A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Master of Science

"Walking in the forest": Tracing traditional ecological knowledge in field-level protected area management

**Ruth PINTO** 

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This thesis is submitted in fulfillment of the Master of Science degree awarded as a result of successful completion of the Erasmus Mundus Masters course in Environmental Sciences, Policy and Management (MESPOM) jointly operated by the University of the Aegean (Greece), Central European University (Hungary), Lund University (Sweden) and the University of Manchester (United Kingdom).

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# ABSTRACT OF THESIS submitted by:

Ruth PINTO

for the degree of Master of Science and entitled: "Walking in the forest": Tracing traditional ecological knowledge in field-level protected area management Month and Year of submission: May, 2015.

The value of traditional ecological knowledge (TEK) in environmental management is increasingly recognised. Indigenous communities reside in and around most protected areas worldwide. Often, individuals from these communities are hired in field-level protected area management in the capacity of forest rangers. However, the role of TEK in field-level protected area management has largely been overlooked. This study explores the significance of TEK as a benefit of hiring local rangers in the field-level management of protected areas through a case study in southern Belize. Between January and March 2015, qualitative and participatory methods including participant observation, 10 in-depth interviews and one data verification workshop were used. This data were analysed through discourse analytic approaches. Results highlight the contributions made by TEK to field-level protected area management, in particular, its role in assisting with rangers' survival in the forest, the identification of illegal activities and biodiversity monitoring. It also identifies TEK as a benefit of local hiring. Greater recognition of the role of TEK in protected area management may also assist in the development of a cross-cultural conservation ethic. The development of a shared ethic, between local resource users and protected area management agencies, could increase local support for protected areas and empower local communities.

**Keywords:** traditional ecological knowledge, protected area management, forest rangers, local hiring, local support, Belize

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# List of Abbreviations

BNR	Bladen Nature Reserve		
COL	Community Outreach and Livelihoods		
FFI	Fauna and Flora International		
GPS	Global Positioning System		
GSCP	Golden Stream Corridor Preserve		
ICDP	Integrated Conservation and Development Project		
ILM	Integrated Landscape Management		
IUCN	International Union for Conservation of Nature		
MGL	Maya Golden Landscape		
NGO	Non-Governmental Organisation		
NPAPSP	National Protected Areas Policy and System Plan		
PA	Protected Area		
PAM	Protected Areas Management		
PHMR	Port Honduras Marine Reserve		
SES	Social-ecological Systems		
ТЕК	Traditional Ecological Knowledge		
UN	United Nations		
Ya'axché	Ya'axché Conservation Trust		

# **1. Introduction**

Since the 1980s, the value of traditional knowledge has been recognised in international law, and within the scientific and policy community (Mauro and Hardison 2000, Berkes 2012). This recognition has resulted in increased interest in, and efforts to include, traditional knowledge in resource management strategies (Usher 2000), despite resistance on multiple grounds (e.g., Nadasdy 1999). In particular, Traditional Ecological Knowledge (TEK), as a subset of traditional knowledge (Stevenson 1996), is of interest to environmental managers. From among the many alternative definitions of TEK, the definition selected to provide a framework for this thesis is adopted from Berkes *et al.* (2000):

"a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment".

According to this definition, TEK is a knowledge-practice-belief complex that is culturally transmitted, dynamic and adaptive. This definition views knowledge as process, as opposed to knowledge as content (Berkes 2012). TEK is typically attributed to indigenous people (Usher 2000), however some scholars extend the term to also include local ecological knowledge (e.g., Johnson 1992, Berkes *et al.* 2000, Huntington 2000).

TEK is also defined in contrast to Western scientific knowledge (e.g., Agrawal 1995, Nadasdy 1999, Wenzel 1999). Many scholars claim that these knowledge systems differ based on their structure and purpose (e.g., Stevenson 1996, Johnson 1992) as well as how they are documented (Fabricius *et al.* 2006). However, despite differing epistemologies and worldviews, these knowledges could be complement each other (Berkes 2009b). Together, they could enhance our understanding of how to conserve biodiversity and manage ecosystems (Reid *et al.* 2006). Some scholars suggest approaches for creating synergies between knowledge systems (Tengö *et al.* 2014), including shifts towards co-production of knowledge (Davidson-Hunt and O'Flaherty 2007). However, it is important to acknowledge

that there are power issues involved in knowledge integration and co-production (Agrawal 1995, Nadasdy 1999).

The focus of this study is the role of TEK in Protected Areas (PA). Huntington (1998) states that indigenous knowledge holders often have detailed understandings of migratory patterns of wildlife, feeding behaviours and prey patterns, predator avoidance, calving, ecological interactions, and human influences, among other related knowledge. Additionally, Fabricius *et al.* (2006) claim that the co-evolution of local knowledge with local ecosystems results in greater feedback, enhancing the potential for developing adaptive management practices. Such scholars point to the potential value TEK could bring to PA management.

Historically, the management of PAs mainly followed principles of conservation biology, based on a Western scientific worldview (Dowie 2009). In the early 1980s, with pressure from international organisations and donor agencies, conservation organisations began to involve local communities in resource management in an effort to integrate conservation and development agendas (Chapin 2004). Around the same time, with increased interest in TEK, the International Union for Conservation of Nature (IUCN) began to place emphasis on the inclusion of people in conservation, including PA management (Williams and Baines 1993). This has led to the increased involvement of local communities, including indigenous people, in the management of PAs through the setting up of collaborative management arrangements between government agencies, conservation organisations, local communities, and others, as well as the recognition of community conserved areas (Borrini-Feyerabend *et al.* 2004a).

Another means of including local people in PA and conservation programmes is through local hiring. Many PA management agencies worldwide provide direct employment opportunities to local residents, including the hiring of forest rangers from surrounding communities (e.g., Vasan 2002, Poppe 2012). These opportunities are provided, in part, to improve the wellbeing of local residents and to encourage local development (McNeely and

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Miller 1984). They are based on the belief that local support is needed for effective biodiversity conservation (Brockington 2004).

Forest rangers are hired by PA management agencies to perform a variety of duties at the field-level; they are "executives in the field" (Kaufman 1960). Their duties may include law enforcement, policy implementation, forest management and monitoring, and other conservation practices (FAO 2015). When referring to field-level PA management, this thesis specifically refers to the management of PAs *in the field*, such as in the capacity of forest rangers.

Local forest rangers are "executives in the field" as well as community members enmeshed in local social networks (Vasan 2002). They could therefore be viewed as bridging agents between PA management agencies and communities, assisting in the building of trust and the reduction of conflict (Stern 2008). However, the costs and benefits derived from hiring local forest rangers have largely been overlooked (for exceptions, see Poppe 2012, Vasan 2002). Additionally, the role of rangers as TEK holders and users, and the potential contributions of TEK to field-level PA management, has not yet been studied.

#### 1.1. Research problem

Indigenous communities reside in, or around, approximately 85% of PAs around the world (Galloway-McLean 2010). Besides their labour and professional skills, forest rangers hired from these communities bring their worldviews, and potentially aspects of TEK, to their work as local-level conservationists. Their ways of knowing contribute to the field-level management of PAs. However, these contributions have yet to be understood and acknowledged.

Why is this important? Firstly, recognising the contributions of TEK to field-level PA management would assist in empowering forest rangers. Furthermore, local forest rangers, as

bridging agents between PA management agencies and communities (Vasan 2002), are in an interesting position; not only can they represent PA and conservation agendas in their communities, but they could add to definitions of conservation through processes of social learning within PA management agencies (Berkes 2009a). This could result in the development of what Berkes (2004) refers to as a 'cross-cultural conservation ethic', whereby the definition of conservation is expanded to include the views of multiple stakeholder groups. Understanding the role of TEK in field-level PA management would assist in the development of such an ethic. A shared ethic would aid the garnering of local support as well as empower local communities (Brosius and Russell 2003). As 'local support' is usually one of the goals of local hiring, exploring the role of TEK in PA management and creating space for social learning would benefit PA and conservation strategies.

PAs are located within wider social-ecological systems (SES) (Berkes *et al.* 1998). As noted by Berkes *et al.* (2000), local resource users that interact with ecosystems on an everyday basis over lengthy periods of time tend to possess relevant knowledge of ecosystem dynamics and related management practices. Therefore understanding how local forest rangers, as local resource users and "executives in the field", perceive and value PA management as a strategy for conservation is important, as their TEK could influence field-level PA management. Moreover, if TEK assists forest rangers in the protection of PAs, it could be considered an added benefit to the already documented benefits of local hiring.

#### 1.1.1. Research aim and questions

This study is interested in understanding the role of TEK held by rangers in field-level PA management. To do so it adopts a case study approach, focusing on the forest ranger team hired by Ya'axché Conservation Trust in southern Belize.

#### Research aim

To explore the significance of traditional ecological knowledge as a benefit of hiring local rangers in the field-level management of Golden Stream Corridor Preserve and Bladen Nature Reserve, Belize.

To address this aim, the following research questions will be explored.

# Research questions

- 1. What motivates the protected area management agency to hire rangers from surrounding communities?
- 2. How does traditional ecological knowledge held by rangers contribute to field-level management of protected areas? Can this knowledge be considered a benefit of hiring local rangers for protected area management?

# 1.2. Method

To explore the aforementioned research questions, this study uses an ethnographicallyinformed case study approach (Stake 1995, Yin 2009, Creswell 2012). Multiple field methods were used to enhance validity through the triangulation of data (Creswell 2012). These included participant observation, in-depth interviews with a team of 10 forest rangers, and a data verification and knowledge sharing workshop. The analysis of the data produced was framed by the research questions. A preliminary analysis was conducted prior to the data verification workshop, following which sociological discourse analysis was used to understand and interpret the data. This involved thematic content analysis and intertextual analysis (Ruiz 2009). Transcripts and fieldnotes were coded using Atlas.ti 6.2., a computerbased qualitative data analysis software. Details on the methods used are presented in chapter four.

#### **1.3.** Thesis outline

This thesis is organised into six chapters. The first (introductory) chapter provides an overview of the research topic and the focus of this study. The second chapter is a review of literature relevant to the research topic, including an examination of TEK definitions and applications, the relationship between PAs and surrounding communities, and local hiring with a focus on field-level PA management. The third chapter details the case selected to explore the research aim and questions. Chapter four presents the methods adopted to produce and analyse data in fulfilment of the research questions. The fifth chapter presents the results and discusses their broader implications. The sixth and final chapter addresses conclusions, insights and recommendations for future studies.

# 2. Review and theory

#### 2.1. Introduction and scope

The purpose of this review is to provide a theoretical framework in which to situate and guide the following study. It explores the state of literature on TEK and its role in field-level PA management. To do so, the review examines discourses on TEK and environmental management, as well as the relationship between PAs and communities, from which individuals are often employed in field-level management.

Other related fields of study that focus on the involvement of local populations in PA management, such as co-management, or community conserved areas, are outside the scope of review, since this study is concerned with the *role of TEK within field-level PA management*. Additionally, other suggestions for local involvement in PA management will not be discussed in detail, nor will conclusions be made regarding how ideal they are. Within the TEK discourse, literature highlighting the meaning of the concept as well as its application in resource and PA management will be explored. The review will then trace the history of the PA approach, the costs and benefits to buffer communities, and reasons for local hiring. This review will therefore outline the development of both, the TEK discourse and the PA approach, their intersections, and provide an investigation of the state of literature in the following areas:

- 1. Traditional ecological knowledge for PA management
- 2. The costs and benefits of local hiring in PA management

#### 2.1.1. Review method

The literature for this review was selected based on their relevance to the aforementioned fields of study. Special attention was paid to publications from the last 30 years. This was

accomplished using online search engines (such as ISI Web of Knowledge, Science Direct and Google Scholar) to identify relevant literature. This was achieved with the following keywords, used in a various combinations:

- "Traditional ecological knowledge"
- "Local ecological knowledge"
- "Indigenous knowledge"
- "Natural resource management"
- "Protected area management"
- "Park management"
- "Local support"
- "Local hiring"
- "Costs and benefits of protected areas"
- "Forest rangers"
- "Foresters"
- "Forest guards"

The relevance of articles was determined based on the title and abstract; for books and special issue journals, the title and introduction were used. Further selection of the literature was achieved with a quick search of relevant keywords (as listed above) within each article or book. A total of 30 articles and books were selected and form the primary basis of this review. With the use of a synthesis matrix, the themes touched upon in this review were further explored in each of the selected article and book. In-text citations lead to related articles, however these were only used to support or challenge claims identified in the selected literature.

#### 2.2 Traditional Ecological Knowledge: definition and application

## **2.2.1. What is TEK?**

Traditional knowledge sustains cultures and livelihoods of communities around the world, and is valued across many academic disciplines (Berkes 2012). Interest in TEK has increased in the past decades due to recognition of its potential contributions to environmental management (WCED 1987). However, there is no universally accepted definition of the term. A number of scholars have proposed variations, including 'indigenous knowledge', 'local ecological knowledge', and 'traditional forest-related knowledge'. The meanings of these terms have been discussed and debated by many (e.g., Stevenson 1996, Usher 2000, Berkes *et al.* 2000, Nelson 2005, Aikenhead and Ogawa 2007, Houde 2007), and although similar, they have subtly different meanings and applications.

'Traditional' is a problematic word for many scholars. Warren (1995) suggests that the term denotes "19th-century attitudes of simple, savage and static", and denies the present-day relevance and efficacy of knowledge held by indigenous communities. For this reason, the less value-laden term 'indigenous knowledge' is often favoured (Gombay 1995, Agrawal 1995). Stevenson (1996) claims that the use of the term 'indigenous knowledge' is considered to be more inclusive, empowering, and avoids misappropriation, unlike 'traditional knowledge'. However, he also claims that indigenous knowledge does not capture the full breadth of knowledge held by most indigenous groups.

According to Stevenson (1996), indigenous knowledge has two sources: traditional knowledge and non-traditional knowledge. This perspective acknowledges that indigenous people possess knowledge and experience beyond their traditional ways of living. It also recognises that indigenous knowledge is the "articulation, and frequently the dialectic, of traditional and nontraditional knowledge" (280). This points to the constantly evolving,

dynamic nature of indigenous knowledge systems. This dynamism has been recognised and highlighted by many scholars (e.g. Agrawal 1995, Berkes 2012, Maffie 2009).



Figure 1 | Conceptual model of indigenous knowledge and its various subsets, adapted from Stevenson (1996)

Stevenson (1996) developed a conceptual model of indigenous knowledge, in which TEK is a subset of traditional knowledge, as described in Figure 1. This indicates that TEK is embedded in systems of knowledge that have broader social, cultural, economic and spiritual dimensions. Brosius (2006) reemphasises this, stating that it is important to engage communities in more than their ecological knowledge in order to enable them to position their knowledge within a larger social and political context. Outside of this context, such knowledge may lose value (Stevenson 1996, McGregor 2004).

Although the term indigenous knowledge is broader than ecological knowledge and provides a more holistic representation of indigenous knowledge systems (Rotarangi and Russell 2009), TEK continues to be widely used when referring to indigenous knowledge in environmental management. This is in part due to the formation of the IUCN working group, by that name, in 1982 (Johannes 1989, Williams and Baines 1993). Additionally, for many groups of indigenous people 'traditional' can mean time-tested and wise (Emery 1997, cited in Berkes 2012).

Whyte (2013) states that the usage of the term is contextual, and greater attention ought to be paid to the different understandings of, and approaches to, the concept of 'knowledge' by different stakeholders. Whyte (2013) also suggests that through collaboration, the integration of different approaches to knowledge can improve the stewardship of nature. With this in mind, the definition selected to provide a framework for this thesis is adopted from Berkes and colleagues (2000):

"a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment".

According to Berkes *et al.* (2000: 1252), TEK is viewed as a knowledge-practice-belief complex that is culturally transmitted, and is "holistic in output and adaptive by nature". This conception of TEK recognises its dynamism, and that it is situated within a wider knowledge system. This definition views knowledge as process, as opposed to knowledge as content (Berkes 2012).

With increasing interest in the potential for TEK to contribute to natural resource management, some scholars began classifying traditional knowledge based on its usage. For example, Battiste and Henderson (2000:46) state that "what is traditional about traditional ecological knowledge is not its antiquity, but the way it is acquired and used". Usher (2000) provides a four point categorisation of traditional knowledge focusing on environmental assessment and management: (1) experiential knowledge of the environment, (2) knowledge of past and current use of the environment, (3) culturally-based values regarding interactions

between humans and the environment, and (4) a culturally-based cosmology or worldview, underlying the other three categories. Of the four categories, experiential knowledge of the environment is the only place-based and scientifically verifiable category, and it has therefore been the subject of most integrative efforts (Usher 2000).

However, Ingold (2000) argues that traditional knowledge is inseparable from practice. I suggest that speaking of traditional populations' 'use of TEK' implies that this knowledge is divisible from beliefs and practices. It suggests that TEK can be 'used' in the absence of the worldview in which it is embedded. Similarly, it implies that worldviews are not fundamentally informed by knowledge. However, I reject the implied Cartesian dualism between the mind and body / physical world (Ingold 2000). As such, I use the definition of TEK provided by Berkes *et al.* (2000). This definition views TEK as a knowledge-practice-belief complex, and rejects the notion that TEK holders 'use' knowledge as an object. However, within this text I do refer to the 'use' of TEK for ease of communication and brevity. Nevertheless, this should be treated as shorthand for the ways that TEK exists as a knowledge-practice-belief complex.

