Victoria Reyes-García · Aili Pyhälä
Editors

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To hunter-gatherer societies, whose culture, livelihood and identity are challenged in the face of ever more rapid globalization.

Foreword

As convener of the Eleventh Conference on Hunting and Gathering Societies (CHAGS 11), it is my great pleasure to offer a few (fore)words to the readers of this volume. The editors of the book undertook the laudable initiative of organizing a plenary session for CHAGS 11, which attracted a large audience and featured exciting presentations, many of which are to be found – in a revised version – in this collection. As the editors well note in their preface, this book is not an attempt to represent all aspects of CHAGS 11; given the more than 350 papers presented at CHAGS 11, this would be an utter impossibility. The book before you thus is only one important result of the conference, and we are looking forward to more to come.

Hunter-Gatherers in a Changing World is a timely collection of articles on a topic that had never been untimely, but which seems to be even more relevant today than in previous decades. A multitude of vectors of change – from global climate change to economic globalization – seem to affect small-scale societies today. While these changes impact all individuals and groups on this planet, hunter-gatherers – due to their small group sizes and direct reliance on the environment – are even more endangered by these developments than other members of global humanity.

We are supposedly living an epoch in which the environmental imprint of humanity is visible geologically, that is, we have arrived in the Anthropocene. At the same time, it is clear that not all humans leave an ecological footprint of equal size. As we know, the differences between individual countries, regions and social groups regarding these impacts are tremendous; however, all of us have to live with their consequences. Given the direct relationship between hunter-gatherer livelihoods and 'readable' (i.e., understandable and predictable within limits) environments, for hunter-gatherers, it is more difficult to deal with rapid environmental change than, for example, for industrial agriculturists, to name one among several kinds of non-hunter-gatherer engagements with the environment that both contributes to change and has technical means to withstand its consequences.

Hunter-gatherer societies have been misrepresented by non-hunter-gatherers in a variety of ways over centuries. Apart from the mistrust of agricultural communities towards their (mostly) non-sedentary foraging neighbours, hunter-gatherers have

been experiencing attempts to categorize their lifeways at least since the Enlightenment. These misrepresentations, however, have often been ambiguous. While there is a long tradition of representing the hunter-gatherer *other* as a bundle of negative characteristics, reminiscent of Thomas Hobbes' infamous line about life at the beginnings of history being 'solitary, poor, nasty, brutish and short', there is the opposite tradition of thought as well, glorifying the 'noble savage', a notion often ascribed to Jean-Jacques Rousseau. Even contemporary discussions about hunter-gatherers and 'indigenous peoples' – a term often seen as synonym for hunter-gatherers, although there is no necessary connection between the two – tend to fall within these poles of misrepresentation.

The book in front of you employs a broad definition of hunter-gatherers, including contemporary societies that engage in a number of other economic activities apart from foraging. This includes not only additional activities that might have been taken up fairly recently but also activities with a much longer history. For example, it is impossible to understand the social, economic and cultural universes of the hunter-gatherer societies of Siberia and northern Europe without looking at the role of a domesticated reindeer and the role of pastoral activities among hunters and fishermen. Also, a broad definition is important in order not to mark hunter-gatherer studies as a form of salvage research. While it is clear that the percentage of hunter-gatherers within the total human population of the globe has been decreasing for the last 10,000 years, our concerns are not driven by visions of groups and traditions 'dying out'. We are concerned about social and environmental forms of devastation often caused by more powerful and more numerous groups than hunter-gatherers. At the same time, there are also new, post-agricultural forms of obtaining food resources, from professional mushroom hunting and dumpster diving to the gastronomic use of wild flowers and the recycling of expired and unwanted groceries that might fall within the hunting-gathering tradition. While none of these 'neo-foraging' activities take centre stage in this volume, it remains relevant to point out that engagement with hunting and gathering is not just about preservation but about innovation as well.

While my own background is in cultural anthropology, hunter-gatherer studies are of relevance to a variety of disciplines ranging from archaeology and history to human biology, evolutionary psychology, political science and environmental studies, to name just a few. Academic disciplines have their own rhythms of what is hotly debated and what is out of fashion, and in some of the mentioned disciplines, hunter-gatherers played – at best – a secondary role in recent years. The general retreat from 'grand questions' in the social sciences and humanities, that is, big overarching theories of society and culture, has certainly something to do with it. Thus, a number of important questions about the 'human condition' are no longer being asked. While there are good reasons to deconstruct the notion of an unchanging 'human nature', ignoring questions about human universals and differences leads to an impoverishment of our disciplines.

CHAGS 11 can be seen as one of the many steps necessary to bring hunter-gatherer research back into the centre of the social sciences and humanities. The book in front of you demonstrates that it is possible to link issues of planetary con-

cern with those of small-scale hunter-gatherer societies. In recent years, anthropologists and other social scientists seem to have neglected hunter-gatherers to a certain degree, almost as if postmodern worlds held no more room for those societies mostly associated with the beginnings of humanity. While it was important to deconstruct certain earlier narratives about 'primitives', as hunter-gatherers were called and seen, neglecting their contemporaneity does not help us in understanding global histories and futures.

To assume that only large-scale industrial and post-industrial societies are of relevance today would mean a high level of ethnocentric ignorance. Pretending that our world is the only thinkable and livable one is not a solution. In that respect, engaging with hunter-gatherers, including the radical differences through which some of them define themselves and others, is an important empirical and theoretical imperative, as long as we do not romanticize assumed and performed alterity. This also means that we can learn from hunter-gatherers, not by copying lifeways and worldviews that cannot be transported across ontological boundaries, but by trying to understand how people in social and cultural contexts different from ours deal with and adapt to a fast-changing world, that is, to natural and social environments in transition.

Vienna, the location of CHAGS 11, is far removed from the lifeworlds of contemporary hunter-gatherers. At the same time, these lives are no longer strictly local ones, limited to remote corners of the globe not yet possessed by agricultural and industrial societies. Hunting and gathering lives have become global ones, concerning civil society members and activists – indigenous and nonindigenous alike – in Vienna, Oslo and New York, as well as in Canberra, Johannesburg and Kuala Lumpur. It seems that at least some parts of humanity care deeply about enabling members of hunter-gather societies the political and ecological space to live lives according to their own choosing.

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30 January 2016

Peter Schweitzer

Preface

Our interest for hunter-gatherer societies goes back in time to our respective graduate-school years. Then, some years ago, we met each other working in a large research project analysing the role of culture in shaping human adaptive strategy (see http://icta.uab.cat/Etnoecologia/lek/). The goal of the project was to collect real-world data to test a pathway through which cultural knowledge might have enhanced human adaptive strategy: The individual returns to culturally evolved and environment-specific knowledge. Data for the project were collected in three hunter-gatherer societies: the Tsimane' (Amazonia), the Baka (Congo Basin) and the Punan Tubu (Borneo). While the project produced a wealth of analysis on multiple topics, our impression was that it still fell short in reflecting upon the most important issue currently facing hunter-gatherer societies: the myriad of changes – both in terms of challenges and opportunities – that impelling globalization brings to them.

We realized that one way to explore the issue would be to bring together a panel of scholars representing different perspectives on the topic. The opportunity arose to participate in the Eleventh Conference on Hunting and Gathering Societies (CHAGS 11) that was celebrated in September 2015 in Vienna, in which we organized a plenary and a panel session, both titled 'Hunter-Gatherers in a Changing World'. Following the spirit of the 10th CHAGS, which concluded with a panel of young researchers discussing their hopes for the future of hunter-gatherer societies, our selection of contributors aimed at promoting dialog between the different generations of scientists working with past and contemporary hunter-gatherer societies. This edited book includes the papers presented at the conference, with an additional few invited contributions.

This book follows a tradition that started with the famous 'Man the Hunter' conference (1966) and that has continued in many of the CHAGS editions. CHAGS periodically brings together specialists in hunter-gatherer societies from different disciplines (i.e., archaeologists, social anthropologists, human evolutionists) and activists concerned about the future of foraging peoples. Such conferences have resulted in the publication of edited books and monographs which, far from only being compilations of analytical cases, have helped summarize trends in

anthropological literature, becoming essential references for the discipline. We do want to point out, however, that the 11th CHAGS covered a far wider and more diverse range of topics than those covered in this volume. Some of the important topics not covered here include warfare, violence and conflict resolution, some of the main topics in the 10th CHAGS. The 11th CHAGS also had a strong focus on historical records and evolutionary trends, hunter-gatherer belief systems, social organization and structure, equality and egalitarianism and human-nature relations. Therefore, this book should not be taken as representative of all topics currently covered by researchers working in contemporary hunter-gatherer societies. Rather, the contributions to this book mostly deal with the topic of how the process of global change is affecting the lives of contemporary hunter-gatherer societies.

Overall, this book highlights that, far from the popularly held and rather romanticized view that hunter-gatherers continue to exist as isolated populations living a traditional lifestyle in harmony with the environment, contemporary hunter-gatherer societies – like many rural communities around the world – face a number of relatively new ecological and social challenges. Despite living in relatively isolated pockets of the world, contemporary hunter-gatherers are increasingly and rapidly being affected by global changes related to both biophysical Earth systems (i.e., changes in climate, land use and water cycle) and social systems (i.e., demographic transitions, integration into the market economy, integration to nation-states and cultural change). The various chapters in this book explore the implications that such changes have on contemporary hunter-gatherer societies, particularly in terms of their culture, livelihood and identity, but also with regard to the natural environment and resources that these societies have managed and depended on for millennia. We hope this contribution helps in providing a realistic view of what it means to be a forager in a changing world.

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Hyderabad, India
24 August 2015

Victoria Reyes-García
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Introduction: Hunter-Gatherers in a *Fast* Changing World

Today's world is undergoing unprecedented planetary-scale changes, including changes in the global geosphere and biosphere systems and changes in the social and economic systems, with effects on cultures, social networks and communications. Scholars use the term 'global environmental change' to refer to biophysical transformations of land, oceans and atmosphere and the term 'global change' when also adding large-scale changes in society (Dirzo et al. 2014; Zalasiewicz et al. 2011). Changes in the Earth's biophysical systems include land-use and land-cover changes and changes in the oceans, in the atmosphere and in the cryosphere, which altogether result in unprecedented transformations in the planet's natural cycles. In its societal context, global change encompasses social, cultural, technological, political, economic and legal changes or what is also known as globalization. Although most of the changes experienced today are not new, the increased scale, pace and extension since the mid-twentieth century make their impacts unprecedented (Steffen et al. 2004). The scale of change is so large and its pace so rapid that some researchers argue that we are entering a new geological era, referred to as the 'Anthropocene', due to the role of anthropogenic causes in driving such changes (Barnosky et al. 2012; Zalasiewicz et al. 2011).

The main question we explore in this book is: *How do these changes affect the lives of contemporary hunter-gatherer societies?* Understanding the impacts of global change on the variety of cultures, ethnic groups, languages and traditions on the planet – or what Davis (2009) has named the ethnosphere – is as important as understanding the much studied impacts of global change on the biosphere. And this is so because research on the topic suggests that global change has large impacts both in terms of intracultural and intercultural diversity (e.g., through the erosion of local ecological knowledge or languages; Harmon and Loh 2010; Reyes-García et al. 2013). The topic, however, remains relatively unexplored and more so in relation to contemporary hunter-gatherers. On the one hand, and despite the pervasive image projected by the mass media of hunter-gatherer societies as isolated groups living in remote places, most modern anthropological literature acknowledges that hunter-gatherers' livelihoods are increasingly being threatened by changes in the surrounding social-ecological systems (see, e.g., Leacock and Lee 1982; Schrire

1984). On the other hand, such work has mostly addressed geographically located (i.e., regional or national) change, and only recently have scholars started to document how global change impacts upon different societies and cultures (see, e.g., IPCC 2014). This nascent literature, neither limited to nor centred on hunter-gatherers, typically comes from multidisciplinary fields such as environmental sciences or development studies (e.g., Adger et al. 2013), with recent contributions from anthropologists (e.g., Barnes et al. 2013; Crate 2011). This book contributes to this literature, with a specific emphasis on contemporary hunter-gatherers.

In this introduction, we review previous literature explaining how global change affects contemporary hunter-gatherer societies and introduce the chapters of the book. We first explore the debate around how to define 'hunter-gatherers' in contemporary ethnographic settings. We then move to explore how historical processes help shape contemporary hunter-gatherer societies. The last three sections of the introduction explore some of the drivers of global change that might affect contemporary hunter-gatherers. Researchers have listed a myriad of drivers of global change (including access to natural resources, integration into the market economy, policy and legal reforms or shifts in social organization) highlighting that these drivers often act synergistically, thereby exacerbating their overall impacts (Dinero 2013; McDowell and Hess 2012; Schwartzman et al. 2013). While acknowledging these complex interactions, to ease the exposition we classify changes as (1) environmental change, (2) changes in the economic, political, and legal system and (3) globalization and cultural change. In each section, we introduce the related chapters of the book.

'Hunter-Gatherers': A Changing Concept

Hunter-gatherers (a term that is hereafter interchangeably used with foragers) have been the subject of anthropological studies since the onset of the discipline, and the debate on the definition of the term is as old and recurrent as is the anthropological interest in it. Scholars working among hunter-gatherer societies have typically relied on a multi-faceted definition, mostly taking into account the economic and the socio-political systems. At the economic level, societies are classified as hunter-gatherers when their subsistence is based on hunting wild animals, fishing and gathering wild plants for food, with no domestication of plants or animals (except the dog). At the socio-political level, societies have generally been classified as hunter-gatherers when their social organization is largely based on sharing and communal ownership of land and resources and when they display egalitarian political relations within 'bands' or small, mobile and non-stratified social groups (Lee and Daly 1999:3).

However, neither of these two components of the definition comes without problems. Many hunter-gatherers practice varying levels of land and resource management, which significantly overlap with horticultural-agricultural practices. For instance, scholars have highlighted that the categorical divide between of wild vs.

domesticated species do not necessarily account for different species and landscape management practices employed by foragers (Yasuoka 2006; Wiersum 1997). In the same vein, many scholars have pointed to problems of classifying modern societies who continue to hunt and gather, even though these are not their primary sources of livelihood (Levang et al. 2007). Furthermore, it is widely agreed that virtually all contemporary hunter-gatherer societies at least partially depend on some cultivated food or domesticated animal sources (Bahuchet et al. 1991; Headland 1987). And finally, with the exception of the few still noncontacted isolated groups (Lawler 2015; Walker and Hill 2015), virtually all contemporary hunter-gatherer societies are integrated at some level in the global market and the nation-state systems. Additionally, the explanation of economic division of labour in hunter-gatherer societies has also received numerous critiques from the feminist perspective. Such critiques have largely centred on the use of sexist language and omission of women's roles in hunting and gathering groups, largely showing that the sexual division of labour is culturally determined and that in hunter-gatherer societies women play an important role in the provision of household resources, sometimes including meat (Bliege Bird and Bird 2008; Brightman 1996). A recent article traces the influence of gender studies in hunter-gatherer research (Sterling 2014).

Scholars have also raised concerns with regard to the socio-political component of the proposed definition, especially when in combination with the economic component. For instance, when strictly applying the economic definition of foragers, all societies lacking horticulturalism, agriculture or pastoralism would be considered hunter-gatherers. This would include societies showing a complex socio-political organization (i.e., social stratification, sedentarization and complex storage technologies), such as those of the north-west coast of North America (Kenneth and Maschner 1999), and therefore falling outside the concept of non-stratified social groups typically used to define hunter-gatherers (Lee and Daly 1999:3). Conversely, if the definition of hunter-gatherer is only based on the notion of 'egalitarian bands', numerous small-scale horticultural and pastoral societies in Amazonia and Siberia would fit the bill, even though their primary subsistence is not hunting or gathering. Furthermore, the definition would exclude contemporary societies who subsist on hunting and gathering but who have had a long history of contact with a variety of neighbouring peoples, including agriculturalists and, more recently, nation-states.

In attempting to find an inclusive definition of hunter-gatherers, some scholars have also taken a cultural approach emphasizing the importance of the system of meaning that gives shape and coherence to hunter-gatherers' identity, irrespectively of the relation these groups establish with others. In Barnard's words, 'Bushmen do not cease to be Bushmen when they encounter other people or come to be dominated by them' (1979). Moreover, for some of these scholars, contemporary foragers' identity is precisely constructed in response to demands of local farmers, herders and traders (Biesele and Hitchcock 1999; Hoffman 1986).

In our view, the difficulty in finding an all-encompassing definition of hunter-gatherers largely lies in the immensely rich cultural diversity of our planet (Davis 2001). Hunter-gatherers in Central Asia have little social or cultural traits in common with hunter-gatherers in Africa or South Asia; although their economies might

contain similarities, their social contexts are quite different. Such cultural diversity, enriched by different historical developments and environmental contexts – which have, in turn, differently affected different societies – challenges any static definition. This observed diversity and the consideration that cultures are ever dynamic call for a periodic revisiting of the definition of 'hunter-gatherers', especially when applied to contemporary, changing societies.

Indeed, we do observe that in recent years, the application of the term 'hunter-gatherer' has moved from a largely undifferentiated description to a more flexible and observation-based use. Furthermore, we see two main tacit agreements in the way scholars use the term 'hunter-gatherer' in reference to contemporary groups. First, scholars largely agree on the need to differentiate 'complex hunter-gatherers' or societies that, despite depending on foraging, are populous; live in the same place for most of the year or for long periods; have developed food storage technologies; live in long-term, organized households and villages; gather specific food products which they combine with secondary resources; and have social hierarchies and generally inherited leadership (Kenneth and Maschner 1999; Woodburn 1998). Second, given that most living societies have a mixed-resource subsistence and that the strict application of the economic component of the definition would leave very few contemporary (but previously considered) 'hunter-gatherer' societies within the category, since the 1990s, scholars de facto use the term to refer to societies that, while still strictly hunter-gatherers in a recent past, nowadays might also engage in other economic activities, such as herding, cultivation or market transactions, although they do so mostly to cover and supplement subsistence needs (Huntington 1992: 15). These two considerations have allowed researchers to expand the array of past and present societies that fall within the category of hunter-gatherers. As the reader will note, we have also taken these two considerations into account when selecting the case studies for this book.

The Role of History in Understanding Contemporary Hunter-Gatherers

In contrast to the popular view depicting hunter-gatherer societies as ahistorical and static, modern anthropology acknowledges the importance of historical events as determinant in understanding contemporary hunter-gatherer societies. The ahistorical approach, i.e., using contemporary hunter-gatherers as analogues for historical and prehistoric societies, was common in the anthropological literature until the 1980s (Trigger 1998). The approach, however, began to receive critiques already in the late 1960s, after the 1966 'Man the Hunter' conference (Lee and Devore 1968). Soon after, Wolf's seminal book *Europe and the Peoples Without History* (1982) spurred a large stimulus to explore the links of foraging peoples with the wider world, both in the present and in the past. Thereafter, critiques to the ahistorical approach became common place, mostly based on the grounds that such an approach

was misleading as it ignored broader historical perspectives and political economic processes that resulted in hunter-gatherer societies being depicted as more bounded, more isolated and more pristine than they really are (see, e.g., Headland 1997; Schrire 1984).

Hence, since the 1980s, most anthropologists acknowledge that the past should not be ignored in exploring contemporary hunter-gatherers' existence. Having tacitly incorporated some of the critiques put forth by the revisionists (Barnard 2006), most scholars nowadays would argue that, for the most part, contemporary foragers have been integrated into larger regional or even international structures of power and exchange and that contact with neighbouring agriculturalist or pastoralist societies has shaped contemporary forager lifestyles significantly. Furthermore, it is also widely acknowledged that the life of contemporary hunter-gatherer societies has been and continues to be largely shaped by modern world phenomena such as resource depletion, land loss, forced resettlement, crowding, health problems, cultural interference and increasing reliance on cash, phenomena that have produced a variety of changes which shape the hunter-gatherer societies we know today (Schrire 1984; Woodburn 1988). The acknowledgement of the historical legacy in shaping contemporary foraging societies has had large implications for those using contemporary hunter-gatherers as analogues for prehistoric societies (Barnard 2006): If contemporary hunter-gatherer societies have experienced historical change (i.e., learned from experience, innovated or adapted to changes in their natural and social environments), their current situation might be far from that of past hunter-gatherers, for which extrapolating findings from contemporary hunter-gatherers to the past might be just inaccurate.

Taking historical processes into consideration has also allowed researchers to explore more holistic and less lineal paths than the ones typically leading from hunting-gathering to horticulture, agriculture and industrialization. For instance, researchers have found that, through time, specific societies seem to have fluctuated between varying degrees of hunting-gathering-fishing and horticulture. The anthropological literature describes cases in which historical processes have created foraging societies, i.e., agriculturalist, horticulturalist or pastoralist groups shifting to hunter-gatherers (e.g., Hoffman 1986). In sum, modern anthropological work largely acknowledges that different historical legacies play a critical role in shaping contemporary hunter-gatherer livelihoods.

Part I of this book presents two examples of specific historical trajectories that help us understand contemporary hunter-gatherers (or hunter-gatherer societies found in the historical record). In Chap. 1, Roscoe examines historical documentation regarding foragers in New Guinea and how the history of colonial expansion affected them. Being the 'Last Unknown', New Guinea foragers are among the most recently contacted, which has resulted in a wealth of historical and ethnographic documentation at contact and during colonial expansion. Drawing on such documentation, Roscoe examines the changes brought in by the colonial suppression of war in New Guinean forager settlement patterns, subsistence and political structures. He uses such evidence to put the question of whether settlement patterns, subsistence, leadership and symbolic culture observed among groups whose history

is less precisely documented (e.g., the !Kung, the Australian Aborigines, or the Mbuti) might at least partly be the product of their own historical legacy.

In Chap. 2, Ståhlberg and Svanberg examine the case of the Loplik in desert areas of the Tarim Basin (China). The argument they posit is that the Loplik were former pastoralists who, during a period of political turmoil, were forced to move into a harsh desert area. To adapt to the new environment, they developed a foraging strategy based on fishing, hunting and some gathering in the marshes of the deepest part of the Tarim Basin. When the first European travellers encountered the Loplik in the nineteenth century, they described them as foragers, as – at that time – they foraged, lived in small communities, were seminomadic and had a small population density, thus meeting the economic and subsistence requirements to be categorized as foragers. However, as Ståhlberg and Svanberg argue, such a definition could be applied to them only for a certain time and under certain conditions.

Environmental Change

It is widely acknowledged that the landscapes and biodiversity that some currently observe, and consider 'pristine', result not only from natural phenomena but also from centuries of environmental change through human management (Heckenberger 2003; Lombardo et al. 2011). Further environmental changes relate to ecological exchanges occurring since the colonial period (i.e., introductions of new species) and more largely to recent impacts of global environmental change. Thus, since the 1990s, scientists have noticed many prominent changes on ecosystems that were – until then – considered as scarcely anthropogenic. Such changes in ecosystems include changes in relative game abundances, what is referred to as the 'empty forest syndrome' (Nasi and Van Vliet 2011; Redford 1992); rapid declines in biodiversity, mostly stemming from significantly high levels of deforestation, habitat degradation and hunting pressures in areas like the Amazon Basin (Asner 2005; Paneque-Gálvez et al. 2013); or the rapid retreat of the sea ice that has defined the Arctic ecosystem for thousands of years (Krupnik and Jolly 2002; Weatherhead et al. 2010).

The relatively low levels of anthropization of the natural environment where hunter-gatherer societies live, together with the acknowledgment of the increasing growing pressures and threats that these ecosystems face, have long attracted the attention of conservationists (and several national governments) whose interests lie in safeguarding remaining the natural habitats and the ecosystem functions and services that these provide. To achieve such goals, many governments have invested in top-down conservation measures (i.e., the establishment of protected areas, hunting regulations and the like), typically entailing the banning or restriction of most, or all, extractive and productive activities (i.e., hunting and gathering) and – in some cases – even the exclusion and relocation of local communities (Chape et al. 2005; Maru et al. 2014). This has been the case for numerous nomadic hunter-gatherer societies around the world (Gilbert 2014; Hitchcock et al. 2009).

Faced with this situation, some researchers have argued that involving local communities – including hunter-gatherer groups – in conservation planning and management can be an effective means to achieve conservation outcomes without generating additional impacts on such populations (e.g., Biesele and Hitchcock 1999; Kothari et al. 2013; Porter-Bolland et al. 2012). Moreover, recently conservationists have started to acknowledge the contribution made by indigenous peoples and local communities to conservation through the recognition of Indigenous Peoples' and Community Conserved Areas (ICCAs) as protected areas (Kothari et al. 2013). While consensus grows on the need to involve hunter-gatherer groups and indigenous peoples in general in environmental management, researchers have also warned that – due to impeding and rapid social changes affecting these populations – there is also a need to better understand how social changes affect contemporary hunter-gatherers' local resource use and management, as those changes can contribute to either enhance or undermine the landscape and its resources.

While the literature addressing the relations between environmental change and hunter-gatherer societies is still scarce, one of the important contributions it has already made is to demonstrate that hunter-gatherers are particularly vulnerable to the many ecological changes derived from global environmental change (see, e.g., Doughty et al. 2010; Finer et al. 2015; Krupnik and Ray 2007; Pringle 2015). For example, several scholars have documented impacts on Inuit hunting practices as the Arctic ice melts (e.g., Berkes and Jolly 2001; Ford et al. 2008; Laidler 2006; Weatherhead et al. 2010) or Yupik ability to detect climatic change (Krupnik and Jolly 2002; Krupnik and Ray 2007). Moreover, compared to other groups hunter-gatherer's vulnerability to climate change is accentuated for several reasons. First, hunter-gatherers typically inhabit ecosystems particularly prone to the effects of global environmental change, e.g., marginal environments or high-risk areas (Bardsley and Wiseman 2012; Lefale 2010). Second, they have a direct dependence on local natural resources for their immediate livelihood needs (Kent 1996; Krupnik and Jolly 2002). And third, they often have a limited capacity to negotiate alternative strategies to adapt to change (Kimerling 2011; Maru et al. 2014). Surprisingly, however, much of this work has adopted an etic perspective, i.e., without considering forager's own perceptions of the impacts of environmental change on their livelihoods.

Part II of this book addresses the three topics just outlined. Bringing the argument that there is a need to better understand how local resource use and management by contemporary hunter-gatherers affects the landscape and its resources, in Chap. 3, Guèze and Napitupulu explore landscape management by a contemporary hunter-gatherer group in Indonesian Borneo, the Punan Tubu. Drawing on trailing data collected during a 6-month period among people in two villages, the authors provide a descriptive account of contemporary Punan spatial patterns of forest use, focusing on how such patterns vary across activities and villages. Findings from this work not only enhance our understanding of mobility patterns of contemporary hunter-gatherers but could also be of use in the design of community-based conservation strategies.

In Chap. 4, Ichikawa and colleagues provide a multi-level perspective of bushmeat hunting in the Congo Basin. They start by presenting the local and international drivers of bushmeat overhunting in the Congo Basin in general and in the territory inhabited by the Baka hunter-gatherers in southeast Cameroon in particular. They then describe how the set of policies established by the Cameroonian government to protect wildlife has restricted Baka access to bushmeat. The authors end the chapter describing an ongoing project among the Baka aiming to conciliate the goals of forest conservation and poverty alleviation through the sustainable use of forest resources.

In Chap. 5, Fernández-Llamazares and colleagues adopt an emic perspective to illustrate how contemporary defaunation (i.e., loss of species and decline in wildlife populations) is being integrated into the worldview of the Tsimane' of Bolivian Amazonia. Drawing on ethnographic accounts of the Tsimane', the authors explore how this global anthropogenic phenomenon is being interpreted at the local level and converted into a culturally relevant form through its integration within the Tsimane' mythological stories. The authors conclude by discussing how such interpretation could affect wildlife management in the area.

Similarly adopting an emic perspective, in Chap. 6, Virtanen explores how environmental degradation is being experienced and explained by the Apurinã people of southwestern Amazonia. The chapter focuses on the so-called master spirits and the narration of the death(s) of the chief of peccaries, emphasizing how nonhuman subjects are fundamental actors in the Apurinã's knowledge-production, namely, as their guides of everyday life. The analysis reveals how contemporary environmental changes are explained by the Apurinã as resulting from the non-natives' disrespectful acts towards nonhumans. The author concludes by discussing how Apurinã socio-cosmology is based on the understanding that humans cannot live well if animal and plant lives are excluded from sociality.

Changes in the World Economy

Anthropologists have traditionally looked at how the expansion of the market economy has affected hunter-gatherer livelihoods. Several studies document how former foraging societies have been forced into marginalized castes or become integrated into a majority population (e.g., Behrens 1992; Henrich 1997; Odysseos 2011). Thus, researchers have documented cases of foragers who have either specialized in the sale or barter of timber and non-timber forest products or have ended up working with handicraft, as peasants, or as wage earners alongside or within a majority population (Murdock 1968; Shah 2011). Much of the research on such cases has focused on local or regional markets, with some theoretical work discussing factors which might pull or push peoples from non-monetarized economies towards or away from markets (see Godoy et al. 2005 for a review).

As the maintenance of subsistence foraging as the main livelihood activity is intricately linked to the maintenance of many other social, economic and cultural characteristics, another popular line of inquiry has been to analyse how integration into

local or regional markets affects the lives of contemporary hunter-gatherers, specifically their foraging economic system. For example, researchers have analysed how integration into the market economy affects norms of reciprocity and gift giving (Henrich et al. 2010) or communal relations of production (Lee 1990). In a recent study among the Lanoh, one of the several Orang Asli groups in Peninsular Malaysia, Dallos (2011) documents how and why egalitarianism (i.e., flexible social organization, without permanent leadership) gives way to the development of social differentiation as this hunter-gatherer society adapts to the trading system.

But hunter-gatherers living in the twenty-first century do not only face increased access to local and regional markets; they also face the emergence of a global trading system with an increasing global demand for products and energy. For example, research among the Huaorani, in Ecuadorian Amazon, shows that, with vast reserves of oil present under their land, this group has quickly become integrated into national and international markets (Doughty et al. 2010; Kimerling 2011). The term 'world economy' or 'global economy' refers to the international exchange of goods and services, inseparable from the geography and ecology of Earth. Indeed, the expansion of the world economy has transformed many of the areas inhabited by hunter-gatherer societies (and other indigenous peoples) into commodity frontiers (sensu Moore 2000). Such areas represent some of the most remote corners of the world. While it is precisely this remoteness that left them unexplored and untargeted for resource exploitation until now, it is also the reason that explains why these areas are the last resource-rich hotspots of the planet. The rising global demand of a variety of products (i.e., precious wood, oil, mineral resources) coupled with the exhaustion of most accessible deposits has generated a situation of resource scarcity that is now pushing resource extraction into remote and previously unexploited areas (Moore 2000; Orta-Martínez et al. 2007). Mining companies move into new territories looking for old or new metals or other materials (coal, gas, uranium). Logging concessions or large areas of intensive agriculture of crops (sugarcane, tea, coffee or soybean) or tree plantations (rubber, cellulose or oil palm plantations for biodiesel) substitute previously forested areas to produce inputs for global economic centres. When such 'commodity frontiers' overlap with the territories of contemporary hunter-gatherers, the new economic activities are likely to heavily impact on local communities' livelihood base and cultural system. While responses to such new economic developments in forager lands vary, with some groups opposing extractive activities and other groups engaging in negotiations with extractive industries (O'Faircheallaigh and Corbett 2005), all in all conflicts generated by the presence of transnational corporations on the land of contemporary hunter-gatherer societies seem to be on the rise (Finer et al. 2015; Swing 2011; Tollefson 2011; Walker and Hill 2015). Such global trends and pressures are the cause for ever more concern with regard to the resilience of the few remaining societies in the world who have chosen to live in isolation or with minimum contact (Lawler 2015).

The three chapters in Part III of this book address how hunter-gatherer societies are affected by, and in turn perceive, cope and adapt to, such shifts in economic systems. In Chap. 7, Kramer and Greaves analyse the internal dynamics and political strategies of hunting and gathering societies that maintain a forager livelihood. Specifically, they question why, despite the availability of other economic alterna-

tives, hunting and gathering remain a viable strategy for mobile Pumé foragers living on the Llanos of Venezuela. The main argument of the chapter is that the Pumé make active decisions to maintain a hunting and gathering way of life instead of moving to agricultural communities. Such decisions are based on (1) the economic returns to foraging, which provide equal or higher returns compared to the horticultural alternative and (2) the social costs to abandon foraging being too large and unbearable.

In Chap. 8, Napitupulu and colleagues explore how sharing is being modified with increasing participation in development projects and the market economy. Their case study focuses on the Punan Tubu from North Kalimantan, Indonesia. Results from this work suggest that the ethic of sharing and the practice of demand sharing still prevail among the contemporary Punan and that sharing behaviour is neither directly related to individual levels of integration into the market economy nor to participation in national development programmes. The authors, however, do find that there are variations between the different products being shared, depending on (1) their visibility, (2) their cultural meaning and (3) the division of labour during the production of the item. The authors conclude that such variations might impact on future sharing trends.

In Chap. 9, Thorton and Momontova examine processes by which Alaska and Siberian hunter-gatherers have been rendered as political subjects: first as 'traditional' hunters-gatherers and later as sustainable enterprise owners, amid their respective colonial and post-colonial industrial economies. They start by showing how in Siberia and Alaska, subsistence and commercial fishing economies are mixed, despite state efforts to enforce boundaries between the two economies. The empirical part of the chapter examines the relationship of Sakhalin and Southeast Alaska indigenous hunter-fishers as strong, independent peoples whose salmon fishing rights were usurped and their corporate groups reorganized to fit notions of modern industrial and neoliberal social-economic organization. The authors conclude by arguing for more synergistic policies between the indigenous subsistence and commercial economies to reduce 'black market' transactions and conserve valuable fishing knowledge, skills and cultural practices which are vital to heritage, livelihoods and wellbeing.

Globalization and Cultural Change

Concomitant with the process of integration into the market economy, many hunter-gatherer livelihoods have engaged in increasing participation (whether voluntary or forced) in the surrounding societies of the nation-states in which they find themselves today. Their incorporation as 'citizens' into nation-states is seen as a powerful driver of cultural change, defined as the changes that take place in a culture through interactions with people from another culture (Berry 2008). Although for most contemporary hunter-gatherer societies the processes of integration into the market economy and cultural change are simultaneous and linked, these two

processes are not equivalent in terms of process and effects, largely because cultural change refers not only to changes in material measures or economic indicators but also to worldviews, ideas and values (Godoy et al. 2005).

Researchers have documented how nation-states have driven cultural change in previously isolated hunter-gatherer groups through, for example, sedentarization policies, development projects (including economic subsidies) or the promotion of schooling or national health systems (Castagno and Braboy 2008; Crawhall 1999; Gilbert 2014). Specifically, sedentarization has been one of the main strategies of nation-states in their attempt to govern previously mobile hunter-gatherers, mainly as the modern nation-state sees nomadic or seminomadic peoples as a threat to the principles of private property and state domination (Gilbert 2014). Therefore, sedentarization has been promoted in direct and indirect ways, such as through development projects favouring sedentary forms of exploitation (i.e., agriculture and commercial livestock production) or through the establishment of policies for sedentary intensive farming, changes that often deeply affect foragers' livelihood, as the case of the San suggests (Kent 1996). National government-driven sedentarization schemes have been a means of getting previously nomadic people to contribute more actively in the nation's labour force and national economy. Such schemes have often been accompanied with government-funded schools and basic healthcare facilities.

Yet, in the same way that hunter-gatherers living in the twenty-first century face pressures of global trading systems, they also face cultural globalizing pressures that go beyond the influence of the nation-state in which their territories are found. The term 'globalization' refers to the process of international integration arising from the interchange of world views, products, ideas or other aspects of culture and promoted by increased contact and interaction of different cultures, with faster transportation and communications at a global scale. Some anthropologists have started to analyse how globalization changes the worldview of contemporary hunter-gatherers (Doughty et al. 2010; Tacey 2013).

It is also worth noting that some scholars have taken an interest in analysing how the very same drivers of globalization (faster transportation and communications) have been used by contemporary hunter-gatherers to meet their own interests. For instance, eased access to transportation and communications has enabled the organization and coordination of movements promoting the civil, political, social, economic and cultural rights of hunter-gatherers and generally indigenous peoples. Mobile phones and other technological devices have enabled such groups (even in remote areas) to partake directly in mapping, monitoring, evaluation and citizen science work, to demarcate their lands and resources and to voice and claim their rights more effectively (see, e.g., Gearheard et al. 2011; Gill et al. 2014; Pulsifer et al. 2010). Such processes have led to many contemporary hunter-gatherer groups having their own representative bodies, many of which are linked to local, regional, national and international level organizations.

Part IV of this book focuses on globalization and cultural change. In Chap. 10, Brightman and Grotti examine the historical and contemporary relations between indigenous peoples in and out of isolation in the Guiana Shield region of northeast-

ern South America and discuss the role of indigenous missionaries in histories of contact. Their chapter focuses on the Akuriyo, possibly a horticulturalist society that suffered fragmentation and reduction during the European conquest, resulting in their isolation and loss of agriculture. From the 1940s onwards, and as a result of the activities of American evangelical missionaries in the region, the Akuriyo have been recontacted, mostly through the Trio, another indigenous group in the region which has embraced the missionization of other indigenous groups. Brightman and Grotti conclude by assessing the ethical dimensions generated by the role of converted indigenous peoples in missionizing other groups as they (re-)emerge from isolation.

The next two chapters focus on how cultural change affects children in foraging societies. In Chap. 11, Gallois and co-authors analyse the impacts of impeding social-ecological factors on the acquisition of local ecological knowledge among the Baka, a hunter-gatherer society in southeastern Cameroon. The chapter evaluates how parental livelihood strategies relate to children's daily activities. Results presented in this chapter indicate that children's involvement in daily activities is not directly associated to parental indicators of cultural change, for which the authors conclude that cultural changes affecting Baka society might be so pervasive as to affect all children equally, beyond direct parental influence.

In Chap. 12, Meehan and colleagues explore whether the degree and pace to which hunter-gatherers are experiencing social, economic and environmental change may have created conditions that alter infant care patterns of hunter-gatherer life. The singularity of the study lies in that the authors examine detailed quantitative data from naturalistic behavioural observations on infant care collected among Aka forager infants over almost 20 years. The main finding of the chapter is that infant care practices seem to be resistant to change, at least to date, a situation that the authors explain as being due to the maintenance of other features of Aka life such as egalitarianism, sharing and autonomy, which make the Aka infant care patterns remain adaptive.

In the last chapter of this book, Benyei and colleagues examine how the intensification of impacts on indigenous communities (including hunter-gatherer groups) brought by globalization processes has also seen a shift in the manners in which such groups have responded to them. They explore the interlinked nature of global impacts and local responses by focusing on two case studies that have used a new methodology of scientific enquiry that enables indigenous communities to lead scientific activities and to confront conflicts through a truly bottom-up approach. The chapter ends by discussing how, despite the potential of such new manners of contestation, the power imbalances that currently underpin many indigenous conflicts are first to be addressed.

Conclusion

Previous anthropological literature has highlighted that most contemporary hunter-gatherer societies are a reflection of how these societies have interacted with and been affected by surrounding circumstances. Today's unprecedented planetary-scale changes – at ecological, economic and cultural levels – bring a new dimension to this understanding. The contributions to this edited volume explore some of the drivers of global change that affect contemporary hunter-gatherers and how contemporary hunter-gatherers reject, react or adjust to some of the global environmental, economic and cultural pressures affecting them. As such, these contributions help in providing a realistic view of what it means to be a forager in a *fast*-changing world.

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Part I
The Historical Legacy

Chapter 1
The Fortunes of Foragers in Colonial and Post-colonial New Guinea

Paul Roscoe

Abstract At contact, New Guinea was home to at least 30 forager groups of one kind or another. As one of the last regions on Earth to fall under colonial control, it therefore provides an unparalleled opportunity to examine how and with what consequences foraging communities engaged with colonial and post-colonial forces. Their experiences were profoundly shaped by a complex conjunction between local subsistence regimes and the logistics of colonial expansion. Groups located on waterways depended on wild sago and aquatic resources and comprised some of the largest villages in all New Guinea. They were also easily accessible to colonial vessels, however, and were therefore some of the earliest and the most profoundly affected by contact. Groups that depended on wild sago and terrestrial fauna, by contrast, formed small, low density, semi-mobile polities, and because they were isolated in the swamplands of the interior, they were among the last and least influenced of New Guinea's communities. This chapter traces the historical contours of these different conjunctions and follows the chains of transformation they set in motion, from the initial and profound consequences of the suppression of indigenous warfare, through the economic effects of a burgeoning engagement with capitalist economies, to their impact on the political and cosmological realms of forager society.

1.1 Introduction

Every forager community that anthropologists have ever studied was already in an early or more advanced stage of encapsulation by colonial or post-colonial states. Yet much of our knowledge about forager lifeways prior to colonialism is grounded in inferences or ethnographic analogies drawn from this dataset. It is therefore important to understand how colonial and post-colonial matrices may have affected these communities.

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Anthropologists have not commonly thought of New Guinea as a home to foragers, but there is strong evidence that, at contact, at least 30 of its language groups could by most definitions be classified as foragers of one kind or another (Roscoe 2002, 2005). New Guinea was also The Last Unknown – one of the last terrains on Earth to encounter the forces of colonialism. It thus provides us with an unparalleled opportunity to glimpse not only the ethnographic contours of foraging communities at contact but also to address the concerns of this volume: how did these communities engage with colonial and post-colonial forces, and how did the experience change them?

1.2 The Foragers of New Guinea

There is a widely held misconception that "the subsistence base for all New Guinea societies is root crop horticulture. There are no societies in New Guinea which only hunt, forage, and collect; every society is dependent to some extent on horticulture" (Rosman and Rubel 1989:27). A detailed review of the New Guinea ethnographic record, however, turns up numerous references to "hunters and gatherers" (Roscoe 2002), and at least ten contact-era groups appear to have subsisted almost entirely by wild resources (defined as resources that people have not themselves intentionally bred or planted). Another 20 or so procured at least 90% of their calories from the wild, and a further 20 probably obtained 75–89% of their calories from foraging.

It is a well-known bias in the contemporary ethnographic record of world foragers that the sample skews markedly towards those that inhabited marginal environments such as deserts, arctic wastes, and dryland tropical rainforests (on Porter and Marlowe's (2007) claim to the contrary, see Roscoe 2014:238). One virtue of the New Guinea record, therefore, is that it helps remediate this distortion: its foragers had access to a richer resource base, which was reflected in densities that were generally higher than those of the standard forager file (Table 1.1; Roscoe 2014:229). Consequently, they are arguably better ethnographic analogues than their contemporary counterparts for the majority of pre-Holocene foragers, who likely inhabited more productive environments.

The mainstay of the New Guinea forager diet was the starch of the wild sago palm (*Metroxylon* sp.). Sago is an attractive subsistence resource because it is highly reliable and yields an abundance of calories for very little effort. A half hour's work in the sago groves is usually adequate to furnish a forager's entire daily energy requirements (Roscoe 2005:558–560). The disadvantage of sago is that it provides almost no protein or fat (Ruddle et al. 1978:57, 61–67); in consequence New Guinea's contact-era hunter-gatherers were critically dependent on aquatic and terrestrial game to meet the rest of their nutritional needs.

The particular balance between aquatic and terrestrial game in New Guinea forager diets had major implications for their density, settlement size, mobility, and cultural complexity, in ways that are now familiar to students of forager societies (e.g., Arnold 1996:78; Keeley 1988; Kelly 2013:242). Those whom I shall call

Table 1.1 Contact-era characteristics of New Guinea forager communities mentioned in the text (Clouse 2002; Martin 1997:123, 126; Roscoe 2005:560–563, 570–572; 2006:33; Roscoe and Telban 2004:103)

Community	Density (/sq.km)	Mobility	Polity Size
Hunter-foragers			
Alamblak	1.6	Sedentary	17
Arafundi (Lower)	2.0	Sedentary	120
Bahinemo	0.2	Semi-sedentary	40
Berik	0.6	Semi-sedentary	94
Iau	1.2	Semi-sedentary?	65
Kirikiri	1.1	Nomadic	NA
Sanio-Hiowe	1.6	Semi-sedentary	20
Sikaritai	0.8	NA	NA
Fisher-foragers			
Asmat (Kawenak)	3.0	Sedentary	505
Jaqai	3.9	Semi-sedentary	110
Kambot	4.6	Sedentary	300
Kamoro	NA	Semi-sedentary	NA
Kapriman	2.3	Sedentary	190
Karawari	2.0	Sedentary	80
Purari	4.7	Sedentary	856
Waropen	25.8	Sedentary	700
Trader-foragers			
Kwoma (Hill)	6.3	Sedentary	275
Murik	3.5	Sedentary	230

Nomadic = move at least once every few weeks; Semi-sedentary = move less than once every few weeks but more than once every half year; Sedentary = move less than once every half year; NA = Not available

hunter-foragers supplemented wild sago with terrestrial and arboreal game, and they generally had lower densities, greater residential mobility, and smaller polity sizes than those I term *fisher-foragers*, who combined sago with aquatic faunal resources (Table 1.1; Roscoe 2006). Where fisher-foragers resided in large, nucleated settlements, most hunter-foragers followed an oscillating settlement pattern, spending most of the year in small dispersed bush camps but congregating from time to time for social and ceremonial purposes in a central settlement, sometimes a group of fortified tree-houses, but more often a handful of houses located on a hill or bluff. These hunter-foragers lacked corporate groups and were politically egalitarian, in contrast to fisher-foragers whose organization was grounded in corporate groups and who had recognizable leaders, some of them hereditary. A third category of foragers, whom I call *trader-foragers*, depended on aquatic resources and consequently were culturally similar to fisher-foragers. They differed, though, in so far as some were fisher-folk who had to export a portion of their harvest to trade partners to obtain their sago staple, while others were fisher-folk by proxy, exporting sago in order to procure fish and crustaceans, which made up their faunal staple (Roscoe 2002, 2005).

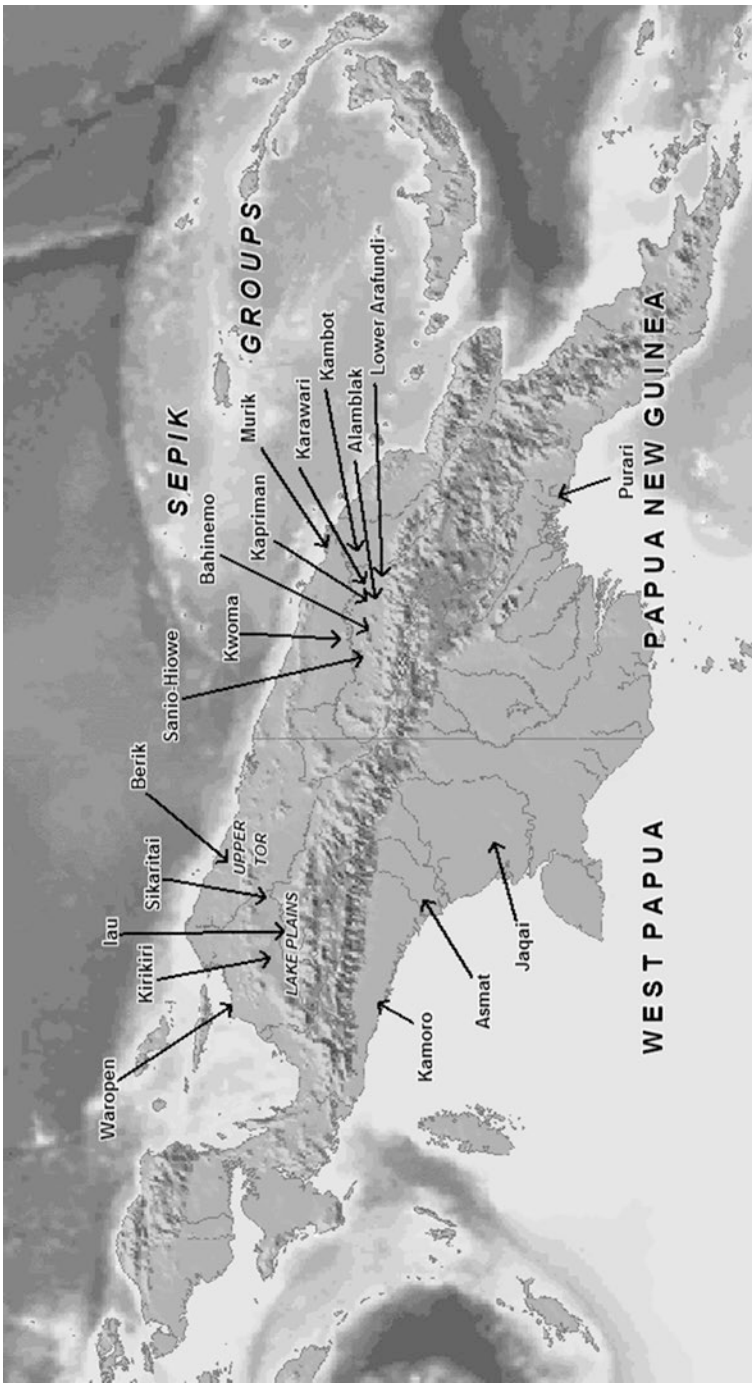

Fig 1.1 New Guinea forager communities mentioned in the text

Table 1.2 Timeline of colonial encapsulation and main consequences for forager societies (Pouwer 1999; Souter 1963)

Date	Historical developments	Main consequences for forager life
1526–1880s	**Colonial contact** European explorers make sporadic contact with coastal New Guinea populations.	Occasional contacts with coastal fisher-foragers; negligible effects on forager life.
1880s–1920	**Early colonial period** Southeast New Guinea becomes British New Guinea, and then the Territory of Papua under Australian control in 1905. Northeast New Guinea becomes German New Guinea. Western New Guinea becomes Netherlands New Guinea. Dutch military exploration force undertakes extensive exploration.	*(a) Fisher- and trader-foragers:* First administrative contacts with, and pacification of, south coast and northwest coast groups; indigenous village officials appointed. Some settlement-pattern changes. Steel and other trade goods, exotic diseases enter some south coast and Sepik groups. First missionaries among south-coast groups. *(b) Hunter-foragers:* Occasional contacts; largely unaffected.
1920–1940	**Mid-colonial period** German New Guinea becomes Mandated Territory of New Guinea. Gradual extension of colonial control throughout the island.	*(a) Fisher- and trader-foragers:* Labour recruitment gets underway. Trade goods spread. Many groups lightly missionized. *(b) Hunter-foragers:* Largely unaffected; first administrative contacts with northwest interior groups.
1941–1945	**World War II** The Japanese 18th Army sweeps from north to south across the island but fails to reach the south coast. In fierce fighting, US and Australian forces push the Japanese back to the north coast and eventual surrender.	*(a) Fisher- and trader-foragers:* Sepik, northwest coast, and southwest coast groups markedly affected by fighting and exotic disease. *(b) Hunter-foragers:* Some Sepik groups marginally affected by fighting.
1946–1980	**Late-colonial period** 1947: Territory of Papua and Mandated Territory of New Guinea become the Territory of Papua New Guinea, under Australian control. 1962: Netherlands New Guinea surrendered to Indonesian control, and annexed by Indonesia in 1969 as the Province of Irian Jaya. 1975: Territory of Papua New Guinea becomes independent nation.	*(a) Fisher- and trader-foragers:* Heavy labour recruitment and missionization of most groups. *(b) Hunter-foragers:* First contacts with Lake Plains groups; first administrative contacts with most Sepik groups. Settlement-pattern changes. Labour recruitment and light missionization of most groups underway.

New Guinea's foragers were all to be found in the island's wet-lands (Fig. 1.1). Seasonal freshwater flooding in these regions provided the optimal conditions for the wild sago on which they depended to thrive, but the same conditions also appear to have marooned them in a kind of subsistence *cul-de-sac*, unable to intensify their production of food to support higher densities. They could not easily intensify hunting or fishing production – the subsistence activities that limited their population levels –without eventually impacting their reserves, and their water-logged environments prevented them from increasing subsistence production through cultivation or pig production.

1.3 European Contact and the New Guinea Forager

The history of colonial expansion (Table 1.2) and the geographical distribution of its forager communities had the odd result that New Guinea's fisher-foragers and trader-foragers were among the first to be contacted by Europeans, while its hunter-forager groups were among the last. Fisher-foragers and trader-foragers were all located on, or in the immediate hinterlands of, coastlines and rivers, and in an era when ships provided the main means of mechanized transport these waterside communities quickly fell under colonial influence. The coastal Kamoro, for instance, were first contacted in the early 1600s and the Asmat and Waropen in the 1700s, though it was not until the late 1800s or early 1900s that contact began to have any significant effects on their communities.

Located in some of the most remote and swampy areas of the interior, New Guinea's hunter-foragers were among the last to fall within the colonial reach. A few experienced early contact with European explorers. A Bahinemo forager and his dog encountered the German geographer Walter Behrmann (1924:67) and his entourage as they trekked through the Hunstein Mountains in the early 1910s, and around the same time the Polish adventurer Moszkowski (1928:114–122) was poling his way across the Lake Plains. But it would be many decades more before any of these groups fell under effective colonial control. And it was the early 1960s before Australian patrol officers began making regular contacts with the Bahinemo and Sanio-Hiowe, for instance, and the early 1980s before groups in the Lake Plains, such as the Kirikiri, even encountered their first outsiders (Clouse 2002; Hunter 1962:12, 15; P. Townsend 1969:8).

1.4 The Vectors of Change

1.4.1 'Pacification'

This contact history had a variety of effects on New Guinea forager lifestyles but none was more transformational than the first: 'pacification.' Contrary to a popular perception that 'simple' hunter-foragers do not practice war (e.g., Fry 2006; Kelly 2000; cf. Allen and Jones 2014), every New Guinea forager community at contact

was either episodically or permanently at war with at least one of its neighbours. Gold miners, missionaries, and administrators were all to have their effects on the island's forager populations, as we shall see, but it was the colonial suppression of their warfare more than anything else that shaped their post-contact world.

At the start, as they struggled to establish an imperial footprint, British, German, and Dutch colonial authorities did little to stop indigenous fighting beyond the occasional admonishment. Once established, however, they soon began to back their admonishments with firepower. Often, it was sufficient simply to demonstrate the power of European weapons to convince local people that they should lay down their spears, bows and arrows, and clubs. If that failed, the authorities took to dispatching punitive expeditions to shoot up and raze offending villages. Later, as legal infrastructures were established, they began a process of arrest, trial, and public hangings. Fragmentary evidence suggests that hanging proved particularly effective, if only because local people could not comprehend what kind of creature a government officer was who could kill in the very coldest of blood.

'Pacification' changed forager lives dramatically. As the enduring threat of attack from neighbouring communities eased, settlement patterns, subsistence regimes, and political structures all underwent major changes. The effects on settlement patterns were complex. A few of the very largest fisher-forager villages split apart. While before they had tolerated long commutes to their subsistence resources in return for the military security of living aggregated in large and nucleated villages, they could now reduce their travel costs by dispersing across village territory. The massive Purari village of Ukiaravi, for instance, which numbered some 2500 people at contact, splintered into four smaller, dispersed villages shortly after pacification and had become six villages by 1939 (Maher 1961:45–47, 49, 51; 1967:310; see also Holmes 1924:93). Among the Purari and the Karawari people, families who would never have dared to stay overnight at a bush-hut before pacification were soon spending time away from the main village (Maher 1961:46; Telban 1999: pers. comm.). By the early 1950s, in fact, over a third of Purari people were away at their bush camps on any particular day (Maher 1961:103).

In contrast, many hunter-foragers aggregated – rather than dispersed – as warfare was suppressed and the need for defensive security waned. For these low density groups, defensive security in the days of war had come from dispersal into small mobile camps, which their enemies found exceptionally difficult to locate (Roscoe 2016:27–29). As peace spread, however, populations such as the Bahinemo and the Sikaritai began to spend a greater portion of the year in their central settlements rather than in their small bush camps (Dye 1990:221; Martin 1997:126). In several other cases, hunter-foragers moved their settlements down towards major waterways, aggregating in the process with other hunter-forager settlements. A number of Sanio-Hiowe hamlets, for instance, moved from the Sepik Hills down to larger, more sedentary settlements on the lower reaches of the Wogamus River (Townsend 1978:33). By 1990, more than a third of the Bahinemo population, which had once lived as eight communities spread across thirteen hundred square kilometres of rainforest, was living in a single settlement on Lake Wagu (Dye 1990:221). To the east, the Alamblak who at contact lived in about 24 small hamlets in the hill country south of the Blackwater River, moved down to form eight new villages on the

Karawari and Wogupmeri Rivers (Haberland and Seyfarth 1974:7, 12–13, 16–17). Several of the Upper Tor groups in West Papua likewise aggregated in settlements on the lower reaches of the Tor River (Westrum 1982:52–56).

These settlement shifts were partly a response to pressure from missionaries and colonial administrators, which affected nomadic fisher-foragers as well as hunter-foragers. Colonial authorities persuaded the fisher-forager Kamoro of West Papua, who traditionally had migrated back and forth between up-river sago groves and coastal fishing settlements, to build more permanent villages towards the coast (Muller 2004:37; Pouwer n.d.:13, 85). The greater effect, though, was on hunter-foragers. Patrol officers in the Territories of Papua and New Guinea, weary of trekking through large tracts of remote bush to census and administer small widely scattered hamlets, pressured hunter-forager groups to relocate in spots more accessible to their patrol posts. With defensive imperatives now relaxed, many were content to comply since moving often provided better access to water and to the material goods and economic opportunities offered by the waxing colonial presence.

