Indigenous communities can visit the park in order to restrict natural resource use as recommended by McElwee (2010) and do not supply food sources and alternate income sources as suggested by Loibooki et al. (2002), Robinson and Bennett (2004), Ohl-Schacherer et al. (2007) and Foerster et al. (2011) emphasise that communities with a tradition of using park resources and proximity to the park may be more likely to suffer. Instead, the park managers should consider a refined approach in implementing the restriction rules based on the rules for existing use so that economic and environmental aspects can be harmonious and local communities can still benefit from the forest without damaging it.

There are no apparent correlations between education, family characteristics or ethnic origins and the resource use strategies employed by people. This result is consistent with the findings of Lamsal et al. (2015), who reported wetland income from Ghodaghodi Lake, western Nepal was not affected by education of respondents.

Adams and Hulme (2001) argued “community conservation is not one thing but many” and highlighted the range of mechanisms that can be used to bridge livelihood activities with conservation objectives. Some of these strategies are focused on building consensus and awareness between community and other (e.g. government) partners. In some cases collaborative approaches to enable community conservation may not provide the solution for protected area management. In the case study of Yok Don National Park, fines and warnings seem not to be effective in preventing natural resource users from harvesting the park resources and law enforcement is ineffective in

modifying patterns of resource use by villages. Therefore, the efficacy of collaborative and regulatory instruments needs to be carefully considered.

This research focuses on individual natural resource use rather than general community use based on the differences of socio-economic factors influencing the use. This can infer more accurately how different strategies might impact on local use. Therefore, socio-economic and natural resource use characteristics need to be targeted for effective community conservation initiatives. Detailed understanding of resource use allows park managers to know which species to focus on when discussing collaborative management arrangements.

Chapter 3 CONSIDERING CULTURAL VALUES IN COLLABORATIVE MANAGEMENT OF WETLAND SPECIES IN PROTECTED AREAS

This chapter is about identifying cultural keystone species of Yok Don National Park based on the most important wetland species. It unpacks the complexity of the roles these species play for Indigenous communities.

3.1 Introduction

The complexity of the social-ecological systems associated with protected areas has meant the management of these systems is seen as a social, ecological and governance challenge (Berkes, 2009, Olsson et al., 2004). Treated as a social-ecological system, protected areas are areas of dynamic and interactive aspects of people – environment relationships.

Half of the tropical protected areas are experiencing the danger of biodiversity erosion, both taxonomically and functionally (Laurance et al., 2012). Human activities impacting the natural habitat such as changing land-use purposes, hunting and exploiting resources of the forest are the causes of this widespread phenomenon (Oldekop et al., 2016). Several factors such as market forces and the diminishing distance between human populated areas and protected areas could induce the increase in pressures humans have brought on protected areas and in conflict between biodiversity conservation and local and Indigenous communities' needs (Joppa et al., 2008, McDonald et al., 2008). The conflicts have caused complex debates in conservation science (Roe, 2008). One side of the debates advocates "fences-and-fines" approach to forbid humans from protected areas (Brockington and Igoe, 2006). This view is resisted by the argument that the approach presents an ethical problem where the local and Indigenous people are socially disadvantaged from protected areas, making long-term conservation outcomes ineffective (Adams et al., 2004). An increasingly favoured strategy is ensuring protected areas provide for the needs of the local and Indigenous communities to deliver environmental protection which is long-term and effective in order to achieve sustainable livelihoods and increase their well-being (Roe, 2008). Therefore, there is a need to integrate local and Indigenous communities in conservation. This also has triggered the requirement to understand the mechanism, potential and limitations of collaboration between multiple actors to share and build new knowledge, build consensus and better manage social-ecological systems that have both cultural and conservation significance. However, mechanisms by which Indigenous communities can communicate cultural dimensions of the ecosystem in a way that can be understood and recognised by environmental managers and used for decision making is still in its infancy (Folke, 2004, Gagnon and Berteaux, 2009, Hill et al., 2010).

Cultural keystone species have emerged as a useful mechanism to build consensus between different knowledge systems and values held by protected area partners (Hill et al., 2010, Robinson et al., 2014). Cultural keystone species are defined as "the culturally salient species that shape in a major way the cultural identity of a people, as reflected in the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices" (Garibaldi and Turner, 2004). The cultural keystone model can contribute to building consensus between co-management partners by highlighting issues of conflict and consensus surrounding different species and their habitats (Robinson et al., 2005). The model can also enhance communication and partnership between researchers and Indigenous communities, enabling researchers to integrate and build new knowledge about these species and their corresponding social-ecological systems (Gratani et al., 2011) and provide a focus for building an adaptive co-management approach that cross-fertilises Indigenous social-ecological systems with conservation goals and governance regimes (Hill et al., 2010).

When Garibaldi and Turner (2004) described cultural keystone species, it opened up an area of scholarship that has allowed the integration of the relationship between human culture and nature. This idea can be used to unpack the attributes of species in order to understand the reasons why these species have value to Indigenous communities. Other researchers have looked at the relationship between culture and species and their habitat in terms of the nature of those species and whether they are invasive (Nuñez and Simberloff, 2005) or are species of conservation or cultural value (Garibaldi, 2009). More recently, attention has been paid to the complexity of culture, and the wide range of different services that species and their habitats provide to Indigenous communities (Platten and Henfrey, 2009). This complexity demands a more refined framework to understand the relationship between conservation and use of species by Indigenous communities. This chapter illustrates how important it is to capture this complexity.

Wetlands in protected areas provide a useful context for this analysis because wetlands are environmentally significant ecosystems that provide a rich source of ecosystem goods and services for Indigenous communities. However, the integrity and function of some wetlands have been threatened by unsustainable resource use by Indigenous communities (Cools et al., 2013, Mombo et al., 2014). These different cultural keystone species show the different cultural values associated with different wetland species, and provide a basis for negotiating levels and types of use to ensure both long-term conservation goals as well as maintenance of cultural integrity.

3.2 Methods

The description of the case study is outlined in Chapter 1. This chapter outlines the methods used to identify and explain culturally important species.

3.2.1 Identifying culturally important species

Heads of villages were asked to nominate thirty key representatives who had knowledge of the park and its use by Indigenous community members. These individuals were interviewed about the most important and most utilised wetland species in the park. The identified species were then discussed in a focus group forum with these thirty representatives to identify the cultural importance of these species for each village. Participants were asked to quantitatively and qualitatively evaluate each species based on the method developed by Garibaldi and Turner (2004) (Table 3.1).

Table 3.1 **Criteria to identify cultural importance of species in Yok Don National Park** (Adapted from Garibaldi and Turner (2004)

Indicators	**Explanation**
Intensity	intensity, type, and multiplicity of use
Own name	naming and terminology in language, including the use as seasonal or phonological indicators
Cultural stories	role in narratives, ceremonies, or symbolism
Persistence	persistence and memory of use in relation to cultural change
Unique position	level of unique position in culture, e.g., it is difficult to replace with other available native species
Replacement	extent to which it provides opportunities for resource acquisition from beyond the territory

Responses for each cultural criterion were then used to create an index value for each species following the method of Garibaldi and Turner (2004). The process to create these index values comprised of four steps. Firstly, the most culturally important species were listed by asking Indigenous communities which species they thought were indispensable to their daily lives for food, medicine, materials and spiritual practices. Once species had been listed, people were asked how important they were to them. Each indicator was scored on a scale of 0 to 5 (0 = lowest to 5 = highest) through discussion amongst Indigenous communities. The highest ranking species were then identified by summing the scores for each indicator. During the ranking process, in-depth discussion and qualitative semi-structured interviews were used to capture Indigenous knowledge of the cultural keystone species. I then picked the five most highly ranked plant species and five most

highly ranked animal species from each village using the same approach. As there was little variation in the top ranked plant species across all villages we kept these five species to be considered in final identification of the most important cultural keystone species. There was variation in the top most highly ranked animal species between villages because villages further away from the park were not able to transport large animals to their village. Therefore these animals had high importance indexes but low use indexes. I also included animal species with high importance indexes but low ratings overall due to the village's ability to access these resources. Combined with the highest ranking plant species, these then formed the list of the most important cultural keystone species across all villages. Finally, Heads or Vice Heads of all villages participating in the research were asked to again rank these species from the most to the least important, giving their own individual rankings. This was done to ensure that the species that are really important but may only fit one of the criteria and therefore can only score a maximum of four are still counted as very important despite their low score. It also guarantees that when information from villages was averaged, there were not major differences between villages. This was done during a modelling workshop between Indigenous communities and park managers. This identification of these most important cultural keystone species was then compared to the list from the village interviews.

3.2.2 Understanding four most important cultural species

Focus group discussions held at local villages with three representatives at each village identified the roles of the four most important cultural species in their lives in relation to diet, medicine, materials and spiritual practices.

3.3 Results

3.3.1 Identifying different cultural dimensions of keystone species

Elephants (*Elephas maximus*) were the highest ranked cultural keystone species by Indigenous communities in all nine villages. Elephants were identified as being used intensively by Indigenous communities for transportation and tourism activities. Elephants had different names in the indigenous community and their significance to the community could not be replaced with any other available species. Community representatives reported that elephants featured in narratives, ceremonies, dances, songs, poems and were a symbol for their Indigenous communities. Therefore, elephants were considered as the most important cultural keystone species of ethnic minority community groups living in and around Yok Don National Park (Figure 3.1).

There were other animals including turtles (*Mauremys* sp. and *Cuora* sp.), frogs (*Pelophylaz lateralis* and *Fejervarya limnocharis*), snakes (Colubridae and Elapidae families), lizards (*Varanus* sp.), shrimps, crabs and fishes that also ranked highly on the cultural keystone species index. Turtles, snakes and lizards played an important role in indigenous community lives as they were part of the diet and used for medicine, household materials and spiritual practices. Frogs, shrimps, crabs and fishes also played a role in people's daily diet but to a lesser extent.

Cogon grass (*Imperata cylindrical*), Indian mulberry (*Morinda* sp.), sweet leaf (*Sauropus androgynous*), rice paddy herb (*Limnophila aromatica*) and sticky adenosma (*Adenosma glutinosum*) were the most important and most used wetland flora by Indigenous communities. Cogon grass was used for making the traditional roofs of the houses in the indigenous communities. However, cogon grass roofs are increasingly being replaced by corrugated iron roofs. Houses with traditional cogon grass roofs were symbolic for the indigenous community living in and around Yok Don National Park. Indian mulberry was used for making the indigenous community's traditional basket for their daily activities. Each indigenous household had at least one of these traditional baskets. Sweet leaf, rice paddy herb and sticky adenosma were used for daily diet by Indigenous communities.

The greatest role played by cultural keystone species in Indigenous communities' lives was for diet, this included rice paddy herb, sweet leaf and all the animals except elephants. These species were also highly used or valued for medicine and materials. Only elephants, turtles, cogon grass and Indian mulberry played integral roles in the spiritual practices of Indigenous communities' lives.

The identification of these cultural keystone species was changed when representatives of Indigenous communities ranked them by themselves based on their villages' demands and needs during the modelling workshop with park managers (Figure 3.1). Elephants were valued the most important cultural keystone species, followed by cogon grass, Indian mulberry and turtles. This showed that the spiritual values still play an integral role in Indigenous lives although the intensity of use of some species has declined such as elephants and cogon grass. Snakes and lizards were important because of their roles in diet, materials and medicine and their high values when they were traded. The other species were less important as they only provided food for Indigenous communities.

There are differences in the ranking of these cultural keystone species between the scores calculated using Garibaldi and Turner (2004) framework and the rankings of Indigenous communities by their villages' needs and demands. Sweet leaf was qualified as high ranking in the Garibaldi and Turner

(2004) framework because this plant was ranked highly in intensity and trade. This plant appears during the rainy season and almost all Indigenous communities came to the forest to harvest this plant for their family and for selling at the market. In contrast, the intensity, persistence and trade of cogon grass had decreased so it was given a low position in the Garibaldi and Turner (2004) ranking ; however this plant provided for the spiritual values in making traditional house roofs for Indigenous communities so Indigenous people valued it highly in their lives. The differences in other species except elephants were minor.

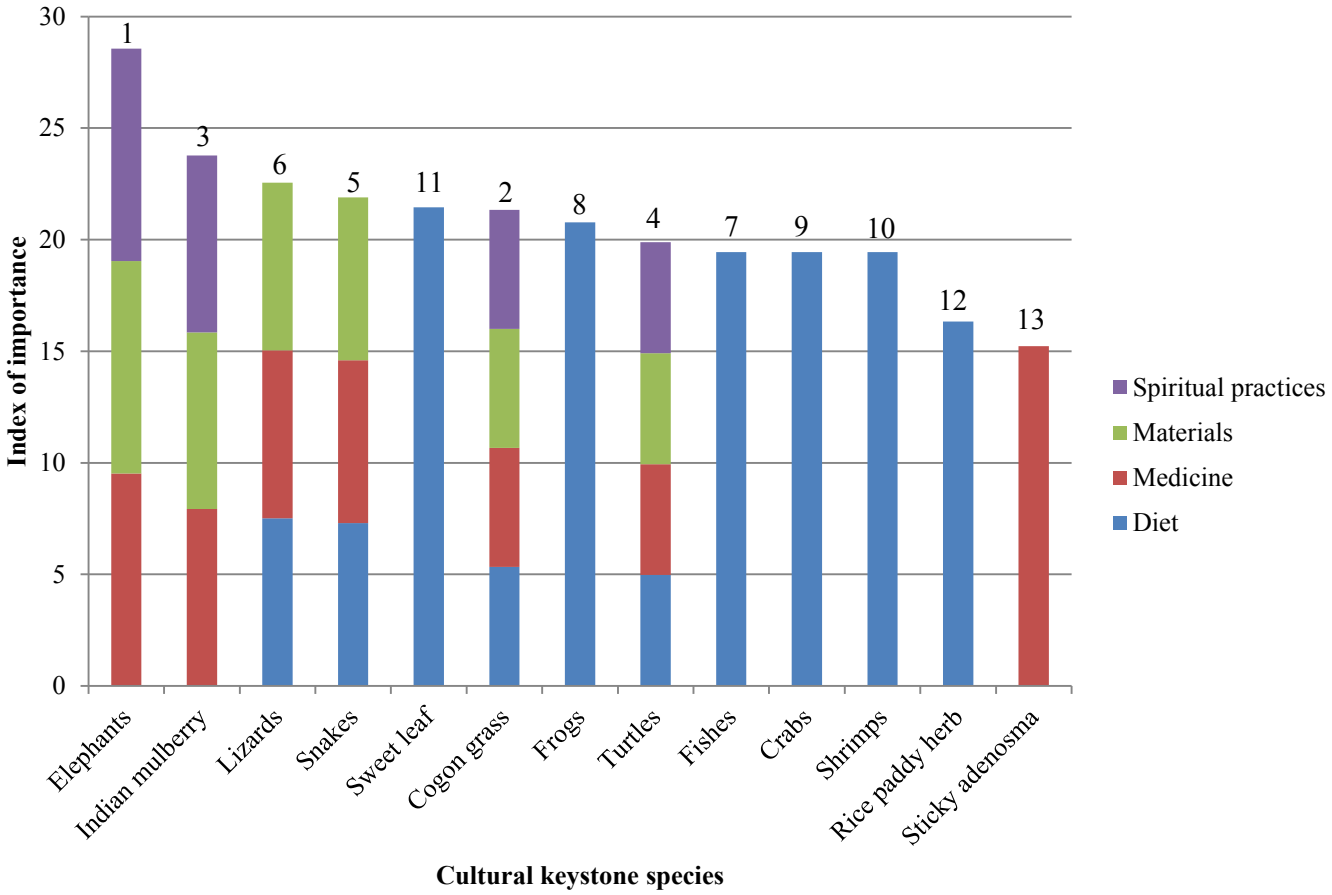

Figure 3.1 **The Indigenous communities' evaluation place on the role wetland species play in their cultural identity and everyday lives.** The value was measured on a 5-point index scale for each cultural sphere. High scores indicate most important cultural keystone species. The number on the top of each bar represents the identification ranked by representatives of Indigenous communities during a modelling workshop with park managers.

3.3.2 Understanding cultural keystone species in Yok Don National Park

During the modelling workshop, elephants were identified as the most important cultural keystone species by representatives of Indigenous communities. Cogon grass, Indian mulberry and turtles were also identified, but to a lesser degree. These species were chosen for more in-depth discussion with Indigenous communities at each village to understand the interactions between Indigenous

communities and these species. These species were analysed by using the cultural keystone species framework adapted from Garibaldi and Turner (2004).

Elephants were ranked with the highest score for all the indicators related to cultural values although the intensity of elephants was very low (Table 3.2). In 2013 (the time this research was conducted), there were five villages owning elephants and each village owned one elephant. However, the elephant belonging to TUB village died in 2015. Therefore, only four villages own elephants at the moment. DON and TRA villages are famous for their experience of traditional wild elephant hunting; therefore they have a better knowledge of elephants than the other villages. This led to very high ranking scores for multiple uses for both these villages.

Turtles played an integral role in the Indigenous lives of the five villages closest to the park. These five villages used turtles more intensively and were trading turtles more, so their importance was much higher than in the other four villages (Table 3.3). Especially, TRA and TRB villages were more concerned about turtles and discussed them more, because they believe that turtles are the ancestors of some families in these villages.

Indian mulberry was also highly ranked by Indigenous communities in all villages (Table 3.4). However, the importance was varied and based on this variation; Indian mulberry was valued as important in the culture of seven villages closest to the park. The majority of Indigenous communities of these seven villages are M'nong, who used Indian mulberry to make the Indigenous traditional basket base. The main ethnic group of the other two villages is Ede, who ranked Indian mulberry as important because of its fruits, leaves and roots.

Although corrugated iron roofs for constructing Indigenous houses around the villages were increasingly replacing cogon grass roofs, cogon grass was still used for making these roofs in the small houses of Indigenous communities on farms (Table 3.5). Because DON, JAL, TRA, DRA and DRB villages were closest to the wetland sites inside the park, Indigenous communities from DON, JAL, TRA, DRA and DRB used cogon grass more than the other villages.

Table 3.2 **Indigenous communities' ranking of elephants.** This ranking was based on their importance on a scale of 0 to 5 (0 = lowest to 5 = highest) using the Garibaldi and Turner (2004) framework during focus group discussions at each village participating in the research.

Indicators	**Villages**								
	DRP	**DON**	**JAL**	**TRA**	**TRB**	**DRA**	**DRB**	**TUA**	**TUB**
Intensity, type and multiplicity of use									
- Is the species used intensively (routinely, and/or in large quantities)?	0	2	0	1	1	1	0	0	1
- Does the species have multiple uses?	2	5	2	4	3	3	2	2	3
Naming and terminology in a language, including use as seasonal or phenological indicators, names of months or seasons, place names									
- Does the language incorporate names and specialised vocabulary relating to the species?	5	5	5	5	5	5	5	5	5
Role in narratives, ceremonies, or symbolism									
- Is it prominently featured in narratives and/or ceremonies, dances, songs or as a major crest, totem, or symbol?	5	5	5	5	5	5	5	5	5
Persistence and memory of use in relation to cultural change									
- Is the species ubiquitous in the collective cultural consciousness and frequently discussed?	5	5	5	5	5	5	5	5	5
Level of unique position in culture (i.e. it is difficult to replace with other available native species)	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Extent to which it provides opportunities for resource acquisition from beyond the territory									
- Is it used as a trade item for other groups?	5	5	5	5	5	5	5	5	5
Total Identified Cultural Influence rating (out of 35)	27	32	27	30	29	29	27	27	29

Table 3.3 **Indigenous communities' ranking turtles.** This ranking was based on their importance on a scale of 0 to 5 (0 = lowest to 5 = highest) using the Garibaldi and Turner (2004) framework during focus group discussions at each village participating in the research

Indicators	**Villages**								
	DRP	**DON**	**JAL**	**TRA**	**TRB**	**DRA**	**DRB**	**TUA**	**TUB**
Intensity, type and multiplicity of use									
- Is the species used intensively (routinely, and/or in large quantities)?	5	4	3	5	5	1	1	1	1
- Does the species have multiple uses?	4	4	5	4	4	3	3	3	3
Naming and terminology in a language, including use as seasonal or phenological indicators, names of months or seasons, place names									
- Does the language incorporate names and specialised vocabulary relating to the species?	5	5	5	5	5	5	5	5	5
Role in narratives, ceremonies, or symbolism									
- Is it prominently featured in narratives and/or ceremonies, dances, songs or as a major crest, totem, or symbol?	1	2	2	2	2	1	1	1	1
Persistence and memory of use in relation to cultural change									
- Is the species ubiquitous in the collective cultural consciousness and frequently discussed?	3	3	2	5	5	1	1	1	1
Level of unique position in culture (i.e. it is difficult to replace with other available native species)	1	1	1	2	2	1	1	1	1
Extent to which it provides opportunities for resource acquisition from beyond the territory									
- Is it used as a trade item for other groups?	5	5	5	5	5	1	1	1	1
Total (Identified Cultural Influence rating (out of 35)	24	24	23	28	28	13	13	13	13

Table 3.4 **Indigenous communities' ranking Indian mulberry.** This ranking was based on their importance on a scale of 0 to 5 (0 = lowest to 5 = highest) using the Garibaldi and Turner (2004) framework during focus group discussions at each village participating in the research

Indicators	**Villages**								
	DRP	**DON**	**JAL**	**TRA**	**TRB**	**DRA**	**DRB**	**TUA**	**TUB**
Intensity, type and multiplicity of use									
- Is the species used intensively (routinely, and/or in large quantities)?	4	5	5	5	5	5	5	5	5
- Does the species have multiple uses?	3	2	2	2	3	2	2	4	4
Naming and terminology in a language, including use as seasonal or phenological indicators, names of months or seasons, place names									
- Does the language incorporate names and specialised vocabulary relating to the species?	5	5	5	5	5	5	5	5	5
Role in narratives, ceremonies, or symbolism									
- Is it prominently featured in narratives and/or ceremonies, dances, songs or as a major crest, totem, or symbol?	1	1	1	3	1	3	1	3	3
Persistence and memory of use in relation to cultural change									
- Is the species ubiquitous in the collective cultural consciousness and frequently discussed?	3	1	3	5	3	5	2	5	5
Level of unique position in culture (i.e. it is difficult to replace with other available native species)	5	5	5	5	5	5	5	0	0
Extent to which it provides opportunities for resource acquisition from beyond the territory									
- Is it used as a trade item for other groups?	3	1	1	1	3	1	5	1	1
Total Identified Cultural Influence rating (out of 35)	24	20	22	26	25	26	25	23	23

Table 3.5 **Indigenous communities' ranking cogon grass.** This ranking was based on their importance on a scale of 0 to 5 (0 = lowest to 5 = highest) using the Garibaldi and Turner (2004) framework during focus group discussions at each village participating in the research

Indicators	**Villages**								
	DRP	**DON**	**JAL**	**TRA**	**TRB**	**DRA**	**DRB**	**TUA**	**TUB**
Intensity, type and multiplicity of use									
- Is the species used intensively (routinely, and/or in large quantities)?	3	5	5	5	1	5	5	4	4
- Does the species have multiple uses?	3	3	2	2	2	3	3	3	3
Naming and terminology in a language, including use as seasonal or phenological indicators, names of months or seasons, place names									
- Does the language incorporate names and specialised vocabulary relating to the species?	5	5	5	5	5	5	5	5	5
Role in narratives, ceremonies, or symbolism									
- Is it prominently featured in narratives and/or ceremonies, dances, songs or as a major crest, totem, or symbol?	1	2	2	1	1	3	5	3	3
Persistence and memory of use in relation to cultural change									
- Is the species ubiquitous in the collective cultural consciousness and frequently discussed?	3	4	5	5	1	5	5	5	5
Level of unique position in culture (i.e. it is difficult to replace with other available native species)	1	0	1	0	1	0	1	0	0
Extent to which it provides opportunities for resource acquisition from beyond the territory									
- Is it used as a trade item for other groups?	0	5	5	5	0	5	5	0	0
Total Identified Cultural Influence rating (out of 35)	16	24	25	23	11	26	29	20	20

There are multiple dimensions of relationship between these cultural keystone species and Indigenous communities living in Yok Don National Park including Elephants (Figure 3.2), Turtles (Figure 3.3), Indian mulberry (Figure 3.4) and Cogon grass (Figure 3.5). These figures were constructed based on the Garibaldi and Turner (2004) framework together with focus group discussions at each village participating in the research.