The following section presents another widespread debate linked to the defining of TEK – how it is contrasted with definitions of 'scientific knowledge'.

# 2.2.2. TEK and scientific knowledge

Attempts to define indigenous knowledge in contrast to scientific knowledge often accompany discussion of the articles considered as TEK. These attempts are more commonly found in literature when compared to definitions of TEK relative to itself. The primary question of this debate remains – are indigenous knowledge systems distinct from those of science?

According to Turnbull (1997: 560) when local knowledge is examined in-depth, "in no case does it come out looking like the standard Western notion of information", but it tends to be a "blend of knowledge, practice, trusted authority, spiritual values, and local social and cultural organization: a knowledge space".

Attributes of TEK	Attributes of Scientific Knowledge
Emic (culture-specific)	Etic (culture-neutral)
Holistic	Compartmentalised
Moral	Value-Free
Long Time Scales	Short Time Scales
Subjective	Objective
Inclusive	Exclusive
Non-systematic	Systematic
Experiential	Experimental
Qualitative	Quantitative
Relative	Absolute
Oral	Literate
Inductive	Deductive

Table 1 | Typical attributes of traditional and scientific epistemologies

The attributes listed in Table 1 are most commonly cited as distinguishing characteristics of the two knowledge systems and have been compiled from relevant sources (including Johnson 1992, Agrawal 1995, Stevenson 1996, Nadasdy 1999, Wenzel 1999). According to some scholars, there are important differences between the structure and purpose of TEK and those of scientific knowledge (e.g., Stevenson 1996). For example, Johnson (1992) claims that indigenous knowledge systems are oral based, experiential, derived from empirical observation, holistic, intuitive and qualitative, rooted in the social context, diachronic, and often spiritual. However, she adds that such generalisations have exceptions, with some indigenous knowledge systems being quantitative and based on experiments. Stevenson (1996) differentiates between indigenous and scientific knowledge, but views them as operating within broader contexts. He therefore states that a discussion of these contexts must precede further clarification of the differences between these knowledge systems. Some authors claim that these differences are due to how these knowledges are documented, and that many indigenous communities adopt an "integrated approach when assessing and managing ecosystems" the dimensions of which are more obvious to resource users than external researchers (Fabricius *et al.* 2006: 170).

Although differing epistemologies and worldviews frame these knowledge systems, suggesting that they ought to be structured and valued exclusively, some scholars argue that they can be reconciled (Agrawal 1995). For example, Berkes and Berkes (2009) use 'fuzzy logic' or a multi-valued logic to place these knowledge systems along a range, instead of dichotomising them. Similarly, Maffie (2009) states that there are many different ways of knowing, all of which are "equally inescapably local". Davidson-Hunt and O'Flaherty (2007) encourage a shift from this dichotomy to a dialogue and partnership in the co-production of knowledge. According to Agrawal (1995: 31) a knowledge system can be classified in multiple ways "depending on the interests it serves, the purposes for which it is harnessed, or the manner in which it is generated". He suggests that substantive, contextual, methodological and epistemological differences limit our understanding of these knowledges.

Reconciling this debate is outside the scope of this review. However, this discussion remains significant in the discourse, and to a degree is related to "claims of authority over knowledge" (Berkes 2012). For the purpose of this study, I adopt a more moderate view, recognising both similarities and differences between indigenous and scientific knowledge, and viewing them as complementary knowledges, especially with respect to resource management (Berkes and Berkes 2009).

#### 2.2.3. TEK and environmental management

Many areas of environmental management may gain from employing TEK (Berkes 2012). Some studies suggest that traditional knowledge allows holders to exist in 'harmony' with their environment, by advocating sustainable resource use (Sen 1992, Inglis 1993). This has led to claims that TEK can contribute to the sustainable management of resources (Stevenson 1996). However, it is important not to assume that all traditional practice and belief systems are ecologically adaptive or wise (Berkes *et al.* 2000).

Berkes et al. (2000: 1252) discuss the use of TEK by communities to "respond to and manage processes and functions of complex systems". They examine practices based on local ecological knowledge, and the social mechanisms behind these practices, noting their contributions to natural resource management. Similarly, Moller et al. (2004) have compiled lists of indigenous ecological practices that contribute to wildlife monitoring. Huntington (1998) states that indigenous knowledge holders often have detailed understandings of migratory patterns of wildlife, feeding behaviours and prey patterns, predator avoidance, calving, ecological interactions, and human influences, among other related knowledge. According to Fabricius et al. (2006), the co-evolution of local knowledge with local ecosystems has resulted in greater feedback, enhancing the potential for developing adaptive management practices. The value of local knowledge as a source of detailed information at temporal and spatial scales useful for monitoring and managing natural resources, enhances the potential of TEK to impact these resources, especially in areas where such information is undocumented by scientists and scholars (Fabricius et al. 2006). Additionally, the dynamic and adaptive nature of TEK could contribute to adaptive management strategies, since both approaches use feedback learning to deal with uncertainty (Berkes et al. 2000). Within this review, the following section focuses specifically on TEK for PA management.

#### 2.2.4. TEK and PA management

Since the early 1980s, the IUCN has placed emphasis on the inclusion of people in conservation, including PA management (Williams and Baines 1993). Indigenous people live in many biodiversity-rich areas around the world (Maffi 2005). This may be because many indigenous practices tend to conserve biodiversity, with these groups depending on a diverse range of resources for their livelihoods (Berkes 2012). In fact, area-specific taboos or sacred sites, as examples of conservation practices in TEK systems, are found in a number of regions across the world and have immense conservation potential (Ramakrishnan et al. 1998). Since the 2003 World Parks Congress, many of these sites have been recognised as community conserved areas (Borrini-Feyerabend et al. 2004a). Additionally, a greater understanding of traditional conservation practices could assist in designing PA strategies that are more ecologically and culturally appropriate to a particular area. This has led to the involvement of indigenous and local communities in the management of PAs, with the argument that the use of TEK for conservation is likely to be effective (Berkes et al. 1995, Borrini-Feyerabend et al. 2004a). This has also resulted in an increase in interest in comanagement or 'collaborative management' arrangements, whereby government agencies, conservation organisations, local communities, and others share the authority and responsibility of PA management (Borrini-Feyerabend 1996).

However, these arrangements do not often account for the involvement and contributions made by TEK holders in the field-level management of PAs, especially in the capacity of forest rangers. Before introducing literature on the involvement of local populations in PAs, and related costs and benefits, the following section provides a brief overview of the PA approach.

#### 2.3. Protected Areas: a strategy for biodiversity conservation

#### **2.3.1.** History of the approach

Since the creation of Yellowstone National Park in 1872, the establishment of PAs is the most well-known and accepted strategy for biodiversity conservation and tackling ecosystem fragmentation (Chape *et al.* 2005). Historically, the management of PAs followed principles of conservation biology, based on a Western scientific worldview (Dowie 2009). Within this worldview, rooted in Cartesian dualism, human beings are considered separate from nature. This resulted in conservation approaches that aimed to exclude humans from certain areas in order to maintain 'pristine wilderness' (Kalamandeen and Gillson 2007). Such a 'fences and fines' or 'island' approach is still found around the world today despite a shift in PA strategies towards managing landscapes (Palomo *et al.* 2014).

In the early 1980s, in response to increased pressure from donor agencies and questioning of the attainment of conservation goals without local engagement, conservation organisations began to support the involvement of local people in natural resource management (Chapin 2004, Palomo *et al.* 2014). Such pressure, bolstered by the United Nations (UN) Conference on the Human Environment (1972) and the UN Conference on Environment and Development (1992), pushed for the integration of conservation and development agendas. This resulted in the inclusion of "sustainable natural resources use, the preservation of ecosystem services and integration with broader social development processes" in the aims of PAs worldwide, along with the core goal of biodiversity conservation (Borrini-Feyerabend *et al.* 2004b: 1).

Table 2 | The evolution of conservation strategies in protected areas; timelines are approximations and vary between regions (for example, the 'island approach' continues to be employed as a PA management strategy, particularly in private PAs) (adapted from Palomo *et al.* 2014).

	Approach to protecte	ed areas		
Attributes	Island approach (ca. 1872–1980s)	Network approach (1990s–mid-2000s)	Landscape approach (mid-2000s–today)	Social–ecological approach (today–?)
Type of management	Static: Seeks to maintain the status quo	Dynamic: Some natural changes are considered necessary	Dynamic: Some natural changes are considered necessary	Adaptive: Natural and social changes should be incorporated into management
Conservation values considered	Intrinsic values of ecosystems, biodiversity and cultural values	Intrinsic values of ecosystems, biodiversity and cultural values	Intrinsic values of ecosystems, biodiversity, ecological processes (functions, ecological integrity), and cultural values	Intrinsic and instrumental values of ecosystems and biodiversity
Knowledge involved	Scientific and technical	Scientific and technical	Scientific and technical	Scientific, technical, and local ecological knowledge
Resilience against perturbations	Reduction of variability	Moderate resilience	Moderate-high resilience	High resilience
Competition against other land uses	Partly competitive because of low demand for the landscape	Competitive because of high demand for the landscape	Highly competitive because of high demand for the landscape	Cooperative: Multifunctional landscapes
Local population involvement	Managed without the local population, which is seen as a threat; managed by researchers and environmental experts	The local population is included in some participatory management processes	The local population is included in participatory management processes	Truly managed with the local population
Landscape management	No integrated landscape management	No integrated landscape management	No integrated landscape management; the landscape is managed to avoid harming the protected area	No integrated landscape management; management of the landscape as a whole

This shift in PA and other conservation strategies lead to more inclusive, people-oriented and community-based approaches to conservation (Ghimire and Pimbert 1997). Examples include Integrated Conservation and Development Projects (ICDPs) aimed at reconciling the management of PAs with the social and economic needs of local people, co-management arrangements between a range of stakeholders including local resource users, and the establishment of community conserved areas (Brown 2003, Borrini-Feyerabend *et al.* 2004a). However, the performance of such initiatives and arrangements in achieving conservation and development goals has been mixed, prompting debate over the effectiveness of such approaches (Redford and Sanderson 2000). In order to understand the factors that lead to the success or failure of these approaches, researchers and scientists have analysed the relationship between PAs and people from surrounding communities around the world (e.g., Holmes 2013).

#### **2.3.2.** PAs and local people

Communities surrounding PAs have been increasingly involved in PA management and other conservation efforts, with the belief that local support is needed for effective biodiversity conservation (Brockington 2004). According to some studies, failure to engage local populations can breed mistrust and resistance to conservation (e.g., Dahlberg and Burlando 2009). Dowie (2009) found that conservation strategies that are socially just are more effective at maintaining biodiversity conservation. Lewis and colleagues (2011) even claim that conservation efforts are destined to fail unless they address local development. Within this review, the 'principle of local support' has an interesting position: it has been widely promoted at major conservation meetings and is often implicit in determining conservation strategies and practices (Brockington 2004). At the 1992 World Parks Congress, the president of the IUCN stated in the opening speech that "quite simply, if local people do not support protected areas, then protected areas cannot last" (Ramphal 1993: 56, cited in Brockington

2004). This presumption that local support makes conservation more effective is challenged by a few scholars (e.g., Brockington 2004, Holmes 2013). Brockington (2004) states that he "believe[s] that the goals of community conservation deserve support, but that its necessity for the success of conservation has been overrated". He emphasises the role of power in enabling or preventing local people from influencing PA management. Holmes (2013) takes this argument further and explores what factors might affect the ability of local people to have a say in PA policies. The claims of these scholars do not dispel the role of local support in PA management, but rather challenge the assumption that it is a strict requirement for conservation to be effective.

There are a number of ways in which local populations could support or be involved in PA management. If viewed from the perspective of devolving power, these range from education/outreach programmes and benefit sharing to co-management arrangements and the establishment of community conserved areas. The following section explores some of the costs and benefits linked to living in close proximity to PAs.

#### 2.3.3 Costs and benefits to local people

The social and economic impacts of PAs on local populations have long been acknowledged and documented (e.g., McNeely and Miller 1984; McNeely 1993; Emerton 2001, Igoe 2006). For example, direct costs to surrounding communities can include displacement, changes in land tenure, restricted access to resources and human-wildlife conflict such as crop raiding and attacks (Coad *et al.* 2008).

Balmford and Whitten (2003) argue that such costs of PAs are mostly borne locally with benefits gained at the global level. However, PAs can also provide a number of benefits to local populations. These include a range of ecosystem services, economic benefits of tourism, direct employment, land leasing arrangements, and profit sharing schemes (McNeely and Miller 1984, IUCN 2005). A number of direct and indirect illegal benefits also exist. However these are often addressed through benefit sharing arrangements, outreach programmes and increased policing (Adams and Hutton 2007). The distribution of benefits between local and non-local or global actors is questionable. Analysing conservation programmes in Nepal, Paudel (2006) found that PAs produce a number of legal and illegal benefits. However these tend to reinforce existing economic inequalities. Access to benefits is generally under the authority of PA management agencies, and dependent on rules of eligibility and compliance to regulations (Adams and Hutton 2007).

Within this discourse, the flow of costs and benefits tends to be viewed as unidirectional – from PAs and their management agencies to local communities (e.g., Gutman 2002, Coad *et al.* 2008). Communities are often seen as passive beneficiaries, whose involvement is typically limited to adherence to PA rules. This is visible even in some co-management agreements that ignore local conservation ethics (Berkes 2004). There is much less focus on the added value of community involvement and the benefits accrued by PAs from the direct employment of local people, especially within field-level PA management. These dynamics are explored in the next section.

#### 2.3.4. Local hiring

As a principle, 'local hiring' is adopted by a wide range of governments and organisations. This is primarily because the benefits of hiring locally are high, and the principle often responds to questions of justice (Mulligan-Hansel 2008). The same logic is used by many PA management agencies, with direct employment opportunities provided to local residents as a means of supporting local economic development.

Many PAs around the world hire forest rangers from surrounding communities (e.g., Vasan 2002, Poppe 2012). Employing forest rangers from local communities can have a range of

advantages and disadvantages, especially when attempting to build local support for PAs, and reduce conflict between PAs and local communities (Vasan 2002, Stern 2008). However, there are costs and benefits to hiring from outside these communities – the primary aim of which is law enforcement and policing. As investigated by Almudi and Berkes (2010), the actions of local people and their ability to influence PA policy and management can be limited if they fear, or are threatened by, violence from forest rangers. Some studies illustrate the significance of social connections between local people and PA staff, particularly with respect to the empowerment of local people. Norgrove and Hulme (2006) demonstrate that personal relationships increased the bargaining power of local people with PA staff, particularly regarding regulations and permissible activities. Alternatively, Stern (2008) found that it was more likely that local people with social connections to PA staff would view PAs as legitimate, obey regulations and invest greater trust in the staff. Bryant (2002) adds that when faced with a more dominant conservation discourse, the ability of local people to assert themselves, including their knowledge, histories and cultures, could not only be empowering, but an effective way of challenging and shaping PA policy.

#### 2.3.5. The role of forest rangers in PA management

Forest rangers are employed by PA management agencies to perform a variety of duties at the field-level. Their duties may include law enforcement, policy implementation, forest management and monitoring, and other conservation practices (FAO 2015). Forest rangers are often hired from communities surrounding PAs, especially in developing countries (e.g., Vasan 2002, Poppe 2012).

Indigenous communities reside in, or adjacent to, approximately 85% of PAs worldwide (Galloway-McLean 2010). The benefits derived from hiring forest rangers from these communities, as well as an investigation of their role in PA management and wider

conservation strategies, has largely been overlooked. Of the few studies that explore this topic, Vasan (2002) focuses on the role of local forest guards as field-level policy implementers in Himachal Pradesh, India. Using an ethnographic approach, she explores the social and professional lives of these forest guards and the ways in which they negotiate and reconcile their role as policy implementers while embedded in local social networks. Another study by Poppe (2012) explores the role of ambiguity of identity in sustaining conservation practice. She focuses on the ambiguous positions held by local rangers of the W Park in Burkina Faso, and claims that this ambiguity, particularly when transforming policies into practices, is necessary for the success of conservation.



Figure 2 | The role of local forest rangers as portrayed in literature

These studies focus on the role of rangers as local-level policy implementers, stewards of biodiversity conservation and law enforcers, among others (see Figure 2). Within this discourse, rangers have yet to be viewed as TEK holders, and users, resulting in the contributions of TEK to field-level PA management being overlooked. Recognising these contributions can add to the development of a cross-cultural conservation ethic, whereby the definition of conservation is expanded to include the views of local resource users (Berkes 2004). It is within this gap in the literature that this study situates itself. Using a case study approach to explore the role of TEK held by forest rangers in the field-level management of

PAs, it adds to the discourse on the use of TEK for PAs as well as the benefits of direct employment of local people in field-level PA management.

In the following chapter, an introduction to the case study – a ranger team in southern Belize – is presented. The chapter provides an overview of the PA management agency, its goals, management arrangements of the concerned PAs, and a profile of the ranger team.