As settlements fissioned or shifted and the degree of sedentism increased, forager subsistence changed. Those hunter-foragers who moved to be closer to waterways likely added more fish, shellfish, and other aquatic resources to their diets. For many, though, the more significant impact was on dietary sago. Foragers whose settlements had fissioned or relocated found themselves in environments that sometimes had inadequate stocks of wild palm to support them. Those who had become more sedentary or who had aggregated their settlements recognized that stands of wild sago were dwindling under the increase in population pressure and in response took to planting sago. By the end of the last century, the Lower Arafundi villages of Woblamas and Yamandim were both planting sago where once they had subsisted solely on the wild palm (Telban 2002:pers.comm). After shifting their villages to some of the few areas of dry land in their territories, Purari fisher-foragers appear to have abandoned wild sago gathering altogether in favour of planting the palm (Maher 1961:17 cf. Ulijaszek and Poraituk 1983:577–578).

At contact, a few hunter-foragers had practiced a desultory incipient cultivation. With population pressure growing in their new environments, however, more groups took up plant cultivation. Having adopted a more sedentary life in their central settlements, the Bahinemo began to plant small gardens because many of their forest products were now too far away (Dye and Dye Bakker 1991:2). The Iau of the Lake Plains took up gardens after they had moved to be closer to a newly established mission station and airstrip in their territory (Bateman 1982:39–40; Miehle 1985:82, fn.1). The Lower Arafundi inhabitants of Woblamas and Yamandim did the same after moving out of the swamplands they had occupied at contact, where cultivation had been impossible. The fisher-forager Karawari took up gardening for quite a different reason: now that it was safe to overnight in small garden camps, they could afford to cultivate patches of dry land that had long lain unused on the borders of their territories (Telban 1999:pers. comm.). As they spent more time in their central settlement and as their access to a wider world improved, the Sanio and Bahinemo were able to add coconuts to their diet for the first time (Hunter 1962:11; P. Townsend 1969:56).

1.4.2 Technological Change

The effects of pacification went far beyond its direct consequences on settlement patterns, locations, and subsistence. Pacification was pivotal also in expediting other forces that brought further change. Once fighting was suppressed and barriers to interaction fell, the spread of steel tools accelerated, transforming work life everywhere. Steel had begun to trickle into Sanio-Hiowe hamlets along traditional trade routes in the 1950s but, once regular administrative patrols had been instituted, a trickle became a flow, and by 1966 steel was replacing traditional tools (W. Townsend 1969:199).

The beneficial effects of steel were less pronounced in New Guinea's forager communities than on the rest of the island's inhabitants, who cultivated the land rather than foraging it. Whereas cultivators found steel axes and bush knives to be an enormous advantage in clearing land for extensive cultivation (Rappaport 1967:261; Salisbury 1962:220), foragers found them poorly adapted to felling a sago palm and pounding out its pith. With their slender head or blade and their sharp edge, steel tools tend to stick fast in the soft core of the palm; as a result, sago gatherers still often use sago pounders of organic rather than steel materials. Hunting technology, too, went largely unchanged. Although pig spears and fishing harpoons are frequently equipped with steel points (e.g., Held 1957:342–344), arrows are still manufactured entirely from organic material because metal tips, being heavier than traditional hardwood or bamboo heads, upset aerodynamic stability and reduce range. Shotguns have also entered the hunting armoury, but because hunter-foragers – those who could make the most use of them – live in some of the most inaccessible parts of the island, their use is commonly limited by chronic shortages of ammunition.

The advent of steel and other foreign technologies have conferred some advantages on the island's foragers. Steel blades might have limited advantages in felling and pounding sago palms, but they provide marked economies of labour when it comes to other trees. W. Townsend computed that steel blades had a 4.7:1 advantage over stone in working harder woods, which translated into overall labour savings of 7 % in constructing a typical Sanio house (W. Townsend 1969:203–204). Fisher-foragers also found steel advantageous in manufacturing dugout canoes and tipping their fishing spears and harpoons, and they profited as well from the introduction of steel fish hooks, stronger fishing line, nylon nets, and, in more recent years, outboards motors (e.g., Held 1957:342; Lipset 1985:85).

1.4.3 The Cash Economy

In the wake of World War II, the colonial reach began to ramp up and foreign monetary economies began to wash more earnestly over New Guinea's shores. In contrast to the island's cultivating communities, which were able to capitalize on

administrative programs promoting dry rice, copra, coffee, cocoa, and peanut cultivation, foragers found their wetland environments unsuited to cash crops. This left labour migration as the main cash-earning opportunity, and from an early time young male foragers began to leave for indentured labour opportunities on the burgeoning gold fields, plantations, and urban centres of New Guinea. The effect was most pronounced in the Territory of Papua and New Guinea, which was under Australian control, much less so in Netherlands New Guinea. Among Kambot and Kapriman fisher-foragers of the Middle Sepik River and Murik trader-foragers of the Sepik Delta, 7–9 % of the male population was routinely absent on labour contracts between 1930 and 1962, rising in some years to between 11 and 15 %. Male absenteeism among the fisher-forager Purari was running at about 18 % in the early 1950s, though this also included students (mostly male) away at school. When censusing of hunter-forager communities in the more remote Sepik swamplands began in the 1950s, it found slightly lower figures: 4–7 % of Lower Arafundi and Alamblak males were routinely absent, rising in some years to 11 % (Amboin, Angoram, and Wewak census registers, 1928–1962; Maher 1961:39–43,104).

Although we have no direct information on the matter, this scale of male absenteeism must have impacted the division of labour in the home community, though fisher-foragers may have been less affected than hunter-foragers because most of the fishing in these communities is done by females while most hunting is male work. Sago processing, though, involves both sexes, so male absenteeism would have thrust an increased the labour burden on men who remained at home and may also have made subsistence more precarious for some women and their families.

These challenges notwithstanding, labour migration brought cash and exotic goods into the community, and though the amounts were not large, they had noticeable consequences. Some were superficial: T-shirts, shorts, blouses, and skirts replaced loin coverings and sago-frond skirts. By the 1980s, some people could afford radios, which brought a modestly greater awareness of the outside world into their settlements. More recently, as kin in urban centres funnel part of their earnings back home, some foragers even have cell phones though, in the case of the Karawari, at least, these are seen as a means of communicating with the dead as much as with the living (Telban and Vávrova 2014).

The more profound development, though, was the inroad that cash made into forager economies that had been based on shell valuables. Since most forager communities practiced sister-exchange rather than bride-wealth marriages, the effect on marriage transactions was not great, though banknotes began to assume a more prominent position in the wealth payments that accompanied life-cycle events. Because cash could purchase western and other goods from a burgeoning network of trade-stores, however, it had a greater impact on the trade networks in which at contact New Guinea's foragers had been embedded. Settlement relocation had already introduced a measure of instability into trading institutions, but trading patterns began to shift and trade relations eventually to crumble as cash opened up access to exotic goods and as traditional commodities fell out of fashion. Trade-store salt replaced salt leached from the ashes of ferns and other plants. Enamel and aluminium pots and plates took the place of less durable clay versions, and ornaments

made from glass, porcelain, cloth, metal, and other exotic materials supplanted traditional necklaces, breastplates, and other decorations of stone, feathers, shells, dogteeth and pig tusks.

The effects were perhaps most marked on the Murik, trader-foragers of the Sepik Delta, whose villages at contact had functioned as a kind of entrepôt, annually shuttling a wide range of subsistence goods and prestige commodities over a hundred or more kilometres of ocean to the Schouten Islands, along the Sepik coast, and up the Sepik estuary into the interior. In the early years following pacification, the Murik were able to add new links to this network, but by the 1980s its reach had contracted considerably, its patterns had shifted, many commodities had dropped out of the trade, and it had become partly monetized. In addition, the fish-for-sago trade on which the Murik depended for their subsistence had become more precarious because their sago suppliers in the interior could now buy fish from other outlets, while they themselves had nowhere else where they could procure sago (Barlow 1985:111, 114; Barlow et al. 1986:18; Lipset 1985:75–76, 79, 85).

1.5 The Demographic Effects of Contact

Operating through several channels, contact had complex and damaging consequences for the demography of New Guinea societies until the spread of western medical services eventually began to counter the effects. Because their waterside locations put them on the front lines of European contact, fisher- and trader-foragers were particularly badly affected by new diseases. Along the south coast, fisher-forager communities appear to have been exposed to gonorrhoea and were probably hit by the 1919 influenza pandemic, which in some areas took away almost 20 % of the population (van Baal 1966:24). Between the early 1920s and the early 1950s, the Purari of the south coast lost slightly more than a third of their population (Maher 1961:105). In the Sepik, the sicknesses that the Australian and Japanese armies left in their wake during and immediately after World War II were particularly damaging. A patrol to Kambot fisher-forager communities estimated that some 20 % of the population had died of a meningitis-like epidemic that people referred to as the Japanese sickness (McIntyre 1946:1, 3–4). By disrupting normal life, the War also seems to have caused birth rates to fall in both areas, a decline that post-War labour migration only accelerated by splitting young married couples up for periods of 3–6 years at a time.

Although there are no hard data to support the contention, hunter-forager demography may not have fared so badly. For one thing, hunter-foragers still spent much of the year dispersed in small bush camps deep in remote jungles, which limited their contacts with the outside world. For another, their population densities were some of the lowest in New Guinea, which hampered the spread of exotic diseases that did make it into their territories. Even so, age-sex pyramids for the people of the Upper Tor Valley reveal an incision among people aged 13–17 years – those who were born when World War II was at its height on the north coast. Before that, epi-

demics of influenza and possibly whooping cough had already "decimated" a couple of tribes (Oosterwal 1961:44–45, 273). By aggregating and relocating in the wake of pacification, moreover, some communities likely increased their exposure to exotic disease. This might be why, for 2 years, every infant born at the Bahinemo's new village site on Lake Wagu (see earlier) died before an American missionary family arrived and began to provide western medical services (Dye 1990:222).

1.6 The Political and Ideological Consequences of Contact

We know far less about the effects of contact on the sociological, political, and cosmological domains of forager life than on their settlement, subsistence base, economic, and demographic patterns. If colonialism affected kinship and marriage patterns, for instance, we know almost nothing about it. Certainly, though, pacification had a major impact on forager leadership forms. Prior to contact, a man's performance in war – his courage, military skill, the number of his kills or, in the case of fishing and trading foragers, the number of heads he had taken – was a major determinant of his status and, derivatively, of his influence in a community. Among the fisher-forager Asmat, Zegwaard (1959:1040) observed at a time when they were still warring "all prestige, and therefore all authority is ultimately derived from achievements in war. It is impossible to be a man of social standing without having captured a few heads. A bunch of skulls at the door post is a measure of status." Among the trader-forager Murik, "great esteem" accrued to men who were "good in war" (Schmidt 1926:56–57, my translation). Likewise, for the hunter-forager Alamblak: "Warfare was the primary avenue for the demonstration of power", "power" here meaning a personal quality of being graced by the ancestors (Edmiston and Edmiston 1989:25; see also for the Jaqai, Boelaars 1971:28; 1981:58, 89; the Waropen, Held 1957:203, 213–214; and the Hill Kwoma, Whiting 1941:12,164). Even among the island's quasi-egalitarian hunter-foragers, an eminent warrior earned prestige and his word a modest weight (e.g., Dye and Dye 1967:18; Oosterwal 2003:pers.comm.; Pennefather 1968:n.p.).

Pacification disrupted political organization by ending military valour as an avenue to male prestige. In most cases, we have little idea what took its place. After the headhunting complex had collapsed among the hunter-forager Alamblak, though, it was eventually replaced by leadership more in the mould of a Highlands Big-Man. This political transition may have been facilitated by the Alamblaks' relocation from small hilltop hamlets down into larger, nucleated settlements on the rivers at the base of the hills (see earlier), which provided would-be Big-Men with a larger political base. The shift to the river also made it easier to travel abroad and to access economic opportunities such as forestry and tourism. The result was that political status and influence moved from performance in war to "oratory, success in business, accumulation of wealth, experience through travel, and association with influencial government figures" (Edmiston and Edmiston 1989:27).

Across New Guinea, contact had major consequences for local cosmology and ritual practice. Missionaries were among the first Europeans to settle in many local communities for extended periods of time, and they had an enormous impact on people's perceptions of, and accommodation to, the colonial presence. In the immediate aftermath of pacification, many missionaries encountered resistance to their preachings and a few were killed. Over time, though, many areas saw large-scale conversions to Christianity, and most people now pronounce themselves Christians of one denomination or another, with a small proportion in West Papua following Islam. The reception of the new religions, however, has often taken a syncretic form. Among Christian converts, God, Christ, and a smattering of their commandments are slotted in alongside local beliefs rather than replacing them wholesale. Interaction with other European agents and institutions also influenced worldviews and ritual behaviours. In many areas, belief systems were adroitly extended to undergird millenarian movements that sort to achieve moral and political equality with Europeans and the material wellbeing they enjoy.

Unfortunately, we have very little information on the degree to which the island's foragers shared these experiences. The hunter-forager Bahinemo of Wagu, who interacted closely with a resident evangelical Christian missionary family from the US over some 25 years, appear to have assimilated a relatively nuanced version of Christianity, albeit one in which prayer seems to have been viewed as not unlike traditional magical practice (Dye 1990). Maher (1961) provides perhaps the most detailed account of how ritual belief and practice changed in a fisher-forager community, the Purari. The first changes came during the 1910s, in the wake of pacification. Exocannibalism had been an essential component in key Purari ceremonies that ordered the relationship between humans and their *imunu*, the life-force that pervades all living things and makes them what they are. Pacification brought an end to this practice. To begin with, the Purari decided to substitute pigs for human victims. As they became more familiar with European culture, however, they also became increasingly impressed with European power and influence in relation to their own, a perception that Maher suggests led them to doubt first the efficacy of substituting pig consumption for human cannibalism and later the efficacy of *imunu*. By 1940, the great ceremonial houses in which young men had been initiated into communion with the "sky *imunu*" (wicker spirit figures) were fast disappearing, a decline hastened by the increasing absence of young men on indentured labour contracts.

Following World War II, the Purari embarked on a quest to become "New Men", humans with the power of Europeans. These efforts culminated in the destruction of cult houses and religious paraphernalia, the removal of villages to drier sites, wholesale conversion to Christianity and, famously, the rise of the Tommy Kabu movement, an indigenous "business" organization that sought to secure sovereignty from Australian political control and economic parity with Europeans. In the end, none of these measures met with the hoped-for results and, as they entered the 1960s, the Purari had been left cosmologically adrift (Maher 1961:36–77).

1.7 Conclusion

New Guinea being "The Last Unknown", its foragers were among the most recently contacted on Earth. As a result, the historical and ethnographic documentation of what their lives were like at contact and in the years that followed is probably as detailed as that of any forager community. A number of lessons relevant to forager scholarship can be drawn from this record, but perhaps the most important concerns the consequences of the colonial suppression of war.

To begin with, the New Guinea record raises doubts about anthropological assertions that 'simple' hunter-foragers had no warfare (Fry 2006; Kelly 2000). These claims are sustained in part by excluding from the traditional definition of war ("armed combat between autonomous political communities") "personalized" lethal violence that occurs between one or two people. This small-scale, targeted violence, it is argued, is not war but "homicide," "spontaneous conflict over resources," or "(collective) capital punishment." Even under this novel redefinition, there is considerable evidence that some archaeologically and ethnographically known hunter-forager groups did in fact war (Allen and Jones 2014; Kelly 2013:205–208; Roscoe 2014:229, 237), a conclusion that the New Guinea record strongly confirms (Roscoe 2014). We are therefore left to wonder whether, if their historical record were as substantial as that for New Guinea foragers, we would find the same to be true of 'simple' hunter-foragers in other parts of the world. In other words, what we think we know of settlement patterns, subsistence, leadership, and symbolic culture among groups such as the !Kung, the Australian Aborigines, and the Mbuti, might not reflect autochthonous cultural forms so much as the consequences of colonial encapsulation and the suppression of war.

However that may be, New Guinea provides us with a useful set of case studies of how colonial powers impacted forager communities in the nineteenth and twentieth centuries. Because of how the colonial reach interfaced with local terrain, the colonial experience of fisher-foragers differed markedly from that of hunter-foragers. For fisher-foragers (and some trader-foragers), located on waterways that were easily accessible to colonial vessels, the European presence came to them. 'Pacification,' the incursions of a market economy, the decline of traditional trade networks, all came early, and they arrived regardless of whether they were wanted or not.

This was not the case for the island's hunter-foragers. In their swampy homelands, in some of New Guinea's more remote locations, hunter-foragers could choose to avoid the European presence if they wanted, and some did, preferring even today to live in the marshes, shunning the apparatus of the post-colonial state. Many others, though, decided that if the colonial presence would not come to them, they would come to the colonial presence. As 'pacification' eased security concerns, they aggregated with other communities in riverine or lacustrine locations that previously would have left them perilously exposed to attack but now improved their access to burgeoning colonial enterprises and infrastructure. Our knowledge of life in these new settlements is limited, but relocation and aggregation likely entailed

both subsistence and social changes. Diets shifted to include planted as well as gathered sago, and they likely expanded to include a greater proportion of fish to accommodate the increased population pressures that larger settlements exerted on hunted prey. Relocation also had social consequences. With better access to indentured labour opportunities and trade-stores, material culture changed and traditional trade-links decayed. The greater social transformations, though, may have gone unreported. Where the fissioning of large fisher-forager villages into smaller settlements reduced ambient levels of internal conflict, the aggregation of small hunter-forager bands into larger, more settled villagers likely had the reverse effect, requiring novel conflict-management innovations and altering the contours of leadership.

And yet. Despite the multiplex effects of colonial and post-colonial developments on New Guinea's forager communities, it must be stressed that they remain among the least historically transformed foragers on Earth. In their marshy redoubts on the southwest coast of New Guinea, for instance, the Asmat may be one of the few peoples anywhere who still follow a fisher-forager life. Where most Aboriginal and Inuit foragers are now heavily invested in market economies and possess trucks, snowmobiles, and satellite TVs, hunter-foragers such as the Bahinemo, Lower Arafundi, and Sanio-Hiowe still maintain a largely hunter-gatherer lifestyle, procuring a greater proportion of their subsistence by foraging than the 85 % that characterized the !Kung when Lee first studied them in 1963 (Roscoe 2002:158). All the more unfortunate, therefore, that these communities continue to be neglected by scholars of the forager spectrum.

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Chapter 2
When Is a Foraging Society? The Loplik in the Tarim Basin

Sabira Ståhlberg and Ingvar Svanberg

Abstract Foraging is regarded as the most ancient human way of living, but it is hardly believable that all contemporary groups identified as hunter-gatherers possess a continuous history as foragers. Cases of former foraging societies who have been forced into marginalized castes or become integrated into the majority population are widely known, yet only a few cases of the process that created foraging societies are described. An interesting case of probably former pastoralists who were forced to move into a harsh desert region and developed a foraging society based on fishing, hunting and some gathering, are the Loplik, who lived in the Tarim Basin. The Loplik were semi-nomadic and had small population density, thus meeting the economic and subsistence requirements to be categorized as foragers, but only for a period of time and under certain conditions.

2.1 Introduction

It is not so commonly known, or acknowledged, that groups categorized today as hunter-gatherers carry a long history of shifts and changes in their livelihood, with periods of sustenance that would perhaps even not meet the definition of 'hunter-gatherer'. Cases of former foraging societies, forced into marginalized castes or integrated into a majority population, are widely known. However the historical processes that *created* foraging societies are relatively poorly covered in the anthropological literature. Some exceptions are the recently documented hunter-gatherer groups which originate from horticulturalists in South-East Asia and tropical South America (see e.g., Fortier 2014; Roosevelt 1998).

One such group is the Loplik, a distinct group within the socio-cultural enclave of the southern Tarim Basin, mostly unknown even among Inner Asian researchers. In the latter half of the nineteenth century, foreign explorers travelling in the desert areas of southern Chinese Turkestan (now Xinjiang in China) encountered a specific group of Turkic-speaking marsh-dwellers, who lived at the southern edge of the Lop

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Nor, a former lake now dried-up, located between the Taklamakan and Kumtag deserts (Dong et al. 2012). Locally known as Loplik (*loplïq* 'Lop people'), with the self-designation *loptïq* (Malov 1956:4, 126), their numbers were estimated to be a few hundred in the late nineteenth century or "400 souls of both sexes", according to Prejevalsky (1885). The Loplik subsisted on fishing, hunting and gathering, in contrast to their agricultural oasis neighbours. Most of these neighbours were called Turki, and nowadays Uyghur, an ethnonym which became common by the 1940s. The Uyghur were concentrated in the mountains foothills oases (Benson and Svanberg 1998:19). A peripatetic group of beggars, basket-weavers and sieve-makers, known as Abdals among the surrounding peoples (self-designation *äynu*), were also roaming in the area (Jarring 1997:1; Johanson 2001:21–22; Svanberg 1996). All these ethnic groups spoke various kinds of Turkic languages.

In the late Qing period (1644–1912) all ethnic groups were integrated into a locally and regionally based administrative structure. Since at least early eighteenth century, until the founding of the People's Republic of China in 1949, their lifestyle remained largely the same. As a peripheral group of a few hundred households, the Loplik could, despite the remote desert setting, subsist on the local biological resources available. While the Loplik used only a handful of plant species for construction, cloth, fuel, handicraft and carbohydrates, their nutritional needs were met by fishing, hunting mammals and birds and gathering eggs. Despite having contact with oasis dwellers, the Loplik developed their ethnic identity by maintaining a niche specialization, using particular cultural strategies and keeping certain linguistic traits, or -in other words- by making up an ethnic boundary that defines a group in inter-group interactions (Barth 1969; Schein 1975). In the early twentieth century the Loplik were still considered by others in the area a separate ethnic group, rather than a social group. In the 1950s, however, the situation changed and the Loplik left the Lop Nor. (Fig. 2.1).

Fig. 2.1 Map of Xinjiang, north-western China. The Loplik lived in the Lop Nor area

This chapter analyses the historical sources available regarding the Loplik and presents a diachronic view on the dynamic process that created this foraging society. Detailed descriptions about the topic are scarce and can be found mostly in travel narratives and some research literature in ethnography and ethnobiology. The case of the Loplik highlights the complexity of reasons behind cultural change. The main hypothesis we posit here is that the Loplik were possibly former pastoralists, who were forced, during a period of political turmoil, to move into the deepest part of the Tarim Basin surrounded by harsh desert areas and who, due to the specific conditions they faced, developed a foraging way of life based on fishing, hunting and some gathering.

"When is an ethnic group?" asked the American anthropologist and psychoanalyst Muriel D. Schein several decades ago (Schein 1975). She analysed the complex relationship between ecology, ethnicity and class among pastoral groups in the southern Balkan Peninsula. Schein realized that time, place and occupation are interconnected. We present here an alternative view on the case of foragers. Alluding to Schein, we ask the question: *When* and *why* emerged a foraging society like the Loplik?

2.2 Framework for Analysis

In recent years, the concept of hunter-gatherer societies has developed from a largely undifferentiated into a more flexible and observation-based description concept. Still many questions, especially about the origins of the societies, remain unanswered. Parallel to this development, the idea of contemporary hunter-gatherer societies as representatives of timeless populations has been largely discarded in the anthropological literature (Jordan and Cumming 2014; Pluciennik 2004).

Well known are cases in which foraging societies are forced into marginalized social groups, working with handicraft, as peasants or wage earners living beside or within a majority population. Anthropological literature reports many cases of foraging communities, which have lost their way of living due to external and internal factors (Murdock 1968). However, it is more seldom acknowledged that it is very improbable that recent groups identified as hunter-gatherers have been hunting and gathering since early human history. Rather, their adaptation as foraging societies must be understood in the context of their surrounding economic, historical and social dimensions. Although hunting-gathering is considered to be the common human mode of subsistence throughout the Palaeolithic, archaeological finds show – even in early human history – significant variability, depending on climate and life zones, available technology, and socio-political structure (Kuhn and Stiner 2001). Forager societies rely on local biological resources. Their way of living and material culture, usually quite basic, are fully adapted to the specific ecological conditions in their surroundings. In addition, the hunter-gatherer societies still existent today possess a long history of contact with "modern" civilisations. A closer look at history reveals that several foraging communities were formed only a few 100 years ago (e.g., Hoffman 1986).

A first argument against a continuous history of hunter-gatherers came from Claude Lévi-Strauss (1968), who stressed that many hunter groups in the Amazon actually originated from horticulturalists, who -for different reasons, such as migration or ecological changes- were pushed into marginal areas. In the early 1980s, a small but vocal segment of anthropologists and archaeologists attempted to show that contemporary groups usually identified as hunter-gatherers often do not have a continuous history of hunting and gathering. Often their ancestors were agriculturalists and/or pastoralists, who changed or were forced to change their livelihood as a result of social, ecological, economic and historical reasons including migration, demographic growth within the group, a majority group occupying their territory, economic exploitation, or violent or non-violent conflict or marginalization, to name a few (Cannon 2014; Schrire 1984).

Changes in climate, demographic, economic and social macro-structures of habitats have a vast impact on the subsistence mode. Especially in a dynamic and ecologically sensitive region like Inner Asia, easily affected by climate change and human factors, many groups are very adaptable and have formed, migrated and disbanded continuously throughout history (Benson and Svanberg 1998:11–29; Ståhlberg 1996:145–157). It is frequently suggested that foragers occupy or have been forced to move to marginal habitats which are too poor for human subsistence, because productive habitats have been taken over by more powerful actors, often agriculturalists (Guenther 2007). However some examples such as those of foragers who existed before agriculture, or who resided in extensive areas in Xinjiang, where agriculture is confined to oases only, challenge the assumption. Moreover, recent work using global remote sensing data to estimate habitat productivity for a representative sample of societies has tested and challenged such assumption. Contrary to what has been the common argument, results from this work show that foraging societies in Xinjiang do not inhabit much more marginal or less productive habitats than agriculturalists (Portera and Marlowe 2007).

2.3 Semi-settled Lake and River Fishers

The Loplik can best be defined as a category of foragers known as fisher-gatherer-hunters. They had a mode of subsistence that relied on fish instead of game (cf. Guenther 2007; O'Neill 2014). Detailed descriptions of foraging societies and castes, relying on fishing in lakes, marshes and rivers as the core subsistence activity, are few, whereas marine hunters and coastal fisher-gatherers are well-known and peasant-fishers renowned (e.g., Firth 1946; O'Neill 2014; Shnirelman 1999). Studies of semi-settled specialized fishers and gatherers along rivers and lakes are even scarcer. There are a few ethnographic reports from various groups categorized as Twa in central and southern Africa, who mainly subsist on fishing (and for whom fish is the most important source of protein), and to a lesser degree on hunting and plant gathering in swamps (see e.g., Brelsford 1946).

Except the Loplik, there are few other ethnic groups in Eurasia who can be categorized as foragers along lakes and rivers, and who used fishing as their salient way of subsistence (Shnirelman 1999). Perhaps the best known groups, whose economy until some decades ago was based on artisanal small-scale fishing along rivers in northern Eurasia, are the Nanai, Nivkh, Udege and Ulch in the Amur Basin and the Itelmen in the interior of Kamchatka (Lattimore 1933; Shnirelman 1994). Also for the Ainu of Hokkaido, fishing was the most important subsistence activity for their foraging economy (Svensson 1999). Similarly, Saami groups in Finland earlier relied on fishing and beaver-trapping along rivers, together with some hunting of wild reindeer (Tegengren 1952).

From the vast Turkic-speaking area of Inner Asia and Siberia, only a small number of cases of fishing peoples are known, such as the Barabin Tatars at the Irtysh River, the Ös people of the Chulym River basin in the Tomsk region, and the Sagai in the Minusinsk Depression in Siberia (Harrison and Anderson 2006; Ippolitova and Svanberg 2014; Ståhlberg and Svanberg 2014).

2.4 Origins of the Loplik

Most ethnographic sources about the Loplik date from the mid-nineteenth and early twentieth centuries. Detailed information was gathered mainly by Swedish explorer Sven Hedin in 1896 and 1899–1901 (Hedin 1900, 1905). When the Loplik were visited by the first Russian and Swedish scientific expeditions, they lived in semi-sedentary settlements, as a rather independent foraging society with a distinct culture, mainly subsisting on fishing. Later expeditions, one of which was headed by Hedin as late as during the 1930s, documented the occurring changes and increasing interaction of the Loplik with the outside world (Ståhlberg and Svanberg 2010).

Archaeological sites, e.g., the ancient city of Loulan in the vicinity of Lop Nor, do not provide any information, and thus sources regarding the Loplik are hardly available before the late nineteenth century. Historical information about their origins, gathered by travellers, tends to be confusing and contradictory. One example is the physical appearance of the Loplik, who differed from their Uyghur (Turki) neighbours; Western Mongolian (Kalmyk) or Turkic Kirghiz origins were suggested by several authors (cf. Stein 1921:335). Prejevalsky (1885) thought the Loplik were "a Mongolian-Turkish race." According to his informants, their ancestors were called Kavria and once lived in the town of Lop, the ruins of which were found south of the lake. At the end of the fourteenth century, the town was destroyed and only a small number of inhabitants managed to hide in the reeds, becoming Loplik in time. Huntington (1907:68) met three Loplik in the village of Abdal, who were of "a fair-skinned, dark-haired mixed race of Aryan and Mongol origin". They spoke a Turki dialect and dressed like other Turki in quilted cotton tunics reaching below the knee, high leather boots, and fur-brimmed caps.

The task to find evidence of the origin of the Loplik is difficult, if not impossible. Their physiognomy was found to be much closer to Mongolian and Chinese than to

their Uyghur neighbours, pointing to a northern origin or Chinese influences, the latter, however, is not easy to ascertain. There were distinct differences between the Loplik and the Chinese, which led a physical anthropologist, after examining measurements made by Stein around 1900, to suggest them to be an early Mongolian offshoot with contacts to both Uyghur and Chinese (Joyce 1912). Sven Hedin stressed what he regarded as similarities, in their way of living and material culture, between Kirghiz nomads and Loplik fishers (Hedin 1900:94). According to Pevtsov (1949:234), the Loplik themselves told stories of how they had migrated from northern Kashgaria some 400 years earlier. American geographer Ellsworth Huntington (1907:144) was told that their forefathers came to Lop Nor between two and three hundred years ago, which would loosely mean around the seventeenth century – in Loplik time scale: when "the lake and the Tarim River were larger than now". Also Hedin (1900:117) was told that their forefathers had arrived from the north.

Pevtsov (1949:234) pointed out several customs among the Loplik which were similar to those of pastoralist nomads in the north. Yet some customs appeared to be new and can be attributed to contacts and economic changes in the last decades of the nineteenth century (Benson and Svanberg 1998). In 1889, French traveller Gabriel Bonvalot (1896:70–71) visited Aqtarma village in the desert not far from the Tarim River, north of the Lop country. The villagers lived in reed huts and subsisted on fishing, hunting and in addition, animal husbandry; they spoke a Turkic dialect and claimed to be Kalmyk Mongols by descent. It is uncertain if they thought of themselves as Loplik, but later visitors, including Hedin and Malov, defined them as such.

The question about language is equally contradictory. Hedin (1900:94) argued that the Loplik language was related to Kirghiz, but he lacked the necessary linguistic training to be certain. Russian turkologist Sergei Malov (1933, 1956) was of the opinion that Loplik, together with Sary Yögur in nearby Gansu province, were of ancient Yenisei Kirghiz descent, a people whose homeland was in the upper Yenisei tributaries in the ninth century. He made his conclusion based on the linguistic peculiarities dividing the Loplik vernacular from Eastern Turki (Uyghur) dialects. His Swedish colleague Gunnar Jarring (1934:191), in his commentaries on Malov's text samples published in the 1930s, stressed its resemblance to Kazakh, but he did not speculate about the origin of the Loplik. The northern theory has been applied also to other small Turkic groups in the region, Salar, Turkic-speaking Yögur and others who inhabit the nearby Qinghai and Gansu provinces. Many have closer linguistic ties with Kirghiz or Siberian Turkic languages than with Uyghur (Ståhlberg 1996:126).

2.5 Why Become a Forager?

Wherever the Loplik originated from, one reason for a possible move south or south-east could be the Russian conquest of Siberia and Central Asia, a long process which started at the end of the seventeenth century. The next step, moving into the

isolated Lop Nor area, would have been caused by the prolonged wars between the Manchu Qing dynasty, which tried to exert control into the Western Territories and subdue the Mongolian Dzhungars, who ruled the region since the beginning of the seventeenth century. The wars started in 1687 and continued into the eighteenth century, creating huge refugee waves through Inner Asia (Benson and Svanberg 1998:36–43).

Following the complete devastation of the region, including agricultural land and pastures, Turkic-speaking groups living under Dzhungar rule scattered in order to survive. Several contemporary groups, most noticeable the Dolans in the Yarkand River valley, are their descendants (Svanberg 1996). It is possible that a Turkic-speaking group migrated to the Lop area, as the Loplik told the travellers, and due to the environmental conditions, changed their occupation, from farmers to foragers. The Lop Nor marshes have been a place of refuge for various groups for centuries, many of them unknown or called only "Lop inhabitants." When climatic conditions permitted, even great cities flourished, such as Loulan, founded some 2200 years ago (Ståhlberg and Svanberg 2010).

Another social turmoil followed the vast Muslim rebellions against the Qing Dynasty in the 1860s and 1870s. Fighting swept all over Xinjiang, as the Qing army lost and regained control. This contributed to the isolation of the Loplik and only after the Qing re-conquered the region from the warlords could they contact neighbouring oases again, which had been severely ravaged during the wars (Benson and Svanberg 1998:19).

It would be historically incorrect to conclude that after the Loplik chose the desert, they were cut off forever. The development after the wars shows that whenever possible, they had, active contact with their neighbours. The most important settlement in the Lop area was a small oasis town called Charkhliq, established around 1830–1840 as a penal colony with exiles from Khotan, located south of the Tarim Basin. A few Loplik moved there and by 1877 nine households lived in the oasis. Charkhliq influenced the Loplik, introducing agriculture and other forms of economy, as well as new technology and further contacts with the outside world. With the reinforcement of state rule and the growing importance of Charkhliq, the Lop area became increasingly dependent on the Chinese state-appointed mayor. The town was also the administrative centre for the Lop region by the end of the nineteenth century (Ståhlberg and Svanberg 2010).

Higher in the hierarchy, the Lop area was administered by the *wang* (governor) of Turpan. The lower levels of administration consisted of local chiefs. Loplik chiefs were called *beg* and possessed various ranks. In the 1890s there were nine *begs*, who inherited their positions from their fathers. There was no special class of chiefs, but the *beg* enjoyed certain privileges and they usually were richer than others (Menges 1933:1222). When Sven Hedin visited the village of Abdal in 1896, he observed that the local *beg* lived in a simple house made of reed, albeit with 14 rooms. His family counted 25 persons and he owned a 100 sheep, 6 cows, 4 horses and a few donkeys. He also had several dugout canoes (Hedin 1900:107).

The local environment was harsh with hot summers and icy winters. By the twentieth century, the Loplik had adapted to the shifting sands, the lake and its

feeding river moving every few decades, and the extremely long distances to fertile land and Turki trade centres. Communication with neighbouring oases was growing, however (Jarring 1997: v). Ecological and political changes took place soon after the first Russian explorers in the 1870s, with several scientific expeditions as witnesses. The ecosystem was largely dependent on water from the Tarim River, which fed the tributaries to the Lop Nor. When the lake "wandered", the Loplik villages followed it. A large-scale drought occurred around the turn of the century, resulting in degraded environments and the outside world crept slowly in from the towns.

Taking into account the sources and narratives, we can assume that the Loplik – at least from an economic point of view – were foragers only from the seventeenth-eighteenth century until the 1950s. In the following sections we discuss their foraging practices in the late nineteenth and early twentieth century, the period which is ethnographically and ethnobiologically best documented.

2.6 Fishing and Its Implements

Fish was an abundant and reliable resource for the Loplik (Hedin 1900:94). Artisanal fishing was the most important livelihood strategy, providing their main source of food. Fishing was also the most developed economic activity, easily implemented at the lake and the Tarim River, which branched out into many riverlets before reaching the Lop Nor. Hedin (1905:132) gives the most detailed information on fishing and fishing gear among the Loplik. Their way of obtaining food resources involved a series of creative activities. Fishing was pursued in small marginal lagoons, where the end of the connecting channels was blocked with poles, willows and earth lumps, or alternatively in the elongated bays, which generally exist below every strip of alluvium. The nets were placed at the mouth of the bays. So-called *nišan* 'sign post', consisting of dried fish-skin hanging on poles, were also placed on the banks to indicate fishing grounds, where only those who had erected them had the customary right to fish (Hedin 1905:126).

The Loplik targeted at least five species of fish in the Tarim River and the Lop Nor marshes: Ili marinka or *egej balïq* (*Schizothorax eurystomus*), Tarim schizothoracin or *ottur balïq* (*Schizothorax biddulphi*), big-head carp or *minlaj balïq* (*Aspiorhynchus laticeps*), Kashgarian loach or *tazek balïq* (*Hedinichthys yarkendensis*), and scaly osman or *it balïq* (*Diptychus maculatus*). The fish were eaten dried or fresh in soup, and dried to be stored for the winter season or for the trade (Jarring 1998:63; Malov 1956:105, 115, 144, 152, 166; Mitrofanov and Turkija 1994; Ståhlberg and Svanberg 2010).

Fishing took different forms during the annual cycle. The spawning-season of the fish was in May, when the fish swam down the rivers to the marshes. During this month, the Loplik had their most energetic and active fishing season. They set out nets and seines (large, vertical dragnets) in the lagoons from their dugout canoes,

made of hollowed-out poplars, skilfully manoeuvred by men as well as women. Standing in the rear or several persons in a row, they drove the fish into the nets with their oars. Larger fish were killed with a wooden club. The greater part of the fish captured during the spring was sun-dried in the arid desert for winter storage. After cleaning and removing the entrails, the fish were cured unsalted. The stock-fish were stored indoors in typical reed huts (Hedin 1905:193). During summer, fishing was also conducted with hooks. Limited ice-fishing with nets was employed during wintertime in the nineteenth century. By then fish were no longer sold, which points to diminishing quantities, but fish oil, extracted from the intestines, was sometimes purchased by itinerant traders (Ståhlberg and Svanberg 2010).

Hedin (1954:259–261) notes another important fishing season, the autumn, when the rivers and the lakes began to freeze over. In autumn, the Loplik used harpoons in addition to nets and seines. Drift-ice, called *kömul* or *qade*, pushed the fish into clear brooks and lagoons of the rivers. Loplik men then went out fishing to fill the winter stores (cf. Jarring 1997:261–263, 337; Malov 1956:123). Some boats were so filled up with fish that they weighed down, the rims being close to the water level. The Loplik pulled their dugout canoes onto the beach for the night, to avoid them being crushed by the forming ice. The canoes were long, thin and low, cut out of one poplar trunk, light and small "like a nutshell". Usually the fishers rowed standing, navigating through narrow passages of the rivers between reeds, islets, poplar trunks, roots and all kinds of debris. They were adept in negotiating rapids. The Loplik also heated their boats using a fire plate placed on wood at the bottom of the canoe.

In winter, the Loplik fished also in the smaller lakes. Fish was taken in nets through holes in the ice of the ponds, being driven into them by men stamping and jumping on the frozen surface of the lakes (Hedin 1954:221, 235–243). Far into the 1950s, even after social and ecological conditions forced the Loplik to move away from the area, fishing remained an important, albeit progressively limited occupation.

2.7 Gathering

Plants played an important role in the Loplik subsistence patterns. In contrast to most other Eurasian groups, the Loplik relied only on a handful of species, especially reed, locally known as *qamïš* (*Phragmites australis*), Lop hemp or *čege/čaga* (*Apocynum venetum*) and Euphrates poplar or *toγraq* (*Populus euphratica*). These species provided food, remedies, construction material, fuel, fibres and tools (Malov 1956:141, 189–190; Ståhlberg and Svanberg 2010; Xie et al. 2012). Only one or two of the plant species in the Lop country were gathered for food. The fresh shoot of reed was gathered and eaten and the Loplik extracted sugar from the roots and the edible fruits of *Eleagnus angustifolia*, known as *karghajigde* ('crowberry'), which were then used to produce a kind of highly esteemed meal (Hedin 1905:134;

Jarring 1997:356). Like most hunter-gatherers the Loplik subsisted on a diet which seems to have been extremely poor in carbohydrates. Their meals were composed mainly of fish and meat, including wild game; few calories were obtained from plants (Cordain et al. 2002). "Till 80 years ago," wrote Huntington (1907), "no Loplik had resorted to agriculture, but all lived on fish or wild-fowl, in spring soft tips of reeds and rushes, but never bread."

The reason for limited use of wild plants can be explained first and foremost by the scarcity of usable plant taxa in this desert area. A Chinese scientific expedition in the 1980s collected a total of 36 species of plants of 13 families, mainly *Chenopodiaceae* and *Compositae*, and 26 genera. All of these species are drought resistant, salt tolerant shrubs and perennial grasses little suited for nutrition (Zhao and Xia 1984). In addition, there was not much need for a wider use of wild plants among the Loplik, as fishing had become the main occupation, seemingly satisfying most of their nutritional needs. Plants were used primarily for construction (reed, poplar), clothing (Lop hemp), and fishing implements (Lop hemp, poplar). Simple tools such as spindles and hand-held distaffs were made of wood (poplar) and used for manufacturing *Apocynum*-fibres, needles of wood for turning the threads into fishnets and seines (Montell 1941:119). Most of the household equipment was, as Hedin observed in 1896, made locally and only a few items were bought from pedlars from Charkhliq or Dural (Hedin 1900:98).

The Loplik were not indifferent to the non-economic plants in their landscape, which is reflected in many toponyms with indigenous plant names recorded by Hedin. Plants and bushes were obviously named by the Loplik and not by their neighbours, thus forming part of their cognitive realm. Tamarisk shrubs (*Tamarix sp.*), known as *šolγun*, were abundant in the vicinity. Juniper or *arča* (*Juniperus* sp.) was common in the higher altitudes (Malov 1956:86). Another well-known plant was a bush called *alqat* 'red berry' and probably identical with wolfberry, *Lycium barbarum* (Jarring 1997:18; Malov 1956:127).

The long list of toponyms recorded by Hedin in the Lop Nor and Tarim areas is an excellent source for Loplik local knowledge, in the form of mental maps and landscape utilization. He noted that the Loplik had an admirable spatial sense and detailed knowledge of channels and passages among the reeds (Hedin 1900:91). As the Loplik spent much of their time on or beside water (Jarring 1997: vi–vii), the number of hydronyms is also striking. The local fishers designated every division of the marsh with various names. Every sheet of open water, bordered by shallow thresholds or thick reeds, had its own name (Hedin 1905:140–141). Other names reflect the traditional knowledge of vegetation and habitat types of various animals the fishers distinguished. For instance, by observing the behaviour of diving ducks, the Loplik were able to navigate in shallow waters with their canoes (Hedin 1900:104). This list gives an intriguing insight into Loplik perceptions, uses, environmental management and local knowledge of the surrounding landscape and its biota.

2.8 Hunting, Herding and Other Economic Activities

Hunting played a smaller economic role than fishing, but was conducted on a regular basis. The abundance of migratory sea birds resting at Lop Nor Lake on their way to nesting sites in Siberia was important for the Loplik. In spring they could add wild fowl and eggs to their diet. They mainly snared the birds, particularly ducks. Prejevalsky (1885) noted enormous numbers of water fowl and waders during the spring migration, especially northern pintails (*Anas acuta*), grey-leg (*Anser anser*) and bar-headed geese (*Anser indicus*), as well as whooper swans (*Cygnus cygnus*), ground jay (*Podoces biddulphi*), saxaul sparrow (*Passer ammodendri*), moorhen, woodpecker, shrikes, sand-swallows, hoopoes and an occasional pheasant. Most of the duck meat was consumed fresh, but some was smoked and stored. Duck feathers were mainly sold to visiting merchants, but some duck skin was used as lining in Loplik winter cloths (Jarring 1991; Prejevalsky 1885).

For large game, Loplik men migrated seasonally to the Tibetan highlands to hunt Asian wild ass (*Equus hemionus*) and chiru (*Pantholops hodgsonii*) for hides (Hedin 1905:78). Wild Bactrian camels (*Camelus ferus*) roamed the Lop desert and were hunted occasionally, but local hunters told explorers that the wild camels had left around 1900 along the Tarim River (Leche 1904:60). Prejevalsky (1885:810) noted also antelope, probably goitered gazelle (*Gazella subgutturosa*), and Tarim deer (*Cervus elaphus yarkandenis*) among the larger animals in the area.

The Inner Asian and Siberian fur trade, for centuries an important connection between Europe and Asia, did not extend into the Lop area, and the Loplik hunted only for subsistence, mainly for getting furs for their own use. Local *begs* also collected tax in furs and the Loplik paid yearly a certain number of otter skin to the ruler of Turpan. During the winter season, some Loplik trapped wolves, red foxes and otters for furs (Pevtsov 1949:233–234). Small rodents and Yarkand hare (*Lepus yarkandensis*) also abounded in the area (Prejevalsky 1885). Now and then, even tigers (*Felis tigris*) appeared in the reed belts of Lop Nor. Since there was a demand among the Chinese for tiger meat for medicinal use and since traders were willing to pay a high price for it, the Loplik used to hunt or poison the animals when they had an opportunity. This was a purely trade-oriented occupation (Ståhlberg and Svanberg 2010).

Certain individuals could obviously accumulate wealth and buy sheep from their neighbours. Chicken were kept in some hamlets. In 1899, Hedin (1905:115) noticed that a few Loplik conducted agriculture and kept sheep besides fishing. In the village Qara-Chilan he found clay houses and wheat-fields watered by a canal from the riverlet Qara-aqïn. In Qaqte village, inhabited by seven families, he observed many sheep. The inhabitants lived to a great extent on fish, but also cultivated wheat, maize and melons. Their taxes were rendered in natural products: sheep, fish, tiger skins and firewood. Hedin characterized the inhabitants of Qaqte as a versatile people, sheep herders, agriculturalists and fishers all in one, and yet they were semi-nomads, moving between winter and summer locations.

Similar conditions were found among the Loplik along the lower Tarim River, only that there agriculture and sheep herding were less important, while fishing was considered as the basis of their livelihood (Hedin 1905:115). Although there were households who had sheep and did some simple tilling, these occupations were of little importance, when fish was abundant in the rivers and marshes. Still, there was a continuous flow of individuals abandoning this way of life and turning to other activities. For various (often personal) reasons, many Loplik preferred to become herdsmen (Hedin 1900:107).

2.9 Folk Religion, Ritual Life and Foraging

The Loplik were nominally Muslims. Their customs connected with life-cycle rituals followed the cultural pattern of the neighbouring Islamic peoples, mainly the Turki (Uyghur). The boys were circumcised when they reached the age of 4 or 5, but the rituals were generally conducted in spring when fish and ducks were plentiful and enough for a celebration with neighbours and kin (Ståhlberg and Svanberg 2010).

In other religious aspects, the Loplik were not so strict. Huntington (1907) tells how women and girls moved freely in the homes and villages. Relationships between the sexes seem to have been rather relaxed, including premarital night courtships occurring among the youth (Ståhlberg and Svanberg 2010). The bride-price among the Loplik consisted of 10 bundles of wild hemp fibre, 10 strings of dried fish, 10 cups of fish oil, a stew pan, 20 or 30 loaves of bread, from 50 to 100 ducks, a flint and steel and a dugout canoe (Bonvalot 1896:72).

Folk religious practices were important and connected with their reliance on local food production. Boys carried amulets of camel yarn. Evil beings were believed to be afraid of camels and therefore a mullah tied eight knots in a rope as an amulet, giving it to the boy to wear around the neck, according to a note by Georg Söderbom in the Loplik village Charchaq at Qum-darja in 1934 (Söderbom 1935).

2.10 Adaptation: When the Water Disappeared

Around the end of the nineteenth century, water in the Tarim River began drying up, and consequently also in the marshes. It became difficult for the Loplik to survive on fishing. The amount of fish diminished and many Loplik had to look for other sources of subsistence. Keeping livestock (sheep) was one alternative many turned to. Animal husbandry can be seen as one of the available alternative strategies for the Loplik at this period, a form of economy they could learn from their sedentary neighbours. In this peaceful period, sheep and other animal trade further supported the local economy. Other alternatives, such as migration to larger towns or taking up unknown occupations, were largely disregarded, as they required greater social and

economic effort and created stress and insecurity. Yet, even after the Loplik took up animal husbandry, meat continued to be rarely consumed as food. Traditionally meat-eating only occurred in connection with special occasions, such as the wedding of a *beg's* son. As long as fish existed, all kinds of fish continued to be the most common food item among the Loplik.

Contacts with the outside world had a serious impact on Loplik economic activities. During his second visit to their area, Prejevalsky (1885:808) noted that the Khotanese colony in Charkhliq influenced the Loplik so much that they "began to engage in husbandry and emerge out of savagery" (i.e., hunting, fishing and gathering). Some Loplik kept donkeys or horses as beasts of burden and even camels, but similar to their Turki neighbours, sheep became the most important livestock. Sheep are still the most important animals for rural Uyghurs. Around 1916, Auriel Stein (1920) found a Loplik colony of a dozen families from the village Abdal, resettled since 1908 in the small oasis of Miran. Slowly turning from fishers and hunters into casual agriculturalists and herdsmen, they could easily provide him with workers and camels. The Loplik seemed still to retain their knowledge about the area, but they were not able to survive any more by the Lop Nor (Ståhlberg and Svanberg 2010).

The officials in the region also contributed actively to the adoption of agriculture. After a smallpox epidemic around 1890, local authorities provided surviving Loplik with plots on the left bank of the Tarim River and forced them to settle down, grow wheat, and keep animals (Hedin 1905:127). Given the circumstances, Loplik tried agriculture in Charkhliq, but were unable to compete with their neighbours, and the transition from one economic activity to another was far from smooth. The arid and poor soil was not suitable for cultivation, the harvests less than enough, and the Loplik often had to barter their sheep to get flour from the greater town of Korla. The Lop area provided some grazing land for their herds, but not for long. When the river moved its course, the vegetation also changed. Occasionally until the 1950s, even after the lake had disappeared, some Loplik would return to the remaining marshes to fish in the summer. By the end of the decade this was not possible any more, as the marshes also dried out (Ståhlberg & Svanberg 2010:15).

Today the area is an inhabitable desert. The population policy of PR China led to a mass influx of Han Chinese to Xinjiang in the 1950s. The Tarim River irrigates extensive farmlands for the immigrants. This destroyed all still remaining Loplik habitats and forced their relocation to nearby oases, where their descendants still remain. China also conducted underground nuclear tests in the Lop Nor area from the 1960s until 1996, with disastrous consequences for the environment and the local population. Since the mid-1990s, the area has been a mining site for pot-ash. In the 1950s, the Loplik amounted to over 7000 persons; today their numbers are unknown, as they do not form an official, separate ethnic group. They live a sedentary life in the oases of Charkhliq (Chinese *Ruoqiang*) and Miran. Although the Loplik still keep a memory of their former socio-cultural distinctiveness, they are today integrated with the Uyghurs and their language is on the verge of extinction (Johanson 2001:20).

2.11 Conclusion

The Loplik are an interesting case of probably former pastoralists who were forced by political turmoil to move into a harsh desert region and who, within only a few centuries, developed a foraging society based on fishing, hunting and gathering. They have shown in the past century a high degree of adaptability, variation and innovative interest in creating a group-specific culture and livelihood, remaining isolated for certain periods and again making contacts when outside conditions allowed. The Loplik were in all likelihood equally adaptable a few centuries ago, becoming foragers as a consequence of political circumstances, which created economic and ecological disaster in their former habitat. After a few hundred years living in the marshes, subsisting on fishing, today they are occupied with agriculture and animal husbandry, partly due to ecological and hydrological changes, and since the 1950s due to social, demographic and economic pressures, as well as the great power ambitions and military pressure of PR China.

As eyewitnesses report, in the nineteenth and early twentieth century, the Loplik fulfil the economic and subsistence requirements to be categorized as foragers. They lived in tiny communities, were semi-nomadic, and their population density was very small. There was hardly any economic specialization, besides the fact that mostly men were fishing and women took part in duties at the settlements, but women could also handle the dugout canoes and assisted the men in fishing. In many aspects the Loplik had similarities with the oases farmers, being officially Muslim, with some keeping sheep and using agriculture as a supplement. Their chiefs were part of the administrative structure of the Qing Dynasty. The Loplik were thus also a somewhat stratified society.

Thus, the case study analysed here suggests that the social formation of hunter-gatherer societies depends also on historical, regional and administrative conditions and on cultural and social contacts with neighbours; not only on economy or ecological adaptation. Hunter-gatherers in Inner Asia have little social or cultural traits in common with hunter-gatherers in Africa or even South Asia, although their economies might contain similarities. In the case of the Loplik, it seems that when history turns over a new leaf, human groups move from one occupation to another or they combine several economic occupations and adapt to another habitat.

The Loplik today participate in the nation-building of the Uyghurs (Rudelson 1997; Svanberg 2005). Their identity is changing from oasis dwellers with local identities to a modern Uyghur self-identification; but some Loplik still try to hold on to a local identity as post-foragers (Wang 2012). The fishers, reed hut dwellers, and duck hunters are gone, but romantic views are passed down to following generations with the help of modern folklore, pseudo-folklore and songs. Elderly men still catch some fish in the nearby river, but the Loplik fishing-gathering-hunter society has disappeared; yet the knowledge about using the Lop hemp (*Apocynum venetum*) for producing wild plant fibres survives, and the plant is also sought after on the international market (Thevs et al. 2012).

We asked *when* and *why* is a foraging group. The answer must be understood in its specific context. The Loplik were foragers long enough for several generations to forget how to tend sheep or cultivate the soil, and to learn how to fish in the marshes and utilize certain plants, but not long enough to forget that they had once lived another life elsewhere. The Loplik can thus be defined as foragers, but not as primeval adaptation but as a new adaptive strategy, for a certain time and under certain conditions (cf. Roosevelt 1998:206). They never lived fully isolated from neighbouring peasants who cultivated fruit, rice, and other products and who kept animals, but the Loplik occupied their own niche in the marshes. They bartered fish and animal products for iron and other commodities, occasionally also food stuff. Local wildlife and a few plants provided them with the necessities, making them rather independent. When conditions changed, they moved from the marshes and settled in oases. An analogue development might also apply to other forager groups.

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Part II
Environmental Change

Chapter 3
Trailing Forest Uses Among the Punan Tubu of North Kalimantan, Indonesia

Maximilien Guèze and Lucentezza Napitupulu

Abstract Community-based conservation approaches are emerging as a viable alternative to classical conservation strategies. These approaches are based on the assumption that hunter-gatherers use and manage their environment in an extensive and sustainable way, but to date little research has focused on documenting hunter-gatherers' current use of ecosystems, especially regarding their spatial movements for resource search and utilization. In this chapter we use spatial data to analyze patterns and intensity of forest use by the Punan Tubu of Indonesian Borneo. We recorded the spatial patterns of forest activities conducted by people in two villages over a 6-month period, during which selected individuals carried a GPS recording one track-point every two minutes. Data collection focused on single-day trips involving hunting, non-timber forest products gathering, and non-commercial logging. After filtering, 116 analyzable GPS tracks were obtained. We provide a descriptive account of Punan Tubu forest movements, emphasizing differences in the intensity of use between villages and individuals and across activities. We also discuss the intensity of intended and unintended impacts on forest biodiversity by analyzing the distribution of stopover areas. Vast areas of the forest are sporadically transited by people and offer important perspectives for forest community-based conservation.

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3.1 Introduction

Researchers and conservation practitioners have been giving growing importance to participatory and community-based conservation approaches as an alternative to exclusionary conservation schemes (e.g., strict protected areas). The main argument driving this shift is that, since exclusionary conservation fails to conciliate biodiversity conservation with the interests and the livelihood of local groups, it is largely rejected by local populations (Porter-Bolland et al. 2011). Indeed, as many indigenous peoples, including the remaining hunter-gatherer populations of the world, continue to directly rely on their land and its resources for subsistence, the regulations in exclusionary conservation areas hinder forager peoples to carry on the traditional livelihood activities that provide them with food and cash income to cover basic needs. Conversely, there is a growing agreement among scholars that engaging local people in conservation planning is an opportunity to achieve conservation outcomes, rather than a threat (e.g., Ens et al. 2015; Kothari et al. 2013). However, despite the recent enthusiasm in including local people in conservation, the actual effects of such approach for conservation are not well understood. This is so, partly because little is known on how contemporary landscape use and management by hunter-gatherers affects (either enhancing or undermining) natural resources and biodiversity.