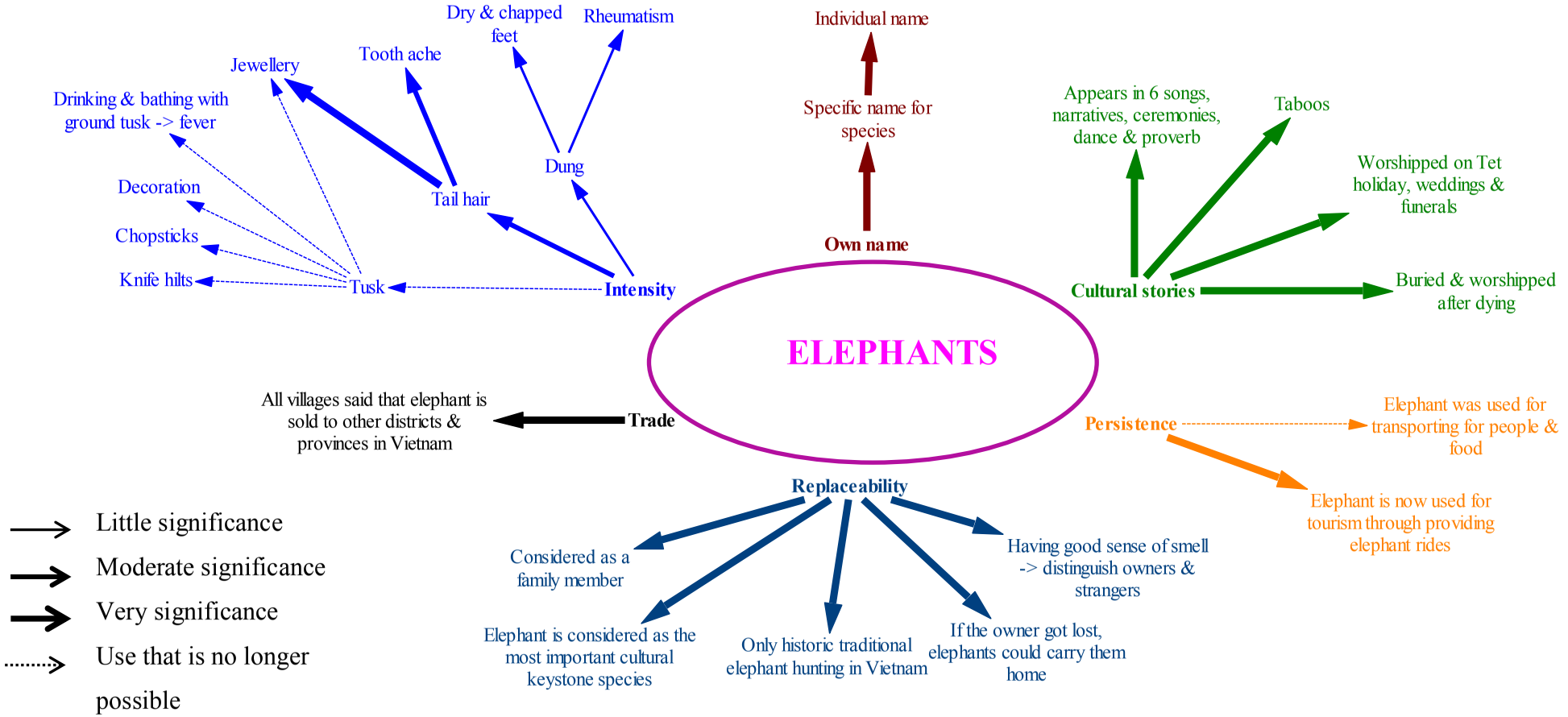

Figure 3.2 **Roles of elephants in Indigenous lives.** The importance levels of its role are shown in the thickness of the arrow based on focused groups discussions with Indigenous communities.

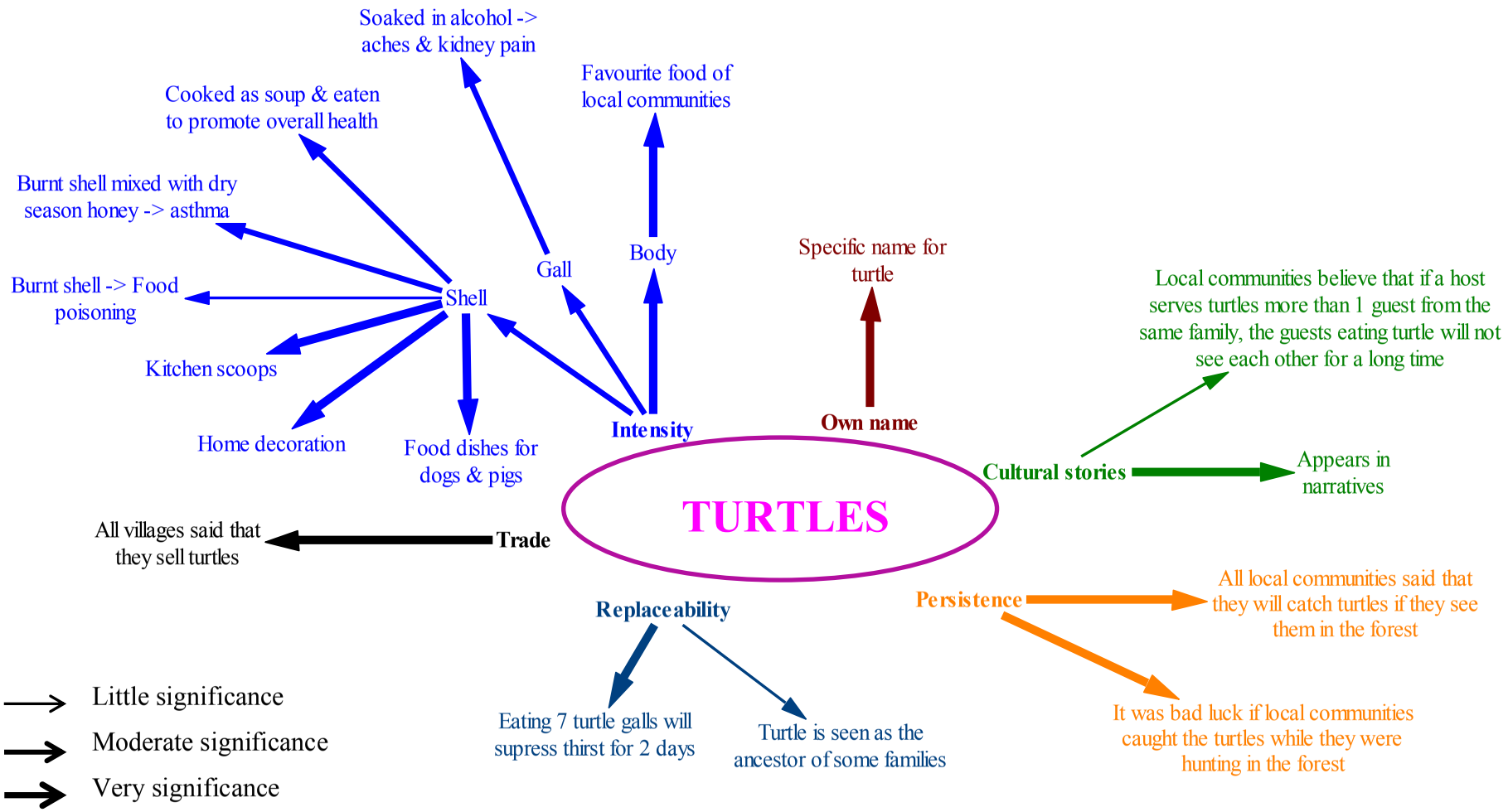

Figure 3.3 **Roles of turtles in Indigenous lives.** The importance levels of its role are shown in the thickness of the arrow based on focused groups discussions with Indigenous communities.

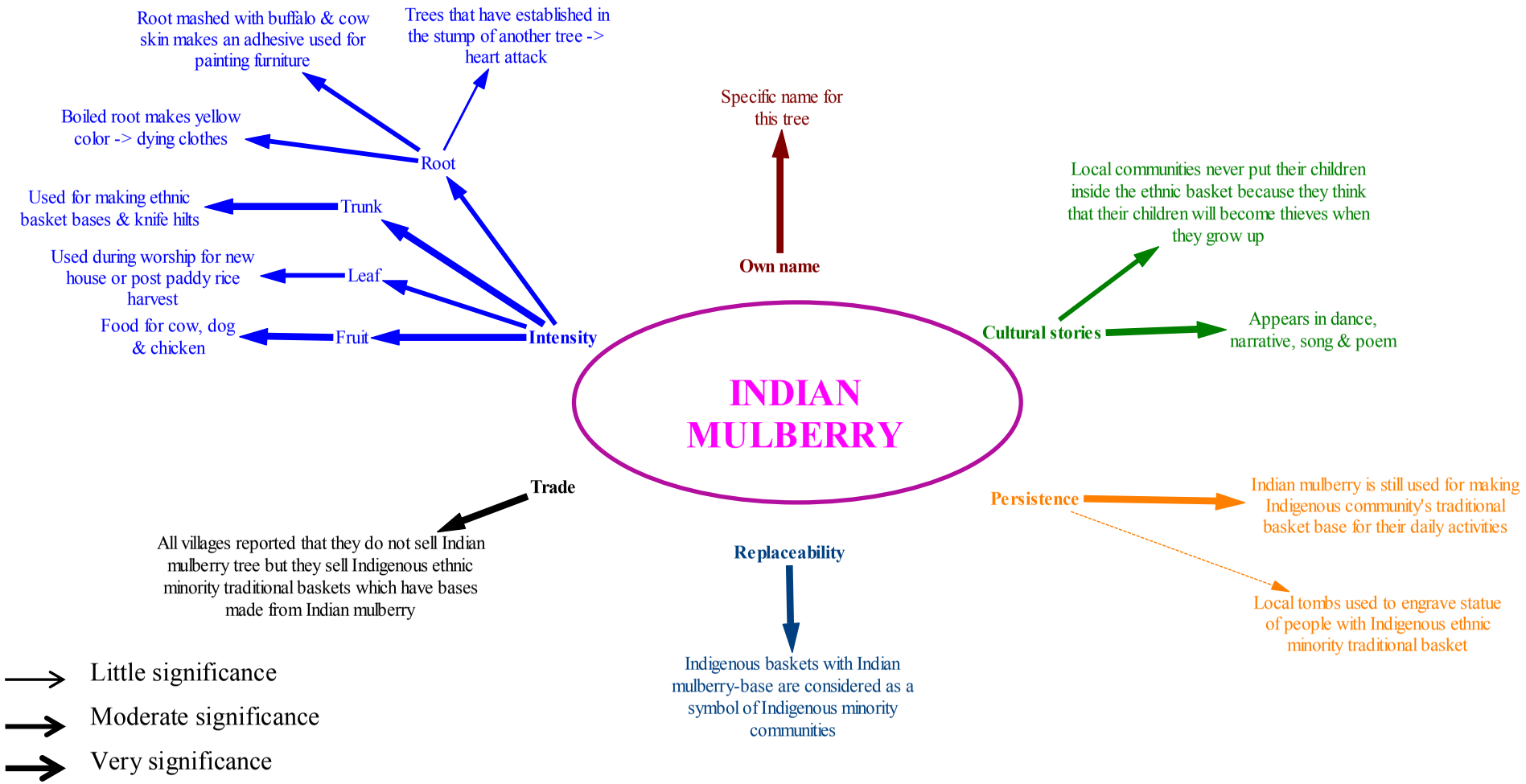

Figure 3.4 **Roles of Indian mulberry in Indigenous lives.** The importance levels of its role are shown in the thickness of the arrow based on focused groups discussions with Indigenous communities.

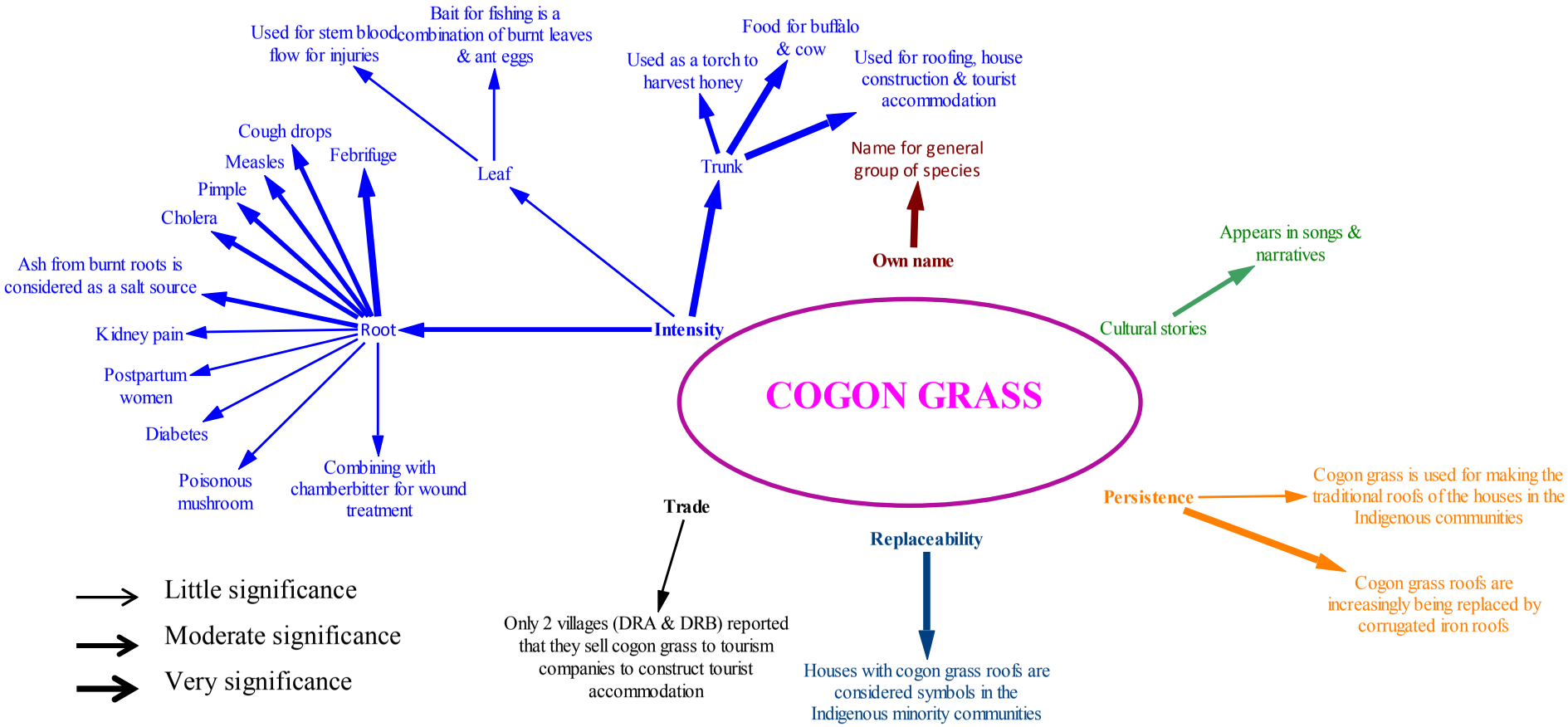

Figure 3.5 **Roles of cogon grass in Indigenous lives.** The importance levels of its role are shown in the thickness of the arrow based on focused groups discussions with Indigenous communities.

3.3.2.1 Intensity, type and multiplicity of use

Intensity

Four villages (DRP, JAL, DRB and TUA) participating in the research said that there are no domestic elephants in their villages at the moment. Each of the other four villages owns only one domestic elephant (DON, TRA, TRB and DRA). Indigenous communities from some villages reported that if their villages do not own any elephants, they are embarrassed when around other villages that do (DRP, JAL, DRB and TUA). Indigenous communities of all villages reported the quantity of wild elephants they see in the forest is less than in the past. Before, Indigenous community members could see wild elephants in the forest during daytime. Now, elephants hide in the forest during the daytime. At night, they start looking for food. In the past, wild elephants came to their village, now they just come to their farms in the forest across the river. Therefore, Indigenous communities said that the chances of their seeing elephants have declined gradually. This is a source of concern for Indigenous communities.

Similarly to elephants, Indigenous communities reported that the number of turtles has reduced significantly because the development of hydroelectric power infrastructure has fragmented turtle habitat and impacted on flow regimes. It is also likely that the number of turtles has declined due to traditional turtle hunting. Indigenous communities from some villages said they always saw turtles whenever they went to the forest in the past. Now, it is difficult for them to find turtles (JAL, DRA and DRB). Indigenous community members from TRB also stated "Before, there were many people breeding turtles. Now, only a few people breed turtles. We are now not interested in breeding turtles because it is difficult and it takes a long time before we can sell them". Indigenous communities also said that they want to have turtles; however it is difficult for them to breed turtles as they do not know the turtle breeding procedure and they need help from the park management agency.

M'nong people (the main ethnic group living around Yok Don National Park) used Indian mulberry (the trunk) for making traditional Indigenous basket bases. A single Indian mulberry tree of a height of approximately 5m and a diameter of 15cm will make two ethnic basket bases or ten knife hilts. Every M'nong family has these Indigenous baskets with a basket for each woman in the house.

On the other hand, the number of Indigenous community members using cogon grass (the trunk) to construct their Indigenous houses varied across villages. While JAL village reported that no households now use cogon grass, the other eight villages said that they still use cogon grass although in lesser amounts than in the past. In six villages approximately 20% to 30% of

households used cogon grass for construction (DRP, DON, TRA, TRB, TUA and TUB). Indigenous communities from DON village indicated “It takes five years to harvest enough cogon grass for constructing a new house” and people from two other villages stated that the park managers allowed them to harvest cogon grass in the forest (TUA and TUB). Seventy percent of households from the other two of the eight villages said that they used cogon grass to make the roofs for their houses (DRA and DRB). Cogon grass plays an important cultural role. Indigenous communities said that the abundance of cogon grass in the park was still high and this plant played an important role in their villages, especially for newly married people who did not have enough money for constructing a new house and would use cogon grass to build their house (DRA and DRB). Grass roofs only last five years before the grass needs to be replaced but the rest of the house is likely to last longer.

Type and multiplicity of use:

Only individual body parts of elephants are used, not the whole animal (Figure 3.2). Use includes dung, tusks and tail hairs but importantly the flesh is never eaten due to cultural reasons. Some villages said that any village that had elephants was prohibited from eating elephants (DRP, DON, JAL, TRA and TRB) while other villages stated that anyone who ate elephant would be mad (DRA and DRB) and they did not dare to eat or scold elephants (TUA and TUB). The reason is that elephants are considered as a family member of Indigenous communities. Most of the uses for elephant products are medicinal (e.g. rheumatism, tooth ache and fever) but they are also valued for decoration and used in domestic lives (e.g. chopsticks and knife hilts), although tusks are no longer used because of legal prohibition. Turtles, on the other hand, have multiple uses. They are eaten, their gall bladders are used to alleviate kidney pain and their shells have a range of decorative purposes.

The two cultural keystone species plants that were examined in more depth were Indian mulberry (Figure 3.4) and cogon grass (Figure 3.5). Indian mulberry is highly valued for basket bases and knife hilts. Its leaves are used for spiritual practices. Fruits are utilised for food and medicinal purposes. Cogon grass is also consumed, it is burnt and the salty residue is eaten by Indigenous communities. Cogon grass has medicinal values, helping injuries, and is used as bait for fishing; it is also fodder for buffalo and cows and can be used to create roofs for shelters for Indigenous communities and their livestock. Cogon grass can also be used as a torch for harvesting honey.

3.3.2.2 Naming and terminology in a language

All species have an Indigenous name but each elephant is given its own name for cultural reasons. Normally, the elephant is named based on its shape and the name is related to strength, valuable

property and power. Normally, only the owners and the village elder know the elephants' names to avoid strangers riding their elephants.

Naming elephants was an important cultural process for Indigenous communities. Wild elephants were named during worship after being caught from the forest. Before the worship, the owners asked the village elder whether the name they prepared for their elephant was similar to any elephant in the village to ensure that the same name is not used twice. During the worship, a shaman threw a handful of rice onto a burning candle and said out loud names that had previously been chosen as possible names for the elephant. If the rice stuck in an upright position on the top of the candle, that name would be chosen as the elephant's name.

There is no variation in the rituals around the naming of elephants between villages.

3.3.2.3 Role in narratives, ceremonies, or symbolism

Elephants, turtles, Indian mulberry and cogon grass are featured in stories. These narratives are usually told by the village elders during dinner time and to people when they are working on cultivating their farms.

Elephants appear in six songs and Kham Thung is the favorite song about elephants. Elephants are also featured in narratives (Tiger & Elephant, Snake & Elephant and Traditional Wild Elephant Hunting), dance, proverb and ceremonies (Appendix A3.1). Indigenous communities worried that they would lose their knowledge about elephants because, as some villages reported, when the young people heard about the Elephant narratives, they just laughed and they did not believe in those narratives (DRP, DRA and DRB). Elders worry that the reason the youth do not believe the narratives any more is because they no longer see elephants very often. Although elephants are rarely seen at the moment, elephants' ceremonies still continue. At the ceremonies, all villages of one commune will provide all their elephants to perform traditional wild elephant hunting in the forest for young people to remember the stories, understand their tradition and also keep their knowledge even though they can no longer hunt wild elephants.

Turtles are featured differently in narratives between villages. For example, turtles appear in the Turtle, Water Bottle and Shoe story (DRP), the Turtle and Tiger story (DRP, JAL, DRA and DRB), the Turtle and Rabbit story (JAL). Indigenous community members from TRA and TRB villages believe that if a host serves turtles to more than one guest from the same family, the family member guests eating turtle will not see each other for a long time. Turtles also appear in the proverb "Stupid as Turtle" and "Slow as Turtle" in TRA village.

Traditional baskets are featured in dance (DON, TRA, TRB, DRA and DRB) and narrative (DRP, DON, TRA, TRB, DRA and DRB) and song (JAL) (Appendix A3.2). At many ceremonies such as Indigenous New Year, weddings, funerals and worship, women usually wear these Indigenous baskets and dance. One belief from some villages is that Indigenous communities should never put their children inside the ethnic basket because they think that their children will become thieves when they grow up (DRP, DON, TRA, TRB, DRA and DRB).

Cogon grass appears in songs and narratives being told by the elders. Indigenous communities said cogon grass helps them build their Indigenous houses, these houses can keep cool in summer and keep warm in winter and help to bring family members together.

3.3.2.4 Persistence and memory of use in relation to cultural change

In the past, elephants were used for transporting paddy rice, corn, trees and the materials for constructing houses and used as a means of transport to the forest, market, farm and when hunting wild elephants. Elephants are now used for tourism through providing elephant rides for tourists and in many ceremonies. Indigenous communities are hired by the tourism centre of the park and other tourism centres to take care of the elephants and to take tourists for rides on elephants. In the past, pregnant or menstruating women were prohibited from riding elephants with strict punishments imposed if they did not follow the rules. However, elephants are now used for tourism and the elephant's owner has to allow them to ride. Therefore, the elephant's owner undertakes extra worship in the early morning and in the evening every day to ask for forgiveness for allowing this to happen.

In the past people were reluctant to catch turtles while they were hunting for other animals in the forest as it was considered bad luck. Now, all Indigenous communities said that they would catch turtles whenever they see them in the forest because they are difficult to find due to their scarcity.

Indigenous baskets with Indian mulberry bases are still used widely. In the past, a statue of people with an Indigenous basket made from a tree was placed on Indigenous tombs to maintain the culture and remember people who passed away. At the moment, because people are prohibited from harvesting trees in the forest, this tradition is declining and only a few Indigenous communities make that statue for their family members. This has led to Indigenous communities from DRP, JAL, TRB, DRA and DRB being concerned that through not making the statue they will lose the knowledge and practice of making traditional Indigenous baskets in the future.

Cogon grass roofs are being replaced by corrugated iron roofs because the prohibition of shifting cultivation throughout the park and because the high concentration of herbicide used to maintain crop output on small portions of land have reduced the extent of cogon grass so that it is now insufficient for the needs of Indigenous communities. Other tourism centres besides the park tourism centre also use cogon grass for constructing Indigenous houses for tourist accommodation. Indigenous communities from TRB village reported the reasons they were no longer using cogon grass were that "There is a shortage of cogon grass to harvest in the forest and we are also scared our houses will be burnt". The tradition of using cogon grass for thatching is changing and some villagers stated if they had enough money, they would use corrugated iron roofs instead of cogon grass roofs (JAL, TRA and TRB). This lack of traditional use may lead them to also lose the knowledge and spiritual connection in relation to this species.

3.3.2.5 Unique position in culture

Each cultural keystone species has its own unique position in culture. However, the level of replaceability of each species varies. For elephants, this is the only area where historic traditional elephant hunting in Vietnam has been carried out with detailed rules and taboos for elephant hunters and their families before, during and after hunting. This is the source of their knowledge about elephants. Elephants are considered as the most important cultural keystone species of Indigenous communities; therefore, no species can replace the significance of elephants to Indigenous communities.

Indigenous communities from two villages said no species could replace turtles, as turtles were seen as the ancestor of their families and all the members were not allowed to eat turtles (TRA and TRB); however, other villages stated they could use other species to replace turtles although they still believed that eating seven turtle galls would suppress thirst for two days (DRA, DRB, TUA and TUB).