# 3. The Case: The Rangers of Ya'axché Conservation Trust

#### 3.1. Toledo District and the Maya Golden Landscape

Toledo is the southernmost district of the Central American country of Belize, known for its high biological and cultural diversity. Toledo District possesses the highest density of forests in the country (equal to that of the Cayo District), and supports a population of over 30,000, of which approximately 82% is rural (GoB 2010). Many of these rural residents are reliant on forests as sources of fuel, building materials, potable water and nutrition (SIB 2010a). In recent years, there has been a sharp population increase in the district, rising from 19,687 in 2000 to 25,434 in 2010 (rural areas excluding Punta Gorda) (SIB 2010b). This rapid population growth (which in part can be attributed to the immigration of seasonal labourers from neighbouring countries), along with insecure land tenure (Steinberg 1998), and the search for fertile farmlands has resulted in increased pressure to the forests of Toledo (Wicks *et al.* 2010).

Within this district, many governmental, community-based and non-governmental organisations (NGO) are working towards the sustainable management of resources, so as to protect the rights of local and indigenous communities as well as preserve remaining forest

cover. Multiple collaborative management agreements exist between the Government of Belize, local NGOs and communities, particularly with respect to PAs ranging from IUCN category Ia Nature Reserves to category VI, which promote sustainable resource use. Among these organisations is

MGL Strategy
Vision Statement
The Maya Golden Landscape serves as a functional
model of integrated landscape management where
socioeconomic development of local communities
and development of enterprises goes hand in hand
with ecological conservation and cultural integrity.
Goal
To engage in effective integrated landscape
management, which maintains the Maya Golden
Landscape's: ecosystem, soil and hydrological
integrity and viability; preserves cultural heritage;
and fosters self-sufficiency and economic
opportunities for all stakeholders.

(Wicks et al. 2010)

Ya'axché Conservation Trust (henceforth Ya'axché), a Belizean NGO that uses an integrated landscape management (ILM) approach within its area of operation – the Maya Golden Landscape (MGL).

The MGL is currently a 3,116 km<sup>2</sup> area consisting of PAs, private lands, Hispanic and Mayan communities (Ya'axché 2015h). The MGL forms the southern biological corridor of Belize, and is a part of the Mesoamerican biological corridor. The intention behind defining such an area is the potential to work at the landscape level, acknowledging the complexity of SES and the need for adaptive management, and including multiple stakeholders in decision-making processes (Ya'axché 2015h). Within the MGL, Ya'axché manages Golden Stream Corridor Preserve (GSCP) and co-manages Bladen Nature Reserve (BNR) with the Forest Department of Belize. A brief introduction to the NGO and these PAs, as well as the forest ranger team, is provided in the following sections.<sup>1</sup>

# 3.2. Ya'axché Conservation Trust

"Ya'axché Conservation Trust is a Belizean organisation which aims to maintain a healthy environment with empowered communities by fostering sustainable livelihoods, protected area management, biodiversity conservation and environmental education within the Maya Golden Landscape."

#### (Mission statement, Ya'axché 2015a)

Ya'axché<sup>2</sup> was founded in 1998 primarily for the management of GSCP. As the NGO continued to engage with surrounding communities, it soon extended its work beyond the boundaries of GSCP and adopted an ILM approach. Through this approach it engages communities located with the MGL in a variety of activities and capacities. The organisation believes that "community support is necessary for successful management of protected areas" (Ya'axché 2015b). From the promotion of diverse livelihood options to providing education scholarships and conducting leadership and conflict management training for community

<sup>&</sup>lt;sup>1</sup> These sections refer primarily to grey literature and personal communications, since the academic literature published on these PAs, their histories and management arrangements, is extremely limited.

 $<sup>^{2}</sup>$  *Ya'axché* is a sacred tree of the Mayans, believed to connect the heavens, the Earth and the underworld (through its branches and roots) as well as provide wisdom.
leaders, the organisation is intent on working with local communities in managing the MGL. In addition to these activities, Ya'axché also provides direct employment to members of buffer communities, from full-time to part-time seasonal labour in a range of capacities (Wicks *et al.* 2010).



Figure 3 | The Maya Golden Landscape; the circled (in red) communities indicate from where forest rangers are currently hired (courtesy of Ya'axché Conservation Trust)

Ya'axché has two programmes that conduct these activities in collaboration – the Community Outreach and Livelihoods (COL) programme and the Protected Areas Management (PAM) programme. The following section provides an overview of the PAM programme.

## 3.2.1. Protected Areas Management: Golden Stream Corridor Preserve and Bladen

## **Nature Reserve**

"Protected Areas Management is at the heart of Ya'axché's work." (Ya'axché 2015c)

As mentioned, Ya'axché manages GSCP and co-manages BNR, with the Forest Department of Belize. The NGO involves surrounding communities in the management of PAs in a number of ways, including the employment of local forest rangers, environmental education programmes and the inclusion of farmers and young people in their biodiversity monitoring efforts. Their motivation behind such involvement is the serving of community needs along with the fostering of environmental stewardship and the preservation of forest resources (Ya'axché 2015c).

## 3.2.1.1. Golden Stream Corridor Preserve

"Golden Stream [Corridor Preserve] is managed primarily to maintain its function as the last remaining forested link (part of the southern biological corridor) between the Maya Mountains and the Coastal Lowlands, as well as to provide an alternative to large-scale agriculture/aquaculture. Ultimately, this is to maintain populations of game species, freshwater health and quality, and building materials/medicinal plants for buffer communities." (PA Manager pers.comm. 2015)

GSCP covers an area of 60 km<sup>2</sup> and is managed entirely by Ya'axché. It is an IUCN category IV PA and its focus is the conservation and sustainable use of forest resources (Wicks *et al.* 2010, ProtectedPlanet 2015).

Prior to the establishment of the PA, this land was a privately owned area.<sup>3</sup> The owner permitted the nearby Golden Stream Village to use the land for subsistence purposes. Therefore, communities that buffer GSCP have been using the area since the 1970s. These lands were used to gather medicinal and edible plants, firewood, housing material (including timber, thatch and vines), farming, hunting and fishing. These activities were largely conducted on a subsistence basis with a few using resources for commercial purposes. Additionally, during this period the area was heavily logged by a number of private companies. These logging companies provided employment and cash income to villagers

<sup>&</sup>lt;sup>3</sup> These lands were owned by an American, Howard Cox, who did not reside in Belize. In 1992, he sold parts of his land to citrus, banana and shrimp farms, financed by foreign investors (Wicks *et al.* 2010)

from neighbouring communities. This activity in the area led to significant losses of the high forest canopy. Some parts of the PA were also used as grazing lands prior to its establishment (Wicks *et al.* 2010, PA Manager pers.comm. 2015).

One of the primary reasons for setting up this PA (in 1998) was to maintain the Golden Stream watershed, and ensure that the quality of water entering the Port Honduras Marine Reserve (PHMR) was relatively free of sediment and other contaminants (Ya'axché 2015e). This is crucial to maintaining the PHMR's sensitive marine ecosystems, which are of high socioeconomic and ecological importance (Wicks *et al.* 2010). Not only does GSCP form a large portion of the corridor connecting the broadleaf forests of the Maya Mountains to coastal plains of Belize, it forms an important component of the Mesoamerican Biological Corridor, facilitating connectivity and wildlife movement between North and South America. GSCP also lies within the Mesoamerican hotspot for species diversity, which plays a critical role in preserving biodiversity in the western hemisphere (Wicks *et al.* 2010).

Ya'axché also views GSCP as an area protecting stock populations, including those resources that are used heavily locally (PA Manager pers.comm. 2015). These include game, non-timber forest products and lumber. However, the PA also provides habitat for species considered 'pests' by local communities, including species responsible for crop raids as well as the killing of livestock and dogs, resulting in conflict (Wicks *et al.* 2010).

Within this PA, activities such as fishing and the use of fire are not permitted. However, since 2010, GSCP has been divided into various 'sustainable use zones'. Within these zones, individuals from buffer communities may extract housing material, firewood, some species of edible plants and practice 'low impact' agriculture.<sup>4</sup> Such activities are co-regulated by Ya'axché and community leaders (Ya'axché 2015c). These zones are located close to buffer

<sup>&</sup>lt;sup>4</sup> 'Low impact' agriculture is permitted in accordance with the agriculture policy of GSCP. This includes restricted usage of biocides and fire, no alteration of natural drainage patterns, increased erosion, contamination or clogging of waterways and the use of integrated farming techniques.

communities, with a majority of the PA demarcated as a 'core conservation zone'. There is also a sacred cave located inside GSCP where elders of Medina Bank Village used to perform annual rituals, sacrificing crops to their gods. This practice was banned when Ya'axché first purchased the land, but permission to perform the ritual was given in 2006<sup>5</sup> (Wicks *et al.* 2010).

Since GSCP is a private PA, it benefits from the flexibility of developing its policies own rules and (through collaborative efforts between Ya'axché, other NGOs and community leaders), particularly with respect to the usage of the PA and, to a degree, enforcement. However, the history of land use adds to the challenge of managing the PA with the support of buffer communities. As with many other private PAs in Belize, GSCP is yet to be integrated in the National Protected Areas Policy and

#### Patrol and enforcement policy

"If someone is found conducting unauthorised activities within the GSPPL, the action taken will depend on the type of offence and previous offences. A major offence is defined as killing any species at risk of national or international extinction (e.g. hickatee turtle/West-Indian manatee/any cat species/tapir/monkey/etc), cutting down mahogany or cedar, harming any human, setting fire to the area, destroying or removing archaeological sites or artefacts, the use of poison or dynamite for fishing or any other activity that causes major damages to the area (subject to the discretion of the staff on site). For a first, minor offence (defined as all other unauthorised activities) a warning will be given to the person and their details (name, age, address) shall be recorded and a picture taken, they shall then be escorted off the property. For major offences or the second minor incidence, rangers shall arrest the offender and bring them to the nearest police station. Any material gathered from the area, whether plant or animal, or in their possession will be confiscated and handed to the Police Department as evidence. The offender shall then be prosecuted to the full extent of the law." (Wicks et al. 2010)

System Plan (NPAPSP), despite being recognised as a PA by the Belize Forest Department. This is viewed as a failing on the part of the NPAPSP, since its aim is to include biodiversity conservation in Belize's national social and economic development strategies, and the exclusion of a number of private PAs ignores their contributions to this system (Wicks *et al.* 2010).

<sup>&</sup>lt;sup>5</sup> However, villagers of Medina Bank chose to perform these rituals at another sacred site.

### 3.2.1.2. Bladen Nature Reserve

"Officially, Bladen is managed for the protection of nature, be it biological communities or species, and to maintain natural processes in an undisturbed state in order to have an ecologically representative example of the natural environment available for scientific study, monitoring, education and the maintenance of genetic resources. However, we have also recognised its function in providing direct benefits to buffer communities of 1) spillover of frequently hunted game species and freshwater fish/crustacean species 2) maintaining and regulating river levels to provide freshwater in the dry season and regulate floods in wet season." (PA Manager pers.comm. 2015)

BNR (405 km<sup>2</sup>) is one of three nature reserves in Belize, located in the Maya Mountain range. It is a national protected area comprising solely of national lands. The area was designated a Nature Reserve (IUCN category Ia Reserve) in 1990 (Nations 2006). In 2008, the Belize Forest Department granted Ya'axché co-management rights, prior to which BNR was managed by the Bladen Management Consortium, of which Ya'axché was a member (Ya'axché 2011). Ya'axché is responsible for the day-to-day management of BNR, including the hiring of forest rangers for patrolling and law enforcement (Ya'axché 2015d).

BNR is often described as the 'crown jewel' of Belize's PAs, and is one of the most biodiversity-rich areas within the Mesoamerican Biological Corridor (Nations 2006). The PA includes a variety of ecosystems, protecting a diverse range of species across elevations. Within the Maya Mountain range, BNR connects a number of other PAs. It also belongs to the "last remaining large, relatively intact block of forest within the region...stretching from Belize to Guatemala and Mexico" (Ya'axché 2011), providing an extensive stretch of forest to many species. BNR also ensures watershed protection to areas where the river system provides water to local communities for domestic and agricultural uses. Additionally, the protection of this watershed provides a number of benefits including flood control, sediment control, and the preservation of fish and other wildlife stocks. The PA also includes many ancient Maya ruins (PA Manager pers.comm. 2015).

BNR is divided into two zones, a 'natural environment zone' within which educational and research activities are permitted, and a 'preservation zone' which covers most of the PA and does not allow any activity except for purposes of law enforcement, and some minimal impact research for which special permission is required (Ya'axché 2011).

Despite the environmental and social significance of Bladen, threats such as the expansion of adjacent agricultural lands, hunting, and illegal extraction, particularly of xaté (*Chamaedorea ernesti-augustii*), have the potential to severely impact the PA (PA Manager pers.comm. 2015). According to Ya'axché (2011), a law enforcement policy has yet to be developed.

## 3.2.2. The Ya'axché Ranger Team

There are 10 rangers currently working for Ya'axché from the villages of Indian Creek, Golden Stream, Medina Bank and Trio (see Figure 3). These are men between the ages of 20-50 all of whom come from agrarian households. Many of the rangers belong to Mayan families that migrated from neighbouring countries or from other villages in Belize during the last 25-100 years. These movements were often driven by the search for forests and fertile lands for milpa and rice cultivation (the latter being a cash crop). Most of their families depend on the forest for a variety of resources, from housing material to game meat. At a young age, the rangers would accompany older male family members into the forest to assist with clearing of land for agriculture, as well as to help out on the farmlands, many of which were located in patches of secondary forest. They also assisted with hunting and the collection of housing material, firewood, edible and medicinal plants. It was during such trips to the forest that they learned to identify tracks and calls of various mammals and birds, a range of plants, and hunting and harvesting practices. Through the sharing of stories, they were also exposed to resource management practices of their ancestors and the knowledge and beliefs on which these practices were based. Six of Ya'axché's 10 rangers are themselves ex-hunters (Ya'axché 2015c).

Many of the rangers spoke of observed sharp increases in population numbers and changes in land use both by local communities and private enterprises. They often linked these changes to increased pressure on, and reductions in availability of, game species and forest (potential agricultural) land.

Most of the rangers attended primary school in English while learning how to farm, hunt and gather forest products from their families. A few attended high school, but for most of their families, the financial costs of schooling were too high. To supplement family incomes, many of them took up cash-paying jobs from the ages of 16 or 18. These included work as labour on banana and citrus plantations, construction sites, as security guards and in various tourism-related positions.

At Ya'axché, they are employed to patrol GSCP and BNR (both on foot and with boats), monitor biodiversity and water quality, and enforce PA-related laws. In order to accomplish these tasks, the rangers are provided with training in biodiversity monitoring, environmental law, arrest techniques, navigation, and fire management, among others (Ya'axché 2015c). Ya'axché has set up a National Ranger Training Academy, along with the University of Belize, to provide such trainings to rangers in PAs across the country. In 2007, Ya'axché and Fauna and Flora International (FFI) produced a ranger training manual for PA management agencies within the MGL. The trainings provided to the rangers allow them to support visiting researchers in a range of fields resulting in them being considered as para-biologists by the organisation (Ya'axché 2015e).

In 2009, Ya'axché developed a 'Biodiversity Research, Inventory and Monitoring Strategy' to monitor indicator species and measure the 'health' of GSCP and BNR. In line with these

efforts, the rangers monitor these species through regular transects in both the PAs and other areas within the MGL. Vegetation and snail plots within the PAs are monitored as well. Additionally, the rangers have been trained to collect rainfall and climatic data, and use devices including acoustic bat detectors, camera traps, GPS, etc. This data is fed into biodiversity reports produced by Ya'axché every three months (Ya'axché 2015c).

Ya'axché also developed a 'Ranger for a day' scheme, through which tourists can accompany rangers on a designated trail, while rangers share their knowledge of the forest and their experiences as rangers. This scheme is not fee-based; rather 100% of the contributions made by visitors goes to the ranger team.<sup>6</sup> This scheme is not only a means to educate visitors on the role of rangers in PA management and allow rangers to share their knowledge, but supplements their income as well (Ya'axché 2015g).

Within GSCP, rangers follow a patrol and enforcement policy (as stated in the box on page 30). In BNR, where such a policy is yet to be established, rangers are required to report any identified illegal activity to the PA Manager, and the Police Department and Belize Defence Force are notified, while the rangers await further instructions. However, incidents involving the meeting and arresting of individuals carrying out such illegal activities are rare. In case of occurrence, such incidents are reported by rangers to the PA Manager, discussed at the PAM team meetings held every 10 days at the GSCP field station, and included in written reports (PA Manager pers.comm. 2015).

In the following chapter, the methods used to produce and analyse data to explore the research aim and questions are described.

<sup>&</sup>lt;sup>6</sup> Unless exceeding US\$30/person for the riverside walk and US\$45/person for the river patrol, in which case the outstanding amount goes directly to the ranger conducting the patrol.

# 4. Methods

## 4.1. Research design, paradigm and approach

To explore significance of TEK in the field-level management of BNR and GSCP, this study adopted a research design that is both exploratory and descriptive. The research design was developed to encourage high levels of participation from the forest rangers, with my role being facilitative, rather than extractive. Therefore, the research was primarily guided by the rangers' choices regarding participation and knowledge sharing.

To explore my research questions, I used an ethnographically-informed case study approach (Stake 1995, Yin 2009, Creswell 2012). The land rights and management arrangements of BNR and GSCP are unique, making this case study valuable in its own right. However, this case study is also being used to address broader questions about the role of forest rangers and their TEK in PA management. Therefore, it lies on the spectrum between an intrinsic and instrumental case study (Stake 1995).