Previous research has explored the impacts on biodiversity of different land use practices, such as agroforestry or small-scale agriculture (see DeClerck et al. 2010 for a review in Mesoamerica). Other researchers have compared deforestation levels in different land tenure systems such as indigenous lands versus protected areas and private lands (Paneque-Gálvez et al. 2013). However, these studies have often relied on large-scale satellite imagery, thus neglecting ground-level spatial patterns of local uses, such as those happening under the forest canopy. Such omission is striking, to say the least, as the study of understory uses is particularly important to understand how hunter-gatherers might influence biodiversity. Indeed, the scant research on the topic suggests that micro-management practices might lead to subtle modifications of biodiversity – not only by creating mosaics of different, interconnected ecosystems, but also by the use and management of forest understory species, which potentially increases cryptic disturbances (Peres et al. 2006). For example, some research has suggested that such practices can increase tree diversity (Guèze et al. 2015), although it is not clear whether understory uses always enhance biodiversity. For example, research on hunting – the most studied understory use among hunter-gatherers- has documented that some structurally mature tropical forests have been largely overhunted, resulting in a depletion of the vertebrate community, a phenomenon called the “empty forest syndrome” (Redford 1992). Nonetheless, it is important to note that the effects of hunter-gatherer communities on faunal diversity are complex and depend, in part, on external pressures, settlement patterns, and the associated spatial differences in hunting intensities (Espinosa et al. 2014; Luz et al. 2015; Wilkie et al. 2011).

Global forces such as land grabbing, colonization, the advance of extractive industries, deforestation, habitat loss, climatic change, or hunter-gatherer's integration into market economies and nation-states, to cite just a few processes, are deeply affecting the livelihoods of local peoples (Reyes-García et al. 2011). Moreover, these processes do not have a homogeneous effect on how people relate to resources, but rather might result in growing intracultural differences, both between individuals and communities (Reyes-García et al. 2013). Therefore, a critical assessment of different understory uses and how global forces might affect these uses is needed to predict future hunter-gatherers' practices, and thus help resolving the conundrum on sustainability in tropical forests.

In this chapter, we draw on spatial trailing data collected during a 6-month period among people in two Punan Tubu villages, Indonesian Borneo, to provide a descriptive account of hunter-gatherer spatial patterns of forest use, most of these being understory practices. We also use disaggregated data to explore whether such patterns vary between communities and among individuals. Although some authors have studied spatial patterns of mobility and hunting among hunter-gatherers (Bahuchet 1991; Espinosa et al. 2014; Levi et al. 2011; Politis 1996), and others have addressed whether foraging strategies displayed by people are random or not (Brown et al. 2007; Miramontes et al. 2012; Raichlen et al. 2014), to our knowledge the present study is the first attempt to systematically trail hunter-gatherers during their daily activities.

3.2 The Punan Tubu and Their Environment

The Punan Tubu villages lie along the upper Tubu River and its tributaries (Fig. 3.1), Malinau district, North Kalimantan, Indonesia (3°0′–3°20′N; 116°0′–116°15′E). The terrain where they are settled is hilly, mainly from metamorphic origin (MacKinnon et al. 1996), with extremely steep slopes, which in some places could reach 100 %, making the area prone to landslides. The climate is tropical, with relatively constant average temperatures all year round. During our fieldwork we recorded an average maximal temperature of 27.2 °C. Annual rainfall ranges from 2000 to 4000 mm, usually with more than 100 mm per month and with a peak of rainfall in December-January. The annual climatic regime is also strongly dependent on the El Niño Southern Oscillation (ENSO), which determines years with extreme events such as drought or flooding due to heavy rainfall (MacKinnon et al. 1996).

The studied villages are located within one of the largest remnants of mature tropical forest in Southeast Asia (Gunarso 2007), relatively protected from logging and oil palm plantations (at least until now) due to their remoteness. The vegetation depends on the altitude, ranging from hill lowland dipterocarp forest (below ca. 500 m) to mixed oak-dipterocarp forests (above ca. 500 m) and including all the transitional stages between these two forest types. All forest types are evergreen with canopy trees reaching 40 m and emergent tree species occasionally exceeding 70 m.

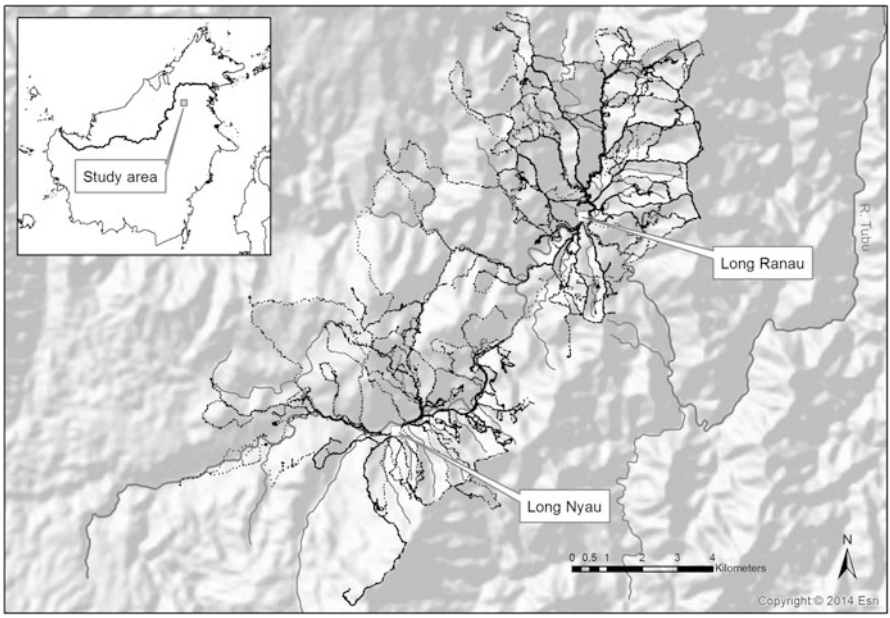

Fig. 3.1 Map of the study area showing the two studied villages (Malinau district, North Kalimantan, Indonesia) and the distribution of GPS tracks according to topography (N = 116)

An important feature of the Bornean rainforest is the supra-annual mast fruiting events of the dipterocarp trees, followed by a range of other tree species. These events have been linked to ENSO (MacKinnon et al. 1996). However, in part due to land cover change, large-scale mast fruiting episodes have decreased in Borneo (Curran et al. 2004) and currently only more localized mast fruiting, as well as annual fruiting, occurs. This has important consequences for the migration patterns, and thus for the availability, of the bearded pig (*Sus barbatus*), Punan's preferred game species.

The name 'Punan' is used to refer to several groups of formerly nomadic hunter-gatherers inhabiting the interior of Borneo. The history of Punan settlement is complex and historical evidences are rare due to their past mobility. Ethnographic work suggests that all Punan groups have had durable interactions with neighbouring Dayak societies (Kaskija 2012), typically semi-sedentary farmers living in strongly hierarchical societies. These interactions involved the trade of non-timber forest products (NTFPs) – the Dayak acting as intermediaries between the Punan and Malay or Chinese coastal traders. As a consequence of these economic interactions, Punan migration patterns were associated to the movements of the Dayak.

The work presented here specifically focuses on the Punan Tubu, a group of Punan living along the Tubu River, and sharing elements of language and culture with the neighbouring Punan Mentarang. Because of previous migrations, the territory currently inhabited by the Punan Tubu has been successively occupied by several

groups of Dayak, in particular the Merap and the Abai. This had important cultural implications as it favoured exchanges amongst groups, in particular the absorption of Dayak elements into Punan Tubu culture (Cesard 2007).

In the past, the Punan Tubu used to move their camps across their territory according to the location of wild palm groves (several genera including *Metroxylon*, *Arenga*, and *Eugeissona*), which provided sago, the main starch source for the Punan (Sellato 1994). However, like the other Punan groups, the Punan Tubu have gradually become semi-sedentary, transitioning to an economy based on agricultural products, with cassava and rainfed rice being their main staple foods. More recently, Punan Tubu mobility has been also affected by a different external factor: in the 1970s, the Indonesian central government initiated a large resettlement program aiming at relocating people living in remote areas, such as the upper Tubu basin, into more accessible places. Many of the Punan Tubu moved to live in resettlements close to main towns; others did not resettle near the towns, but aggregated in the upper Tubu, forming the current five permanent villages found in the area and thus being gradually fully sedentised. As part of this program, the government also established a subsidization system with items from the market, including food, and more recently in-cash payments for villages (Napitupulu et al. Chap. 8).

Although, since the 1970s, Punan Tubu reliance on swidden agriculture has increased, they remain extremely dependent on forests for their survival. Hunting continues to be crucial as it provides most of their protein intake. Although blowpipes, a traditional hunting weapon used for small and medium game, are nowadays seldom used, traditional hunting techniques are still preferred for large game species, such as the use of spear and dogs for bearded pig hunting. Moreover, despite the abandonment of sago palm grove management, other wild edibles such as wild mangoes (*Mangifera* spp.), durians (*Durio* spp.), and rambutans (*Nephelium* spp.) remain an important part of the Punan Tubu diet (Puri 2001). Most of the NTFPs traditionally involved in Punan-Dayak exchanges are no longer traded, either because there is no market (e.g., dammar) or because the resource is extinct or close to extinction (e.g., rhinoceros horns). However, the Punan Tubu nowadays exploit several species of rattan (*Calamus* spp.), which they use to craft utilitarian items such as mats and baskets. Nevertheless, currently the most valuable forest product in Borneo is *gaharu* or eaglewood, the fungi-infected part of a tree (*Aquilaria* spp.) used in the perfumery industry and reaching extremely high prices in market towns. The Punan Tubu typically organize expeditions to isolated parts of the forest lasting several days or weeks to look for the highest quality eaglewood.

We focused on the two most remote Punan Tubu villages, Long Nyau and Long Ranau, located at altitudes ranging from ca. 350 to 450 m (Fig. 3.1). Long Ranau is only accessible by a 2 to 3-day boat journey, people generally using long-tailed engines because of the hydric regime of the Tubu River, shallow and prone to sudden overflowing. Long Nyau lies about a half-day walk farther than Long Ranau. Long Ranau has 154 people (31 households) and Long Nyau 107 (24 households), although it is common that people periodically relocate from a village to another – or resettlement close to Malinau town.

3.3 Methods

Data collection took place from February to July 2013, in the framework of a larger research project (http://icta.uab.cat/Etnoecologia/lek/). This research complied with the ethical code of the International Society of Ethnobiology. Before starting data collection, we organized a meeting in which we explained our intended research plans. Participation was voluntary and free, prior and informed consent was obtained for every participant.

3.3.1 Spatial Georeferenced Data

We used GPS devices to obtain data on the spatial location of Punan Tubu forest activities. During a meeting before the onset of data collection we explained basic principles of geolocalization. Data collection consisted in giving people a watch GPS (Garmin Forrerunner 301) that would track their position every 2 min. Specifically, every day we looked for people who were going to the forest and gave them a GPS. If two or more persons were planning to go together, we only asked one of them to carry a GPS. We obtained participant's oral consent every time we gave a GPS device. Upon arrival to the village, people returned the watch and we asked them to report the main activity performed. Track records were saved on the computer. We focused data collection on activities that occur within a day in old-growth and secondary forests, i.e., hunting, collection of NTFPs, and logging. We excluded activities that occur in agricultural plots and bushes around the villages. We also excluded from our monitoring long expeditions such as the occasional trips organized for eaglewood collection. Although climate is relatively constant over the year in the study area, we were not able to collect data during the peak of rainfall.

3.3.2 Data Analysis

We performed visual analyses of the track-points using ArcGis 10.3, superimposing the tracks with relief maps. We also calculated the total area under use using the convex hull tool. To identify and visually analyze the stopovers, i.e., the areas where the density of track points is higher, we used a kernel density analysis with a 200-meter kernel radio, which allows the identification of hotspots, or areas of higher intensity of use. We performed a kernel density analysis for all the tracks and for the tracks of different activities (hunting, rattan collection, and logging).

To visualize the difference in track shape according to the activity, we plotted tracks for hunting, rattan collection and logging on a single map. To analyze the differences in spatial patterns of use between the two villages, we determined the intensity of use with a count of track-points in relation to the distance to the centre of each village and to the activity performed. We constructed concentric one-kilometre ring buffers around the village centre and counted the number of track points in each ring, excluding all the points that were less than 200 m from the village centre, since these points were mostly due to GPS error or to the fact that once people were carrying a GPS, they would not necessarily leave straight away.

3.4 Results and Discussion

3.4.1 Methodological Issues

Although we tried our best to explain people geolocalization principles and to keep a non-intruding attitude, we found a potential self-selection bias in people willing to carry the GPS. Some people were reluctant to carry a GPS because of the fear it would be lost or broken, or because of cultural fears like the belief that the GPS would bring bad luck for hunting or record voices. On the contrary, for other people carrying a GPS was associated with entertainment, and it is possible that this "positively" affected the trailing. When people came back from a hunting trip, we did not ask the outcome of the hunt, not to bring the focus on whether they had been successful or not, and not to create further association between GPS devices and hunting outcomes or cultural fears. Whenever possible, we obtained the information afterwards in an informal way.

Although the time the Punan invest nowadays in cassava and rice cultivation seems to be growing in detriment of the time spent in the forest (Sellato 1994), we acknowledge that the methodology used here cannot capture the actual frequency of forest visits. Some days, people would massively go to the forest – most probably depending on environmental conditions and game availability (Kaskija 2012) – while at other times they would mostly stay in or close to the village or in their agricultural plots several consecutive days. Moreover, our data do not include forest trips that lasted more than one day and which constitute a non negligible part of forest activities, villages occasionally being almost empty of men gone for NTFP collection. We also observed a distribution in the roles among villagers: some people went to the forest almost on a daily basis – even though they would not always accept to carry a GPS – while others seemed to favour investing time in their agricultural plots. Besides this individual specialization, our spatial data also reflect gender specialization. Women were underrepresented in the dataset, with only 11 % of the tracks being done by women. As it occurs for other forager groups (e.g., Posey 1985), besides housework Punan women are in charge of most agricultural tasks, which explains why they do not visit the forest as frequently as men.

This first experience with this innovative methodology suggests that potential ways of improving the quality of the data include (1) generating a deeper interest of people in spatial uses of the territory, e.g., by engaging them in programs monitoring biodiversity or natural resources; (2) reinforcing trust between people and researchers, e.g., through the training of local monitors; and (3) working more closely with women and with local foraging specialists.

3.4.2 Area Under Use

During the 6 months of data collection, we recorded a total of 116 tracks in the two villages – about one track every 2 days, corresponding to the movements of 54 adults. The total area under use, calculated as the area comprising all the tracks obtained, was 73.0 km^2 for Long Ranau and 68.3 km^2 for Long Nyau. This result is comparable to the average of 88.6 km^2 found for Tsimane' forager communities of the Bolivian Amazon, which encompassed the area used for several activities such as hunting, logging, and NTFP collection (Cruz-Burga et al. 2013).

The farthest track-points reported in our dataset correspond to hunting activities, so we can compare Punan hunting area to hunting areas reported for other hunter-gatherer groups. Overall, we found that researchers have documented relatively similar hunting areas for people living in Neotropical forests. For example, Smith (2008) reported a total of 131 km^2 for five Buglé and Ngöbe communities in Panama; Dunn and Smith (2011) found a total of 336 km^2 for two Miskitu villages in Honduras; and Constantino (2015) estimated an average of 32 km^2 for the hunting territory of Kaxinawa villages in Brazil when considering only one-day hunts. However, Read et al. (2010) found that kill sites in Makushi communities in Guyana are farther from the village centre than in our work, with an average distance of 9 km between the kill site and the village centre. This difference can be due to a higher population of Makushi villages and to differences in their transportation system.

The review of ethnographic information, however, suggests that the area nowadays under use is probably smaller than the area the Punan Tubu used in the past. Thus, Sellato (1994) estimated that a group of 25 Punan using sago as main staple would have needed roughly 50 sago palm groves to survive. Although the distribution of palm groves is unpredictable, the estimated number is an indication of the large size of the area previously used by the Punan. Therefore, and although long NTFP collection trips are not included here, it is probable that the area under use nowadays is smaller than the area previously used, likely indicating a concentration of the spatial patterns of use closer to the villages. Such new pattern resembles forest use by other sedentary indigenous peoples (Bennett and Robinson 2000). The current use of space by Punan Tubu implies that distant parts of the territory formerly used are nowadays seldom walked, although people might still use these areas for occasional hunts and eaglewood collection.

3.4.3 *Punan Tubu Foraging Strategy*

When describing movement patterns, the question arises of people's optimal foraging strategy in terms of resource use. Humans in different contexts – from hunter-gatherers to urban dwellers – might display random or non-random foraging strategies. In the case of hunter-gatherers, it has been shown that the foraging movements (including bouts for hunting and wild edible collection and transport) of two groups – the Ju/'hoansi in Namibia and Botswana and the Hadza in Tanzania- have Levy flight strategies (Brown et al. 2007; Raichlen et al. 2014), a type of random walks which "can be described subjectively by "clumps" of small steps separated by dramatic jumps" (Brown et al. 2007: 130).

In our work, topography seems to influence Punan forest movements; people usually follow environmental elements, such as rivers and ridges, and avoid steep slopes, thus clearly taking the easiest paths for their walks (Fig. 3.1). The choice of path, however, might not be only explained by the difficulty of the trail. Researchers have argued that, when looking for a resource, the easiest way to explore an area is to locate remarkable environmental features as an orientation point (Kelly 2003). Rivers have been reported to be the major feature of the cognitive map of the Penan of Malaysia, a neighbouring nomadic group (Harrison 1949: 135), so it is possible that, for the Punan Tubu to follow rivers is also the best way to recognize the territory. However, while giving clues, topography alone does not allow us to conclude that the Punan Tubu do not follow random walks while foraging. Finer analyses based on distribution probability models using different step length between two track-points are needed to understand how hunter-gatherers utilize resources. This could help define potential spatial clusters of people's resource use and thus inform on natural resource conservation, especially in ecosystems where satellite data are not always available or informative, such as tropical forests.

3.4.4 *Stopovers and Unintended Forest Biodiversity Management*

The territory transited by the Punan Tubu is marked by stopovers, i.e., areas where people slow down or stop walking, as determined by an untypical concentration of GPS points in a given area. We used kernel density analyses to identify stopovers for several forest activities: hunting, rattan collection, and logging (Fig. 3.2a). These stopovers can correspond either to a simple rest or to activities related with the purpose of the trip, such as a hunting catch or the preparation of an animal to take it back home, or rattan collection at a particular grove.

The analysis of stopovers is important because at these stopovers people intensively use and manage forest biodiversity either in an intended or in an unintended way, due to different practices involving plant and animal species. While forest

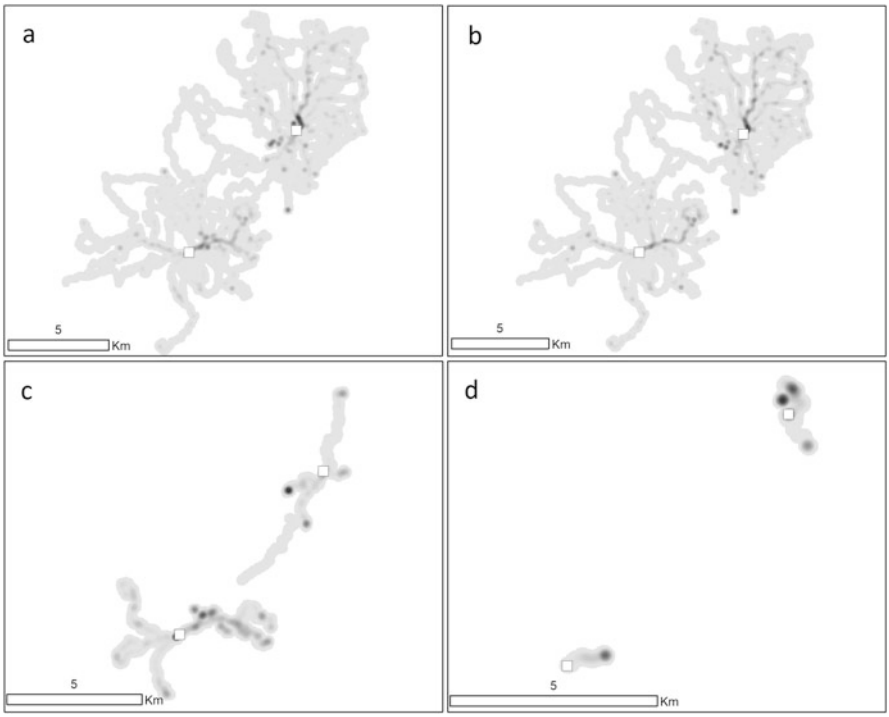

Fig. 3.2 Kernel density maps of track points for forest trips including (**a**) all activities; (**b**) hunting; (**c**) rattan collection; (**d**) non-commercial logging. Kernel radio is 200 m. *White squares* represent village centres

trails are regularly maintained and have an influence on vegetal diversity (Ballantyne and Pickering 2015), the intensity of management is also high at stopovers and likely impacts plant diversity, particularly at resting areas that are communally utilized and where small temporary shelters can often be observed. Management activities include passive sowing of fruit kernels and seeds collected in other forest areas, occasional transplanting of saplings to homegardens, slashing, and cutting of small trees and lianas for different purposes (Peres et al. 2006).

The kernel density analyses highlight the fact that many areas of the territory used by the Punan Tubu are walked with a low frequency and appear empty of track-points. In such areas, the human influence on plant and animal diversity is likely to be very low. Researchers have used source-sink fauna dynamics to assert that areas where hunting pressure is lower or inexistent – no-take areas – are desirable for game sustainability among hunter-gatherer communities (Ohl-Schacherer et al. 2007; Shepard et al. 2012; Sirén et al. 2004). It is possible that the Punan Tubu also contribute to the existence of such areas with much less intensity of use. However, our data do not allow an inference on the size of source areas, since the analysis for sustainability studies usually cover larger areas (see Parry and Peres 2015) and the size of

the no-take areas should relate to the reproductive biology of game species of interest.

3.4.5 Track Features Across Forest Activities

The Punan Tubu show a range of forest activities, including hunting and wild food collection (fruits, honey, mushrooms, small vertebrates), NTFPs collection (mostly rattan, gaharu, and firewood), logging for village house construction, and travelling to other villages and to former camps or agricultural plots. Here we focus on hunting, rattan collection, and logging, since these three activities represented most of the tracks collected during our fieldwork. Our main finding in relation to these activities is that the different activities performed by the Punan Tubu are associated with different spatial movement patterns, specifically the shape of the tracks and the distribution of track-points (Fig. 3.3).

During hunting expeditions, Punan's movements are rather scattered in space, seemingly corresponding to intended walks along different paths as to maximize the opportunity of game encounter. A pattern found in our data is that the distal end of

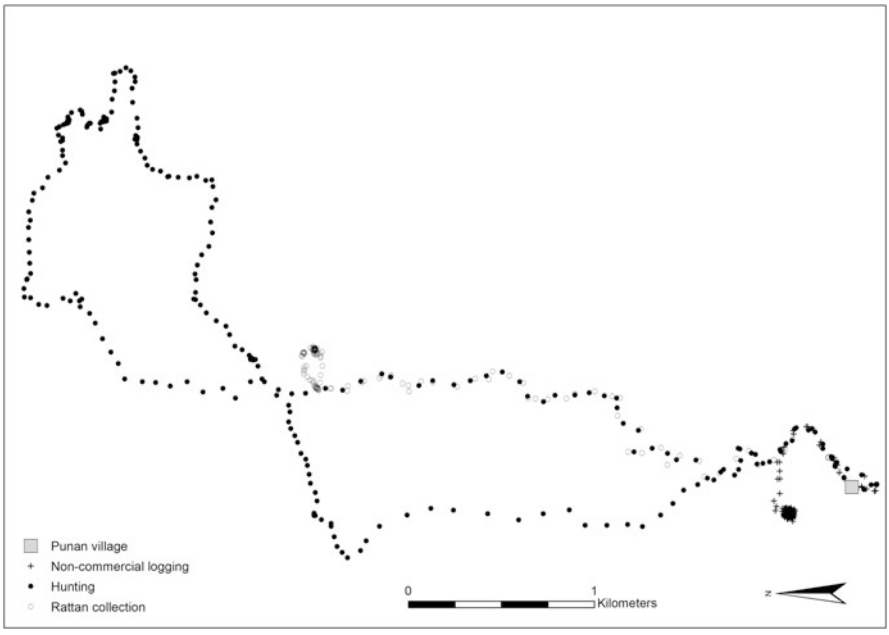

Fig. 3.3 Spatial representation of three examples of GPS tracks generated during three different activities: hunting, rattan collection, and non-commercial logging. GPS tracked one point every 2 min (total time = 518 min for hunting, 290 min for rattan collection, and 546 min for logging)

the track with respect to the village contains more points than the rest of the track. This pattern can be attributed to a possible catch and the associated activities (tracking the animal, preparation of the prey to take it back home), or to a shift in hunters' behaviour. Thus, previous research has found that the hunting behavior of hunter-gatherers can change towards the end of the hunt to adapt to the lack of availability of the preferred species (Levi et al. 2011). Then, the pattern we observed in hunting tracks might be due to a change in the pursued game species or at least to a change in the hunting strategy, e.g., a slower walk to maximize the chance of finding a prey. Nevertheless, it is worth noticing that in our case study, the catches reported mostly correspond to the preferred species among the Punan Tubu -the bearded pig. In just one track the person brought a monkey (*Macaca fascicularis*) and in another case, a monitor lizard (*Varanus* sp.).

Compared to hunting tracks, rattan collection tracks are spatially more concentrated and tend to follow one single path for both ways of the trip. The observed tracks likely reflect the ecological distribution of rattan groves as a fixed concentrated resource (sensu Bahuchet 1991). People already know where the rattan grove is, and they maximize the time in the place of interest and minimize the walking time to reach the grove.

Logging tracks show similar patterns to rattan tracks, but are located closer to the villages. This observed pattern might be due to two reasons. First, the Punan lack heavy machinery to help them transport the logs, and the wood is usually cut in situ and carried on people's shoulders, who take turns for the transport. This certainly affects the place where the timber is cut, as people probably seek the closest trees so to minimize transport. Second, timber had not been exploited by outsiders in the area, at least until our fieldwork ended. Thus, woods with good construction properties such as meranti (*Shorea* spp.) could be found relatively close to villages.

The visual analysis of stopovers also highlight differences in stopover spatial distribution according to the activity performed. While hunting leads to numerous stopovers relatively scattered in space and rather evenly distributed around villages (Fig. 3.2b), the stopovers for rattan collection and non-commercial logging are less abundant and trails seem to be free of stopovers others than the collection places (Fig. 3.2c, d). Differences in stopover spatial distribution according to the activity suggest that the maintenance or modification of biodiversity in stopover areas changes with the performed activity; while for hunting stopovers mostly involve unintended plant diversity modifications as "secondary" activities, for rattan collection and logging the modification is central, i.e., intended.

3.4.6 Village and Individual Differences in Spatial Patterns of Use

Our data highlight inter-village differences in the distances walked when considering different activities. Overall, most activities were performed within 4 km from the village centre, and the ring between 3 and 4 km comprised more than 25 % of all track points (Fig. 3.4a). People in Long Nyau showed more activity in the medium

rings (2–5 km) while people in Long Ranau showed more activity in the closest (200 m to 1 km) and the farthest (5 km and more) rings. This pattern is similar when considering only hunting track points (Fig. 3.4b), but people in Long Nyau spend more time collecting rattan farther from their village than people from Long Ranau, who spend more time in the 3 to 5-km rings (Fig. 3.4c).

Such inter-village differences most probably reflect the distribution of the resource. Although we could not obtain data on the location of rattan groves, these seem to stand closer to the village in Long Ranau, while game seems to be found closer to Long Nyau than Long Ranau. The observed game distribution could be related to topographic differences – the terrain around Long Nyau is somehow flatter than in Long Ranau-, or other environmental differences between the two villages, such as the distribution of fixed resources for game, e.g., food or salt licks. However, it is also possible that longer settlement time in Long Ranau (ca. 40 years) than in Long Nyau (ca. 20 years) has lead to a depletion of game resources close to the village, forcing people to walk further in the forest to hunt (Constantino 2015).

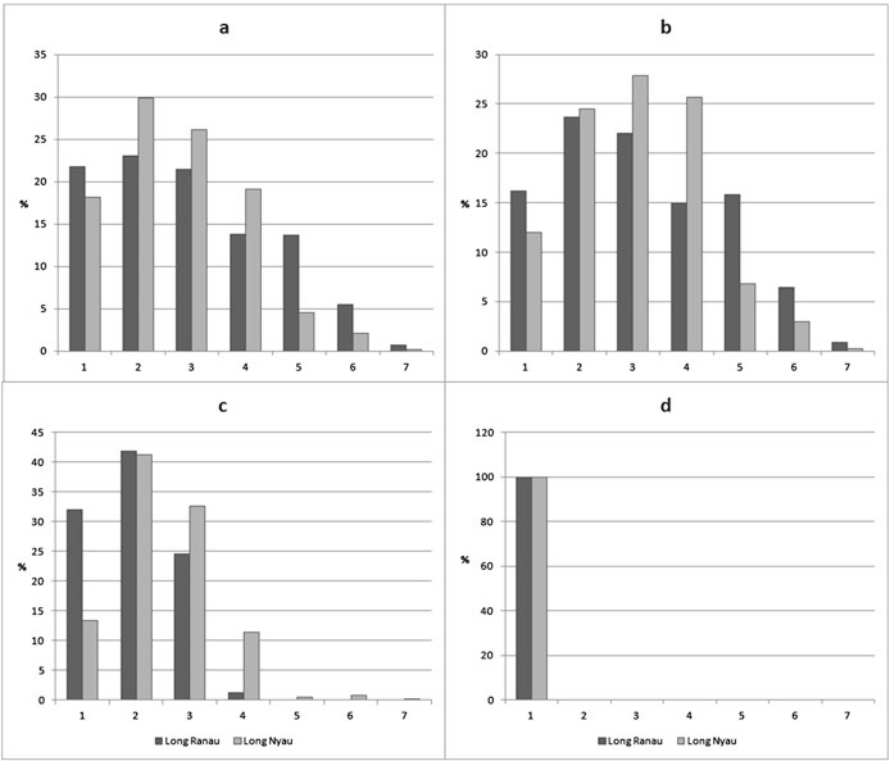

Fig. 3.4 Share of track points recorded in ring buffers around two Punan villages, distributed per type of activity. Number categories represent the farthest distance of the buffer (in km). Category 1 includes track points from 200 m to 1 km from the village. (**a**): all activities; (**b**): Hunting; (**c**): Rattan collection; (**d**): Non-commercial logging

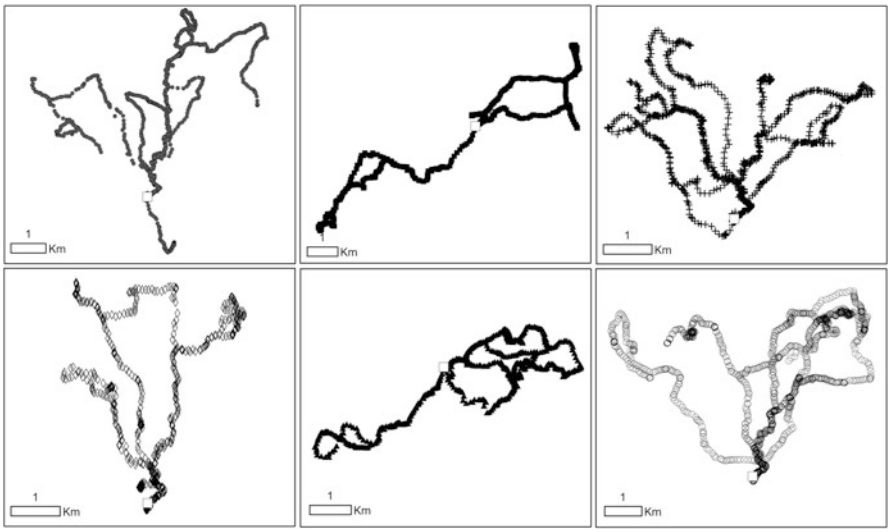

Fig. 3.5 Spatial plots of individual tracks in Long Ranau. Each plot represents the track points of at least three forest trips for one individual. *White squares* represent the village centre (Long Ranau)

Besides inter-village differences in movements, differences can also be observed amongst individuals. Although our data are too scant to conclude on individual trends in spatial use, we provide an example of how individuals share the territory of Long Ranau by plotting spatial patterns of use for people who recorded at least three tracks (Fig. 3.5). We draw two main observations. First, individual people seem to prefer certain areas of the forest for their daily activities, as they repeatedly use these areas. Second, the areas of preference can overlap amongst individuals: additional analysis by family or clan would be helpful to understand the drivers of this distribution.

Thus, our data suggest a spatial partitioning of the territory amongst individuals, which reflects the importance of individual social or cultural characteristics as drivers of forest use. Research has shown that some hunter-gatherer groups have recently developed individual ownership of resources such as thatch palm groves, while in the past the same resource would be communally owned and managed (Fernández-Llamazares et al. 2016; Salo et al. 2014). In our case study, we understood from informal interviews that the Punan Tubu have developed an individual or household usufruct of valuable tree individuals, such as durians or eaglewood. For instance, some trees bear marks on the trunk so as to recognize such ownership, and consent might be asked to gather fruits from these trees. Although this remains speculative, it is possible that the same kind of customary rules apply for hunting areas and not only for species individuals or groves. It is also possible that the rules developed for species individuals influence the use of certain parts of the forest more than others – such would be the case when people "owning" the usufruct of

trees might be more prone to hunt in the area containing these trees. Spatial partitioning of forest use might also be related to a within-household transmission of traditional ecological knowledge and beliefs associated with those areas (see Tsai and Lo 2013).

3.5 Conclusion

Findings from this work suggest that forest uses vary in intensity and spatial distribution across communities and individuals of a group, and that such diversity might result in differentiated impacts on the landscape and lead to different conservation value for areas seemingly under identical management. Spatial data generated by the use of GPS to trail the walks of foragers are rich with information; however further analyses should include social and biological data to fully assess the conservation value of such forest areas – as well as to give an estimation of the sustainability of forest people's practices. Researchers have emphasized the role of community-based resource management and conservation. Results obtained with the methodology proposed here could help the planning of such actions because they highlight fine-scale spatial patterns of use reflecting intracultural differences in livelihoods and practices, thus implying that conservation initiatives should be locally adapted to fit these differences. Since the area used by the Punan Tubu is likely to have decreased as a consequence of sedentism and government resettlement programs, some areas distant from the villages and seldom transited nowadays are also likely to have a better conservation value than more used areas around the villages. These differences in the intensity of use according to the distances to settlements can be compared to zonation approaches in conservation (e.g., Kareksela et al. 2013), and can be captured by GPS-based individual trailing. Furthermore, our spatial analysis shows differences in forest use patterns between villages. Thus, it can inform about differences in the conservation value of forest areas that are used by different communities, albeit from the same ethnic group (see also Parry and Peres 2015).

GPS-based individual trailing also holds potential for informing community-based conservation approaches, especially to help anticipate current and future changes and pressures indigenous communities are facing. In the case of the Punan Tubu, the recent construction of a road promoted by district government and logging companies might create new incentives and economic opportunities not only for outsiders, but also for the Punan Tubu themselves, as well as for those Punan who resettled close to cities and are now starting a return to upriver villages. These opportunities will certainly affect the way people use and manage the forest – in terms of frequency of visit, distance of use, and activities performed- and intensify the differences across individuals. Thus, as forest dwellers still maintain their traditional livelihood for subsistence, they should be able to rely on techniques to inform both on forest uses and biodiversity changes, such as individual tracking and community monitoring. We found differences in the stopover spatial distribution,

reflecting differences in the – often- unintended management and biodiversity across activities. These differences imply that if some activities are favoured at the cost of others due to the development of a road, the unintended management of forest would also change. Future analyses should include the fine-scale identification of stopovers and their relation with biodiversity, since it is crucial to determine the conservation value of areas traditionally used by foragers.

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Chapter 4
Bushmeat Crisis, Forestry Reforms and Contemporary Hunting Among Central African Forest Hunters

Mitsuo Ichikawa, Shiho Hattori, and Hirokazu Yasuoka

Abstract Several million tons of wild animals are hunted and their meat is consumed as an important source of food in central African forest countries. Hundreds or even thousands of tons of bushmeat are also smuggled into Europe, a situation that has recently posed health problems. There is a strong preference for bushmeat among the central African people, who distinguish "hunger for meat" from hunger for starchy food. Furthermore, bushmeat is not only a source of protein, but also valued as the source of "wild power" that can not be obtained from fish or domesticated animals. Improved access to remote forests through logging roads and the development of a consumer economy have resulted in a rising demand for bushmeat, both among African town dwellers and abroad. The excessive hunting pressure resulting from the increasing demands is, however, imposing serious impacts both on animal resources and the forest ecosystem and on local people's livelihoods. This chapter describes the current situation of bushmeat hunting and consumption, and the background leading to the increasing demand for bushmeat. Taking Cameroon as an example, we also discuss the ecological problems brought about by overhunting, and address the issue of adverse impacts imposed by the recent national forestry reforms and of hunting regulations. The final section of the chapter describes an ongoing project aiming to reconcile forest conservation and poverty alleviation through the sustainable use of forest resources.

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4.1 Introduction

On June 15th, 2001, a story that ran on the BBC pointed to the global implications of bushmeat hunting in African countries. According to this story, two shopkeepers were sent to prison for smuggling the meat of endangered animals into Britain in what was reported to be the first bushmeat case to come before an English court (BBC 2001). This case raised the issue of the conservation of endangered animals among the inhabitants of the UK. Reports on the illegal bushmeat trade continued in subsequent years. According to the BBC, in 2002, 10 tons of African bushmeat may have reached London every day (Kirby 2002). Similarly, an investigation by Chaber et al. (2010) calculated that about 5 tons of bushmeat per week are smuggled in personal baggage through the Paris Charles de Gaulle airport.

Smuggled bushmeat is mainly consumed by African immigrants living in Europe, but also by people who like exotic and rare food. It is informally sold at relatively high prices. In Paris, for example, it is sold for 20–30 euros/kg, compared with 15 euros/kg for domestic meat sold at supermarkets (Chaber et al. 2010). At the time of this research, a smoked monkey weighing four kilograms costed approximately 100 euros in France, about 20 times the local price in Cameroon (i.e., around 5 euros). In New York, bushmeat from Africa was sold at 5–8 dollars per pound (Milius 2005). In other words, bushmeat trade is a potentially lucrative business.

Bushmeat consumption, however, may pose health threats. For example, a study of African forest hunters has shown that a virus similar to HIV can be passed from apes to humans through bushmeat consumption (Wolfe et al. 2004). The Ebola virus is also thought to be transmitted through bushmeat, in particular through the consumption of fruit-eating bats. Rodents and antelopes, the major targets of hunting in the central African forest region, are also suspected of transmitting the Ebola virus through feeding on fruit partly eaten by bats (WHO 2014). With the increase in studies showing that bushmeat may bring human health problems, EU countries have become more cautious and bushmeat has now become an issue of public health, in addition to being a concern in wildlife conservation.

Most bushmeat traded in Europe comes from Africa and in particular from central and west Africa. Africa produces the largest amount of bushmeat, estimated between a million to several million tons in the Congo basin alone (UK Parliament Office 2005). However, most bushmeat is consumed within the region, with only a small part is brought into Europe and the US. According to the literature, central African hunter-gatherers consume between 50 and 200 g of bushmeat per person per day, with cultivators and other groups consuming a slightly lower amount (20–185 g) (Ichikawa 2008; Wilkie and Carpenter 1999). As there are about 50–60 million people living in central Africa, several million tons of bushmeat are presumably harvested each year in the region.

The recent increase in the demand for bushmeat may endanger the wildlife population in the region (Ichikawa 2008). In particular, larger-sized mammals, including rare and endangered species, such as forest elephants, leopards, great apes, and larger types of antelopes, are most vulnerable, because of their slow

reproduction rate. For conservationists, the raise in bushmeat consumption hampers the maintenance of healthy ecosystems and biological diversity. A blanket ban on bushmeat hunting in central Africa would, however, endanger the livelihood of local human groups, and can ironically result in further defaunation through uncontrolled poaching. In other words, the bushmeat crisis is not only a crisis in relation to the extinction of wildlife; it is also a crisis of livelihood and food security. As Nasi stated, in an interview from September 2014, the amount of bushmeat harvested in Central Africa is estimated at 5 million tons per year, or about the equivalent to the cattle production of Brazil or of the European Union. To produce this amount of cattle in the Congo Basin, it would be necessary to deforest 20–25 million ha (CIFOR 2014).

Additionally, we must note that people are not necessarily driven to consume bushmeat by a lack of alternative sources of protein. In the African context, bushmeat is highly prized for providing "wild power" (the power of the forest), which cannot be obtained from the meat of domestic animals or fish. This is a major driver in the consumption of bushmeat and therefore of the development of bushmeat markets in the region. Increases in wealth among Africans, far from reducing the demand for bushmeat, may actually increase demand. Furthermore, the emigration (diaspora) of Africans and the globalization of their food culture are additional drivers affecting the demand for bushmeat. For example, although in the UK, France, or the USA domestic meat supplies most of the meat demand, there is a growing market for imported bushmeat despite its high price. For some Africans living in large towns (even in their own countries), bushmeat may have a special value as a luxury or a nostalgia food, reminding them of the forest wilderness. Thus, although the bushmeat sold in towns is usually smoked, tough and lean without much fat, people express a strong preference for wild animal meat, as it is the food of their homeland and, as such, is valued as a symbolic restoration of the relationship with the forest or wilderness of the homeland. In other words, the issue of bushmeat consumption is not restricted to providing nutrition for poor Africans; rather the consumption of bushmeat has cultural roots that have generated an increasing demand for bushmeat with global ramifications.

It is, therefore, necessary to consider the issue of bushmeat within a wider context. While hunter-gatherers in central Africa are not directly involved in the intercontinental bushmeat trade discussed above and do not play a major role in the overall harvest of wildlife in the region, it is important to understand wildlife hunting in this wider context, because increases in external demand for bushmeat may result in overhunting and the deterioration of the animal resources on which forest peoples depend. Notably, due to overhunting and international pressures to conserve forest wildlife, governments in the region have imposed policies to restrict local hunting practices. Such conservation policies directly affect the food security of hunter-gatherers in the region.

In this chapter, we first describe the importance of bushmeat to the livelihood and culture of central African hunter-gatherers, and the background for the increasing demand for bushmeat in the region. Then, mainly drawing on information from our previous work in Cameroon, we show the potential ecological problems

generated by excessive hunting, and how recent restrictive forest policies and hunting regulations have resulted in adverse impacts on the livelihood of hunter-gatherers. In the final section, we introduce our current research project, aimed at establishing sustainable uses of forest resources while maintaining a forest ecosystem that sustains local livelihoods and cultures.

4.2 Bushmeat in the Food Culture of Central African Forest Peoples

Central African forest peoples distinguish between two types of hunger. One is the hunger for starchy food, or energy, which is called *nja* or *njala* among Bantu-speaking Mbuti hunter-gatherers and *pote* among the Ubangian-speaking Baka hunter-gatherers. The other is hunger for meat, called *kpelu* among the Mbuti and *pene* among the Baka. Hunter-gatherers complain that they suffer from "meat hunger" when subsisting on a village diet with little meat input, whereas they say they get "tired" when eating much meat but little starchy food while in forest camps (Ichikawa 2008). This distinction is widespread among forest-dwelling peoples in central Africa and illustrates the importance of both meat and starchy food in their diet. Moreover, as mentioned, bushmeat is not just a source of protein: it is also highly valued as a source of "wild power" (or the power of the forest). Moreover, hunter-gatherers in the region do not usually eat the meat of goats and other domestic animals, which are considered farmers' food.

In a previous research among the Baka hunter-gatherers in Cameroon, we found that bushmeat accounts for about 38 % of the total weight of side dishes eaten during the research period (Hattori 2012). Bushmeat is also an important source of household income. A comparative study by Nasi et al. (2008), based on available literature, shows that about half of all bushmeat is sold to people outside the village of capture. In the study mentioned before, we also found that bushmeat accounted for as much as 45 % of household cash income among the Baka in Malea Ancien, southeastern Cameroon (Hattori 2005, 2012). Additionally, bushmeat is also exchanged for agricultural food, clothes, cooking utensils, other manufactured goods, and alcoholic drinks. In the village of Gribe, southeastern Cameroon, where we have been working for the past years, 26.7 % of the animals captured in 2013 were used for self-consumption, whereas 67.8 % (particularly duikers) were sold for cash (Bobo et al. 2015).

As a highly valued food, bushmeat also has social significance. Hunted meat is always shared with other camp members and serves to strengthen or restore social relations. Among Central African hunters, an animal belongs to the owner of the hunting tool with which the animal was killed, i.e., the owner of the net in the case of net hunting, the owner of the spear that gave the first fatal stab, or the owner of the cable snare with which the animal was trapped (Ichikawa 2004). However, usually the meat is widely distributed. Meat distribution starts with the participants in the hunt, who receive meat depending on the roles they played. For example, from

the game the Mbuti hunt with a net, a hind limb is given to the hunter who actually used the net and captured the animals, a front limb to the woman who carried the carcass to the campsite, part of the chest to a man who assisted in capture, and so on. (Ichikawa 1983). In this way, cooperative hunting is linked to cooperative consumption, through which the integrity of a hunting group consisting of people with different roles is reconfirmed. The Aka net-hunters in northern Congo-Brazzaville express such group cohesion by shouting "*bando!*" in chorus during the hunt, an expression which literally means the distribution (or parts of meat distributed) based on the roles played in the hunt (Ichikawa 2004; Takeuchi 1995). Those who have received meat in the first distribution further share the meat among other camp members who did not participated in the hunt. When big game, such as an elephant, is killed, the entire camp moves to the killing site. Each person takes as much meat as desired and a feast, which lasts until everyone is satisfied, follows. In such a way, meat plays an important role in maintaining social relations.

Despite the economic and social importance of bushmeat, there is also a widespread belief among central African forest people that some wild animals may cause serious diseases and abnormalities both among those who eat them and their dependent children. Such "bad" animals, which are thought to cause disease, are called "*kuweri"* among the Mbuti hunter-gatherers, "*eke*" among the Efe, "*ekila*" among the Aka in Congo-Brazaville, and "*ki*" or "*kila*" among the Baka in Cameroon (Ichikawa 1987, 2007). The diseases deriving from these animals are named after the animal species suspected to have caused them, such as "fever of (a specific type of) monkey".

In sum, bushmeat consumption is deeply rooted in the cultural beliefs of central African hunter-gatherers, with wild animals providing nutritional food, symbolic strength, and income, but also potentially causing various diseases and other misfortunes.

4.3 Bushmeat Trade and Its Ecological Impact: The case of Cameroon

4.3.1 The Intensification of Bushmeat Trade in Cameroon

Commercial meat trade has increased in southeastern Cameroon since the late 1980s, when industrial logging intensified and bushmeat became a protein source for the employees of logging companies. The opening of the roads also allowed the transport of bushmeat to towns, where the increasing purchasing power of city dwellers allowed the spread of a bushmeat market. Moreover, during the economic crisis and the following structural adjustments in late 1980s and early 1990s, some of those who lost jobs in town returned or moved to forest areas (Bikie et al. 2000). While some began to pursue agriculture, others got engaged in the bushmeat trade as an easy way to earn cash. From the 1990s to the early 2000s, as a network of logging roads began to reach deep into the forest where the Baka live, traders entered the interior forest to acquire bushmeat and other forest products. The traders brought

Fig. 4.1 A Baka man drying meat for trading (Photograph by Yasuoka)

commercial food items, cables, alcoholic drinks, and other goods which were given in credit to the Baka, who agreed to repay the products with bushmeat. At that time, Baka hunter-gatherers began to use a larger number of snares with steel wire, provided by meat traders. In this way, debt-ridden Baka were pressed into intensive forest hunting. Some traders even entered the hunting territory of the Baka to set traps themselves. The Baka hunter-gatherers started to dry large amount of bushmeat for trading (Fig. 4.1). According to Yasuoka (2006), who studied the Baka hunters before and after the beginning of logging operations, hunting pressures increased abruptly when the logging roads were opened and meat traders reached his study site at Zoolabot, located to the north of Nki National Park.

During the 1990s the government attempted to halt the increase in bushmeat hunting through a new Forest Law. The 1994 Forest Law classifies the forest into zones of different land uses (*plan de zonage*). A UTO (*Unite technique de Operation* = Operational Technical Unit) was set up in southeastern Cameroon for the integrated planning and management of natural resources. The UTO in southeastern Cameroon consists of three national parks, 22 Forest Management Units (FMUs), 14 community managed areas of hunting interest (ZICGC), and nine sport-hunting areas (ZIC). Of these, only the ZICGCs (which include community forests) can be used for hunting by local people (they can also be leased out to sport hunting companies). In other words, under the 1994 Forest Law, most of the permanent forest area in southeastern Cameroon was designated either as an area devoted to conservation (e.g., national parks and other protected areas), or reserved for logging operations (e.g., FMU) (Fig. 4.2). Moreover, several years after the establishment of the 1994 Forest Law, most FMUs were allocated to logging companies. Local communities were allocated only narrow strips along the roads, in non-permanent forest zones, where they could engage in cultivation and limited hunting and gathering. Parts of non-permanent forest areas were designated as community forests subject to the approval of a sustainable management plan by the Ministry in charge of forestry. In such areas, local communities could exploit timber. More than half of the areas traditionally used by the Baka hunter-gatherers were designated either as logging areas (production forest), or as national parks in which the Baka are prohibited from hunting or spending nights for the purpose of hunting and gathering (Fig. 4.2).

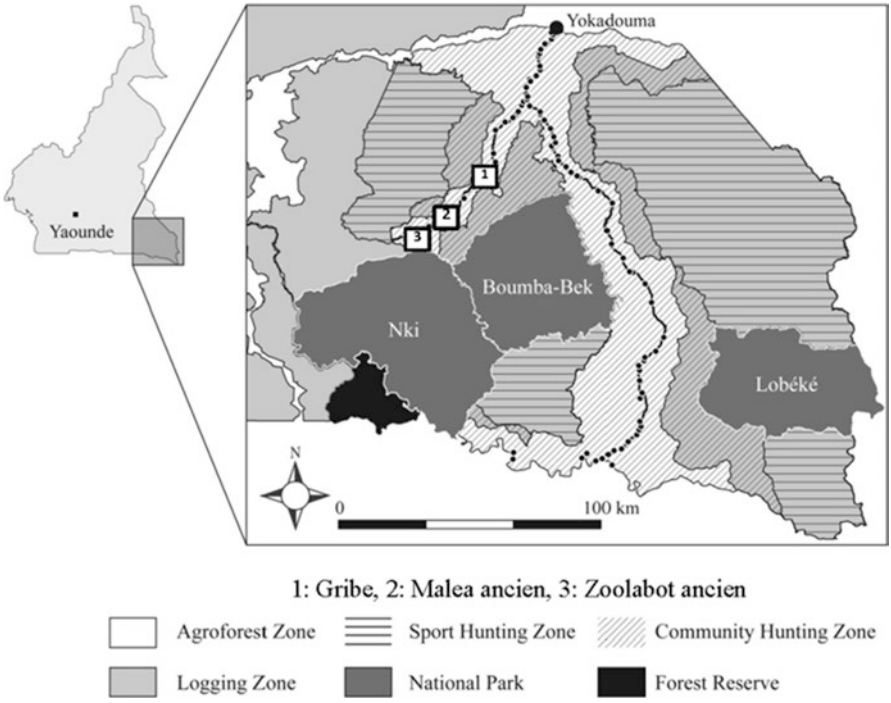

Fig. 4.2 Study area and land use classification in Southeastern Cameroon (Modified from Hirai 2014)

The restriction of hunting grounds, coupled with the increasing demand for bushmeat, posed a risk to the sustainability of hunting in the area. Before industrial logging began, hunting was carried out mainly for subsistence and hunting pressure was well within the sustainable ranges (Yasuoka 2006). After the construction of logging roads and the arrival of commercial meat traders to the interior forest, hunting pressure rose drastically, increasing 15–20 times and reaching a level several times above the maximum sustainable yield (Table 4.1). As mentioned above, most bushmeat is now hunted for commercial purposes and, in some cases, the amount of meat for sale or barter accounts for as much as 10 times the amount of meat for self-consumption. This heavy hunting pressure is currently reducing the resource base and threatening both biological diversity and livelihoods in the area.

4.3.2 Ecological Problems

The major hunting targets in Southeastern Cameroon are ungulates, mainly forest duikers, which account for as much as 80 % of the total catch. Where gun hunting is practiced, arboreal primates are also hunted with shotguns during the day. In other

Table 4.1 Maximum and actual hunting yields before and after the road opened

Game	Maximum sustainable yield	Actual yield	Remarks
	(head/km^2/year)	(head/km^2/year)	
Red duikers	0.5–6.0	0.9	Yasuoka (2011): Before road opened
Red duikers	0.5–6.0	13–16	Yasuoka (2011): After road opened
Red duikers	0.89–2.5	2.93	Bobo et al. (2015): After road opened
Blue duikers	1.28–3.91	12.17	Bobo et al. (2015): After road opened

central African forest areas, as for example among the Mbuti in Democratic Republic of Congo and the Aka in Congo-Brazzaville, duikers are also a major target of net hunting. In the Ituri Forest, 60 % of the total individuals caught are small blue duikers (Ichikawa 1983). By contrast, the major portion of the catch from snare hunting among the Baka in Cameroon consists of medium-sized red duikers, accounting for almost 80 % of the catch (Yasuoka 2006, 2014). The difference in the composition of catch is related to the difference in hunting methods, which in turn reflects the relative abundance of major game species in the area. In the Ituri forest, where net hunting is prevalent, smaller blue duikers are more abundant, whereas medium-sized red duikers predominate in southeastern Cameroon, where snare hunting is a more common method.

A notable exception is the roadside area of Lobeke in Cameroon, where snare hunting is the most common method, despite the relative abundance of smaller blue duikers (Table 4.2). According to Yasuoka (2014), this difference may be due to the overharvesting of medium-sized red duikers. The hunters in this area, therefore, seem to have adapted their snares to the change in target animals. While the steel wires used in store-bought snares consist of six finer wires, in hunting red duikers (weighing 15–20 kg), such wires are used separated into two parts, with three finer wires each. By contrast, when the hunter targets the smaller blue duikers (weighing 4–5 kg), the hunter uses only one fine wire (instead of three), which better suits smaller animals (Yasuoka 2014).

The difference in the composition of the catch suggests differences in the degree of hunting pressure in the area. Generally speaking, rodents and other small animals account for a larger part of the catch in West African regions, where there has long been heavy hunting pressure (Davies and Robinson 2007). Arguably, this results in the replacement of larger by smaller animals, which reproduce more quickly and are more resistant to heavy hunting pressures. As ecologists have shown, the change in relative game abundance influences the forest ecosystems, favouring or disfavouring certain plant and animal species (Abernethy et al. 2013; Nasi et al. 2010, 2011; Wilkie et al. 2011). In extreme cases, the forest becomes “empty” with few or no game animals, even if the tree populations remain intact. This is called the “empty forest syndrome”, a phenomenon that has been reported in some parts of the Congo Basin (Redford 1992). The disappearance of game animals has a profound impact on the forest ecosystem, since animals play a vital role as herbivores, prey animals,

Table 4.2 Hunting method, abundance and catch among Central African hunters

Area	Group	Method	B. density	R. density	B. catch	R. catch	Relative abundance
Ituri south, settled area	Mbuti	Net	6.9	2.2	356	107	B>R
Ituri south, remote area	Mbuti	Net	11.7	3.9	1054	335	B>R
Ituri eentral, settled area	Mbuti	Net	14.8	8.2	698	303	B>R
Ituri central, remote area	Mbuti	Net	17.8	8.7	974	465	B>R
Zanga-Sanga	Aka	Net	10.7	2.7	440	64	B>R
Lobeke, 0–10 km	Baka	Snare	3.6	2.5	245	113	B>R
Lobeke, 10–20 km	Baka	Snare	2.3	5.5	55	82	B<R
Lobeke, 20–30 km	Baka	Snare	1.4	6.3	22	85	B<R
Lobeke, 30 km<	Baka	Snare	3.8	15.1	3	16	B<R
Zoolabot ancien	Baka	Snare	0.6	8.0	35	486	B<R

B Blue duiker, *R* Red duikers; Yasuoka (2014)

and seed dispersers. Without these animals, the forest ecosystem cannot be maintained in the long term, and the future role of the forest as a carbon sequester to help prevent global warming may be undermined (Nasi et al. 2010).

4.3.3 Cameroon Forest Reform and Local Livelihood

To combat increasing hunting pressures, and under strong pressure from UN organizations and international NGOs, governments in the region have been taking measures to control hunting and protect wildlife. The regulation of hunting has been implemented through institutional reforms of the forest sector, which includes wildlife components. In this section, we examine how the current Cameroon Forest Law adversely affects hunting practices and poses a risk for forest peoples.

In Cameroon, current regulations on wildlife hunting mainly derive from the 1994 Forest Law (Government of Cameroon), and the following Prime Minister's Decree and the Ordinances of the Minister of Forests and Wildlife. Although the 1994 law is currently being revised, the new bill has not yet been submitted to the parliament. Even if the new law is approved, it will not be immediately implemented. In addition, there is already a risk, noted by some NGOs, that the draft revision of the Forest Law would fail to guarantee adequate protection for the right of indigenous peoples to own, use, and control their lands and resources (OKANI et al. 2013).