Indigenous baskets with an Indian mulberry base are considered as a symbol of Indigenous communities and they revealed that they did not want to replace the Indian mulberry with any other plants (DRP, DON, JAL, TRA, TRB, DRA and DRB).

Houses with cogon grass roofs are considered symbols in the Indigenous communities living in and around Yok Don National Park and they reported no other plant species can replace cogon grass to make their houses' roofs; however, if they had enough money, they would use corrugated iron roofs.

3.3.2.6 Extent to which it provides opportunities for resource acquisition from beyond the territory

Indigenous communities at all villages said that they had sold elephants to other districts and provinces in the past. Now, they said that their villages do not even own any elephant (DRP, JAL, DRB, TUA and TUB). On the other hand, in the past Indigenous communities of all villages did not sell turtles, keeping them for personal use. This has now changed with most turtles that are caught being sold.

All villages reported that they do not sell Indian mulberry tree but they sell Indigenous baskets to other Indigenous community members within their villages.

Seven villages reported that the amount of cogon grass harvested is just enough for the houses in their villages, therefore they only sell cogon grass to other people within their village (DRP, DON, JAL, TRA, TRB, TUA and TUB). Only two villages stated that they harvest cogon grass to sell to other tourism centres (DRA and DRB).

3.4 Discussion

This chapter has unpacked the attributes of important cultural keystone species to identify the reasons why these species are valued by Indigenous communities. The results were in line with Platten and Henfrey (2009) and Uprety et al. (2013) who emphasised a cultural keystone species should be considered as a "complex" which comprised many material and nonmaterial system factors instead of a "single biological species". For example, elephants play integral roles comprising materials, medicine and spiritual practices in Indigenous lives in which tusks, tail hair and dungs are used for kitchen utensils, decoration and medicine and elephants are considered as family members. This chapter also investigated the complexity of cultural keystone species and how this leads to people valuing them differently. Elephants play a different role from turtles, which play a different role again from cogon grass and Indian mulberry in Indigenous communities' lives. These differences are rooted in the attributes of those animals and plants as well as their interactions with these species, how they identify, manage, celebrate and worry about the future of these species. Because of the different ways people interact with and value these species, the same management strategies are unlikely to be effective for all species.

There was a common value for some species and their attributes and the importance placed on them by all villages participating in the research. For example, cogon grass is valued by everyone for its role in making Indigenous roofs. Yok Don National Park case study showed that cultural keystone species are valued highly by Indigenous communities because they can be for domestic use or

spiritual use. Turtles are important as they are the favourite food of Indigenous communities or they play an important role in Indigenous spiritual values. Alves et al. (2013) argued that historical interactions between Indigenous communities and same species may change over time. This is confirmed in this chapter in which taking turtles while hunting other animals was considered a bad luck in the past; however, 100% Indigenous community members stated that they preferred poaching turtles in the forest now. This finding emphasised that the cultural significance of species with Indigenous communities could vary over time, particularly before and after management strategies were implemented.

This chapter used the Garibaldi and Turner (2004) framework, but added to this framework by examining whether there were variations in the order of cultural keystone species from this framework and from Indigenous needs and demands through a modelling workshop. This approach was supported by Garibaldi (2009) who argued that the Index of Identified Cultural Influence is a quantitative research tool for determining cultural keystone species but the final validation of species needs to be qualified by local communities. The results showed that although elephants were valued the most important cultural keystone species, order of other species has changed. In all villages, sweet leaf had high intensity and trade value; therefore its index of identified cultural influence was high and accounted for the fifth most important position in the list. However, Indigenous communities qualified sweet leaf as the eleventh most important position as this plant did not play a vital role in Indigenous culture and could be replaced by other species. Therefore, this chapter has contributed to the Garibaldi and Turner (2004) framework in order to achieve a more refined approach to teasing apart how people interact with species and use them in their everyday lives. A refined approach should be followed by taking two steps. First, the Garibaldi and Turner (2004) framework can be used to identify the most important cultural keystone species. Second, these species should be examined again with all the representatives of Indigenous communities to identify which species play integral roles in Indigenous lives.

Garibaldi (2009) found that the three most important factors to determine cultural keystone species were intensity and multiplicity, persistence in cultural change and level of unique position in the community. However, this chapter showed that although elephants do not have high intensity, they play an important role in the spiritual practices of Indigenous communities and cannot be replaced by other native species available in the territory. Therefore, intensity, type and multiplicity of use were not an important element in determining cultural keystone species, the replaceability of species reflects the high cultural significance of the species as advocated by Uprety et al. (2013) and there were variations in the importance level of different indicators of index of identified cultural influence.

Franco et al. (2014) argued that taboos and the entire belief system on cultural keystone species have a positive impact on conservation. This was confirmed in this case study of Yok Don National Park in which Indigenous communities are prohibited from eating elephants and none of them had broken this taboo. Therefore, this is a starting point for park agency managers to build consensus with Indigenous communities in conservation. Understanding cultural keystone species in social-ecological systems may help with co-management arrangements in conservation areas. It points out the need to have more refined approaches. This refinement might be species, for examples agreements made in relation to turtles are very different from the ones being made in relation to cogon grass or Indian mulberry. Also, villages that do not have elephants require different co-management relationships compared with the ones that still have one or two. This suggests that management agreements are needed to be specific to the internal, regional and local complexity which exists in social-ecological systems.

Chapter 4 TRANSLATING COMMUNITY VIEWS INTO CONSERVATION ACTION

This chapter examines whether collaborative development of a conceptual social-ecological systems model improves understanding of park management and community needs and impacts amongst both managers and other stakeholders. This chapter builds on Chapter 2 which elicited different strategies employed by Indigenous communities living in and adjacent to Yok Don National Park to understand the impact on park resources and manage resource use of Indigenous communities. This understanding provided a starting point for identifying the most important wetland species Indigenous communities have used and how they interact and manage them. Then Chapter 3 identified the most important cultural keystone wetland species based on the most important wetland species from Chapter 2 and unpacked the complexity of the roles these species play for Indigenous communities. Cultural keystone species were used as they can be a lens to understand the cultural dimensions of the social-ecological system (Berkes, 2002, Garibaldi and Turner, 2004) and to build consensus between different knowledge systems and values held by partners in protected areas (Hill et al., 2010, Robinson et al., 2014). These most important cultural keystone species were used at a modelling workshop to better understand the components' interactions within the whole system. This chapter will place this complexity into the context of the management of the park by developing a conceptual social-ecological systems model through a collaborative effort between park managers and Indigenous communities. The aim of this conceptual model was to provide a better understanding of the social and environmental relationship between Indigenous communities and the protected area. Often, social-ecological systems models have been suggested and developed to assist with management without examining their accuracy after initial development. However, social-ecological systems models may not reflect real life because, in distilling the complexity down to a simple diagram, some of the accuracy may be lost. Therefore, the accuracy of this conceptual model was examined by developing detailed individual conceptual social-ecological systems models for the most important cultural keystone species. These more detailed models were used to look for additional opportunities for collaboration amongst stakeholders not immediately obvious from the full system model.

4.1 Introduction

The application of models such as system dynamics models (Forrester, 1997), agent-based models (Bousquet and Le Page, 2004), scoping models (Sandker et al., 2010, Collier et al., 2011), quantitative ecosystem models and conceptual or qualitative ecosystem models to inform conservation planning and management is a growing global phenomenon. This requires models to be designed and applied so that they are useful to decision makers charged with setting and

delivering targets that meet environmental and community priorities. The styles and applications of these models are diverse, but all rely on processes that generate "usable knowledge" – that is knowledge that can improve understanding of complex environmental problems and produce effective solutions (Cash et al., 2003, Salerno et al., 2010). Conceptual models are one of the most effective types of models, particularly when they are built using a cooperative strategy in which scientists, resource managers and other stakeholders develop the models together (Svarstad et al., 2008, Chan et al., 2012). Participatory forms of environmental planning and decision making now exist that enable a diversity of societal actors to present information and ideas and deliberations about relevant knowledge and appropriate behaviour (e.g. Lejano and Ingram (2009)). This requires participatory modelling frameworks and procedures that can improve knowledge about the dynamics and complexity of social-ecological systems, help us to understand potential effects of human actions and their roles and identify the utilisation of ecosystem services by societal actors (Roux et al., 2006, Delgado et al., 2009). Participatory modelling uses system models as the main tool for improving social learning about ecological systems, building consensus and scoping problems (Costanza and Ruth, 1998).

The concept of social-ecological systems contributes an effective tool to explain the dynamics, complexity and uncertainty of systems and develops a better understanding of the interconnectedness between environmental and societal components (Berkes and Folke, 1998, Ostrom, 2009). The social-ecological systems models are used to link social and ecological factors and their interactions with the objective of building a foundation for structuring and analysing social-ecological systems (Ostrom, 2007, Ostrom, 2009). This concept also enables researchers to consider cases in a systematic manner to determine core factors of social-ecological systems (Cox, 2014, Leslie et al., 2015).

In order to integrate Indigenous knowledge and science and management knowledge to achieve effective natural resource management, there is a need of involvement of Indigenous people and other people who have a "stake" in protected areas and their management as stakeholders and understanding their roles (Ostrom, 1990, Borrini-Feyerabend, 2011). Stakeholders may be communities, government agencies and range from local users to regional and national level stakeholders and even to international level (Folke et al., 2005a). Some of the roles of these stakeholders include:

- Federal and State Government: recognise Indigenous community rights and their knowledge in management and use of biological resources by issuing legal binding agreements (United Nations, 1992a, United Nations, 1992b).

- Managers: The knowledge is applied by managers through developing strategies. The managers are seen as "decision makers", they take the science and convert the information from theory to practice (Roux et al., 2006).
- Scientists: Scientific knowledge is provided and promoted by the scientists. They are seen as "experts", and argue for the relevance of scientific knowledge to management (Roux et al., 2006). The contribution of the scientists may be considerable if they foster the participation in management by different groups (Schultz and Lundholm, 2010, Du Toit et al., 2004).

In the manager–scientists relationship, a cooperative learning system is established when new knowledge is created by shared understanding (Roux et al., 2006). In addition, risk can be abated not only by managers composing an explicit commission but also by scientists certifying their advocacies (Roux et al., 2006).

- Local users and residents or Indigenous communities: Local and Indigenous communities have their rights to be dependent on natural resources and collective right to survival through self-determination (Crawhall, 2015). Important roles of Indigenous communities in conservation were better understood, Indigenous communities were put back into the ecosystem. Indigenous communities play a vital role as a core factor in long-term protected area conservation strategies as the environmental issues can be realised and the results of exploitation can be monitored by local resource users much earlier than by government agencies (Berkes et al., 2006). The policies and rules of these strategies will be followed by Indigenous communities when they are involved in decision-making processes through incorporating their knowledge and opinions (Mascia et al., 2003, Fu et al., 2004, Pretty and Smith, 2004, Andrade and Rhodes, 2012). Indigenous knowledge is characterised by practical skills and wisdoms created at a local scale through gaining livelihoods from nature over progressive eras (Berkes, 1999, Brook and McLachlan, 2008). Indigenous knowledge can be conceptualised as different levels of the complex comprising knowledge, practice and belief (Berkes, 1999).

In conclusion, there has been a growing recognition that stakeholder participation is crucial for natural resource management. The integration of Indigenous knowledge and scientific and management knowledge improves the social-ecological systems resilience by contributing a diverse source of knowledge for problem solving (Folke, 2004, Folke et al., 2005b, Berkes and Turner, 2006, Davidson-Hunt, 2006, Bohensky and Maru, 2011). While Indigenous knowledge can provide information about place and spatial and temporal changes, the scientific and management contributes contemporary large-scale ecological processes knowledge (Moller et al., 2004, Aikenhead and Ogawa, 2007, Wohling, 2009).

Modelling social-ecological systems has been applied in many case studies over the past ten years to unpack the characteristics of complex social-ecological systems and showcase how social-ecological systems models can be used for assisting in management issues. Franzén et al. (2011) built a conceptual social-ecological systems model for evaluating policy options for nitrogen management in Sweden and emphasised the critical role of stakeholders' participation in the modelling process. The stakeholders' participation in the modelling procedure helped communicate current management scenarios to the stakeholders and stakeholders confirmed social gains and knowledge gains as a result of network building. In Chile, a physical, ecological and social system approach was implemented through participatory modelling to develop conceptual models for managing conflict in relation to the Río Cruces wetland (Delgado et al., 2009). Each societal actor group showed that they understood and perceived the interaction between humans and the ecosystem in a different way. Delgado et al. (2009) argued this approach was an effective communication tool among societal actors that could be used by decision makers for building consensus between societal actors as one way to deal with conflict. In Nepal and Pakistan, a participatory modelling framework was applied with consideration of the needs of decision-makers at a local level and helped them define strategies for sustainability in mountain areas rather than suggesting technical solutions to deal with problems Salerno et al. (2010). They found that the advantages of modelling are provoking communication and discussion among participants, information guide management research and providing validation of knowledge. However, there was a variation in attitudes of local communities participating in this research. In Pakistan, two workshops were organised and assessed positively by stakeholders and local communities asked whether this approach could be applied in the future. On the other hand, during a case study in Nepal, which included two workshops and a prolonged series of meetings, was realised that local communities easily lost their interest in participation over time. Qualitative social-ecological modelling was also applied to manage Indigenous aquatic hunting and gathering in tropical Australia (Barber et al., 2015). Two models including a short-term model (drivers of effort by active individuals) and a long-term model (persistence of subsistence at the community scale) were developed to predict how the systems might respond to potential perturbation. The complexities, potential management and policy levers were identified, defined and debated. These models were built based on participatory resource use survey and aquatic subsistence in Indigenous community survey with observations from the sources of published literature only. These case studies have shown that social-ecological systems models have been supported to be an effective means in communication among societal actors (Delgado et al., 2009, Salerno et al., 2010, Franzén et al., 2011, Barber et al., 2015). The stakeholders played a critical role in participating in the modelling

process. However, a prolonged series of workshops and meetings might lose the interest of local communities in the long run.

This chapter focuses on building a conceptual social-ecological systems model with social actors through exploring how communities interact with the ecosystem. One of the ways that social and ecological information can be linked and examined for ecosystem conservation and restoration is through using cultural keystone species (see Chapter 3) as cultural keystone species can be a useful focus to understand the cultural dimensions of the social-ecological system (Berkes, 2002, Garibaldi and Turner, 2004) and as a basis for building consensus between different knowledge systems and values held by partners in protected areas (Hill et al., 2010, Robinson et al., 2014). This chapter considers the design of a model that describes a park's social-ecological system as a mechanism to ensure that scientific information, as well as information from managers and Indigenous communities can be used in developing informed conservation strategies. This chapter focuses on a participatory research methodology that investigated 1) whether collaborative development of a social-ecological systems model process improves understanding of park management and community needs and impacts amongst both managers and other stakeholders 2) how the extent of understanding and the recognition of each other's viewpoints, interests and needs might underpin not only a specific negotiation about an issue but also the relationships between managers and communities.

4.2 Methods

Semi-structured interviews were used to collect information on the views of members of Indigenous communities bordering Yok Don National Park to gain an understanding of how they interact with the park and the park managers. This information was then used in a workshop with members of the communities and park managers to develop a conceptual social-ecological systems model of the park incorporating ecosystem components cultural keystone species, management strategies being applied by the park management agency and Indigenous livelihood strategies employed by Indigenous communities. In order to examine how well the overall conceptual social-ecological systems model matched the detailed information about individual keystone species, conceptual social-ecological systems models for the four most important cultural keystone species were built through observations, interviews with Indigenous communities and extracted from the main conceptual model. After the workshop, through semi-structured, open ended questions and semantic differential scales, we evaluated the effectiveness of this modelling procedure on communication and shared understanding between Indigenous communities and park managers.

4.2.1 Understanding relationships between park managers and Indigenous communities

To ascertain baseline information about the relationship between Indigenous communities, the park and managers, a questionnaire eliciting the relationships-frequency of contact and extent of cooperation between park managers and Indigenous communities-was completed. Ten individual park managers and 259 Indigenous community members were interviewed about ten key themes surrounding effective collaboration. These themes were derived from a review of the literature (Chapter 1) and are summarised in the interview schedule. The park managers participating in the research included the Director of the park, Vice Head of Division of Science and International Cooperation for the park and eight of the fourteen Heads of Forest ranger stations. The information collected was then evaluated graphically comparing the relationship scores given by managers and Indigenous community members.

4.2.2 Determining threats facing Yok Don National Park

The current threats facing Yok Don National Park were determined through interviews with senior managers and field managers. Six of the fourteen Heads of the Forest ranger stations, two of the Heads of Mobile Forest ranger teams, the Head of the Division of Organization and Administration and senior staff of the Division of Science and International Cooperation were individually interviewed about the current threats facing Yok Don National Park. For each potential nominated threat, the root causes and impacts of the threat were discussed. The participants were asked to rank each threat on a scale from 1 to 10, with 1 being least harmful and 10 being most harmful to the park ecosystem.

4.2.3 Developing the social-ecological systems model

The development of the social-ecological systems model was undertaken in two stages: 1) identifying components of the model and 2) building the overall conceptual model and models for the four most important cultural keystone species.

4.2.3.1 Identifying components of the model

Firstly, to gain an understanding of how Indigenous communities depend on the park, local activities being undertaken, frequency and importance level of each activity and wetland species in the park being used were identified (Chapter 2).

Secondly, Heads of villages were asked to nominate thirty key representatives who had experience and knowledge of the park. These representatives were interviewed to determine the most important

and most used wetland species in the park, and these species were then discussed in a focus group with thirty key representatives of each village. Cultural keystone species for the people of each village surrounding the park were identified based on an index of the cultural influence of the most important and most commonly used species (Chapter 3).

Thirdly, discussions were held with park managers, covering all the nominated threats.

4.2.3.2 Building the social-ecological systems model

All this information was brought together to develop a conceptual social-ecological systems model through a workshop with stakeholders and managers. Prior to the workshop a list of the most important cultural species that were components of the park's wetland was developed. We began with the ranked lists of species obtained from each of the discussions with the villagers. We then picked the top five ranking plant species and top five ranking animal species from each village. As there was little variation in the top ranked plant species across all villages we kept these five species to create a combined list for all villages. There was variation in the top ranked animal species between villages because villages further away from the park were not able to transport large animals from the park to their village. Therefore these animals had high importance indexes but low use indexes (Chapter 3). Therefore I also included those animals with high importance indexes but low use indexes overall due to the village's inability to access these resources. These species then formed the list of the most important cultural keystone species across all villages.

The workshop to develop the model was held at the park's main office and included two park managers and the Heads or Vice Heads of nine villages participating in the research. We felt that the Heads or Vice Heads of the villages were the most appropriate people to be involved in the process as they are the people who lead the village and they interact with all the people living in that village. I aimed to undertake all nine Heads or Vice Heads of nine villages participating in the research and tried to arrange the most suitable time for all of participants. However, I fell short of this on the day the workshop was conducted, two representatives of two villages could not attend due to their personal issues.

The first activity at the workshop involved asking each Indigenous representative to again rank the combined list of the most important species from all nine villages. This was done to ensure that the species that are really important but may only fit one of the criteria and therefore can only score a maximum of four are still counted as very important despite their low score. It also guarantees that when information from villages was averaged, there were not major differences between villages. These lists were then collated to develop a list of the most important and most used wetland species

for all nine villages. Overall ranks through the workshop were then calculated in order to derive an overall flora and fauna wetland species list with cultural keystone species for Indigenous groups. The roles, interactions between these cultural keystone species and the threats were discussed to incorporate these relationships into the conceptual diagram that was built at the workshop. The managers then explained for all participants the reasons why these species needed to be conserved and outlined the management activities undertaken at Yok Don National Park in relation to these species. Finally, suggestions for conservation strategies from Indigenous communities and the managers were provided for discussion during the workshop.

4.2.3.3 Building conceptual social-ecological systems models for the four most important cultural keystone species

In order to evaluate how well the overall social-ecological systems model matched the detailed information about individual keystone species, conceptual social-ecological systems models for the four most important cultural keystone species comprising elephants, turtles, Indian mulberry and cogon grass were built through observations, interviews with Indigenous community members and the information shared by park managers and Indigenous communities from the modelling workshop.

4.2.4 Evaluating the development of the social-ecological systems model process between park management and Indigenous communities

After the workshop I evaluated what people learnt from the workshop to determine if the use of the social-ecological systems model led to enhanced understanding and ability to identify opportunities for development of more collaborative management arrangements. Two questionnaires with open-ended questions using a semi-structured and semantic differential method with options for longer explanation of answers were used to separately interview representatives at Yok Don National Park office. Park management representatives included the Vice Heads of the Division of Science and International Cooperation and Division of Organization and Administration. Representatives from Indigenous communities consisted of the Head or Vice Head of each village that participated in the study. A seven-point Semantic Differential scale was applied across twelve questions to assess the perception of participants. The twelve interview questions covered three major topics: benefits of the workshop process, learning that occurred from the workshop and likelihood of changing their initially stated intentions after workshop. For each question the responses from individual managers and village' representatives were combined to provide an average response for the management group and the Indigenous communities.

4.3 Results

4.3.1 Relationships between park managers and Indigenous communities

First, the focus was on the issues of trust, communication and response from the park managers that affect the relationships between park managers and rangers and Indigenous communities. Then, the impact that park rules and regulations have on Indigenous communities' livelihoods was identified. Finally, the management strategies being applied were examined to expose some of these issues.

Park managers had a more positive view of their relationship than members of Indigenous communities (Figure 4.1 and Appendix A4.1). Indigenous communities viewed the lines of communication including daily life and needs communication between them and the park managers to be very limited with less than 3% of people reporting they had good communication with park managers and over 80% responding that there was no communication (-3 point on the seven-point scale in Figure 4.1). Indigenous communities mentioned that they only communicated with park managers during village meetings and on patrols with forest rangers through implementing the forestry land contract. The issues that Indigenous communities often raised with park managers were for general park information and requests about concerns inside the park. Park information sought by communities included the park rules (e.g. the boundary of the park and building fences to protect cattle inside the park) or assistance to improve Indigenous livelihoods (e.g. advice on cultivation techniques). Indigenous communities also raised short-term concerns such as land issues including land for cultivation inside the park and unequal land contract payment between villages as well as questions relating to their daily needs from the park resources. For example, Indigenous communities came to park managers and asked for permission to collect woody plants for constructing houses and cattle sheds in villages and for making coffins. The long-term concern of Indigenous communities was about the future access to natural resources for themselves and future generations because of the free movement of ethnic minority groups from the north. Although the park managers understood that these were the customs of Indigenous communities, harvesting of woody plants within the park was prohibited by the park managers based on the Vietnamese Government's decree 99/ND-CP dated 24th September, 2010 on the policy on payment for forest environment services (Government of Vietnam, 2010b), Vietnamese Government's decision 186/2006/QD-TTg on Promulgating the Regulation on Forest Management (Government of Vietnam, 2006b), Vietnamese's decree 32/2006/ND-CP on Management of endangered, rare animals and plants (Government of Vietnam, 2006a), Vietnamese Government's decision 08/2001/QD-TTg on Promulgation of Regulations on Management of Special-use forests, protection forests and production forests (Government of Vietnam, 2001), Vietnamese

Government's decree 117/2010/ND-CP on Management Organization Special-use forest system (Government of Vietnam, 2010a), Vietnamese National Assembly's law 29/2004/QH11 on Forest Protection and Development (Vietnamese National Assembly, 2004), Vietnamese Government's decree 157/20132013/ND-CP on Penalties imposed on Administrative sanctions in Respect to Forest control, Forest development, Forest protection and Forest product management (Government of Vietnam, 2013b). This led to a conflict between park managers and Indigenous communities, which resulted in the illegal harvesting of timber.

All respondents said new conservation strategies were not discussed with Indigenous communities before they were implemented; however, a minority (20%) of Indigenous community interviewees said that park managers would always tell them about these strategies once they were implemented. Over two-thirds of Indigenous communities reported that conservation strategies implemented by managers were impacting negatively on their livelihoods. The reasons for this were that they could not use the park's natural resources or undertake cultivation inside the park, and that enforcement of the new rules meant that more people were being held in prison. In spite of these issues raised by Indigenous communities, overall they reported their family and village would be worse off if there was no longer protection of the park because protection limited illegal activities and overexploitation in the forest by Indigenous and non-Indigenous communities. They thought these activities could lead to the disappearance of the forest, a lack of plants and animals, and erosion and floods. Without the park, they could not participate in the land contract to co-manage with park managers and no one would help them construct irrigation channels to develop their cultivation from single crop to double crop.