The use of multiple methods to collect data is typical of the case study approach in order to enhance validity (Creswell 2012). Additionally, when documenting TEK, it is important to develop an equal partnership with participants through reciprocity and humility (Berkes 2012). Therefore, this study uses a combination of qualitative and participatory methods, and recognises the role of the researcher in producing data. In conducting TEK research there is no one set of accepted methods. However, case studies and published guidelines for indigenous knowledge research have been developed by various researchers, communities and institutions (e.g. Smith 1999, Cochran *et al.* 2008). Additionally, TEK studies that employ participatory methods are recognised as assisting in the empowerment of indigenous and local communities (Berkes 2004). This study employed field methods such as participant observation, in-depth interviews, and a data verification workshop (Huntington 2000, Usher

2000).

Since this study views knowledge as a dynamic process, and sees individual learning as taking place "against a backdrop of shared understandings, practices, languages and so forth", it fits well within the social constructivist paradigm (Schwandt 2007). Additionally, it is important to note that this study is not attempting to comprehensively document the knowledge held or used by these forest rangers. All knowledge systems, and the management systems that spring from them, are embedded in worldviews (Berkes 2012). In line with Holmes (1996), I do not believe I am in a position to document and interpret the knowledge of the rangers as they would, considering differences in worldviews. Therefore, I will only use examples of TEK shared by the rangers to illustrate their application of this knowledge and its contributions to their work.

## 4.2. Participants

Studies on TEK and its use in environmental management employ a range of sampling strategies. The selection of 'experts' can be challenging, although some methods of identifying expertise are recognised by other TEK scholars (see Berkes 2012). However, many do not depend on large sample sizes, with some well-known studies relying on narrative styles with a single informant (e.g. Johannes 1981). This research did not use any sampling strategy since 100% of the sample agreed to participate. This was possible due to the boundaries of the case being limited to the cohort of 10 forest rangers employed by Ya'axché.

The participants of the study therefore included nine field rangers, one head ranger,<sup>7</sup> and the Protected Areas Manager of Ya'axché.

<sup>&</sup>lt;sup>7</sup> The study did not distinguish between the head ranger and field rangers.

## 4.3. Field methods

## 4.3.1. Participant observation

Participant observation was used to facilitate a deeper understanding of the rangers' work, and the role of TEK in how they perceive and respond to their position as rangers. I spent 6 weeks between the end of January and early March 2015 (the onset of the dry season) at the GSCP field station, where the rangers are stationed for 10 days each month in groups of three.



Figure 4 | The Ya'axché field station, GSCP (Source: Pinto 2015)

This field station was also the location for PAM team meetings, occurring every 10 days. These meetings were attended by all the rangers. One purpose of the meetings was to strengthen communication across the PAM team, with oral reports of the previous 10 days being presented, and plans for the next 10 days discussed. In addition to these meetings, I was also able to participate in a 'leadership workshop' conducted by Ya'axché in January. The purpose of the workshop was multiple. Firstly, to discuss their role as 'ambassadors of Ya'axché and conservation' (especially in their communities). Secondly, to increase openness among the group through reflexive and team building exercises. This was a great opportunity for me to introduce myself to the rangers through the sharing of my own life experiences and challenges, as well as learn about their lives and how they viewed their role and position in the PAs and conservation agenda. Although I had not known of these meetings or the workshop prior to my arrival in the field, they assisted in strengthening my field methods and in the triangulation of data.



Figure 5 | A team building exercise conducted during the leadership workshop (Source: Ya'axché 2015i)

In addition to living at the field station, during the first 2 weeks of the study I was able to accompany the rangers on three patrols / biodiversity monitoring transects. This assisted in developing an understanding of what the rangers daily activities involves, and also facilitated the building of rapport and trust. 'Learning-by-doing' is the customary way to share

information in Maya communities (Zarger 2002). Accompanying the rangers into the forest provided me with practical insights on how TEK, and the training provided by Ya'axché, contribute to their work. Many of our conversations centred on their culture, stories from their villages and childhoods, and the work they do. They often asked me to share my stories of growing up in a city and other anecdotes about different Indian cultures, particularly related to rural lifestyles, belief systems and related practices. Although it could be argued that such conversations might interfere with what the rangers chose to share with me, it also assisted in building rapport with them, which I believe led to the development of trust and increased openness.



Figure 6 | Rosewood tree monitoring, GSCP (Source: Pinto 2015)

I cannot accurately comment on how the rangers perceived me or my presence at the field station. However, it is a common practice for other researchers and volunteers at Ya'axché to reside at the field station. This could have influenced their interactions with me. It is likely that my gender and age played a role in the knowledge and views they shared with me. Nonetheless, I do believe my interest and the degree of my naiveté with respect to their perspectives and cultural values assisted in my ability to suspend judgements, which strengthened our relationships and my research (Bernard 2006).



Figure 7 | Hammock used on an overnight transect (Source: Pinto 2015)

I maintained a daily journal to record my observations during my entire field season, following Emerson *et al.* (2011). These journal entries or fieldnotes assisted in the development of my interview guide during the first two weeks, and constantly informed my methods during the remainder of my field study period.

## 4.3.2. In-depth interviews

The individual in-depth interviews conducted with the 10 rangers were aimed at exploring TEK related to forests, regardless of if it was employed in their ranger activities, and their perceptions of how it contributes to field-level PA management. The interviews were also

used to understand their perspectives on the role of rangers in PA management. Additionally, the interviews explored the recruitment process from the perspective of the rangers. Prior to the interview, consent forms (for the interview as well as the workshop (Appendix A)) were read out. Oral consent was obtained prior to initiating of the interview. Two copies of the consent form were given to each ranger, to read over and sign at their convenience. The option to participate and later withdraw from the study was emphasised before the interview and throughout my field study period. It was ethically important that the rangers were comfortable to choose whether or not to participate in the data production process. It was also methodologically important for the quality and validity of the study.

The interview guide (Appendix B) re-introduced my research topic and objectives. Maps of the PAs and their surrounding landscape were provided to assist in stimulating memories (Huntington 1998, Tobias 2000). Blank sheets were available to allow for other forms of expression. The interview introduced five key topics, all of which began with an open-ended question that encouraged descriptions (i.e. 'Could you tell me about...') in relation to a given topic. All 10 interviews were conducted in English, audio recorded, and accompanied by notes and postscripts. The interviews lasted approximately 90-150 minutes, and concluded with a debriefing thanking the participants for sharing their time, knowledge and perspective.

Routine member checks (Creswell and Miller 2000) were conducted at the end of interviews, as well as during the data verification and knowledge sharing workshop conducted at the end of February. As my fieldwork had to be organised around the schedules of the rangers, nine of the 10 individual interviews were conducted prior to this workshop at the field station, with the last interview scheduled for the day after the workshop at the home of the ranger. All other interviews were held at the field station – one of the places of work of the rangers – in order to increase data richness (Stevenson 1996).

In addition to the in-depth interviews, I engaged in informal conversations and one interview (Appendix C) with the Protected Areas Manager of Ya'axché, to understand the recruitment process and types of training provided to the rangers.

## 4.3.3. Data verification and knowledge sharing workshop

The workshop was organised on a day when seven of the 10 rangers were at the field station and were able to participate. Of the other three rangers unable to attend, one was attending a training programme, while the other two had the day off. However, an invitation to participate in the workshop was extended to all 10 rangers.

The purpose of the workshop was threefold: (a) verification of data gathered during the interviews with the rangers; (b) further identification of TEK held and used by the rangers; and (c) discussion on how the data produced during this study could be shared, within the thesis and more widely (see workshop guide, Appendix D). In order to encourage participation, the rangers and I sat in a circle, with my role being that of a participant as well as a facilitator. After re-introducing my research, the purpose of the workshop was explained. Upon receiving permission from all present, the workshop was audio recorded. This was followed by a brief session dedicated to the collective development of rules to guide the workshop. Rules surrounding participation were voiced and put up on a whiteboard once agreed upon by the entire group. These rules encouraged mutual respect for all those present and assisted in creating a more comfortable space for participants to share their thoughts.

Six themes that emerged from the interview transcripts and fieldnotes were then presented to the group. With the introduction of each theme, I refrained from listing all examples of related knowledge, beliefs or practices that had been mentioned during the interviews, and instead presented only one or two examples to initiate discussion. The rangers were then encouraged to add to these examples, as well as further describe other related TEK that they find useful in their work. At this stage of the workshop, participation levels were high, with one of the agreed upon rules being that every ranger has the right to comment on every theme presented. Trust among the rangers and I also played a role during the workshop. Rangers less comfortable communicating their perspectives on themes presented often spoke in Que'qchi,<sup>8</sup> relying on the other rangers to translate their views. I believe this was indicative of the urgency with which they wished to share their knowledge. Participation in the workshop was therefore dependent on the internal dynamics of the ranger team. At the end of these discussions, I revisited my preliminary findings from the interviews and presented data that had yet to be discussed and verified. These themes were presented on a whiteboard, in the form of conceptual maps (see section 5.3.1). Such an approach was chosen so as to ensure the workshop was dynamic and the rangers were able to guide the flow of the workshop and add to the data already produced. Additionally, it allowed for them to provide perspective on how their TEK informs, or does not inform, the work they do.

After these discussions, an open-discussion on how this group of individuals as members of the buffer communities identifies with, and understands, their position as rangers. This discussion was centred on *'aren't you one of us?'*, a question once posed by an individual from one of the communities to a ranger. This discussion had not been scheduled within the workshop, but sprung up organically. Despite it not being in line with my research questions, the discussion continued since the rangers felt the need for it in the shared space we had created.

<sup>&</sup>lt;sup>8</sup> A language commonly spoken by all the rangers, and the first language of 8 of the 10 rangers



Figure 8 | Participants of the data verification workshop, GSCP (Source: Pinto 2015)

At the end of the workshop, the group discussed potential ways in which they would want to be recognised as contributors to the study (Appendix E). This was a notable shift from wanting to remain anonymous to wanting to be recognised as TEK holders and users. This was indicative of their trust in me and the data we had produced together. We also discussed how the data produced during the study should be presented and shared. These discussions have directed the presentation of the findings within this document, a copy of which will be sent to the rangers after thesis submission. The rangers also requested a brief version of my thesis be produced for their reading. These documents will be sent to Ya'axché and the ranger team in June. The workshop lasted a total of three hours, with 10 minute breaks every hour.

### 4.4. Data verification

In addition to the data verification workshop, data corresponding to research questions was verified through triangulation (see Figure 9) (Creswell 2012).



Figure 9 | Data verification through triangulation: 1) What motivates the protected area management agency to hire rangers from surrounding communities? 2) How does traditional ecological knowledge held by rangers contribute to field-level management of protected areas? Can this knowledge be considered a benefit of hiring local rangers for protected area management?

#### 4.5. Analytical methods

### 4.5.1. Discourse analysis and coding

Beyond the preliminary analysis conducted prior to the data verification workshop, sociological discourse analysis was used to understand and interpret the data produced during the entire study period.

'Discourse' can be defined as "any practice by which individuals imbue reality with meaning" (Ruiz 2009). In order to understand the actions of participants, it is important to explore the meaning they attach to their actions; discourse analysis provides the means to do so. For practical and theoretical reasons, I have focused on the verbal discourse produced during the field study period to arrive at the results presented in chapter 5. These include transcripts from all interviews and the workshop, as well as journal entries and fieldnotes.

Firstly, I undertook a complete reading of transcriptions and fieldnotes, and made notes in order to develop an understanding of the meaning behind the entire discourse. This was followed by a thematic content analysis, by which these texts were organised based on themes, and then coded and categorised using a computer-based qualitative data analysis software: Atlas.ti 6.2. Coding was conducted in two stages, descriptive followed by analytical coding. An intertextual analysis (Ruiz 2009), was simultaneously conducted to identify associative or conflicting relationships between texts. I also kept in mind the situations in which these data were produced (individual/collective, my relationship with the participants, the location, season, etc.) and their potential influence on the data. The research aim and questions of the study, along with the literature review, framed the analysis, resulting in the identification of themes as presented in chapter 5.

## 4.6. Limitations

The participatory methods employed, and the high levels of participation, added value and validity to this study. However, a superior approach would have involved participants in the data analysis phase as well. Had I spent more time in the field, the feasibility (in terms of time considering the schedule of the rangers) of a data analysis workshop could have been assessed. Additionally, it would have been more inclusive and useful for a draft of the thesis to be sent to the rangers for feedback and corrections prior to finalisation. That said, I feel confident that the triangulation techniques used in this study allow for accurate representation of the perspectives of the rangers as well as the role of TEK in their work. As English is not the first language of the rangers, these techniques, particularly the data verification workshop, also assisted in minimising language-related issues.

As stated previously, the study does not document TEK in a systematic or comprehensive manner. This could be viewed as a shortcoming. Yet, the aim of the study was not to document TEK, but rather to understand how it contributes to field-level PA management. A related limitation of the study could be that it does not explore the gendered nature of TEK. Rocheleau (1991) writes, "half or more of indigenous ecological science has been obscured

by the prevailing 'invisibility' of women, their work, their interests and especially their knowledge." As all the rangers currently employed by Ya'axché are men, exploring the TEK held and used by women in similar PA management roles was not possible. The number of women forest rangers in Belize is limited. Although I could have attempted to contact these women, it would not have been in line with my research questions, which seek to explore TEK held and used on an individual and collective level and how this knowledge benefits the management of PAs. It was therefore of greater importance to understand the role of TEK of a single ranger team in PA management.

Lastly, in exploring the potential contributions of TEK to field-level PA management, the study ignores many other related benefits of hiring local forest rangers. However, to do so would have required additional resources in terms of capacity and time. The field methods used did allow for discussions on related aspects, but to a restricted degree. In limiting itself to investigating the role of TEK in field-level PA management, the study clearly defined its scope and was able to explore this topic in-depth.

The next chapter presents the results of the study and discussions linking these results to the research aim.

# 5. Results and discussion

## **5.1. Introduction**

"The story that I tell you is from my ancestors, you know, because they told me about it, they told me the secrets, and now I have told it to you, to another country...these stories will remain [with you in] your life, you know, because to me I keep it a secret in my life. But in the same way you have to share it with your friends, you know, sometimes it is important for them...I also appreciate you for asking me, bringing me new ideas in my mind, which I could recognise sometimes in my life, but now I recognise clearly." (FR09)

The dialogue that the rangers and I entered into during my six weeks at Ya'axché was rooted in trust, particularly with respect to my role in sharing and representing their views and knowledge. I begin this chapter with the responsibilities of such a role, and the aims of this research, in mind. As far as possible, extended quotes will be used to present results in order to provide the reader with a sense of the discourse. In this chapter, the research questions will guide the presentation of results and discussion. It will therefore begin with a discussion of case-specific driving factors that influence the hiring of forest rangers, and related consequences. It will then proceed to present findings on how TEK plays a role in the everyday work of this ranger team. The results of this section (5.3.1) were developed in collaboration with the rangers during the data verification workshop. This section will also consider knowledge sharing within the ranger team, and will close with a discussion on whether TEK can be considered a benefit of hiring local rangers for PA management.

## 5.2. Motivation for hiring local rangers

### 5.2.1. Recruitment process: a brief overview

The recruitment process employed by Ya'axché is strategically aimed at hiring individuals from buffer communities (men or women) who are familiar with the surrounding landscape, particularly its forests. The process seeks to assess the applicant's "knowledge of the forest, whether they can read and write in English, and whether they are inclined to learn new things

and seem receptive to Ya'axché work and ideas...whether they can commit to the work" (PA Manager pers.comm. 2015). Positions are advertised in buffer communities through word of mouth and by putting up adverts/fliers in public spaces such as community centres and bus stops. Applicants are expected to fill out a form indicating their interest in working as a ranger; these forms are to be completed in English. Ya'axché then invites applicants for interviews at the GSCP field station or head office in the nearby town of Punta Gorda. Stated reasons for seeking applicants from buffer communities include benefit sharing through direct employment and the creation of a 'point of contact' between Ya'axché and the communities. The NGO prefers applicants with a history of hunting or similar extractive activities.

In addition to full-time positions, community members are informed of temporary ranger positions by word of mouth. Individuals in such positions mostly fill in for full-time rangers on days they are unavailable, and get paid a daily wage. A few of the present rangers were initially hired to fill temporary positions, and were later given full-time jobs when there was a vacancy.

Many of the rangers applied for this job to supplement farming incomes, generating additional revenue to support their families' health, education and subsistence needs. Other employment opportunities that provide steady income, and are based close to the communities, are uncommon. Therefore, those hired by Ya'axché are considered to be 'lucky' within the communities.

"[My friends] told me that there is a vacancy, that they need four rangers. So I said to myself, if I try to apply or not, but one of my friends came and told me, he said, 'apply, just apply, you doesn't know what's your luck'. So I said okay, I just...write a letter and I forward my letter to them. I never know because there's many persons that apply on that day. And those guys are more qualified than me. They were high schools...like I said I never did finish my primary. So I never put in my mind that I will be, I will be given a job like this, but I just fill in my letter. And the next two weeks' time, they sent me another letter that say that they need

to interview me...but I never, I never never believe on myself [that I] will be hired because many guys are higher educated than me." (FR07)

As mentioned in the previous chapter, many of the rangers have not completed primary school, with only a few spending some time at high school. Rather than requiring extensive formal education, Ya'axché looks for forest-related experiential knowledge held by applicants.