The 1994 Forest Law has a provision for "community forest", which is created in non-permanent forest zones. According to Article 27-(4) of the Decree of 1995,

the surface area of a community forest may not exceed 5000 ha, an extension clearly too small for hunting, typically needing an area up to ten times as large as that of community forest areas. Thus, "illegal" hunting is an inevitable consequence of the law's restriction. To address this issue, in 2001 the Government of Cameroon created new types of hunting zones: the *Zone d'Intérêt Cynégétique* (ZIC), or Hunting Interest Zone (for sport hunting), and the *ZIC á Gestion Communautaire* (ZICGC), or Community Managed ZIC. There are a total of 10 ZICs and 14 ZICGCs in the south eastern forest region. The management of ZICGCs is undertaken by the COVAREF (*Comités de Valorisation des Ressources Fauniques*), which includes both Baka and Bantu members. For example, ZICGC No. 13 is managed by a committee consisting of 49 members, of which 21 are Baka, including the vice-president of the Committee. Actual decisions are, however, usually made by the Bantu members of the Committee. While the Baka are, to some extent, represented in this forest resource management committee, their presence is insufficient and they are seldom able to make their voice heard in the actual decision-making process.

A ZICGC is a maximum of 100,000 ha, mainly consisting of non-permanent forest (agro-forestry) areas, but partly overlapping with logging areas in the permanent forest zone (see Fig. 4.2). A ZICGC can either be used for hunting by local populations or leased out to sport (trophy) hunting operators. In the latter case, leasing fees and 10 % of the hunting tax collected are given to the local community (Hurst 2007). The more game-abundant forest areas are, however, either classified as protected areas or as ordinary ZICs, reserved for sport hunting operators with government-issued hunting licenses.

In the 1994 law and the 1995 decree that followed, provisions were also made for other hunting regulations. First, local people without hunting licenses are allowed to engage in "traditional hunting," or hunting with implements made from plant-materials (Decree 1995 Article 2-20). Thus, although most animals are actually captured by local people using steel wire traps (Hattori 2012), this hunting technique is technically prohibited by law. Even in villages where gun hunting is commonly practiced, steel wire traps and guns contribute almost equally to the catch, with about 40–50 % of the catch each (Bobo et al. 2015). Gun hunting is also practiced at night with flashlights, which is also illegal (Article 80 of 1994 Forest Law).

The 1994 law and the 1995 decree, as well as the 2006 Ministerial Ordinance (Government of Cameroon), also stipulate the protection of animal species by classifying them into three categories. Class A animals are those threatened with extinction, including great apes and leopards, which are strictly protected species. A total of 32 mammal species are classified as Class A, of which 16 species are found in the southeastern region of Cameroon. Class B animals are also protected, but can be hunted with a permit obtained from the government. Nineteen species are categorized as Class B, of which 11 are recorded in the study area. People who are found with protected animals without proper permits can be punished by a fine of 50,000–200,000 CFA and/or sentenced to 20–60 days imprisonment (Forest Law, Article 155). The remaining species are Class C animals, which can be hunted for consumption by local people using "traditional methods" (Djeukam 2012). Although the list of protected animal species is, in principle, to be periodically reviewed by

Table 4.3 Animals captured in South-East Cameroon, by class

	Zoolabot 2003	Melea Ancien	Gribe (CHZ13&14)	
	Number (%)	Number (%)	Number (%)	Weight kg (%)
Animal class				
Class A	71 (10.7)	11 (4.8)	32 (5.7)	317.07 (9.4)
Class B	519 (78.4)	147 (64.2)	60 (10.7)	1096.71 (32.4)
Class C	72 (10.9)	71 (31.0)	470 (83.6)	1971.72 (58.2)
Total	662 (100.0)	229 (100.0)	562 (100.0)	3385.5 (100.0)

Bobo et al. (2015), Hattori (2012), Yasuoka (2006)

the Minister of Forests and Wildlife (Djeukam 2012), no revisions have yet been made.

While the catch species composition suggests that there are differences in the abundance profiles of species in different areas (Yasuoka 2014), the law of classification of protected animals in Cameroon does not take differences in local abundance and catch into consideration. In southeastern Cameroon, the most frequently captured animals are red duikers, and in particular Peter's duikers (Class B) which are relatively abundant in the area, accounting for 60 % of the total catch (Yasuoka 2014). Our field research in two villages shows that animals of Classes A and B together account for 70–90 % of the total catch in the studied villages (Table 4.3). Regulations on protected animals, therefore, disregard the reality of actual hunting practices by local people. It is worth noticing that, if they were to be strictly applied, it would seriously affect the livelihood of forest hunters who heavily depend on wildlife.

In addition to the restrictions on hunting grounds and the methods and targets of hunting, there are other regulations with regard to hunting, an important one being that any hunting for commercial purpose is forbidden (Decree 1995, Article 24-(3)) except for authorized meat purchases using permits obtained from the government, called *Permis de collect.* The permit, however, usually applies only to meat obtained from sport (or trophy) hunting. Thus, according to existing law, the common practice of selling meat in villages is illegal.

In sum, current hunting laws and the regulations derived thereof largely disregard actual hunting practices, and it is therefore hardly surprising that the effective implementation of laws that restrict activities of common practice is not working.

4.4 Towards a Sustainable Hunting System

So, in this situation, what should be done with respect to bushmeat hunting? A total ban on hunting does not seem to be a feasible solution, as there are no readily available alternative food resources in the region. Moreover, hunting and bushmeat are deeply rooted in local culture, which imply that bushmeat consumption cannot easily be replaced by domestic meat or fish consumption. A strict prohibition of

hunting may even result in uncontrolled poaching by local people in protected areas and hostility towards any conservation initiatives. Even in practical terms, if an extensive area of a million or more hectares were to be strictly protected, the human and economic costs of simply monitoring poaching would be enormous. Given these facts, it would probably be far cheaper and more effective to encourage local people to take an active part in conservation. As has often been pointed out, a "wildlife sanctuary" that entirely excludes human activities from protected areas may be less effective as a means of nature conservation than a "multiple-use reserve", which would allow the use of forest resources by local peoples (Curran and Tshombe 2001; Ichikawa 2006). The challenge is to achieve sustainable hunting of some species, while obtaining the cooperation of local people for the protection of the most ecologically valuable and endangered species. The sustainability of hunting is important because individuals driven by commercial demands often pursue short-term benefits, which might eventually threaten their livelihood in the longer term. The protection of ecologically important species is indispensable for maintaining the healthy forest ecosystem on which they depend.

Emerging movements in the region are fighting for the rights of hunter-gatherers to the forest. Such movements address, for example, human rights issues, rights to land and resources, community capacity building, and the legal recognition of their indigenous status (Pyhälä 2012). While these initiatives have been successful to varying degrees, there are some notable developments and lessons to be learnt from these attempts. In particular, there has been substantial progress made in the capacity of community development for claiming customary rights to the forest and addressing environmental degradation, with the introduction of participatory mapping methods. Participatory mapping has attempted to show actual forest use in maps that could be the basis of local people to claim their customary rights to the forest. It has also been used to protect the forest from illegal exploitation by locating illegal logging spots via GPS (Lewis 2012).

We have ourselves been engaged in a research project aiming to establish sustainable forest resource use, including sustainable hunting. The project addresses issues of (1) the ecological potential of Non-Timber Forest Products (NTFPs), including game animals, namely, the abundance and production of major NTFP species; (2) the actual use of NTFPs, namely, the importance of NTFPs to local subsistence and household economy; and (3) the local social system, which can assist sustainable forest management through moderating excessive competition over resources, the latter an important driver of overhunting (Fig. 4.3). Actual research activities along these lines are being carried out with the participation of local people. These activities also provide local groups with opportunities for capacity development in sustainable forest management. Some preliminary results of these studies have already appeared in a supplementary issue of the journal *African Study Monographs* (Hirai et al. 2014).

The research site where we developed this initiative was located in the area around Gribe village, north of Boumba-Bek National Park (see Fig. 4.2). Our Cameroonian counterparts have investigated the abundance and spatial distribution

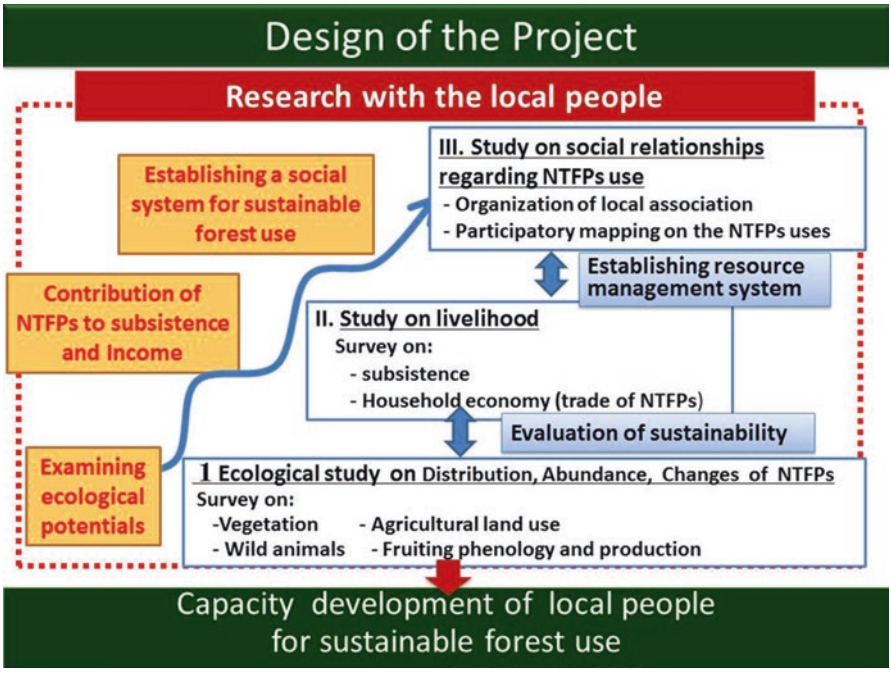

Fig. 4.3 Project design

of large and medium-sized mammals in the northern periphery of the National Parks and community hunting zones in the area (Bobo et al. 2014). They have surveyed animal tracks on a total of 126 transects, each 2 km long, recording a total of 31 large and medium-sized mammal species. Their data suggest a relatively high density of endangered species such as gorillas and elephants, indicating the potential of this area for biodiversity conservation. Human tracks, a sign of hunting pressure, were also widely observed in the study area. The team also studied local hunting activities and hunting yields in order to evaluate hunting pressure on animal species.

We have also carried out quantitative research on the importance of NTFPs for local livelihoods, household economies, and local markets. Market studies on useful plants, such as *Irvingia*, *Gnetum*, and a few other species have also been conducted in coordination with CIFOR (Center for International Forestry Research; Ingram 2009; Ingram et al. 2010). However, despite their importance to livelihoods and household economies, as well as their increasing commercial demand, no detailed quantitative research on their ecological potential and use is available for southeastern Cameroon.

Through a livelihood survey, we are working with literate Baka hunter-gatherers and Konabembe farmers to record all the products brought back to the village or camp, including the name of the person who brought the products, the vernacular name of the products, their weights, and their place of collection. In this way, we

attempt to evaluate the importance of NTFPs in local livelihoods, including their contributions to household income. Based on data obtained from these studies, we aim to estimate harvest levels of various NTFP products and compare them with their ecological potential to evaluate the sustainability of their resource use. In this line, studies have suggested that due to the commercial meat trade, hunting pressure on duikers, the major game species, have surpassed the maximum sustainable level (Bobo et al. 2015; Yasuoka 2014). In contrast, the nuts of *Irvingia gabonensis*, the most important plant NTFP, are under-utilized, mostly due to a lack of labour power and efficient extraction techniques (Hirai 2015).

Furthermore, the establishment of a sustainable livelihood system should take into account people's social relations and how such relations affect forest use. In other words, it is necessary to establish a social system for the sustainable use of forest resources. According to the argument of the "Tragedy of the Commons", open access to resources often leads to over-exploitation, because individuals tend to pursue short-term benefits without reference to long-term sustainability (Hardin 1968). The avoidance of this "tragedy" is very important to the establishment of sustainable forest use. We consider that customary rights to forest will enable local groups to use resources on a long-term sustainable basis. In order to establish the existence and extent of customary rights, it is necessary to understand customary forest uses, namely, how local people actually use and manage forest space and resources.

For this purpose, it is helpful to visualize actual land and resource use through participatory mapping, using GPS and GIS technology (Lewis 2012; Lewis and Nkuintchua 2012). A map of local resources will provide a basic picture of the spatial distribution of resources and how they are used by different groups. This geographical representation might form the basis for adjusting space and resource uses, thus avoiding excessive competition over resources in a particular place. In our project, participatory mapping starts by plotting the distribution of cultivated plots and NTFP resources in the forest and identifying social units of local people with regard to forest use. We then ask people from different social units to carry a GPS instrument with them when entering the forest to record the position of the places they visit. GPS data are then integrated into a base map, using GIS. Using this methodology, we have recorded how different Baka hunter-gatherer groups use different parts of the forest to collect *Irvingia* nuts (Hirai 2015) and for setting hunting traps (Kamgaing, personal communication). In this way, we visualize an existing customary land and resource use system based on which groups avoid excessive competition over the land and resources.

GPS technology has been used by international NGOs to provide people with the basic data to claim their customary rights to the forest, particularly when it comes to negotiations with forest authorities, as such maps allow them to provide evidence for customary forest uses (The Rainforest Foundation n.d.; Forest Peoples Programme n.d.). Mapping information on resource use can also be used for the purpose of forest management, that is, to adjust access to forest resources by local peoples among themselves. We hope this project will provide us with a model or a pilot case for integrating forest conservation and sustainable use through participatory methods.

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Chapter 5
Defaunation Through the Eyes of the Tsimane'

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Abstract Defaunation is one of the most critical challenges faced by contemporary hunter-gatherers worldwide. In the present chapter we explore how this global anthropogenic phenomenon is being explained by a hunter-gatherer society: the Tsimane' of Bolivian Amazonia. First, we briefly review the historical context of contemporary Tsimane', with a special focus on defaunation trends in their territory. We then draw on ethnographic accounts to understand how this society explains the drivers of defaunation and integrates them in their understanding of the world, and specifically in their mythology. The Tsimane' perceive widespread defaunation in their territory, which they tend to largely interpret as a result of both natural and supernatural forces, with intertwined arguments. The Tsimane' think that supernatural deities control animals and, consequently, they largely associate wildlife scarcity with punishments by the spirits in response to disrespectful conducts. As such, defaunation is interpreted as a consequence of (a) direct harm to wildlife populations by the inappropriate hunting and fishing behaviour; and (b) the discontentment of the animal deities for not respecting certain established cultural norms. In the Tsimane' view, the latter is also aggravated by their recent relative inability to communicate with the spirits, due to the disappearance of shamans. Considering that the way people interpret environmental change can determine their behaviour

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towards proposed conservation actions, understanding the symbolic dimensions of defaunation is of direct relevance to any initiative aiming for sustainable wildlife management in areas inhabited by hunter-gatherers.

5.1 Introduction

Human–animal interactions are at the core of contemporary hunter-gatherers' cultural identity (Denevan 1980; Kelly 1995; Schweitzer et al. 2000). Across the Amazonian Basin, representations of animals are deeply rooted in the culture and history of many hunter-gatherer groups, with numerous legends, rituals and beliefs emphasizing the critical role of animals in the sustenance of their livelihoods (Cormier 2006; Good 1989). Given that nature-culture interactions are inherently co-evolutionary (Berkes et al. 2000; Posey 1985), researchers have addressed both how cultural practices referring to animals (e.g., norms or taboos) shape the way in which hunter-gatherers manage animal populations and adapt to game scarcity (Ross et al. 1978; Virtanen 2009; Virtanen et al. 2012), and how local wildlife changes are represented in the cultural expressions of hunter-gatherers, such as for example in their myths, customs and traditions (Fausto 2008; Luz 2013; Shepard Jr 2002).

However, under the context of Global Environmental Change, the livelihoods and cultures of contemporary hunter-gatherers are under exceptionally great pressure (Maru et al. 2014; Pringle 2015; Weatherhead et al. 2010), also affecting human-animal interactions. Throughout Amazonia, economic processes resulting in land-grabbing, colonisation, the advance of extractive industries, deforestation, habitat loss and climate change are all dramatically altering the access that hunter-gatherers have to their surrounding environment and resources, including animals (see for example Espinosa et al. 2014; Finer et al. 2015). Similarly, cultural processes such as access to western-style education and health, the adoption of national languages, access to mass media, or religious expansion are also dramatically changing the way in which people living a hunting-gatherer lifestyle understand the world (Doughty et al. 2010; Reyes-García et al. 2014a).

From the many changes affecting hunter-gatherers, defaunation, defined as the loss of wildlife, including species and populations (Dirzo et al. 2014:401), has arguably a huge impact on the livelihood of hunter-gatherer populations. This is largely due to the importance of animals for their sustenance (Alvard 1993; Mena et al. 2000). In Amazonia, hunting and fishing are not only the primary source of protein, and hence critical to human health, but also fundamental metaphors that structure the relation between hunter-gatherers, animals and the spiritual world (Århem 1996; Fausto 2007; Reichel-Dolmatoff 1976). As a result, changes in the availability and/or distribution of wild animals are often quickly perceived and interpreted in spiritual terms (Virtanen 2016). Studying such interpretations is important because they shape how people might respond to the impending changes. Furthermore, such interpretations might have direct implications for the maintenance of the livelihood

strategies of contemporary hunter-gatherers (Fernández-Llamazares et al. 2015a). For this reason, the symbolic dimensions of defaunation can be of direct relevance to any initiative aiming for sustainable wildlife management and biodiversity conservation in areas inhabited by hunter-gatherers (Franzen 2005; Lu 2001).

Here, we illustrate how defaunation alters the way a hunter-gatherer group, the Tsimane' of Bolivian Amazonia, perceive the world. First, we briefly review the historical and ecological context of contemporary Tsimane', emphasizing social-ecological change, and with a special focus on defaunation trends in their territory. We then draw on our ethnographic work on the area to understand how the Tsimane' explain the drivers of defaunation and how the phenomenon is made culturally relevant through its integration into Tsimane' mythological stories. For the purposes of this chapter, we reviewed classical ethnographies to understand the role of wildlife, specifically game and fish, in Tsimane' mythology. Furthermore, we present results from our own ethnographic work in the area, as part of a research project conducted over the course of 3 years (2012–2015; see http://icta.uab.cat/Etnoecologia/lek). We draw on our extensive participation in Tsimane' daily activities and on informal interviews that we conducted with two villagers and with local political authorities to compile information on how Tsimane' perceive recent defaunation trends. We also include information on Tsimane' conceptions of defaunation collected through in-depth interviews and focus groups about local perceptions of changes in wildlife (game and fish species) and their explanations for such changes (see Fernández-Llamazares et al. 2015a for a complete description of the methodology and results).

The Tsimane' provide an interesting case to study the local interpretations and explanations of defaunation for three reasons. First, having remained isolated until the mid-twentieth century, a large part of their traditional belief system still persists nowadays. Second, their territory is being increasingly affected by considerable levels of pervasive environmental change, including defaunation (Fernández-Llamazares et al. 2015b; Pérez-Llorente et al. 2013). And third, with the scientific discourse on anthropogenic Global Environmental Change being still largely inaccessible to this group (Fernández-Llamazares et al. 2015c), the Tsimane' understandings of defaunation are most probably conferred to local manifestations of such phenomenon and based on their cultural epistemologies.

5.2 The Tsimane' of Bolivian Amazonia

5.2.1 Cultural and Historical Context

The Tsimane' are a native Amazonian society living in the south-western department of Beni, Bolivian Amazonia. Nowadays, they number approximately 14,000 people (Undurraga et al. 2014) living in some 125 villages of commonly ca. 20 households per village, mostly concentrated along riverbanks and logging roads (Reyes-García et al. 2012). Traditionally, the Tsimane' were hunter-gatherers and

fishers, but nowadays they also practise small-scale shifting agriculture (Vadez and Fernández-Llamazares 2014). Furthermore, some Tsimane' (particularly those in villages close to market towns) are starting to engage in cash-generating activities such as cash cropping (mostly rice and plantain), sale of non-timber forest products (e.g., thatch palm), and wage labour in logging camps and cattle ranches (Fernández-Llamazares et al. 2015b; Reyes-García et al. 2014b). Despite these new sources of income and livelihood, forests continue to provide an essential basis for Tsimane' subsistence (Fernández-Llamazares et al. 2015b; Reyes-García et al. 2014a).

Historical accounts of the Tsimane' depict them as a particularly elusive ethnic group (Chicchón 1992; Nordenskiöld 1924; Pauly 1928). Escaping from the violence and abuses of the Hispanic conquests, the Tsimane' confined themselves to the remote upper parts of the Apere and Maniqui Rivers (Reyes-García et al. 2014a). Hidden in '*almost impenetrable forests*' (Pauly 1928:116), the Tsimane' succeeded in resisting Catholic and Protestant proselytes' incursions from the early seventeenth century up until the 1950s (Martínez-Rodríguez 2009; Pérez-Díez 1983). Ethnographic works also describe the Tsimane' as being a highly mobile society, with dispersed settlement patterns and lacking a hierarchical system of authority (Califano 1975; Daillant 2003; Ellis 1996), possibly explaining why they managed to withstand the evangelisation process and to remain relatively isolated until the mid-twentieth century. Moreover, living in a land lacking the commercial resources valued by Europeans (i.e., gold, silver and rubber trees), the Maniqui and Apere basins provided the perfect hideout for the Tsimane' to resist the whirlpool of conquest and illnesses brought by the arrival of colonists elsewhere in the region.

Thus, up until the late 1930s, the Tsimane' largely maintained a semi-nomadic and self-sufficient lifestyle, keeping occasional and selective contact with outsiders (Nordenskiöld 1924; Pauly 1928). Moreover, the little contact that did take place has been attributed to the Tsimane' interest in market goods such as clothes and metal utensils like axes, knives and fishhooks (Nordenskiöld 1924). However, after the 1952 Bolivian Revolution, the construction of new roads, the logging boom, the land tenure reforms and the different waves of government-planned Andean colonisation of the Bolivian lowlands pushed the Tsimane' into increasing contact with other segments of the national society (Reyes-García et al. 2012, 2014a). This period also saw the onset of the trade in animal pelts, an activity in which Tsimane' actively participated. Local ranchers and colonists started to pay low salaries to the Tsimane' for tracking wild animals such as black caimans (*Melanosuchus niger*), tapirs (*Tapirus terrestris*), and white-lipped peccaries (*Tayassu pecari*). Several authors had reported that trade of animal pelts had important repercussions on animal populations, with some of the most precious species eventually becoming locally depleted (Herrera-MacBryde et al. 2000; Luz 2013; Roca 2001). Finally, the settlement of evangelic missionaries in the area in the 1950s also had profound impacts upon the local culture, replacing many native cultural rituals with Christian practices (Huanca 2008, 2014). Today, the beliefs held by most Tsimane' represent a syncretic blend of animist beliefs and those brought by Christian missionaries (Ellis 1996; Fessler et al. 2015).

5.2.2 *Tsimane' Relation with Wildlife and the Natural Environment*

As other Amazonian groups (Descola 2004, 2005; Virtanen 2016), the Tsimane' see human beings as part of the natural world, which is inhabited by animals, spirits and human beings altogether. This is reflected in different features of Tsimane' culture, such as their numerous hunting and fishing rules, customs and taboos, which are intended to respect the wellbeing of animals and promote a harmonious relation with the spirits (Chicchón 1992; Huanca 2008). The Tsimane' are (partially) animists and believe that they share their territory with a number of spirits (*a'mo'*) who 'own' trees, stones, water bodies, animals and animal breeding grounds. The Tsimane' show reverential attitudes towards these spirits, because –in their view- these spirits can interfere with their daily life, for example causing sickness or controlling game and fish availability (Reyes-García 2001; Riester 1976). Consequently, the Tsimane' have specific rules and rituals to regulate their behaviour in relation to resources protected by spirits, such as wildlife. For instance, Tsimane' hunters often pray to the animal masters before hunting, asking them to provide enough meat to sustain their families. Taboos regulating hunting behaviour, such as the interdiction to hunt for those having had sexual intercourse, or *micdyidye'*, can also be interpreted as a way to regulate the time between hunting expeditions. Again, according to the Tsimane', neglecting to follow these rules has negative consequences, since the spirits have the power to protect or harm humans, depending on their behaviour (Chicchón 1992; Luz 2013).

One of the many Tsimane' wildlife-related mythological stories recounts the story of *Jäjäbä*, the main guardian of game. *Jäjäbä* is considered the master of animals, responsible for taming, caring and managing the flock of wild animals (Huanca 2014). The Tsimane' see *Jäjäbä* as a shepherd or cattle owner. The guardian owns a large farm where he keeps, feeds, breeds and herds wild animals. *Jäjäbä* periodically opens the door of the farmyard and releases his herds so that the Tsimane' can hunt. According to Tsimane' beliefs, *Jäjäbä* has the power to nurture and endanger human life. He controls the supply of game, and can easily get angered by inappropriate human actions, e.g., those that drive away or hurt animals (Ellis 1996). For instance, if a hunter did not treat animals with respect, *Jäjäbä* may bewitch him, cause illness to his family, or deprive the community of game by not opening the doors of the farm. According to the words of a Tsimane' elder, in response to misbehaviour "*Jäjäbä would take all the animals from the forest*" (Luz 2013:22). In other words, lack of compliance with the demands of *Jäjäbä*, e.g., by not following well-established cultural practices, could break down the balance between people and supernatural beings, with pernicious consequences for humans. Given its enormous power, the Tsimane' consider it crucial to negotiate with *Jäjäbä* before engaging in hunting.

Similarly, the Tsimane' have a myth that explains how to regulate access to fish. According to Tsimane' mythology, fish availability is regulated by human interactions with two fish deities: *I'dojore* and *O'pito* (Chicchón 1992; Díaz-Reviriego

et al. in press). *I'dojore* is a beneficent spirit who provides the Tsimane' with fish when they are in need, whereas *O'pito* is a harmful owner who controls fish resources, monopolising without sharing them, and thus causes fear and distrust amongst the Tsimane' (Chicchón 1992). Moreover, *O'pito* is responsible for watching and managing the periodic movements of migratory fish along the river (Huanca 2014). Like *Jäjäbä*, *O'pito* has the power to bewitch people if they disobey his rules, particularly when he carries the fish upriver. Because of *O'pito*'s frightening powers, the Tsimane' are afraid to fish in excess during upriver fish migrations. Our interpretation of the myth is that the portrayal of *O'pito* as a frightful and appalling spirit responds to the importance of allowing migratory fish to move unimpeded through waterways in order to maintain healthy fish populations all along the river and prevent fish stock declines.

5.2.3 The Shamans as Mediators Between Humans and Spirits

While spirits could observe and act upon humans, humans required a mediator to communicate with the supernatural world, a role that traditionally corresponded to the figure of the shaman (*cocojsi'*) (Huanca 2014). Although research on Tsimane' shamanism is scarce, previous ethnographic works suggest that shamans were relatively common in the Tsimane' villages prior to the arrival of missionaries to the area in the 1950s (Huanca 1999, 2008). Shamans performed a variety of functions, including folk healing (particularly administering plant treatments for sorcery and bewitchment), storytelling, and enforcing law and order. Shamans were also in charge of teaching and reminding that wild animals, as well as plants and other natural features, deserved respect and required worship. They were also responsible for communicating with the spirits on behalf of the whole community. For example, through chanting in the ritual house (*shípa*) the shaman implored the spirits to supply animals for the Tsimane', who in turn offered fermented beer made from manioc (*shocdye'*) to the owner of the animals. Tsimane' people understand that killing animals requires a reciprocal relation, so they compensate the master of animals by providing *shocdye'* in appreciation of the meat. The shaman would also offer payments (e.g., duck eggs or coins) to the animal masters, in order to reinforce the alliance between humans and spirits (Århem 1996). Such payments were dedicated to the owners of the animals as a way of thanking them for having supplied wildlife.

Similar to other Amazonian native groups (e.g., Reichel-Dolmatoff 1999), the shamans in the Tsimane' society also acted as managers of wildlife stocks. The shamanic rituals provided the Tsimane' with the opportunity to communicate with the spirits in critical times (e.g., during periods of game scarcity). If game was scarce, the shaman would call *Jäjäbä* to the ritual house and beg him to supply animals. According to Huanca (2008), the Tsimane' would get answers from supernatural beings and modify their hunting behaviour accordingly. In the shamanic rituals, *Jäjäbä* would come, speak sharply, and say "*you are annoying my animals*" (Huanca 2008:151). Then the shaman would negotiate with the animal guardian and ask for

forgiveness in order to re-establish the reciprocal pact established between humans and spirits (Århem 1996). In other words, the shaman was responsible for alleviating the tensions that could arise between humans and spirits when the animal master's rules were not obeyed and/or respected. Moreover, the shaman was also able to impose restrictions on the amount of game that the community or a specific hunter could hunt, in order to please the spirits (Huanca 2008). For example, it was common that for certain species, such as the spider monkey (*Ateles chamek*) or the white-lipped peccary (*Tayassu pecari*), the Tsimane' could only capture one animal per hunting trip, as prescribed by the shaman (Luz 2013).

Similarly, shamans would also mediate the relation between Tsimane' and the fish masters. In Tsimane' oral accounts, the shamans guided people to find fish and prepared them to meet the fish owners. The shaman actively encouraged to follow the rules of *O'pito,* so that the spirit did not kill or bewitch people. If someone captured excess fish or interrupted their migratory movements, *O'pito* would get angry and use sorcery to bring illness and death (Huanca 2008). Similarly, *I'dojore* used to warn the Tsimane' about the allowed fishing quotas. For example, oral accounts describe how *I'dojore* would join the Tsimane' in their shamanic rituals and warn them with statements such as "*If you want fish, you must not fish too much nor throw away what you have fished*" (Huanca 2014:347). Through his teachings, the shaman might have contributed to protect the fish stocks in the Maniqui River.

Due to strong influence of the missionaries from the 1950s onwards, Tsimane' shamans do not exist anymore. The last shaman passed away three decades ago. Although some of their descendants, assistants, and some local elders still sporadically exercise some of their functions (mostly plant treatments), they rarely mediate between humans and the spirits (Huanca 2014).

5.3 Defaunation in the Tsimane' Territory

5.3.1 Scientific Evidence of Defaunation

The above-mentioned socio-economic and cultural transformations, combined with substantial environmental changes in the Tsimane' territory (Fernández-Llamazares et al. 2015a, b; Pérez-Llorente et al. 2013; Ringhofer 2010), have all contributed to the rapid decline in biodiversity recurrently reported in the area. Such decline mostly stems from significantly high levels of deforestation, habitat loss, and hunting pressures (Guèze et al. 2014; Luz et al. 2015; Paneque-Gálvez et al. 2013). Concomitantly, defaunation has become an important threat, with some authors describing the Tsimane' territory as suffering an '*empty forest syndrome*' (Chicchón 1992; Luz 2013; Ringhofer 2010). Indeed, an exhaustive analysis of published research in the area provides evidence of substantial faunal changes at the local level (Fernández-Llamazares et al. 2015a). For example, Luz (2013) found that overall, the vertebrate fauna in the Tsimane' territory is less diverse (in terms of

number of species) than in other *terra firme* Amazonian forests also subject to hunting pressure (Endo et al. 2010; Peres 1997). Thus, the author found that encounter rates of large-bodied species (e.g., *Tayassu pecari*) assessed in 2.6 km transects in 40 Tsimane' villages were on average lower than the ranges described for other hunting forest sites in Amazonia (Luz 2013).

In general, most of the game species culturally-valued by the Tsimane' are highly endangered, with significant rates of population decline and fragmented distributions (Fernández-Llamazares et al. 2015a; Luz et al. 2015). The spider monkey (*Ateles chamek*), a favourite game species for the Tsimane' (Chicchón 1992), is now classified as a vulnerable species (IUCN 2014). Likewise, the giant anteater (*Myrmecophaga tridactyla*), the giant armadillo (*Priodontes maximus*), and the lowland tapir (*Tapirus terrestris*) are all catalogued as vulnerable according to the Bolivian Red List (MMA 2009). Most of the population trends for these species are considered to be decreasing due to overhunting and habitat loss (IUCN 2014). Such impacts are amplified by the low ability of some species (e.g., *Tapirus terrestris*) to quickly repopulate the areas where they previously lived. Fernández-Llamazares et al. (2015a) reported that the status of the above-mentioned species has deteriorated in the Tsimane' territory since previous IUCN Red List assessments.

Similarly, local extirpation of valued fish species, as well as changes in freshwater communities (e.g., reduction of fish population sizes and alteration of age structure) are also widely reported in the area (Díaz-Reviriego et al. in press; Pérez 2001; Zycherman 2013). Overall, it is likely that the Maniqui River is affected by overfishing, or what is referred to by some as '*fishing down the foodweb*', a process by which the largest species from the top of the food web are depleted, leading to successive pressure down the food web to smaller sized fish species (Castello et al. 2013). Although the Tsimane' fish all year round, there is significant seasonal variation due to the fact that several of the fish species targeted by the Tsimane' are migratory (e.g., large-bodied catfishes and the golden dorado). These species migrate from the lowlands to the headwaters of the Maniqui River for spawning, a general pattern observed in response to the annual hydrological regime occurring in large rivers across the Amazonian Basin (Cañas and Pine III 2011; Junk and Wantzen 2004). Widespread fishing during the fish migration periods interrupts the biological cycle of many species and causes stock declines (Salo et al. 2014). The Tsimane' report that at least five fish species have become locally-extinct in the Maniqui River (Fernández-Llamazares et al. 2015a).

5.3.2 Tsimane' Interpretations of Defaunation

It is clear that the Tsimane' identify a wide array of local indicators of a handful of environmental changes occurring in their territory, including climate change, deforestation and notably, widespread and pervasive defaunation (Fernández-Llamazares et al. 2015a). Recent research has found that the Tsimane' report wildlife scarcity (including game and fish) when comparing present with past times

(Fernández-Llamazares et al. 2015a; Zycherman 2013). The Tsimane' report large differences between the composition of those game species perceived as more abundant in the past and those perceived as more abundant in the present. In general, Tsimane' reports of faunal change match relatively well the population trends calculated through the IUCN Red List Index (Fernández-Llamazares et al. 2015a).

According to our ethnographic information, in general, the Tsimane' care about wildlife scarcity and think that they bear certain responsibility for it. However, the Tsimane' do not conceive changes in the faunal composition and distribution as the consequence of global phenomena or major habitat loss at the regional level. Rather, the Tsimane' tend to consider defaunation as a local phenomenon. In their understanding, animals have not been extirpated, rather they have simply moved away from their territory to other areas. Some Tsimane' elders attribute game scarcity to the fact that the animals might be returning back to the farmyard of *Jäjäbä*, where they might live far more peacefully than outside, in the now highly intervened Tsimane' territory. For example, a Tsimane' woman reported "*The chainsaw is guilty for the lack of animals. Animals listen to its sound and smell the oil. Since they do not like it, they are going away, leaving back to the original place from where they came*" (Woman, 65, June 2013).

According to the Tsimane', local wildlife scarcity is caused by three main drivers, which include natural and supernatural forces that they often present in intertwined arguments. First, many Tsimane' argue that currently experienced animal scarcity is due to the disrespectful attitudes of certain people whose hunting and fishing behaviour directly harms wildlife populations. Second, due to such inappropriate conducts, there is widespread discontentment of the animal deities (namely *Jäjäbä* and *O'pito*), who could be limiting the supply of wildlife even more. And third, with the disappearance of shamans, Tsimane' cannot reverse the defaunation trends in their territory and re-establish the reciprocal relationship between humans and spirits. We elaborate on each of these points in the three following paragraphs.

The Tsimane' are well aware of the impacts of certain hunting and fishing activities upon wildlife. For example, they realize that new hunting technologies such as cartridges, shotguns and headlamps -which are displacing traditional techniques such as crossbows, spears and traditional traps- result in larger game offtake. Similarly, the ability to move faster and further (e.g., by using canoe motors) also allows them to reach hunting grounds previously far of reach. The Tsimane' recognise that this technification of hunting has important effects upon wildlife populations offtake. Similarly, the Tsimane' also realize that the use of dynamite for fishing results in the destruction of some of the local fishing grounds. Some Tsimane' disapprove these techniques (especially the use of dynamite, which is subject to public shaming) because they realize that they result in unsustainable harvest levels and local extirpation of species. It is worth noticing that the Tsimane' often blame outsiders for the use of such aggressive techniques. For example, the Tsimane' argue that dynamite fishing is mostly practised by loggers and merchants. But, through time, some of these techniques are also becoming frequent amongst some Tsimane' individuals.

According to the Tsimane', due to the current erosion of traditional hunting and fishing practices, it is likely that the animal deities are angry with human beings. It is important to remind that most of the Tsimane' hunting rules are built around the idea of respecting the animals and their well-being. The masters of the animals frown on excessive killing of wildlife by people and might punish them with game scarcity if they do not respect their rules. Consequently, it is not surprising the defaunation is being interpreted in spiritual terms, as a result of the discontentment of animal deities for the use of shotguns and other modern weapons that lead to increased game harvests. Although some Tsimane' feel that disrespecting traditional rules is justified by the imperative need of obtaining food to meet immediate subsistence needs, others expressed to us their concern that these practices could be undermining the mutual pact established between the Tsimane' and the spirits. Most Tsimane' elders still respect many of the traditional norms that regulate adequate hunting and fishing behaviour, and attribute the current game and fish unavailability to the increasing lack of respect towards animals and their spirits, particularly by young generations. For example, a Tsimane' man told us that "*The elders are very angry, because the young people do not respect our traditions anymore… Some youngsters do fish with* 'palometa' (a modern bow type) *and make the fish bleed into the river. They say that this makes the spirits become furious!*" (Man, 40, April 2013).

Finally, some Tsimane' also point to the disappearance of shamans as an aggravator of the defaunation trends observed. Many Tsimane' bemoan not having shamans anymore, because their role as mediators was crucial to improve the availability of wild animals. The shaman would ask to the master of the animals to provide game, and then transmit to hunters the location and adequate quota of animals to harvest (Huanca 2008). In the absence of shamans, some elderly people, particularly in villages further from town, still privately chant and blow spells to *Jäjäbä* asking for wild game to hunt (Huanca 2014), but the idea prevails that communication with the spirits has weakened, worsening game scarcity.

5.4 Conclusion

A review of Tsimane' classical ethnographies and our current research in the area suggests that the Tsimane' do perceive that defaunation is taking place in their territory, a phenomenon that they interpret with the help of their mythological accounts. Wildlife scarcity is generally conceived by the Tsimane' as a consequence of them not having respected certain established cultural norms, which ultimately results in direct harm to the wildlife populations, as well as by the animal deities discontentment. The latter is also believed to be exacerbated by the Tsimane' relative inability to communicate with the spirits protecting the animals, due to the disappearance of shamans.

Given that most Tsimane' think that natural and supernatural powers control the relation between humans and nature, it makes sense for them to associate their own

hunting and fishing behaviour with rewards and retributions from supernatural spirits. Understanding this connection made by the Tsimane' is important because the way in which people perceive ecological changes determines in great part how they respond to them (Fernández-Llamazares et al. 2015b; Oldekop et al. 2012). At least some of the Tsimane' harvesting and management actions are shaped by their local understandings of defaunation. Hunter-gatherer's perceptions of defaunation can thus play an important role in creating or blocking incentives for the sustainable management of wildlife.

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Chapter 6
The Death of the Chief of Peccaries: The Apurinã and the Scarcity of Forest Resources in Brazilian Amazonia

Pirjo K. Virtanen

Abstract Increasing large-scale economic activities have resulted in a shortage of game, fish, and other forest resources for a number of indigenous peoples in the Amazonian rainforest. This chapter addresses how the current scarcities are being experienced and reflected by the Apurinã in Brazilian Amazonia. Drawing from ethnography, it looks particularly at the changing web of socio-cosmological exchange relations whereby nonhuman actors such as animals, plants, and trees have contributed to Apurinã lives over many generations. Apurinã oral histories recount that certain non-human life forms are ancestors who have transformed into animals. In this chapter alterations in narratives of the chief of peccaries that reflect recent social-ecological changes in the region are examined. Narrations of the recent death and subsequent replacement of this non-human chief of forest game show how socio-political, economic and environmental changes are interpreted and explained through the subjectivities of the forest, not just as acts of human agency. Humans do not adapt to the environment as a static entity; rather, animal subjectivities also have their own transformative capacities. The ethnographic discussion of the two Apurinã communities addressed here highlights moral values that reciprocal exchange is not typical only of hunting, but is also the form of relations the Apurinã wish to have with non-native actors: not only with those settlers extracting forest products in their own areas, but also with the nation state and other vital actors in the region.

6.1 The Indigenous Population in the Central Purus River

Increasing forest extraction including logging, mining, overfishing, and overhunting, and the development of transportation systems, hydroelectric energy, and oil extraction are all contributing to environmental degradation in the rainforests of Amazonia. This chapter examines how the resulting decrease in forest resources are

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experienced and explained by local indigenous people, focusing on the Apurinã of the Central Purus River region of Southwestern Amazonia. I show how environmental change is interpreted through specific, changing narrations of animal and plant lives, reflecting a form of sociality based on the contributions made by nonhuman entities to ways of life and knowledge-making. It should be noted that sociality between humans and other-than-humans is lodged in convivial relationships which are, in fact, the same type of connection the Apurinã would like to cultivate with the dominant society.

My research builds on previous work that has explored Amazonian animist ontologies – especially that of Eduardo Viveiros de Castro (see e.g., 1996, 2001, 2012) and Philippe Descola (see e.g., 1996, 2005) – and the studies of scholars addressing relations between dominant societies and indigenous populations in Southwestern Amazonia in general (Aquino 1977; Bonilla 2007, Gow 1991, 2001; Piedrafita 2008; Weinstein 1983; see also Taussig 1986). Indigenous perceptions of interactions with non-natives, and their categorizations of the 'other', provide the study of human-environment relations with crucial social and historical context. Such studies enable a better understanding of the aims of indigenous peoples to maintain a place in Amazonian rainforests beyond nature/culture divides.

Brazil is home to some 240 indigenous groups who speak approximately 150 languages. The country's indigenous population numbers almost 818,000, of which about one third lives in urban areas (IBGE 2010), though before the arrival of the Europeans and their new diseases, about 500 years ago, the indigenous population was much more numerous and diverse (see e.g., Neves 2011). Towards the end of the nineteenth century, with the beginning of the rubber boom, the Central Purus River region was colonized by non-Apurinã rubber producers/patrons and tappers. This forced take-over altered the lives of local indigenous populations (including the Apurinã, the Paumari, the Jamadi, the Jarawara, and the Deni among others), enslaving them not only by means of their physical labour and the change in power relations, but also through a manufactured indebtedness to their patrons (cf. Aquino 1977; Piedrafita 2008; Taussig 1986; Weinstein 1983). Missionaries also had a strong hold on the indigenous population, with paternalistic projects. Meanwhile, under the state's paternalist approach (de Souza Lima 1992), the national Indian Protection Service (*Serviço de Proteção ao Índio* – SPI) established "Indian posts" in the region to administer assimilation politics that were maintained until the 1960s (Schiel 1999). In the 1950s, the Brazilian national government began practicing so-called "developmentalist" politics, initiating in the 1980s the integration of Amazonia to that trajectory, promoting its economic development (Carneiro da Cunha 1992). The Amazon region simultaneously started to experience an accelerating rate of urbanization (see e.g., Browder and Godfrey 1997). After the end of the 70s – and especially after the military regime came to an end in 1985 – the voices of indigenous people began to receive more attention and in 1988 the Brazilian constitution recognized the collective and individual rights of indigenous peoples. Despite this, both the growing Brazilian population and investors alike continue to look to the Amazon rainforests for the location of new economic activities, and thus extractive pressure on the region continues. As a consequence, the exploitation of

natural resources, road construction, intensifying agriculture, cattle-farming, and settler colonization are still deforesting large areas once inhabited by the Apurinã (cf. Menezes 2011).

In the following sections, I first describe how the recent social-ecological changes have been experienced by the Apurinã communities along the Asimã and Tumiã Rivers. I specifically focus on how such changes have affected their daily life and social relationships, leading to discussion of the fundamental roles of nonhuman subjects in Apurinã socio-cosmology and knowledge-production. I then examine in more detail an orally transmitted narrative concerning the "chief of peccaries" which exemplifies and illustrates both the Apurinãs' interpretation of their changing political and economic situation, and how such interpretation is effected. I conclude by discussing how such cosmological explanations highlight the aim to construct social relations with the dominant society on the same basis of conviviality and exchange that the Apurinã maintain with the nonhuman agents in their socio-cosmos.

6.2 The Apurinã and the Depletion of Forest Resources

The Apurinã (population approximately 8,000, auto identifying as *Pupỹkary*) live in several indigenous reserves (demarcated indigenous territories), mostly in the state of Amazonas, along the Central Purus River, Brazil. The analysis presented in this chapter draws from ethnographic fieldwork methods (interviews, participant observation, and audio-visual recordings) employed while living with Apurinãs settled in indigenous territories on the Tumiã and Asimã Rivers, tributaries of the Purus. Tumiã (population approximately 70) and Asimã (population approximately 100) are situated about 3 days' fluvial travel from the closest urban area, Lábrea (population over 40,000) or Pauini (population nearly 20,000). The people in both reserves speak Apurinã, an Arawakan language, in contrast with many other Apurinã communities which have not managed to retain their language because of their subordination under suppressive powers in the area.

A typical meal in the Tumiã or Asimã is fish, grilled in leaves or boiled, served with manioc as flour and some game. A variety of insects, as well as cultivated bananas, herbs and many types of fruits, including those from the palm tree, accompany the main meals. Local livelihoods involve hunting, fishing, slash-and-burn agriculture, foraging, and gardening and – reflecting the understanding that all actors are equally important in mutuality-based ecological relations – a good meal is regarded as one that consists of elements from all Apurinã modes of subsistence. While these food sources principally stem from the natural environment, some industrially produced staples, such as salt and sugar, are also consumed.

One of gravest concerns of these two communities is that game and fish populations have decreased recently. The Apurinã claim that outsiders (non-Apurinã) overhunt and overfish the areas adjacent to their territories, downstream (at the mouth of the river) in particular, but also inside demarcated Apurinã territory, selling the catch in large quantities to the markets in expanding urban areas. Among forest

resources, the Apurinã are especially worried about decreasing Brazil nut crops, as Brazil nuts have a high market demand and provide a good seasonal income for them – as well as for many other riverside inhabitants. In addition, increasing water pollution affects and worries the indigenous communities as their drinking water comes from the river. These grievances can be heard when the Apurinã meet representatives of non-governmental and governmental organizations but, as I discuss in the next two sections, the environmental changes also instigate transformations in the lives of forest subjectivities that have severe consequences for Apurinãs' lives.

The indigenous territories of Tumiã and Asimã were demarcated in 1997, but at the time the lower river areas were excluded, even though they constitute Apurinã ancestral lands. Elders can still recall the names of people from past generations whose burial sites are situated in the area. New allies, such as nongovernmental organizations, have now said that this fact is crucial to their claim to the lands, and that by emphasizing that historical perspective they may have better chances in future legal processes to demarcate these lands.

To date, overfishing and overhunting have caused some conflict between the Apurinã and the non-Apurinã settlers in the area, but disputes have been particularly generated by Apurinã dissatisfaction with outsiders' extracting Brazil nuts inside the demarcated indigenous territories. Some of these external harvesters have reacted to Apurinã attempts to limit their extraction in the protected area by threatening them with violence, even death, and seizing possessions such as hunting weapons. The Apurinã are also unhappy that non-natives have appropriated Brazil nut groves on the lower river, as even if the area is not officially demarcated Apurinã territory the community still regards it as their ancestral land. The relations between the Apurinã and the few non-natives exploiting resources in the area remain tense.

As a result of ongoing conflict, the Apurinã of the Tumiã and Asimã Rivers have pressed the FUNAI (*Fundação Nacional do Índio*), the state agency responsible for indigenous affairs, to protect their lands against invasions. When I asked the local FUNAI representative how such territorial violations can be allowed to occur, the response was that the regional FUNAI office supervises numerous territories in the Central Purus and does not have enough resources to monitor all of them, let alone intervene. As a result, the two Apurinã communities have turned to other potential allies, such as nongovernmental organizations, who have their administrative centres in Lábrea. The local representative umbrella organization of indigenous people, FOCIMP (*Federação das Organizações e Comunidades Indígenas do Médio Purus*) has managed to unite indigenous forces, giving local politics a new turn. Indigenous political events and meetings, for example, have increased in recent years in the Central Purus River region, convened to discuss and negotiate various issues such as protection of lands, health, and education. Among the pro-Indian agencies, the church-run CIMI (*Conselho Indigenista Missionário*, the Missionary Council for Indigenous People) of Lábrea also supports the communities' claims for their rights. Thus, through new interactions with the nongovernmental sector, the Apurinãs' self-determination and political articulation has altered. However, opposition is fierce and some of those who have attempted to defend their lands,

both local indigenous peoples and individuals from other traditional communities, have been threatened. Meanwhile, established commercial elites are determined to retain their own power in the Central Purus area.

While the changes experienced by the Apurinã are very local, and conflicts mostly occur with people who have lived in the area for long time, the Central Purus is linked to national and global economic production, such as rubber in the past, Brazil nuts currently, and possibily other natural resources in the future. For example, in 2014, in the tributaries of Purus further north of Lábrea (low-river), the infrastructure for petroleum prospecting was suddenly installed without any prior consultation with indigenous people. The ILO Convention 169 requires, *inter alia*, obligatory consultation before any economic activities is started in indigenous areas. These types of activities are of great concern for both indigenous communities and conservationists – largely based on earlier examples from Peruvian and Ecuadorian Amazonia where oil extraction activities were rife in the 1970s (cf. Betancur 2011). The Brazilian government aims to introduce new laws to alter indigenous people's constitutional rights; the proposed Constitutional Amendment No. 215 (so called PEC-215), for example, would transfer the decisive power over indigenous peoples' territories from the FUNAI to the National Congress, the legislative sector of the state, National Congress. As decisive legislative power is in the hands of large landowners and those who support explorative extractive activities in forest areas, this could lead to the private sector having ever more access to freely explore and exploit indigenous territories. Financial interest in, and support for, the petroleum and logging industries, cattle farming, mining, and the construction of hydro-power infrastructure sources also come from foreign and multinational corporations. Moreover, several ongoing demands by indigenous people for demarcation and homologation would practically be ignored as a result (Capiberibe and Bonilla 2015), among which would be the demands of the Apurinã from the Tumiã and Asimã to expand their reserve to include the ancestral lands that to date have remained outside their demarcated territory.

6.3 Nonhuman Guidance and Protection for the Apurinã

Amazonian social realities and animist ontology have been the subjects of recent debate (see e.g., Descola 2005; Viveiros de Castro 1996, 2012). For the Apurinã, certain fish, game, plants, and trees, among other non-human agents, are regarded as persons, as is typical for many Amerindians. They are considered to share the same humanity and may be seen in human form, especially during dreams and rituals. Moreover, according to the Apurinã, these plant and animal subjectivities have master or chief spirits, *awĩte* (Virtanen 2015a; see Fausto 2008 on other Amazonian peoples), which are considered to be "owners" of their beings, especially of certain animals, trees, stones, or meteorological forces. As leaders of their beings, they resemble the Apurinã leaders, and thus the social organization of nonhumans is considered to have a similar form to that of the Apurinã.

According to the Apurinã, the *awĩte* master spirits must be consulted and their advise respected whenever people aim to exploit forest resources, as ignoring them could have dire consequences. The master spirits are known, for instance, for shooting lethal (invisible) arrows (or small stones) at people causing fatal illnesses. Thus, one needs to behave respectfully when close to a master spirit, such as certain powerful trees. Presence in places associated with chief spirits is strictly controlled, and babies, children, and pregnant women are forbidden to pass in their vicinity (see Virtanen 2015a). However, the master spirits are also known to provide people with game, fish, and knowledge and, in addition to making forest resources available, they (re)produce health and personal growth as they supply protection and strength. Therefore, the master spirits are also called to communal festivities (*kyynyry*), though their arrival and departure require long rituals that only certain trained and experienced persons can undertake.

The *awĩte* pass their power and knowledge to shamans (*myyty*) in the form of shamanic stones (*isuryke*), which both enable shamanic practices such as healing and allow the shamans to negotiate with the *awĩte*. In the past, a shaman would negotiate with the chief spirit of forest game, the chief of peccaries, before the hunters left on a hunting expedition (cf. Lima 1999). This was done early in the morning with the help of *awiri* snuff (a mix of sacred plants, tobacco leaves, and the bark of a specific tree), which had to be consumed before the chief of peccaries would also take snuff (this thought of master spirits using the same herbal substances of the community clearly illustrates the perceived similarities between animal and human worlds). Exchange takes place as the shaman promises only moderate hunting and the game master reveals places with an abundance of game (see Virtanen et al. 2012 on the same type of being among the Manchineri). Even if only a few communities today still have shamans, before their hunting and fishing trips people may still consume *awiri* snuff. The sacred plants help people to dream and interact better with animal spirits (Virtanen 2015b) and have contributed to the Apurinã's living and knowing since ancestral times.

Based on many generations of observation, the Apurinã narrate that the animal behaviour also indicate many other things besides the presence of game, such as the arrival of people in the village, a forthcoming fight, an impending storm, rain, or dangers awaiting hunters in the forest, such as attacks by jaguars or snakes, or even *awĩte* spirits. Animal behaviour indicates that a tree can fall on a person walking along the forest track, that a hunter's gun will go off accidentally, or that one might step on invisible shamanic *arapani* stones left on a path by an animal or other entity, all of which can result in illnesses. These indications, foretelling futures (see also Kohn 2013), are indicated by birds such as *musakury, upee*, *txuipyra*, *txikary,* as well as by specific bats (*xiuu*), and frogs (*xitupa*), and the foretold future is not narrated as if it "could" or "might" happen but as something that "will" happen. If one hears the *txiupyra* bird when in the forest, one of the hunters of the village explained to me, "*You know that you can go home now. It's not right for a person to go on. Something will happen. And when a txiupyra comes to your home, you don't go out. He is warning you that something will happen*." The behaviour of animals thus influences people's decision-making.

From the Tumiã River, the closest form of communication technology is a telephone booth 6–8 h away along the Purus River, close to the Tumiã tributary mouth, where some non-Apurinã live in a few settlements. As mentioned above, it then takes about 3 days to reach the nearest urban areas: Lábrea (down-river) or Pauini (up-river). Animals are thus considered to be important messengers, and hunters listen to the sounds of birds in particular. For instance, for the Apurinã the call of the *musakury* owl is a telling sign that peccaries are close, so if the owl is silent a hunter will stay home. Then again, if one hears a *musakury* singing aggressively: "*You don't trek, you stay still*." Often, when I arrived in an Apurinã family, somebody in the house would say that they already knew that I was coming because they had heard the sound of a particular animal or dreamt of it. For instance Celia, a woman about my own age, once said, "*I heard the bird and I said, today [Pirjo] Kristiina is coming*!" An Apurinã man in the village of Kanakuri along the Tumiã River also told me that the *upee* bird would always sing on exactly the same tree, close to the path leading to Mapuã – a village on another river – whenever people from there were coming for a visit. Now, this bird had not sung for ages; nor had the people from the Mapuã been to Kanakuri.

It is not only the sound, but also the type of sound, that is crucial in indication, as it is loaded with information. For instance, an animated type of singing by a bird predicts a positive event, whereas another type of singing means that people will argue with each other or will not catch anything on a hunting trip. The number of times a bird repeats a call can also foretell, for instance, how many people will arrive at the village. But in some cases, people cannot avoid their "futures"; with the particular singing of a particular bird, there will be a fight, or there will be the onset of a disease.

When I asked how the animals know these things, the answer was often that the birds see far, but it was also observed that "*For us it is like that, and many times it is indeed like that. We are familiar with this*." A more detailed explanation was that these specific animals, which bring such valuable and vital information to the lives of the Apurinã, are ancient shamans who have undergone transformation; usually they are recalled by their proper names. It becomes apparent that exchanges and conviviality with certain animals and plants have contributed to Apurinã selfhood over generations; indeed, those with whom there is a long history of interrelations are considered ancestors even if not shamans. It is essential to note that relations between the Apurinã and animal and plant ancestors are so embedded in Apurinã selfhood and society that one does not precede the other (see also Virtanen 2011b). Furthermore, the presence of ancestor spirits changes the way in which the forest is experienced: they are understood to live in the forest, but if they should, finally, "die", as I discuss in the following section, the whole sensory experience of the environment as well as embodied subjectivity alters. Moreover, in Apurinã social reality, even talking or thinking about ancestor spirits may produce relations with these other-than-humans, and thus requires differently ritualized spaces and more experience of relating. When the Apurinã participate in political meetings with the institutions and various sectors of dominant society, however, this relationality is rarely addressed; political, environmental, or legal discourses are adopted in such

circumstances that enable indigenous people to break into social spaces designed instead by the social structures of the Brazilian society (see also Virtanen 2009; Virtanen et al. 2012).