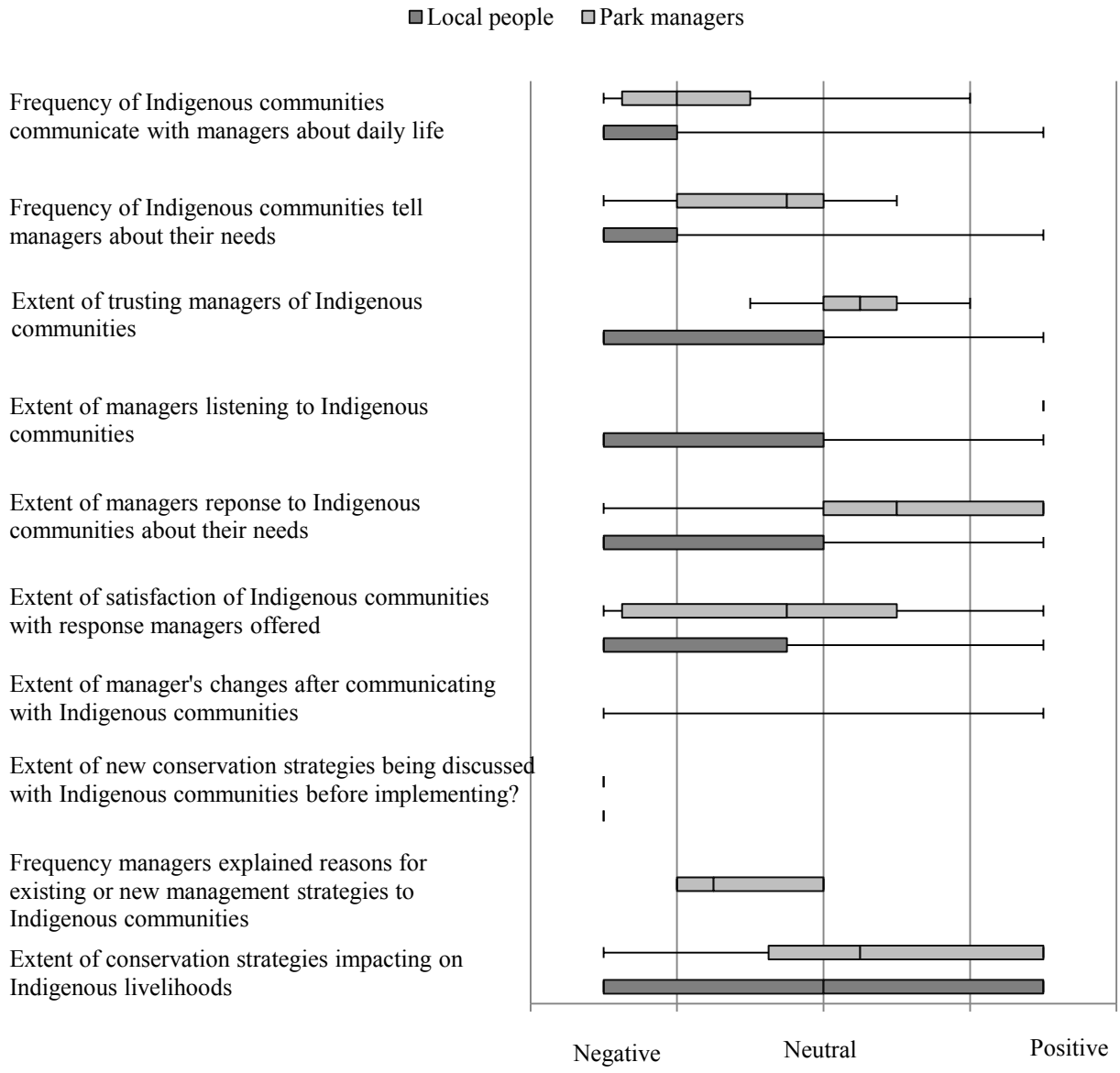

Figure 4.1 **The relationship between park managers and Indigenous communities before the modelling workshop.** Error bars show range. First and third quartiles depicted using box (seven-point Semantic Differential scale, N = 259).

4.3.2 Threats to Yok Don National Park

The current most important threats facing Yok Don National Park fell into two distinct groups, small scale community threats and large scale developmental threats (Figure 4.2). The local threats were considered to be Indigenous communities, poaching and illegal harvesting, habitat alteration and destruction and livestock grazing inside the park. Indigenous communities are considered as threats to natural resource conservation in Vietnam (KimDung et al., 2013). The activities that Indigenous communities, including indigenous and non-indigenous groups, undertook in the park were considered as the most important threat to Yok Don National Park. Migration to the buffer zone of the park posed the largest threat. Non-indigenous groups continue to freely migrate from the north of Vietnam to become permanent residents in the park buffer zone. This migration is coupled

with population growth of the newly migrated groups, leading to an increasing demand for land. Park managers reported that livelihoods of both indigenous and non-indigenous groups depend on direct use of the natural resources of the forest which is the traditional way of life for ethnic minority groups in Vietnam. The demand for woody plants, NTFPs and rare, endangered animals is high and increasing. This demand has been the root of poaching and illegal harvesting leading to the depletion of natural resources. It is traditional for Indigenous communities to graze livestock and they consider the land within the park to be good land for grazing. Some Indigenous households have impacted on the forest through livestock grazing activities. Although these activities are prohibited based on article 18 of the decision 186/2006/QD-TTg from the government, often through negotiation with the Indigenous communities some grazing is allowed within the park (Government of Vietnam, 2006b). These Indigenous community activities have led to habitat alteration and destruction. The use of the park resources continues to increase as the local population continues to grow.

Threats associated with development were aspects that the Indigenous communities did not necessarily have direct control over. These included the development of a hydro-electric power plant within the park and park infrastructure development. Infrastructure development included the construction of roads and houses for forest rangers for improving access for patrols and for the army and border guards, thus improving protection of the border of the country.

Construction of a hydroelectric power plant and infrastructure development were identified as large scale developmental threats to Yok Don National Park. At the time of the interview, construction of hydroelectric power plants had not been allowed in this park; however, there was a preliminary plan to build one. Infrastructure development is very likely to continue to occur within the park.

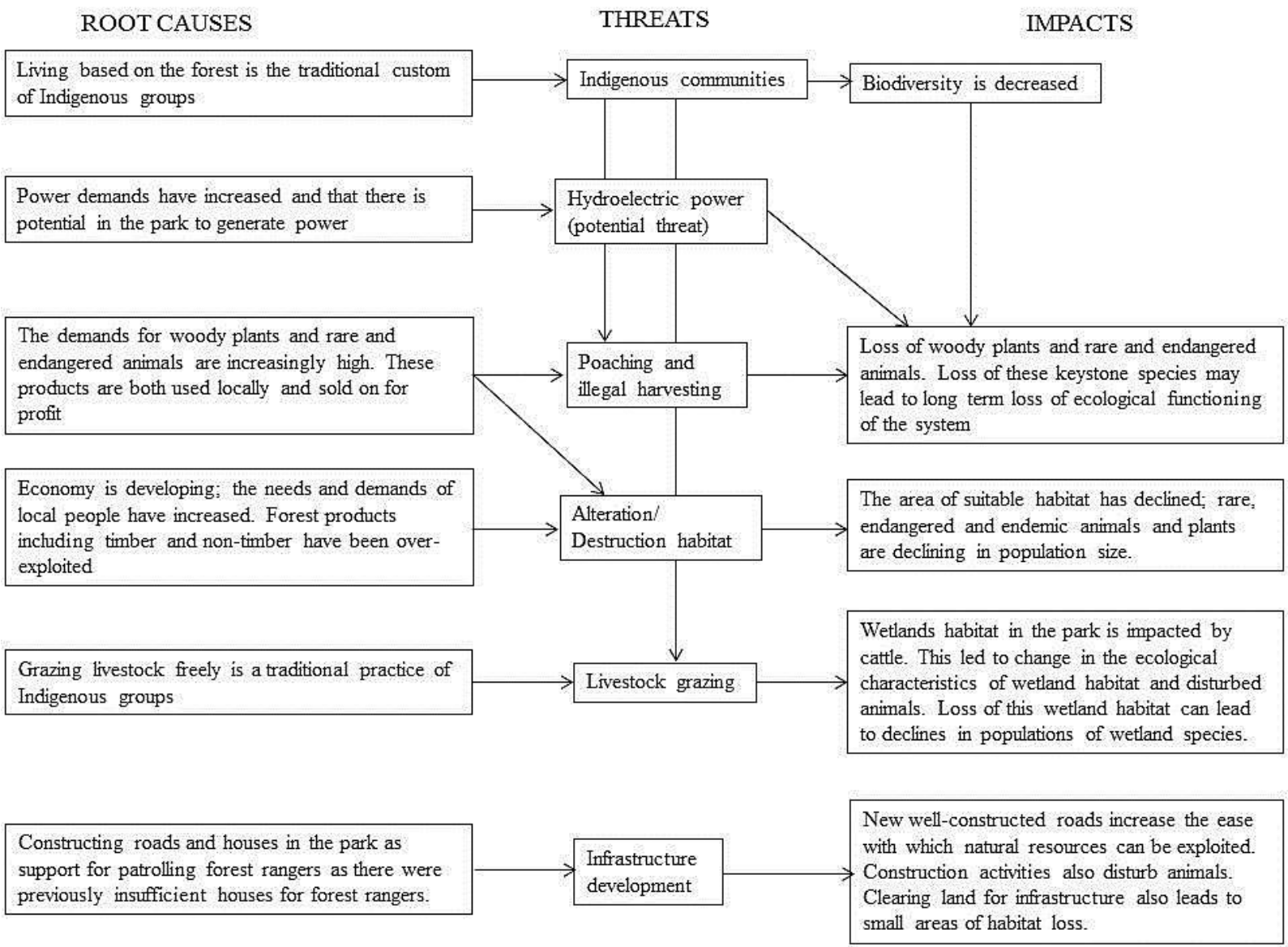

Figure 4.2 **Potential threats to ecosystem functioning of Yok Don National Park.** This information was provided by park managers and each threat was ranked on a scale from 1 to 10, with 1 being less harmful and 10 being most harmful to the park ecosystem.

4.3.3 Using the conceptual social-ecological systems model to improve understanding of park management and community needs and impacts amongst both managers and Indigenous communities

The wide range of social, ecological and institutional attributes and interactions exposed by the social-ecological systems model provided a useful platform for Indigenous communities and park managers to check and integrate statements from Indigenous communities with park manager information and views and allowed the collection of evidence which needs to be questioned, tested and, where appropriate, integrated, with evidence provided from other sources.

During the modelling workshop, the park managers and Indigenous representatives were actively involved in sharing scientific knowledge and traditional knowledge to further their understanding of each other (Figure 4.3). From the Indigenous communities' view point the park was a social-ecological system that held species that were key to their livelihoods. Most of the participants mentioned that they entered the park at least once a month for harvesting plants, hunting animals, cultivation, grazing livestock and recreation. This information was similar to the information resulting from the individual interviews with 259 Indigenous community members (Chapter 2). Visiting inside the forest for harvesting plants and hunting animals plays a most important role in Indigenous communities' daily lives, for their food, medicine and materials and also for their spiritual practices. Grazing livestock freely in the park is a traditional custom of Indigenous communities and this was one of the important sources of income. The views of the Indigenous people at the workshop were representative of the overall communities being surveyed, as reported in Chapter 2. Indigenous representatives reported that knowledge about the uses of the park was shared across generations (Chapter 3). This was also confirmed by the Indigenous respondents of differing ages who stated that the same knowledge was shared across the generations. Representatives from each village exposed a list of the most important cultural keystone species of that village.

The senior managers spoke about the impact these Indigenous views about their social-ecological system had on park goals and management regulations. Both legal resource use and poaching have caused negative impacts on the wetland habitat. Some regulations focus on regulating Indigenous use of animals and plant species, although in practice these institutional rules have been re-negotiated at a local level between park managers and Indigenous communities to allow some use.

The park managers identified some strategies for conserving the environmentally important Dipterocarp habitat that are currently undertaken in Yok Don National Park including education,

law enforcement, photographic monitoring and rehabilitation and re-release of poached animals (Table 4.1). Each conservation strategy had its own conservation actions in order to manage and protect the park. The park managers also explained the reasons why they applied these strategies to Yok Don National Park. Signs, meeting with Indigenous communities and broadcasting were three ways used by park managers to improve the awareness of Indigenous communities about the importance of conservation. Every year, there were meetings between park managers and Indigenous communities focused on protection strategies for the forest. At these meetings the decision on forest management and decrees on organisation and management of the special-use forest system and on payment for forest environment services were discussed between park managers and Indigenous communities. Daily plans for law enforcement patrols based around risks of illegal use were developed by the Director. If there were any violations of forest protection and management, as outlined by the government decree 157/2013/ND-CP on penalties imposed on administrative sanctions in respect to forest control, forest development, forest protection and forest product management appropriate penalties were applied (Government of Vietnam, 2013a). For minor violations of park rules, fines were paid directly to the forest rangers station. For more serious violations, forest rangers would deliver the violators to the police station.

By the end of the workshop, there were several conservation strategies that the Indigenous community had agreed were beneficial both to them and to the wetlands within the park (Table 4.1). Some of these were strategies that were already in place to some degree, such as forest patrol in order to prevent impacts from external parties using the park resources, while others were new suggestions. The Indigenous communities felt that the most effective management strategies that could be employed to protect the park were the continuation of forest patrols to prevent illegal resource use and the minimisation of new construction projects within the park. The use of non-timber forest products (NTFPs) from the park was essential for the daily lives of the Indigenous communities and therefore alternatives needed to be found in order for the amount of these resources being taken from the park to decrease. Indigenous communities suggested that planting rather than harvesting from the park plants such as cogon grass and sticky adenosma would reduce park resource use but would require the construction of irrigation canals. Irrigation canal construction surrounding the buffer zone could also provide enough water for Indigenous communities to plant a second and third paddy rice crop, as well as allowing for rotation of crops and keeping perennial plants alive during the dry season. Based on the individual interviews and focus group discussions with the Indigenous communities, water scarcity was one of the important issues that Indigenous communities living in and around the buffer zone of Yok Don National Park are concerned about. Irrigation canals had been constructed at Drang Phok village in order to

increase the number of crops in a year from one crop to two or three crops. This could be extended to other villages in the buffer zone if the irrigation canals could be constructed. Breeding buffalo, cows, wild pigs, snakes, lizards and frogs was suggested by Indigenous communities to reduce the poaching or legal harvest of animals from the park. Different villages suggested different animals depending on the situation of their village. If local villages were to undertake a breeding program, it would consist of six steps based on discussion between park managers and Indigenous communities. Firstly, the permission for breeding must be approved by the People's Committees of Dak Lak and Dak Nong Province before implementing. Permission is likely to be given to breed frogs, buffalo, cows and wild pigs. However, when breeding snakes and lizards it would be necessary to find the most appropriate species and prove to the Committees that breeding them will not impact on the biodiversity of the region. Finding potential funding is the next step. Potential funding can be from the government, the People's Committees, Vietnam Forest Administration and other projects. Thirdly, representatives to trial each breeding program need to be carefully chosen by Indigenous communities. The representatives could then learn the methods and the breeding process from other successful models. After understanding the process, young individuals for rearing and breeding need to be provided. Finally, the produce will be promoted to the market. If the model is successful, it will then be introduced and applied to other households in that village; therefore, finding a potential market plays an integral role at this step. The steps 1, 2, 4, 5 and 6 would need assistance from the park management agency.

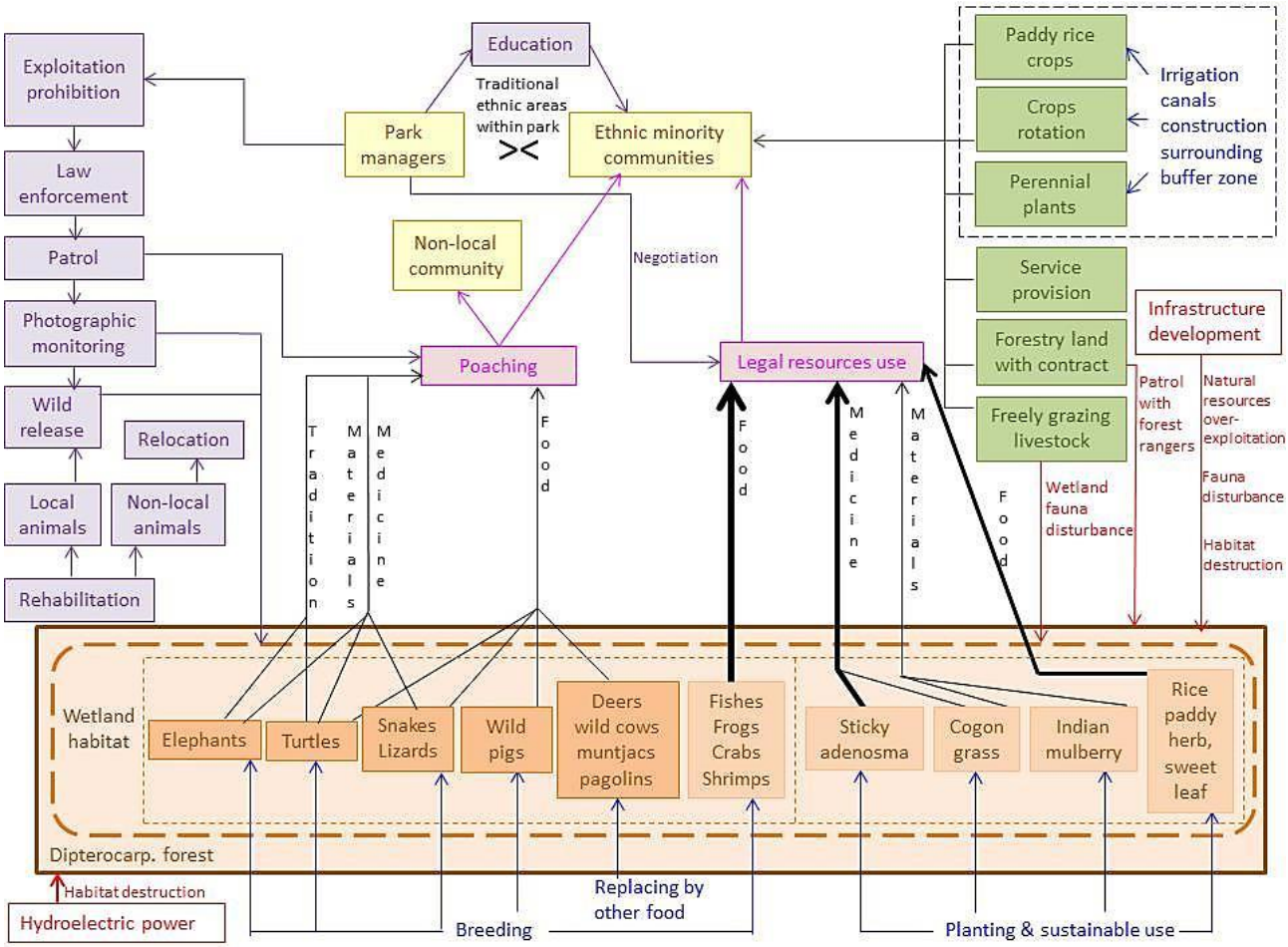

Figure 4.3 **Social-ecological systems model of Yok Don National Park.** Arrows show flow of resources through this system to produce park resources. Different components are shown by different colours (yellow – human players in the ecosystem, orange – components of Dipterocarp forest, purple – conservation strategies implemented by park managers, pink – activities undertaken by local and non-Indigenous communities, green – income sources of Indigenous communities, black – park resources used by Indigenous communities with line thickness denoting use levels (4-point scale), red – threats to the park and blue – suggestions generated at the modelling workshop for reducing human impact on wetland resources in the park.

Table 4.1 **Park management strategies for conserving the park and livelihood strategies for improving the livelihoods**

Strategies		Actions
Park management strategies aim at conserving the species within the park and returning poached species back to the park	Education	Signs Meeting with Indigenous communities Broadcasting
	Law enforcement	Patrol Remind Fine
	Photographic monitoring	Cameras are used for tracking animals and taking photos of poached animals
	Rescue, release, rehabilitation of poached animals	Poached animals are rescued. If poached animals are local animals, they will be released. If poached animals are non-local animals, they will be rehabilitated and relocated.
Livelihood strategies aimed at improving the livelihoods of Indigenous communities (Chapter 2)	Paddy rice crops	Growing single or double seasons paddy rice crops depends on water source
	Crops rotation	Growing corn, cassava, bean
	Perennial plants	Growing cashew, coffee, rubber, fruit trees
	Service provision	Soldier, businessman, office worker, teacher, doctor, nurse, tourism worker, police, worker are all the careers that Indigenous community members employed except farmers (accounting for only 7% of Indigenous communities).
	Free grazing of livestock inside the park	Free grazing of livestock inside the park is the traditional custom of Indigenous communities living in and around the park; especially the villages that are close to the park (less than 4 km away from the park).
	Forestry land contract	Indigenous communities are employed to protect some areas of the park by park managers.
	Harvesting wetland resources	Indigenous communities harvest plants and animals from wetland resources
	Harvesting forest resources	Indigenous communities illegally harvest the resources from the forest

4.3.3.1 Using social-ecological system models of the most important keystone species to understand park management strategies and Indigenous strategies

The government, park management and Indigenous communities have different areas of agreements and conflicts with each other on conservation through social-ecological system models for elephants (Figure 4.4 and Table 4.2), turtles (Figure 4.5 and Table 4.3), Indian mulberry (Figure 4.6 and Table 4.4) and cogon grass (Figure 4.7 and Table 4.5).

Generally, different species have different areas of consensuses and conflicts between the government, park managers and Indigenous communities. The main conflicts between Indigenous communities and the government and the park management agency occur when the authorities are applying the exploitation prohibition or building hydroelectric power stations and roads and staff housing for military to protect the Vietnam border. These conflicts arise from the needs of Indigenous communities to use natural resources. A consensus between the stakeholders is more likely on the plants as the park managers and Indigenous communities have an agreement that allows Indigenous communities to collect the wetland plants inside the park.

Elephants: There are more consensuses in elephant conservation among government, park managers and Indigenous communities than conflicts. Although patrols for preventing subsistence use put negative impacts on Indigenous communities in which there is a loss of Indigenous wild elephants hunting traditions, Indigenous communities agree with the government and park managers about the need to conserve the elephants. There is also an agreement among the government, park managers and Indigenous communities and it allows Indigenous communities to cultivate and graze their cattle freely inside the park. These activities are important sources of Indigenous income but they have caused fragmentation of the elephants' habitat and alteration leading to reducing the elephants' population. Harvesting forest resources and animals also cause elephants' population reduction; these actions are the roots of the conflicts among the government, park managers and Indigenous communities.

Turtles: There are more conflicts in turtle conservation among government, park managers and Indigenous communities than consensuses. Indigenous communities agree with park managers in conserving some areas of the park through forestry land contracts; however, this agreement has put negative impacts on Indigenous communities because turtle hunting trading income is much better than salary from the contract. The conflicts between park managers and Indigenous communities divide into two types comprising of conflicts that put positive impacts and conflicts that put negative impacts on Indigenous communities. Patrol, rescue, release and rehabilitation are

management strategies of park managers that put negative impacts on Indigenous communities because of reductions in turtle hunting, leading to decline in turtle income. Harvesting wetland and forest resources are Indigenous community strategies that put positive impacts on Indigenous communities because these resource incomes form one of the main sources of Indigenous income.

Indian mulberry: There is an agreement between park managers and Indigenous communities in which Indian mulberry is allowed to be harvested sustainably by Indigenous communities. Indigenous communities conflict with the government because the hydroelectric power will change the habitat of Indian mulberry only.

Cogon grass: There is an agreement between park managers and Indigenous communities in which cogon grass is allowed to be harvested sustainably by Indigenous communities. However, cogon grass grows through shifting cultivation throughout the park and this shifting cultivation tradition is prohibited by the government and park managers. Therefore, this has led to conflict among the government, park managers and Indigenous communities. High concentrations of herbicide to maintain crop output on small portions of land, together with shifting cultivation inside the park are the roots of the reduction in the cogon grass's population. This reduction is increasing and the amount of cogon grass is not enough for the needs of Indigenous communities.