"They are posting some vacancies in the villages and that's how I get to know, you know, they're in need of rangers, and I say I want to try how to be a ranger and know more what is going on you know...and so I applied for that. They asked me more about the forest, if I'm good in the forest or you know, like interview me, so I told them yeah, I know how to walk in the forest, move in the forest here, I know most of the forest here. Yeah, so that's the reason why they choose me." (FR04)

How the NGO assesses this knowledge is unclear. However, such a recruitment process allows for the majority of community members to apply to the position, with the only requirement being the ability to communicate in (pidgin) English. This process also avoids elite capture, more commonly found in other management arrangements. Additionally, it is a combination of factors that lead to employment, including an applicant's desire to learn.

Although Ya'axché considers the TEK of applicants to be important (PA Manager pers.comm. 2015), prior to this study, no attempts had been made to understand how the TEK of rangers contributes to their work. Instead, more emphasis had been given to technical training programmes. Based on the findings of this study, the following sections explore other potential motivations behind hiring local rangers, such as the instilling of conservation values in local resource users, PA-community conflict management, and intra-organisational learning.

#### **5.2.2. Instilling of conservation values**

The rangers hired by Ya'axché are exposed to an array of conservation strategies and ways of thinking. Ya'axché considers its rangers to be 'ambassadors' of the organisation in the buffer

communities. As 'ambassadors', the rangers' perspectives of PAs have changed over time. They commented on the significance of these areas, particularly in supporting the future needs of their communities. Some even mentioned the preservation of stock populations to ensure availability of forest resources for future generations, mentioning the importance of 'sustainable use'.

"Well, I thought it was like, just like patrolling patrolling and then, and I don't know why are we going to patrol or why do we go on patrol, I didn't realise that from the very beginning. But after that I see that it's true. Because if you go somewhere else into a community land, you will not find a game um um game bird or a game something else, peccary<sup>9</sup> or paca<sup>10</sup>, you will not find it there. The reason why, it's because all of the area it's been hunted. You can't find anything out there, so. Otherwise you have to go into this area now, you will find them close by. But why they don't, I think people they don't um, think I would say because um Ya'axché is doing something good for them, but some people they don't think of that." (FR01)

"Before, I never want to work in the organisation because I doesn't want to hear them because sometimes they reach there and said this is what we are doing...because, I just don't waste my time and listen to them. I never want to hear any meeting from this organisation because I thought to myself that they are taking away our land, that's what I understand. But whenever I start to work, like in the ranger meeting, like in any meeting that they held, I get to understand that this organisation is trying their best to protect something, and which is the forest, which is the...watershed, that's what I understand. So when I get to understand they are doing good, I said that from before I never did want, I never did like their ideas, but I get to know now and I like the ideas what they're doing." (FR07)

"When I got this position as a ranger you know I was zero at conservation, but as the days went by and as the years went by, I realised I learned. You know I did a lot of reading about the organisation. I love the work they're doing, it's something I'm really interested in and I wish, my family as well in the future I'm going to educate them, my kids that's something that they could do as well in the future, at some point. Something that will benefit them...I used to you know hunt, be a hunter, done a lotta hunting in the past and outside as well [as in] the community, and I saw that, you know...like I mentioned to you that one time my dad, we went out and we shot seven pacas and it was really crazy, for me it was really crazy to see that so you know that's when I, we decided that it was too much. So most of the time he go out to hunt, if he will shoot one that's good enough or two, and if you don't get any that was good enough as well. So you gotta, you know you gotta be thankful for what the good Lord has given you and as well the forest provide for you every time you go out, I mean that's the

<sup>&</sup>lt;sup>9</sup> Tayassuidae family <sup>10</sup> *Cuniculus paca* 

way I take it. And that make me change, like I said from being a hunter to like a ranger now. And I see the benefit of it." (FR02)

Such an instilling of conservation values is intentional, with regular meetings and workshops emphasising the need for PAs, and the role of the rangers in ensuring their protection. Moreover, the inclusion of tasks such as biodiversity monitoring influences how the rangers view their work. Although their primary task remains that of law enforcement, many of the rangers thought of themselves as local-level conservationists actively contributing to PA management, with several of them citing other tasks, such as biodiversity monitoring, as adding perspective to their work.

"The knowledge, experience I've learned is so overwhelming, to work with different people, to work with my people. I was a ranger just patrolling for almost I think five years, just doing patrols. At that time when we start ranger work it was just running in the forest, patrolling. There was no data collection, there was nothing until maybe 2004 or 2005 when we had other volunteers coming to assist in our work and we started to develop biodiversity monitoring, right. How we could collect different information in the field, so you can able to know what is out there, and all these things started. And everything takes training, so we start to train our rangers, so that we can able to collect information on what we need to do. And also when researchers do come we work with them, so we get knowledge of what they do, the reason why they do it, and then sometimes when they go back we continue doing it, and enter it into our database so we can able to look at the work we started up to know like five or ten years, so we can able to see after the biodiversity monitoring that we do, I think every year or every two years we do a synthesis report. And then when you look at that, I mean, you feel very proud of the work that you do, of collecting the information so you can able to project and see how much wildlife you've seen, where it was a particular wildlife or bird. And then you look at the following year or two years and see whether it is up and down, and these give us some indications of what is happening within the protected area. And comparing to other um areas in the community. You know it's very very interesting." (FR03)

"It's the first job, you know, I felt for it. The work they do, it interests me...and as a Maya person, we know the jungle as well, we know how to move or how to navigate our way in the forest...so it's really easy for me, and you know, they provide trainings as well and that is how it gets more interesting than just being a ranger – it's more than that, it includes a little bit of science as well." (FR06)

This shift in perspective from hunters to local-level conservationists might be considered desirable by some, and a motivation for hiring local staff. However, it is important to

recognise the challenges and risks involved for such local-level conservationists who are situated within wider social networks (Vasan 2002). It is also important to not underestimate the degree to which these rangers are involved in co-producing conservation practices (Poppe 2012). TEK held by rangers, and the worldview in which it is embedded, shape their views of concepts such as 'sustainability' as well as their positions as local-level conservationists.

## 5.2.3. PA-community conflict

As mentioned in the previous section, local rangers act as 'ambassadors' for Ya'axché, increasing communication between the organisation and communities. Herein lies an inherent struggle between two of the roles that shape the identities of these individuals – their professional role as rangers, and their position and roles within their communities (Vasan 2002). According to Vasan (2002), this is "reflected in their contrasting discourses in different social situations". Therefore, rangers' decisions are informed by a variety of factors including their position in social networks. Poppe (2012) argues that this ambiguity of identity is necessary for the success of conservation. However, it can also produce challenges that the practice of local hiring intended to reduce. For example, it is assumed that direct employment will garner local support and thereby reduce conflict between PA management agencies and surrounding communities. In reality, Ya'axché rangers often face daily challenges in defending the work they do.

"The challenge is that, okay this land is now protected, it's created a conflict with the buffer communities because their still used to using the land, and what I want to mention here is that the Mayan communities, we rely on the forest for their survival, we hunt, we use the resources for our house, and everything is in the forest, on the land, so it is a conflict when you, when um you block an area from them because they are not able to come and hunt and um extract and all this thing causes a big, a big problem. Because conservation and protecting an area is not what the communities that live that want to do all...and we must understand why they don't want to protect because its its its their survival, they need to cut down forests to plant their food, right, without doing that they we can't survive. So they have to cut down the forest. But our message at that time was yes, we're not stopping them from cutting down the forest, but the message is that there we need, it's a private area. It was bought and it will

be protected for the benefit of the community in terms of the resources that we have. Because if you cut down the forest, where are you going to get your sticks? Where are you going to get your firewood? Or leaves for your thatch houses? So we need to protect certain areas where we can always have resources and where we can get and use them sustainably, and that is very hard to change um a lot of the peoples' way of thinking because some of them just ignore and don't want to do it although they know that continue destroying, population is growing, clearing land is destroying our resources. But some just don't want to...they know about the benefit, but just don't want to understand because they just think of living now and not thinking of their children or grandchildren that need what they have right now that is the challenging part of it, right, so. But eventually um we gone through a lot of challenges, um going to communities and explaining to them, we're not welcomed easily, and um it's a big conflict with people, and it's still up to right now." (FR03)

Additionally, rangers are expected to represent the views of the NGO in their communities and conduct tasks such as biodiversity monitoring, while simultaneously being seen as law enforcers by other community members. As pointed out by some of the rangers, balancing these varied tasks and roles has resulted in their authority being challenged, especially when their work involves entering community lands to monitor biodiversity.

"Sometimes in the meeting, we try to tell, but some people they don't want to understand...because sometimes they tell us that, 'you are not the guys who need to explain things in the meeting. You're just a ranger and you just go in the jungle, out in the bush, they [upper management] are the correct guys who can explain it'. They need a big boss to explain things in the community meetings. You know how people are, they just...I don't know why." (FR05)

"I think what mostly the challenge that we have around here as a ranger is with the community. Well, they, um well they they they um take us as the ranger as for nothing because...you know, we have been um told in public community meetings that protected area, Golden Stream and Indian Creek are not allowed in there...and everybody knows this. But some of the people, some of those men, they wanted to see if it is true that we can arrest them, detain them, but after all when they reach to that point that they, um have been arrest or um charged, then they feel bad. But again what I say is that we are doing our job, and that we are not just, um we are not going out into the community to look for um these people, they come and look for it into the protected area. So it's a challenge for us that um, that they really keep us um they keep track on us wherever we move, and whenever we are patrolling they don't go. So, yeah, that's what I've been experiencing, and that they don't like us, the ranger, patrolling out in there. And that they don't really like us when we go into the community land. But we go out there, we don't go out there to take out their land, we just go out there to do um biodiversity monitoring. We have two of our transects there...so that's the only thing that we go to do every month...it is their land, it is

community land, but where we enforce the law is around here with this protected area. That's where we try to keep the law, and by doing so they don't like us." (FR08)

A potential means of reducing the conflict between Ya'axché and buffer communities would be to engage more households in Ya'axché activities. As with the Ya'axché rangers, other members of buffer communities are more likely to support the aims and work of the NGO if able to access more tangible and immediate benefits (Dahlberg and Burlando 2009). As pointed out during an interview:

"A few could understand...especially those that um who get help from this organisation. We ask them um please to help and cooperate with us that together we can help protect our watershed, our forest, our wildlife. Yeah, yeah. And they agree on that." (FR08)

However, building mutual respect, creating spaces for shared learning, and the development of a cross-cultural conservation ethic is potentially of greater importance in strengthening the long-term relationship between Ya'axché and communities (Berkes 2004). One potential starting point could be intra-organisational learning, as a form of social learning (Berkes 2009a).

### 5.2.4. Intra-organisational learning

Social learning is increasingly viewed as an important facet of decision-making in environmental management (Berkes 2009a). Here, I refer to social learning as a process of repeated reflection through the sharing of experiences and ideas (Keen *et al.* 2005). A prerequisite for such learning, and for any collective action, is social capital (Berkes 2009a). It appears that this social capital is already present in Ya'axché, including its ranger team. Despite existing efforts at intra-organisational learning (between the rangers and upper-level management at Ya'axché) through various workshops that encourage reflection, the rangers view learning as a unidirectional process occurring through the trainings provided by the organisation. As pointed out by Berkes (2009a) "social learning occurs most efficiently through joint problem solving and reflection". It is therefore possible that changes in current power sharing arrangements through the involvement of rangers in collective problemsolving and decision-making processes might change ranger perceptions of the role of their TEK in field-level PA management. Simultaneously, it would assist in empowering the rangers, allowing for 'local hiring' to contribute to the organisation's mission of assisting in empowering communities (Ya'axche 2015a).

Yet, Ya'axché does recognise that TEK held by rangers enhances their capacity to perform their duties, as is evident in their recruitment process.

"The rangers come with a lot of knowledge from their past and ranger experience. It is important that they know we value this knowledge and that they value it as well. It is important for us to develop feelings of mutual respect." (PA Manager)

Although TEK held by the rangers is valued by the organisation more generally, the organisation was less awareness of the significance of this knowledge in enabling the rangers to carry out their duties. When asked what they would teach a new recruit from outside the buffer communities, the rangers responses listed knowledge and skills they believed integral to their work, most of which were based on TEK and other experiential knowledge. These included how to survive in the forest, how to navigate using 'natural' elements, to identify signs of illegal activities and to always carry a machete.

"I would teach them how to survive here in Belize in the jungle, how to navigate in the jungle as well...as well, you know, if they want to be a ranger, teach them about, you know, tracks of hunters. If you see trails of people, just broken [tree] limbs marking their trail, you know that's definitely someone hunting in the area. You know that person don't want you to know his track or follow his track cause he, he want to make er you know he's smart, he thinks he's smart, but you know to be smarter than him to know he's hunting in the area." (FR02)

"If you got lost and then you want to cut something, with what are you going to cut with? You need a machete...let's say if I am lost um, I don't know the forest, and if I don't have anything with me, then you can use a machete for like um for um cutting er maybe a cohune<sup>11</sup>, um I don't know if you have taste a cohune cabbage? Yeah, yeah...A lot lot lot lot

<sup>&</sup>lt;sup>11</sup> Attalea cohune

we can use machete with. If you don't have anything whereby to camp, you can cut anything that you want and then set it up. Always. Always. That's the first thing – machete." (FR01)

Therefore, intra-organisational learning through the sharing of knowledge, experiences and ideas may provide Ya'axché and its rangers with a more holistic understanding of conservation strategies as well as the SES in which they are put into practice. In this way, the hiring of local rangers can add to the effectiveness of conservation practice in the MGL.

## 5.3. The role of TEK in the field-level management of the PAs

Ya'axché rangers depend on their TEK to perform their duties on a daily basis. This section does not aim to comprehensively present this TEK, but rather the ways in which it contributes to field-level PA management. This focus is important not only because it is of interest to this research, but also because many of the rangers do not view themselves as experts of this knowledge, recognising that it is commonly-held by many in their communities. Moreover, not being aware of the value the organisation places on their TEK furthers their undervaluing of this knowledge.

"The way I see, we are almost in the same level, whatever I know the other rangers know as well. Most people in the community know these things, because, like I said, most of us we were taught by our parents about forests products, and that's where we learned." (FR08)

"I learned a lot from him [my father] and as well from people in the communities, things that you could eat in the forest that are really good, for food. So you know here in Belize I've learned a lot, how to utilise the forest as well. I know ways and means how to survive. So I don't think I will die, the forest will provide. That's what they, most of the hunters teach you when you go out to do hunting in the forest. It's like, it will always provide for you. Yeah, it's just a matter of survival." (FR02)

"Most of the stuff that you would need when you're lost in forest and you need to survival there, that's the stuff that he [my father] taught us at the time when we were out there...teaching us um about the forest and like how to find water and stuff out there, which plant to avoid and which plant you can use for like like like um survival if you need to. Yeah, it's just like an introduction to forests that we had from him. Yeah, it's not just on one trip, it's all like um lesson for us every time we're out with him, he shows us stuff." (FR10)

Therefore, the following section will focus on the role TEK in field-level PA management as a benefit of local hiring. A brief section on how knowledge is shared within the ranger team is also presented.

## 5.3.1. TEK in field-level PA management: to work and to survive

The rangers spoke of their TEK as serving a dual purpose. In addition to recognising its usefulness in their work, they depended on it to survive when out in the field. To them, this was important, and allowed them to perform their duties with more confidence.

"Just to survive as well, survival is the main thing. In case you get lost, what to eat, and what not to eat as well...because you can find poisonous things in the forest. But you know once you know it is good, you know survival is the main important thing, so in case you get lost, you need to survive and find a way how to you know, get out of the jungle if you get lost." (FR02)

As described by Usher (2000), TEK includes (1) experiential knowledge of the environment,

(2) knowledge of past and current use of the environment, (3) culturally-based values regarding interactions between humans and the environment, and (4) a culturally-based cosmology or worldview, underlying the other three categories. With these categories in mind, this section presents the TEK of the Ya'axché ranger team, highlighting its role in their work. The following six themes describe different ways in which the rangers' TEK supports field-level PA management by (1) assisting in their survival (2) providing reassurance and enhancing confidence and (3) enabling them to fulfil their ranger duties, i.e., identification of illegal activities and biodiversity monitoring.

These themes and all visuals presented (Figures 10, 11, 12, 13, 14 and 15) were developed in collaboration with the Ya'axché ranger team.

## 5.3.1.1. Respect for the forest



Figure 10 | Respect for the forest

The rangers' understandings of the forest, including their reasons for respecting it, stem from their experiences of the forest and stories passed down by elders in the community. These reasons differ from their motives to protect forests based on conservation values learned while employed as rangers (see section 5.2.2). These experiences and stories greatly influence their perceptions of the forest as well as their behaviour, even while on duty.<sup>12,13</sup>

"Well, one of the things that really helps that I learned when I was young was not to be scared when going out to the jungle. You always need to be a strong person. [Be]cause in the

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<sup>&</sup>lt;sup>12</sup> These stories and experiences will not be shared in this document, as requested by the rangers.