6.4 The Death(s) of the Chief of Peccaries and his the Re-Election

Among the master spirits that the Apurinã often speak about is the chief of peccaries – the leader of a band of game (*Tayassu pecari*) that is highly valued. He is called by a generic name *irary awĩte* (literally 'chief of peccaries', but also known as *matatari*). In the Tumiã and Asimã territories this spirit entity is known by his proper name: Awaru. The chief of peccaries is in fact the leader of all the animals of the land: a kind of master of game animals. All the water beings, on the other hand, have their own master known as Awarikaari.

In ancient times, Awaru had been a shaman who transformed himself into a peccary along with his three sons and continued to live by the Purus River (see also Schiel 2004:285–288). In Awaru's time the socio-cosmological order became imbalanced. One time when Awaru was sick, his mother-in-law insisted that he went hunting for his family and others. In his mother-in-law's opinion, Awaru was lazy, despite the fact that he was a shaman and a negotiator with the animals and therefore someone who, rather than hunting himself, guarantees the abundance of game. The narrative goes on to describe how the hunters of the village returned from the forest and shared their catch with the others. After insisting, Awaru also left for a long hunting trip with his sons, and there he caught many different types of game. But when he returned to the village with his sons, fortunately his mother-in-law unknowingly ate a wrong piece of meat from their catch. She died and Awaru's wife became angry with Awaru. Moreover, his kin no longer recognized him, and therefore he decided to join the band of peccaries, eventually becoming their leader.

This narrative demonstrates the interesting point that the spirit world is not static, but also changes in the course of social changes. Like the Apurinã leaders, the master spirits can be replaced, depending on the political and social situation. Awaru became the new chief of peccaries, because the previous one had been killed accidentally: yet the transformation was also the result of disrespectful actions on the part of the hunters, who should not have killed the previous master, and also a result of Awaru's wife and mother-in-law not being respected their husband/son-in-law in his role as shaman.

When hunters are unable to bring game back from their hunting trips, the most common reasons given are that they must have behaved disrespectfully towards the master of game. As many studies have shown, hunting is based on complementary exchange relations with animals (Descola 1996; Fausto 2007; see also Corsín Jiménez and Willerslev 2007); a hunter should be careful in following the hunting rules and respecting the places indicated by game masters. Moreover, if a hunter has not con-

trolled his behaviour with women, disorder in cosmological relations will occur. In general, women must avoid contact with hunting equipment and also with a hunter right before and after the hunting trip (Virtanen 2012). This is even more crucial during menstruation because, even though blood is considered a vital element of life, it also represents a dangerous animal component that is opposed to humanity (see also Vilaça 2005) and can cause disorder and fracture in social relations, especially with nonhuman beings (see also Belaunde 2005; Viveiros de Castro 2012). Traditionally, women's bodies have been controlled because their menses in particular symbolize reproductive power and invite proximity to non-humans which pose threats to the community. A woman has to control her flow of menstrual blood in part for her own but also for the community's sake, or else people may become sick, which is explained as the revenge and punishment of the game master.

In the story of Awaru, however, as there is a break in the convivial relations between community members and the game master, Awaru has no alternative but to transform into the peccary himself. He could do this as he was a shaman, but he also needed to make the bodies of his sons similar to peccaries, an argument that meshes with the idea that corporeality is the foundation of Amazonian thinking (Seeger et al. 1979). In order to give them hair-like peccaries, Awaru tied branches and fishbones to their bodies. Awaru played a flute early in the morning as a sign for the passing peccary band, as these animals had advised him, and joined them, already on all fours. Even though Awaru had to leave his community, the contemporary Apurinã were grateful as it meant that they will continue to have peccaries. When there is no game master, daily subsistence is threatened.

This oral history clearly demonstrates how master spirits are considered to be related to the Apurinã through ties of kinship, usually "grandfather", which may occur as the Apurinã moiety system is inherited on patrimonial lines. It is also said that several shaman ancestors transformed into birds, with kin terms used to refer to them (though, as already noted, using kin terms for non-humans also occurs due to long convivial relations). The Manchineri, another Arawak-speaking people who do not have moieties, refer to several entities as "grandfather" or "grandmother", and, like Siberian Yukaghirs who refer to the spirits of their hunting places in kin terms (Willerslev 2007: 188), Manchineri also consider certain hills, for instance, as kin (Virtanen 2011a).

Given the role that ancestor spirits play in explaining everyday life, it is not surprising that contemporary Apurinãs have also integrated current dilemmas and the impact of non-indigenous people into cosmological explanations (see also Gow 2001 – on Piro myths and historical experiences). During my last visit to the Apurinã community on the Asimã River, I was told the sad news that Awaru, the chief of peccaries, had died three years earlier. His death, had resulted in the disappearance of the bigger game animals, such as the tapir and deer which, besides peccaries, are amongst the most cherished game animals for the Apurinã. Awaru's death was the local villagers' cosmological explanation for the present decline in game and the wave of misery that now faced the community. The significance of this for Apuriña livelihood and wellbeing must not be underestimated, as their subsistence comes from the forest.

I discussed Awaru's death with Julio (pseudonym) – a shaman trainee in Asimã who had already cured many patients – who explained to me in more detail what had happened. We were sitting in his house on a hot afternoon of November discussing master spirits. According to him, two non-native settlers had been hunting on the lower river and one had shot Awaru with his rifle. "*It was dangerous to kill the chief of the peccaries. Awaru took the man!*" Julio asserted. The spirit of Awaru was so powerful that the hunter died shortly after the incident. The fate of the hunting companion had not been much better: he had gone crazy (*mapitxiri-ta*) and was no longer even able to speak.

Julio explained that after the death of Awaru, the forest had been quiet for several years, as all the animals had disappeared or moved further away. Landscape of movement and soundscape had greatly altered. "*There was no place where a peccary could be found. All types of game disappeared from all over the place. Everything!*" This situation had been a big alteration for the communities, because the behaviour of animals and plants play an important role in knowledge-production and empowerment. Ultimately, the shortage of game was not explained as being the result of the actions of Apurinã men or women, but of non-Apurinãs, thereby reflecting the understanding that the current economic and political situation and tensions originate with the non-natives. The animal world had experienced a severe hit, reflecting the pressure placed on the Apurinã by the increasingly limited forest resources.

Fortunately, however, when I asked if the master of water animals (Awarikaari) had also faced difficulties, Julio exclaimed: "*He was never killed! God save me from that!*" Julio explained that if they were left without fish, it would be fatal, as when there is no game, there is still fish for those prepared to catch it. The upper parts of the river were still rich in fish, even if seasonal movements were affected by the exploitation of the lower course of the river by non-natives. Julio continued with his tale, telling me that when the community heard from other people that a *kariwa* (non-native) had killed Awaru, the people in the village had already known that he was dead as they had felt it in their bodies, thereby implying how closely connected by their bodies the Apurinã are to other persons and beings, both humans and non-humans (Uzendonski 2004). The Apurinã often say that they "*know it in their hearts*" when something happens.

Even though the death of Awaru had caused game to vanish, there was still hope, however. With great relief, Julio went on to explain that forest animals were again returning to many places, and hunting trips were becoming shorter once more. When a hunter has to walk long distances in the forest, it takes up a lot of his energy and time. "*It is only now that game is growing. Now they are coming close*." According to him, the reason for this change was that in fact the peccaries had just chosen a new peccary chief called Arisanto. As the animals had been re-empowered, it was again easier to hunt and animals were even being seen on the forest paths. Julio then listed the animals that had reappeared in the vicinity: agoutis, pacas, small forest pigs and so forth. There was still very little game though. In my analysis, these improved arrangements in the animal world accurately reflect what the community felt about its own human context: its members had new hope as a result

of recent constructive partnerships which had been cemented with different sectors of civil society, as I discuss in the following section.

6.5 Building Complementary Relations with the Non-Apurinã

The Apurinã social networks include essentially non-human actors, but also increasing numbers of non-natives from different sectors and backgrounds. These latter links have recently produced a number of events that have been experienced in a positive light by the people of Tumiã and Asimã and which are working together to produce new hope: the recently inaugurated regional indigenous federation, FOCIMP, has issued new demands that the government execute all its promises towards indigenous people. FOCIMP has an Apurinã coordinator, and the organization is working on the Apurinã's claims that their indigenous territories be expanded to include all the ancestral land, and not only part of it. The CIMI, besides giving a voice to indigenous people in the area, provide the communities of the Tumiã and Asimã Rivers with crucial informations. In Tumiã it has built a well to provide drinking water for the community, though gasoline is still needed before the pump may operate. On the same line, Apurinã language was strengthened by our linguist-anthropological team (collaborative work between the Federal University of Pará, University of Helsinki and partner indigenous organizations) that for some years now has been providing training for indigenous teachers and new school materials in their own language. All these new collaborations have been established on the basis of mutual understanding and indigenous collaboration and have therefore empowered the Apurinã. Moreover, some indigenous people in the region of Central Purus have recently obtained new resources, training, and infrastructure from state programs (such as PNEGATI – National Policy for Environmental Management in Indigenous Lands –designed by FUNAI and the communities), and increasingly from non-governmental organizations and other allies. Despite the long historical background of oppressive relations with the dominant society, the Apurinã are pleased with the recent changes. Just as the lack of game was explained by the death of the Awaru, so are changes for better in the socio-political context, a reflection of the re-stabilized world of animals since the election of the new chief of peccaries, Arisanto.

From the Apurinãs' point of view, and in its idealized form, co-operation and collaboration with non-native actors should occur in the same mode as the conviviality and exchange between the Apurinã and animal and plant beings. But, like the master spirits who provide game, fish, knowledge, and other benefits, non-natives also pose a predatory threat. Bonilla (2007) has examined these ideas of relationality and predation among the Paumari, who also live in the Central Purus, where relations with rubber patrons and local merchants, known as *regatões*, effectively illustrate how Amazonian social relations are constructed on foundations of poten-

tial danger, but also potential humanity (see also Viveiros de Castro 2001, 2012). As Bonilla demonstrates with regards to the Paumari, a good non-Paumari boss (rubber patron or merchant) is one who provides basic necessities and takes care of the people who serve him.

Among the Apurinã of the Tumiã and Asimã Rivers, local ambulant *regatões* still maintain a type of working relationship akin to slavery, because they enter the indigenous areas to obtain indigenous handicrafts to exchange with the commodities but with negligible compensation. Some older Apurinã call *regatões* their "patrons", because this exchange resembles that which was commonplace during the rubber period (similar to the system of *aviamento* rubber producers as discussed in Aquino 1977; Piedrafita 2008; Weinstein 1983). Generally, however, they seem to be content that commodities are so easily available to them through their "patron" (*regatão*), and continue to trade their produce – craftwork such as baskets, honey, and manioc flour – for market goods such as detergents, ammunition, clothing, sugar, salt, milk powder and biscuits, even if the prices are much higher than in urban areas.

In wintertime, bigger purchases (e.g., flash lights, radios, or other new technologies) are usually made after the Brazil nut harvest or when receiving state benefits such as retirement pensions, family benefits for a newborn baby, and family allowances called the *Bolsa família*, which was created by a state social welfare program to reduce poverty. Governmental cash transfers are collected in the closest municipality, where commodities are immediately purchased and then often shared in nuclear families in reserve. Unsurprisingly, *regatões* have also benefited from the new cash incomes among those they exploit. Furthermore, the *regatões* sell alcohol and, subsequently, the consumption of alcohol is linked to increasing internal disputes between community members.

Even if to some extent the relationship between the local merchants and the Apurinã has satisfied undemanding criteria of mutual reciprocity, the exchange is very fragile. According to the latest news I have from Tumiã, one of the *regatões* has declared his rights over several Brazil nut groves, thereby limiting the access of Apurinãs to forest resources and additional income. The Apurinã, in their turn, see this as terminating exchange relations, and want to expel the merchant from the territory. They have already called on governmental agencies and indigenous organizations to support and defend them. Unfortunately, none have yet made an appearance in the Central Purus. Yet, this case from the human-to-human relations (Apurinãs-merchants) demonstrates how social relations with others can even in their predatory forms be accepted, but over-control and disrespect from the other subjectivities ceases mutually constitutions and interactions, including both humans and non-human subjectivities. In a similar way, as described earlier in this chapter, the lack of respect from non-Apurinã hunters harmed the relationships between the humans and forest entities.

6.6 Conclusions

The ethnographic discussion of the two Apurinã communities addressed here highlights that reciprocal exchange with non-humans is only not typical of hunting and between kin (see also Uzendoski 2004), but is also the form of relations the Apurinã wish to have with non-native actors: not only with those settlers extracting forest produce in the region, but also with the nation state and other vital actors. Conviviality and exchange remain crucial elements in Amazonian indigenous people's social production, both between humans and between humans and non-humans. The narratives of the death of the chief of peccaries and his recent recreation and revival summarized in this chapter demonstrate that cosmological explanations alter according to the community's relationships to the main surrounding actors (see also Gow 2001). Despite the changes in the oral history story line, however, the narrations underlined proper behaviour and moral values. Humans do not just adapt to the environment as a static entity; rather, animal subjectivities also have their own transformative capacities. They have their own memories and interrelations.

Humans are thus not independent of animal and plant lives; moreover, as implied by what my Apurinã research collaborators said with regards to their bodily experiences and ways of knowing, their relationships are lived in an embodied way. Additionally, even though the Apurinã are integrated into the market economy and the political national system, their sociality includes relatedness with the animals and plants that number among their life givers, even if this relationality is rarely voiced at the national political negotiation tables. This aspect of social philosophy and social practices should be a more central element in definitions of hunter-gatherers.

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Part III
Changes in the World Economy

Chapter 7
Why Pumé Foragers Retain a Hunting and Gathering Way of Life

Karen L. Kramer and Russell D. Greaves

Abstract Much of our success as a species derives from the ability to adapt hunting and gathering to diverse ecologies and incorporate a wide range of food resources. Throughout their history foragers have been making strategic decisions about whether to incorporate new resources and technologies. This appears to be both the strength and resilience of hunter-gatherer lifeways. Despite recognition that hunting and gathering includes broad-spectrum subsistence options, an assumption is commonly made that the incorporation of domesticates leads to a directional shift toward greater reliance on food production. In this chapter we consider instead how the adoption of some horticultural practices supports the continued viability of, and primary reliance on, hunting and gathering. Although the Pumé live in close proximity to and interact with their horticultural relatives, they have not assimilated into their communities or become sedentary and increasingly reliant on horticulture. We explore how a combination of both economic and social factors are critical to their retention of a mobile foraging way of life and helps to explain why hunting and gathering remains a viable, and even desirable subsistence choice in the twenty-first century.

7.1 Introduction

While many have been forced, compelled or chosen new ways of making a living, some contemporary hunter-gatherers retain a foraging way of life. Despite living in close proximity to horticulturalists, hunting and gathering remains a viable strategy for the Pumé living in the Llanos of Venezuela. Regional political instability, geographic isolation and a poor terrestrial environment no doubt buffer the Pumé from the effects of national economics, market integration, tourism, and habitat transformation. However, they also make active decisions to remain hunter-gatherers.

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During half of the year, when the Pumé are food stressed due to low protein and fat returns, they might be vulnerable to assimilating or moving into horticultural communities. Rather than doing so, however, they broaden their subsistence base through the adoption of small-scale manioc cultivation. Because foraging provides equal or higher economic returns, cultivation has not replaced traditional foods or a mobile way of life. Further, the social costs are too great to abandon foraging. Wild foods are closely tied to Pumé sharing patterns, food security, group stability, the status of women, and cultural institutions that promote group cohesion. This combination of economic and social factors appears critical to their retention of hunting and gathering.

In this chapter we use the Pumé example to examine why hunting and gathering remains a subsistence choice in the twenty-first century. First, we discuss drivers of subsistence change, and interactions between foragers and farmers. We then introduce the Pumé, focusing specifically on subsistence, and the economic, and social influences that affect their decisions to remain hunter-gatherers when other options are available. We conclude by examining the Pumé case study's implications for the long-term stability of foraging and mixed economies that we see both ethnographically and archaeologically.

7.1.1 Foragers Living on a Transitional Landscape

While modern hunter-gathers often are characterized as isolated from outside influences, living as people did in the past, they have lived on a transitional landscape since they can be identified in the archaeological record. Throughout the Pleistocene, foragers adopted novel technologies, intensified their resource base, and moved into an ever-increasing diversity of environments (Klein 2009). Sometimes new resources or strategies were added to their subsistence base. Occasionally, these replaced previously used foods and technologies. With the origins of domestication at least 10,000 years ago, hunter-gatherers no doubt were knowledgeable food producers. Both the archaeological and ethnographic records indicate that foragers often lived in close proximity to and interacted with food producers, without themselves becoming agriculturally reliant (Smith 2001). Rather than being secluded from the forces of change, we would argue that hunter-gatherers have always been adapting to new social and environmental conditions, interacting with other groups, and making decisions about what new foods, resources, technologies, and strategies to add, replace or retain (Kramer and Codding 2016).

Today the scope of interactions and impact of external influences undoubtedly have accelerated for many hunter-gatherers as regional and national economies increasingly extend their reach. Many twenty-first century hunter-gatherers have had little choice in integrating certain aspects of globalization and market integration, becoming caught in political strife that instigates change in their lifestyle. The range of effects these factors have on hunter-gatherers is the subject of this book. While the Pumé have minimal contact with the nation state within which they live,

they interact with, speak the same language, and are related to the horticulturalists surrounding them. Yet, for as long as an historic record exists, the Savanna Pumé have retained a foraging way of life (AGI Caracas 135: 1786, 1787, 1788; AGI Caracas 252: 1776). While external pressures are not new challenges for the Pumé, their proximity to horticulturalists provides an opportunity to look at what hunter-gatherers value about their way of life, and the decisions they make about what to retain in their subsistence base when options surround them.

Although the origins of domestication literature often emphasizes an inevitable transition from foraging to agriculture following access to cultigens (Bellwood 2005; Richerson et al. 2001; Zeder and Smith 2009), this is at odds with both archaeological (Piperno and Pearsall 1998; Smith 2001; Winterhalder and Kennett 2006) and ethnographic hunter-gatherer data (Bailey and Aunger 1989; Hart and Hart 1986; Headland and Bailey 1991; Hitchcock and Ebert 1984; Peterson 1978; Smith 2001; Wilmsen 1989). Rather, the relationship between foragers and farmers often is long-term and stable, and foragers often retain their way of life despite these interactions. In this chapter, we ask what do foragers find worth conserving about hunting and gathering and what do they assimilate from external influences? The Pumé are an ideal population to examine these questions because they are divided into two distinct economies with different histories of interactions with outsiders. The River Pumé are horticulturalists and have had greater contact with other indigenous groups and with Europeans over the past 250 years. The Savanna Pumé are hunter-gatherers who have had much less contact with groups other than the River Pumé.

7.1.2 Making Subsistence Decisions When Presented with New Options

Some contemporary hunter-gatherers retain a foraging economy even though they are well aware of food production, wage labour and other drivers of modern change. For example, the Hadza, hunter-gatherers living in the woodlands of Tanzania, are a well-documented case of active resistance to relocation, sedentarization, and schooling (Blurton Jones 2016). Many Arctic groups have maintained or reincorporated aspects of hunting-gathering subsistence (Wenzel 2016). Some Kalahari bands have returned to foraging after years of forced settlement (Hitchcock and Sapignoli 2016). Baka foragers of the Congo Basin continue to gather forest tubers and rely exclusively on wild foods at particular times of the year despite increased cultivation, wage labour, and sedentarization (Yasuoka 2006).

Models characterizing how foragers make decisions about which foods to incorporate in their diet usually include the nutritional benefits and the energetic and time costs to pursue a food item (Kaplan and Hill 1992; Smith 1991). From a forager's perspective, resources vary in nutritional value, which is weighed against the time and effort expended to retrieve a resource and the opportunity costs not to pursue

some other activity (Tucker 2006; Winterhalder and Kennett 2006, 2009). While a new resource might add nutritional diversity to a hunter-gatherer diet and minimize risk by broadening the subsistence base, a greater labour investment or poorer nutritional quality might outweigh these benefits. Labour investments may include search and travel time, time spent accessing and harvesting the resource, or processing a resource for consumption.

At its simplest, if one resource is more nutritious or offers a labour savings in search or handling costs, it is expected to replace less nutritious or more labour intensive resources. Alternatively, in the absence of these advantages, hunters and gatherers may either ignore the novel resource or incorporate it into the diet as a complementary or fallback food. While the Pumé include small amounts of cultivated bitter manioc into their diet, they have made a strategic decision for the continued predominance of foraging rather than intensifying horticultural reliance.

7.2 Savanna Pumé Hunter-Gatherers

The Pumé are native South Americans who inhabit the Llanos of southwest Venezuela. Today most are River Pumé who live in semi-permanent villages along major tributaries of the Orinoco River and have a mixed subsistence base of fishing, hunting, gathering, manioc horticulture, animal husbandry, wild foods and occasional wage labour. In contrast, the Savanna Pumé who live between these major rivers are mobile foragers, subsisting on hunting, fishing, wild root and fruit collection, and small inputs from manioc horticulture. The Pumé recognize these distinctions in mobility, subsistence, and lifestyle and use the autodenomination terms of 'river-dwelling' and 'savanna-dwelling' Pumé in reference to these differences.

The River Pumé were first ethnographically described in 1934 (Petrullo 1939), and subsequently during the 1940s–1950s (le Besnerais 1948, 1954; Leeds 1961, 1964). Most ethnographic work has focused on the largest and most acculturated villages in the region because of their easier access. The River Pumé maintain some wild food foraging, but have intensified food production, and invest in larger gardens and in a broader range of cultivated plants than the foraging Savanna Pumé. The River Pumé formally practiced limited seasonal mobility, but today are largely sedentary.

The first anthropological research with Savanna Pumé was conducted in the 1980s (Gragson 1989) and 1990s (Greaves 1997a, b, 2006; Hilton and Greaves 2004). Greaves has lived and worked in the savanna Pumé communities of Doro Aná and Yagurí since 1990. Since 2005, our research also has expanded to include an additional savanna community and three River Pumé villages. Here we focus on those ethnographic details affecting Savanna Pumé subsistence decisions (for a more extensive ethnographic account see Kramer and Greaves 2016).

In response to hyperseasonal fluctuations in rainfall, the Savanna Pumé move 5–6 times throughout the year between dry and wet season camps. Extreme rainfall variation dramatically alters the flora and fauna available during each season.

Dry season camps are located adjacent to streams and lagoons for easy water access. Related nuclear families live in clusters of ephemeral brush shades. During the 6-month dry season, Savanna Pumé subsistence is centred on fish that are concentrated in restricted pools and small segments of streams. Groves of feral mango trees, though often distant, have been incorporated into the foraging radius and are an important dry season source of carbohydrates and calories. This is the relatively abundant time of year when food is plentiful and disease burden is low.

When the llanos flood, during the wet season, the Savanna Pumé move their camps to higher ground and families aggregate in more substantial thatch houses (Gragson 1989; Greaves 1997b, 2006; Mitrani 1988). The wet season presents a number of challenges to Pumé foragers. Fish are too dispersed to be reliable, and the resource base shifts to small game (primarily burrowing animals) and wild root collection. Savanna Pumé have a mean return weight of 2.51 kg per hunter per trip, with a return rate of .40 kg per hour (n = 61 trips; including all pursuit time). However, prey diversity is low and focuses on small animals. Three species of fossorial game, (armadillos, tegu lizards, and small teiid lizards), which weigh between 100 and 900 g, represent 87 % of all game captured. Wild roots are collected in significantly larger quantities during the wet season, providing approximately 25 % of the total annual Pumé diet (Greaves and Kramer 2014). The most common roots (*Dracontium margaretae*) are relatively small (mean = 20 g), but are located in dense patches and usually are only a few centimetres below the ground surface. Unlike foods pursued by men, because patch locations are known, root collection requires little search time. Further, all root foraging trips result in food returns, and return rates are directly proportional to the time spent collecting roots (Greaves 1997b; Greaves and Kramer 2014).

The wet season also is when the Pumé include some cultivated bitter manioc, a low quality carbohydrate, in their diet. Their swidden gardens are small and locations are limited to the relatively small patches of forest not flooded during the wet season (0.10–0.12 ha/person; Gragson 1989). Consumption varies from year to year, but contributes less than 10 % of the annual diet (Kramer and Greaves 2011). During any particular year, many households (~45 %) have no gardens under cultivation. The relatively low dietary importance of manioc is evidenced by the small size of harvested tubers and the lack of specialized technology (griddles and sebucans) to process manioc compared with more committed manioc horticulturalists.

The Savanna Pumé have access to a few nonlocal goods (cloth, machetes, cooking pots) through trade with the River Pumé. This trade network likely has been in place for as long as the Pumé have lived on the Llanos. Exchanges are usually initiated by the River Pumé who travel in small family groups into the savanna interior bringing well-worn tools and clothing, which they exchange for raw materials such as arrowcane, fibre, resin, weaving materials, and finished arrows. There is no use of currency, and no food items are traded. On the rare occasion when Savanna Pumé men work for ranchers, they are paid with rice or pasta. This is the only input of market foods into their diet.

No savanna community has a school, health clinic, store, electricity, well water, or can be reached by a road. Most Savanna Pumé are monolingual; 4 % report rudi-

mentary understanding of Spanish, Venezuela's national language, and no Savanna Pumé have attended school. While some Savanna Pumé were immunized for small pox in the 1990s following local outbreaks, very few children have been vaccinated in the past 15 years.

The primary study community of Doro Aná moved to its current location in the early 1960s from further south, near the Cinaruco River. Initially, several families came into the area in response to rumours that a planned community was being created as an indigenous centre. However, these Savanna Pumé found the lifestyle of frequent contact with non-Pumé outsiders highly stressful, and moved back into the savanna where they continued a foraging lifeway. They specifically stated that the use of alcohol caused fighting and a range of antisocial behaviours that they consider abhorrent such as not sharing, prostitution, and particularly the disintegration of cultural values that inhibit holding ceremonial dances. Periodic efforts by local non-Pumé ranchers or local governments have resulted in brief attempts to incorporate the Savanna Pumé as labourers or initiate unsolicited help, especially during the Chavez administration. Despite these attempts, the Savanna Pumé have explicitly chosen to live away from these influences and to rely on foraging rather than to change their subsistence and social practices.

7.2.1 Living in a Marginal Environment

As is the case with many contemporary hunter-gatherers, the Pumé live in a marginal environment that has little exploitative interest to non-Savanna Pumé. While a lean period of several months is not uncommon in many traditional economies, it is particularly severe on the Venezuelan Llanos in predictably lasting half the year. During the 6-month, wet season protein and fat are in short supply, and nutritional stress can be extreme in some years. Women may lose up to 8 % of their body weight (Kramer and Greaves 2007, 2010). This also is the season of highest epidemiological exposure, especially to malaria and other serious arthropod-borne diseases.

The extreme seasonality on the Llanos has marked effects on fertility and mortality. Food is abundant enough during the dry season to support successful conception and pregnancy, and fertility is relatively high (completed fertility = 7.4, $n = 48$ women, period rate of live births; Kramer and Greaves 2007). But child mortality also is high (surviving completed fertility =4.2, $n = 61$ women, period rate). Young children are especially challenged to survive their first several wet seasons, when food availability and the quality of mother's milk decline and disease exposure increases. Of children born, 35 % do not survive infancy, and an estimated 45 % do not survive to reproductive age (Kramer and Greaves 2007).

The Pumé have a number of strategies to cope with wet season challenges. Our study problem here comes from the observation that both wild and domesticated tubers are collected during the lean season, but cultivation has not replaced the dietary importance of foraging. Below we look at both the economic and social components of these decisions.

7.3 Economic Impacts of Dietary Choices

To cope with low wet season food availability, the Savanna Pumé diversify hunting and gathering to incorporate some manioc horticulture. In doing so they combine two similar and compatible resources, wild and domesticated tubers (referred to interchangeably as roots or tubers). Wild roots have several key attributes that make them particularly attractive to hunter-gatherers during lean seasons. They are generally high in starches and carbohydrates and can be harvested across a greater proportion of the year than many fruits and seeds, especially in seasonally extreme environments. While return rates are on the order of 1000–3000 kcal/h (Eder 1978; Endicott and Bellwood 1991; Hurtado and Hill 1987; Kelly 1995; Tucker and Young 2005; Yasuoka 2006) or low compared to resources such as honey or meat, roots are more predictable and provide reliable returns because patch locations are known and resource condition can be monitored prior to foraging trips. Consequently, search time is negligible and daily variance in return rates measured in calories is much lower than for hunted or fished resources (Greaves 1997b; Tucker 2006). For example, Pumé women depart from camp on a foraging trip having selected carrying baskets of particular size capacities suited to their age and family size. They walk to a predetermined patch and return to camp when their baskets are full. The ability to anticipate their returns is very different from hunting and fishing trips when men may spend the same amount of time, or longer, but may return with plenty, little or nothing. Wild roots are critical foods sources to smooth daily consumption requirements, especially when downturns occur in the availability of protein and fat resources (Hildebrand 2003; Malaisse and Parent 1985; Rusak et al. 2011).

Although gardening is not a part of normal wild-food foraging activities, several properties of bitter manioc (*Manihot esculenta*) make it attractive as a complementary resource. The opportunity cost of allocating time to cultivation tasks is relatively low because manioc gathering does not conflict with foraging activities. This point has been made with respect to the dietary inclusion of *Chenopodium*, a small-seed crop, among eastern North American hunter-gatherers (Gremillion 2004). Unlike other cereal crops, such as maize, that require support tasks been done at specific times of the year, the scheduling of manioc garden labour is flexible and can be distributed throughout the year around other foraging tasks that are temporally constrained. Pumé garden preparation, which is calorically expensive work, occurs during the dry season, when food is relatively abundant and disease less prevalent, minimizing competing energy demands (Kramer et al. 2009). Unlike seed and fruit crops, manioc can be stored in the ground until needed with little loss in yield (Cock 1982; Rival and McKey 2008), avoiding harvest labour bottlenecks and conflicts with other activities. Compared to other crops, vegetative propagation entails less garden preparation time and reduces the vulnerability of new plantings to rainfall. Because bitter manioc is drought tolerant and pest resistant relative to many other crops, it requires little tending and weeding.

Fig. 7.1 (**a**) Wild roots and (**b**) bitter manioc are similar in the environment in which they grow, the predictability of patch locations, low search time for roots, underground storability and the technology used to access them

Other aspects of manioc cultivation also complement a mobile forager's way of life. Because both wild root patches and gardens are known locations, little search time is needed either to find a patch or harvestable plants within a patch, and returns for both resources are highly predictable. The technology used to access both types of plants also is similar (Fig. 7.1). The Savanna Pumé do not manufacture specialized leaching or cooking implements to process manioc, and the same simple tools (i.e., digging sticks or machetes) are used to harvest both wild and domesticated roots. We point out these particulars of Pumé foraging because they are likely common to the many other hunter-gatherers who combine some bitter manioc into their subsistence base.

Using time allocation and nutritional analyses, we found that bitter manioc provides no clear macronutrient, caloric or labour advantage compared to wild roots (Greaves and Kramer 2014; Kramer and Greaves 2016). Results showed that, per unit dry weight, wild roots and bitter manioc statistically have similar carbohydrate and caloric content. Manioc has significantly less protein but more lipids than do wild roots (Fig. 7.2). The average individual return rate for wild roots is 1.83 kg. per hour ($n = 21$ individuals; 126 foraging trips, range 0.39–3.5) and 2.456 for bitter manioc ($n = 19$ individuals, 153 trips, range 0.28–5.8). This difference is not significant ($p = .0737$; Greaves and Kramer 2014). Although bitter manioc takes more time to process than wild roots and is not highly nutritious, it is more economical (takes less time and energy in tending per harvested amount) than many cereal crops (Cock 1982; Ember 1983).

While investing in cultivation supplies critical calories during the wet season, the Savanna Pumé could alternatively increase wild root returns by expanding their

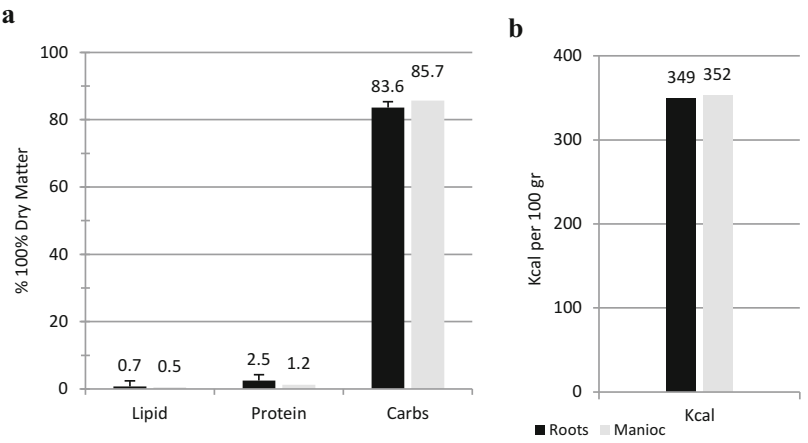

Fig. 7.2 Macronutrient and calorie analysis of wild roots (*Dracontium margaretae*) and bitter manioc (*Manihot esculenta*). (**a**) percent of 100 % dry matter for lipids, protein and carbohydrates; (**b**) kcal per 100 g of 100 % dry matter

foraging time and range. Because they do not do so, this suggests that increasing wild root productivity is not as economic as combining foraging with minimal cultivation. Intensifying root collection requires additional mobility and energetic costs during the season of greatest nutritional and epidemiological stress. Rather than expanding foraging ranges, the Savanna Pumé promote plant productivity of nearby locations where wild roots are not otherwise available and increase dietary diversity during the lean season. Travel distances to gardens are lower than for wild tuber collection, boosting return rates for manioc. When asked, the Pumé say that they cultivate manioc because it provides additional food on days when they do not expend effort foraging for wild roots, but wild roots are more filling in fighting hunger.

7.4 Social Impacts of Dietary Choices

The social costs to not forage are significant for many hunter-gatherers. For example, social networks appear to explain the persistence of foraging among Botswana foragers such as the G/ui and G//ana (Hitchcock and Sapignoli 2016) and among the Hadza (Blurton Jones 2016). In the Savanna Pumé case, small-scale manioc cultivation adds a low-cost fallback food to the diet without replacing wild foods, or compromising social relations and autonomy. Critical inputs of wild tubers during the wet season have important social implications associated with the subsistence value of women's contributions to the diet and their political equality with men. Although garden work and harvesting are equally performed by women and men, women's wet season foraging is both more frequent and more productive than men's hunting.

Retention of wild plant and animal foods also reifies several group cohesion mechanisms including bilocal residence patterns (the Pumé live with both matrilineal and patrilineal kin; Kramer and Greaves 2011) and their commitment to ritual activities that enhance resource sharing and activity coordination (Kramer and Greaves 2016).

7.4.1 Sharing and Redistribution

While some foragers store food (Binford 2001; Kelly 2013), Woodburn (1982) suggests that hunting and gathering economies are largely focused on immediate returns that are shared widely to others. Delayed returns, which are common among pastoralists, agriculturalists and wage labourers, are distinct from immediate returns in having a temporal lag between the labour input to produce the resource and its consumption. Consequently, delayed returns are argued to remove one from many of the social obligations that keep networks of interdependence, shared risks, and rewards intact. The central African Bofi, for example, have long-term relationships with neighbouring horticultural populations (Lupo 2016). While alternative economic opportunities concentrated on bush meat trade or wild plant collection could earn higher returns, the time demands of such specialization would force individual Bofi to break ties with their neighbours. Many central African foragers have access to cultivated foods, raw materials, or market goods because they provide short-term labour or periodically exchange wild food or forest products. Social alliances between groups of people, even between different economies, diversify potential resource access without a commitment to necessarily decreasing foraging options.

One distinction that has been made between immediate and delayed returns is that cultivated foods do not enter exchange and sharing networks in the same way as wild foods (Gurven et al. 2004). However, we do find this to be the case with the Pumé. Manioc is treated similarly to foraged foods. Wild and domesticated roots have similar redistribution patterns where both raw and cooked roots are shared among labour groups, families, and less related individuals regardless of whether they helped produce the food. No household retains all of the manioc it harvests or processes it without sharing out some to multiple hearths. Despite the labour demands of planting, weeding and harvesting, manioc is fluidly exchanged and does not occupy a separated realm of "ownership". Although bitter manioc is a delayed-return resource, its redistribution is similar to that of wild roots, ameliorating a potential social cost to incorporate it into the diet. Rather than disrupting the traditional system of exchange obligations and sharing norms, manioc is folded into the redistribution network (Kramer and Greaves 2016).

Among the Pumé both male- and female-contributed foods are critical to the diet and, unlike many other foragers, carbohydrate and protein foods are equally and widely shared across households (Kramer and Greaves 2011). Food distribution and sharing networks are particularly important for the Pumé to get through the wet season when fishing is impractical and terrestrial game, while present, is available only in low densities and package sizes. In comparison to low hunting returns (~2.2 kg/man/trip), roots have much higher and frequent returns (~12 kg/woman/trip).

Not enough game comes into camps to facilitate reliable distribution. Sharing women's foods provides calories, but also functions to maintain reciprocal relationships for times when others are not foraging or returns are poor. For the Pumé, only women's gathered foods are common and predictable enough during the wet season to serve both these roles. Because men's wet season food contributions are infrequent and small packages, their garden work provides their only substantial input into the sharing network during this time of the year.

Food sharing and interdependence are also reflected in children's foraging contributions and the dynamics of how foods are shared between households. Children are socialized from a young age to cooperate and contribute to redistributed foraging returns. For example, a Pumé boy has an average return rate of 1.43 kg. of fish (~1717 kcal) and 12.4 kg. of wild fruit (~8410 kcal) per foraging trip. This represents their food return to camp after any potential field snacking, and is a large enough return to feed himself and contribute to his family's daily food intake. All foods brought into camp, are shared by re-distributing them both raw and again when cooked. This suggests that social obligations are part of the calculations about sharing, not simply providing food to other camp members. Raw and cooked foods often are exchanged by women quite visibly within camps, even among participants who have returned from the same trip and may have evened out loads before coming into camp. Cooked plant and animal foods are commonly shared back to households that initially provided the raw foods.

Making a living in a food-challenging environment also is reflected in the prevalence of community-wide dancing that reifies group membership and identify. During frequent night-long dances (37 % of nights in residence, n = 488), all individuals participate by singing and dancing, activities known to promote cooperation (Adams 2004; Wiltermuth and Heath 2009), storytelling and performing healing rites. The entire community gathers in the early evening, hanging their hammocks in poles in a central area. Songs and stories typically reiterate kin relations and close ties among individuals. Only rarely does a camp member not attend. The Pumé stand out in both the frequency and effort committed to these social dances, which often are followed by foraging and hunting bouts.

The social and sharing networks maintained through foraging and sharing appear to have significant time depth for the Savanna Pumé suggesting the incorporation of manioc is not an indication that Pumé foragers are intensifying horticulture and becoming more strongly affiliated with the River Pumé. Aspects of Pumé mobility and ritual activity highlight the importance that cooperation, pooling risk among camp members, and group cohesion play in strategies to cope with the food challenges.

7.5 New Challenges Facing the Pumé

Venezuelan nationals have been migrating into the Savanna Pumé region to establish small cattle ranches since the 1960s. Conflicts periodically erupt between the Pumé and ranchers over land and resource claims. Recent examples include the

killing of four Pumé in 2005 over alleged pig theft and the attempted fencing of a critical dry season water source for exclusive livestock use. Clashes over land rights and access to resource areas probably represent the greatest threat to their foraging way of life. The Pumé are concerned about encroachment into their traditional lands, but have no legal voice or representation. National efforts to provide indigenous land titles have been mired in inefficiency. Outside attention to resolve these potential conflicts has focused on the better known and more accessible River Pumé, while issues facing the Savanna Pumé remain unacknowledged.

Because the ranches are situated along the major rivers, opportunities for trade, wage labour and access to market food are much greater for the River compared to the Savanna Pumé. These recent subsistence alternatives contribute to reduced seasonal variation in food availability and lower food stress among the River Pumé. Although wage work is infrequent, 73 % of river men report having spent at least one day over the past year in wage labour. Labour is paid for in food and other consumables. The River Pumé generally earn higher wages and may occasionally receive cash payments, which has never been reported by Savanna Pumé. A consequence of increased individualized subsistence among River Pumé is factionalized dance participation. Several river communities no longer hold community-wide dances, but engage in dance only as extended family groups. Many River Pumé communities with significant increases in alcohol availability no longer practice dances at all. Former dance leaders state this is because the village members do not behave with appropriate social conscience and community mindedness, and as a consequence sharing and interdependence have decreased.

The River Pumé's contact with the regional and national economy is accelerating. River communities have some access to government-provided building materials and market foods. However, attempts to maintain health clinics and schools have not been successful. Savanna communities are outside the reach of government, NGO or private sector assistance. For example, funds were distributed in 2005–2007 through government-sponsored programs in river villages ostensibly to purchase food and needed goods; the savanna communities were excluded from this assistance.

7.6 Implications to the Long-Term Stability of Foraging and Mixed Economies

While the Savanna Pumé have accepted certain novel technologies since contact (metal tools and clothing) and new foods (feral mangos), they have actively chosen not to incorporate greater amounts of domesticates into their subsistence base. The combination of wild and some cultivated tubers appears to be a long-term and stable strategy for the Savanna Pumé. The extent to which horticulture is limited is in part environmentally influenced. Soils adjacent to the major drainages where the

River Pumé have their communities are more fertile and have a higher nutrient renewal from the gallery forests and periodic flooding. In contrast, the interior savanna soils are more impoverished (Sarmiento et al. 1971) and forested areas for swidden production are smaller and more limited. The earliest historic records that refer to the Pumé, some 250 years ago, describe them as nomadic hunter-gatherers with some small-scale manioc cultivation (AGI Caracas 135: 1786, 1787, 1788; AGI Caracas 252: 1776). Rather than indicating an erosion of their foraging way of life, some cultivation allows the Pumé to diversify their diet with a relatively inexpensive fallback food. By maintaining a broad set of subsistence options the Pumé can continue a general forager lifeway. This has implications to the long-term stability of mixed economies seen both ethnographically and in the archaeological record.

Archaeologically, cultigens commonly appear several 1000 years before the emergence of fully committed agricultural economies. Taking the perspective of a hunter-gatherer deciding whether to incorporate a new food, because wild roots have the equivalent nutritional value and similar if not more efficient return rates, manioc is an unlikely candidate to replace reliance on wild roots. These properties likely explain why several South American tropical hunter-gatherers incorporate this cultigen into their diet as a long-term and stable fallback strategy rather than transitioning to horticultural reliance or developing trading relationship with neighbouring farmers. This suggests that in those cases where hunter-gatherers do replace wild foods with manioc cultivation and become horticulturalists, they do so for other reasons.

For some hunter-gatherers, small-scale incorporation of a low investment cultigen may be one of many strategies to build a stable subsistence base. We emphasize that manioc, unlike other cultigens, has several specific qualities that make it compatible with hunting and gathering. Because the annual consumption of manioc varies with the availability of wild roots, wild tubers appear to be the more valued food. The view that hunter-gatherers may adopt resources or strategies that enable them to retain reliance on wild foods rather than replace them is more consistent with the archaeological and ethnographic record (Early and Headland 1998; Piperno and Pearsall 1998; Tucker 2006). The combination of hunting and gathering and small-scale cultivation is widespread among many tropical foragers around the world, especially in South America. For example, the Hoti (Venezuela; Zent and Zent 2007) and the Nukak (Colombia; Politis 1996, 2007) are highly mobile foragers who also prepare small gardens. Nukak mobility often is structured by combined foraging with travel to garden locations. In some cases, cultigens have been recently adopted, but in other cases a mixed subsistence strategy is evident from the earliest ethnographic records. As well, the archaeological record contains abundant examples of small-scale cultigen use being incorporated into foraging economics well before a transition to committed agriculture. We have used the Pumé example to illustrate that decisions regarding whether or how to adopt cultigens is not based on

the greater economic (e.g., return rates) or nutritional value of horticulture. Rather, the Pumé and other ethnographic examples indicate that scheduling and labour complementarity of novel foods appear to be important factors in determining whether a new food will enter the diet. Further, getting through the lean wet season depends not only on complementary foods, but on a subsistence base that maintains residential practices that foster sharing obligations, bilateral kinship, and other social interactions promoting group cohesion.

7.7 Conclusion

Hunting and gathering has been a successful adaptation because it incorporates a broad diversity of strategies. The persistence of foragers into the twenty-first century is evidence of this flexibility. Hunter-gatherers today show astute awareness of changing opportunities and often develop ways to take advantage of novel resources, technologies or interactions with non-foraging neighbours.

In terms of the central question addressed in this book, what are the drivers of change in hunter-gatherer livelihoods, we make two points. First, the economic returns to foraging can provide equal or higher returns to the horticultural alternative. Second, the social cost of incorporating bitter manioc cultivation is negligible for the Pumé and other South American foragers. Rather than disrupting the system of exchange obligations, manioc folds an additional fallback resource into the traditional redistribution network. Additionally, the Savanna Pumé express a preference for living as small-scale foragers rather than in larger river communities. River Pumé recognize that their savanna hunting and gathering relatives have greater environmental knowledge, retain critical traditional medical practices, and hold more of the historical and ritual knowledge.

The Pumé case suggests two main reasons why some non-foraged foods are compatible with stable hunting and gathering economies. First, although wild foods often are characterized as being of lower value compared to cultigens, our analyses show that wild roots are nutritionally equivalent to manioc and have similar return rates. Because of these qualities, manioc is an unlikely candidate to replace Pumé reliance on wild plant foods. This may explain why other South American tropical hunter-gatherers also incorporate bitter manioc into their diet. Second, small-scale horticulture can extend the viability of a primarily hunting and gathering economy. Manioc is a predictable fallback food that smooths potential fluctuations in wild foods during a particularly food-limited season. The seasonal incorporation of manioc, however, does not signal a directional shift away from hunting and gathering toward greater reliance on food production. In a changing world, whether it be in the past or present, incorporation of novel resources has been a common aspect of strategies that allow foragers to continue their primary economic reliance on wild resources and autonomy as hunter-gatherers.

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Chapter 8
Sharing in a Context of Rural Development. A Study Among a Contemporary Hunter-Gatherer Society in Indonesia

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Abstract This chapter looks into the practice of sharing among a contemporary hunter-gatherer society, the Punan Tubu from North Kalimantan, Indonesia, to explore whether sharing changes with increasing participation in the market economy and national development programs. As the Punan Tubu are experiencing rapid social changes partially driven by government cash-transfer programs, our study offers a unique opportunity to examine how sharing varies along varying levels of involvement in such process. During 18 months of fieldwork in two villages, we recorded observations of giving (n = 543) and receiving (n = 544) amongst 118 adults. Our results suggest that sharing prevails among contemporary Punan Tubu. However, we found that there are variations in the products being shared. This variation seems to be related to the product's visibility and cultural meaning, and also to the way it was produced. Although sharing behaviour is not directly related to individual levels of integration in the market economy, nor to participation in national development programs, changes in practices of sharing may occur as market food products are shared differently from non-market products, including meat, wild edibles, and/or cultivated food.

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8.1 Introduction

Researchers have documented the uniqueness in the way in which humans share and the prevalence of sharing in small-scale societies (Hawkes et al. 2001; Jaeggi and Gurven 2013; Kaplan and Hill 1985). Sharing among humans is practiced beyond kin (Bliege Bird and Bird 1997; Hill 2002). Food sharing is considered to be one of the original forms of sharing among humans (Kameda et al. 2005) and is believed to be linked to the universal human tendency to cooperate (Hill 2002). From an evolutionary perspective, food sharing has been proposed as an adaptive mechanism that increases group fitness through the distribution of resources (Reyes-García et al. 2016), contributing to greater reproductive success by facilitating faster production and greater survival of group members (Jaeggi and Gurven 2013).

Many studies on sharing among contemporary hunter-gatherer societies have adopted an evolutionary perspective, aiming to elucidate why humans share or what are the evolutionary roots of sharing among humans (see Hawkes et al. 2001; Kaplan and Hill 1985). However, integration into the market economy and participation in national society are major factors affecting the ways of life of contemporary hunter-gatherers (Behrens 1992; Putsche 2000), and for which effects on sharing remain insufficiently studied. In this chapter, we study sharing among a contemporary hunter-gatherer society undergoing rapid socioeconomic changes.

Researchers have debated the effects that integration into the market economy and participation in national development may have on traditional or customary, well-established norms of sharing. The two processes are often interrelated, which contributes to magnify their impacts (Godoy et al. 2007). For example, the increase of governmental socio-economic development programs has accelerated integration into the market economy mostly by resettling and/or encouraging engagement in cash and wage labour (e.g., Odysseos 2011; Thornton 2001). Meanwhile, some researchers have found that market integration does not necessarily change sharing practices, as sharing often provides benefits that are not met through the market, such as the establishment of political alliances (Bliege Bird and Bird 1997) or showing off a personal quality that is favoured in the community (Gurven et al. 2001). Furthermore, it is suggested that even the increase of wealth will not diminish sharing practices, as wealthy households most probably become more likely to reciprocate to others with material help or in some context they might even be obliged to share more (Nolin 2012). Hence, some researchers have argued that the arrival of new market opportunities might not necessarily change sharing practices.

In contrast, some other researchers have argued that integration into the market economy destroys traditional forms of sharing and cooperation (Tucker 2004). Integration into the market economy creates income inequality, which in turn weakens traditional community customs, generates conflicts, makes exchanges difficult, and results in shifting towards self-interest rather than group-interest (Putsche 2000). For example, with more access to markets, the sharing of resources –such as of hunted game meat – has an increasing opportunity cost for the hunter and/or his household, as the time devoted to the procurement of wild meat competes with time-investment in income generating activities, such as cash cropping (Behrens 1992; Tucker 2004),

or with direct commercialization of wild meat (Tucker 2004). Furthermore, some scholars have found that as societies access the market economy and participate in national development, they also access new forms of socioeconomic organization (e.g., credit, insurance, warranty) that might help them buffer against possible environmental and economic shocks that hunter-gatherer societies have traditionally faced and overcome through sharing. Such new forms of economic organization could potentially undermine the practice of sharing (di Falco and Bulte 2011).

Despite the literature on the topic, the debate continues to be unresolved. Furthermore, the topic has recently gain renewed relevance, as many governments and international organizations are implementing development programs that involve the transfer of cash. For example, conditional or unconditional cash-transfer programs (e.g., Brazil '*Bolsa Familia*') aiming on reducing poverty (Das 2005). Similarly, the international community is developing mechanisms that encourage payment for environmental services to upstream stakeholders (e.g., REDD+) (Pham et al. 2014). Such influx of cash to local communities accelerates the process of integration into the market economy and into national societies with unknown effects on traditional forms of transfers, including sharing practices.

This chapter contributes to this debate by analyzing the practice of sharing amongst a contemporary hunter-gatherer group in Indonesia, the Punan Tubu. The goals of the study are (1) to provide a description of sharing among the Punan Tubu (i.e., what do they share, to whom do they share) and (2) to explore how those practices relate to individual levels of integration into the market economy and the national society. As the Punan Tubu are currently experiencing different levels of socioeconomic change driven by Indonesia's political emphasis for development in poor-and-remote areas (Government of Indonesia 2014), they represent an ideal case study for the aims of this research.

8.2 Indonesia's Rural Development

In 1997, with the downfall of Soeharto after more than 32 years of dictatorship, the national government in Indonesia underwent massive changes, including a shift of power from the central to local governments, i.e., to the regency level *(kabupaten)* or city level *(kota)*. The shift was mostly motivated by the unbalanced economic development between Java (the centre of governance) and all the other islands, many of them rich in natural resources yet economically less developed (Bebbington et al. 2006). With decentralization, regions abundant in natural resources received large fiscal budgets for which they also received greater economic decision-making power. Thus, during the last few decades, local governments have been experimenting on how to manage their acquired power, including decisions on local development.

This has been the case for Malinau, a regency in North Kalimantan established in 2012 as a result of the 1999 Decentralization Law. Covering an area of 42.620 km^2 of mostly tropical rainforest (GoI 2014), Malinau is home to 21 ethnic groups, including the Punan, the largest hunter-gatherer group in Borneo (Wollenberg et al.

2006). In 2012, the Malinau local government launched the *"Gerakan Desa Membangun"* or GERDEMA, a program committing to spend 100.000 USD per year for each village in Malinau aiming to empower villages to decide on their development pathway so they could independently decide the use of the cash transferred. With the introduction of GERDEMA, the government has also required the establishment of new administrative structures in each village, including the appointment of a head of village, a village legislative, and a head of village customary practices. These officers are in charge of implementing and supervising the execution of the programs and they receive an individual government salary for performing their jobs. Most villages are using the cash transfer to build permanent houses (with glass windows and tin roofs), and to purchase communal equipment (e.g., chainsaws) or agricultural inputs (e.g., herbicides). Overall, GERDEMA has resulted in many important changes for villages in the Malinau regency, including changes in settlement patterns of standardized housing, increased demand for wage labour (e.g., carpentry, builders), and frequency in travelling to town market for government meetings.

8.3 Case Study: The Punan Tubu and New Livelihood

We conducted research among the Punan Tubu, a group of Punan from the upper basin of the Tubu River, in the District of Malinau. Influenced by Indonesia's rural development policies, the Punan Tubu are today sedentized in permanent villages, some living in villages upstream along the Tubu River and others in a resettlement placed nearby the city of Malinau. Ethnographic accounts of the Punan describe them as an egalitarian society, without strong hierarchies (Sellato 1994; Kaskija 2002, 2012). They were also characterized by the lack of accumulation of wealth whether in cash or in material possession (Klimut and Puri 2007; Kaskija 2012).

Traditionally, the Punan lived in bands comprising several kin-related households in which resources were widely distributed, with sharing being an integral part of the their way of live (Kaskija 2002, 2012). Food was shared among all the members of the group or band, even when it was procured individually. The sharing of meat, an important component in the diet, is a well-established custom among the Punan. It is also important to notice that recent ethnographic work among the Punan has found that demands to share, a practice that has also been observed in other hunter-gatherer groups (Peterson 1993), are very common (Kaskija 2012; Koizumi et al. 2012).

At least for the past decade, the Punan Tubu have been observed to express interest in embracing the market economy and adopting the services from the Indonesian national state (Levang et al. 2007). Since 2005, the Punan Tubu have settled in permanent villages and, to a large degree, participate in national development programs. Nowadays, the Punan Tubu economic system rests on two main pillars. On the one hand, most Punan Tubu have adopted agriculture and largely rely on upland rain-fed rice and cassava cultivation, as well as on a range of vegetables and fruits which they grow in home gardens. On the other hand, they maintain a hunter-gatherer livelihood: they hunt and collect non-timber forest products (NTFP).

Across these livelihood strategies, there is relatively clear gender division of labour. The opening of cassava plots and the maintenance of rice fields is mostly done by women, who are also in charge of harvesting. Meanwhile, men are more involved in the collection and commercialization of NTFPs. Men are also the direct counterparts of government programs, whether through their work as village level officers with government salary or through wage-labour work, e.g., in house building, carpentry, or transportation.

Although most of the food that the Punan Tubu consume comes from their agricultural plots or from the forest, they are showing increasingly dependence on cash to buy food items such as coffee, sugar, and salt. Cash is also used to purchase other commercial goods highly valued locally, such as cigarettes, mobile phones and even televisions. In this context, cash income, either from the commercialization of forest products or from salaries and cash-transfer programs, is becoming a perceived need for Punan Tubu households.

8.4 Methods

We conducted fieldwork between March 2012 and July 2013. Methods of data collection included systematic observations on sharing and the measurement of individual levels of integration into the market economy and of participation in the national development through variables such as visit-to-town, school, wage, village to town distance.

Prior to the fieldwork, we obtained Free Prior and Informed Consent from each village and individual participating in the study, in which we guaranteed anonymity of the individuals and village. In addition, this research adheres to the Code of Ethics of the International Society of Ethnobiology.

8.4.1 Sampling

The sample consist of all adults (>16 years of age) living in two Punan villages and willing to participate in the study, for a total of 118 adults from which 55 (or 47 %) were women. Of the two villages, one is more populated (~154 individual) and slightly closer to the city of Malinau (i.e., 3 days canoe ride) than the other (population of ~107 individual; with distance of 3 days canoe ride and 1 day walking) (Fig. 8.1). Both villages participate in the GERDEMA program, with the same budget allocation (about 100.000 $US/year).

8.4.2 Methods of Data Collection

Individual Census At the beginning of the study we collected individual sociodemographic information of all the participants in the sample, including data on sex, age, education, and frequency of visits to the main town (Malinau).