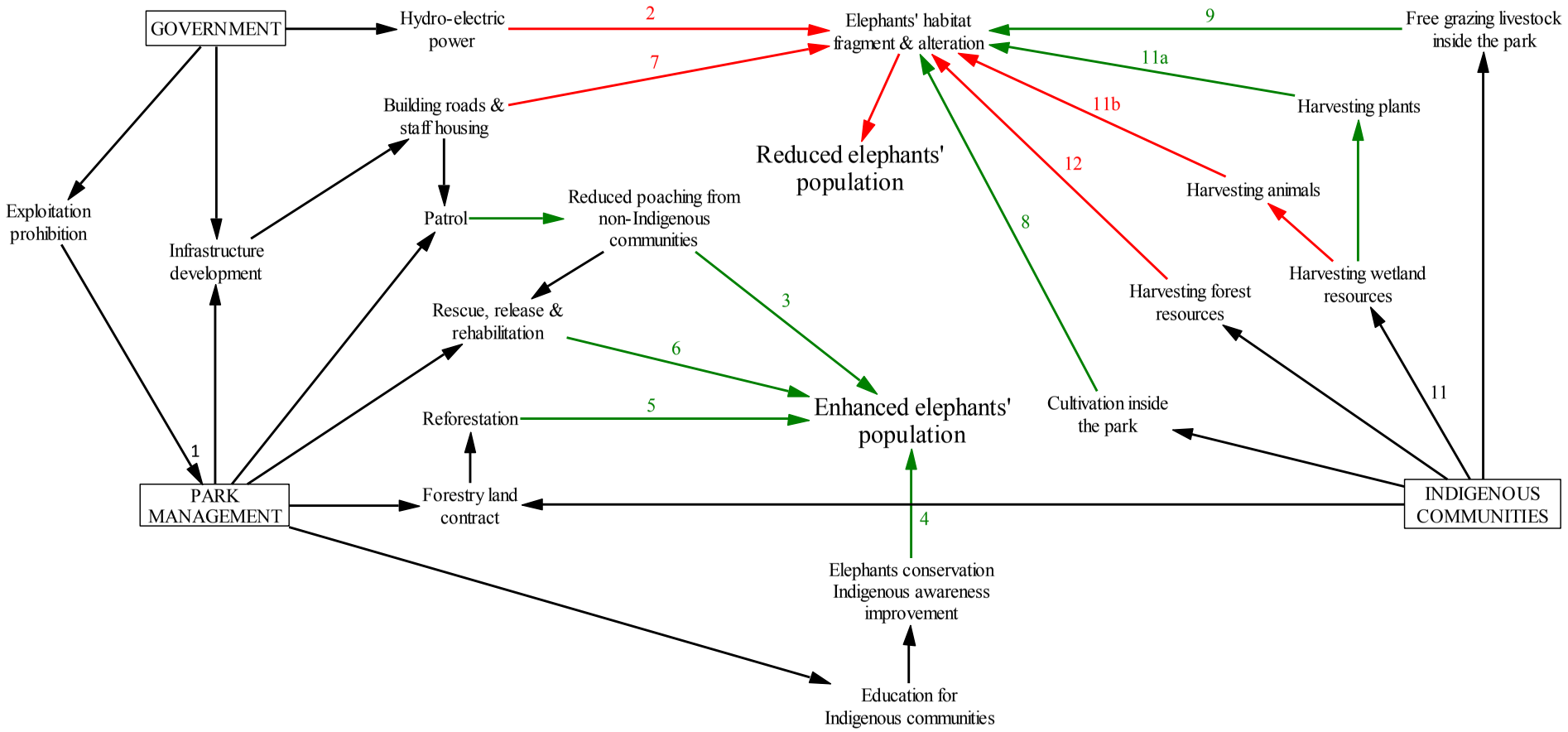

Figure 4.4 **Social-ecological systems model of elephants.** Green and red arrows show the consensus and conflict respectively between Park managers and Indigenous communities. Black arrows show the actions of the government, park management and Indigenous communities

Table 4.2 **Explanations of social-ecological systems model of Elephants.** Each impact was rated based on a seven-point scale from -3 negative impacts to +3 positive impacts from the observations of author during individual interviews, focused group discussions and workshop with Indigenous communities and park managers. Number reference is related to number in figure 4.4

Who enforces strategies?	No ref.	Strategies/Issues	Consensus or Conflict between Government/Park management and Indigenous communities	Impact on		
				Elephants	Park management (Ecosystem/ Biodiversity)	Indigenous communities needs and demands
Government	1	CITES Forest protection and development law Biodiversity law	Consensus Indigenous communities agree with government about the need to conserve the elephants because elephants play the most important role in Indigenous spiritual practices although this action still has big negative impact on Indigenous communities	+3 Protecting elephants by law	+3 Protecting elephants by law	+3 Protecting breeding elephants to ensure elephants survive for next generations of Indigenous communities -3 Prohibiting Indigenous wild elephant hunting tradition
	2	Hydro-electric power	Conflict Indigenous communities conflict with government about building hydro-electric power because Indigenous communities think that hydro-electric power can negatively impact on elephants' population	-3 Habitat fragment and loss	-3 Biodiversity loss	-3 Reducing the chance to see elephants in the forest
Park management	3	Patrol Preventing subsistence use Preventing non-Indigenous communities hunting elephants	Consensus Indigenous communities agree with Park managers about the need to conserve the elephants although this action still has negative impact on Indigenous communities Consensus Park managers and Indigenous communities agree with each other about preventing external impacts.	+3 Protecting wild elephants +2 Protecting wild and domestic elephants	+3 Protecting elephants' habitat → Biodiversity conservation +2 Biodiversity conservation	-3 Indigenous wild elephants hunting tradition loss Income loss +2 Protecting wild and domestic elephants

4	Education	Consensus Indigenous communities are educated to increase their awareness about biodiversity conservation.	+3 Protecting wild and domestic elephants	+3 Biodiversity conservation	+2 Improving Indigenous communities' awareness in elephant conservation so they can protect elephants better and keep elephants for their next generations
5	Forestry land contract Indigenous communities are employed to protect some areas of the park by park managers.	Consensus Indigenous communities who can make an acceptable amount of money from the contract because they have less travel cost to get to the park and larger area per person that they are paid more to protect Conflict Indigenous communities who cannot make an acceptable amount of money from the contract because they have more travel cost to get to the park and smaller area per person that they are paid less to protect	+3 Protecting wild and domestic elephants	+3 Biodiversity conservation	+3 Indigenous communities can have a say in park conservation strategies through discussion with forest rangers Income source of Indigenous communities
6	Rescue, release and rehabilitation of poached animals	Consensus Indigenous communities and park managers agree that this is the good strategy for maintaining the elephants' population	+3 Protecting wild and domestic elephants	+3 Biodiversity conservation	+3 Indigenous communities do not poach elephants therefore this strategy can protect wild and domestic elephants
7	Infrastructure development including staff housing for forest rangers and small roads inside the park for	Conflict Indigenous communities and park managers conflict with each other about infrastructure development because Indigenous communities say that elephants	-3 Elephants' habitat fragment and loss	+2 Better for patrol -2	-2 Reducing the chance to see elephants in the

		better patrol and also for protecting Vietnam's border	are very sensitive to noises and smells from humans and petrol from the vehicles that Indigenous communities use in the forest		Increasing illegal access	forest
Indigenous communities	8	Cultivation	Consensus Some villages close to the park are allowed to cultivate in their farms inside the park	-3 Conflict between Indigenous communities and Elephants	+3 When Indigenous communities spend time on cultivation, they will spend less time in the park -3 Patrol more, difficult to protect the biodiversity (some villages still cultivate inside the park)	+3 Income source of Indigenous communities
	9	Free grazing livestock inside the park	Consensus There is an agreement between park managers and Indigenous communities and it allows Indigenous communities to graze their cattle freely inside the park	-3 Impact on the water quality of wetlands → Elephants' habitat loss	-3 Biodiversity loss	+3 Income source of Indigenous communities
	10	Service provision	Consensus Once Indigenous communities go to work, they do not have time to impact on the park	0	0	+3 Income source of Indigenous communities
	11 11a 11b	Harvesting wetland resources	11a Consensus There is an agreement between park managers and Indigenous communities; it allows Indigenous communities to harvest the plants from the wetland resources only. 11b Conflict Indigenous communities are prohibited hunting animals from the forest	-1 -2 Elephants' habitat is fragmented and changed	-1 -2 Elephants' population is reduced	+1 Income source of Indigenous communities +3 Income source of Indigenous communities
	12	Harvesting forest resources	Conflict This action is illegal and prohibited.	-3 Elephants' habitat is changed and lost	-3 Elephants' population is reduced	+3 Income source of Indigenous communities

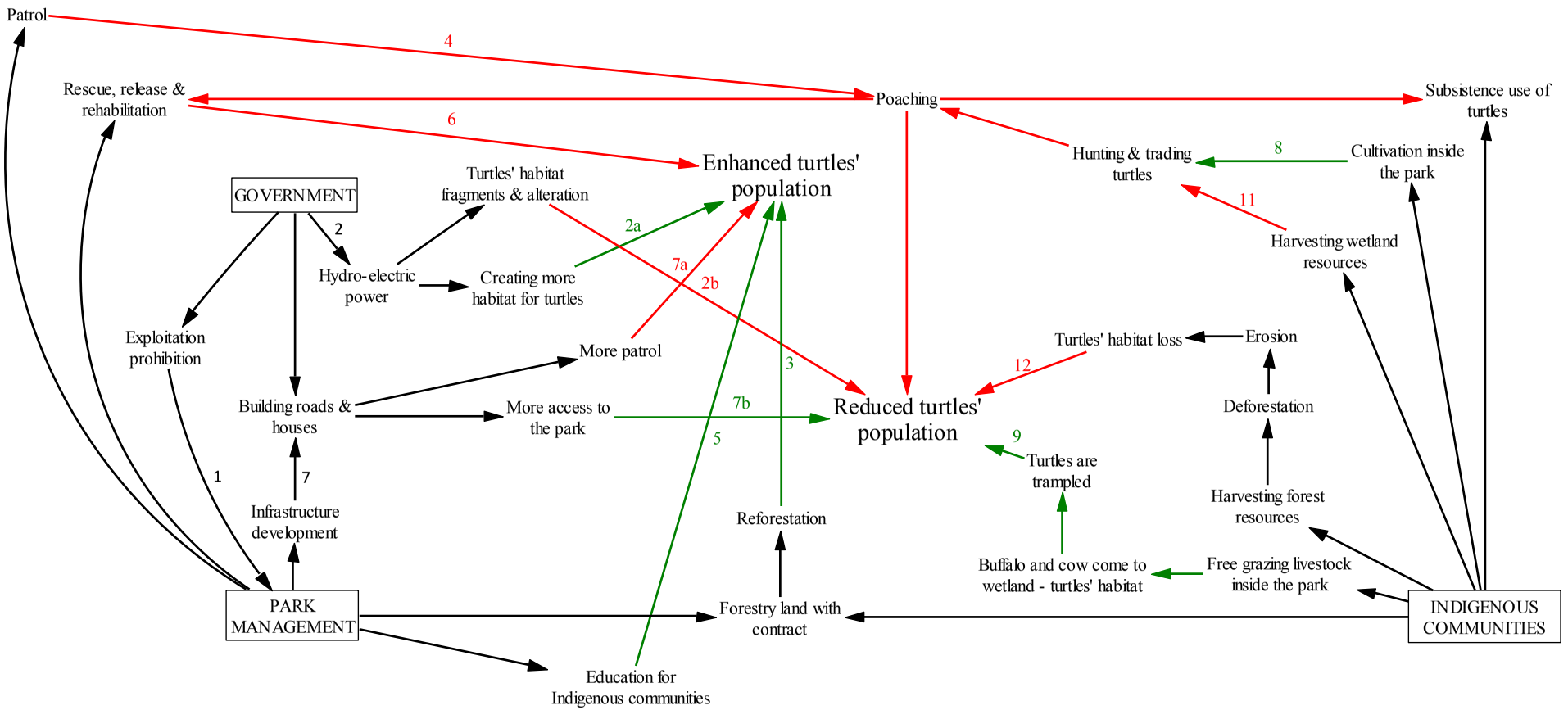

Figure 4.5 **Social-ecological systems model of turtles.** Green and red arrows show the consensus and conflict respectively between park managers and Indigenous communities. Black arrows show the actions of the government, park management and Indigenous communities

Table 4.3 **Explanations of social-ecological systems model of Turtles.** Each impact was rated based on a seven-point scale from -3 negative impacts to +3 positive impacts from the observations of author during individual interviews, focused group discussions and workshop with Indigenous communities and park managers. Number reference is related to number in figure 4.5

Who enforces strategies?	No ref.	Strategies/Issues	Consensus or Conflict between Government/Park management and Indigenous communities	Impact on		
				Turtles	Park management (Ecosystem/Biodiversity)	Indigenous communities needs and demands
Government	1	CITES Forest protection and development law Biodiversity law	Conflict Indigenous communities conflict with the government about the prohibition of hunting turtles inside the park	+3 Protecting turtles by law	+3 Protecting turtles by law	-3 Prohibiting turtles' poaching from Indigenous communities
	2	Hydro-electric power	Consensus Indigenous communities agree with government about building hydro-electric power stations because this construction creates more turtle habitat.	+1 Creating new wetland habitat for turtles	+1 The more habitats for turtles will lead to improving the turtles' population.	+2 Income from turtles enhances
			Conflict Indigenous communities conflict with the Government about building the hydro-electric power because this construction destroys turtle habitat.	-1 Turtles' habitat is fragment and changed	-1 Habitat fragments and loss Biodiversity loss	-2 Income from turtles declines
Park management	3	Forestry land contract	Consensus	+3 Protecting turtles	+3 Biodiversity conservation	-2 Comparison between the salary from the contract and the turtle hunting trading → Turtle hunting trading income is much better than salary
	4	Patrol	Conflict	+1 Protecting turtles but not much	+1 Biodiversity conservation but not much	-2 Income from turtles declines
	5	Education	Conflict	+1 Protecting turtles but not much	+1 Biodiversity conservation but not much	+1 Improving Indigenous communities' awareness in conservation

	6	Rescue, release and rehabilitation	Conflict	+2 Protecting turtles	+2 Protecting turtles	-1 Reduction in turtles hunting Strategies in Yok Don National Park: management and conservation to exploit and use sustainably
	7	Infrastructure development	Conflict	-1 Habitat fragments and loss	+1 -1 +1: Patrol more - 1: Biodiversity loss	+1 More chances for park access and also for trading turtles -1 Reduction in turtles hunting
Indigenous communities	8	Cultivation inside the park	Consensus	-1 Habitat threatening	-1 Turtles' quantity threatened	+3 More chances to hunt turtles Increase income from cultivation
	9	Free grazing livestock inside the park	Consensus	-3 Habitat loss	-3 Biodiversity loss	+3 Increase income of Indigenous communities
	10	Service provision	Consensus	0	0	+3 Income source of Indigenous communities
	11	Harvesting wetland resources	Conflict	-3 Habitat change	-3 Biodiversity loss	+3 Income source of Indigenous communities
	12	Harvesting forest resources	Conflict	-1 Habitat threatening	-1 Turtles' population threatening	+3 Income source of Indigenous communities

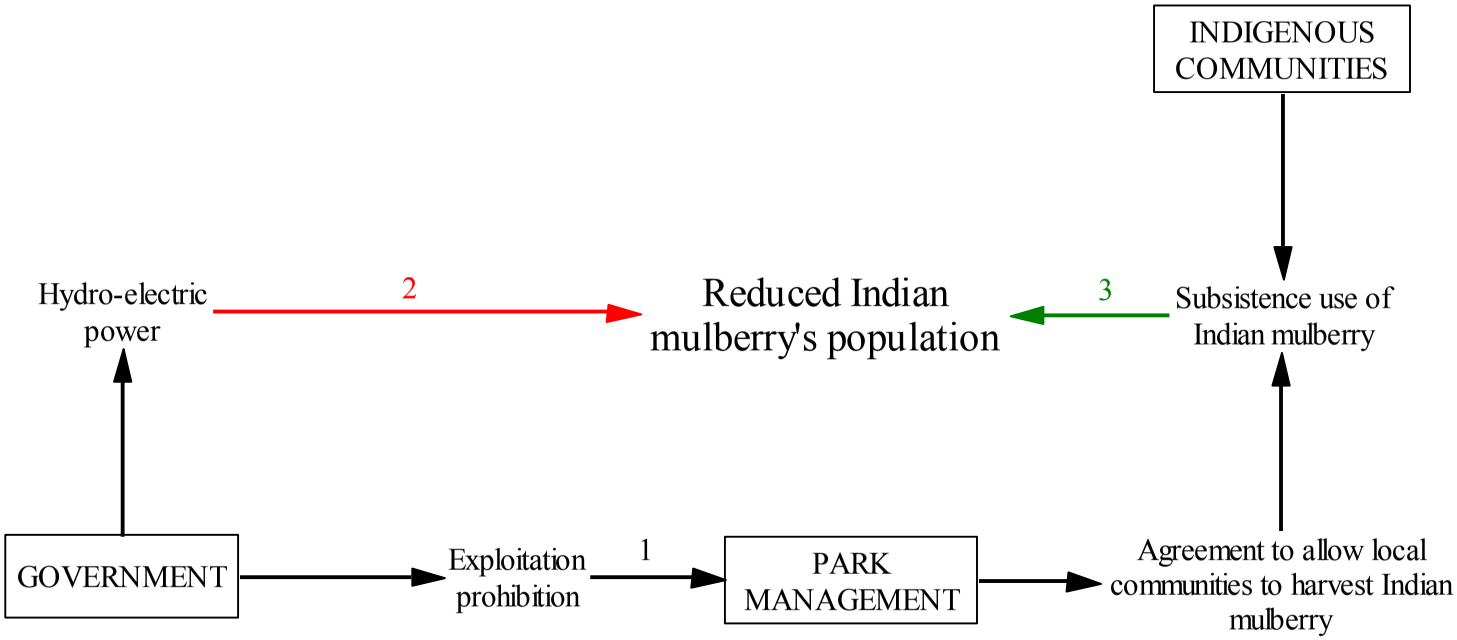

Figure 4.6 **Social-ecological systems model of Indian mulberry.** Green and red arrows show the consensus and conflict respectively between park managers and Indigenous communities. Black arrows show the actions of the government, park management and Indigenous communities

Table 4.4 **Explanations of social-ecological systems model of Indian mulberry.** Each impact was rated based on a seven-point scale from -3 negative impacts to +3 positive impacts from the observations of author during individual interviews, focused group discussions and workshop with Indigenous communities and park managers. Number reference is related to number in figure 4.6

Who enforces strategies?	No ref.	Strategies/Issues	Consensus or Conflict between Government/Park management and Indigenous communities	Impact on		
				Indian mulberry	Park management (Ecosystem/ Biodiversity)	Indigenous communities needs and demands
Government	1	Forest protection and development law Biodiversity law	Conflict Indigenous communities conflict with the government because the government prohibits Indigenous communities harvesting Indian mulberry inside the park	0	0	-3 Indian mulberry plays an important role in Indigenous lives as it is used for making Indigenous basket's base (Chapter 3).
	2	Hydro-electric power	Conflict Indigenous communities conflict with the government because the hydro-electric power will change the habitat of Indian mulberry	-1 Indian mulberry's habitat fragments and alteration	0 Indian mulberry grows around all the wetland sites inside the park	-1 There is less Indian mulberry for Indigenous communities to use; however, this tree is still widespread inside the park. Therefore, the impact on Indigenous communities is not significant.
Park management	3	Agreement to allow Indigenous communities to harvest Indian mulberry	Consensus	0	0	+3 Indian mulberry is used for making Indigenous communities basket's base
Indigenous communities	4	Cultivation inside the park	Consensus	0	0	+3 Income source of Indigenous communities
	5	Free grazing livestock inside the park	Consensus	0	0	+3 Income source of Indigenous communities
	6	Service provision	Consensus	0	0	+3 Income source of Indigenous communities
	7	Harvesting wetland resources	Consensus	0	0	+3 Income source of Indigenous communities
	8	Harvesting forest resources	Conflict	0	0	+3 Income source of Indigenous communities

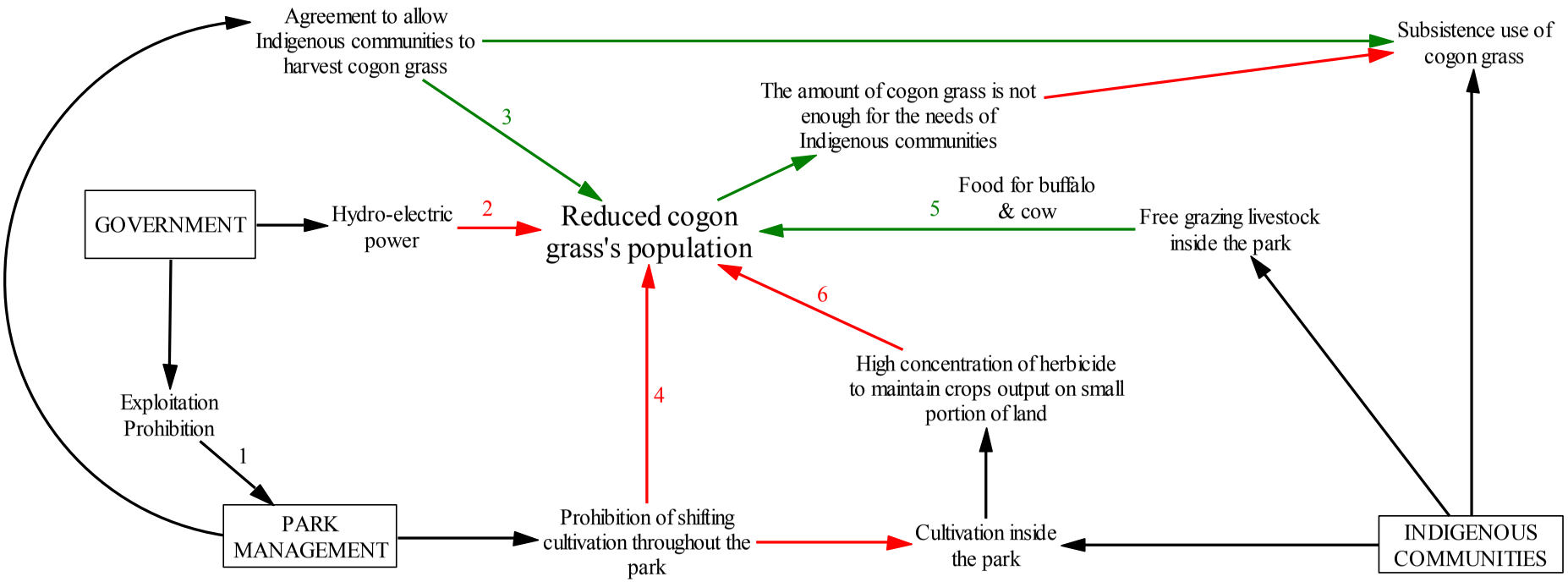

Figure 4.7 **Social-ecological systems model of cogon grass.** Green and red arrows show the consensus and conflict respectively between park managers and Indigenous communities. Black arrows show the actions of the government, park management and Indigenous communities

Table 4.5 **Explanations of social-ecological systems model of Cogon grass.** Each impact was rated based on a seven-point scale from -3 negative impacts to +3 positive impacts from the observations of author during individual interviews, focused group discussions and workshop with Indigenous communities and park managers. Number reference is related to number in figure 4.7

Who enforces strategies?	No ref.	Strategies/Issues	Consensus or Conflict between Government/Park management and Indigenous communities	Impact on		
				Cogon grass	Park management (Ecosystem/ Biodiversity)	Indigenous communities needs and demands
Government	1	Forest protection and development law Biodiversity law	Conflict Indigenous communities conflict with the government because Indigenous communities are prohibited harvesting cogon grass inside the park.	0 If Indigenous communities do not harvest cogon grass, the grass will be burnt during the dry season.	0	-3 Cogon grass plays an important role in Indigenous lives as it is used for making roofs of Indigenous houses (Chapter 3).
	2	Hydro-electric power	Conflict Indigenous communities conflict with the government because hydro-electric power will change the cogon grass's habitat.	0	+1 Reducing the development of cogon grass	-1 Less cogon grass for Indigenous communities to use
Park management	3	Agreement to allow Indigenous communities to harvest cogon grass	Consensus	0	+1 Reducing forest fire because cogon grass is one of the fire-prone materials Reforestation	+1 Harvesting cogon grass for making Indigenous tradition houses' roofs Selling for cash
	4	Law enforcement Prohibition of shifting cultivation throughout the park	Conflict Indigenous communities conflict with park managers because park managers only allow some households have cultivated inside the park before can continuing cultivating inside the park; however these villages can cultivate on their farms only, they are not allowed to shift cultivation throughout the park	-1 Reducing the development of cogon grass	+2 Increasing biodiversity of the park	-3 No land for cultivation whereas over 93% Indigenous people are farmers (Chapter 2).
Indigenous communities	5	Free grazing livestock inside the park	Consensus	0	0	+3 Income source of

					Indigenous communities
6	Cultivation inside the park	Consensus	+1 Increasing the development of cogon grass	-2 Patrol more, difficult to protect the biodiversity	+3 Main source of income of Indigenous communities
7	Service provision	Consensus	0	0	+3 Income source of Indigenous communities
8	Harvesting wetland resources	Conflict	0	0	+3 Income source of Indigenous communities
9	Harvesting forest resources	Conflict	0	0	+3 Income source of Indigenous communities

4.3.4 Communication and negotiation between park managers and Indigenous communities

After the modelling workshop, what park managers and Indigenous communities representatives was evaluated to determine if the use of the social-ecological systems model led to improved understanding and ability to identify opportunities for development of more collaborative management arrangements (Table 4.6). Three main major topics comprised benefits of the workshop process, learning that occurred from the workshop and likelihood of changing the initially stated intentions.