<sup>&</sup>lt;sup>13</sup> The dichotomous nature of the figure is only for ease of communication.

past you know we hear rumours of things in the forest, you know ghosts and whatever, so you need to be strong and you need to be confident you know when you go out into the jungle. I've learned that, and that's one of the reason why if I am sent in any deep patrol or anything, I will not back down, I always make sure that I'll be there, yeah. That's one thing that I learned, you always need to be strong and stay positive, you know don't be scared. Yeah, yeah...the forest is something that I always respect. Yeah, it's something that I always admire and respect, give it that respect. It's not something that you could take advantage of or make joke out of it, no you gotta have that. That's what my dad told me and teach me when I was young, that you respect everything that you see around. Forests, whatever you see, you need to respect it." (FR02)

The threat of being attacked by wildlife or cursed by spirits of the forest influences the behaviour of the rangers prior to entering, and whilst in, the forest. As articulated by one ranger, "the forest is alive" and disrespecting the gods and guardians of the forest can result in negative consequences, including death. It is therefore important to protect oneself from these threats by appeasing the spirits of the forest and ensuring one is "positive, brave and confident", as signs of weakness could result in being tested or attacked by spirits or wildlife.

"They [hunters] have, their tradition is they have to pray, they have to get permission, they ask permission when they go in, so they don't get scared. It's like they believe it as um, you have, they compare it to um, I mean if you have a farm animal, you are taking care of them and you wouldn't want anybody to just come and kill them, you know, otherwise you'll find way of scaring them, you know. So that is how they believe. But when you go in there, and if you have a farm animal, and you want something, you ask that person. And when you will ask that person then they will give you the permission to choose what you want to take, and that's you want to buy. And that is how they believe. But if you just go in there, something might happen to you in the forest because you are just taking things away without permission, you're stealing from the forest, yeah. But by praying, and by burning, they believe in burning um incense, is feeding and making the forest god happy with you so they can give you wildlife, game meat in return. It's like yeah, we're happy with this person because he has like respect, and he ask for everything what he need, and yeah no harm will come to him. That's how we believe, yeah." (FR03)

"He told me, whenever you want to go and hunt...you need to pray, you need to ask, because this is what the old people did from before...it is a culture for them. You need to pray and ask those mountains, those mountains have names, that you can ask them because they're the owner for those animals, so that you can get whatever you want, you cannot get hurt...or anything cannot scare you because you already asked the owner for those animals." (FR07) The act of asking permission from the forest gods and guardians applies not only to hunting, but to the harvesting or use of any forest resource. Moreover, if resources are misused or damaged, there are similar consequences, including potential attacks by jaguars or snakes, injuries and death.

"When you go to the forest, the forest gods already know why you are there. If you don't ask for permission, or try to take more than you asked for, you will have bad luck." (FR09)

"Maybe the forest just don't like you when you go hunt, or just killing the animals in the area...my dad tell me to sometimes like you killing lot of animals in the same area, so then that's why they just show you a sign that make you no go back that side. Sometimes my parents told me about that. Just to hunt few and that's it. Some people do hunt, do business or just sell it, maybe that's why. And some people, they just like they they shoot the um the gibnut<sup>14</sup> dead, or sometimes they not dead, sometimes they just walk and go died somewhere, maybe that's why. That's what my parents used to tell me. Because that's what my parents used to tell me, the animal they got owner, somebody own them, that's what they told me, yeah." (FR05)

The rangers mentioned experiences wherein they witnessed signs that furthered their belief in

the presence of spirits in the forest. They viewed these sites as being sacred and believed that

the gods and guardians of the area, along with the sites themselves, must not be disturbed.

"Um a lot of, a lot of hunters, people that go into the forest, some people um talk stories when they would go into the forest they would get frightened by, you know by noise, or some people would hear rooster, or some people would say they would hear drumming and they believe it is the spirit of ancestors that used to live in the forest in the caves or so because there is still um evidence of like Mayas who used to live there long long time ago. There is still patches in the hills, in in the caves, there are still, um um sometimes you find figurines in the cave so. And people believe, when that happened they believe there is still spirits of the Mayans in the cave and they believe that is what the sound they hear. Sometimes um, nobody knows why, when you camp there you put your hammock or your camps or whatever, and then maybe during the night you would hear strong wing, whirling over trees breaking down as if they is going to fall on you. And um during the morning you see nothing happened. We don't know why that happened, and some people would move in the area to somewhere else because they um it's too much disturbance. And people again they believe that there is some spirit of some chiefs or some rulers somewhere around close by, and they believe again that spirit is guarding that area and doesn't want anybody to be around there. So, some people when they move out, nothing happen. It's only within a specific area all these thing will

<sup>&</sup>lt;sup>14</sup> Paca (*Cuniculus paca*)

come. And it happens, it happens. You will hear like the clear day like this, you camp there it gets dark and its 7-8 o'clock or 9 o'clock and any time in the night you will hear a strong breeze around you breaking branches and this and that, and um you get scared. As if trees are broking, and in the morning, nothing. Yeah, so all these things happen in the forest, especially in the Bladen Nature Reserve, where, um this happens in areas where not much people would go into. It's um very isolated areas where no people visit, nature is still there." (FR03)

Excluding these sites, the rangers asserted that the forest and its resources exist to be used. This outlook that "we respect the land because we use it" is commonly held by indigenous groups around the world (Berkes 2004). When discussing why they think it is important to 'sustainably' use resources, the rangers often spoke of these beliefs along with their understandings of conservation as learned during workshops and training programmes at Ya'axché. They also believed that 'extinction' of species and the need to maintain stock populations for future use were reasons not to overhunt. These different belief systems are in many ways complementary (Berkes 2009b) and support the sustainable use and management of forests in the MGL.

These beliefs inform a range of practices that ensure an individual's safety when in the forest. For examples, a commonly-held belief is that one must not engage in any sexual activity before entering a forest, as any such act would weaken you, making you unable to overcome potential dangers you may face. The rangers also believe that the consumption, application or possession of garlic protects them by keeping spirits, snakes and insects away, as well as providing other benefits.

"If you have garlic, that is always one of the tradition my father tells us, if you always take garlic along with you in the forest, nothing will happen to you, not even the '[Tata]Duente' or 'Sesemite' can come close to you. I think it's the scent of the garlic they don't like, it keeps them away. I always take garlic on deep patrols, I feel, yes, it helps. It also protects us from snakes. And in anything as well you can use garlic. Let's say you have a stomach ache, you can drink garlic, and if you have air in your stomach, you can also drink that. Garlic in water, it release that pain in your stomach. It's really really useful, and helps during our patrol." (FR06)
Other means used to protect themselves from the dangers of the forest include the marking of their campsites (with a cross made of branches or urine) and keeping their machete near their head while sleeping. The rangers also voiced the importance of knowing how to "walk in the forest" in order to protect themselves from harm. The meaning behind this phrase, and its role in their work, is explored in the following section.

5.3.1.2. "Walking in the forest"



Figure 11 | "Walking in the forest"

Linked with their respect for the forest was a commonly voiced practice of "walking in the forest". This phrase was mentioned during every interview when speaking of traditional forest-related knowledge. During the data verification workshop the meaning of this phrase and practice were explored, which resulted in a trifold understanding: knowledge sharing, observation and "one mind".

#### Knowledge sharing

One explanation for the phrase equated it to experiential learning, and a means for knowledge sharing. This 'learning-by-doing' is the customary way in which information and knowledge is shared in Maya communities (Zarger 2002). To the rangers, it is how they learned to survive when out in the forest, and its adaptive nature continues to allow them to learn from

each other and based on their experiences. It is while "walking in the forest", while patrolling

and completing transects, that learning takes place and knowledge is shared.

"Sometimes I follow my father when we go into the forest because we want to look for something, like you know, pacaya<sup>15</sup>...anything that's good to eat, we just...I was still young and follow him, you know, the pacaya was just broke and put in a sack and I just back it you know that is how I know more about the forest. And I grow up grow up grow up, and now I could go in the forest anywhere, and I won't get lost, yeah. So we know where to go, yeah." (FR04)

"He [one of the rangers] gives good advice of how to, you know to be, to move in forest, to be really careful of things. There are you know, trees that are poisonous, for example the um the poison wood. He point out that you know this is poison wood...and some other medicinal plants that he know that I don't know he point out, you know this is good for this...and that is how we share things amongst ourselves.' (FR06)

# **Observation**

While "walking in the forest" with the male elders in their families, the rangers learned of the importance of being observant. To do so, the rangers emphasised the importance of using all

their senses, particularly their sight, smell and hearing. They added that paying attention to

the trail you are on is of utmost importance.

"He [my father] taught us how to like like um walk in the forest, how to be careful where you are going, where it is dangerous, just try to not go there...that's what he taught us when going to the forest, yeah." (FR04)

"We had this fire coming from afar and we were out on the lookout if it's gonna cross our boundary line within Golden Stream. And we saw this fire coming towards the area and we we made a call that we need back up to um fight this fire. They told us to come for the equipments, so I was um walking back to the road to get this stuff, and I jumped down in a dry creek bed and it was same like this season, it's in the dry season, and everything was dry and the fire was just like coming into the forest. So I didn't I didn't um exactly saw this animal coming in front of me. I jumped down into this dry creek bed and this snake was right there front of me. And when I jumped down it was just like inches apart from us, like my foot was just like inches from its head. And then when it just like pulls back its head to make that strike, I just like jumped back, and it just missed me by inches, I just said what, I was so scared I just stopped there right there, doing nothing. I was so lucky the snake didn't bite me

**CEU eTD Collection** 

<sup>&</sup>lt;sup>15</sup> *Chamaedorea tepeiilote* 

that I I can't move again, yeah. That's the Fer-de-Lance<sup>16</sup>. That um kind of like teaches us to be more on the lookout for those kind of little animals, yeah." (FR10)

Knowing how to "walk in the forest" is therefore important to their survival. Moreover, it enables them to patrol more effectively, directly contributing to law enforcement and fieldlevel management of PAs.

"When we go on patrol, we don't have a specific thing for us to look at, it could be anything. Either hunting, logging, um um gold mining or anything once it's like illegal things, you can easily identify by whatsoever you found. It's, let's say somebody was harvesting xaté in here, illegal, they would find um um tracks of um people that um is not um, let's say it's not a person from that organisation, we could tell maybe it's from, maybe it's somebody some other rangers that went ahead because of their um footwear, maybe it could be a different type of boot and then if you follow that maybe not far away then you could find remaining xaté, or maybe remaining of...let's say maybe they are doing logging, you would see um far, that they have fallen a tree, or maybe people that are um doing um gold mining, you would like um heard that people like knocking something on the rocks or something else. I think those are some of the things you can be able, like expect, when you are out with the other rangers." (FR01)

# "One mind"

"when I go in the bush, the mind is empty...that's why, I love forests, but forest is dangerous." (FR09)

Ranger beliefs influence the respect they have for the forest, and guide the way they "walk in the forest". In addition to being brave and staying positive while in the forest, the rangers believe that it is important to be present in the forest, and not allow yourself to be distracted. They believe that if you allow you mind to wander, you will face repercussions, including potential snake or jaguar attacks, injuries, or find yourself lost in the forest.

"My parents told me, if you are not brave enough and then you are out into the forest, you start to...a person start to think about home, then something might happen to that person because of his mind is not there into the forest, his mind is at home, wanting to reach at home, and um definitely, definitely something would happen to the person. But if he put his mind that he is there and then he is happy that he is there away from home then, everyone will be happy and nothing will happen. So that's the reason why um hunters must not have two mind whenever he go into the forest. While some hunters they take garlic, they have

<sup>&</sup>lt;sup>16</sup> Bothrops asper

garlic into their pocket [be]cause to remove the evil spirit away, to clear the way especially. Snakes as well, it scares snakes away, it clear the pathway wherever a person is going and then nothing will happen to the person." (FR08)

Such 'presence of mind' also allows them to be more observant, further enabling them to perform their duties, i.e. identification of illegal activities and biodiversity monitoring, effectively.

#### 5.3.1.3. Navigation



Figure 12 | Navigation

Ya'axché provides technical training on map reading, compass reading and the use of equipment including Global Positioning System (GPS) navigation devices and satellite phones. The rangers are therefore well equipped and if lost can depend on their training and provided equipment to navigate out of the forest.

"As a ranger, we use compass, we use map and we use GPS. So that is a better um, guide for us. Yeah...the way I see, if we don't have compass, we don't have map, we don't have none of GPS ...well eventually we might get lost because of nothing that is guiding us where to go...that is where a lot of people, especially the hunters, they get lost, they don't have um GPS, they don't have nothing, they just navigate into the forest on their own. Sometimes that um hunters can get lost into the forest and would camp there he would not come home until someone in the community would go out there to rescue him and find out where he is. And if they don't find the person then...because he is lost, he cannot go nowhere, and he don't have um no kind of um phone as for communication, and no kind of GPS as his location, yeah. So it's hard like that to navigate into the forest, which is...you're not familiar with. But if forest like these around here is not farmed, we could just um navigate on our own, but if we have to get to a point, we are looking for a point then we have to use GPS to take us directly to where that point is." (FR08)

Yet, most rangers viewed their TEK on navigation as being essential to their work and survival in the forest. They placed greater trust in a range of traditional navigating methods including the use of the sun and stars as a compass, their memory of the landscape, their ability to create and follow trails, as well as the use of certain plants as a compass ('vines of wisdom', 'compass tree'). The reassurance these traditional methods provide collectively increases their confidence when out in the forest.

"These [traditional] methods, it's really useful, it can really help us, in case you know GPS or compass sometimes they broke. And you're out there in the jungle, and even if you run out of food, you can survive from the forest. And you can always go out by navigating your way with the sun...it works really good, and it, it can save lives of people." (FR06)

"Yeah, he [my father] always tell me, you need to remember, when you enter the forest, you need to more or less out a mark, more or less where you entered it. It's not a mark that you could actually see, or even you know how you put on the trees. You know sometimes like marking, if you have hills you look at the hills and say which hills, you know more or less which direction you enter, so more or less, if you come out somewhere around there you remember that. Yeah. Yeah, or trees big trees that he could remember in his mind. Yeah, markers which he always had, yeah...I've seen my dad do it a lot [create a trail], and as well [one of the rangers] [laughs]. Even as a ranger he love to do that. I can always see him going in the forest and breaking, but they will not do it every step they make, like they will take ten steps, five steps, or fifteen steps and you can see them broken [laughs], yeah." (FR02)

"You don't need compass or GPS, just need to use your head. By the sun, how you move, east and west. So that's what my parents show me when I go in the jungle. And some trees in the jungle, it could guide you, that's what everyone, that's what my parents say...we call it the 'vine of wisdom', and it works. And plus they have a tree too, in the jungle in some areas you find it. If you cut that, it shows you like compass." (FR05)

On one occasion, the GPS used by two of the rangers ran out of battery. It was their TEK navigation techniques that not only let them find their way, but also reassured them in case such a situation repeated itself.

"I don't know how comes like to be in a forest, it's kind of tricky when um you don't have any GPS. Our GPS was run out of um battery, so I don't know how comes we did that a small curve and then we found another creek and we thought that it was the same which was, which is um we followed the first time going, but it's not it was a completely different creek that was come more up, so we followed that and then we like, coming down again, like instead of going up we was coming down. So, finally I think he realised and he like he knows more to be in a forest, so he told like we got lost, I asked him why, why why you say that, and I tell that we are going in the right creek, we are going up...we're not going up, we're going down. I asked him why. Don't you see that um the sun...so, he told me, don't you see that? Then I told him, yeah it could be. So what we did, we didn't continue from there, we just have, we just follow the sun direction. We were not far...we just meet nearby the other creek whereby we came the first time. So, he told me that we were lost and then I told him yes, we were lost. So, through that sun we followed from there we brought to that same creek. Then from there we were tired, we didn't want to go more, so we just went down, so yeah. Just the sun like um, it's really common thing like for hunters, they mostly use the sun. Yeah, that's the only thing I could um compare like using um before when I was um young, and sometimes we just have to like use it now, like when maybe it's er we don't expect like maybe we get a battery lost, at some point we have to use it." (FR01)

However, such instances are rare. Most often, the rangers 'practice' these TEK navigation techniques along with the navigating skills they gain through training programmes. The use of these knowledges in combination adds to their ability to navigate as well as their security when in the forest. This provides them with greater confidence to perform their duties.

#### 5.3.1.4. Plant identification



Figure 13 | Plant identification

As noted in the previous sections, the rangers' ability to identify some species of plants assists in their ranger activities and survival. This section will present a selection of the varied ways in which plant species can contribute to the rangers' work. It will not attempt to provide information on the specific species used, instead focusing on their role in the work of the rangers.

In addition to assisting with navigation, plant identification, particularly the knowledge of which plants are poisonous, edible and have medicinal value, is integral to the rangers' survival when performing duties in the forest. The rangers have yet to depend on their knowledge of edible plants to survive when in the forest. However, their one primary concern when in the forest is survival, to which this knowledge contributes significantly.

A consistent concern for rangers is the availability of water. The rangers always aim to carry sufficient drinking water. However, if lost, or if a ranger over-estimates the availability of water along a trail, the ability to identify 'water vines' (where they can attain potable water) is crucial. Rangers have used these vines on multiple occasions, particularly within the dry season during multiday patrols, when the availability of water can sometimes be difficult to predict.