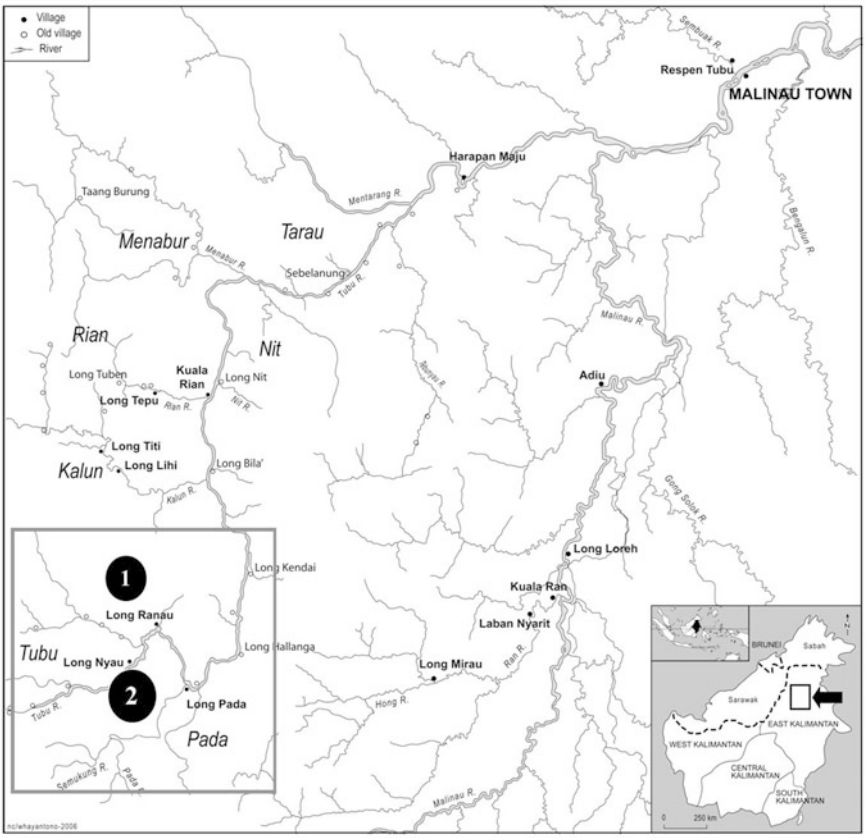

Fig. 8.1 Location of Study Villages (Adapted from Césard (2007))

Open-Ended Interviews and Participant Observation During the first months of fieldwork, we conducted open-ended interviews about sharing and about socio-economic development in the area, especially to inform the design of the quantitative data collection instruments. We also actively participated in daily activities including accompanying informants during harvesting and helping in processing agricultural products.

Sharing-Survey We collected self-reported data on sharing using a modified version of an anthropological technique called scan interviews (Reyes-García et al. 2009). Specifically, once every fortnight, on a day chosen at random, we visited each household and asked all adults present about all the goods given to (or received from) other people in the village during the previous 2 days. Informants were asked about the type and quantity of products they had given/received, as well as the name of the giver/receiver and its social relation to the informant (i.e., family, neighbour, or outsider).

We compiled the information on sharing into four different variables. The first two variables capture (1) all self-reported events of giving (n = 543), defined here as each recorded event of an individual giving a specific product to another individual (outside the household) and (2) all self-reported events of receiving (n = 544), similarly defined. The other two variables were constructed at the individual level (n = 118) to capture (3) the share of times an individual reported giving, defined as the number of giving events reported by the individual divided by the number of scan interviews in which the individual was observed and (4) the share of times the individual reported receiving, defined as above. Since each observation can include multiple giving/receiving events, the last two variables can be higher than 1.

Quarterly Wage-Survey We proxied individual levels of integration into the market economy with information on whether the individual had received wage or salary every quarter over the course of fieldwork. Specifically, we asked all adults in the sample *"in the last two weeks, have you received any wage or salary?"* and coded the answer as a yes (=1) or no (=0).

Village-Price Survey To estimate the monetary value of products being shared, we collected data on the products' village price. For tradable products, we asked informants to report the products' selling price. For non-tradable products, such as wild edibles collected for household consumption, we followed the methodology used by Wunder et al. (2011) and assigned the village price of a similar substitute product.

8.4.3 Methods of Data Analysis

We conducted descriptive, bivariate, and multivariate data analyses. All statistical analysis used STATA for Windows version 13.

Descriptive Analysis We coded items reportedly given (or received) into the following categories: (1) wild meat, (2) wild edibles other than meat, (3) cultivated food, (4) market food, and (5) non-food products. We also classified actors participating in sharing events by coding whether the person giving (or receiving) the product was (1) from the same nuclear family (parent, sibling or offspring) but different household, (2) from the same village but not the same nuclear family, or (3) from outside the village. We then computed descriptive statistics of each recorded sharing event, defined as each giving (or receiving) report of a specific good at a specific time involving people external to the household. Thus, the giving of two pieces of meat to two people from two separate households was computed as two different sharing events; similarly, the sharing of two products (i.e., meat and wild edibles) to the same person in a different household was also computed as two sharing events. We calculated the monetary equivalent of products shared based on the quantity of the product shared and the substitute market price of the product, accounting for the relative value to the purchasing power parity (in US $).

Bivariate Analysis To assess how integration into the market economy relates to sharing, we first calculated the relative sharing frequency at the individual level. We then used census data to generate five dummy variables. Our first variable (1) captured whether the person was a man (=1) or a woman (=0). The other four variables proxy for individual levels of integration into the market economy and national society as follows: (2) *visit-to-town* (binary variable that takes the value of 1 if the person had visited the market-town in the 12 months prior to the interview, and 0 otherwise), (3) *schooled* (binary variable that takes the value of 1 if the person had received any formal schooling, and 0 otherwise), (4) *wage* (binary variable that takes the value of 1 if the person had received any wage or salary within the past 12 months, and 0 otherwise), and (5) village *closer -to-town* (binary variable that takes the value of 1 if the person lives in the village close to the market town, and 0 otherwise). We used a two-sample (independent) t-test to assess potential variations in individual observations of sharing (giving and receiving) across the five selected variables.

Multivariate Analysis We used multivariate regression analysis to test the association between the five selected variables and individual measures of sharing. As most of the observations on sharing equal 0, we used a Tobit regression model. We tested for multicolinearity among the five different explanatory variables by doing a collinearity diagnostic with the Variation Inflation Function (VIF). As we obtained a VIF mean of 1.2 and none of the values were higher than 10, we discarded multicollinearity and included all variables in the analysis.

8.5 Results

During the course of the entire data collection period, we obtained a total of 1946 individual observations from the 118 participants in the study. About 70 % of the observations on sharing were 0 or meaning that the person did not share anything. From the total number of individual observations, 231 (11.8 %) involved the individual giving and 348 (17.8 %) receiving. Because our definition of a sharing event allows for multiple events in one interview, the total number of giving events amounts to 543 and the total number of receiving to 544 events. Over the period of study, 27 participants (23 %) did not report any giving event and 16 participants (14 %) did not report any receiving event.

8.5.1 Giving and Receiving Among Contemporary Punan Tubu

What Do the Punan Tubu Share? The large majority (about 92 %) of all giving events that we recorded relate to food, including wild meat, other wild edibles, cultivated food, and market-purchased food-products (Fig. 8.2). Most giving events correspond to the sharing of wild meat (45 %), a percentage that is even higher when

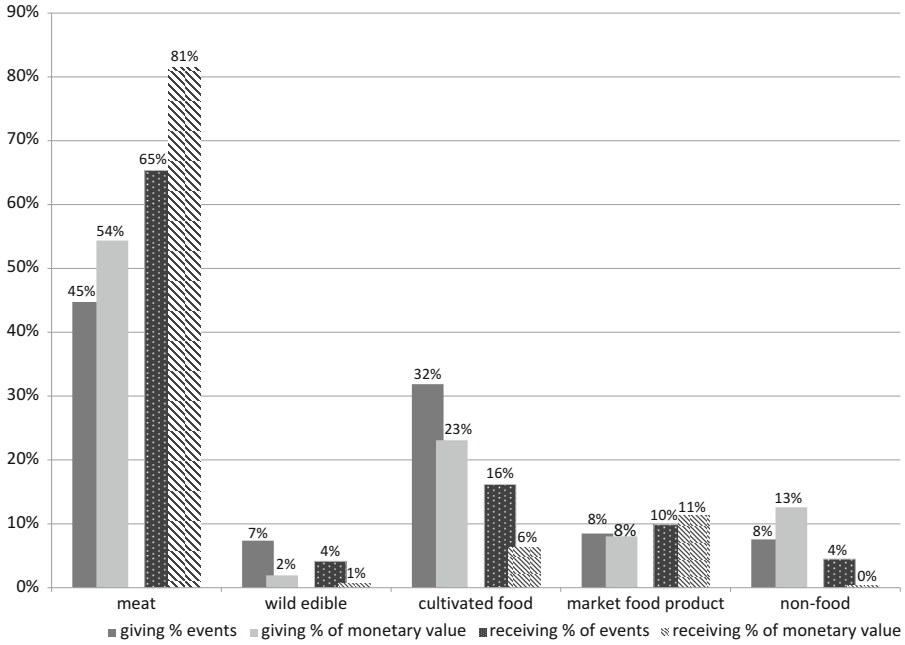

Fig. 8.2 Percentage (%) of sharing events (giving and receiving) and their monetary value, by category of products

accounting for the monetary value of products shared, as the value of the wild meat given represents 54 % of the monetary value of all goods given. Despite this clear prevalence of wild meat sharing, in the individual interviews some people complained that there is less meat sharing than in the past.

Cultivated foods, whether raw or processed, also accounted for an important share of giving events (32 % of all giving events and 23 % of the monetary value of goods given). The sharing of wild edibles other than meat, such as fruits and honey, has a much lower prevalence. Events involving wild edibles represent only 7 % of giving events, and only 2 % of the monetary value of goods reportedly given. Food products purchased from the market were also occasionally given to people outside the household, less than wild meat or crops, but more than other wild edibles: amounting to 8 % of the giving events and 8 % when accounting for the monetary value.

Finally, our data show that the Punan Tubu also share non-food products, including forest products such as firewood and rattan, and commercial non-food products such as cigarettes and clothes. Indeed, about 8 % of giving events reported relate to non-food products, representing 13 % of the value of all products given.

All in all, we recorded more receiving than giving events: overall informants reported to have received something from someone outside their household in 18 % of the scan interviews conducted (compared to 12 % having given). The distribution of receiving events across categories resembles the distribution of giving events.

Of the goods reportedly received, 96 % involved food items, most obtained from the forest, with wild meat being the most frequently received product both in terms of reports (65 %) and in monetary value (81 %). Only 4 % of the receiving events related to wild edibles, which represented only 1 % of the monetary value of all items received. Informants reported receiving cultivated food with a much lower frequency than they reported giving it (16 % vs. 32 %), with crops representing only 6 % of the monetary value of products received. The monetary value of market food products was about the same as the frequency of receiving market food (11 % vs. 10 %). Non-food items were reported in 4 % of receiving events, with an insignificant monetary value, because the items reported (e.g., firewood) had a low monetary value.

Overall, the largest differences between giving and receiving events were found for wild meat and crops. People reported more often receiving than giving wild meat (65 % vs. 45 %), whereas people reported more often giving than receiving crops (32 % vs. 16 %).

With Whom Do the Punan Tubu Share? The Punan Tubu shared products differently across the three categories of actors used for analysis: i.e., family, neighbours and outsiders (Fig. 8.3). Meat, other wild edibles, and cultivated foods were given more often to neighbours than to family members. The sharing of meat and wild edibles to outsiders were rarely reported. Market food items followed a different

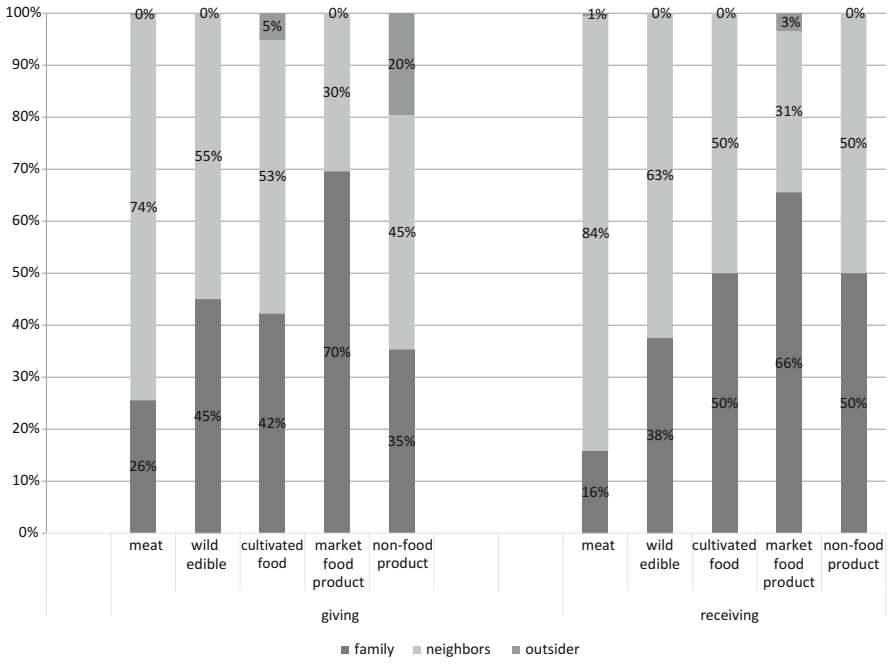

Fig. 8.3 Giving and receiving, by actor and category of products

pattern as they were mainly shared with the family (70 %), but rarely with neighbours (30 %), and never with outsiders. Finally, non-food items followed yet another distinct pattern, as they were given more or less evenly across the three categories of actors (35 % vs. 45 % vs. 20 %).

Most receiving events involved products given by neighbours (Fig. 8.3). Informants reported receiving wild meat (84 %) and wild edibles (63 %) mostly from neighbours. While informants reported receiving cultivated foods and non-food items to the same degree from family members as from neighbours (50 %), when it came to market-purchased foods, family was the main giver (66 %).

8.5.2 Bivariate Analysis: Correlates of Sharing Among the Punan Tubu

Across all shared products, the average share of times an individual reported giving was 0.37 (Standard Deviation/SD = 0.63), whereas the average share of times an individual reported receiving was 0.31 (SD = 0.31) (Table 8.1).

Women reported giving less frequently than men: while the share of giving events reported by women averaged 0.3, the share of giving events reported by men averaged 0.50 ($|t|(118) = 2.35$, $p = 0.02$). Furthermore, the SD was much larger among men, indicating that there was a larger variation in sharing patterns among men than among women (Table 8.2, column A). We also found that women and men gave products belonging to different categories (Fig. 8.4). Wild meat was more commonly given by men, whereas cultivated food was more commonly given by women. Food products purchased from the market were equally given by men and women, despite the fact that men are the ones commonly earning cash to buy market-food. Overall, non-food items were given more often by men. In contrast with previous results, the share of receiving was higher for women than for men in all categories of products (Fig. 8.4), although a t-test proved that the differences in the share of receiving by men and women are not statistically significant; ($|t|(118) = 0.90$, $p = 0.37$) (Table 8.2).

Out of the 118 people in our sample, 70 individuals (60 %) reported having travelled to the market town at least once over the past 12 months. Overall, we found that these 'more travelled' individuals also appear as having a larger share of giving and receiving than those who had not visited the town; ($|t|(118) = 3.12$, $p = 0.002$ for giving and $|t|(118) = 2.78$, $p = 0.006$ for receiving) (Table 8.2, column B).

Only about 30 % of the informants in the sample reported having attended school, with only 8 % having passed the elementary grade (1–6 grades) and less than 1 % having passed the standard 12-years of formal national schooling. We did not find any statistically significant difference in the share of giving or receiving events between these two groups (Table 8.2, column C).

A total of 44 informants (37 % of the sample) reported having received wages. Of those, 77 % were men working in government-related jobs, with only 4 % reporting having received earnings from non-government related work (e.g., the selling of

Table 8.1 Summary description of explanatory and outcome variables

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
Outcome variables*						
sh_give	Share of times the person gave any item	118	0.37	0.63	0	5
sh_givenmeat	Share of times the person gave meat	118	0.33	0.40	0	5
sh_givenwe	Share of times the person gave wild edibles	118	0.06	0.19	0	1
sh_givencult	Share of times the person gave cultivated food	118	0.26	0.37	0	1
sh_givenmod	Share of times the person gave market food	118	0.06	0.20	0	1
sh_givennon	Share of times the person gave non-food items	118	0.06	0.18	0	1
sh_rec	Share of times the person received any item	118	0.31	0.31	0	1.7
sh_recmeat	Share of times the person received meat	118	0.58	0.41	0	1
sh_recwe	Share of times the person received wild edibles	118	0.04	0.14	0	1
sh_reccult	Share of times the person received cultivated food	118	0.15	0.27	0	1
sh_recmod	Share of times the person received market food	118	0.09	0.22	0	1
sh_recnon	Share of times the person received non-food items	118	0.01	0.06	0	1
Explanatory variables						
male	Dummy variable that captures whether the person is male (=1) or female (=0)	118	0.53	0.50	0	1
visit-to-town	Dummy variable that captures whether the person has gone to the market town in the previous 12 month (=1) or not (=0)	118	0.59	0.49	0	1
schooled	Dummy variable that captures whether the person has gone to school (=1) or not (=0)	118	0.31	0.47	0	1
wage	Dummy variable for whether the person has received wage in any quarter (=1) or not (=0)	118	0.37	0.49	0	1
closer-to-town	Dummy variable for whether the person lives in the village closer to town (=1) or otherwise (=0)	118	0.58	0.50	0	1

*The outcome variables capture the share of times a person received a product

Table 8.2 T-test on share of giving and receiving events, by socio-economic attributes of informants

Correlates of Sharing										
	[A] Male		[B] Visit-to-town		[C] Schooled		[D] Wage		[E] Closer-to-town	
	Female	Male	No	Yes	No	Yes	No	Yes	Vid1	Vid2
n	55	63	48	70	81	37	74	44	68	50
Share of products given										
Mean	0.3	0.50	0.16	0.52	0.38	0.36	0.27	0.53	0.46	0.25
SD	0.24	0.82	0.19	0.78	0.74	0.47	0.38	0.90	0.78	0.33
t-test		2.36*		3.13**		0.14		2.17*		1.84
p-value		0.02		0.002		0.89		0.03		0.07
Share of products received										
Mean	0.34	0.28	0.21	0.37	0.31	0.30	0.33	0.27	0.42	0.16
SD	0.29	0.31	0.22	0.34	0.30	0.34	0.31	0.31	0.35	0.16
t-test		0.90		2.79**		0.27		0.86		4.74***
p-value		0.37		0.006		0.78		0.39		0.000

*, **, and *** statistically significant at 0.05, 0.01, and 0.001

NTFP). A t-test analysis examining differences in the share of giving events between adults who received wages and those who did not suggested that adults who receive a wage also report a higher share of giving than those who do not (0.53 vs. 0.27;|t|(118) = 2.17, p-value = 0.03). We did not find those differences when analysing data on receiving (Table 8.2, column D).

Finally, we did not find any statistically significant difference in the share of giving between people when comparing between the two studied villages. Meanwhile, we found that people in the village closer to the market town reported a higher share of receiving events than people in the more isolated village (0.46 vs. 0.25); |t|(118) = 4.74, p-value = 0.000) (Table 8.2, column E).

8.5.3 Multivariate Analysis of Potential Covariates of Sharing

Results from our multivariate analysis suggest that once we include the different covariates in the model, the only variable related in a statistically significant way to individual reports of giving is the one capturing the differences between those who have visited the town and those who have not (Table 8.3, Model 1). Specifically, if a person had visited the town during the last 12 months, the expected share of giving events was 0.408 higher than a person with the same characteristics but who had not visited the town (99 % confidence level). None of the other explanatory variables used in the analysis appeared to be associated in a statistically significant way to individual reports of giving.

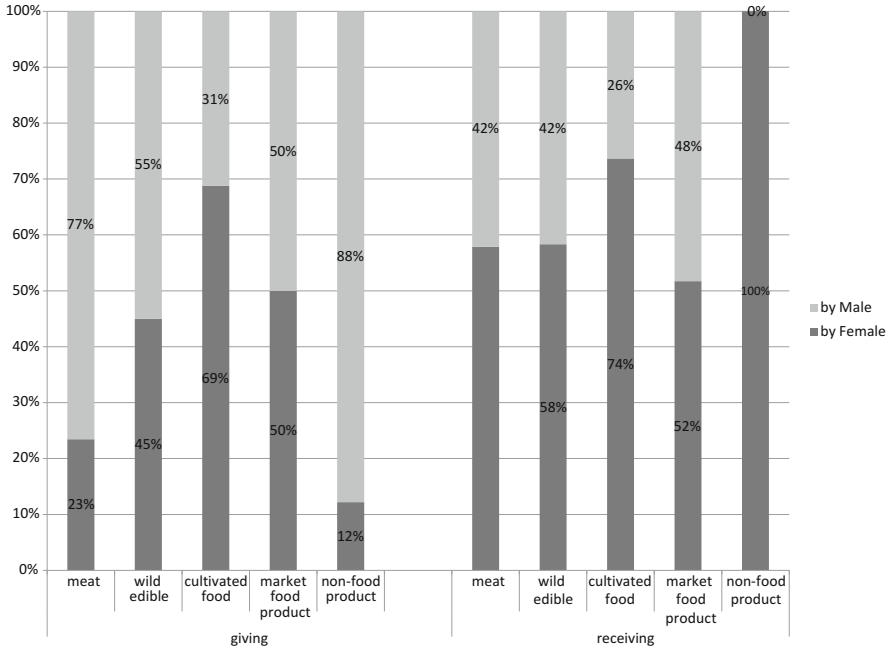

Fig. 8.4 Percentage of products given and received, by category of products and sex

We ran a set of similar models, but using the share of products given by categories of products as the dependent variable (Table 8.3, Model 2–6). None of the explanatory variables explored were consistently associated with all the categories of products. Rather, the significant explanatory factors varied from model to model. Specifically, the variable *visit-to-town* was positively associated to the share of giving market food products (Model 5) and non-food products (Model 6); the variable *schooled* was negatively associated with reports of giving wild meat (Model 2), and; the variable *male* was positively associated with giving wild meat (Model 2) and negatively associated with giving crops (Model 3).

Results from the multivariate analysis for individual reports of receiving suggest that, once we control for the different covariates, only *visit-to-town* and village *closer-to-town* were positively related to share of receiving (Table 8.4, Model 1). Specifically, if a person had visited the town during the last 12 months, her expected share of receiving events was 0.15 higher than a person with the same characteristics that had not visited the town. Similarly, for a person living in the village closer to town, the expected share of giving events was 0.22 higher than for a person with the same characteristics but living in the village further to town.

As for giving, we ran a set of similar models differentiating between the products received (Table 8.4, Models 8 to 12). Again, none of the variables analyzed were consistently associated with the share of receiving across all the product categories; rather, the significant associations varied across models. For instance, the variable

Table 8.3 Tobit analysis showing the association between individual values for the share of products given and explanatory variables, by type of product given

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
	sh_give	sh_ givenmeat	sh_ givenwe	sh_ givencult	sh_ givenmod	sh_givennon
male	0.18	0.38*	−0.17	−0.49	−0.08	0.2
	(0.15)	(0.15)	(0.22)	(0.15)	(0.25)	(0.22)
visit-to-town	0.41**	0.003	0.26	0.09	0.8*	0.79*
	(0.15)	(0.14)	(0.22)	(0.14)	(0.32)	(0.34)
schooled	−0.14	−0.34*	−0.34	−0.03	0.20	0.30
	(0.15)	(0.15)	(0.24)	(0.15)	(0.23)	(0.24)
wage	0.1	0.06	−0.12	−0.07	−0.06	0.03
	(0.16)	(0.16)	(0.23)	(0.16)	(0.25)	(0.21)
closer-to-town	0.17	0.2	−0.56*	0.08	−0.33	0.04
	(0.14)	(0.14)	(0.22)	(0.14)	(0.23)	−0.22
Constant	−0.18	−0.17	−0.36	0.15**	−1.17**	−1.64**
	(0.14)	(0.15)	(0.21)	(0.14)	(0.38)	(0.48)
N	118	118	118	118	118	118

Standard errors in parenthesis. For definition of variables see Table 8.1
*p<0.05, **p<0.01

Table 8.4 Tobit analysis showing the association between individual values for the share of products received and explanatory variables, by type of product

	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)	Model (12)$^{\Phi}$
	sh_rec	sh_recmeat	sh_recwe	sh_reccult	sh_recmod	sh_recnon
male	−0.08	0.02	−0.17	−0.27	−0.23	2.56
	0.06	(0.11)	(0.19)	(0.15)	(0.19)	
visit-to-town	0.15*	0.26*	−0.05	−0.29*	0.19	−0.14
	(0.06)	(0.11)	(0.17)	(0.14)	(0.18)	
schooled	−0.32	−0.19	0.35	−0.12	−0.02	−2.5
	(0.06)	(0.11)	(0.18)	(0.14)	(0.17)	
wage	−0.034	−0.06	0.15	0.08	0.21	0.33
	0.07	(0.11)	(0.19)	(0.16)	(0.19)	
closer-to-town	0.22***	0.15	−0.42*	−0.12	0.01	0.4
	0.06	(0.15)	(0.18)	(0.13)	(0.17)	
Constant	0.133*	0.33*	−0.48	0.16	−0.59**	−2.96
	0.06	(0.10)	(0.21)	(0.12)	(0.21)	
N	118	118	118	118	118	118

Standard errors in parenthesis. For definition of variables see Table 8.1
*p<0.05, **p<0.01, ***p<0.001
Model(12)$^{\Phi}$ does not converge, too many explanatory dummy variables that are equal to 1 when the outcome variable is 0

visit-to-town was positively associated with receiving wild meat (Model 8), but negatively associated with receiving crops (Model 10); and *male* was negatively associated with receiving market products (Model 11).

8.6 Discussion

In this study, we use information from self-reported sharing events (giving and receiving) to provide a quantitative description of sharing in a contemporary hunter-gatherer society. We point out three main findings from the study. First, our results suggest that sharing prevails among contemporary Punan Tubu. Second, despite the prevalence of sharing, we found variations between the different products being shared, with market-purchased food products shared in a different way than meat and other wild edibles and cultivated food products. And third, sharing behaviour among the Punan Tubu is not directly related to individual levels of integration into the market economy or to participation in national development. We discuss these three findings in more detail below.

8.6.1 The Importance of Sharing Among the Punan Tubu

The first important finding of this work is that sharing prevails among contemporary Punan Tubu. While not perhaps as commonly practiced as in other settings (e.g., Gurven et al. 2000), we observed at least one giving event in 11.8 % and one receiving event in 17.8 % of our observations. In terms of the numbers of individuals that reported either giving and/or receiving at least once over the course of 1 year, the average share of times an individual reported giving was 0.37 or the average share of receiving was 0.33, suggesting the continued importance of sharing in the studied population.

In addition to these findings, our ethnographic data suggest that there are other forms of sharing not captured by our methodology. For example, we observed the frequent sharing of some product such as soap or shampoo while bathing in the river; we also observed that the Punan Tubu engage in other types of non-food sharing, such as passing on clothes from one individual to another. Gift giving is also part of Punan social relations; for example with the birth of a child, family members from the newborn father's side give jewels or electronics to the family of the newborn mother, while family members from the newborn mother's side give a rattan mat or other rattan made craft to the family of the newborn father.

In our results, most sharing events relate to food and especially to wild meat, which the latter contributing to about half of all the sharing observations. The finding is not surprising, but rather in line with reports of food sharing, and specially wild meat sharing, among other hunter-gatherer societies (e.g., Hawkes et al. 2001;

Patton 2005). Meat is shared with the family and also neighbours. It is not a rare occasion that non-relatives ask for a share of meat. Neighbours may even wait for a hunter in his house – while he is out hunting – and already ask for a share of the expected meat; the practice is not considered shameful (Kaskija 2012). This practice of demand sharing suggests that the recipient are the instigator of sharing, such reliance on others for food procurement also signals the continued prevalence of sharing behaviour (Kaskija 2012; Koizumi et al. 2012).

Other food items, especially other wild edibles and cultivated foods, are also shared although to a lesser extent than wild meat. It is probable that the sharing of wild edibles was more prevalent in the past, when the Punan Tubu used to make sago –their traditional staple food- from wild palms (e.g., *Arenga-undulatifolia*, *Eugeissona-utilis*).

8.6.2 The Sharing of Different Products

The second important finding of this work is that, despite the prevalence of sharing, there are variations between the different products being shared. Most giving events correspond to the sharing of wild meat (45 %). Cultivated food (both raw and processed) also accounts for an important share of giving events (32 %), whereas market-purchased food items represent only 8 % of the giving events. Non-food market products are even less commonly shared.

Based on our ethnographic observations, we offer three plausible, non-excluding explanations for the differences in how different products are shared: (1) their visibility; (2) their cultural meaning, and (3) the way in which the item was procured. First, in a context in which demand sharing is prevalent, differences in the visibility of the product might result in differences in the way some products are shared. Scholars suggest that when food becomes available in public display, the social pressure to share it increases (Peterson 1993; Tucker 2004). During our work we observed that most of the wild meat shared was of medium- or large-sized animals (e.g., *Sus barbatus*, *Cervus unicolor*), hence clearly visible. Only on a few occasions did we witness the sharing of small animals such as rodents. We speculate that small animals are directly brought into the house and consumed without being noticed, while middle-to-large animal are harder to hide. Similarly, products most commonly brought from the market (such as sugar, coffee, instant noodles) are package goods that can be stored for longer time, but they can also be easily hidden. Products brought from the market can be partially (or even totally) hidden and both the amount to be shared and the pool of recipients can be more restrictive.

A second explanation of the different patterns found in the sharing of products relates to the different cultural meanings attached to different products. Scholars have suggested that, beyond the intrinsic value or purpose of products, the sharing of certain products provide individuals who share a higher status and prestige (Hawkes et al. 2001; Mccracken 1986). For example, scholars argue that meat shar-

ing signals the giver's value as a good hunter and as a good mate (Bliege Bird and Bird 1997; Franzen and Eaves 2007), or demonstrates the approval on behalf of the villagers, the latter favouring prosocial characteristics (Nolin 2012). Studies have found that particularly sharing meat is socially important (Hawkes et al. 2001). Hence, the question arises about how cultural meaning varies according to the sharing of different market and non-market products. We found that market-purchased food items were mainly shared with the family but rarely with neighbours. As market products arrived relatively late into the Punan Tubu consumption patterns, the rules about how and with whom to share might be less defined compared to local resources (like meat), which have been traditionally shared over multiple generations, thus allowing for more time for associated customs and norms to form (Bird-David 1990; Nolin 2012).

The third possible explanation for differences in the amount and type of sharing that takes place relates to the division of labour between men and women during the acquisition of the shared item. Previous works suggest that the items women share are commonly acquired, come in smaller sizes, have a relatively low risk of unsuccessful procurement, and are often associated with high processing costs. In contrast, men produce and share products that are rarely acquired, larger, have higher risk of pursuit failure, and are associated with lower processing costs (Bliege Bird and Bird 1997). Along the same line, our results suggest that men and women share according to what they procure or produce: men share wild meat and honey more often than women, while women share cultivated goods more often than men. However, the fact that households typically pool resources is a factor that needs to be considered when interpreting individual patterns of giving and receiving. This is particularly relevant when examining patterns of receiving events, where –overall– women receive more products than men: a finding that probably relates to the fact that households are the units of consumption among the Punan Tubu, and women in a household are in charge of food preparation.

8.6.3 Socio-Economic Covariates of Sharing

The third important finding from this work is that sharing behaviour among the Punan Tubu is not directly related to individual levels of integration into the market economy, nor to their participation in national development programs. Indeed, only the variable *visit-to-town* appeared to be statistically associated with more reports of sharing. Given the relative isolation of the studied villages, people who had visited the nearest town might be in a better position to give purchased market food and non-food products, incentivizing further gifts to such individual.

Overall, we find that integration into the market economy and participation in national development programs do not necessarily relate to different sharing behaviour among the Punan Tubu. Our proxies did not suffice to explain the extent of sharing among the Punan Tubu, possibly because the context in which sharing

occurs is not only about distributing one product from one person to another, but might be an expectation (or cultural obligation) that applies to everyone, regardless of their socioeconomic status. Nor does it exclude the giver's possible interest to hide what they have and thereby get away with not sharing (Koster 2011; Widlok 2013).

8.7 Conclusion

The main goal of this study was to explore how sharing relates to individual levels of integration into the market economy and participation in national development programes. We found that while sharing practices prevail, differences in sharing behaviour among individuals cannot be explained through individual level variation in integration into the market economy and participation in national development. However, our results do suggest that there are differences in the way products are shared, and particularly that market-purchased food products are shared differently from locally produced or sourced resources. This is important to note, for with the increasing level of engagement by the Punan Tubu in government work and other wage labour, they are also increasingly introduced to new products and consumption patterns, thereby likely to change the context and dynamics in which sharing occurs.

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Chapter 9
Hunter-Gatherers and Fishing Rights in Alaska and Siberia: Contemporary Governmentality, Subsistence, and Sustainable Enterprises

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Abstract This paper examines processes by which Alaskan and Siberian indigenous peoples have been rendered as political subjects, "traditional" hunters-gathers, and sustainable enterprise owners amid their respective colonial and post-colonial industrial economies. The comparison is instructive because, despite being part of diametrically opposed (Soviet *versus* USA) national political organizations, policies and the exercise of biopower towards indigenous peoples have proceeded along similar lines. In the post-colonial era, these lines have converged around neoliberal and social development policies which support indigenous "self-determination" through minimal subsistence rights and the creation of ethnic enterprises and partnerships with non-indigenous capitalist corporations. On both sides of the North Pacific, however, this transition has come about without formal recognition of the well-developed systems of aboriginal marine tenure and fishing rights, as has been the case in other indigenous-state Treaty regimes (e.g., Canada and New Zealand). The lack of such protections, we argue, has led to poor management of coastal zones as social-ecological systems, making sustainable indigenous livelihoods and small enterprises based on marine resources difficult to develop or maintain. We examine, in particular, the relationship of Sakhalin and Southeast Alaska indigenous hunter-fishers as strong, independent peoples whose salmon fishing rights were usurped and their corporate groups reorganized to fit notions of modern industrial and neoliberal social-economic organization. Further, we argue for more synergistic

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policies between indigenous subsistence and commercial economies to reduce 'black market' transactions and conserve valuable fishing knowledge, skills, and cultural practices which are vital to heritage, livelihoods, and wellbeing.

9.1 Introduction

The indigenous hunting, gathering, and fishing peoples of the North Pacific are among the most complex, diverse, resilient, and politically savvy in the world (Ames 2003). This is in no small part due to the rich salmon and other maritime resources they have come to rely upon, cultivate, defend, and exchange through various knowledge-belief-practice complexes (Berkes 2012) that can be loosely dubbed "subsistence economies," a term with various popular, indigenous, and legal-political meanings across the region (Wheeler and Thornton 2005). In the contemporary era, however, subsistence economies are recognised as existing in a world of commercial exchange, development, and need. Virtually all North Pacific hunter-gatherer communities have mixed, if not integrated, subsistence and cash economies today, and a plethora of rules and strategies—both formal and informal, traditional and modern—to regulate and coordinate them.

What is to be learned by comparing them? We suggest that looking at cultures dependent on similar keystone resources, such as salmon in the North Pacific (Colombi and Brooks 2012; Garibaldi and Turner 2004), but under different indigenous-state political-economic regimes can be useful in determining the best way to strike a sustainable balance between the increasingly centripetal commercial economies of the North Pacific, based on resource extraction for global markets, and the diverse, more centrifugal subsistence economies for cultural and physical sustainment. Such comparative case studies have heightened relevance where similar environmental and environmental change conditions, including climate change impacts on coastal systems, exist (Gilberthorpe and Hilson 2014; Nuttall et al. 2005).

This chapter, based on research carried out in conjunction with the Dynamics of Circumpolar Ethnicity and Land Use project (CLUE, 2008–2016), compares the development of aboriginal rights, land and resource use, and commercial fishing economies among complex hunting-gathering societies of Russia, Alaska, and Fennoscandia. Research among indigenous communities was carried out in all three regions, with the bulk of fieldwork concentrated in Russia, where data on sociocultural and environmental change were most urgently needed. Both authors conducted fieldwork on Sakhalin Island, including participant observation, surveys, interviews, and archival research, between 2009–13. Thornton has conducted similar research on subsistence economies and social-environmental change in Alaska since 1989. This comparative analysis focuses specifically on the evolution and nature of indigenous subsistence uses of Pacific salmon in relation to the larger commercial salmon fishing industry and industrial resource economy.

9.2 Background

9.2.1 The Problem

High aspirations for indigenous self-determination and development are evident on both sides of the North Pacific, including Alaska and Siberia. In Alaska, the indigenous peoples' discontent with land and resource dispossession lead to the formation of the first major multi-ethnic indigenous civil rights organization in the country, the Alaska Native Brotherhood (founded in 1912) and Sisterhood which helped win educational, political, and land rights for Tlingit, Haida, Tsimshian, Eyak, Alutiiq, Aleut, Athabascan, Yupiit, and Inupiat peoples (Metcalfe 2014). Similarly, in post-Soviet Russia, indigenous peoples have asserted their interest, beyond their status as ethnic minorities, to achieve opportunities to pursue sustainable economic livelihoods on their traditional lands. In the period that followed the collapse of the Soviet Union, the Russian government recognized indigenous minorities' right to self-determination. In 1993, the term "indigenous peoples" was adopted into the Russian Constitution. In the following years this term replaced all other terms previously utilized both in official and public discourses (Sokolovskiy 2008). The Russian Association of Peoples of the North (RAIPON), established in 1990, also changed its name by adding "indigenous" into the title. The most significant result of this political organization process was that indigenous peoples began to assert rights to self-determination, traditional territories, and cultural lifeways.

Yet failures of implementation and adaptive management of the commercial and subsistence economies have created tenure, resource, and livelihood insecurities in both systems, leading to non-compliance, protests, legal disputes, and indigenous mobilization for reform. Both regimes show evidence of "legal stagnation" and even retrograde centralization and standardization of economic priorities at the expense of diverse indigenous lifeways. Seemingly neutral terms, such as "mixed economy", ostensibly recognise the inextricable links between modern commercial and subsistence economies, but the legal regimes and institutions which support these relationships remain for the most part uncoordinated, ill-supportive, or otherwise ineffective in promoting a sustainable mutuality between subsistence and commercial activities. As a result, creative, informal, quasi-legal or extra-legal economies have emerged in both Alaska and Siberia, especially in the salmon fisheries, to maintain hunter-gatherer livelihoods where cash or employment is limited.

From a theoretical standpoint, the reasons for the "disconnect" between subsistence and commercial endeavours can best be understood in terms of political ecology and governmentality. Political ecology suggests that competition for resources in a given space or system of interest typically results in unequal allocation and impact according to the balance of power among the various constituents within that system (Robbins 2011). Michel Foucault's concept of governmentality—or environmentality as it is sometimes termed when married to political ecology (Agrawal 2005)—asserts that control over populations is partly achieved through the exercise of what he termed "biopower," or "the numerous and diverse techniques for achiev-

ing the subjugations of bodies and the control of populations" (Foucault 1978:140). The exercise of biopower is vital in structuring relations between the state and its populations in terms of ownership, access, and use of land, water, food, and other staples. In this framing, the entire construction of the subsistence economy vis-à-vis the commercial one can be seen as an exercise in biopower in order to define subsistence hunter-gatherers as environmental and political subjects within a state-governed economy. An intensive look at salmon fisheries among indigenous peoples of Sakhalin Island and Southern Alaska shows how these relations of identity, livelihood, and governmentality are being worked out at the local scale in both legal and extra-legal, even "anarchic" (Scott 2009), fashion.

9.2.2 The Development of Subsistence Economies in Alaska and Siberia

Alaska Native subsistence was largely self-regulated prior to the landmark Alaska Native Claims Settlement Act of 1971 (ANCSA). ANCSA, a combination of self-determination (enabling independent development) and termination (ending federal responsibility for Natives as dependent nations) legislation, spawned not reservations, as had been customary in the "Lower 48" US, but rather 13 regional and more than 200 village business corporations. Awarding Alaska Native title to more than 10 % of the state's lands, and compensation of about $3 an acre for lands taken ($965 million in total), ANCSA ostensibly provided indigenous peoples with the natural capital and institutional engines to drive their own economic development. The legislation also cleared legal obstacles for the building of a major pipeline through the state to carry oil from the North Slope to the ice-free port of Valdez in the Gulf of Alaska. To make way for the pipeline, Congress extinguished all aboriginal hunting and fishing rights as part of the settlement. These aboriginal rights had of course been largely ignored if not flouted for more than a century with the colonisation of Alaska, first by Russia and then by America (Haycox 2002), but resource competition in the remote and sparsely occupied territory had been limited, so many Alaska Natives had been able to participate in their so-called traditional subsistence economy, which at least since the late nineteenth century also had included significant cash inputs (Arnold 2009). Significantly, despite extinguishing all aboriginal hunting and fishing rights, ANCSA provided no compensation for marine waters or resources taken – a major blow to maritime Natives, especially those dependent on salmon, for which they were increasingly in competition with non-Native commercial fishing interests. In fact, fishing rights had been the major impetus for the original land claims movement (Mitchell 1997).

To compensate for the extinguishment of aboriginal rights and the usurpation of most lands and all waters, ANCSA directed the Secretary of Interior and the State of Alaska to "take any action necessary to protect the subsistence needs of the Natives" (PL 92–203). As a result, both the state and the federal governments passed

major legislation on subsistence activities. The federal subsistence law (Title VIII of the Alaska National Interest Lands Conservation Act, or ANILCA, PL 96–487), passed in 1980, recognized subsistence as "essential to Native physical economic, traditional and cultural existence" (Sec. 801), and mandated a *priority* for subsistence uses—customary and traditional uses "of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible by products of fish and wildlife resources taken for personal and family consumption, for barter, or sharing and for customary trade" (Sec. 803).

However, ANILCA allocated its subsistence priority to rural Alaskans rather than to Alaska Natives. This *rural preference* resulted from a political compromise to avoid creating special rights on the basis of race or ethnicity — something that powerful non-Native interests vigorously opposed. Some advocacy groups representing non-Native Alaskan urban hunters and fishers also viewed the rural preference as unfairly discriminatory and eventually succeeded in having it declared unconstitutional by the Alaska Supreme Court, hence putting the state out of compliance with the federal subsistence law. This set the stage for dual management, with the federal government taking over management of much of subsistence hunting and fishing, while the state retained authority over most commercial fisheries.

For salmon, state management of commercial fisheries means that both subsistence priority and rural preference are hard to realise. The problem is both a spatio-temporal and a political-ecological one. In space and time, it is impossible to give subsistence users genuine priority over salmon when most commercial fisheries take them at sea, before they reach their terminal spawning streams, where most customary and traditional subsistence salmon fishing takes place. If fisheries managers miscalculate returns and allocate too many fish to commercial fishers, subsistence users suffer, as their access and use are subordinated, and might be further reduced or curtailed to meet (highest priority) conservation goals (i.e., minimum escapement of salmon to spawn and sustain the fishery). From a political-ecological perspective, 95 % of fishing in Alaska is for commercial purposes (Fall 2012), and thus it is easy for subsistence uses and user groups to be overlooked or marginalised in management considerations, despite the fact that ANILCA calls for a subsistence users to have a "meaningful role" in management. In fact, Alaska's constitution mandates commercial development of fisheries and other natural resources "for maximum benefit of its people" (Article VIII, Sec. 1–2), according to "common use" (i.e., non-exclusion, Sec 3) and the "sustained yield principle subject to preferences among beneficial uses" (Sec. 4). While preference for "beneficial uses", in theory, can support a subsistence priority, "common use" undermines any attempt exclusion (e.g., of urban hunters under a rural preference) or privatisation of access rights. Without strong conservation management, such a policy of destroying communal property (as in the Tlingit and Haida tradition of territoriality over salmon streams) can lead to a tragedy of the commons (Hardin 1968), as was the case in the early 1970s, when open access to commercial fisheries abounded and salmon stocks declined, necessitating strong management restrictions to avoid collapse. Ironically, such a policy ultimately threatened the viability of commercial fishing livelihoods

themselves, and the fisheries had to be effectively re-enclosed under a "limited-entry" permit system to reduce competition for fish stocks (Langdon 1989; Thornton 2008). Although the limited-entry commercial fishing permit system was created to allow local fishers to gain permits on the basis of historical participation in salmon fisheries, it preceded contemporary subsistence laws, and thus was not designed with subsistence users or economies in mind. Most management effort and priority is directed toward maintenance of the commercial fisheries, and consequently the commercial and subsistence sectors have not integrated or complemented each other well in many Alaskan rural communities, as discussed in the next section.

Meanwhile, in the USSR, state policy took a radically different path toward indigenous economic development and self-determination than in Alaska, following Marxist principles of collectivisation and ownership of the means of production (see Vakhtin 1998). However, since the end of the Soviet era in 1989, similar dispossession and disconnect issues have emerged between commercial development and indigenous subsistence economies in Siberia (Pika 1999). Numerous conflicts surrounding Siberian land and natural resources use rights are largely rooted in the latest amendments to the Russian legislation that was developed after *perestroika*. The Presidential Decree № 397 "On urgent measures for protection of the places of residence and traditional economic activities of small-in-number indigenous peoples of the North, Siberian and the Far East" (as of April 22, 1992) defined the territories of traditional resource management as essential heritage of the indigenous peoples. According to this Decree, indigenous families and subsistence households (*obshchinas*)—indigenous kinship or neighbourhood-based non-commercial enterprises involved in traditional activities and having priority access to the territories of traditional nature use (104-FL, 2000)—were provided with life tenure or lease of reindeer pastures, fishing and hunting areas. However, the Decree did not specify whether "territories for traditional nature use" meant only subsistence use or that they could also be used for commercial development (Fondahl 1997). Another obstacle was that indigenous peoples needed the state to assert their sovereignty, whereas the official bodies still paternalistically considered them as incapable of making decisions on their own (Slezkine 1994: 383–385). This uncertainty to some extent reinforced an indigenous movement toward self-recognition. In Sakhalin, prominent intellectuals like Vladimir Sangi (Nivkh) started to promote the idea of "ancestral territories" or ethnic reservations under the motto "back to the origins".

In 1991, the Department for Indigenous Peoples' Affairs of the Sakhalin Region's Administration set up an advisory committee on social and economic development of Sakhalin Natives which supported the establishment of *obshchinas* and other indigenous enterprises, including commercial ones (e.g., "Aborigen" in Poronaysk). As a result, by 1992 more than 40 % of the working-age population was involved in traditional activities, and the number of *obshchinas* increased by 2.5 times (SHASR, f. 1198, l. 1, c. 188, p. 54). In 1996, the Sakhalin government passed the "Provisional regulations on the territories of traditional nature use of the Sakhalin indigenous peoples and the provisional regulations on *obshchinas*, clan-based and family enterprises of the indigenous peoples of the Sakhalin Region," confirming the right of indigenous members to carry out traditional hunting-gathering activities in the

allocated areas. However, private corporations and enterprises, including oil and fishing companies, considered indigenous activities as potential barriers to their rapidly developing businesses, and worked actively to undermine the new legislation (Grant 1996; see also Fondahl 1998; Funk and Zenko 2008; Ziker 2002).

The current period of indigenous rights development in both Alaska and Russia may be regarded as one of legal stagnation, at best, with respect to implementation of indigenous protections, and, at worst, as one of regression toward disenfranchisement and dispossession. In Alaska this period started in the late 1970s with the stagnation around how to solve the problem of subsistence rights between ANCSA and ANILCA, and has regressed with the erosion of Native subsistence rights to a rural subsistence preference for consumptive uses of natural resources (marine mammals being an exception) and the political-ecological and spatio-temporal subordination and circumscription of subsistence fishing economies to commercial ones. In Russia, the most significant changes occurred in the 2000s and coincided with the promotion by official bodies and media of the idea of a unitary state. Despite the fact that ethnic federalism inherited from the Soviet times recognizes the rights of ethnic groups on their officially designated territories, the past decade has shown a clear shift from the ideology of multi-ethnic federal state to the civic nation with the dominance of Russian culture and language. In fact this policy focuses more on the state rather than on the nation and may be considered a form of 'statist nationalism' (Rutland 2010).

This policy has undermined indigenous minorities in several ways. First, it has resulted in the abolishment of a few former indigenous autonomies created in the 1930s. Some amendments to the current legislation have restricted access of indigenous groups to their traditional territories, including fishing grounds. Thus, the federal law "On general principles of the organization of *obshchinas* of Indigenous Peoples of the North, Siberia, and the Far East" (FL-104), adopted in 2000, facilitated the withdrawal of the lands from civil circulation. Although the federal law "On the territories of traditional land use of the Indigenous Peoples of the North" (FL-49) states that the territories having the status of protected areas may be transferred to indigenous individuals and their communities free of charge, it came into contradiction with the Land Code of the Russian Federation (FL-136), adopted in the same year (2001), where the respective provision was absent (Murashko 2006). In Sakhalin, these legislative changes, along with indigenous residents' concerns about the worsening ecological situation on the island, led to a series of protests against an the oil company, Sakhalin Energy, which resulted in the establishment of the Indigenous Minorities Development Plan (SIMDP) (Roon 2006). Most importantly, in 2007, the government completely excluded the life tenure right of indigenous peoples from the law on "the territories." According to the new legislation, indigenous members had to re-register their *obshchinas* to maintain access to their territories, but many of them were not aware of the newly introduced changes. As a result, they lost their fishing grounds, a situation that led to conflicts and numerous trial proceedings between the indigenous members and the representatives of the official bodies, fishing and oil companies (see Donahoe 2014; Mamontova 2015;

Wilson 2002). Finally, the past several years have witnessed unprecedented cases of discrimination and oppression against indigenous leaders and NGOs, including RAIPON, which the state attempted to close down in 2012.

9.2.3 Biopower, Boundaries, and Linkages Between Subsistence and Commercial Fisheries

In both the Alaskan and Siberian regimes, state supported commercialization of natural resources is achieved through the subordination and circumscription of the subsistence economy. This is essentially a two-stage process involving what Povinelli (2002) terms "the cunning of recognition." First, the state draws sympathetic attention and recognition to cultural differences, such as between the subsistence economy of Natives and other consumptive uses (commercial and recreational fishing, for example). Then, the state delimits the nature and extent of those differences such that the diversity is not threatening to its overall state-building project. In this case biopower facilitates this process by defining preferences (or not) among wild resource "users," be they indigenous minorities (Siberia) or rural residents (Alaska), and a weak consumption priority for "subsistence uses." There is particular effort in delimiting subsistence uses in relation to the more dominant commercial economic interests by asserting what is "reasonable" (i.e., minimal) in terms of allocation. For salmon in different regions of Siberia, this limit may vary from 30 to 350 kg per person annually for indigenous subsistence fishing (potentially more for *obshchinas*). This is similar to the range of Alaskan rural community per capita harvests, although in many cases there are no quotas or limits (Fall 2012). In Siberia the size of the subsistence quota is normally lower for urban residents (Gerkey 2011: 80), but in Sakhalin there is no difference between urban and rural indigenous fishermen in terms of the their rights as most of the townships and the city of Yuzhno-Sakhalinsk are recognized as places of traditional residence and economic activities of indigenous peoples (Government Order N 631-p as of May 8, 2009).

Since both hunter-gatherer economies involve exchange or trade, the boundaries between subsistence and commercial transactions can be fuzzy. To prevent subsistence from becoming a "stealth" commercial activity (not legible, accountable, taxed, etc.), biopower through laws and regulation may be imposed to enforce a boundary between what is a subsistence activity and a commercial one. In Alaska, the relevant subsistence terms for legal exchange are defined in regulations:

- **Barter**: "the exchange or trade of fish or game, or their parts, taken for subsidence uses (A) for other fish or game or their parts; or (B) for other food or for nonedible items other than money if the exchange is of a *limited non-commercial nature*" (AS 16.05.940(2), emphasis added).
- "**Customary trade**: "*limited non-commercial exchange*, for minimal amounts of cash, as restricted by the appropriate board, of fish or game resources" (AS 16.05.940(8), emphasis added).

As these relational definitions suggest, commercial exchange cannot be easily divorced from subsistence exchange, at least by simple quantitative thresholds, like number of units, weight, or price. Instead, it is up to the state's biopower apparatus—its enforcement and judicial arms— to define the threshold at which an exchange of "limited non-commercial [i.e., subsistence] nature" becomes "commercial exchange" [i.e., not subsistence]. Thus far, this has been rather tricky business and few precedents have emerged. A case brought against Haida herring egg sellers (938 F.2d 942 (9th Cir. 1991)) for attempting to sell thousands of pounds of herring eggs on kelp to international buyers was not successfully prosecuted, the court ruling that the quantities of eggs harvested were not clearly beyond those authorized under ANILCA's broad definitions of customary trade, including for cash (Schroeder and Kookesh 1990; Victor-Howe 1992:70). While this seemed at first to be a victory for subsistence users, the case resulted ultimately in the promulgation of new State of Alaska regulations to limit the customary trade of fish in Southeast Alaska exclusively to herring eggs. Thus, under the state's biopower regime, anyone seeking to sell fish other than herring eggs for cash is subject to prosecution. These regulations are often ignored, however.

On the basis of political ecology theory, one would hypothesize that more specific state restrictions on subsistence would arise around resources of high value, like herring roe and salmon, for which subsistence and commercial interests might compete directly, and further that the biopower exercised through these rules would favour the more powerful commercial interests. Such is the case with Alaskan fish harvests, 98 % of which are taken by commercial fishing interests. Only 1.1 % of fish are caught for "subsistence uses" (the other 1 % going to recreational or other users; Fall 2012). Subsistence fisherman thus must beware of rule 5 AAC 01.010(d) of Alaska Fish and Game regulations, which states that "It is unlawful to buy or sell subsistence-taken fish, their parts, or their eggs, except that it is lawful to buy or sell a handicraft made out of the skin or nonedible by-products of fish taken for personal or family consumption." Moreover, "customary trade" of fish is limited to whole or unprocessed fish, and exchange of processed fish, such as smoked or jarred salmon, for cash is governed by commercial food safety regulations administered by a separate bureaucracy (The Alaska Department of Environmental Conservation).

In Russia, the federal law "On fisheries and conservation of aquatic biological resources" (FL-166 as of December 20, 2004) states that indigenous peoples are allowed to fish for personal consumption without any "special fishing area" and without permission. However, the salmon fishery is largely regulated by additional rules to serve commercial interests, which harvest, on average, more than 100,000 tons of salmon every year. As of January 2015, 435 commercial enterprises were involved in the extraction of marine resources in Sakhalin. At the same time, the number of registered indigenous fishing *obshchinas* and enterprises remains scarce, currently about 70. Among them, commercial indigenous enterprises constitute 25 %. According to the Russian legislation, *obshchinas* may engage with economic activities, including the salmon fishery, in accordance with the quota system. The size of the quota is defined for each region by the Federal Fisheries Agency and local self-government (Government Decree N 768 as of December 15, 2005).

The subsistence quota may be received by any person who is recognized as indigenous. The quota varies from one community to another but it was strictly 100 kg of dog and humpback salmon per person annually. This amount was established by the Federal Fisheries Agency as early as in 1987 and has been increased to 300 kg only in 2015. *Obshchinas* are allowed to sell the "products of labour" (e.g., souvenirs made out of fish skin) and to sign short-term contracts with state bodies for the provision of services. For example, a school can make an agreement with an *obshchina* for the supply of fresh fish. Otherwise, their access to commercial markets is almost completely restricted.

Commercial fishing in both Alaska and Siberia is regulated by the state according to space (region, management area), time (season), take (harvest quotas, limits), access (limited-entry), technology (vessel, gear type), and resource (type of fish). Participation in commercial fishing (as in some subsistence fisheries) requires a permit. Unlike subsistence permits and rights, commercial permits for fisheries may be permanently transferred. In Alaska the transferrable limited-entry permit system, established in 1973 and implemented in most salmon fisheries by 1974, is designed to promote conservation and security of tenure and livelihood for commercial fisheries in the wake of failures of open access regimes. Transfers may occur by gift, inheritance, or sale, with prices set by the marketplace. The program is viewed as a success by the state but the individualized transferability of permits has often meant that lower income families, including rural Natives dependent on subsistence and commercial fishing but vulnerable to the financial stress, are constrained to sell their permits to cope with debt. Within the first five years of the program, some 30 % of the limited entry permits were transferred from rural communities to outsiders, with severe impacts on the culture and economy of Native communities in particular (Langdon 1980). Transferrable fishing skills (i.e., harvest and processing techniques), technologies (e.g., boats and gear), and catches (i.e., commercial fish retained for subsistence use) were attenuated with the loss of commercial fishing access, along with the organizational units of production, which for Southeast Alaska Tlingits and Haidas constituted a critical basis for modern occupational identity (e.g., boat captains and crews).

Similarly, in Sakhalin the main problem in the post-Soviet period has been the lack of indigenous access to commercial fishing quotas to sell their fish harvests legally. Meeting the technical, financial and bureaucratic criteria is almost impossible for people mainly involved in traditional economy and with no other sources of financial support. Even in the city of Poronaysk, where most indigenous enterprises are licensed, commercial households are able to produce only raw materials—caviar and frozen fish—as they cannot compete with the huge state and private fishing enterprises working in proximity to their *stans* (fishing camps). Considering the high level of unemployment among the indigenous population, which constitutes in some districts 70 % (Social Indicators 2012), selling fish and caviar on the "black market" has become an expedient custom to earn much needed cash for many Sakhalin Natives. And, as in Alaska, the Russian authorities have shown a willingness to prosecute subsistence fishers who engage in "black market"

transactions deemed to be of a commercial nature so as to maintain the state's preferred boundaries in the increasingly mixing subsistence and commercial economies.