After the workshop, representatives from Indigenous communities said that they now felt more comfortable initiating discussion with park managers. All participants agreed that they valued the workshop. Sharing ideas with other Indigenous communities and park managers was the most common response as a source of benefits from the workshop, as well as an increased understanding of the purpose of wetland natural resources conservation and forest management. One of the park managers said that they benefited from the workshop because it gave them an opportunity to help people and understand their needs better, another that the comfortable sharing environment led to active and enthusiastic participation of everyone.

Overall most people obtained an increased level of awareness about the park and a better understanding of the different values people held for the park. All Indigenous communities said they had an increased awareness of the importance of wetland natural resources, the functions of some important species and the need to maintain the wetland resources.

More than half the Indigenous communities also said they had an increased awareness about the crucial role of the forest management and protection and the values of the forest to the residents. The park managers reported learning different aspects from the Indigenous communities. One manager said he had learnt that a lack of land for cultivation is the most important concern for residents at the moment while another said he had learnt traditional knowledge from Indigenous communities and now better understood the need for collaborative management of Yok Don National Park. Both managers reported that they were now aware of the need to work with Indigenous communities to support them in obtaining and breeding livestock and improving their animal husbandry techniques which would improve local livelihoods.

During the workshop, all participants reported that they gained a better understanding of other participants' needs. The majority of Indigenous communities said that the role of park managers was to manage and protect the forest, cooperate with other organisations and local residents (e.g.

visiting the forest with residents, actively preventing forest fires). Some of them understood that the park managers had to follow the laws from the government, manage staff and ensure the quality of the management activities. The park managers, on the other hand, understood that investment in cultivation and water for farming are the most important needs of Indigenous communities.

The majority of Indigenous groups and both managers present at the workshop reported an improvement in their knowledge about wetland animals and plants, especially the rare, endangered and endemic species. All the Indigenous communities believed that they would tell the other residents in their villages to limit their use of both prohibited and non-prohibited species.

In addition to managers and Indigenous communities learning about different aspects of the park during the workshop the perceptions of both Indigenous communities and the managers had also undergone some changes. All of the Indigenous communities thought that the knowledge they gained from the workshop would change the way they use the important species through limiting hunting, ceasing hunting rare animals, endangered and endemic species and advocating to other people for more efficient use of natural resources. Some residents thought that awareness about the role of the managers and the community in managing and protecting the forest had been raised and some understood why hunting animals and harvesting plants in the park were prohibited. Both managers changed their perspective about the needs and demands of Indigenous communities and understood sharing the benefits could be one of the efficient ways to protect the park.

Finally, community suggestions for improving conservation and livelihoods after the workshop identified breeding cows as the most common suggestion of the majority of representatives. Some Indigenous communities wished that the park and their community had more domestic and international projects to develop the economy. The other representatives had their own suggestions based on the conditions of each village (i.e. planting grass, jackfruit, breeding buffalo, wild pigs and lizards). One participant suggested preventing the hydroelectric power plants in order to have enough water for cultivation and daily activities.

Table 4.6 **Effectiveness of modelling procedure on communication and share understanding between Indigenous communities and park managers.** Representatives of Indigenous communities were identified from A to G and park managers were identified from H and I.

Topic	Indigenous communities		Park managers	
	Response	Respondent	Response	Respondent
Did you learn anything from the workshop? What types of thing have you learnt from the workshop?	Awareness of the importance of wetland natural resources, the functions of some important species and the need to maintain the wetland resources	A, B, C, D, E, F, G	Lacking of lands for cultivation is the greatest of the residents at the moment	H
	Awareness about the crucial roles of forest management and protection and the important values of the forest to the residents	B, C, E, F	Learning more about the local knowledge and understand the need to be based on Indigenous communities and to support the breeds, animals for husbandry, and technique for the residents.	I
	The village's responsibilities for protecting the forest	E, F		
	Propaganda to other residents	C, D		
	Figuring out some potential ways to develop economy and restructuring plants and animals	A		
	understanding more about law enforcement	G		
Did you enjoy the workshop?	Wetland natural resources knowledge improvement	D, F, G	Using method of holding the workshop to help people more understand about each other	H, I
	Sharing ideas with other Indigenous communities and park managers	B, F, G	Sharing ideas with other Indigenous communities and park managers	H, I
	Understanding conservation and forest management purposes	A, B, C		
	Earning benefits for themselves and the village	E		
	Helping develop the economy	A		
Did you change your perspective? About what?	Higher awareness about the role of the managers and the community in managing and protecting the forest	B, C	The needs and demands of the Indigenous communities	H, I
	Being clearer about hunting animals, collecting plants. Which animals are forbidden or allowed (fish, crabs and shrimps) to be harvested.	D, G	Sharing the benefits	H, I
	Understanding more about the decree 99 on payment for forest environmental services	C	Suggesting to develop some projects to support the Indigenous communities	I
	Conserving the natural resources	A	Understanding the investment for the poor is not effective because the poor only need food and clothes for their daily lives and they are too poor to have enough conditions to take care of the husbandry and crops	H
	Understanding the forest's values helping protect the forest better Identifying well all the harmful activities to the National Park in forest management and protection.	E		

	Raising problems to be solved and understanding more about the matters being discussed	F		
What do you think about the participation of other people?	Enthusiasm, actively involved	A, B, C, D, E, F, G	Enthusiasm, actively involved	H, I
Do you now understand each other better?	Understanding more about the demands of other villages and the park managers	A, B, C, D, E, F, G	Understanding the livelihoods of the Indigenous communities: what they need, what they are lacking	H, I
Do you now understand the importance of wetland resources better? What are they?	Improved knowledge about the animals and plants of wetlands (which are rare and endangered)	A, B, D, E, F, G	The rare, endangered and endemic species	I
	The animals and plants create the presence of the forest	C	The need to keep the wetland ecosystem sustained	H
Do you now understand why it is important to conserve important species more Can you list all the reasons why we conserve important species?	The rare, endangered and endemic species, small quantities	A, B, C, D, F, G	The rare, endangered and endemic species, small quantities	H, I
	Increasing the value of the environment, economy and tourism for Yok Don National Park	B, D	They are strongly decreasing because of hunting, narrowing down the forest areas	I
	Conserving the ethnic minority cultures of Indigenous communities	E		
Do you now understand each other's needs better?	The roles of park managers are propagandising, managing and protecting the forest, cooperating with other organisations and local residents (e.g. visiting the forest with residents, actively preventing forest fires) [Although understanding clearly the roles of park managers, they still need to improve their responsibilities]	A, B, D, E, F, G E, F	The needs and demands of Indigenous communities are helping invest in cultivation, water for farming	H, I
	The park managers have to follow laws, manage the staff, ensure the quality of the management activities	B, C, D	Projects providing support for Indigenous communities	I
	Understanding that the park managers are flexible with the poor residents through allowing them to harvest plants and catch fishes, shrimps and crabs	B	Creating jobs, increasing incomes for local workers	H
Do you now learn from each other about how important different species were from talking to each other during the workshop Will you tell other people in your village about the importance of these species?	Telling the other residents to limit the exploitation and the species that they are allowed to use and which are prohibited	A, B, C, D, E, F, G		
Do you now think the	Limited hunting of the animals, efficient use, stop hunting rare,	A, B, C,		

knowledge you gained from the workshop will change the way you use these important species? Which ways will you change?	endangered and endemic species, allowing to catch fishes, shrimps, crabs without using electricity	D, E, F, G
	Propagandising, talking to other people about more efficient use	F
Do you now feel more comfortable about talking to the managers Will you tell them about your daily life and your needs?	Being more comfortable for discussion	A, B, C, D, E, F, G
	If the benefit sharing mechanism is equal, the needs and demands would be shared	E
Do you now identify opportunities that could benefit you through information acquired through the model Which opportunities could benefit you?	Breeding cows	A, C, D, F, G
	Hoping to have more domestic and international projects to develop economy	B, E, F
	Planting grass	A, C
	Looking for cultivation lands for 2 to 3 crops	B
	Planting jackfruit	C
	Breeding buffalo	A
	Breeding wild pigs	D
	Breeding lizards	C
	Preventing the hydropower plants in order to have enough water for cultivation and daily activities	G

4.4 Discussion

This chapter showed that collaborative development of a conceptual social-ecological systems model process through a workshop improved the understanding of park managers and Indigenous communities of the social-ecological systems of the park. After the development of the social-ecological systems model, both park managers and Indigenous communities had a better understanding about park management and Indigenous community needs and demands. There was a difference in perceived management between park management agency and Indigenous communities. The results showed that park managers concentrate on conserving the whole ecosystem. They have a range of similar management strategies that they apply to whole groups of species. On the other hand, Indigenous communities have different demands and needs for different species. For example, Indian mulberry is mostly used for making traditional basket base, this means that the impact on Indian mulberry is small and constant whereas the turtles have more uses and are able to be sold for income so that the impact on turtles is large and even increasing. Therefore, the management strategies being applied might not work for all species and the park managers need to think carefully about natural resources use of Indigenous communities before implementing management strategies.

To manage local use of species, different management strategies may be required and to compensate for this difference, I further examined the accuracy of the conceptual social-ecological systems model by developing individual conceptual social-ecological systems models for the four most important cultural keystone species within Indigenous communities. This revealed that the number of components and connections in the system differed between individual models because of the complexity of the roles that each species played in Indigenous lives. For example, different species have different agreements and conflicts about their management between the government, park managers and Indigenous communities. The government, park managers and Indigenous communities agreed with each other to conserve elephants although Indigenous communities still desired elephants for their own households. However, this type of agreement on turtles was not achieved and conflicts about conserving turtles have increasingly arisen among the government, park managers and Indigenous communities. Therefore, the management strategies being implemented were useful to elephants but not turtles. Indigenous communities reported that it was bad luck if Indigenous communities caught the turtles while they were hunting in the forest in the past (Chapter 3). However, after the park's establishment and the management strategies being implemented, there is an interaction between some of the rules that have been implemented that change people's behaviour and have now led to a cultural practice that may impact on the way local

people harvests turtles. All Indigenous communities said that they would catch turtles if they saw them in the forest. These findings have showed that conservation could be achieved with involvement of Indigenous communities. Indigenous knowledge is essential and understanding Indigenous knowledge is a first step in building consensus among the government, park managers and Indigenous communities.

This study provided insight into how different groups viewed their relationship with each other. Park managers always perceived the relationship to consist of better communication and trust than did the community members. The government conflicts with Indigenous communities through issuing the laws and building hydroelectric power. This conflict is likely for the whole country although Indigenous communities have rights to use the resources. The need is to include the government in conversations with park management agencies and Indigenous communities because different societal actors understand and perceive differently the relationships between humans and the environment (Delgado et al., 2009). Understanding the relationship between the government, park management agencies and Indigenous communities, especially concerns of Indigenous communities and the roots of the conflicts between them can provide an effective starting point for understanding the extent of collaboration. Developing a platform through modelling workshop between park management agencies and Indigenous communities can improve the understanding of park management and help to meet Indigenous communities' needs and demands.

Participants' assessment of the workshop process was positive in relation to benefits of the workshop process, learning that occurred from the workshop and likelihood of changing their initially stated intentions after workshops. The modelling workshop was confirmed as a concrete communication means for societal actors to better understand each other. This is in line with Andersson et al. (2008), Delgado et al. (2009) and Franzén et al. (2011) who argued that a modelling workshop was an effective communication tool among societal actors. This was an improvement on conservation in developing countries where bottom-up management is currently being applied as Indigenous communities show they have more power in making decision with park managers.

During the interviews and focus group discussions, I found that Indigenous community members gradually lost their interest. This is consistent with the work of Salerno et al. (2010) who reported that Indigenous communities easily lost their interest in participation over time as they participated as volunteers. However, my results have shown that their interests were gained again when they were provided a platform to share Indigenous knowledge as well as their demands and needs with park managers. My research also showed consensus between stakeholders can be achieved even

though there are significant negative impacts of park management on stakeholders. For example, the government, park management agency and Indigenous communities have agreed to conserve elephants although the desire of Indigenous communities is having their own elephants. This showed that if a species is important enough to both conservation purposes and Indigenous communities, agreements to conserve this species can be achieved and this is a corner stone for conservation to integrate the views of Indigenous communities and encourage them to participate in conservation. There is a need to be careful because certain levels of restrictions on resource use may be accepted by local communities based on realistic and negotiated trade-offs between conserving species and sustaining local livelihoods. However, local perceptions may change and mistrust and resistance will increase if local communities feel they are being treated inequitably (Dahlberg and Burlando, 2009). Understanding and improving the consensus between stakeholders is one of the only ways to solve the conflict (Delgado et al., 2009) and could be a concrete step for building social-trust that is a core component of managing complex social-ecological systems with involvement of all stakeholders (Biggs et al., 2015).

Chapter 5 IMPLICATIONS AND DISCUSSION

5.1 Dissertation review and summary

Around the globe Indigenous people and park managers are working through the complexities of managing protected areas that balance conservation, cultural and livelihood goals and priorities. The challenges are significant and include a range of conflicts between the park managers and Indigenous people. Research is needed not only to understand the values and priorities of Indigenous communities but also to find ways to reconcile these with better park management directions and to incorporate these views into decision-making. This dissertation builds on a growing body of work that is focused on styles of governance that enable and empower Indigenous people in conservation decisions (Dovers et al., 2015), the impact of conservation on Indigenous rights and livelihoods (Crawhall, 2015), the cultural and economic services park ecosystems provide or deny Indigenous people (Sarmiento et al., 2015) and the importance of protected areas and protected species for Indigenous people (Stolton et al., 2015).

The aim of this dissertation is to examine whether collaborative development of a conceptual social-ecological systems model improves understanding of park management and community needs and impacts amongst both park managers and Indigenous communities. This dissertation overview is summarised in Figure 5.1.

Understanding the Indigenous social-ecological systems is key to efforts to bridge Indigenous and conservation goals and agendas. Chapter 1 provided an overview of understanding the social-ecological systems and the interactions between social-ecological systems and Indigenous communities. Although literature is reviewed in subsequent chapters, this chapter provided the context for inquiry. It unpacked the interactions between protected areas and local and Indigenous communities, and the effectiveness of management strategies being applied. An understanding of the social-ecological systems and cultural keystone species and the roles of stakeholders comprising the government, managers, scientists and local and Indigenous communities was provided. Collaborative approach to conservation has been an effective strategy to communicate and negotiate conservation and local values in protected areas (Berkes, 2009).

Understanding Indigenous people and how their activities have an impact on parks is also part of building Indigenous conservation alliances. Chapter 2 explored impacts on park resources of Indigenous communities through examining levels of natural resource use of Indigenous communities living in and adjacent to Yok Don National Park to identify different strategies in

relation to resource use being employed by Indigenous communities. The majority of respondents visited the park daily or weekly (49%) harvesting plants, hunting animals, grazing livestock, tending cultivation and conducting spiritual practices. Cluster analysis was used to distinguish different groups of park users based on their patterns of wetland use. Four local groups were comprised of Low income, Mixed resource users, Crop-focused mixed resource users and Wetland specialists. The people who were having the biggest impact on the park were characterised by high total income, visiting the park daily or at least weekly for harvesting plants, hunting animals, grazing livestock and cultivation. In Yok Don National Park, a wide range of penalties comprised of warning, confiscation of forest products and tools, confiscation of forest products and tools and a fine and prison are implemented to deter illegal and unsustainable natural resource use. The higher the level of forest resources a group used, the more enforcement actions of deterrents the local people reported receiving from park managers (except the Wetland specialists group). There were no apparent correlations between education, family characteristics or ethnic origins and the resource use strategies employed by people. These findings are important to the broader question of whether better understanding of Indigenous impacts on natural resources can help improve collaborative management of protected areas because understanding of Indigenous community strategies is a stepping stone in mitigating the trade-offs between conservation and natural resources use by local and Indigenous communities and creating win-win scenarios between conserving species and sustaining human populations (Crawhall, 2015).

Understanding interactions between Indigenous people and wildlife is a stepping-stone for developing Indigenous conservation collaboration. Chapter 3 identified cultural keystone species of Yok Don National Park and the roles they played in maintaining cultural identity and integrity. The most important cultural keystone wetland species of Yok Don National Park were elephants, cogon grass, Indian mulberry, turtles, snakes, lizards, fishes, frogs, crabs, shrimps, sweet leaf, rice paddy herb and sticky adenosma. Multiple dimensions of relationships between the first four, which are the most important cultural keystone species and Indigenous communities showed the complexity of cultural keystone species and why these species were highly valued by Indigenous communities. This understanding of cultural keystone species in social-ecological systems can help with integrating Indigenous knowledge into science and management strategies in order to develop collaborative management in protected areas.

Following the analysis of Indigenous social-ecological systems, livelihoods and cultural keystone species, I then examined how we can bring Indigenous knowledge and scientific and management knowledge together for better collaborative management of a protected area. A workshop was held between representatives of park managers and Indigenous communities to develop a conceptual

social-ecological systems model for the protected area. Understanding social-ecological systems of a protected area plays a key role for Indigenous conservation development (Cumming et al., 2015). Chapter 4 investigated how the collaborative development of a conceptual social-ecological systems model for Yok Don National Park improved understanding of park management and community needs and the impacts amongst both managers and Indigenous communities. The relationships between frequency of contact and extent of collaboration between park managers and Indigenous communities were examined. The park managers always had a more positive view of their relationship with Indigenous communities than members of Indigenous communities had of their relationship with park managers. A conceptual social-ecological systems model was developed in a collaborative effort with park managers and Indigenous communities. This model was to provide a better understanding of the social and environmental relationship between Indigenous communities and protected areas. Because of the complexity of real life, the individual conceptual social-ecological systems models for the four most important cultural keystone species were developed to examine the accuracy of the main overarching conceptual social-ecological systems model and understand park management strategies and Indigenous strategies. These models were also used to identify possible additional opportunities for collaboration among park managers and Indigenous communities not immediately obvious from the full system model. After the modelling workshop, in order to evaluate whether the development of the social-ecological systems model process led to enhanced understanding, all the participants were individually interviewed and reported that they gained a better understanding of other participants' needs and wetland species knowledge.

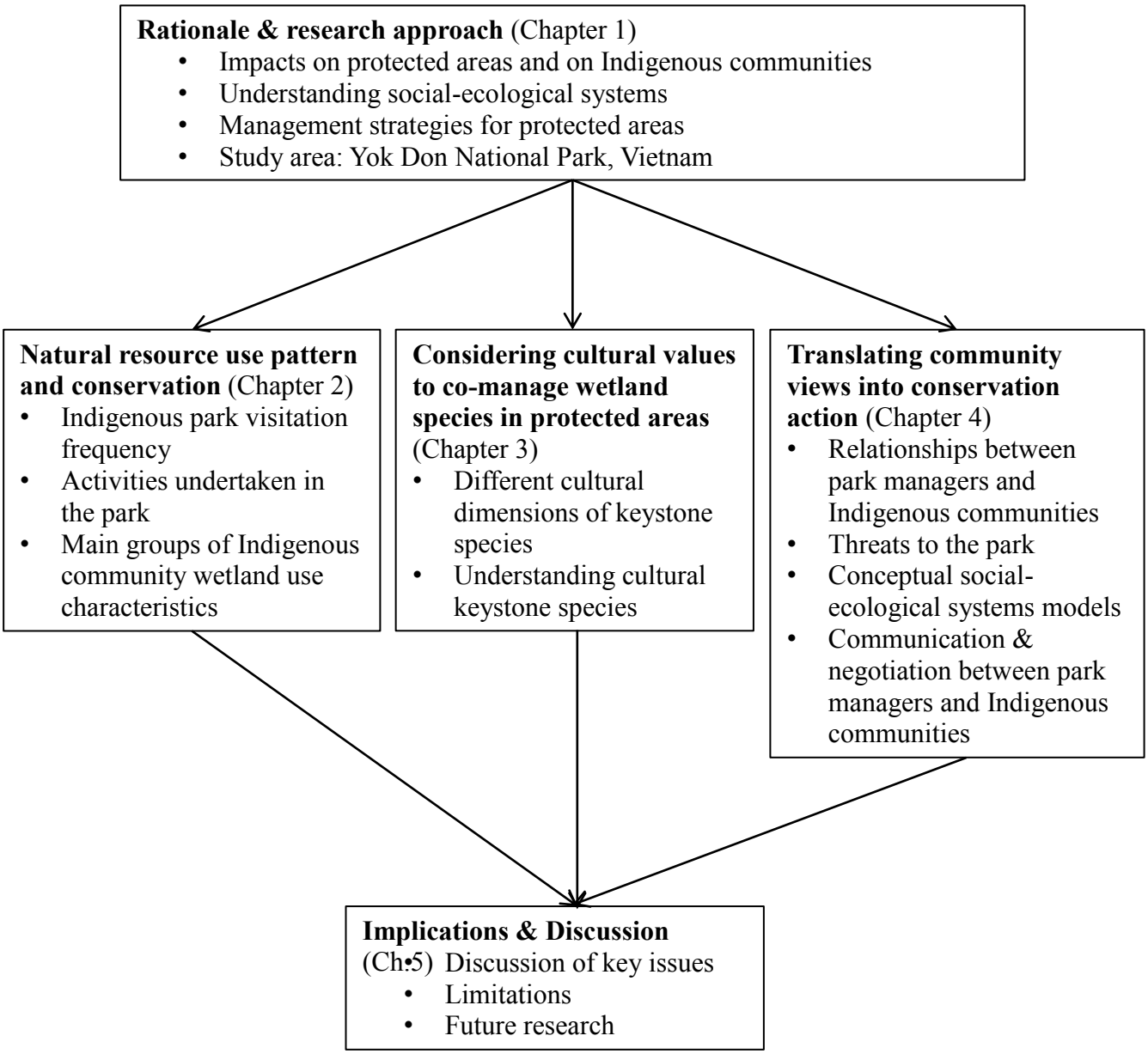

Figure 5.1 **Dissertation overview**

5.2 Discussion of key issues

This dissertation highlights the different nuances involved in considering conservation systems as a social-ecological system to understand key interactions between Indigenous communities and wildlife in Yok Don National Park, Vietnam. The objective of thesis was to assess the potential for developing a more collaborative management strategy for managing Yok Don National Park. In assessing this potential, the benefits of enhanced and shared understanding of the social and ecological attributes and processes of the region through development of social-ecological systems models and the role of shared understanding were examined.

5.2.1 Natural resource use

Chapter 2 identified how the diversity of a group of Indigenous communities and environment interactions are influenced by the amount of income from various sources, frequency of park use, activities undertaken in the park and the importance of these activities to individuals. This is in line with the findings of Vaughan and Vitousek (2013) who argued there was a need to first understand local people's interactions with the natural resources by showing that Indigenous communities are variable in their use of and relationship with the park and in species use and that this variability is important in terms of their impacts on natural resources. Significantly, this research in Yok Don National Park has revealed that the majority of the natural resources taken from the park are taken by a minority of people who visited the park very frequently, who had the highest income overall and the highest income from the park. Resource use is dominated by an economic "elite" within the community. Similar patterns of high natural resource use of this economic "elite" have been found in India (Jodha, 1986), Nepal (Adhikari, 2005), Vietnam (Mcelwee, 2008) and Bolivia (Uberhuaga et al., 2012). One strategy to improve collaborative management is focusing on the users that use the park the most. However, engaging them in collaborative management may result in their becoming even richer and having greater control over the park resources, further marginalising the poorer users who use the park less. The lower income users may be left with no power to use the park resources to maintain their daily needs although all Indigenous communities should equally have rights of access to natural resources and collective rights to survival through self-determination (Crawhall, 2015). This domination by an elite may trap lower income members of the community in a cycle of poverty.

Chapter 2 also focused on individual natural resource use rather than general community use based on the differences of socio-economic factors influencing the use. This can infer more accurately how different strategies might impact on local use. Therefore, socio-economic and natural resource

use characteristics need to be targeted for effective community conservation initiatives. Specific detailed understanding of resource use information allows park managers to know which species to focus on when discussing collaborative management arrangements.

5.2.2 Equity in collaborative management

Equity in collaborative management is a foundation for participating in the negotiation process and ensuring an equal share of management functions, rights, benefits and responsibilities of institutional actors (Borrini-Feyerabend, 2000). However, Chapter 2 showed that groups of Indigenous community members using the park resources are different and differ in the amount of use. This is the root of the conflict over natural resource use between park managers and Indigenous communities. Similar conflict in other protected areas was caused in a case study by Lele et al. (2010) by ignoring the rights and needs of different groups in protected areas. Oldekop et al. (2016) argued that the more equitable the sharing of benefits between park managers and local and Indigenous communities, the more the likelihood of effective conservation. A case study in Rwanda by Martin et al. (2014) emphasised that the perceived equity of local and Indigenous communities can affect local motivations in protected area management. Therefore, issues of equity as part of the collaborative management process need to be considered carefully. This result may be useful in reducing the conflict between park managers and Indigenous communities and therefore minimising the trade-offs between conservation and Indigenous livelihood sustainability, creating a win-win scenario in managing the protected areas.