"If there's no creek, and you get of thirst, and you cannot get water, but there's a vine you can cut. You cut those vine, but you need to cut them quick. You cut them up and down, so the water is staying in the middle. If you just cut one side, the water will drain to the other side." (FR07)

"That vine helped us a lot, like knowing stuff like that is just gonna help you. You don't know when, but it's gonna help." (FR10)

"Not all vines are good to get water because some are poisonous. They look similar, but they have different substance, so some might be poisonous. So those are the difference between a good vine and a bad vine." (FR08)

Some of the rangers also stated that knowledge of plants with medicinal properties, or bush medicine, was important for survival.<sup>17</sup>

"It's good that we know these plants because in like forests we go on deep patrol and then we run out of medication and we can still use some of those um forest product – yeah, medicinal plants. And um we can survive." (FR08)

The trust the rangers have in the effectiveness of bush medicine varies depending on their own experiences and related stories from family elders. None of the rangers are bush doctors. They distinguish between knowing how to use some bush medicine and the extensive expertise held by bush doctors. The rangers, as a team, are aware of bush medicine for a variety of gastric illnesses, the treating of snake bites, joint pains, wounds, swelling, headaches, epileptic seizures, and to reduce stress. They gained most of this knowledge from their parents and grandparents. Within the ranger team, greater trust was placed in the knowledge held by those rangers with bush doctors in their families. The rangers often shared their knowledge of medicinal plants when in the forest by 'pointing out' plants and discussing their uses.

Ya'axché once organised a workshop for the rangers on bush medicine. This was conducted by a group of bush doctors from Indian Creek village. During the workshop, the rangers walked in the forest and tagged plants highlighted to them by the bush doctors. A few of the rangers expressed their appreciation for such a workshop, claiming it to be important for their work and survival in the forest. The organisation of such a workshop is indicative of Ya'axché's recognition of the importance of TEK to field-level PA management.

The rangers' plant identification capabilities also directly impact their work, particularly tasks such as tree monitoring. Additionally, the rangers know of the local uses and values ascribed

<sup>&</sup>lt;sup>17</sup> The rangers are not always equipped with relevant allopathic medication

to different plant species. They are also aware of harvesting methods, seasons, and behaviour employed by local communities.

"The tradition that we take is um, it has to be full moon when you um cut these um these trees to serve on any of our house. Even, it goes to leaves as well, it has to be full moon when we cut these um materials from the forest. One reason is to make the um materials um serve longer because there are um bugs that comes in and go in like the beams of the house and borrows through it and you know it wear out very quickly. That is why we have to cut these leaves and sticks on full moon." (FR06)

"Knowing when people are building house or so then you keep a look out like where you think they're going to extract...that kind of helps." (FR10)

Such knowledge allows them to predict when and how the illegal harvesting of plants may occur within BNR and GSCP. The value of such knowledge is explored further in the section on identifying illegal activities (section 5.3.1.5).

# 5.3.1.5. Animal identification



Figure 14 | Animal identification

As with plant identification, the ability to identify various animal species contributes to the rangers' capacity to perform duties and survive in the forest. The rangers' learned how to

identify a variety of mammals and birds, as well as some species of snakes, amphibians and fish at a young age. On visits to the forest to hunt and harvest products, as well as on trails to their farmlands, the rangers' learned to identify species based on sightings, tracks, faeces, calls and smell. On these occasions, they also developed skills in aging tracks.

"Yeah, the different animal tracks, how fresh it is, like when the animal has passed you can kind of get to know how far, how far along the animal has passed before you got there, yeah. Depends if there is any leaf or kind of stuff in the print itself, you can say, depending on the forest itself too, if the trees are just like dropping their leaves then you can see how deeply the leaf is in the track, or if it's just fallen, you can tell. If the ground is soft and it rains two or three days before, you can see the freshness of the mud, if it's dry or if it's not really dry, you can get to know, yeah. They showed us the tracks of different animals, and then showed us which is good to eat and good to hunt. You can also use their droppings, their scat in different places, yeah you can identify them with that. The jaguar<sup>18</sup> itself have different one, the tapir itself have um different dropping, the deer themselves have different, you can see the difference, you can tell the difference with those ones, yeah. And the call of the animal themselves. Like the different sound that animal make, yeah the warree<sup>19</sup> for example, you can you can either know if they are around by their call, like sometimes they just when they scent you around, they just make a clucking noise with their teeth, or you can smell them at a distance, like they have an odour, a scent that you kind of smell it and say yeah something is around, either the white-lipped or the collared peccary<sup>20</sup>, you can tell the difference between those ones. Or even the deer itself, it has a scent to them that you can smell. Yeah, all the different scent out there, you can identify something without seeing it. Yeah, it's just like um it needs practice, it needs practice." (FR10)

"There are animals that you know pass in the trail that that we go that leads to the um farm. He [my father] would like show us the um the tracks of different animals that pass on the trail. You would see um the tracks of the white-lipped peccaries, and you would also see the tracks of um agouti<sup>21</sup>, the paca. He shows us the difference of um, how these tracks are, how he knows them. And he also shows us how long it is, whether it is during the night, or the day before or three days before that day that we go to farm. He shows us, and he also shows us the tracks of jaguars...yeah, he teach us that how to read the tracks of animals. And also by their scent. You can also smell the peccary because they have that strong scent that they have...and by hearing them as well, you can tell the difference by how they sound. And it's also with the coatimundi<sup>22</sup>, you can tell by the sound they make, and also with the jaguar, you know it has the hooping noise, you can tell that it's a jaguar. Yeah, he taught us that, which is

<sup>&</sup>lt;sup>18</sup> Panthera onca

<sup>&</sup>lt;sup>19</sup> White-lipped peccary (*Tayassu pecari*)

<sup>&</sup>lt;sup>20</sup> Collared peccary (*Pecari tajacu*)

<sup>&</sup>lt;sup>21</sup> Cuniculus bale

<sup>&</sup>lt;sup>22</sup> Nasua narica

really useful. And with this bird as well, um the great  $curassow^{23}$ , he um taught us um which time of the year, which month in the year these animals make their noise. Like during this time of the year, like dry season, you can hear the great curassow making noise...I believe it is the time they start mating, yeah." (FR06)

This knowledge is particularly useful when the rangers conduct biodiversity monitoring transects in BNR and GSCP. Their ability to identify and observe the presence of different species within the PAs, as well as contrast it against species frequenting their communities, is useful in understanding the health of the forest and of specific species populations. The rangers also share their observations of 'unusual' behaviour of species at PAM meetings. Such information, identifiable due to their TEK, can benefit Ya'axché's understanding of the forest dynamics in BNR and GSCP. Since the rangers' are representative of local communities, their perspectives of forest health could provide Ya'axché with insights to local conservation values. This could be instrumental in the development of a cross-cultural conservation ethic (Berkes 2004).

Most of the rangers learned to hunt at a young age. While learning to hunt from the male elders in their families, they acquired hunting-related TEK. This included knowing when to hunt.

"Yes, yes, it [hunting at night] is quite different. What they hunt in the night is brocket deer<sup>24</sup> and um gibnut. And the other wildlife you know, travels during the day, so they hunt in the day, like wild peccaries, deer, umm, that's about it, game meat. Yeah, if you want gibnut you have to go at night. Or, some people hunt with dogs, hunting dogs you know, they will track where a gibnut is, in the burrow and dig them out." (FR03)

"My grandpa say, if you hear an owl making sounds around this time, it is the best time to hunt, you will definitely have your game meat with you when you are coming back. And for the animals, for example, if you see opossum<sup>25</sup>, they say you have a bad luck, or if a snake you meet on the way, you'll find nothing, that's a bad luck for you. Most of my uncles they do huntings, and that's what they say, which is true because when they come back they have their game meat with them. Yeah, everybody knows that in our culture, yeah." (FR04)

<sup>&</sup>lt;sup>23</sup> Crax rubra

<sup>&</sup>lt;sup>24</sup> Mazama americana

<sup>&</sup>lt;sup>25</sup> Didelphidae family

Along with the observation of different species activity, such knowledge is useful in predicting when and where illegal hunting might be occurring in the PAs. Intimate knowledge of hunting methods is also beneficial since it allows the rangers to sight traps as well as identify if hunting had occurred within the PAs. This is explored in more detail in the following section.

# 5.3.1.6. Identification of illegal activities



Figure 15 | Identification of illegal activities

The ability to identify illegal activities is central to the work of a forest ranger. As law enforcers, Ya'axché rangers are required to be constantly vigilant for signs of unauthorised human activity in the PAs. As is demonstrated in this section, the role of their TEK is essential to such work.

As described in the previous sections, Ya'axché rangers learned to hunt and harvest forest resources from male elders in their families. Through repeated trips to the forest, they learned how to "walk in the forest", navigate and identify a variety of species. This TEK allows them

to observe and predict human activity in the PAs, particularly those deemed illegal by PA management agencies and the Government of Belize.

"A person or hunter have different um trails than animals. It it all comes down to tracks also, like you can tell the difference between a human track and animal. And the trails that these people do is just like gonna be like, sometimes they drag um plants on the way, like they're just gonna like um, people are just gonna step on plants, and that's where we're gonna see if it's fresh or not, if it just continues on its trail or if the plant went back on the other way, that's when you can tell if these guys are still out there or they went back on the trail. You can see. It's easier to follow human tracks than animals. Sometimes animals just like just goes all about and it's really difficult, yeah. But a hunter is just gonna follow one direction, he turns somewhere, but you're gonna see signs of where he goes. Sometimes these guys just make a cut on the tree or a plant itself to mark their way that where they're going. That's some of the stuff we look out for. That's the main thing these hunters do. My father and grandfather, how you need to mark your trail, that's something they showed us. It's just like um the direction, how plants are going to be marked...as a hunter, each person marks their trail differently, um like each hunter has its own way." (FR10)

"Every hunter have a trick of hunting. Sometimes some hunters will open trails, sometimes hunters they don't open trails. They would normally break some branches while going, you know, you can actually see that somebody breaks it. And you...if you don't pay much attention to their trail, you won't be able to find it, but if you really good to identify hunters...you can find it. That is their tricks, so that you can't find them. You know, we learned because we used to use these methods in our hunting. Yeah." (FR06)

Their capacity to identify tracks and signs was developed through their experiences in the forest prior to becoming rangers. The rangers emphasised that "it takes practice" and that they continue to build these skills as rangers through experiential learning and knowledge sharing. Such knowledge includes an awareness of what a person might need when out in the forest and therefore where they might camp, local methods used to navigate, methods used to hunt and harvest resources, traditions and beliefs that guide hunting and harvesting practices, local and national economic and cultural values of resources, and the ability to predict how much time it takes to cover distances in different terrains. The rangers also spoke of being able to predict the age of human tracks and signs, by examining campsites as well as trails (for example, how long ago a cut had been made in the bark of a tree).

"You know hunters, when you do hunting, you go into the forest you don't want to make a lot of scenery for people to know that you are hunting in the grounds or whatever grounds you're using. So a lotta times people just tend to use slight little marks like just bending leaves, or bending tree branches to mark their trail. So I've learned that from experience, and so when I see that in the forest I continue tracking it, in the forest you find bends of leaves going in going in going in, and you continue track it. You will know that it's a hunter around or someone because a lot of hunters are really great in doing that, they don't wanna really mark their tracks or their trail, so you have to be skilful as well when you see fires, I mean like fires that they have used in the past for hunting you could more or less tell you know by examining the ashes or touching the ashes how long that have been there, more or less, yeah. Once it's dried you could be more or less able to tell if he had been there for a two days or two weeks or one week." (FR02)

"Yeah, it's easier [to recognise signs of hunters] because when you go out into the forest, and this our rangers are very good at, if it's dry, you are able to see tracks, or you can see fresh cuts on the trails, or you can see a cartridge shell, or they are able to see a strip on a big tree...this is to tell them, if it's a round tree, they want to go this way, they will strip this side, this is to tell them their trail go this way. So, they don't move a big trail because they're looking for wildlife, they don't want to see big trails, yeah so. You can able to know when somebody is out there, like maybe a cartridge shell, and if they shoot any bird, then maybe the fresh feathers will be there, and um camps, hunting camps, and if fresh fire hearth, you know fresh firewood...and all these things can able to tell you if they're one week, two days, three days when they're out there. So yeah, those are some of the evidence of knowing that people are out there." (FR03)

Therefore, it is not only the TEK that rangers gained prior to being employed that is useful, but the development of this knowledge based on professional experience as well. This capacity to learn-by-doing is developed over years, and therefore allows for adaptive fieldlevel PA management. Additionally, as members of the buffer communities, rangers are more aware of changes in local practices related to activities considered illegal within PAs. For example, changes in local hunting methods would require rangers to observe different signs indicating any hunting activity within the PA. This is also observable with illegal commercial activity, such as xaté harvesting. As mentioned by one of the rangers, the accessibility of a road that supports large vehicles can help determine what illegal activity is occurring and where. It is therefore important to recognise and value the role of TEK in the daily work of forest rangers, as well as the contributions it makes to the successful management of PAs. Understanding how this knowledge is transmitted within the ranger team could provide PA managers with a clearer picture of the dynamics of a ranger team and influence how training programmes can be conducted to optimise learning.

#### **5.3.2.** Knowledge sharing within the ranger team

The ranger team is further divided into three sub-teams. The members of each sub-team are moved between sub-teams every few months such that each ranger has the opportunity to work with other members of the team. The practice of working in groups is to increase safety, in case of an emergency when in the forest. Such an arrangement also facilitates the sharing of knowledge among rangers. As demonstrated in section 5.3.1.2, while the rangers "walk in the forest" together, they share information about different plant and animal species, navigation techniques and how to identify signs of illegal activity.

"Like the water vine, yes. I told them, or any fruit that you can eat and survive, I told them. Like, whenever I start to work, sometimes I I laugh on myself because some of the rangers doesn't know. They see me picking some fruit on the ground and eating it. They say why you're eating it? Because it's good to eat, I learned when I small...and sometimes they told me, they said, one of these days you will turn into a spider monkey! [laughs]. They say because eating those fruits. I said no, that's what my old grandfather taught me to eat. If no one taught me I would never eat those fruits. Yeah, that's what I told them." (FR07)

"Everybody know how to identify animals and follow trail, like the rangers themselves, most of us could um, when we started out like most of us could do like um trail reading also. Um, but the only thing like um um we haven't done is like um well we kind of test out each person when they're out in the forest with us, we ask each member to to lead um patrol or expedition like just to see how good he is. If not then we need to like um point out like what he misses or stuff like that and we kind of help him along. But most of the rangers know how to follow trails and stuff and um...all of us do know how to identify animals...and the plants, the ones to be um to keep away from, that's that's the one where we kind of like help out each other." (FR10)

"Oh yeah, because with other rangers, sometimes thing well, I know they told us, especially with like with the map reading. Maybe somebody he never know, is not really good at map reading, so we just help in the jungle. Yeah, we do that, yeah, we help each other because they give you like you freshen your ideas like in the jungle. Yeah, it helps, it helps a lot, just refreshing each other's ideas." (FR05)

When a new recruit joins the team, his capabilities are often tested. These are mostly in relation to the recruit's ability to survive in the forest on his own. This includes the testing of knowledge gained through Ya'axché training programmes (e.g. map reading, GPS usage, trail maintenance, etc.) as well as TEK (e.g., navigation, identification of animals, plants, and illegal activities). However, the beliefs and values that inform these knowledges are rarely discussed.

"You have to ask them first like what's their their their experience out in the bush like for survival and if they're really good with with directions, or or following trails or map reading and stuff. You need to to to find out from each members if they're good in those stuff. Especially like um survival when you're out there. Could you survive by yourself if by accident you separate from your team? Yeah, you need to find that from your team members. If not, you can kind of like give them some advice on how to survive." (FR10)

These informal assessments and trainings that occur in the field highlight what the rangers consider important to their work, and allow for the transfer of knowledge within the team, especially to first-time rangers. These informal trainings can also strengthen the effectiveness of field-level PA management.

The following section discusses how the above presented TEK benefits PA management, both on an everyday basis in the field as well as the overall management.

#### 5.3.3. TEK as a benefit of local hiring

As demonstrated in the previous section, the TEK held by the Ya'axché rangers supports field-level PA management. On a daily basis, TEK of rangers (1) assists in their survival (2) provides reassurance and enhances confidence and (3) enables them to fulfil their ranger duties, i.e., identification of illegal activities and biodiversity monitoring. These knowledges, practices and beliefs influence decisions they make when performing ranger duties in the forest. Ya'axché provides training on all these fronts. Yet, the rangers continue to rely on a combination of their TEK and their learnings from technical training programmes. This may be since the trainings received cannot replace their TEK, which is embedded in a worldview

that informs their understanding of the forest as well as related values and ethics (Berkes 2012). In addition to the direct contributions of the rangers' TEK to field-level PA management (section 5.3.1), other indirect benefits are explored here.