9.3 The Mixed Economy in Practice

So far we have seen that in Siberia and Alaska subsistence and commercial fishing economies are mixed, if not integrated, but that the state actively enforces boundaries between the two economies through its biopower and creation of subsistence and commercial subjects and natures. The resultant effect is to circumscribe and limit subsistence in order to protect commercial interests and development from being undermined by too much subsistence "infiltration" into the commercial fishing economy. Ostensibly, subsistence is protected but only to a minimal level, which may not match peoples' real livelihood needs, customs, or traditions. Given the existing historical-legal frameworks for subsistence and ethnic enterprise in these two economies, how do their mixed economies work in practice? Before attempting to answer this, we first turn to a more in depth analysis and comparison of the relationship between the subsistence and commercial fishing among the Nivkh of Sakhalin and Native Tlingits, Haidas of the Gulf of Alaska.

Table 9.1 compares subsistence harvest patterns among two contemporary indigenous Siberian communities on Sakhalin Island, collected as part of the CLUE project, with three Alaska Native communities in the Gulf of Alaska, based on Alaska Department of Fish and Game, Division of Subsistence data (ADF&G 2015). Table 9.1 shows a high reliance on subsistence resources in all communities, ranging from 182 to 531 lbs per person annually in wild food harvests. These figures might be contrasted with the typical urban Alaskan figures of about 20 lbs per capita (Fall 2012). At the same time, we see significant diversity in harvests of different species across various categories, including salmon and non-salmon fish, marine invertebrates and marine mammals, and terrestrial plants and animals. Most important in both regions, however, are cultural keystone species of salmon, especially chum (*Oncorhynchus keta*) and pink (*O. gorbuscha*) salmon among the Siberian Nivkh, and sockeye (*O. nerka*) and king salmon (*O. tshawytscha*) among the Alaska Native groups. Both data sets also show a high degree of participation in these salmon fisheries and high rates of sharing (giving and receiving) among households. The Alaska subsistence data, for example, show that in Angoon, a Tlingit village in Southeast Alaska, 98 % of households use subsistence fish, wildlife, and plant resources, 92 % of households harvest them, and 84 % and 94 % of households give and receive these resources, respectively.

In Sakhalin all surveyed households are involved in harvesting. The figures are high for fishing (salmon, smelt fish, navaga) and gathering (different kinds of berries and mushrooms). On the Pomr' Bay (Nekrasovka) the contribution of salmon is approximately 17 % of the total harvest weight. In comparison, non-salmon fish constitute 40 %. For Nogliki, proportions of salmon and non-salmon harvests

Table 9.1 Subsistence patterns in selected Sakhalin Siberian and Alaska native communities

Nekrasovka, Siberia population 802, 88 % native (Nivkh) in 2013, based on household (HH) survey						
Resource	**% HH using**	**% HH harvesting**	**% HH giving**	**% HH receiving**	**Total harvest (lbs)**	**Commerce links**
All resources	100	100	95	70	35266.5 lbs (346 per cap; 1763 HH)	
All salmon	100	90	90	50	6578 lbs (64 per cap; 329 HH)	287 lbs (4.6 %) reported as traded
Dog (Chum) salmon	100	85	80	50	3803 lbs (37 per cap; 190 HH)	287 lbs (8 %) reported as traded
Humpback (Pink) salmon	100	75	70	40	2800 lbs (27 per cap; 140 HH)	—
Other salmon	20	25	15	5	20 lbs (0.2 per cap; 1 HH)	—
Other resources	75	70	80	60	28688.5 lbs (284 per cap; 1434 HH)*	106 lbs (36 %) of the total caviar harvest reported as traded
*** Among them: non-salmon fish – 50 % (14272 lbs), caviar – 1 % (295 lbs), marine mammals – 8 % (2352 lbs), vegetation – 40 % (11545 lbs), birds and eggs – 1 % (224.5 lbs)**						
Nogliki, Siberia population 10109, 8 % Native (Nivkh) in 2013, based on household (HH) survey						
All resources	100	100	31	62	42480 lbs (1465 per cap; 2832 HH)	
All salmon	93	73	25	31	18426 lbs (635 per cap; 1228 HH)	5864 lbs (32 %) reported as traded
Dog (Chum) salmon	93	73	25	31	8333 lbs (287 per cap; 555 HH)	1786 lbs (21 %)

(continued)

Table 9.1 (continued)

Nekrasovka, Siberia population 802, 88 % native (Nivkh) in 2013, based on household (HH) survey						
Humpback (Pink) salmon	53	40	19	12	9446 lbs (326 per cap; 630 HH)	4079 lbs (43 %)
Other salmon	20	20	19	12	646 lbs (22 per cap; 43 HH)	0
Other resources	68	57.5	31	56	24054 lbs (829.5 per cap; 1604HH)*	3765 lbs (16 %) reported as traded: caviar 2222 lbs (59 %) or 67 % of the total caviar harvest, non-salmon – 1543 lbs (41 %) or 9.4 % of the total non-salmon harvest
***Among them: non-salmon fish – 68 % (16453 lbs), caviar – 14 % (3329 lbs), marine mammals – 10 % (2375 lbs), vegetation – 7.5 % (1812 lbs), birds and eggs – 0.5 % (3 lbs)**						
Angoon, Alaska population 342, 76 % native (Tlingit) in 2012						
All resources	98	92	84	94	62416 lbs (182 per cap; 511 HH)	
All salmon	92	65	47	76	12709 lbs (37 lbs per cap, 104 HH)	No retention from commercial fishing reported
Sockeye (Red) salmon	75	37	35	53	4262 lbs (12.4 per cap, 35 HH)	—
King (Chinook) salmon	76	35	27	51	3288 lbs (10 per cap, 27 HH)	—
Other salmon	40	30	15	20	5156 lbs	
Other resources	61	42	33	47	49707 lbs*	
***Among them: non-salmon fish – 36 % (18251 lbs), land mammals – 35 % (17452 lbs), marine mammals – 6 % (1808 lbs), marine invertebrates – 15 % (7671 lbs), vegetation – 9 % (4404 lbs), birds and eggs – 0.4 % (121 lbs.)**						

(continued)

Table 9.1 (continued)

Nekrasovka, Siberia population 802, 88 % native (Nivkh) in 2013, based on household (HH) survey						
Hydaburg, Alaska population 332, 77 % native (Haida) in 2012						
All resources	100	98	90	98	176310 lbs (531 per cap; 1482 HH)	
All salmon	100	73	71	90	71235 lbs (214 per cap, 599 HH)	No retention from commercial fishing reported
Sockeye (Red) salmon	98	63	65	63	45259 lbs (12 per cap, 35 HH)	—
King (Chinook) salmon	88	46	46	67	6541 lbs (20 per cap, 55 HH)	—
Other salmon	35	25	20	17	19435 lbs	
Other resources	67	50	49	57	82465 lbs*	
***Among them: non-salmon fish – 47 % (44197 lbs), marine invertebrates – 29 % (27630 lbs), land mammals –24 % (22610 lbs) , marine mammals –2 % (1666 lbs), vegetation – 9 % (8835 lbs), birds and eggs – 0.2 % (137 lbs)**						
Ouzinkie, Kodiak Island, Alaska population 173, 94 % native (Alutiiq) in 1986						
All resources	94	91	47	79	78973 lbs (405 per cap, 1274 HH)	
All salmon	85 (CF 40?)	74 (35)	32 (14)	53 (?)	37749 lbs (193 per cap, 609 HH)	30 % of subsistence salmon retained from commercial catches
Sockeye (Red) salmon	84 (35?)	65 (29)	27 (12)	47 (?)	11437 lbs (59 per cap, 184 HH)	Significant percentages derived from commercial catches
Coho (Silver) salmon	79 (37?)	68 (27)	27 (9)	41 (?)	17242 lbs (88 per cap, 277 HH)	Significant percentages derived from commercial catches

(continued)

Table 9.1 (continued)

Nekrasovka, Siberia population 802, 88 % native (Nivkh) in 2013, based on household (HH) survey						
Other salmon	52 (15)	45 (28)	15 (9)	23 (?)	9070 lbs	
Other resources	78	62	30	43	41224 lbs*	
***Among them: non-salmon fish – 32.5 % (13429 lbs), marine and land mammals – 47 % (19509 lbs), vegetation – 2.3 % 935 lbs, marine invertebrates – 14 % (5643 lbs), birds and eggs – 4.2 % (1708 lbs)**						

are 43 % and 39 % correspondingly. However, it is hard to estimate the share of salmon harvest within the total households' harvest as the official quantitative data is incomplete and unreliable. On the basis of our observations and interviews with the communities' members, it seems obvious that the existing harvest recording system significantly underestimates actual harvests. The poor reporting is evident even in our results: people usually do catch more than they report.

Alaska figures are similarly high for use (92 %) and receiving of salmon (76 %) but considerably lower for harvesting (65 %) and giving (47 %). Hydaburg, a Haida community in southern Southeast Alaska, displays significantly higher per capita salmon harvests (214 lbs versus 37 lbs in Angoon) and higher rates of harvesting (73 %), giving (71 %), and receiving (90 %). Ouzinkie, an Alutiiq community on Kodiak Island, shows similarly high per capita harvest (193 lbs per capita) and high household harvest participation (85 %) for salmon, but with significantly lower rates of giving (32 %) and receiving (53 %).

In the Nivkh communities, the figures are high for both using (100 % and 93 %) and harvesting (90 % and 73 %). In Nekrasovka, per capita salmon harvest constitutes only 64 lbs. For Nogliki it is almost ten times higher (635 lbs). The rate of giving in this community is 31 % for salmon (25 % of HH) and 20 % for non-salmon fish. Although the survey does not determine the rate of receiving, based on our observations we suggest that this percent would be rather high in both Nivkh communities (31 % and 50 % of the households in Nogliki and Nekrasovka correspondingly received at least some salmon fish in 2009).

Giving and receiving may include sharing, barter or customary trade (for cash, despite its illegality for most fisheries), however the precise nature of these exchanges is not legible in most Alaska subsistence surveys. Yet ethnographic reports document that customary trade and barter in these communities has long involved salmon and salmon products (e.g., Emmons and de Laguna 1991; Hancock 2002; Messhtyb 2009; Sasaki 1998; Smolyak 1975; Suttles and Sturtevant 1990). Trade was carried out both to mitigate localized shortages or scarcity and to acquire goods locally not available or accessible. Significantly, dried or smoked salmon products remain among the most popular and valuable customary trade products in exchange networks in Alaska. Recent research on the role of cash in subsistence economies (Wolfe 2015) suggests that "customary trade" transactions involving

cash are generally localized within indigenous cultural regions and their urban hubs, involve relatively small amounts of subsistence foods (e.g., less than 50 lbs per transaction) for modest monetary sums (e.g., less $200) and exist predominately outside of kin-networks. Within kin-networks, cash may be given to producers, but it is done as part of the production unit. For example, an uncle with a wage job may provide his nephew with "gas money" to fuel a subsistence fishing excursion, or vice-versa. Cash in this case is considered an element of the household production function (Langdon 2015b).

Among the indigenous groups of Sakhalin and Amur, salmon has been exchanged for centuries (Roon 2010). According to Smolyak, the Nivkh living on the both sides of the Tatar Strait were well adopted to money-commodity relations flourishing in the Amur area in the second part of the nineteenth century. Trade was a prevalent occupation there due to the influx of Russian merchants involved in the Russian-American Company (Smolyak 1975: 174–175). On the Lower Amur, in the 1920s only 4 % of the Nivkh did not sell at least some fish products, which indicates their high rate of participation in the market economy (Messhtyb 2009: 35). Salmon has often even functioned as a kind of currency. For example, Sakhalin indigenous residents pay in fish for their harvest delivery (the cost of petrol). Some unemployed residents exchange fish (salmon and smelt) for products.

Going the other way—converting commercially caught fish into subsistence food—is not so problematic, legally. In theory, one can retain as many fish from a commercial catch as one wishes for subsistence uses, provided they are not reconverted into commodities by being sold for cash in transactions of a commercial nature (such as to a restaurant or other business). Retention of commercial fish for subsistence is an important characteristic of Ouzinkie households, many of whom still hold permits in commercial salmon fisheries. In harvest survey year 1986, this community reported nearly a third (30 %) of its total subsistence salmon catch (7548 salmon) was retained from commercial fishing (Fall and Walker 1993:71; see also Table 9.1). In contrast, in Angoon and Hydaburg, by 2012 there were few commercial salmon fishing permits left, and the contribution commercial salmon fishing removals for the subsistence economy is estimated at zero (Table 9.1).

The decline of commercial salmon fishing in Alaska Native communities is thus a source of great concern. Angoon is an exceptionally severe example with the loss of 168 out of 183 local commercial fishing permits since 1983, a situation that has had many deleterious knock-on effects including loss of revenue, businesses, jobs, and tradition knowledge and skills (Van Vactor 2015). Yet this was not always the case. In the early twentieth century, many canneries, for example at Sitkoh Bay in Angoon territory (Thornton et al. 1990), worked with local Tlingits to provide jobs in exchange for access to fishing grounds. Tlingit men could apply to captain one of the cannery boats, select a crew (often based on traditional social organizational lines) and fish the season for a share of the boat's profits. Women and men also had employment opportunities at the canneries themselves. These jobs provided meaningful local employment based on traditional skills, livelihoods, and territories. Eventually, Tlingit families began to use the financial capital they earned to build their own boats, thus earning a larger share of the profits and greater self-

determination over their participation in the fisheries (Betts and Wolfe 1992; see also Smolyak 1975:160 about similar processes among Amur Nivkh). This adaptation also proved useful in maintaining a balance between commercial and subsistence fishing and other foraging activities, such that families could pursue both, often using the same gear (e.g., boats, trolling rods or nets) but at different times and locations (often traditional sites). At the same time, commercial fishers could choose to move a portion of their commercial catch (perhaps less marketable salmon) into subsistence, as discussed above. But increasing competition, especially from the proliferation of boats (prior to limited entry) and fish traps (operated by the canneries until outlawed with Alaska statehood in 1959) made this arrangement increasingly untenable, as salmon stocks declined precipitously in the 1950s, devastating both the subsistence and commercial economies, and leading to the exclusive limited-entry permit system.

The loss of commercial fishing permits, including all salmon seining permits, has affected the Angoon subsistence economy in a number of ways. First, it has made access to distant fisheries, like Sitkoh Bay, which lies more than 15 miles away across open water, more difficult due to high fuel costs for subsistence-only harvests, or the lack of suitable seaworthy boats, such as those used for commercial fishing. Second, it means that the opportunity, flexibility, and efficiency of removing subsistence fish from commercial catches is no longer an option. These losses, in turn, make residents more dependent on more accessible localized subsistence resources to meet their needs, leading to increased competition (including from commercial capture at sea of salmon destined for terminal stream subsistence fisheries) and vulnerability to fluctuations or failures in fish returns. These effects are compounded by the political-ecological priority of commercial fisheries management areas and interests over subsistence ones (see Thornton 2015a:370–372).

Finally, the loss of access to commercial fisheries affects the phenomenon of the super-household (Wolfe et al. 2009) in Alaskan subsistence economies. A super-household is one that exhibits high levels of subsistence harvests, but which shares or exchanges these resources to a wide network of households both inside and outside the community. Research among hunting-gathering communities in Alaska suggests a 30–70 rule, whereby the high third (30+%) of households (super-households) produce 70+% of the resources, but distribute them widely (as reflected in the giving and receiving statistics in Table 9.1). This pattern is remarkably consistent, despite wide variation in community and household harvest profiles. In rural Native communities with commercial salmon permits, the permit holders are typically members of these super-households, producing for both the subsistence and commercial economy, because they possess the knowledge, skills, labour organization, technology, and financial assets to harvest larger amounts of fish. Yet, more Native households in rural Alaska now lack commercial fishing permits as a result of alienation of permits under the limited entry system imposed by in the 1970s. The loss of commercial fishing households effectively reduces the resilience and productivity of these units as super-households for salmon production, in turn rendering more vulnerable the networks that rely on them. Angoon is illustrative of this process, though super-households still exist.

The main problem for Sakhalin natives is to gain legitimate access to commercial fishing. The loss of fishing grounds is a significant part of the local discourse over indigenous rights (Wilson 2002). Nivkh do not feel well protected as any company may stake its business in their traditional territories. This situation has worsened over the past decade. According to the abolished regional law "On Fishery and fishing activities in the Sakhalin Region" (1999), the right of Sakhalin indigenous peoples was guaranteed on the priority use of aquatic biological resources in the areas of their traditional residence and economic activities (Article 25). They also enjoyed the right of choosing fishing areas out of the tender system and had the exclusive right of harvesting certain species of aquatic biological resources. But in 2007, new amendments made to the federal law "On fisheries…" (FL-166), eliminated any priority for indigenous peoples over commercial enterprises in terms of access to fishing areas. This has led to a competitive system for marine resources, with the best areas being dominated by the state and private commercial enterprises, typically at the expense of subsistence users. This process is not dissimilar to the Alaska case of de-territorializing indigenous fisheries in favour of common access, only to re-enclose the commercial fisheries under a limited entry system (in this case quotas, awarded via market bidding) to exploit salmon fisheries. Indigenous Sakhalin Islanders do not have the means to bid for commercial concessions. In desperate response to the lack of access to legal commercial fishing or other wage livelihoods, many indigenous households simply catch more fish than the subsistence quota allows and sell the fish to the local commercial enterprises.

Harvest survey data among the Nivkh fishing households reveals the existence of a super-household phenomenon similar to that among Alaska Natives. The transferable subsistence quota system makes it possible for a few household leaders to legally accumulate a high percentage of the salmon harvest (68 % in Nogliki) and other resources to distribute them among the community's members (44 % of their own salmon catches or 31 % of the total salmon harvest is given away; see Table 9.1). As these households have no commercial permits, they have to combine subsistence fishing, distribution, and informal market practices. It seems that this system, although semi-legal and risky, is so far beneficial to both sides—the super-household leaders and the quota holders. Based on our field data, we conclude that the locals prefer supporting the household leaders involved in illegal fishing rather than directly dealing with outsiders and state enterprises. Yet, relationships are not constant. Unfair fish distribution and "greediness", for example when someone only sells the harvest without sharing a portion of it, serve as the main causes of conflict among super-households and the quota holders who support them. Legally, however, the amount of salmon caught must not exceed the limit that is determined by the number of received subsistence quotas. For this reason, all households which are responsible for distribution collect transferable fishing permits from the households and individuals who are no longer fishing and to whom they are supposed to bring the fish. Every fisherman has his or her own list of quota holders. In some cases these recipients may be "shared" between the super-household leaders (Mamontova 2012). The fishermen are allowed neither to retain the catch nor to overfish. In reality, however, the heads of such households give away only half of

the harvest and retain the rest of the fish in order to sell it on the black market along with any "illegal" catch.

The retention of salmon is possible because not all quota holders need their catches. For example, some *obshchinas*, involved in souvenir production, get fish bones and skin in exchange for their subsistence quotas. But usually, in the spirit of reciprocity, people expect some money in return. This strategy allows more indigenous members to engage flexibly in commercial activities without a permit; yet the activities are technically illegal and outside the system for harvest assessment (5864 lbs or 32 % of salmon were sold in Nogliki in 2009), and thus not accounted for in fisheries management. Effectively the system works only as long as all members support each other and no one abuses the opportunities for small scale "trade for cash" of "surplus" common pool fish. Hence, a sense of reciprocity and trust between all participants is highly important (Ostrom and Walker 2003). The same is true for subsistence sharing and proxy fishing (of subsistence salmon permits, where extant) in rural Alaska.

9.4 Discussion

A healthy relationship between subsistence and commercial economies is vital to modern indigenous fishing communities in the North Pacific. State laws and regulatory biopower have attempted to separate the two economies in terms of their "nature" and subject participants so as to minimize infiltration of subsistence livelihoods into the commercial economy and to provide minimums or reasonable opportunities for subsistence. In practice, however, the interpenetration of the two economies is vital and significant. Subsistence livelihoods today need cash to support them, and in indigenous villages a significant infusion of cash and other assets has come from commercial fishing employment. Meanwhile, commercial fisheries, when fished beyond sustainable yield, can have deleterious impacts on subsistence. This is particularly the case when salmon are commercially fished and intercepted prior to subsistence harvests, and actual returns at key subsistence salmon streams may be less than estimated when setting commercial harvest guidelines.

Our examination of the legal historical context and actual development of these mixed commercial-subsistence economies in the Alaska and Siberian Native salmon fisheries sheds some light on how these two economics can become mutually supportive to enhance community wellbeing and sustainable livelihoods. As Fig. 9.1 shows (at right), complete separation of the cash and subsistence economies can produce a profound disconnect, such that there is little articulation between the two economies in terms of shared participation or assets. In such circumstances, the more politically and economically powerful fishery—in this case the commercial salmon fishery—tends to rule and receive disproportionate support and advantage in management regimes. Moving fish from the subsistence economy to markets, even in small amounts through customary trade, may be deemed illegal, or severely restricted, as in both Alaska and Siberia cases. This can effectively outlaw tradi-

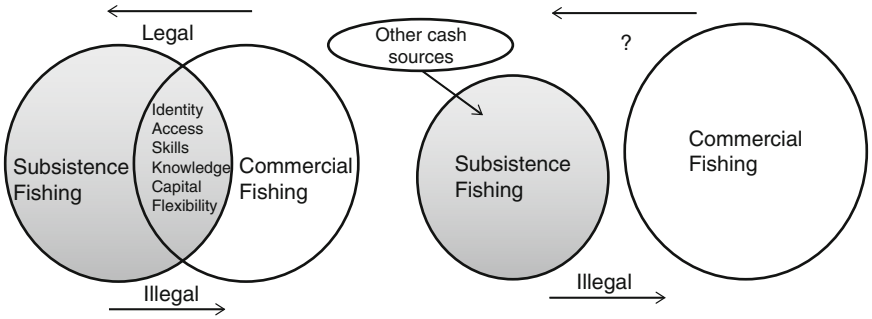

Fig. 9.1 Alternative relationships between subsistence and commercial fishing economies

tional forms of exchange, leaving poor and jobless subsistence fishers with little choice but to obtain cash through other sources, including black market activities. Meanwhile, legitimate indigenous enterprises, such as the Russian *obshchinas* or Alaska Native corporations, receive no priority in commercial fishing rights and find their enterprise opportunities severely limited, not only by regulation but by competition from wealthier (typically outside, non-indigenous) interests bidding for limited fishing permits or concessions.

An alternative and mutually supportive middle ground of interaction between commercial and subsistence economies is depicted at the left in Fig. 9.1. Here indigenous households' participation in commercial salmon fisheries supports subsistence through a strategic intersection within which are maintained the key knowledge, skills, capital (social, physical, human, cultural, and financial) and flexibility to move assets, especially commercially caught fish, from the commercial economy to the subsistence economy. Commercial fishing households also support the super-household phenomenon in subsistence communities, where 30% of households specialize in harvesting a disproportionately high amount (>70%) and variety of resources within a community, and distribute these subsistence goods widely through kinship and other networks. Super-households specialize because they possess the critical assets to do so efficiently and consistently, whereas other households may lack these capacities, at least at points in their developmental cycle (Wolfe et al. 2009). The strategic intersection or positive infiltration between the two economies increases resilience by sustaining livelihood capital through synergy, thus reducing vulnerabilities posed by disconnect and subordination of subsistence in relation to commercial fishing. However the mutually supportive intersection can collapse if the household mode of production, based on kincentric and communal production and distribution networks, breaks down. This may happen under financial stress, as in the Sakhalin case where lack of wage income sometimes leads to black market commercialisation of the subsistence fishing sector, which in turn may erode reciprocity and trust if the cash or other benefits accrued by "poachers" are not shared like subsistence fish. However, even among the Sakhalin Nivkh, as in Alaska, "customary trade" for cash tends to be self-limiting, as such trade is primar-

ily about maintaining basic livelihoods under a household mode of production, rather than converting to a commercial enterprise model (cf. Wolfe 2015).

The political-ecological conflicts in Russia and Alaska are evident in the current legal stagnation and undermining of indigenous subsistence and commercial fishing economies. Fortunately, there are exceptions. Some indigenous communities in Alaska have managed to maintain high participation rates and supportive interactions between subsistence and commercial economies over generations. Such fisheries, typically small, set net operations where gear is anchored from shore. They also tend to involve low capitalization and maintenance costs (nets may be used for commercial or subsistence fishing), and thus provide relatively easy entry for participants with limited finances who would be unable to purchase expensive equipment or vessels. In the Alutiiq community of Tyonek, for example, Holen (2013:9) found that commercial salmon fishing permit holders "are giving permits to their children when they come of age and are capable of taking over the family fishery." Langdon (2015a) found a similar pattern in Yakutat, a Tlingit community in Southeast Alaska, where the Situk River system, a hugely productive multi-species species salmon stream accessible from the town's road system, provides ample opportunities for set net commercial and subsistence fishing. Thus scores of Native households are able to hold commercial permits and fish from the same set net camps in both fisheries (subsistence being held on "off days" for commercial fishing). In this way, fishing knowledge, skills, and capital are retained from generation to generation.

In the more heavily capitalized fisheries, such as salmon seining, the loss of permits is difficult to halt, much less to reverse. Social enterprise programmes funded by Alaska Native corporations to buy back commercial permits on the open market and repatriate them to local shareholders have not met with widespread success (Thornton 2015b). Some Native corporations, such as Sealaska, have also sought to buy into seafood processing as a way to maintain jobs and a local fishing industry, reminiscent of Native efforts to secure fishing reservations and canneries in the mid twentieth century (Betts and Wolfe 1992). An alternative, community based approach, known as the Western Alaska Community Development Quota (CDQ) Program, has arguably been more successful, at least in maintaining benefit flows within rural fishing communities, if not traditional skills. In this scheme, communities receive a permanent (i.e., non-transferrable) revenue portion of the total allowable catch for certain industrial fisheries carried out in the Bering Sea region (see Langdon 2008).

Our results suggest that the key to success in managing conflicts between emerging mixed commercial-subsistence fishing economies in hunter-gatherer societies is to improve and legitimise indigenous household and community enterprise participation in both the commercial and subsistence fishing sectors. By exploiting the symbiosis between them, the two economies can remain mutually supportive and appropriately integrated so as to sustain livelihoods and key cultural values. Constructive examples of mutually supportive integration exist in places like Yakutat and Tyonek (e.g., Holen 2013, 2015), Alaska, which are worthy of emula-

tion and further policy support. Without such support, rural indigenous salmon fishing economies will continue to be at risk, and local moral economies may show continued resistance to state biopower and its attempts to ring-fence subsistence from the cash economy. Twenty-first century hunting and gathering will continue to thrive only with a legitimate and symbiotic role for money within traditional household and communal modes of production, distribution, and exchange.

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Part IV
Globalization and Cultural Change

Chapter 10
Indigenous Networks and Evangelical Frontiers: Problems with Governance and Ethics in Cases of 'Voluntary Isolation' in Contemporary Amazonia

Marc Brightman and Vanessa Grotti

Abstract The periodic emergence of indigenous peoples living in voluntary isolation in Amazonia have given rise to sensational media reports and heated academic debate. In this chapter we describe briefly the historical and contemporary relations between indigenous peoples in and out of isolation in the Guiana Shield region of North-eastern South America and discuss the role of indigenous missionaries in histories of contact. After considering these facts in relation to some of the general debates about isolated peoples and policy, we assess the ethical dimensions of the question of emergence from isolation.

10.1 Introduction: Hunter-Gatherers, Governance and History

In many countries it is far from taken for granted that the rights and responsibilities of citizenship apply also to hunter-gatherers, who tend at best to be wards of the state. The ways in which states (together with various para-state actors such as non-governmental and intergovernmental organisations) define and carry out their responsibilities towards their citizens are important aspects of governance. Yet although states often deny indigenous peoples in general, and hunter-gatherers in particular, full recognition as citizens, this has not exempted such peoples from

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being the object of governmental interventions in the name of their protection or improvement (Li 2007). James Scott (2009) has argued that such peoples actively choose to live beyond the reach of the state and that the remote geographical areas in which they dwell lend themselves to the practice of this 'art of not being governed'. Scott's thesis ranges widely across Southeast Asia and deeply through historical time. We shall take a similar albeit more modest approach to the peoples of Amazonia, who were described by Clastres (2011) as 'societies against the state' in the classic essay that inspired Scott's study. Confining our argument to a part of this region, we shall also focus on a single set of phenomena: the dynamics of voluntary isolation and emergence and the associated interventions of state and civil society actors. We refer to the discourses surrounding these interventions as discourses of governance, that is, as discourses expressing modes of governing, for, although they employ humanitarian language, they are grounded in assumptions of paternalistic responsibility and knowledge-power relations.

Indigenous peoples' marginal relationship with citizenship can be understood in light of their widespread treatment as 'outside history', since historical narratives have tended to be dominated by the perspective of states. The 'historical turn' that took place in anthropology from the early 1980s onwards, marked with the publication of seminal texts such as Eric Wolf's *Europe and the People without History* (1982) and Johannes Fabian's *Time and the Other* (1983), ensured that indigenous peoples could no longer be understood as 'lacking' history or as existing outside it. Much of the most interesting subsequent work in lowland South American ethnology focused on debates about indigenous historicity and the question of what historical change looked like from an Amerindian perspective (Fausto and Heckenberger 2007; Hill 1988; Santos-Granero and Hill 2002; Whitehead 2003). Hunter-gatherers are, nonetheless, still often discussed as 'survivals' of humans' evolutionary past, if not necessarily wholly representative of prehistoric societies then at least giving clues to some aspects of them. However, already in his contribution to the *Man the Hunter* volume of 1968, Donald Lathrap noted that one could hardly take such a view when considering the remaining Amazonian hunter-gatherers, who live in the relatively marginal environments in the zones between the *várzea* floodplains. There was already strong evidence that the ancestors of most if not all such populations had, in the near or more distant past, left the rich alluvial soils of the *várzea*, fleeing the disease and violence brought by other Amerindian groups or by the European conquerors (Lathrap 1968). Lathrap's view has since been supported by further archaeological research (*e.g.,* Heckenberger 2009; Roosevelt 1994). Nevertheless, recognition of Amerindian peoples as subjects with historical agency, fully involved participants in historical processes remains restricted to narrow academic circles. Lowland South American native peoples, particularly those who live a nomadic lifestyle, are still widely considered as living outside of time and modernity.

In this chapter we discuss the question of Amerindian communities who are presented as 'isolated', or as living in 'voluntary isolation' in Lowland South America. Such peoples are often hunter-gatherers, in the narrower sense of foraging peoples who have no domesticated plants or animals except for dogs (Lee and Daly 1999: 3). But the majority are swidden horticulturalists for whom hunting, fishing and gathering are nevertheless also culturally and economically central activities to

an equal if not greater extent than horticulture (*cf.* Lathrap 1968: 25; Rival 1999: 78–9). Native Amazonian populations who now live in 'voluntary isolation' are generally understood as communities which, at a certain time in their history, have made the conscious decision to break existing bonds with neighbouring groups and to retreat to deeper recesses of the rainforest, away from large rivers, to live in temporary villages which can be abandoned every few days. High mobility and autonomy can come to support one another, as peoples in voluntary isolation move through a living environment using paths which carry seasonal and ritual significance, and are suffused with anthropogenic biodiversity (Jara 1996; Politis 1996; Rival 2002). It is extremely difficult to attach numbers to a population which is by definition invisible and indeed surveys of nomadic peoples tend to be inappropriately designed and inaccurate (Randall 2015). Estimates of the number of isolated groups range from around 50 for the whole of Amazonia (Walker and Hill 2015) to 97 registered entries of such groups with the General Coordination of Isolated and Recently Contacted Indians (CGIIRC) in Brazil alone (FUNAI 2015; see also Corry 2015).[1]

The existence of people living in 'voluntary isolation' represents one of the last exotic frontiers of the Western imagination, and sightings of such peoples trigger worldwide media attention (AP 2013; BBC 2012; The Guardian 2015; The Telegraph 2015). It also poses a challenge to normative ethical guidelines and human rights principles. Humanitarian discourses, both secular and faith-based, stress empathy and suffering, but the hopes and desires of isolated peoples remain a matter of guesswork. A number of different sets of actors with differing opinions vie for the privilege of speaking on their behalf, but who, if anyone, is the most legitimate representative to voice their perspectives? This question is especially challenging given that, as the remainder of this chapter will illustrate, their situations vary greatly from case to case.

10.2 Voluntary Isolation: Sensation and Debate

It is clear from the periodic mainstream reports of encounters between peoples described as 'isolated' and other neighbouring indigenous groups, extractive industry workers or state agencies, that their isolation is far from absolute or permanent, and that they are affected by various forms of global change in profound ways. For example, The Mashco-Piro's periodic appearances in recent years in Peru have been the subject of particularly fervent international media attention, (*e.g.,* AP 2013; BBC 2012; The Guardian 2015; The Telegraph 2015). One reason for the high level of media coverage was the high quality of the images that were circulated, as the BBC coverage points out. Much recent debate on isolated peoples has centred upon the question of whether or not it is desirable for authorities to orchestrate controlled

[1] For an overview of the issues surrounding isolated peoples in lowland South America from a human rights perspective, see http://www.iwgia.org/culture-and-identity/isolated-indigenous-peoples.

contact, ostensibly for the benefit of the peoples concerned (Walker and Hill 2015), or whether it is preferable to leave them alone and to protect their territory from outside influences (Bodley 2015; Corry 2015; Feather 2015; Plotkin 2015; Torres 2015). In these debates, morality in general and humanitarian reason in particular are invoked to justify either precipitating contact or preserving isolation. The peoples in question are often portrayed as physically and mentally fragile. Discussions tend to focus on specific cases and their sensational nature often eclipses broader political contexts, longer term historical change, or the dynamics of regional economic systems. This tendency is more marked in the case of arguments in favour of precipitating contact. Blame for the tragic outcomes to which contact situations have tended to lead (including illness, physical violence and death) tends to be quickly dealt out, without always giving due consideration to the underlying causes of such occurrences. It is indeed difficult to separate proximate from ultimate causes. Multiple factors are involved, including the continued expansion of extractive industries (both informal and formal) and infrastructure developments with an impact that reaches into all parts of Amazonia, as well as clandestine activities, particularly gold prospecting and drug smuggling (Pringle 2015). An exhaustive and detailed comparison of cases in their full variety would require an entire book, but to illustrate the complexity of the issues at stake, let us take one example. Laura Rival discusses the controversy surrounding the massacre of indigenous people who were in voluntary isolation and under state protection by a group of Huaorani men, which took place on March 30th, 2013. She writes,

> Seven of these Huaorani men…are in custody awaiting trial for genocide, which is a concept they neither knew nor even now understand. Those who campaign for the arrest and incarceration of these men are still debating against those who argue that indigenous people cannot be thrown in jail, especially the Huaorani, who are [themselves] indigenous citizens of 'recent contact', hence with limited knowledge of national norms and laws… Some actors…stress that the recent killings were not caused by logging or other extractive economic activities, but, instead, by timeless cultural framings of blood revenge, which will not be put to rest without religious or legal intervention and further integration…[others emphasise] how Huaorani communities have adapted to the specifics of economic development in the Ecuadorian Amazon and, most especially, to the apparently unlimited material wealth of oil companies…the intent of these actors has been to point to the genuine, yet incomplete, transformation that 'being of recent contact' represents…[they argue that] far from having remained authentic hunters and warriors, they have instead become lawless terrorists who must be brought under control and held accountable for their actions (Rival 2015: 276–7).

This case illustrates how the interplay of isolated and non-isolated indigenous peoples, or those more or less 'recently contacted', with the materiality of 'development' is enlisted in the discourses of different actors with specific agendas for control and 'improvement'.

Another important factor influencing the dynamics of emergence and isolation is the complexity and contradictory pressures of governance. For example, those familiar with indigenous and environmental politics in the Brazilian Amazon are well aware that the national foundation for indigenous peoples (FUNAI) suffers from chronic underfunding and is under sustained political attack from the

agricultural lobby, the '*ruralistas*'. This constitutes part of a long history of confrontation between those who would support the rights of indigenous peoples to maintain their livelihoods and those who support the development of Brazil's interior through large scale agriculture. FUNAI has become weakened to the extent that it now struggles to cope with the range of threats to native Amazonians, whether isolated or not (Globo 2015; Pringle 2015); neighbouring countries like Peru suffer from a similar lack of resources (Lawler 2015: 1075).

Stories of first encounters and contacts are often tragic and highly emotive, but the contacted peoples in question are frequently portrayed as silent victims with little agency. This reinforces the feeling that they represent something larger than their historical fate, a humanitarian trope in which they represent a dying fragment of humankind. It is notable that Walker and Hill, who have received considerable criticism for their position expressed in a recent article in *Science* (Walker and Hill 2015; cf. discussion in Bodley 2015; Corry 2015; Feather 2015; Hill 2015) take a relatively unsentimental approach to their argument. They present themselves as practical and well informed about the realities of contact:

> The most important lesson learned from these experiences is that mortality can be reduced to near zero if the contact team is prepared to provide sustained, around-the-clock medical treatment, as well as food. A well-designed contact can be quite safe, compared to the disastrous outcomes from accidental contacts. But safe contact requires a qualified team of cultural translators and health care professionals that is committed to staying on site for more than a year (Walker and Hill 2015: 1061).

The authors correctly understand that a very high level of commitment and responsibility on the part of exceptionally well trained, funded and equipped professionals would be necessary to make orchestrated contacts as harmless and viable as possible, rather than causing epidemics and rapid cultural loss. They also attempt to show respect for the intellectual capacities and agency of the isolated peoples, questioning the assumption behind current policies to maintain such peoples' voluntary isolation, 'that they would choose isolation if they had full information (i.e., if they were aware that contact would not lead to massacre and enslavement)' (Walker and Hill 2015: 1061). However, one must question the implicit assertion that the authors, or other scientists, are in possession of 'full information', whatever that may be. Their strategy of argumentation, vaunting the capacities of modern technology and forms of organisation and planning to save populations living in childlike innocence and ignorance (though carrying the potential for improvement) is identical to that of missionaries, who have been perhaps the principle agent of deliberately orchestrated contact or 'pacification' of isolated peoples in South America since the sixteenth century, and have continued to fulfil this role since states relinquished it in the 1980s. Furthermore, Walker and Hill's orientation is in direct continuity with nineteenth century colonialism and with the discourses of improvement, characteristic of international development policy (Li 2007; Rist 2014).

Even if one takes an interventionist stance on the ethical debate about respecting autonomy (Scoccia 1990), one must also be careful about the assumptions made: the idea of 'full information' is a very difficult one to sustain on the Amazonian frontier (and we leave aside here the problem of how information or knowledge is

culturally mediated and dependent on context and position). The uncertainties of contact are as great, if not greater, than the uncertainties of isolation. If there is a worsening lack of resources for the protection of both isolated and non-isolated indigenous people in the face of growing pressure from multiple quarters, the same problems apply to the perilous endeavour of precipitated contact. So, whether or not one subscribes to the modernist agenda of salvation and improvement, it is only in an ideal world that national agencies such as Brazil's FUNAI would be able to choose between keeping the territories of isolated peoples thoroughly intact and free from the incursions of outsiders or carrying out perfectly orchestrated 'controlled' contacts, and maintaining the emerging peoples in legally sanctioned 'controlled' isolation for a sustained period, as FUNAI itself has been attempting to do for the Zo'é of northern Pará for some time (Gallois 1997). Unfortunately we do not live in such a world and, for better or worse, institutional control is necessarily limited by economic and political pressures.

Another fundamental ethical question that must apply to the issue of intervention is that of prior and informed consent. It is of course normally impossible to document the perspectives of isolated peoples, when their occasional emergences tend to be sporadic and fleeting. However, the avoidance of contact, together with signs such as spears or arrows placed on paths (Hill 2015), not to mention acts of hostility, can be taken as an expression of a rejection of contact with neighbouring peoples. On the other hand, it is possible ethnographically and historically to document cases of emergence from isolation. The 'post-contact' period can be very protracted, as is the case of the Akuriyo, with whom we have worked, whose present situation, decades after their emergence from isolation, remains almost wholly defined by this event. The Akuriyo case underlines that, as Torres (2015) has pointed out, great attention should be paid to the neighbours of isolated peoples. His reason for underlining this fact is principally that it is the neighbours of isolated peoples, whom the latter first encounter or approach when they choose to come out of isolation. This seems to apply to a wide range of cases, including the Akuriyo, who used to appear in Trio and Wayana gardens and villages in search of metal goods and other tools and items before they were contacted by missionaries. The example of the Huaorani introduced above is a case in point.

Torres is mainly concerned with the increasing number of cases in Western Amazonia of isolated peoples periodically emerging from the forest in a context of increasing pressure on their territories which, though to a certain extent protected by law as officially demarcated indigenous areas, are in fact subject to incursions and encroachments of a variety of sorts, including extractive industries on both large and small scales, both legally sanctioned and clandestine, and illegal activities such as drug smuggling. Indeed most of the debate on the subject of isolated peoples has seemed to share two common, tacit assumptions: that isolated peoples emerge from, but do not return to, isolation, and that their emergence is inevitably driven by the global momentum of material 'progress', the expansion of the world system. As we shall now see, from our case studies from the Guiana region, there are other factors at play, and these do not always lead to emergence from isolation. Indeed, the

response of some peoples to changing relations with the outside world can be quite the opposite.

10.3 Isolation and Contact in Guiana

In the eastern part of Amazonia and the Guianas, the extractive industrial activities, especially mineral extraction (notably gold and diamonds) that often put pressure on the territories of isolated peoples are certainly taking place. But here, unlike some other areas, small scale mining is the most significant and is having the greatest direct impact. The impact of small-scale mining is often hard to measure on a regional scale, but initiatives such as Amazon Conservation Team's mapping programme show the scale and distribution of goldmining, which has expanded rapidly over the last 10–15 years (ACT 2015). Even so, in the borderlands of eastern Guiana, extractive industry's expansion seems to play a smaller role in the emergence of isolated peoples than do certain initiatives taken by neighbouring indigenous groups. These initiatives take the form of evangelical contact expeditions, which received their initial impetus from outsiders – North American missionaries – but which have taken on a momentum of their own, and are expressions of native Christianity – a widespread religious phenomenon with its own distinctive features, many of which have been the subject of ground-breaking ethnographic studies in recent years (Vilaça and Wright 2009). Here it is common for indigenous missionaries actively to seek out neighbouring isolated peoples in order to 'civilise' them and to 'save' them.

In this section we shall outline how certain external interventions that have taken place over the last half century or more in Guiana brought about profound changes in interethnic relations. We will then examine more closely some of the specific events that occurred in relation to contemporary debates about isolated peoples. We will draw attention to two movements: a deliberately orchestrated concentration of previously dispersed populations into large permanent villages located on large rivers, and a later dispersal of the populations of these villages onto small creeks or interfluvial regions.

The Guiana Shield region of Northeastern South America, overlapping with Amazonia, includes one of the largest uninterrupted areas of intact rainforest in the world. It is home to various indigenous groups, most of whom speak Carib languages, while a small number speak Arawakan or Tupi languages. We choose to focus on the border regions between Suriname, Guyana, French Guiana and Brazil, leaving aside the western part of Guiana which extends across the savannah area shared by Brazil and Venezuela, and as far as the Rio Negro.

It is worth noting that a great many of the isolated peoples of Amazonia -or 'greater Amazonia', if we are to include the whole of Guiana – inhabit such border regions. National borders in South America are often situated in geographically remote areas, following watersheds or river systems far from urban centres. Many indigenous groups were indeed first documented and contacted during expeditions

by boundary commissions, such as those of Euclides da Cunha and General Rondôn for Brazil (Hecht 2013) and Robert Schomburgk for what was at the time British Guiana (Rivière 2006). Yet at the same time they are subject to particular kinds of political claims, not only on an international level, but perhaps more importantly on a national level. For example, the Brazilian military sought to argue for the necessity of establishing a presence in these remote areas in order to protect the borders from foreign incursions (Hemming 2003).

States have, throughout their history, aimed to regularise the situation of all of the peoples living within their territories, and the history of the bureaucratic state is also a history of homogenisation, of cultural and linguistic assimilation as the state extends its reach throughout territories by means of the creation of infrastructure and services, and by counting and monitoring its citizens (Dean 2010). As James Ferguson's (1990) well known study shows, all kinds of development projects can serve as catalysts for the extension of the reach of the state, and are often more successful in this than in achieving their declared aims. Citizenship itself, indeed, can be understood as a set of privileges granted in return for participation in this system of bureaucratic control. At the time of their constitution as independent states in the early nineteenth century, Latin American countries gave their citizens a far greater freedom of movement between the various states of the continent (compared to Europe), due to the diplomatic influence of the merchant class in relation to the newly established regimes; however citizenship did not extend to the native Amerindian populations until much later (Acosta Arcarazo 2015). Later attempts to transform native peoples into citizens were directly connected to the adoption of a paternalistic, humanitarian attitude towards them, beginning in Brazil with the creation of the Indian Protection Society (SPI) in 1910 (ISA n.d.), and entering a new phase of development with the creation of the Xingú National Park in 1961 as a result of the activism of the Villas Boas brothers (Hemming 2003). However, the subsequent proliferation of protected areas for indigenous people came to be seen as an affront by certain factions of the establishment; the continued calls for the 'civilisation' or 'assimilation' of native peoples echo those made in response to frontier conflicts in the early twentieth century (ISA n.d.). In Brazil, the project of assimilation gave rise to the status of wardship, whereby native peoples were classified as 'relatively incapable' and thus placed under the tutelage of the National Indian Foundation, FUNAI (French 2014). In French Guiana, where full citizenship is extended to native peoples without special provision for their indigenous status, another complex set of problems is generated (Mathieu et al. 2014).

From the 1950s, the native peoples of the region were systematically contacted, mostly by privately funded missionary organisations, to persuade them to move to large villages or mission stations. This effort took place either at the instigation of the state or with its encouragement and logistical aid. The former was the case in Brazil, where a series of mission stations called *trinômios* were set up, combining the presence of the air force, the missionaries and the Amerindians themselves to establish a 'civilised' and 'civilising' presence in what were viewed as strategic border areas (Hemming 2003). Meanwhile in Suriname, a Protestant missionary organisation called 'Door to Life' obtained the approval of the government to create

mission stations in the interior in 1959; the government, seeing this as an opportunity to initiate the development of the remote southern region of the country, gave logistical support for the cutting of airstrips (Conley 2000).

At the same time, a separate missionary organisation, the 'Unevangelized Fields Mission' (UFM), carried out an operation which was to have wide reaching consequences across the region. When they arrived among the Waiwai, the latter were a small group whose first ethnographer, Nils Fock, considered them the product of a continual 'ever-repeated process of tribal admixture and division' (Fock 1963: 9), whose very name appears to derive from the neighbouring Wapishana's term for tapioca, in reference to their light skin (Fock 1963: 5). However, Fock does not discuss the role of evangelical Christianity in the process of 'tribal admixture' which was in the ascendant from the 1950s onwards. The Waiwai, following their conversion, enthusiastically embraced the missionaries' project of bringing God's word to other groups. But for them, this was also a project of social expansion through the domestication of other Amerindians, leading to their transformation into Waiwai through intermarriage and linguistic and cultural assimilation (Howard 2001).

Some Waiwai also became involved in the missionisation of the Trio, and as our Trio informants told us, the missionary Claude Leavitt, of UFM, brought Waiwai men with him when he came to work among the Trio in the early 1960s. To help establish the villages which were to act as centres of attraction and permanent settlement for large numbers of Amerindians 'becoming' Trio, Waiwai men built the first collective houses, modelled after their own traditional roundhouses, the *müimó* (Yde 1965: 152), since Trio did not traditionally have collective houses. The roundhouses themselves are in fact associated with collective feasts in which people from outside the village play a vital role, and during the building of the *müimó* young men from outside the village dance with the new central pole before putting it in place (Fock 1963: 169; Rivière 1984: 85). Their construction in Trio villages can be seen as a symbolic and ritual marker of the Trio's conversion, but also as a reminder that this was less of a conversion to Christianity in the Western evangelical sense and more of a conversion to a new spatial and ontological orientation towards alterity.

In turn, converted Trio people carried out similar activities of attraction and assimilation, so that the Trio identity of today is in fact composed of a number of different historical groups (*jana*). However, while most of these groups seem to have been in sustained mutual contact before the arrival of missionaries, certain groups remained isolated in the forest, and indeed to this day some peoples still live in a state of voluntary isolation in the region. During the late 1960s and early 1970s, Trio people worked with missionaries to contact and sedentarise one such isolated group, whom they referred to as the Wajarikure. These hunter-gatherers later came to be known as the Akuriyo, after their own name for one of their sub-groups. Based on the missionaries' own reports from the field and on the narratives of Trio and Akuriyo people who were involved, we have described in detail elsewhere how this healthy group of people who had chosen to live in isolation succumbed to disease, anxiety and shock following contact, and how the few survivors came to remain among the Trio, mostly in the village of Tëpu on the upper Tapanahony river (Grotti

and Brightman 2010, 2016). The remaining Akuriyo, though they have been 'domesticated' by the Trio, have not been fully assimilated by them. They continue to aspire to become Trio themselves, but they maintain a distinctive social and bodily identity which is explicitly linked to their status as 'proper' hunter-gatherers; that is to say, who do not practice, or know how to practise, agriculture. The Trio speak disparagingly, and the Akuriyo with self-deprecation, about how the latter used to rely on *napy* potatoes as a staple instead of manioc.

In 2011 we learned from a nurse that some Trio missionaries from Tëpu in Suriname had visited a newly contacted group across the border in Brazil. The nurse showed us a video that had been taken by the Trio missionaries using mobile telephones, and which showed a boy whom they had brought to their village. Descriptions of the people, together with the video footage, led us to understand that this was another group of Zo'é, and this was confirmed subsequently as we investigated further. The Trio missionaries wanted to bring 'the good news' of Jesus Christ to the people who they said were living in darkness, ignorance and misery in the forest. Their desire to help echoed the humanitarian rhetoric of advocates of 'controlled contact'. However the Zo'é continue to be protected by FUNAI and have had only limited encounters with missionaries.

Still, intermittent stories of attempts by Trio and Waiwai missionaries to contact isolated peoples circulate in the Guiana region. This is in the context of an evangelical resurgence across Guiana: 'bible conferences' are held regularly every couple of years, during which hundreds of people from different ethnic groups travel to remote villages accessible only by days of trekking and river travel in shallow waters using dugout canoes, or by light aircraft. At these 'conferences', indigenous pastors preach for extended periods and the pilgrims sing repetitive hymns for hours on end. There is a powerful Durkheimian 'collective effervescence' as these different peoples, from groups who were enemies not long ago, enter a collective trance-like state. This 'brotherhood in Christ' is the ecstatic fellow feeling, called *sasame wehto* by the Trio, that native missionaries want isolated groups to feel, and they pity them for not yet having known it. It is clear from our Trio friends' accounts of them that these 'bible conferences' have become nodes in space and time for invigorating a regional network and fomenting will to go out and seek more 'brothers'.

Here, some indigenous groups have come to believe that they have a moral duty to continue the work of evangelisation begun by foreign missionaries. Moreover they have 'amerindianised' this process of evangelisation, so that it becomes assimilated to native ideas of predation and domestication, and the expansion of consanguineal ties.

10.4 Minimalist Societies vs. Networks of Relations

As Ribeiro and de Queiroz point out (2015), a reappraisal of the history of the eastern Guiana region over the last six decades shows that there have been two symmetrical movements: an earlier movement of concentration of peoples into mission

villages, and a later movement of dispersal into smaller settlements. In relation to the previous ethnography of the region, it is worth considering the relationship between these two broad movements and modes of representation of the region's characteristic forms of social organisation and patterns of interethnic relations. Some of the first systematic professional ethnographic studies of the region, most notably those of Rivière (1969) and Overing (1975), have been interpreted as emphasising the 'atomistic' nature of Guianan societies. Rivière in particular attached importance to a regional preference for 'settlement endogamy'. Contributors to *Redes de Relações nas Guianas (*Gallois 2005), on the other hand, emphasise the networks of trade and interethnic (or inter-settlement) feasting that are evident not only in later ethnographic studies (Barbosa 2002; Grotti 2010, 2013) but also in ethnohistorical material (Butt Colson 1973; Dreyfus 1992). It is our view that the reading of the regional literature became unnecessarily polarised, perhaps due in part to the influence of Viveiros de Castro's characterisation of Guianan societies, based on his portrayal of the regional social model, described in Rivière's *Individual and Society* (1984), as 'minimalist' (Viveiros de Castro 1996). Taken out of the comparativist context for which it was originally intended, and considered against the ethnographic record, this label appears rather reductive.

Nonetheless, in the debate that followed the publication of *Redes* (Gallois 2005), it was suggested that the different representations of Guianan societies reflected not only theoretical predispositions, but also historical changes (Rivière et al. 2007). Certainly Trio people themselves told us, indeed with great emphasis, that they had experienced an important rupture in their own history when they decided to leave the interfluvial areas in which they used to dwell in relative isolation, although frequently engaging in warfare against other groups, choosing instead to live in mission stations cheek by jowl with affine and former enemies. Akuriyo hunter-gatherers, to an even greater extent, experienced a radical and traumatic rupture when they themselves took the same path, albeit perhaps less willingly.

The association between isolation and warfare on one hand, and peacefulness and contact on the other, should not be taken uncritically. The Trio and Akuriyo are not the only ones to make this dual opposition explicit. There is a long history of Western or European representations of Amerindians as either 'peaceful' or 'wild', and indeed early descriptions of Arawakan and Carib speaking peoples are classic examples (Whitehead 2002). Groups that had chosen to eschew peaceful collaboration with the colonial invaders were described as 'wild' or '*bravos*', and the '*bravos*' versus '*mansos*' ('tame') dichotomy served as a shorthand for categorising vast swathes of the indigenous population. The early ethnographers of the Guiana region such as Coudreau (1887) and Schomburgk (1845) resorted to such categories, and as Niels Fock points out (somewhat admiringly), Protasio Frikel, the Franciscan missionary and ethnographer who founded the Trio village of Missão in a strategic location close to the Surinamese border, had developed theories about the differences between these 'peaceful' and 'wild' indians (Fock 1963).

This crude typology goes back to the earliest colonial period and is repeated today in the discourses of parties wholly unsympathetic to indigenous rights, such as *ruralistas*, the powerful Brazilian agricultural lobby that campaigns – with

growing success – for the revision of the existing mechanisms, such as indigenous reserves, for protecting native peoples' rights and livelihoods (see above). In a certain sense, it is also repeated by some of the humanitarian narratives that treat isolated peoples as needy, lacking, and inevitably destined to be 'pacified' one day, for good or ill, when they are at last caught up in the unstoppable march of history and progress.

In a direct empirical challenge to this linear and teleological view of change, it is well known that native Amazonians periodically choose to go into isolation. The recent cases of dispersal in the Guianas are examples of history repeating itself. Indeed many peoples came to the Guiana Highlands in order to isolate themselves from the impact of colonialism, as is well documented for the Wayãpi (Gallois 1986). As Lévi-Strauss foresaw in his work on the Nambikwara, Amazonian archaeology has gathered evidence that many of the region's present population were remnants of less dispersed and often more differentiated social formations (Heckenberger 2009).

The phrase 'voluntary isolation', now routinely employed by Amazonian ethnologists, expresses the fact that isolated peoples are pursuing a relational strategy, based on a deliberate choice which was often a reaction to experiences of trauma or exploitation – epidemics or enslavement, for example during the rubber boom (Virtanen 2010). Trio people speak about the historical moment of their emergence from isolation as a deliberate choice on their part: they chose to come out of the forest and live on the large rivers or on the savannah, in sustained contact with affines and former enemies. But they were, on the whole, not truly isolated before the arrival of missionaries; many of the various sub-groups were already in the habit of engaging with each other periodically (in more or less peaceful ways), and used to trade with Maroons downriver (Rivière 1969).

The Akuriyo on the other hand do not present their emergence from isolation as having been a choice of their own – as indeed it was not. The Akuriyo represent two patterns of inter-group relation which one could choose to describe without reference to global change. From the perspective of a relatively short timescale of two or three generations, they represent a pattern typical of hunter-gatherers who have been enslaved or otherwise placed in a subordinate and dependent position in relation to neighbouring peoples. Similar cases following this pattern can be found elsewhere in Amazonia, such as the Maku (Silverwood-Cope 1972), and in other regions, for instance in Africa (Turnbull 1966). Meanwhile, from the perspective of a much longer timescale, the Akuriyo show evidence of being a people who at a certain point in their history became solely hunter-gatherers, in the sense that they gave up agriculture to adopt a more mobile way of life. Their language is close to Kali'na, the 'true Caribs', a once powerful group whose territories lie along the coast from Venezuela to Brazil, and they continued to have a cultural memory of manioc production when they were contacted (Jara 1996).

However, both processes are better understood with reference to global change. The Akuriyo are an example of part of the fragmentation and reduction in scale of societies that took place after the European conquest. Their isolation and loss of agriculture should be seen as the result (whether direct or indirect) of the first great

wave of globalisation that took place following Colombus' arrival in the Americas in 1492. And on a shorter timescale, the contact and emergence of the Akuriyo and their subjection to the Trio took place as a result of the activities of American evangelical missionaries in the region, from the 1940s onwards.