5.2.3 Different knowledge systems integration

As these collaborative management arrangements mature there is growing interest in decision-support mechanisms to enable co-managers to identify and resolve differences in park decisions and priorities. In this dissertation cultural keystone species were identified and embedded within a conceptual social-ecological systems model that was co-developed and applied with local communities and park managers (Chapter 3 and 4). As Garibaldi and Turner (2004) assert conceptual social-ecological systems models can integrate Indigenous knowledge and science with scientific knowledge support development of management strategies. This study highlights the challenges and benefits of such an approach. The application of Indigenous knowledge in the management of cultural keystone species including their life histories, distributions and behaviour can be embedded with traditional Indigenous culture and resource use rights (Butler et al., 2012). Cultural keystone species information identified in Chapter 3 builds on the work of Garibaldi and Turner (2004) by showing the complexity of species interactions and the reasons why these species

are significant to Indigenous communities. These results are consistent with the findings of Platten and Henfrey (2009) and Uprety et al. (2013) who argued that cultural keystone species should be considered as a "complex" which includes many material and nonmaterial system elements instead of a "single biological species". This chapter demonstrated that the social-ecological systems around these species indicate that Indigenous communities highly valued these species because of their domestic and spiritual uses. It also revealed that there was a common value across all communities for some species and their attributes and the importance placed on them throughout villages.

However, the findings from Chapter 3 indicate that cultural significance of species with Indigenous communities varies over time, particularly before and after management strategies have been implemented. For example, Indigenous community members in Yok Don National Park reported that catching turtles while hunting animals in the forest was bad luck in the past; however, this belief has changed most likely because of restrictions on use imposed by managers and turtles are now hunted whenever Indigenous people see them.

However, the example of elephants showed that taboos and belief still play an integral role in Indigenous lives in which it is still prohibited eating elephants. Therefore, consensus between park managers and Indigenous communities can be developed if park managers understand the taboos and belief system of Indigenous communities. This is support for the work of Franco et al. (2014) who argued that taboos and the entire belief system of cultural keystone species could bring a positive impact on conservation. The findings also provide support for the work of Robinson et al. (2015) who reported that Indigenous knowledge can be used to inform culturally appropriate social-ecological systems models by enabling Indigenous communities and park managers to work together without the need for full consensus. These findings are the starting point for park managers to understand Indigenous community needs and demands and there is a need for park managers to achieve a more refined approach to teasing apart how Indigenous communities interact with species and use them in their daily lives.

As the integration of Indigenous knowledge and scientific and management knowledge improved the social-ecological systems resilience by contributing a diverse source of knowledge for problem solving (Folke, 2004, Folke et al., 2005b, Berkes and Turner, 2006, Davidson-Hunt, 2006, Bohensky and Maru, 2011), work on the cultural keystone species was then connected with conceptual social-ecological systems models in a collaborative modelling workshop between park managers and Indigenous community members. As Chapter 4 revealed, collaborative development of a conceptual social-ecological systems model process improved the understanding of park

managers and Indigenous communities of the social-ecological system of a conservation area. This supports the findings of Robinson and Wallington (2012) who reported that there is a need to bring different knowledge systems into a conceptual model to help park managers and Indigenous communities carve out collaborative pathways to better manage key species and habitats.

5.2.4 Communication

Communication and shared understanding were also issued in Yok Don National Park. In Chapter 4, before the modelling workshop, Indigenous communities reported the lines of communication between them and park managers to be very limited. However, after the modelling workshop, all the representatives of Indigenous community members felt more comfortable initiating discussion and sharing ideas with park managers. This supports the conclusion made by Andersson et al. (2008), Delgado et al. (2009) and Franzén et al. (2011) who report that conceptual social-ecological systems models are an effective communication tool for societal actors to better understand each other. In addition, a study of Salerno et al. (2010) shows that Indigenous communities easily lost their interest in participation over time as they participated as volunteers. During individual interviews and focus group discussions with Indigenous communities, Indigenous community members gradually lost their interest. However, their interest could be gained again if they were provided a platform to share Indigenous knowledge as well as their demands and needs with park managers.

One strategy to enhance collaborative management for better achieving conservation outcomes is improving livelihoods. Plummer and Fitzgibbon (2004) argued that to have successful co-management incentives must be provided and local communities must be willing to participate. The collaborative behaviour is improved through monetary incentives (Castro and Nielsen, 2001, Pomeroy et al., 2001, Plummer et al., 2012). During the modelling workshop reported in Chapter 4, breeding programs based on the Indigenous communities' needs and demands were suggested as means of improving local livelihoods.

While co-management has some benefits for conservation such as community-based economic and social development, decentralisation resource management decisions and a mechanism for reducing conflict through participatory democracy (Armitage et al., 2010), these arrangements are not without some challenges. Conflicts between values, agendas, and benefits have been identified. In Chapter 4, the Yok Don National Park case study reveals some of these challenges particularly in management strategies. Park managers concentrated on conserving the whole ecosystem and they have a range of management strategies implemented for all species in the ecosystem. However, in Chapter 3 it was found that Indigenous communities noted that they had different needs and

demands for different species. This has led to growing conflicts between park managers and Indigenous communities. The lack of communication between park agency managers and local and Indigenous communities can reduce the effectiveness of conservation. Consensus understanding between stakeholders is one of the ways to solve the conflict (Delgado et al., 2009) and could be a starting point for building social-trust that is a core factor of managing complex social-ecological systems with involvement of all stakeholders (Biggs et al., 2015).

5.3 Limitations

There were difficulties and limitations experienced during the conduct of this research.

The number of Indigenous community members contributing was less than I anticipated. I aimed to interview 30 Indigenous community members per village; however, I fell short of this in six villages due to Indigenous community members not having time or desire to be involved in this research (four had 29 participants, one had 28 participants and one had 25 participants). However, the sample size (N=259) is adequate for analysis.

A similar trend was found in the number of park managers participating in the research due to park managers not having time to contribute. This led to different managers attending to different parts of the research and providing different responses. Also, there were only two park managers who participated in the modelling workshop (Vice-Heads of the Forest Ranger Station and the Science and International Cooperation Division). Neither position can directly decide management strategies for this conservation area. The discussion at this workshop would have been better if the Director of the Park, Heads of Forest Ranger Stations who interact directly with Indigenous communities every day and representatives of the Forest Protection Department which directly manages the park had participated.

Yok Don National Park is located across two provinces but all nine villages that were chosen to participate in this research belonged to Dak Lak province due to time limitations of a PhD research project and because of the suggestions from park managers who reported that Indigenous natural resource use of villages located in Dak Nong province is still limited and controllable. A more comprehensive view of the effect of proximity to the park on park use by local and Indigenous people would have been possible if a wider range of villages were able to be included.

5.4 Future research

One of the main findings of this dissertation is to identify different strategies in relation to resource use being employed by Indigenous communities living in and adjacent to a protected area for managing protected areas at a local level. Conducting long-term studies is essential for the government and park managers to use this information to develop different Indigenous strategies to target the groups of Indigenous communities and to expand the opportunities for collaboration amongst park managers and Indigenous communities. This is supported by Lamsal et al. (2015) who argued that local and Indigenous people who participated in conservation organisations have used natural resources less than those who did not participate in any conservation organisations because the participation raises their environmental awareness.

Another key finding of this dissertation shows that the conceptual social-ecological systems model is effective in increasing understanding between park management and Indigenous community needs and demands. The next steps are about using improved understanding as a basis for expanding approaches to governance to be more collaborative, changing interactions between park managers and local and Indigenous communities and finding ways for improving local and Indigenous livelihoods.

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APPENDICES

Appendices for Chapter 2

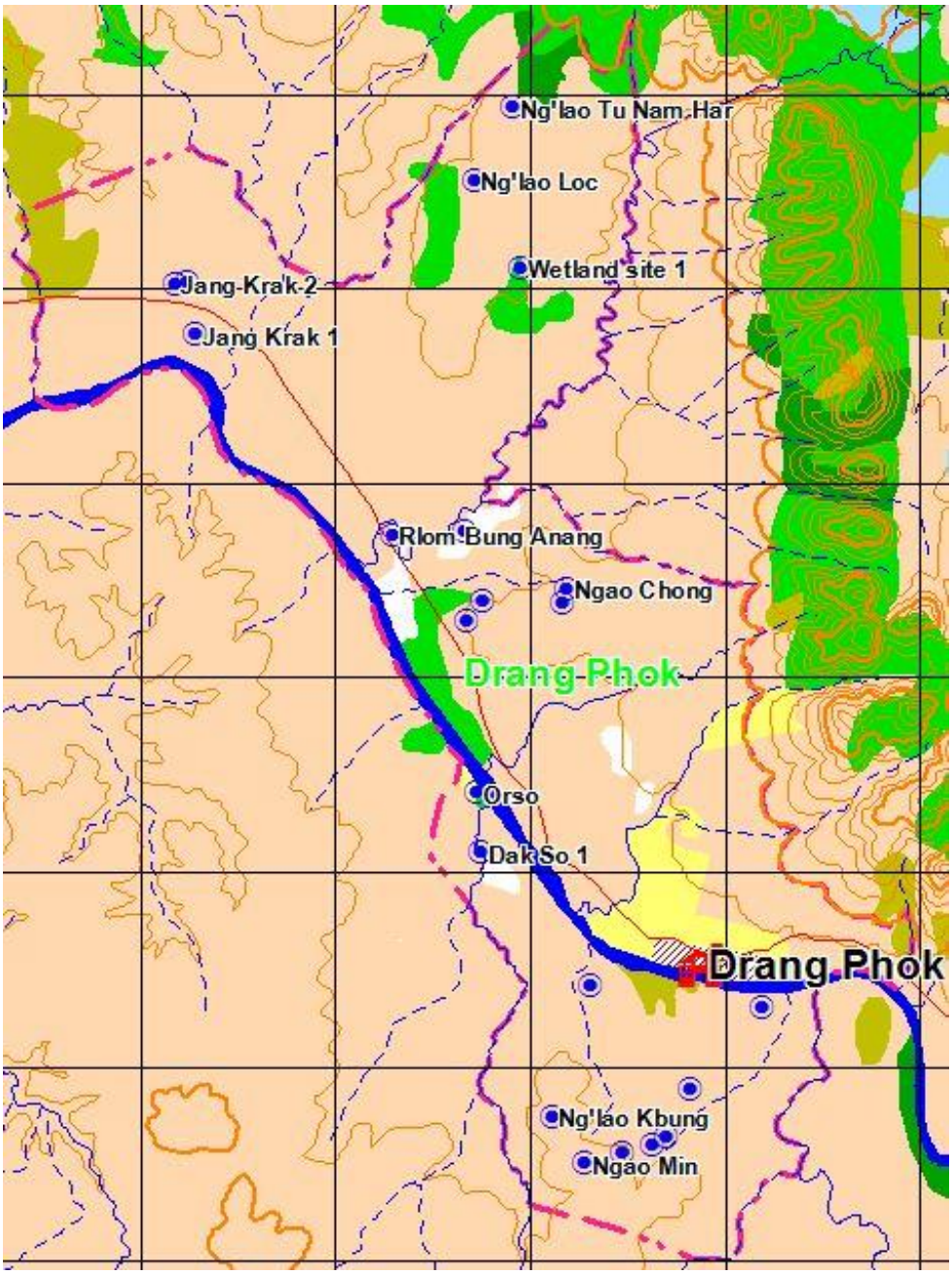

Figure A2.1 Drang Phok village and the region impacted by Indigenous communities in Drang Phok village. Different components are shown by different colours, in line with different shapes (red house – location of Drang Phok village, pink dash line – the region impacted by Indigenous communities in Drang Phok, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

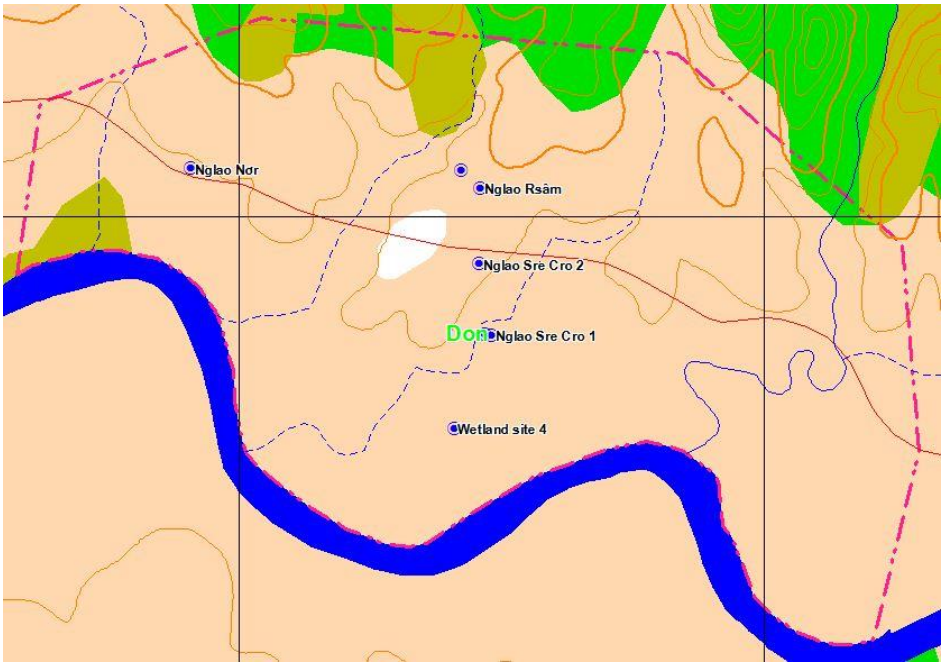

Figure A2.2 Don village and the region impacted by Indigenous communities in Don village. Different components are shown by different colours, in line with different shapes (pink dash line – the region impacted by Indigenous communities in Don, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

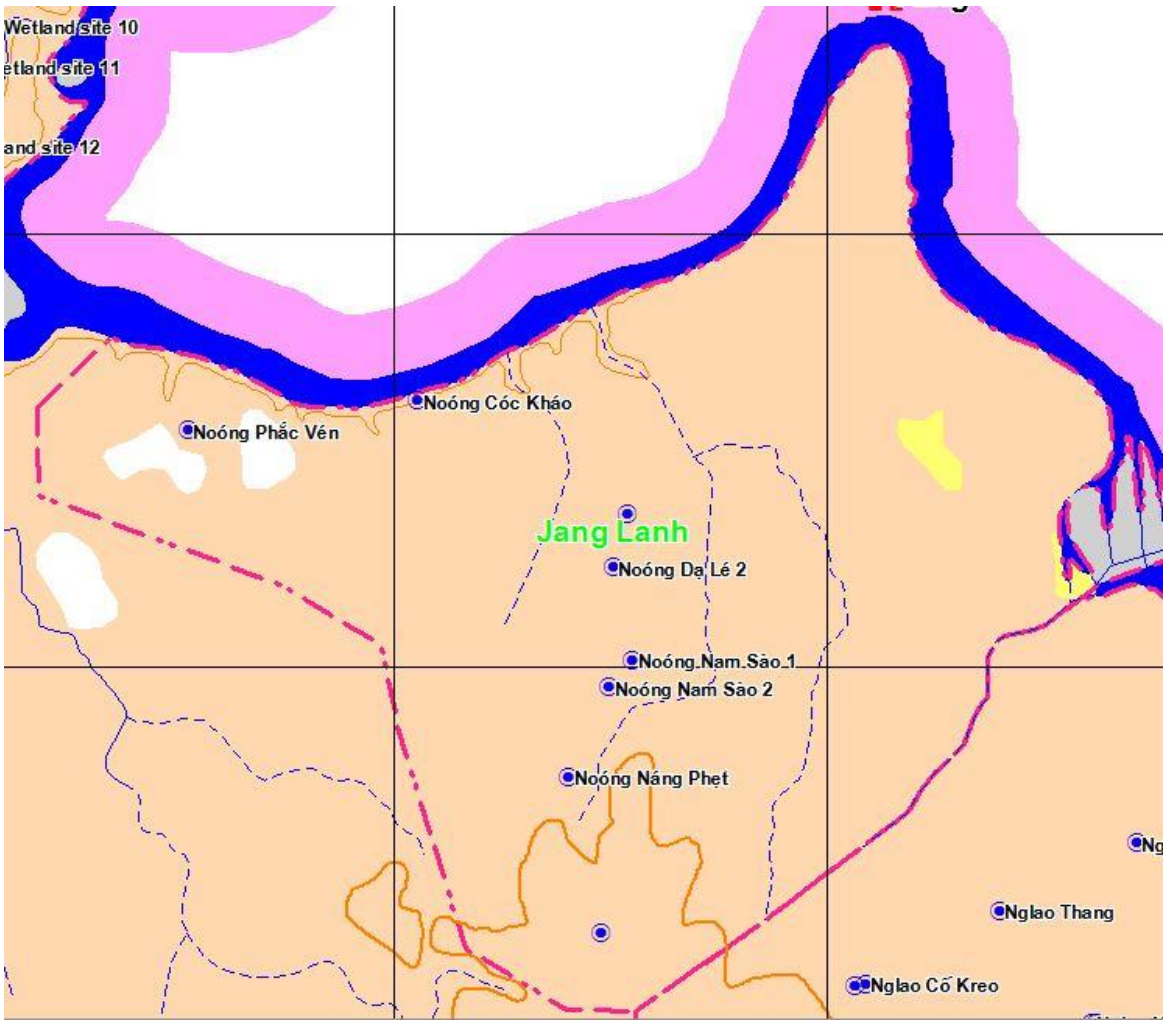

Figure A2.3 Don village and the region impacted by Indigenous communities in Jang Lanh village. Different components are shown by different colours, in line with different shapes (pink dash line – the region impacted by Indigenous communities in Jang Lanh, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

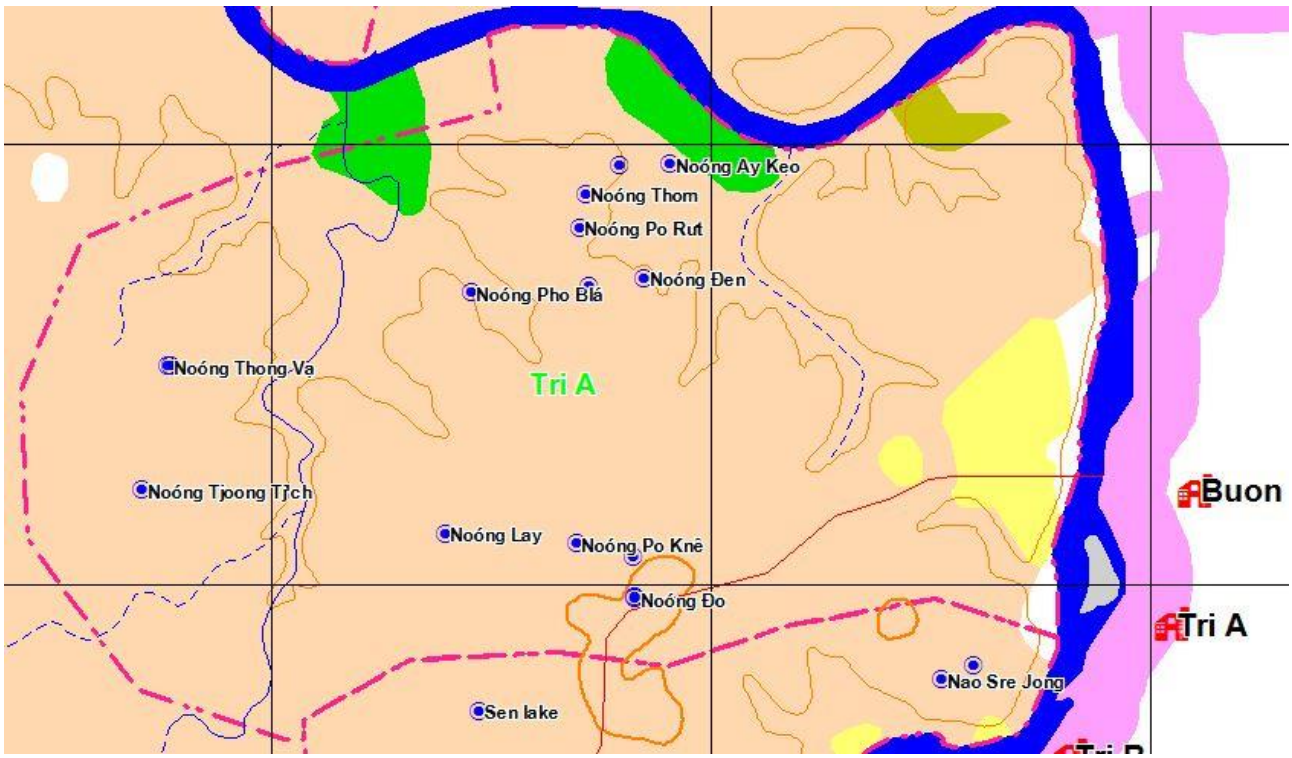

Figure A2.4 Tri A village and the region impacted by Indigenous communities in Tri A village. Different components are shown by different colours, in line with different shapes (red house – location of Don village, pink dash line – the region impacted by Indigenous communities in Tri A, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

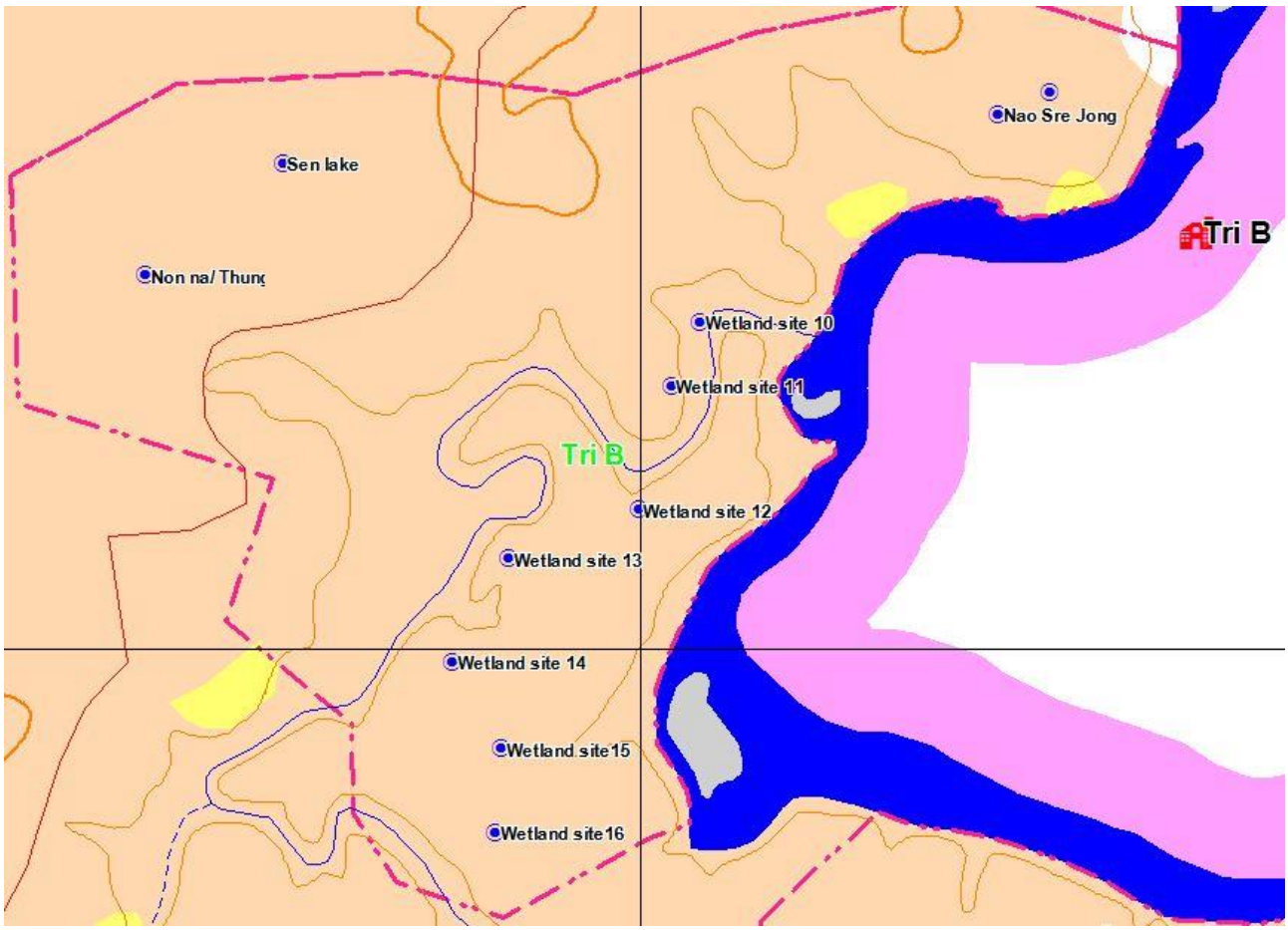

Figure A2.5 Tri B village and the region impacted by Indigenous communities in Tri B village. Different components are shown by different colours, in line with different shapes (red house – location of Don village, pink dash line – the region impacted by Indigenous communities in Tri BB, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

Figure A2.6 N'Drech A&B villages and the region impacted by Indigenous communities in N'Drech A&B villages. Different components are shown by different colours, in line with different shapes (pink dash line – the region impacted by Indigenous communities in Don, blue dot points – locations of wetland sites impacted by Indigenous communities, blue bond line – Sre Pok river).