Ya'axche recognises TEK as a motivating factor for hiring local forest rangers (PA Manager pers.comm. 2015). Without this TEK, training and capacity building efforts of the organisation would potentially have had to been greater. As articulated by one of the rangers:

"My father is a traditional healer as well. And um he knows a lot of um plants, medicinal plants. So at my very young age, when you go and hunt, he will take you to the forest and he will tell you, okay this plant is good, it's a medicinal plant and it's good for this and it's good for that. Because he wants us to learn. Because they rely on medicinal plants, they don't go to hospital whenever they get sick. So he wants to transfer that knowledge to us. So I learned a lot of that medicinal plant in my young days, and I learned a lot of identifying plants as well, like trees, like big trees, like palms, like ferns, like whatever. He knows a lot of it, the uses, he knows about the um the um name of trees in their, in our own language, so when I come to Ya'axche it's just a matter of, I know these trees, I know these animals, it's easy. Animals as well, birds as well, I know their Que'qchi name, so I know that particular animal and I can just say, okay this is their English name." (FR03)

However, rather than only providing technical training, Ya'axché could utilise its social capital to increase learning across the organisation, allowing for the enriching of knowledges (Berkes 2009a).

Additionally, the Ya'axché rangers are the organisation's primary source of information on the everyday realities of BNR and GSCP. Their field-based observations and predictions influence their daily work and, at times, the overall management of the PAs. In particular, the rangers often report their observations of illegal activities and forest health, which feed into PA planning and management decisions. To an extent, these observations are informed by their TEK.

The rangers themselves have begun to voice the role of TEK in their work. A PAM team building workshop was held on 19 March, 2015, two weeks after my field study period. During this workshop, rangers were asked to identify factors that keep them motivated to

perform well in their work. One factor identified was the opportunity to "combine traditional knowledge with contemporary skills" (PA Manager pers.comm 2015). If the role of TEK in field-level PA management is recognised by Ya'axché, it could further motivate the rangers to perform their duties effectively, as well as assist in their empowerment. As noted by Bryant (2002) when faced with a more dominant conservation discourse, the ability of people to assert themselves, including their knowledge, could not only be empowering, but an effective way of challenging and shaping PA policy.

For Ya'axche, TEK already contributes to the management of BNR and GSCP, and the organisation acknowledges it to be a benefit of hiring local staff (PA Manager, pers.comm. 2015). For other PA management agencies, viewing TEK as a benefit and motivating factor for hiring local forest rangers could result in more effective PA management. As pointed out by Berkes *et al.* (2000), local resource users that interact with ecosystems on an everyday basis over lengthy periods of time tend to possess relevant knowledge of ecosystem dynamics and related management practices. With the hiring of local forest rangers, PA management agencies could gain insight into TEK used to respond to and manage ecosystems. This could be possible through the creation of space for intra-organisational learning (see section 5.2.4), and in turn a cross-cultural conservation ethic (Berkes 2004).

#### 5.4. Conclusion

As demonstrated by this chapter, TEK contributes significantly to field-level PA management, and is therefore an observable benefit of local hiring. Recognising these contributions, and working with rangers to increase intra-organisational learning, would assist in the empowerment of local rangers. Moreover, it could open doors for collaborative conservation between PA management agencies and communities, with rangers as bridging agents.

The TEK of the Ya'axché rangers is, as Turnbull (1997: 560) states, a "blend of knowledge, practice, trusted authority, spiritual values, and local social and cultural organization: a knowledge space". This knowledge is used by the rangers to respond to and manage BNR and GSCP. It is, as described by Usher (2000), a combination of experiential knowledge as local resource users and forest rangers, knowledge of past and current forest uses, and culturally-based values, all of which are informed by a culturally-based worldview. However, the rangers often use this knowledge in combination with information, knowledge and values derived from their training and time spent at Ya'axché, indicating that these knowledges could be used in combination (Berkes 2009b).

The TEK of the rangers is embedded in a worldview that informs their understanding of the forest as well as related values and ethics (Berkes 2012). The rangers, as members of buffer communities, know the forest in the same way "an experienced craftsman might be said to know his raw material. That is, he is acutely sensitive to its forms and textures, can respond creatively to its variations, and is even alert to the possibilities these afford – and the hazards they present – for pursuing different kinds of tasks" (Ingold and Kurttila 2000: 186). Recognising the contributions of their TEK and the influence of their worldview in field-level PA management would create space to develop a cross-cultural conservation ethic (Berkes 2004). Developing a shared ethic would assist in garnering local support and in empowering local communities (Brosius and Russell 2003). As this is one of the goals of local hiring, exploring the role of TEK in PA management and creating space for intra-organisational learning could provide insights for the development of a cross-cultural conservation ethic.

As field-level conservationists and law enforcers, the rangers are not only agents of conservation practice (Poppe 2012) and 'ambassadors' of PAs, but Ya'axché's source of information on the everyday realities of the PAs as well. Their field-based observations and predictions influence their daily work and, when communicated, the overall management of

the PAs. These observations are, in part, informed by their TEK. Here too lies another opportunity for the building of a cross-cultural conservation ethic. How the rangers perceive forest dynamics and observe forest health could provide further insight into how forests are valued by local communities. Rangers could function as bridging agents between Ya'axché and the communities (Vasan 2002), and could assist in developing synergies across knowledge systems (Tengö *et al.* 2014), in addition to a shared ethic. However, this would require a shift in current power sharing arrangements through the involvement of rangers in collective problem-solving and decision-making processes (Berkes 2009a). Such a shift would assist in the empowerment of the rangers, allowing for 'local hiring' to contribute to the organisation's mission (Ya'axche 2015a).

This chapter address the research questions of this study, presenting and analysing motivating factors for the hiring of local forest rangers, the contributions of TEK to field-level PA management and the potential for TEK to be viewed as a benefit of local hiring. Additionally, it proposes recognising the role of TEK of forest rangers in field-level PA management as a means for building mutual respect, creating spaces for shared learning, and the development of a cross-cultural conservation ethic (Berkes 2004), which in turn could strengthen the long-term relationship between Ya'axché and communities within the MGL.

# **6.** Conclusion

The aim of this study was to explore the significance of TEK in the field-level management of GSCP and BNR, as a benefit of local hiring of forest rangers. This was achieved with the support of two research questions: (1) What motivates the protected area management agency to hire rangers from surrounding communities? (2) How does traditional ecological knowledge held by rangers contribute to field-level management of the protected areas? Can this knowledge be considered a benefit of hiring local rangers for protected area management?

As presented in the previous chapter, for Ya'axché, motivation for hiring local forest rangers includes benefit sharing through direct employment and the creation of 'points of contact' between Ya'axché and the buffer communities. Other motivating factors, such as the instilling of conservation values, PA-community conflict management and intraorganisational learning are discussed as well. The case of the Ya'axché rangers also highlights the ways in which TEK contributes to field-level PA management and suggests that TEK can be viewed as a benefit of hiring local forest rangers. On a daily basis, the TEK of rangers provides reassurance and contributes to their ability to survive, monitor biodiversity as well as identify illegal activities while in the forest. The management of BNR and GSCP therefore benefits from the hiring of local rangers.

Beyond this case, if TEK is viewed as a benefit of local hiring by PA management agencies, it could have many positive impacts on PA management strategies. Firstly, it could encourage these agencies to hire locally and create space for shared learning between the agency and rangers (Berkes 2009a) resulting in the extension of conservation definitions and the development of a cross-cultural conservation ethic (Berkes 2004). Additionally, recognising the contributions of TEK to field-level PA management would assist in empowering forest

rangers. Moreover, it would allow for the development of synergies across knowledge systems (Tengö *et al.* 2014) aimed at increasing the effectiveness of PA management

TEK is only one benefit of local hiring for PA management. There still remains much to be explored with respect to the role of forest rangers in PA management, and the benefits and costs of hiring local rangers. While the ambiguous identity of local forest rangers and its influence on conservation practice has been studied (Vasan 2002, Poppe 2012), the notion of rangers as bridging agents needs further investigation. In addition to the development of a cross-cultural conservation ethic, how else can the role of rangers as bridging agents benefit conservation? What would be the consequences of rangers assuming such a role, for rangers, other community members and PA management agencies?

The implications of hiring local rangers could result in a range of costs and benefits for PA management. These might be linked to managing conflict or power sharing between PA management agencies and local resource users. However, the role of rangers in such contexts will depend on the dynamics of the community from which rangers are hired, and the rangers' positions within local social networks. Therefore, increased investigation of the role of forest rangers in PA management through case studies would assist in increasing our understanding of the consequences of local hiring in field-level PA management.

Another recommendation for future studies is the conducting of institutional analyses in order to understand the role of forest rangers within PA management agencies. For example, how is power shared within these agencies? In what capacities do rangers function in different agencies? Such studies could potentially contribute to a shared global understanding of the requirements of PAs at the field-level and even our definition of the role of a forest ranger.

The role of forest rangers in PA management is poorly understood and many questions related to this topic have yet to be explored. As illustrated in this thesis, further exploration of

this topic would increase our understanding of the needs of field-level PA management and the potential of local hiring. By exploring the significance of TEK in the field-level management of GSCP and BNR, and as a benefit of hiring local rangers, this case study directly contributes to this discourse.

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# Personal Communication

Protected Areas Manager (PA Manager), Lee Mcloughlin, Ya'axché Conservation Trust, 2015.
# Appendices

### **Appendix A**

#### Consent form for participation (individual interview and group workshop)

Research project: Traditional Ecological Knowledge and Protected Areas Management: Exploring the role of knowledge held by forest rangers in the management of Bladen Nature Reserve and Golden Stream Corridor Preserve

Dear Research Contributor,

This is a consent form, a copy of which will be left with you for your records. It should give you an idea of what the research is about and what your participation will involve. If you would like any more details, please feel free to ask.

The objective of this research is to explore the role of forest rangers and their knowledge in the management of Bladen Nature Reserve and Golden Stream Corridor Preserve. We shall spend some time together and I will conduct an in-depth interview (approx. 90 minutes) to understand your relationship with these protected areas, and your work as a ranger. All the information that you provide me with will be confidential and you will not be identified in any of my written material, presentations or published work. With your permission, I would like to record our interview discussion with a personal recording device so I can focus on our conversation rather than taking notes. After the interview, I will transcribe our discussion, using numbers to identify participants and maintain confidentiality. I will then go through the transcript and look for themes. I will check back with you during the workshop to make sure that I am representing your contributions accurately. It is likely that quotes from this interview will appear in my published work, but I will not use your name. Group discussions from the workshop are also likely to appear in my work, however only the group as a whole (Ya'axché Conservation Trust forest rangers) will be identified, and your individual contributions to the discussion will remain confidential and anonymous.

I do not anticipate that your participation in this research should expose you to any risks, other than those you encounter in your daily work and life. One benefit of participating in this research is the opportunity to share your knowledge and discuss possible ways in which it can be shared more widely.

Your signature on this form indicates that you have understood the information regarding participation, and agree to participate as a contributor. In no way does this waive your legal rights nor release the researcher, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or refrain from answering any questions, without prejudice or consequence.

If you have any questions or concerns about this study, please contact Ruth Pinto at Central European University at +36705343537 or ruth.pinto@mespom.eu

#### I agree to participate. I understand that the interview will be recorded and that the researcher may quote from my written or oral comments, but that my name will not be associated with any of these comments.

Participant's name Signature

Date: \_\_\_

## Appendix B

#### Interview guide (Rangers)

**Research project:** Traditional Ecological Knowledge and Protected Areas Management: Exploring the role of knowledge held by forest rangers in the management of Bladen Nature Reserve and Golden Stream Corridor Preserve

Location: Ya'axché field station, Golden Stream Corridor Preserve

(After signing of consent form)

Thank you for giving me this opportunity to learn from you.

The objective of this research is to explore the role of forest rangers and their knowledge in the management of Bladen Nature Reserve and Golden Stream Corridor Preserve. Through this interview (approx. 90 minutes), I hope to understand your relationship with these protected areas, your work as a ranger, and how your traditional knowledge contributes to your work.

You should know that I am not in a position to influence anything at Ya'axché Conservation Trust, however, the final document I write will be available to Ya'axché.

This is meant to be a relaxed, two-way conversation, and we can take a break whenever you like. Please feel free to use the maps and the blank sheets of paper to further express yourself.

#### 1. Introduction

Could you tell me about yourself? Where are you from? Are your parents from the same village? Do you have any siblings? Are you married now? Children?

Did you go to school? What did you learn there?

#### 2. Relationship with the forest

Could you tell me about your relationship with the forest growing up? When was the first time you visited the forest? With others, alone? Any other stories? Do you take your children to the forest?

### 3. Becoming a ranger

How did you spend your time before becoming a ranger? How did you heard about the ranger job? Why did you apply? How long have you been working with Ya'axché?

### 4. Experience as a ranger

Could you please take me through a day of your work life? (highlights, ask for stories) How have these experiences informed your relationship with the forest?

### 5. Forest-related traditional knowledge and Protected Areas management

Could you share with me some of the knowledge or practices you have (not received technical training for) that you think are relevant to forest management. Do you apply any of these practices or knowledge while at work? Role play exercise: If you had to teach someone who had never been to a forest before to be a ranger, what would you teach them?

Debriefing: Thank you for taking the time to share your knowledge and experiences with me. As I mentioned, I will spend time going over our interview and picking out themes that I will present back to you during the workshop. I hope that you will be able to attend and can let me know if I am representing your experiences and perspectives accurately. Again, thank you for this opportunity. If you have any further questions or comments, please contact me (contact details provided on consent form).

## Appendix C

#### Interview guide (PA Manager)

**Research project:** Traditional Ecological Knowledge and Protected Areas Management: Exploring the role of knowledge held by forest rangers in the management of Bladen Nature Reserve and Golden Stream Corridor Preserve

Purpose: To gain an understanding of the history and management arrangements of the PAs; the recruitment process of rangers; training programmes provided to rangers. Location: Ya'axché head office, Punta Gorda

Themes	Primary questions	Secondary questions
Protected Areas	To begin with, could you tell me about the history and management arrangements of BNR and GSCP?	<ul> <li>history</li> <li>management arrangements</li> <li>aims</li> <li>enforcement policies</li> <li>benefits for the social-ecological system</li> </ul>
Community engagement	Why is it important to Ya'axché to engage with buffer communities?	<ul> <li>rationale</li> <li>current activities involving locals</li> <li>engagement in what capacities?</li> </ul>
Local hiring	I have a few questions about the ranger staff. As I understand it, all the rangers are from the villages surrounding Bladen and Golden Stream. Was this a conscious, strategic decision from Ya'axché?	<ul> <li>recruitment process</li> <li>how does this strategy fit within the aims of Ya'axché?</li> <li>is TEK considered?</li> </ul>
Training programmes	Could you tell me about the training programmes provided to the rangers?	<ul> <li>what are the aims of these programmes?</li> <li>benefits of these trainings</li> <li>are there any other training programmes available for rangers?</li> </ul>

## Appendix D

#### Data verification workshop guide

**Research project:** Traditional Ecological Knowledge and Protected Areas Management: Exploring the role of knowledge held by forest rangers in the field-level management of Bladen Nature Reserve and Golden Stream Corridor Preserve, Belize

Location: Ya'axché field station, Golden Stream Corridor Preserve Date: February 23, 2015 Time: 8:30am to 11:30am Number of participants: 7 (not including researcher)

Purpose of the workshop: (a) verification of data gathered during the interviews with the rangers; (b) further identification of traditional ecological knowledge held and used by the rangers; and (c) discussion on how the data produced during this study could be shared, within the thesis and more widely.

Guide:

We will sit in a circle, and I will be a facilitator as well as a participant. A recording device will also be placed in the middle of the circle, if consent is provided by all present.

Introduction: Welcome. I'd like to begin by thanking all of you for sharing with me your knowledge and experiences over this past month. As you know, I am here to learn about the knowledge you hold and how it contributes to your work in Bladen Nature Reserve and Golden Stream Corridor Preserve. Just as a reminder, my research is not directly connected to the activities at Ya'axché Conservation Trust (Ya'axché), neither am I in a position to influence anything at Ya'axché. However, the final document I write will be available to Ya'axché.

I consider you to be partners rather than participants of this study, and therefore would like for you to share in this process of data production and to feel a sense of ownership of the end result. Does anyone have any questions?

Workshop rules: For this workshop, I would like for us to develop rules collectively, just as we had done during the leadership training (open the floor to rule suggestions that must then be agreed upon by the entire group. Agreed upon rules will be listed on the whiteboard).

Presentation of data gathered: Based on what you shared with me during the interviews and our discussions, I created a list of themes, and related beliefs and practices. Using the whiteboard, I will present the data produced thus far per theme. I would like for us go around the circle and discuss each theme and related practices. I would appreciate your input, particularly if any clarifications are needed or if you have any additional thoughts/perspectives.

- Themes:
- 1. Navigation
- 2. Respect for the forest
- 3. Camping
- 4. Plant identification
- 5. Animal identification
- 6. Identification of illegal activities

Sharing of the data produced: I would like to discuss with you the sharing of and potential use of the data produced by all of us during this study (open for discussion).

Permissions: To end this workshop, I would like to discuss the potential ways in which you might or might not want to be identified. As you are aware, this study will reveal that its sample consisted of the rangers of Ya'axché. I would therefore like for us to discuss how much of your identity you would want revealed (through photographs, a list of participants/contributors, etc).

Thank you again for sharing your knowledge and experiences with me over the past month, and especially today. I have really appreciated this opportunity to learn from you. I look forward to sharing my thesis with you. If you have any further questions, concerns or comments, please feel to contact me anytime.

# Appendix E

### List of Participants

The Ya'axché Ranger Team:

Marchilio Ack

Victor Bonilla

Octavio Cal

Vigilio Cal

Andres Chen

Marcus Cholom

Rosendo Coy

Anignazio Makin

Mateo Rash

Marcus Tut