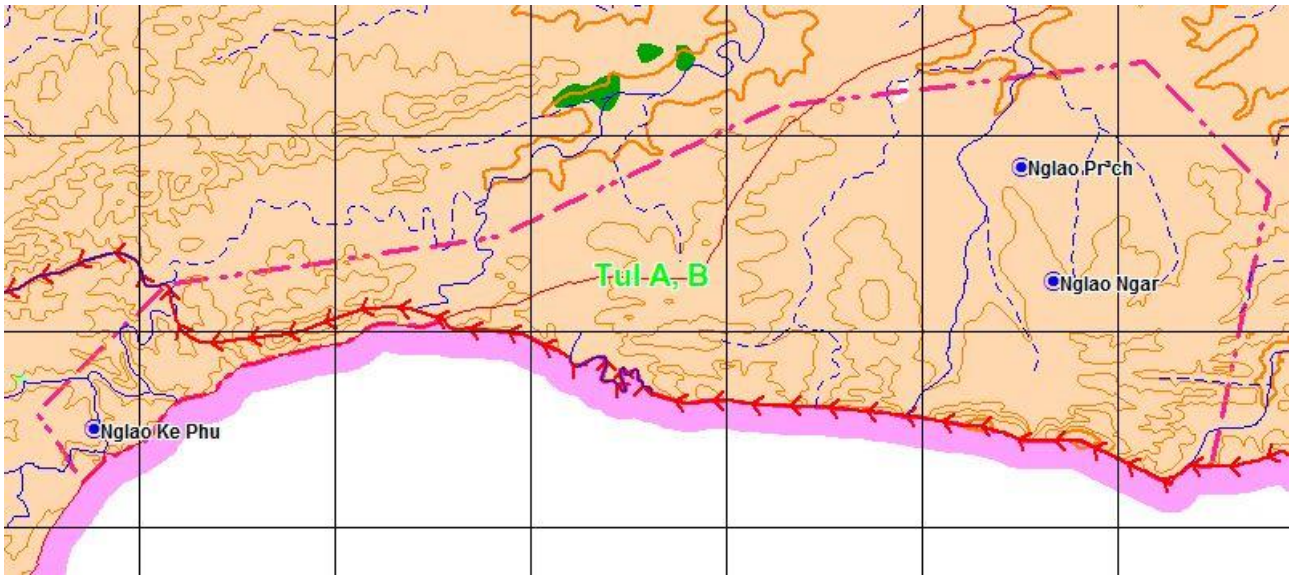

Figure A2.7 Tul A&B village and the region impacted by Indigenous communities in Don village. Different components are shown by different colours, in line with different shapes (pink dash line – the region impacted by Indigenous communities in Don, blue dot points – locations of wetland sites impacted by Indigenous communities).

Appendices for Chapter 3

Appendix A3.1 Elephant cultural stories

- The baby elephant ate farmers' rice. A man climbed up a tree and told the elephant "You often eat my rice, how can I catch you?" Then he jumped down on to the elephant's back, the elephant ran away and the man broke an egg and told the elephant " I broke your head!" The elephant was so scared that he was caught and tamed.
- A salamander fell out with an elephant. The elephant said "the human beings are young forever and never die", the salamander said "the human beings do not die of both old age and young age". The salamander jumped into the elephant's nose and the elephant could not say anymore.
- A man went to the forest and met an elephant. The elephant asked the man "The human being is very small, why do all of the animals fear him? And I do not know where the human being is". The man cut a string of rattan and said "if you want to meet the human being, you pull this string over your head and tie your legs". Then the elephant could not budge and asked the man "Where is the human being? Why do you tie me like this?" The man said "I am the human being, are you scared of me?" And the elephant has feared the human beings since then.
- A tiger asked an elephant: "You are very big, why are you afraid of human beings? If I meet them, I will eat them immediately". The elephant said "Humans eat fire (smoking cigarettes). Although the fire is very hot, the humans still eat it". The tiger said "oh, it is strange, if the humans even eat fire, they can eat me".

Wild elephant hunting tradition:

- Rules: During hunting
  - Need to go upwind to avoid wild elephants smelling the human beings → wild elephants would slink off.
  - The hunters were allowed to hunt elephant only.
- Taboos:
  - Women were prohibited from hunting elephants.
  - Elephant hunters were prohibited from eating tamarind and cutting tamarind trees (they would go mad or be gored by elephants). They could not eat Muntjacs (Muntiacini), turtles and peacocks during the hunt, but they could eat them when they came back home.
  - A hunter's wife could not wash her hair when he went hunting because it was thought that "washing hair means smooth". So the hunter could not catch elephants. Moreover, his wife was not allowed to go to funerals or weddings while he was hunting.

- After pounding rice, people had to pour rice out slowly. If people poured rice fast, their elephant would fall down.
- People who had hunted elephants were not allowed to eat the head of the buffalo offered to the gods.
- When a man went hunting elephants, his family often did not allow strangers to visit their house. They did not visit sick people or go to funerals…They put leaves in front of their house for three days to warn strangers not to come their house.

- Before hunting: Before hunting, a hunter had to organiee a ritual with a pig, chicken and wine. The organiser of the ritual was often a man who had hunted at least 30 elephants.
- During hunting:
  - Elephant hunters were drawn up in ranks:

    + Bac siai was a hunter who had captured from 1 to 29 elephants. When hunting, bac siai was forbidden to wear a shirt but had to wear a loincloth. He was just allowed to use a lighter to burn a cigarette if he was using a female elephant to catch a male elephant. Bac siai hunting elephants for the first time were not allowed to catch an elephant with left ivory. Catching the elephant with left ivory was equivalent to catching five normal elephants. He was allowed to eat bamboo - tube rice, anchovy, catfish and honey. He avoided eating catfish, red-tailed hemibagrus and fish with fangs. He had to get water by buffalo's horn and not with a pot. If he caught an elephant with right ivory, he had to pay one buffalo. If he caught a male elephant with no ivory, he had to pay two buffaloes and could not eat tamarind.

    + Gru was a hunter who had captured between 15 and 30 elephants and they were divided into two ranks.

    Gru lieutenant: From 15 to 29 elephants

    Gru captain: ≥ 30 elephants

    Gru was allowed to eat the tamarind, but only half of it.
  - Tools for catching elephants: were often:

    + Ropes made from buffalo skin.

    + Rattan for fettering an elephant's leg.

    + A control stick which was called kreo and consisted of a rod and crampon. The rod was made from wood of any kind of tree. The crampon was used to control the elephant to turn left and right.

    + A thing for forcing an elephant to run fast was called Mong Play Măt. It consisted of a handle made from rattan, string made from rope and decoration made from buffalo horn.

- The manner of eating and sleeping of a rider and his assistant were different. The rider slept in front and his assistant slept behind. The rider had the right to take food and rice from his assistant but the assistant was not allowed to take food and rice from the rider.
- Clothing when hunting: A hunter who had captured five elephants was allowed to use a cigarette-lighter and wear a scarf and shirt.
- A hunter who had captured 30 elephants was called Gru. Gru was allowed to wear both pants and shirt when hunting. He had the right to punish a bạc siai who made mistakes as follows:

  While hunting, if a bạc siai's elephant refused to eat, Gru would ask that bạc siai whether he had made any mistakes before the hunt (adultery, eating fish's head…). If the bạc siai said no, he would organise a ritual to make apology to his elephant and go home to find out whether any person at home had made mistakes. Then his elephant began to eat as usual.
- Hunters who captured no ivory male elephants would be fined a certain number of buffaloes (Gru: two buffaloes and bac siai: one buffalo).
- Hunters who hit an elephant's forelegs and left hind leg or dirtied a baby elephant would be fined a certain number of buffaloes (Gru: two buffaloes and bac siai: one buffalo).
- When hunting elephants, hunters had to avoid saying everyday words such as wood (replaced by the word "sung")…
- An elephant rider and his assistant were not allowed to speak to each other face to face any closer than three metres apart.
- Elephant hunters used bamboo tubes for drinking water. The rider and his assistant used different tubes. They were forbidden to use the same tube. If they used the same tube or poured water directly from the tube to their pot, they would be dipped in water three times as a punishment.
- Capturing a white elephant was equivalent to capturing 100 normal elephants.
- If Gru captured a white elephant, he had to offer two pigs and two buffaloes to the gods in order to hope to capture more elephants next time.

- After hunting:
  - When leading wild elephant, when Gru was about two km from home, he blew a buffalo horn to signal people in the village to start preparing food and wine to welcome the hunters. Gru tied a piece of white cord around four candles and then tied them up in a tree to indicate that they hunted elephant and would worship (each ring tied represented each elephant being hunted).
  - If anyone had hunted many elephants, that person would have hired other people to lead the elephant's home.

- A wild elephant was trained in three months by three people hired by the owner.

- Prayer at worship:

  People prayed for the elephant's health. The elephant owner prayed as follow: "This is my elephant, he has done many useful things this year. Now he is taking a rest. I organise a party to invite villagers to share the joy with my family".

Appendix A3.2 Turtle cultural stories:

- Formerly, people often kept turtles and kids played with them. When the adults killed turtles to eat, the kids usually grieved for them. After people had caught fish in a pool, they put a turtle near a slipper and a bottle of water because they thought that the turtle could speak to the slipper and the bottle. The turtle asked the bottle "Is there any kid in your master's house?". The bottle answered "Yes, I had headaches all day because he always spills my water. I am happier when he goes out". The turtle said "If your master has a kid, I will certainly survive". The bottle asked why and the turtle answered "When your master wants to kill me to eat, his kid will cry, he will give me to his kid to feed. When I am grown up, I will trick that kid to escape and survive". Then the turtle also asked the slipper the same questions and the slipper answered "Yes, the kids kick me all day so that I had headaches and got hurt from whole body. Now my master goes out and I have chance to walk for a while". The turtle said, "If your house has kids, I will survive because they will play with me and I will cheat them to escape. If your houses (bottle and slipper) have no kids, I will certainly die because your masters will kill me to eat".
- A tiger and a turtle decided to compete to jump over a spring with the winner able to eat the loser. The turtle's legs were short and the tiger's legs were long. So, the turtle held the tiger's tail in his mouth. When the tiger jumped, his tail moved forward and the turtle reached the finish first and won. Then the tiger climbed up the tree, the turtle butted against the tree by his carapace and said "Tiger, look the tree, it is falling down". The Tiger answered "The tree can not fall down, why can you eat me?". The turtle said, "From the morning to the evening, this tree will fall down, if you don't believe, look at the sky". The tiger looked at the sky and saw the clouds flying and thought that it was the evening and the tree would fall down. He was so scared that he jumped off the tree and died. The turtle came near the tiger's body and said, "You are very big but you have still been tricked into death. It is not difficult to eat me. You just hang my head and tail and then eat me". Suddenly, another tiger appeared from behind and said, "It is unbelievable! Your body is very hard but I just hang your head and tail to eat you". The turtle thought to itself that it would certainly die. It said, "You and I will compete to jump over that spring. If you reach the finish first, you will be my older brother and have the right to eat me;

and vice versa". The tiger wanted to eat the turtle and asked, "Now, who jumps first?" The turtle answered "You first, then me". When the tiger jumped, the turtle held the tiger's tail in his mouth, the tiger's tail moved forward and the turtle reached the finish first. The turtle said "You are very big and you jumped first but I still won". The tiger said "You are so fast. And now no more words, I eat you or you eat me". The turtle asked the tiger to vomit. The tiger vomited many kinds of animals such as tiger, wolf…and even turtle-shell. The tiger said "You see I eat even your fellow creature". The turtle said "Now it is my turn". It vomited fishbone, crab and even tiger's hair". The tiger did not believe and said "It is not my hair; it is the other tiger's hair". The turtle said "If you do not believe, you can look at your tail to check whether you lost your hair or not". Then the tiger said "Oh, I do not even know when you eat me" and the tiger has been scared of the turtle since then.

Appendix for Chapter 4

Table A4.1 The relationship between park managers and Indigenous communities from Indigenous communities' perspectives before the modelling workshop

How do Indigenous communities interact with park management?	Negative (%) 1	(%) 2	(%) 3	Neutral (%) 4	(%) 5	(%) 6	Positive (%) 7
Frequency of Indigenous communities communicate with managers about daily life	71.8	8.9	3.1	13.5	1.2	1.2	0.4
Frequency of Indigenous community tell managers about their needs	69.5	8.1	1.9	17.4	0.8	0.4	1.9
Extent of trusting managers of Indigenous communities	55.6	5.0	3.9	22.8	5.0	1.5	6.2
Extent of managers listening to Indigenous communities	53.7	12.4	2.3	23.9	1.5	2.7	3.5
Extent of managers response to Indigenous communities about their needs and their concerns	56.0	11.2	5.4	18.1	4.2	1.9	3.1
Extent of satisfaction of Indigenous communities with the response the managers offered	62.2	6.9	5.8	16.6	4.2	0.8	3.5
Extent of managers' changes in the outcome after communicating with Indigenous communities	77.6	8.5	1.9	9.7	0.8	1.2	0.4
Extent of new conservation strategies (hunting and exploitation prohibition, patrol, law enforcement,…) being discussed with Indigenous communities before they are implemented?	49.8	1.9	3.5	25.1	0.8	2.7	16.2
Extent of conservation strategies impacting on Indigenous livelihoods	30.9	4.6	1.5	19.3	3.5	9.3	30.9

Appendix for Thesis – Questionnaires

SOCIO-ECONOMICS OF VILLAGES IN THE CORE AND BUFFER AREAS QUESTIONNAIRE

Village: Commune: District: Province:
Date of research: Name of researcher:
Source of information: (Head of village)

1. Population
2. Number of households
3. Number of poor households/households below poverty threshold
4. Ethnic groups

5. Number of ethnic minority households
6. Number of poor ethnic minority households
7. Number of religious households
8. Total areas for farming
   - Agricultural land
     - Annual crops
     - Perennial plants
     - Others
   - Forestry land
     - Forest Land Allocation
     - Forest Planting Contract
9. Livestock
   - Total area for grazing cattle?
   - How many cattle?
   - Fisheries (How many lakes, ponds)?
10. Other research projects

Name of project (Describe the project)	**How long has the project been running for?**	**Outcomes that have already occurred**	**Effects on village and people**

11. Infrastructure present
    - Electricity system
    - Water system
    - School

RESIDENT QUESTIONNAIRE

Village: Commune: District: Province:
Date of research: Name of researcher:

A. Demographic information:

1. How long have you been here?

Whole life	**Period of time (why did you relocate?)**		
	Resettlement programs	Free movement	

2. Ethnic group
3. Do you want role in the household?
4. Number of persons/Working-age persons/Job

No	**Age**	**Sex**	**Education**	**Job**	**Note**
1					The person being interviewed
2					
3					
4					
5					
6					
7					
8					
9					
10					

5. Indicators of economic status

Name of property		Describe	Amount (current value)	When did you buy?	Note
Do you own	Vehicles				
	Buffalo, cow				
	Fish pond				
	Other machines				

B. Land for produce of household

Types of Land		Total area (ha)	Land license agreement or not? Which year?	Productivity/ha (kg/ha)	Note
Residential & Garden land					
Annual crops land	Single season paddy rice crops				
	Double seasons paddy rice crops				
	Shifting cultivation				
	Others				
Commercial plant cultivars, perennial plants	Coffee				
	Cashew				
	Rubber				
	Fruit trees				
	Others				
Forestry land with license agreements					
Regrowth forest					
Forestry land with contract					
Land for fisheries, fish pond					
Land for grazing cattle					
Others					

C. Source of income

Place of produce	Type of produce	Volume of agricultural production (kg-VND)			Investments in agriculture (seeds for planting, fertilizer, food for grazing cattle, hiring labours, preventive medicine, pesticides) Not including labour provided by this household	
		Total volume	Household consumption	Volume sold	Products	Value (VND)
Residential land						
Land for growing one-year cultivars						
Land for growing commercial plant cultivars, perennial plants						
Forest						
Grazing cattle						
Wetland						
Others						

- How much does your household earn in a month/year?

D. Use of the park

1. How often do you visit inside the park?
   A. Everyday
   B. 1 – 3 times/week
   C. 1-4 times/month
   D. 1-11 times/year
   E. Never

2.

What do you do in the park?	**For those activities that you undertake, please indicate how important each activity is to you? Please explain**			
	Not important	Slightly important	Quite important	Extremely important
Harvesting plants				
Hunting animals				
Cultivation				
Grazing livestock				
Sightseeing/recreation				
Others				

3.

How do you interact with park management?	Negative Neutral Positive
Communicating with managers about daily life	No communication Limited communication Good communication
Telling managers about your needs	Never Some of the time Always
Trusting managers	No trust Trust some of the time Totally trust
Managers listening to you	Never Some of the time Always
Managers response to you about your needs	Never Some of the time Always

Managers response to you about your concerns	Never Some of the time Always
Being satisfied with the response the managers offered	Unsatisfied Some of the time Satisfied
There is a change in the outcome after you have communicated with them	No change Some change Change always occurs
Are new conservation strategies (hunting & exploitation prohibition, patrol, compliance, law enforcement,…) discussed with you before they are implemented?	Never Some of the time Always
Are conservation strategies impacting on your livelihood?	Not at all Some of the time Very much

4. Is there any specific instance of communication with managers about an issue and what eventuated?

5. Have you ever been fined or punished for doing something that is not allowed within the park?

6. What would have happened if the park had not been established? Would your life be better or worse? Please explain

7. If there was no longer protection of the park, what would happen to your family and your village?

8. What are the purposes of the park from your perspectives?

Purposes of YDNP	**Not important** **Somewhat important** **Very important**
Scientific research	
Wilderness protection	
Preservation of species and genetic diversity	
Maintenance of environmental services, such as water supplies	
Protection of specific natural and cultural features	
Tourism and recreation	
Education	
Sustainable use of natural resources	
Maintenance of cultural and traditional sites	
Provisioning services (e.g. provision of the conditions for food, fibre, water, natural medicine and genetic resources,…)	
Regulating services (e.g. regulation of climate, water flows, erosion and pollination,…)	
Supporting services (soil formation. Photosynthesis, water and nutrient cycling,..)	

9. List of wetland species used in the park

Species	**What do you use for?**				**How much do you used?**	**How much do you sell?**
	Diet	Medicine	Materials	Spiritual practices		

IDENTIFYING CULTURAL KEYSTONE SPECIES QUESTIONNAIRE

(Park managers, environmental nongovernmental organizations, scientists and representatives of local community)

Date of research: Name of researcher:

Information	Data collection
How long have you been/worked here?	
Which species are most important and most used for food and trade to local community and explain the reasons? Because they play the fundamental roles in: A. Diet B. Materials C. Medicine D. Spiritual practices	
Choose the 5 most important species of YDNP. For each species, what is the name of that species, how is it used, what is the economic significance of that species? Please explain	

Species of cultural importance	Rating					Explanation
	Species 1	Species 2	Species 3	Species 4	Species 5	
Is the species used intensively (routinely, and/or in large quantities)? (Large quantities will be depended on specific species)						
Does the species have multiple uses?						
Does the language incorporate names and specialized vocabulary relating to the species?						
Is it prominently featured in - narratives and/or ceremonies, - dances, songs, - or as a major crest, totem, or symbol						
Is the species frequently discussed by people in the village?						
Would it be hard to replace this species with another available species?						
Is this species used as a trade item with other groups?						
Total						

Notes:

- All these academic questions will be worded in Vietnamese language so that local people can understand easily and when I interviewed local people in pilot study, local people could discuss in group and responded with a consensus.
- Firstly, some of the most dominant species are listed by asking local people which species they think are indispensable to their daily lives. Secondly, species will be ranked based on their index value on a scale of 0 to 5, with 0 representing the answer “no, not used”; 1, “yes, although low or infrequent”; 2, “yes, low”; 3, “yes, moderate”; 4, “yes, high”; and 5, “yes, very high”. Finally, the highest ranking species will be identified as cultural keystone species.

SOCIAL-ECOLOGICAL SYSTEMS MODEL

(Park managers and representatives of local community)

Date of research: Name of researcher:

Topics to discuss:

1. Could you (local community) list all the plants and animals that you think are important (most – average – less) for food and trade to your village?
   Could you (local community) list all the plants and animals that you use (most – average – less) in your village?
   Combining the importance and usage level lists together → List of all the plants and animals that are the most important and most used by the local community
2. Could you (local community) list in order these species from the most important and most used to the least important and least used ones?
3. Could you (park managers) list in order these species from the most important for conservation to the least important for conservation?
4. When do you (local community) use/collect them during the year?
   → Using ecological calendar (dry and rainy season)
5. What are the interactions/impacts between these species?
6. Based on the roles including diet, medicine, materials and spiritual practices, could you tell us the roles of these species?
7. How do you (local community) impact most important and most used species through your activities?
8. Could you (park managers) tell us about the management activities undertaken at YDNP?
9. How do park management activities undertaken by the managers (e.g. ecotourism) impact these species (e.g. impact of tourist operations, particularly in disturbing animals)?
10. What would happen to the park if these species disappear?
11. If you did not have species X, how would that impact on your ability to maintain your culture?
12. Are there any of these species that only appear if another important species appear?
13. Could you (local community) suggest any solutions for preventing impacting to these species, especially the most important and most used species?
14. Could you (park managers) comment on if local people's suggestions are things that you might be able to implement and if not what are the problems with implementing the suggestions?

THREATS TO YOK DON NATIONAL PARK

(Park managers)

Date of research: Name of researcher:

Topics to discuss:

Could you list all the threats and constraints including broad-scale, existing and potential threats that could affect park management effectiveness? Please explain

Possible threats	Root causes	Impact	Severity
1. Habitat: - Alteration? - Destruction?			
2. Encroachment - Residential? - Agriculture?			
3. Natural resources - Invasive species? - Fire?			
4. Poaching and illegal harvesting? Commercial harvesting? Overharvesting?			
5. Impacts of tourist operations, particularly in disturbing animals?			
6. Forestry activities?			
7. Community: support for conservation? - Attitudes? - Actions?			
8. Livestock grazing: legal or illegal?			
9. Monitoring and evaluating system: effective or ineffective?			
10. Funds: adequate or inadequate?			
11. Staff: sufficient or insufficient? - Numbers? - Training? - Qualified?			
12. Legislation: adequate or inadequate?			
13. Policy or administrative arrangements: adequate or inadequate?			
14. Infrastructure development?			
15. Adjacent land use/development: appropriate or inappropriate?			
16. Hydroelectric power: appropriate or inappropriate?			
17. Military activity: appropriate or inappropriate?			

NEGOTIATION BETWEEN PARK MANAGEMENT AND COMMUNITY NEEDS

Date of research: Name of researcher:

Topics to discuss:

Did you…	Bad Some of the time Good	
learn anything from the workshop?	Not at all Very much	What types of thing have you learnt from the workshop?
enjoy the workshop?	Not at all Very much	
change your perspective?	Not at all Very much	About what?
What do you think about the participation of other people?	Passive Active	
Do you now…		
understand each other better	Not at all Very much	
understand the importance of wetland resources better	Not at all Very much	What are they?
understand why it is important to conserve important species more	Not at all Very much	Can you list all the reasons why we conserve important species?
Park managers		
Do you now understand local people's needs better?	Not at all Very much	Can you list the needs/requests of local people?
Local community: Did you/Do you…		
learn from each other about how important different species were from talking to each other during the workshop	Not at all Very much	Will you tell other people in your village about the importance of these species?
think the knowledge you gained from the workshop will change the way you use these important species?	Not at all Very much	Which ways will you change?
learn anything about the roles of the park managers through the workshop	Not at all Very much	Can you tell us about the roles of the managers?
Feel more comfortable about talking to the managers	Not at all Very much	Will you tell them about your daily life and your needs?
identify opportunities that could benefit you through information acquired through the model	Not at all Very much	Which opportunities that could benefit you?