10.5 Conclusion

We suggest that the Guianas case presents a more complex ethical problem than other areas in which the pressures for peoples to emerge from isolation are more clearly related to resource extraction. When native peoples have incorporated evangelical ideologies of contact into their own systems of thought and reconciled them with their own traditions, a conundrum is presented for the anthropologists whose profession is grounded in the respect for other cultural practices and who understands that traditions are not static but are historical phenomena, responding and changing with cultural interactions through time. Anthropologists have often condemned Western missionaries for interfering with native practices and cosmologies, but here is a new indigenous Amazonian tradition of interfering in ways which are also recognised, and, it seems, sometimes even welcomed by the objects of their interventions. Should one advocate non-intervention in indigenous affairs, allowing Trio and Waiwai missionaries to domesticate and convert isolated communities such as the Zo'é and the Akuriyo as they wish? Or should anthropologists urge states to intervene to prevent such activities (as indeed many South American anthropologists already do)?

These questions arguably test the limits of the cultural relativism which is the mainstay of social and cultural anthropological method. But given the unique insights that anthropologists can bring to these questions, we suggest that it is important to take a position. We have already given reasons for our disagreement with the arguments in favour of controlled 'scientific' initiatives to bring peoples out of isolation, and the same arguments apply to indigenous missionaries. States have a moral responsibility to protect their citizens, and there is much to say in favour of special rights for indigenous peoples, which should include the right to self-determination. Expansive evangelical movements impinge on the right to autonomy that isolated peoples have shown that they wish to exercise, and it is the responsibility of states to protect isolated peoples from missionaries as well as from extractive industry and overzealous scientists. There are many practical challenges to an agenda of protection, just as there are practical challenges to enacting policies of 'controlled contact': rather than states, it is missionaries and camera crews that mobilise the most resources to reach isolated peoples (Shepard 2014), and different state agencies often have agendas that are in conflict with one another. Nonetheless, if the voices or actions of anthropologists can influence matters even in a small way, we advocate promoting a principle of respect and tolerance for the alternative lifeways that specific peoples may choose.

Asking states to protect and respect the autonomy of peoples who have chosen to disengage with the frontier of material progress and, by extension, with the state itself, may raise a paradox. If these are 'societies against the state', why should states respect them? In practice, states get around this paradox by characterising them as 'relatively incapable'. For anthropologists this is troubling, perhaps even more so than the notion that the enlightenment values of humanitarian reason should sometimes be allowed to trump our own tradition of cultural relativism. The solution may lie in some other enlightenment values such as freedom and tolerance, from which our own cultural relativism also in fact derives. Voluntary isolation (which as we have seen is rarely if ever absolute or permanent) should be seen as belonging to a wider category of alternative livelihoods, livelihoods which are chosen by actors who are fully aware of the dominant discourses and agendas of developmentalism and progress. A growing number of anthropologists has been studying and actively engaging with social movements that seek to create and build spaces for such alternative lifeways, in the name of cultural autonomy, holistic wellbeing and social and environmental sustainability (Escobar 2008). These movements rarely pose genuine existential challenges to the state, but they do raise challenges for existing models of governance, and they demand new understandings of the nature of citizenship.

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Chapter 11
'Like Father, Like Son'? Baka Children's Local Ecological Knowledge Learning in a Context of Cultural Change

Sandrine Gallois, Romain Duda, and Victoria Reyes-García

Abstract Hunter-gatherer societies face social-ecological changes that have led them to alter their living strategies. Given the importance of local ecological knowledge for subsistence and for the preservation of biocultural diversity, this chapter analyses how social-ecological changes affect the acquisition of local ecological knowledge among the Baka, a hunter-gatherer group in southeastern Cameroon. As the acquisition of local ecological knowledge is embedded in daily activities, we evaluate how parental livelihood strategies relate to children's daily activities. We analyse Baka children's involvement in their activities using a sample of 98 children between 5 and 16 years of age. We then use three parental indicators of cultural change: (1) involvement in traditional vs. modern productive activities, (2) income, and (3) level of schooling to test differences in children's activities related to parental indicators of cultural change. Our results indicate that children's involvement in daily activities is not directly associated to parental indicators of cultural change. We conclude that cultural changes affecting Baka society might be so pervasive as to affect all children equally, beyond direct parental influence.

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11.1 Introduction

Contemporary hunter-gatherer societies living in tropical forests face important social-ecological challenges. New economic activities, such as logging, large-scale farming, and mineral, oil, and gas extraction are some of the current drivers of social-ecological change in the tropics (Laurance 2015). These drivers are especially acute in developing nations, where the standards of living are rapidly changing. For decades, the Cameroonian tropical forest has witnessed the opening of mining and logging concessions, first from European, later from American, and more recently from Asian companies (de Wasseige et al. 2012; Ichikawa 2006). The improvement in the transport system propitiated by those companies brought poachers, bushmeat, and ivory traders to the area, actors who -all together- are impacting local wild species and human populations (Ichikawa 2006, 2014; Wilkie et al. 2011). In response to threats to the local ecological system, international institutions and policy-makers have promoted biodiversity conservation programs, including the creation of protected areas. Less political emphasis, however, has gone to mitigate the impact of current social-ecological changes on local populations, who face pressures both from new actors arriving to the forest and from conservation polices restricting their access to natural resources (Ichikawa 2014; Ichikawa et al. 2016). In this context, Baka populations have to adapt their livelihoods strategies to their new circumstances (Ichikawa 2001).

Here, we examine the impact of current social-ecological changes among the Baka on an understudied topic: children's acquisition of Local Ecological Knowledge (LEK). Following the definition proposed by F. Berkes and colleagues, LEK might be defined as "*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*" (Berkes et al. 2000: p.1252). Because of the importance of LEK for subsistence and for the preservation of biocultural diversity (Maffi 2005), numerous studies have focused on how local knowledge systems react in face of social-ecological changes similar to the ones described above (see for example Gómez-Baggethun and Reyes-García 2013; Reyes-García 2015). However, few studies have considered the dynamic nature of LEK, mainly shaped by the way knowledge is culturally transmitted and acquired within each specific society. In many small-scale societies the acquisition of knowledge, devoid of written forms, is largely embedded in daily activities through observation and mimicry (Hewlett 2014; Zarger 2010). In such context, the analysis of children's participation in daily activities might be a valuable tool to inform us of the likelihood that local knowledge is transmitted and acquired (Bliege Bird and Bird 2002; Gurven and Kaplan 2006). Indeed, because there are trade-offs in the acquisition of different types of knowledge (Boyette 2010; Morelli et al. 2003), and specifically between knowledge directly related to the environment and not, children's involvement in different activities would provide valuable clues regarding the type of knowledge they would likely acquire (Morelli et al. 2003; Sternberg et al. 2001).

In this chapter we assess whether changes in parental livelihood relate to changes in children's involvement in daily activities, a proxy for children's LEK acquisition. We first describe children's daily activities. We then examine three indicators of change in parental livelihood: use of time, income, and level of schooling. Finally, we analyse whether these three indicators relate to children's use of time in daily activities, discussing potential effects on children's LEK acquisition.

11.2 The Baka

The Baka are hunter-gatherers from the Congo Basin, mostly living in southeastern Cameroon, counting around 30,000 individuals (Leclerc 2012). Holding deep knowledge about their environment, the Baka are known for their forest expertise, e.g., they are valuable guides for foreigners seeking access to forest's natural resources (ivory, game, ebony). Their knowledge of the local environment, essential for their subsistence, is embedded in specialized practical skills, adapted to their daily subsistence needs. For example, previous researchers have documented how Baka wild yams gathering was indeed a complex system of paracultivation including specific techniques and knowledge for the maintenance of such resources (Dounias 2001; Sato et al. 2012). Wild yam gathering was also intimately related with rituals, involving both a rich set of material items and many cultural beliefs (Joiris 1998).

During the last five decades, the Baka have witnessed changes in the forest they inhabit, somehow responding to those changes. As a result, Baka are now relatively sedentary, have partially adopted agriculture, are involved in wage labour for their neighbours -Bantu speaking people-, and are exposed to national education and healthcare programs (Althabe 1965; Bahuchet 1991; Leclerc 2012).

As other hunter-gatherer societies (Hewlett 2014), Baka rely on oral communication and daily experiences to transmit their cultural knowledge and cosmology. Since infancy, Baka children experience a high physical and emotional intimacy with both their parents and with other members of their family and community (Hewlett 2014), which are probably important in the transmission of knowledge. Thus, children acquire their ecological knowledge mostly through close interaction with the social and ecological environment, through observation and imitation of those around them while performing their daily activities (Gallois et al. 2015).

11.3 Methods

Data were collected from February 2012 to August 2013 in several Baka communities in southeastern Cameroon, in the districts of Lomié and Messok from the Haut-Nyong department. The two first authors conducted extended fieldwork in two communities: one comprised 264 individuals (119 adults, > 16 years of age) and the

other comprised 410 individuals (187 adults). The sample includes children and their parents. We obtained Free Prior and Informed Consent of each village and individual participating in the study. For children, we obtained the informed consent of one of the parents. The research adheres to the Code of Ethics of the International Society of Ethnobiology and has received the approval of the ethics committee of the Universitat Autònoma de Barcelona (CEEAH-04102010).

11.3.1 Data Collection and Variable Construction

Our extensive fieldwork enabled qualitative data collection through participant observation. We followed local socio-cultural norms, e.g., on sharing, cooking, and children caretaking; we participated on the daily life of neighbouring households. Initially, we worked with two translators, a Baka and a Nzime -Bantu-speaking ethnic group of the area-, although after some months in the field we could speak enough Baka to directly interact with adults and children. Drawing on information collected during the initial months in the field, we designed the tools presented below for the collection of systematic data.

Children's Daily Activities To assess children's involvement in daily activities, we asked 98 children (boys and girls 5–16 years of age) to report the activities they performed during the day time of the previous 24 h. During the interviews, we coded self-reported activities into one of 15 activity clusters, developed over the course of ethnographic data collection. Each cluster of activities may thus contain similar activities using different techniques (e.g., a child who responded that he hunted rats with machete and a child who reported hunting birds with bow and arrows would be coded in the hunting cluster). Once the children stopped listing activities, we continued the interview by systematically asking whether they had also performed any of the remaining activities in our list. Involvement in the 15 clusters of activities was coded as 1 if the child performed the activity and 0 otherwise.

The 15 clusters were grouped into three higher-level categories, according to the activity's potential for LEK acquisition. The first category includes subsistence-related activities that may favour the acquisition of LEK. The second category includes activities indirectly-related to subsistence but that also favour the acquisition of LEK because they are integral to Baka's culture (through the acquisition and transmission of norms, values and cosmology). And the last category includes activities unlikely related to the acquisition of LEK, such as school attendance or modern leisure (playing football, or going to bars).

Parental Indicators of Cultural Change We proxied cultural change among Baka parents through three indicators: main daily activities, total income, and level of schooling.

To evaluate parental main daily activities, we used self-reported interviews on the main activity performed during the day time of the 2 days before the interview.

Between August 2012 and August 2013, every week we visited every household in the sample, and conducted interviews with all the adults present. Parental activities were grouped into 17 different categories. We estimated the individual's involvement in an activity as the ratio between the number of times the activity was mentioned by the respondent and the total number of days reported in interviews. Therefore, the variable that captures an individual's involvement in an activity took a value between 0 and 1, where the sum of the involvement in the 17 activities equals to 1.

To measure total income, over the course of a year we collected thrice data on all the sources of income received during the 15 days before the interview. We asked about income perceived from sales and wage labour. As Baka are often paid in kind for their work, we converted information on the products obtained into their monetary equivalent. Income data were averaged to obtain a single measure for each individual. Economic values were recorded in local currency (Francs CFA) and then transformed into US$ PPP values (Purchasing Power Parity; 251 XFA = 1 $ ppp – according to World Bank website, 2015).

Additionally, we conducted a census with all individuals living in the two study villages. As most Baka cannot recall their birth date, we estimated age using both physical estimations and kinship information. We also asked every individual about the highest level of education reached. We coded 0 when they have never attended school; 0.99 when they only completed the first year of schooling, and assigned a number from 1 to 8 corresponding to 1st to 8th school grade. None of the Baka in our sample had attended high school.

11.3.2 Data Analysis

We analysed children's involvement in daily activities by computing the frequencies with which the different activities were performed by children. We also run the analysis differentiating between boys and girls. As children's activities can largely vary with age, we also took into account the child's age category (middle childhood: ≥5-<9 years-old; pre-adolescents: ≥9-<13 years-old; and adolescents: ≥13-≤16 years-old). We conducted similar descriptive statistics (for the full sample and by sex) for Baka adult's use of time and for our two other proxy measures of parental cultural change (total income and schooling).

We first examined the correspondence between children's and parent's involvement in different types of activities. Specifically, we focused our attention on three potential associations: (1) parent's and children's involvement in subsistence activities (i.e., hunting, gathering, fishing and agriculture); (2) parent's involvement in wage labour (i.e., for logging companies and commercial agriculture) vs. children's involvement in subsistence activities; and (3) parent's involvement in wage labour vs. children's involvement in activities in which LEK acquisition is unlikely (i.e., soccer playing, listening to modern music). For the three cases, we ran a series of Wilcoxon ranking tests between children's and parent's involvement in

the selected activities. We ran the analysis first with the aggregated sample, then by sex, and finally by children's age category. We followed a similar approach and ran a series of Wilcoxon ranking tests to assess whether parental income or parental level of schooling were related to children's involvement in daily activities. Again, we conducted such analysis for the full sample, by sex, and by children's age category.

11.4 Results

11.4.1 Baka Children's Daily Activities

Irrespectively of sex and age, Baka children's predominant daily activities relate to subsistence, mostly household maintenance and play. Boys and girls show different levels of involvement in most, but not all, daily activities (Table 11.1). Regarding activities directly related to LEK acquisition, irrespectively of age, girls are more frequently involved in household activities (97 % of the girls interviewed) and fishing (32 %). Boys are more frequently involved in hunting activities, with 69 % of them reporting having hunted the day before the interview. Finally, gathering also tends to be more frequent among girls, especially during preadolescence (53 %) and adolescence (64 %).

Table 11.1 Children's involvement in daily activities (in frequency – percentage)

Categories of activities	Activities	Middle childhood		Pre-adolescence		Adolescence	
		Girls	Boys	Girls	Boys	Girls	Boys
		(n = 10)	(n = 15)	(n = 22)	(n = 22)	(n = 14)	(n = 15)
Subsistence activities, directly related to LEK acquisition	Household maintenance	100.0	93.1	95.4	97.0	96.4	73.3
	Hunting	17.5	81.8	19.3	79.3	26.2	42.5
	Gathering	36.5	61.8	53.4	39.0	64.3	43.8
	Agricultural work	46.0	15.6	30.0	22.6	41.1	34.3
	Fishing	35.5	20.0	38.6	25.1	19.9	3.9
Activities indirectly related to LEK acquisition	Handicraft	12.5	8.9	2.3	13.4	4.2	18.0
	Plays	64.0	75.6	55.7	52.0	37.9	52.3
	Maintenance	12.5	31.3	12.5	24.4	23.5	35.8
	Traditional songs, tales and dances	13.5	13.3	20.4	5.5	12.5	4.4
Activities unlikely related to LEK acquisition	Listening to music	25.0	25.3	46.2	32.7	45.2	62.8
	School	11.5	23.3	22.7	29.5	20.2	4.9
	Other activities	9.0	16.9	6.8	25.0	17.5	20.4
	Football	4.5	19.6	3.4	23.0	0	24.9
	Alcohol drinking	2.5	0.0	6.8	2.0	18	38.6
	Socializing	2.0	11.1	2.3	0.9	16.9	25.4

In contrast with activities directly related to subsistence, girls and boys engage with the same frequency in activities indirectly related to subsistence, with one exception: once they reach pre-adolescence, girls report performing traditional songs, tales, and dances more frequently than boys (13 % vs. 4 %).

Adolescents play less frequently than younger children but socialize and listen to music more frequently than them. Interestingly, as girls move into adolescence, they go fishing less frequently than during middle childhood (20 % vs. 36 %); they are also less involved in handicraft activities than during middle childhood (4 % vs. 13 %). Contrarily, adolescent girls are more frequently involved in gathering activities than during middle childhood (reported by 64 % vs. 37 %). As they enter into adolescence, boys seem to be less frequently involved in household maintenance activities. Adolescent boys are also less frequently involved in hunting (43 % vs. 81.8 %), gathering (43 % vs. 62 %), and fishing (4 % vs. 20 %) activities than middle childhood boys.

11.4.2 Parental Indicators of Cultural Change

Agriculture is the predominant parental daily activity, including agricultural work in Nzime's fields (18 % of the reports) and subsistence agriculture in their own plots (19 % of the reports) (Fig. 11.1). Leisure was reported as the main activity in 14 % of the interviews, followed by gathering (12 %), hunting (7 %), and craft making (6 %).

Baka adults main daily activity largely varies according to sex. Women are more involved in agricultural work (24 % of the reports working in Nzime's fields and 21 % in their own plots) than men (10 % and17%). Women also spend more time than men gathering (14 % vs. 9 %) and fishing (5 % vs. 1 %). Conversely, men are more involved in hunting (14 % vs. 2 %) and unskilled labour (4 % vs. 0 %) than women. Moreover, it is worth noticing that Baka adult's main daily activities are diversified and largely vary between individuals (Table 11.2). For instance, whereas women's involvement in agricultural activities is high, with only 5 % of them reporting never having performed subsistence agriculture (and 7 % of them for agricultural job), their involvement varied (SD = 14 for subsistence agriculture; SD = 16 for agricultural job). Men's involvement in agriculture was also variable (SD = 11 for subsistence agriculture; SD = 9 for agricultural job), as 10 % of them reported having never performed subsistence agriculture and 18 % of them reported having never performed agricultural jobs. The same occurs with other subsistence activities, such as the involvement of women in hunting activities (not reported by 59 % of the women). Men's involvement in gathering activities also varied (SD = 7), with 12 % of them not reporting gathering. Finally, men's involvement in unskilled labour also varied (SD = 8; and 53 % did not report unskilled labour).

We also found diversity among parental income (Table 11.3). The average income earned in a fortnight period was 9.31$ppp, varying between 0 and 24$ppp for women and 0–51$ppp for men. Four percent of the sample did not receive any income. Most income earned by Baka adults in our sample comes from wage labour performed for the Nzime. However, total income largely varies among men and

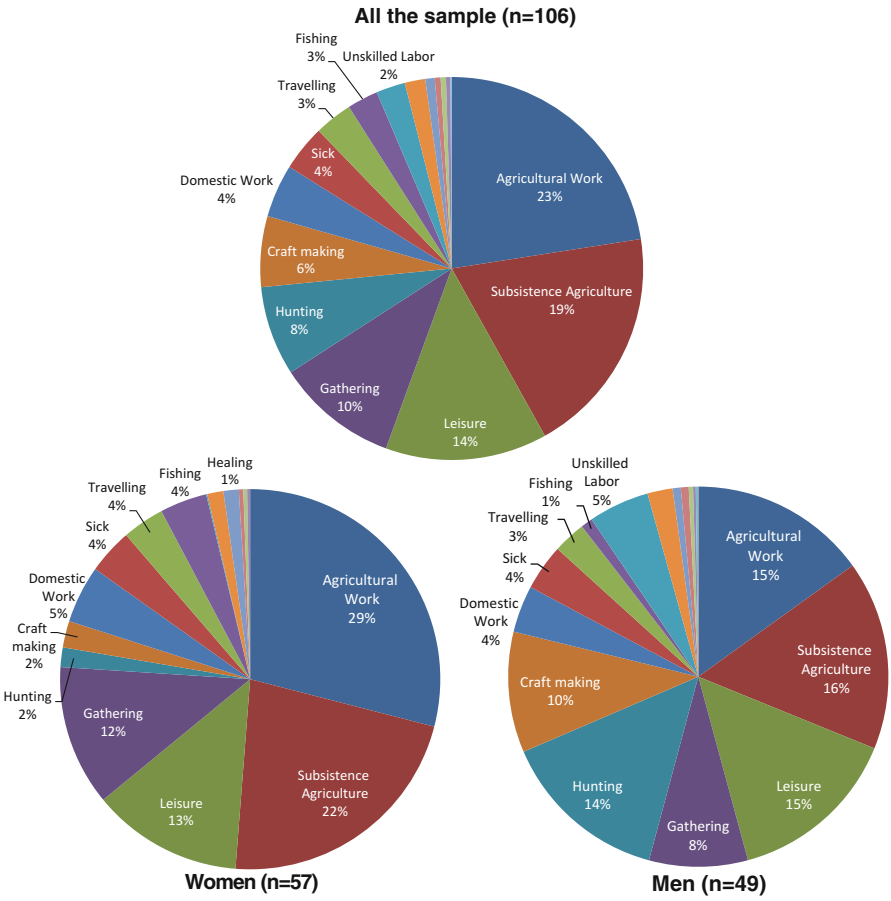

Fig. 11.1 Parental main daily activities (2359 direct reports: 1312 from women, 1047 from men)

women. Additionally, while men are typically paid in cash, most women are paid in kind (typically with agricultural products). Income from sale is mostly owned by men through the sale of wild meat and forest products.

We found lower diversity in parental levels of schooling. On average, Baka adults had only completed the first school grade, although averages were higher among men (1.71) than among women (0.73). Six percent of men and 33 % of women had never attended school; 4 % of the men in the sample had completed fifth grade, but the higher school level completed by a woman was third grade (reached by 3.5 % of them).

11.4.3 Parents' and Children's Use of Time

Results of a series of Wilcoxon Ranking tests showed no statistically significant association between parents' and children's involvement in similar subsistence activities (aggregated by sex and by children's age category), with only two

Table 11.2 Parental main daily activities, by sex; in percentage

	Women		Men	
Activities	Mean	Std. Dev.	Mean	Std. Dev.
Subsistence agriculture	21.18	13.83	16.56	11.32
Agricultural work	23.96	15.86	10.15	8.89
Commercial agriculture	4.11	6.19	5.49	6.19
Unskilled labour	0.09	0.38	3.83	8.42
Fishing	4.56	4.36	1.05	2.21
Hunting	1.63	2.50	14.17	9.91
Gathering	13.46	7.86	9.11	7.08
Healing	1.19	2.78	0.23	0.85
Domestic work	5.09	5.39	4.45	6.09
Craft making	2.10	3.65	9.46	14.41
Skilled work	0.29	1.11	0.62	1.81
Communal work	1.24	2.82	2.25	3.56
Leisure	13.31	7.62	15.50	10.59
Religious ceremonies	0.37	1.05	0.34	1.09
Trading	0.00	0.00	0.20	1.43
Travelling	3.32	6.26	2.80	3.17
Sick	3.75	5.09	3.63	5.62

Table 11.3 Descriptive statistics of parental total income and level of schooling

		Income (in $ppp/15 days)	Level of schooling*
All the sample (n = 106)	Mean	9.31	1.19
	Std. Dev.	8.88	1.12
	Min	0	0
	Max	50.67	5
Women (n = 57)	Mean	7.28	0.73
	Std. Dev.	5.00	0.64
	Min	0	0
	Max	24.33	3
Men (n = 49)	Mean	11.59	1.71
	Std. Dev.	11.45	1.32
	Min	0	0
	Max	50.67	5

* 0 = no school, 0.99: kindergarten, 1–8: 1st to 8th grade

exceptions (Table 11.4). Children's involvement in gathering activities bears a positive association with mother's involvement in gathering ($z = -2.11$, $p = 0.03$), especially for boys ($z = -2.46$, $p = 0.01$); and children's involvement in agriculture is associated with father's involvement in agriculture ($z = -2.12$, $p = 0.05$), especially for girls ($z = -1.99$, $p = 0.05$).

We found, however, statistically significant associations between parents' and children's involvement in *different* subsistence activities. For example, children are

Table 11.4 Results of Wilcoxon ranking test testing the association between indicators of adult's cultural change and children's involvement in daily activities

Indicators adult cultural change			Girls involvement in				Boys involvement in			
			Hunting	Gathering	Fishing	Agriculture	Hunting	Gathering	Fishing	Agriculture
Father	Involvement in subsistence activities	Hunting	0.26	−1.38	−0.31	0.32	0.72	0.16	1.20	−1.67*
		Gathering	−0.17	0.02	−0.58	−0.58	−0.61	0.58	0.67	0.63
		Fishing	−0.08	−0.25	0.62	−1.65*	−0.72	−0.32	1.33	−0.82
		Agriculture	0.21	−1.64	1.30	−1.99**	−0.56	0.47	−2.70***	−0.85
	Modern wage labour	Agricultural job	−2.02**	−1.62	−0.22	−0.11	−2.64***	0.37	−1.15	−1.15
		Commercial agriculture	−2.30**	−0.23	−2.04**	−0.65	−0.43	0.17	−1.56	1.56
		Unskilled labour	−1.08	0.64	1.14	0.61	−0.60	−1.76*	0.63	−2.18**
	Total income		−1.08	0.46	0.34	0.59	−0.42	−0.54	1.10	−0.78
	Level of schooling		−0.43	0.62	1.11	−0.29	1.77*	−1.59	1.28	0.37
Mother	Subsistence activities	Hunting	−1.13	−0.11	−0.06	−0.92	1.15	−1.44	0.51	−0.26
		Gathering	−0.72	−0.05	0.23	−0.34	0.38	−2.46**	1.10	0.90
		Fishing	−1.04	0.60	0	0.05	−1.24	1.68*	−1.0	−2.13**
		Agriculture	−1.29	−0.89	0.15	−1.44	−1.13	−0.75	−0.30	−0.19
	Modern wage labour	Agricultural job	−0.35	−0.35	−0.40	0.95	−1.11	1.62	−0.88	−1.42
		Commercial agriculture	−0.97	−0.38	−0.40	−0.97	−0.24	−0.83	−0.40	1.39
		Unskilled labour	0.87	−0.24	−1.14	1.36	–	–	–	–
	Total income		−2.5**	−1.31	−0.21	0.05	−0.12	0.46	0.82	−2.36**
	Level of schooling		−0.99	0.58	−0.56	−0.43	−0.42	−2.12**	0.46	1.04

There is no observation of boys whose mother was involved in unskilled labour; *p<0.1, **p<0.05, ***p<0.01 to the Wilcoxon ranking tests

more frequently involved in agriculture when their fathers are more involved in fishing ($z=-2.29$, $p=0.02$), and preadolescent boys are more frequently involved in agriculture when their fathers are more involved in hunting ($z=-2.08$, $p=0.04$). Boys are also more frequently involved in agriculture when their mother perform fishing more often ($z=-2.13$, $p=0.03$). We also found some associations between parent's involvement in agriculture (own plot) and the performance of other subsistence activities by children (Table 11.4). For example, boys are more frequently involved in fishing when their father devotes more time to subsistence agriculture ($z=-2.70$, $p=0.007$). When their mother devoted more time to subsistence agriculture, pre-adolescent children are more frequently involved in hunting ($z=-4.1$, $p<0.001$), and preadolescent boys are more frequently involved in fishing ($z=-2.6$, $p=0.001$). When looking at parent's involvement in agricultural job for the Nzime, we found a positive association with children's involvement in hunting for both girls ($z=-2.02$, $p=0.04$) and boys ($z=-2.64$, $p=0.008$) (Table 11.4).

When exploring whether parental involvement in modern wage labour relates to children's involvement in subsistence daily activities, we generally found low associations (Table 11.4). The most remarkable associations in this group include that, when fathers are more involved in commercial agriculture, children are more involved in hunting and fishing activities (respectively $z=-2.08$, $p=0.04$, and $z=-2.15$, $p=0.03$), and especially girls ($z=-2.30$, $p=0.02$ for hunting and $z=-2.04$, $p=0.04$ for fishing). Similarly, when their fathers are more involved in logging, boys are more frequently engaged in agriculture ($z=-2.18$, $p=0.03$), especially during preadolescence (-3.42, $p<0.0001$).

We found few associations between parental involvement in unskilled labour or commercial agriculture and children's involvement in activities unlikely related to LEK acquisition, except the association between father's involvement in wage labour and children attendance to school. The association was positive for girls ($z=-2.24$, $p=0.02$), but negative for boys ($z=1.82$, $p=0.07$).

11.4.4 Parental Income and Education and Children's Use of Time

We ran similar analyses with our two other proxies of adult cultural change: total income and schooling (Table 11.4). The only statistically significant results found are the positive association between mother's income and girls' involvement in hunting ($z=-2.5$, $p=0.01$) and boys' involvement in agriculture ($z=-2.36$, $p=0.02$). Parental income is not associated with children's involvement in activities not linked to LEK, except for the positive association between father's income and girls frequency of reports in listening to music ($z=-2.06$, $p=0.04$), and the negative association between mother's income and boys school attendance ($z=1.71$, $z=0.09$) (results not shown).

Some statistically significant associations appear when testing the relations between parents' schooling and children's involvement in subsistence activities (Table 11.4). Namely, higher father's education is associated to lower children's reports of

hunting ($z=2.31$, $p=0.02$) especially for boys ($z=1.77$, $p=0.08$). In contrast, boys engage in gathering more frequently when their mother's schooling is higher ($z=–2.12$, $p=0.03$). Finally, higher maternal schooling is associated to lower children's school attendance ($z=1.71$, $p=0.09$), especially during middle childhood ($z=1.73$, $p=0.08$). For preadolescents, higher father's schooling is associated with lower boys' school attendance ($z=1.92$, $p=0.06$) but higher girls' school attendance ($z=–2.26$, $p=0.02$).

11.5 Discussion

11.5.1 Children's Daily Activities and Local Ecological Knowledge Learning

As in other hunter-gatherer societies (Boyette 2010; Demps et al. 2012; Ruiz-Mallén et al. 2013), subsistence activities predominate in Baka childhood, which implies that Baka children are frequently involved in activities where they are likely to acquire LEK.

The predominance of activities related to household maintenance also suggests that the mechanisms that facilitate the acquisition of culturally relevant knowledge continue to be largely in place in the studied society. During our ethnographic observations, parents told us that children would take advantage of activities such as fetching water or collecting firewood to engage in the opportunistic hunt of little animals or in the gathering of wild edibles. Engaging in such activities from an early age allows children to obtain basic knowledge needed for more complex skill acquisition as they age (Schniter et al. 2015; Reyes-García et al. 2016). Our data also show that, as early as middle childhood, activities are sex-differentiated, with hunting appearing to be a predominant boys' activity whereas fishing and household chores (specifically child caretaking) are predominantly girls' activities. Such data then suggest that the progressive acquisition of LEK is sex-differentiated.

Newly introduced activities have infiltrated children's lives to varying degrees. School is not very frequently attended among children in our sample, and our observations suggest that, even among children who attend school, they do so for very few hours. Yet, children spent considerable time at bars, listening to music and dancing. As these activities mostly occur during the evening, they seem to be replacing other traditional leisure activities (tales, songs and traditional dances). In that sense, the increase in evenings spent at local bars may be impacting acquisition of cultural knowledge (Weig 2015), including LEK (Fitzgerald 2011).

11.5.2 Cultural Change Among the Baka

The analysis of contemporary Baka adult's use of time allows for a discussion of the impact of cultural change in Baka livelihoods. Scholars have highlighted the progressive changes faced by the Baka and the potential consequences on their

livelihoods. Such changes relate, for instance, to sedentarization (Althabe 1965; Bahuchet 1991; Bailey et al. 1992; Leclerc 2001, 2006), adoption of agriculture (Leclerc 2012; Yasuoka 2012), and the impact of the monetarization (Kitanishi 2006; Oishi 2012). Our results corroborate the importance of such changes. For example, we found that agriculture—not hunting and gathering—is now Baka adults' main occupation. Agriculture provides the Baka with food and cash and has become the main subsistence activity for some households in our study area (Leclerc 2012). From ethnographic observations we know that there is certain gender specialization in agricultural chores. When working in their own plots, men seem to specialize in tasks bounded to a specific time (i.e., planting), whereas women's involvement is prolonged through the agricultural cycle. When performing wage agricultural labour, women are generally more involved in Nzime's subsistence plots; whereas men seem to work more often in Nzime's cacao fields (a cash crop). There is also a sexual division of agricultural wage labour that relates to income differences between men and women, with men receiving up to twice the salary received by women. Men's and women's income differences are exacerbated by men's participation in the logging industry.

The changes described above affect to some extent all Baka households, although variation exists in the use of time and the income received among different households. Indeed, whereas some households tend to develop strategies based mostly on hunting and gathering, others concentrate in agriculture, and still others in wage labour. However, many households also display a diversified strategy, combining hunting, gathering (for subsistence or commercial purposes); wage labour and agriculture.

Finally, among the three different indicators of cultural changes, parental education appears as the indicator showing the lowest variability, probably because schooling is relatively recent in the area. Although many adults, especially young adults, reported having attended school, they did so for very few years. In that sense, parental education does not seem to be a relevant indicator of cultural changes for the studied villages.

11.5.3 Local Ecological Knowledge Learning and Parental Livelihoods

The third important finding of this work is that, despite the high diversity in parental livelihood activities and income, children's daily activities do not seem to be associated to any of those two indicators of cultural change. Why children's choice of activities does not resemble parental choices? We can think of two related explanations.

Our first explanation relates to specific traits of Baka childhood. As in other hunter-gatherer societies, Baka children are highly autonomous and independent since an early age (see Hewlett 2014). For instance, Baka parents are rarely present during children's daily activities. Moreover, allo-parental care is very common among the Baka: several adults and adolescents are involved in child caretaking,

what allows children to access a diversity of role models, in addition to their parents. Contrarily to what is known among farmers (Hewlett 2014), Baka children are not necessarily pushed to help their parents in subsistence activities. Baka children enjoy more freedom on how to use their time than the children of Bantu-speaking neighbours. So, our first explanation for the lack of association between children's choice of activities and parental indicators of cultural change is that parents are not sufficiently present in children's days as to exert a strong influence in children's activity choice.

Second, our results also suggest that children tend to perform activities that differ from those performed by their parents, especially when their parents are involved in agricultural work or wage labour. By engaging in different activities than their parents, children might be contributing to the household sources of food diversification. Thus, during middle childhood, while their parents are away, children mostly engage in subsistence activities, including catching little animals and gathering subspontaneous tubers for which they often get their own food. In accordance with what has been reported in other settings (Bird and Bliege Bird 2005; Crittenden et al. 2009; Tucker and Young 2005), the outcomes of Baka children's subsistence activities seem to provide them an important part of their daily food during parental absences. As they grow, the products gathered are increasingly important for household consumption, complementing the products brought by their parents. Therefore, our second explanation for the lack of association relates to the adoption of a diversified strategy within the same household in which the activities that children's and their parents perform are complementary in ensuring household subsistence needs.

11.6 Conclusion

Although Baka children frequently engage in traditional subsistence activities, they also engage in activities that were unknown only some decades ago. There is also an important shift in the way parents use their time, with a predominance of agricultural work and wage labour. Nevertheless, there is no association between children's and parent's engagement in daily activities. The puzzle we are left with is: if parental changes do not affect children's daily activities, then, what does?

Data presented here mainly focus on behavioural characteristics, but cultural change also refers to changes in perceptions, ideas, and values (Godoy et al. 2005). In that sense, the impacts of cultural change on children's involvement in daily activities, and thus, on ecological knowledge learning, might also relate to more general trends that affect children and adults equally. For example, as new opportunities of wage labour appear, they convey a new way of valuing nature: through commercialization, a shift that can affect how Baka adults and children alike perceive their environment and their own livelihood. Therefore, in the study of local ecological knowledge learning more emphasis should be made in the way both children and adults perceive and value the different activities, and how those perceptions and values shape children's choices towards their daily activities. In con-

clusion, the unexpected lack of association between parental and children's daily activities found here opens the door to alternative explanations on how children in contemporary hunter-gatherer invest their time. We propose that cultural changes on children's LEK acquisition might relate more to the general tendency driving several cultural changes among Baka society, rather than to parent's indicators of cultural change. Further research could explore such assertion through the study of changes in children's representations and worldviews.

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Chapter 12
Persistence of Infant Care Patterns Among Aka Foragers

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Abstract Early research found commonalities across hunter-gatherer communities in regards to infant care. Infants were held frequently, spent most of the day and night in skin-to-skin contact, breastfed on demand, received intimate caregiving, and experienced low levels of distress. These shared infant care practices are assumed to have deep evolutionary roots and together serve as a defining characteristic of hunter-gatherer life. Yet, the degree to which hunter-gatherers are experiencing social, economic, and environmental change may have created conditions that alter these defining characteristics. In this chapter we explore infant care among the Aka foragers in the Central African Republic. We utilize naturalistic behavioral observations collected over almost 20 years to examine whether care patterns have persisted or changed over the course of a generational timespan. The Aka discussed in this chapter remain a mobile foraging population, but they have also experienced change at multiple levels. Whether or how these changes influence infant care has not yet been examined. Results indicate that Aka infant care patterns have persisted. Although some significant changes were noted, not all caregiving showed a decline, some increased and some changes were only limited to one age category. Additionally, the vast majority of caregiving practices remained constant across the periods. Cross-cultural data presented also support this finding. Aka infant care patterns are comparable to other hunter-gatherer populations and the frequency of care and interactions match or exceed most farming and Euro-American patterns. We argue that Aka infant care patterns have persisted because they are vertically transmitted and highly-conserved. Moreover, Aka infant care is indicative of a much larger cultural pattern of trust, intimacy and sharing, not immediately affected by outside influences.

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12.1 Introduction

Research on hunter-gatherer childcare practices, particularly infant care, discovered patterns that appear to be common across hunter-gatherer communities (for review see Hewlett and Lamb 2005; Konner 2005, 2016). Hunter-gatherer infants are in physical contact most of the day, receive quick and intimate attention from caregivers, experience high frequency of allomaternal care, breastfeed on demand, and infrequently fuss or cry. These shared care practices and behaviors are assumed to have deep evolutionary roots and together serve as a defining characteristic of hunter-gatherer life. Additionally, hunter-gatherer caregiving practices are vertically transmitted (i.e., from parent to child), and are thus hypothesized to be relatively stable across generations (Hewlett and Cavalli-Sforza 1986). Yet, the degree and pace to which hunter-gatherers are experiencing social, economic, and environmental change may have created conditions that alter this characteristic of hunter-gatherer life.

Here we explore whether Aka forager infant care patterns have persisted or changed over a generational timespan. The Aka, a Central African foraging population, discussed in this chapter remain mobile, but families spend more time close to the neighboring horticultural village. Logging concessions to the south have disrupted landscape usage, educational opportunities have begun to change, and access to medical care from missionaries has increased. To examine the potential impact of these changes on child care practice we analyze detailed quantitative data from naturalistic behavioral observations on infant care collected over almost 20 years. We center our analyses on attributes that have defined hunter-gatherer infant care. Additionally, we utilize available published data from other hunter-gatherer, farmer and Euro-American studies as a comparison to examine whether Aka care practices fall within the range of hunter-gatherer care patterns or whether they are going through a transition to more "farmer-like" or others' patterns of infant care (see Hewlett et al. 1998). Lastly, as the largest sample of hunter-gatherer infants in any study to-date, we are able to present a needed overview of hunter-gatherer infant care and infant behavior across almost two decades offering insights into the lives of Aka infants and caregivers.

12.2 Hunter-Gatherer Infant Care

Interest in hunter-gatherer infancy and caregiving owes much to the initial research from the Harvard Kalahari Research Group from the 1960s and 1970s. Their studies reported many of the features noted above and considered them to be indicative of hunter-gatherer infant care. !Kung infants were described as in almost constant physical contact with caregivers, primarily their mothers (Konner 1976). Passive physical contact with caregivers was on average under 80 % during the first several

weeks of life (Konner 1976, Table 10.3). Between 10 and 20 weeks, contact rose to approximately 90 % and then declined for the remainder of children's first year (Konner 1976, 2016). !Kung infants breastfed 4.06 times per hour, for an average nursing time of 7.83 min per hour (Konner and Worthman 1980). Additionally, although !Kung infants' crying pattern in early infancy matched the cross-cultural pattern (i.e., the frequency of events), the duration of the events were shorter than found in a Dutch sample, indicating that !Kung infants cried less during the day than did Dutch infants (Barr et al. 1991). Low levels of distress among hunter-gatherer infants were attributed to rapid and sensitive responses by caregivers to infant signals (Barr et al. 1991; Konner 1972). Konner (1977) suggested that !Kung infants, unlike many infants in the West, do not need to proceed to higher and longer levels of arousal to capture the attention of and care from their caregivers, which explained lower levels of crying.

In the decades that followed, the patterns described for the !Kung were found to not be unique (for review see Konner 2005, 2016). Although cultural variation in infant care practice exists among hunter-gatherers, commonalities are widespread and key care practices appeared to be a pan-hunter-gatherer characteristic (see Hewlett and Lamb 2005; Konner 2016).

Our (BH and CM) studies on the Aka supported much of what was seen among the !Kung, but also emphasized the importance of allomaternal care (Hewlett 1992; Hewlett and Lamb 2005; Meehan 2005, 2009; Meehan et al. 2013). Hewlett's research in the 1980s on infant care reported that Aka 1–4 month olds, "were held essentially all the time in both settings [camp and forest], while older infants were held about half the time in the camp and more than 90 % of the time on the net hunt" (Hewlett 1992: 77–79). Even beyond early infancy, children (6–32 months old) were only separated from their mothers (not even including other caregivers) on average 2.9 times per day, with approximately 80 % of the mother-infant separations lasting ≤10 min (Meehan and Hawks 2013).

Reports from other groups were similar. Efe infants are involved in social interaction (either touched or engaged with) 97 % of the time in early infancy (Tronick 1995). Similar to the !Kung, Efe caregivers' interaction with infants decreased over the first year, but remain high, with 1 year old children engaged in some type of social interaction approximately 65–70 % of the day (Tronick 1995). Despite the decline in social interactions, at 1 year of age Efe infants are still near caregivers 100 % of the time (Ivey 2000). Crittenden and Marlowe's (2008) study on Hadza infant care showed the common steady decline in care over the first year, but also noted a high average holding frequency in early infancy (Crittenden and Marlowe 2008). Combined, these hunter-gatherer studies have situated care practices within a larger cross-cultural and evolutionary perspective and have had a profound influence on our understanding of infants' needs (e.g., McKenna et al. 1997; Sellen 2016), and the evolution of childhood (e.g., Hrdy 1999; Konner 2010; Meehan and Crittenden 2016).

12.3 Aka Foragers: Stability and Change at the Regional and Local Level

As the chapters in this volume express, change for many hunter-gatherer communities has been rapid and frequently disruptive to local environments, economic lifeways and cultural traditions. The experiences of the Aka are no exception to this worrisome pattern. The demarcation of reserves or parks, the intensification of logging and mineral extraction, the bush meat trade, and "emerging" diseases all impact Congo Basin foragers (Hewlett 2014). Foragers also face political marginalization and discrimination within their countries, often, "placed in a structurally subordinate position" (Ichikawa 2014: 328). Yet, the foragers of the Congo Basin, remain the largest, most diverse and active hunter-gatherers in the world (Hewlett 2014; Bahuchet 2014). Characteristics, such as an emphasis on egalitarianism, respect for the autonomy of others and sharing, whether food, possessions, or child care, have been maintained even in the face of these changes (Hewlett 2014).

The Aka continue to hunt and gather and frequently move their camps—families spend portions of each year residing in the forest as well as living on the periphery of the forest. However, despite continued mobility, there is an observable increase in the number of camps and length of occupancy in camps on the outskirts of horticultural villages. During the mid-1990s to the early 2000s, Aka camps in the study area were sporadic along the approximately 45–60 min walk to the end of the fields and the start of the forest. By 2009–2013, the density of camps in village fields had increased. Although most huts continue be built in the traditional style (a dome-shaped construction of branches covered by leaves), many village camps now have one or two more permanent wattle and daub structures. Yet, camp size still ranges from approximately 10–35 individuals (Hewlett 2014). Although varying across season and location, this range with an average in the mid-twenties has remained relatively stable over the years (see Hewlett 1992; Meehan 2005; Meehan et al. 2013). These small and intimate social units form the foundation of infants' early social environments.

The Aka have also experienced changes to subsistence patterns and diet. They continue to net hunt, but the frequency has declined, in association with an increase in gun and snare usage. Additionally some Aka (particularly those who are establishing longer-term camps near villages) have taken up farming at some level. As long as ethnographers have interacted with these populations, domesticated crops have constituted a regular portion of their diet (Bahuchet 1988), but given subsistence changes, the proportion of domesticated plants to their diet has likely increased in recent years.

The past 20 years have also bore witness to rapid changes beyond residence, mobility and diet. In the 1990s and early 2000s a village health clinic serviced the village and Aka populations. However, due to structural and financial issues, care was seldom available to the Aka. In the intervening years, between 2002 and 2009, a Catholic mission hospital was completed and now operates in addition to the community health services. Aka frequent the Mission hospital, but individuals often

carry labor debts as a result of services provided. The few free services offered to the Aka, i.e., leprosy medication, are limited in outreach as the Aka are not sedentary and frequently leave the area prior to completing the medication cycle.

The number of community or mission schools for the Aka has increased and attracts students. Parents express a strong desire for their children to gain an education, citing the changing times as a primary motivation (Hewlett 2013). Mission schools offer meals to the children as a way to entice the student and their parents to remain in one location. However, while systematic data have not been collected, families typically depart for the forest throughout the year regardless of school attendance.

Gold and diamond mines operate close to the horticultural village, attracting both young village and Aka men. Engagement in mine labor by village men is now widespread and increasing inroads into Aka communities are occurring. The logging industry exploits regional forests and although they are not extracting timber near the study area their impact is felt. Improved roads have increased urban hunters entrée into forest lands, facilitating the bush meat trade (Wilkie et al. 2011; Ichikawa 2014), and resulted in the Aka noting a decline in hunting success. Moreover, the area of focus is on the border of the Republic of Congo (ROC). ROC police and military patrols, which are placed there to protect lumber concessions, have somewhat impeded Aka traditional movement back and forth across the border.

Given the list of changes we presented, it is important to note that the time period represented marks neither a start date nor a completion to changes in Aka society. Logging industry presence in the forest and its impact on hunting success was noted by BH in the 1980s. The impact of mission schools on residence patterns was discussed by the Aka and their neighbors, the Ngandu, in the early 2000s (see Hewlett 2013). However, the 20 year time span discussed in this chapter represents a period in which change has perhaps been at its most rapid pace.

12.4 Persistence or Change in Infant Care: Cultural Transmission of Care Patterns

Hunter-gatherer childcare patterns have been argued to be learned young and vertically transmitted (i.e., parent-to-child). As such, change is hypothesized to be relatively conservative—caregiving patterns are likely to be maintained across generations (Hewlett and Cavalli-Sforza 1986). Yet Hewlett and Cavalli-Sforza note that this conservation may be in part maintained due the homogeneity of the habitat and lack of schools, features that have been altered for the Aka in recent years. They argue that when social and physical environments change rapidly, horizontal and oblique transmission are more likely—information derived from parents may be outdated and individuals will turn to their peers or others for new methods and information, accelerating change.

12.5 Methods

12.5.1 Child Observation Procedure

Quantitative behavioral observations were conducted using a focal-child sampling technique (Altmann 1974) during three time periods [Time Period (TP) I – 1994–1996; TP II – 2000–2002; TP III – 2009–2013]. Researchers observed one focal child at a time and recorded the infant's and their caregivers' behaviors. Observations occurred in multi-hour segments, were spread over several days, and spanned all daylight hours (6am–6pm). Every 45 min of observations, however, were followed by a 15-min observer break, resulting observations occurring for 9 of the 12 daylight hours. Directed by a recording, the researcher starts to observe at the top of the minute, record observations during 0:00:20–29 s, resume observation at 0:00:30 s, record during 0:00:50–59 s, etc. Thus, observation units are 30-s (see Meehan 2005; Meehan et al. 2013).

12.5.2 Participants

In TP I quantitative behavioral observation data were collected on 20 3- to 4-month-old and 20 9- to 10-month old Aka infants. In TP II data were collected on 15 8- to 12-months-old Aka infants. In TP III data were collected on children between birth and 4 years, but are here limited to 26 infants between 2 weeks – <6 months and 13 infants between 6–12 months. Due to maternal post-partum recovery practices, infants less than 2 weeks are not included in the analyses. The upper limit of 12-months for TP III was chosen for comparative purposes with the first two samples. In total, 94 2-week to 12-month old infants are represented across the three time periods. Infants were observed for approximately 846 h. Table 12.1 provides a

Table 12.1 Sample summary across age and time periods

	Early infancy (2 weeks–<6 months)			Late infancy (6–12 months)		
	Time period I	Time period II[a]	Time period III	Time period I	Time period II	Time period III
N	20	–	26	20	15	13
Age[b]	–	–	2.99	–	9.9	9.3
Range	3–4 months	–	2 weeks–5 months	9–10 months	8–12 months	6–12 months
Sex[c]	.65	–	.35	.45	.47	.92

[a]Data were not collected on younger infants during the 2000–2002 field season
[b]Mean age in months. Infant age was determined to a 2 month range (3–4 and 9–10 months) during Time period I
[c]Proportion of male infants

basic summary of the sample of infants by each time period. Note that in late infancy, TP III is comprised of 92 % boys (12/13). Hence, it is impossible for us to determine if any behavioral differences found in late infancy between TP III and TP I or TP II are due to cohort or sex.

12.5.3 Focal Behaviors and the Social Environment

We focus on five caregiver behaviors (*maternal breastfeeding, maternal and non-maternal physical affection, non-physical affection, holding,* and *physical contact with infants*), two features of infants' social environments (*proximity to caregivers* and *time alone*), and three infant behaviors (*crying, fussing,* and *the composite variable of fussing and crying, termed fuss/cry*). *Breastfeeding* is defined as when infants were actively nursing and is limited to maternal nursing. *Physical affection* is caregivers displaying positive affect to the child (e.g., nuzzling or kissing). *Non-physical affection* includes positive affection through verbal or other non-physical displays (e.g., smiling at infant). *Holding* refers to times when the infant was held in a sling, arms, or lap. *Physical contact* is a composite variable comprised of holding and touching and data is limited to TP II and TP III. As infants are cared for by a wide network of caregivers (Hewlett 1992; Meehan 2005; Meehan et al. 2013), physical and non-physical affection, holding and physical contact encompasses all caregivers' contact with infants, not only the mother.

The infants' social environment is conservatively defined. *Proximity* to caregivers is defined as an infant within a forearm's distance to a caregiver. Whether the infant was *alone* was only coded during TP I, but was cautiously inferred for TP II and III. In TP I, an infant alone was defined as the percent of observations where a caregiver was not within view or was ≥5 meters away from a caregiver. In TP II and III, we calculated the percentage of observations where no caregivers were interacting or near the focal infants and when the mother was not within view. Therefore, if an infant was in a hut by himself and the mother was just outside but not visible, he was considered alone. This likely overestimates the percent of time infants were alone in the latter two time periods, but given the infrequent occurrence of Aka infants being alone, these variables are similar and we argue highly comparable. Again, given the importance of allomothers, we considered all caregivers when examining proximity and time spent alone.

Crying refers to when a child was significantly agitated and/or upset. In TP II and TP III the child also needed to have visible tears to be coded as crying. Despite this difference, crying was coded at all periods when the child was visibly upset beyond low-level fussing. *Fussing* is when the infant was awake and manifesting signs of agitation or was upset—whined, moaned or whimpered, but did not cry. The composite variable *fuss/cry* is the combination of the two.

12.5.4 Data Analysis

Analyses were done in R. Data were converted to a proportion by summing the number of observation periods in which the behavior was observed, and dividing by the total number of observation periods. The total number of observation periods was 1080 for 91 infants and was either 1078 or 1079 for the remaining three infants.

Our data were proportions of binary observations, which would typically be analyzed using a binomial error distribution (e.g., logistic regression). However, the observations exhibited considerable autocorrelation (e.g., an infant crying during observation t was usually also crying during observation t+1), which means our observations were not independent, contrary to the assumptions of this model. In addition, we only had the actual sequence of observations for some infants; for most, we only had the counts of observed behaviors and total number of observations. Thus, we could not adjust for autocorrelation. We therefore tested for cohort differences in the proportions of each behavior using a non-parametric permutation test (Hothorn et al. 2008). We also computed 95 % confidence intervals using a basic nonparametric bootstrap (Harrell et al. 2014). Although sex differences in infant care have not been previously found in Aka studies (e.g., Hewlett et al. 1998), below we note where there are two possible confounds due to sex.

12.5.5 Cross-Cultural Comparisons

Cross-cultural comparisons from published infant care studies among European/Americans, farmers and other forager groups are presented (see Table 12.2 and Fig. 12.1a–c). Euro-American (Hewlett and Lamb 2002) and Ngandu (Hewlett et al. 1998; Hewlett and Lamb 2002; Meehan 2009) data were collected via the same methodology and are thus more easily comparable. The other examples, however, should be cautiously compared. Variation in methodology, age categories, and definitions make direct comparison difficult. Moreover, the cross-cultural comparisons do not represent all infant and caregiver behavioral studies; rather they are limited to those which are most comparable. Nevertheless, the available cross-cultural examples help contextualize our results.

12.5.6 Limitations

There are limitations to this study. We did not track specific individuals and/or families across the timespan. Thus we are not specifically testing whether one generation of caregivers are interacting in a different manner than the previous generation. Also changes within Aka society are not linked to a specific date, from which we can examine care patterns prior to and after. Environmental and social change are not

Table 12.2 Cross-cultural comparisons of caregiver behavior, social environment and infant behavior[a]

				Early infancy			Late infancy		
Population category		Population	Variable	Mean %	Range in %	Source	Mean %	Range in %	Source
Forager									
	Caregiver behavior	Baka[b]	Nursing	14.9	–	Hirasawa (2005)	14.9	–	Hirasawa (2005)
			Physical contact	80.0	–	Hirasawa (2005)	80.0	–	Hirasawa (2005)
	Infant behavior	!Kung	Fuss/Cry[c]	5.8	5.3–6.2	Barr et al. (1991)	2.8	–	Barr et al. (1991)
		Baka[b]	Crying	2.9	–	Hirasawa (2005)	2.9	–	Hirasawa (2005)
			Fussing	1.8	–	Hirasawa (2005)	1.8	–	Hirasawa (2005)
			Fuss/Cry	4.7	–	Hirasawa (2005)		–	
		Efe[d]	Fuss/Cry	8.0	7.0–9.0	Morelli et al. (2014)	80.0	7.0–9.0	Morelli et al. (2014)
Farmer									
	Caregiver behavior	Bombong[b]	Nursing	10.2		Hirasawa (2005)	10.2	–	Hirasawa (2005)
			Physical contact	62.2	–	Hirasawa (2005)	62.2	–	Hirasawa (2005)
		Guatemalan[e]	Physical contact	23.75	19.5–28.0	Klein et al. (1977)			
		Ngandu	Nursing[f]	12.6	–	Hewlett et al. (1998)	8.7	–	Meehan (2009)
			Holding	54.2	–	Data obtained from Hewlett	54.5	–	Data obtained from Hewlett
		Ye'Kwana[g]	Nursing	8.3	–	Hames (1988)	3.9	–	Hames (1988)
			Physical contact	54.0	–	Hames (1988)	39.0	–	Hames (1988)

(continued)

Table 12.2 (continued)

				Early infancy			Late infancy		
Population category		Population	Variable	Mean %	Range in %	Source	Mean %	Range in %	Source
	Social environment	Ngandu	Alone[h]	7.7	4.8–10.6	Hewlett et al. (1998)	7.9	6.1–9.8	Hewlett et al. (1998)
			Proximity	65.3		Hewlett et al. (1998)	63.4	–	Hewlett et al. (1998)
	Infant behavior	Ngandu	Crying	3.8	–	Hewlett and Lamb (2002)	–	–	
		Ngandu	Fussing	9.5	–	Hewlett and Lamb (2002)	–	–	
		Ngandu	Fuss/Cry	12.4	–	Hewlett et al. (1998)	6.8	–	Hewlett et al. (1998)
Euro-American									
	Caregiver behavior	American – Washington, DC	Holding	33.0	22–44	Hewlett and Lamb (2002)		–	–
	Social environment	American – Washington, DC	Proximity	58.0		Hewlett and Lamb (2002)		–	–
	Infant behavior	American – Washington, DC	Crying	1.8		Hewlett and Lamb (2002)		–	–

		American – Washington, DC	Fussing	6.3		Hewlett and Lamb (2002)		–	–
		American – Washington, DC	Fuss/Cry	8.1		Hewlett and Lamb (2002)			
		Dutch[i]	Fuss/Cry	10.0	8.3–12	Barr et al. (1991)		5.3	Barr et al. (1991)

[a]These examples represent the best-available known comparative numbers due to clarity of definitions and/or age categories. However, due to variation in methodology, age categories, and definitions, several of the numbers above needed to be calculated from published results. We note where we calculated the range or mean percent from published accounts. Where ranges were published, we calculated the mean of the range and when published sources provided ranges or means for all of infancy, we present that mean in both the early and late categories. Table 12.2 and Fig. 12.1a–c are meant as a tool to help contextualize our results from the Aka, but examples should be cautiously compared

[b]Baka and Bombong data represent infants between 1–13 months. No division between early and late infancy was made in the publication (Hirawasa 2005). We present the mean percentage for the 1–13 month old infants in both the early and late infancy categories

[c]!Kung infants are reported to cry or fret 3.7 min/waking hour between 0–3 months and 3.2 min/waking hour between 4–6 months (6.2 and 5.33 % respectively). The average of that range is reported mean in early infancy

[d]The reported range included infants and toddlers. We present the mean of that range in both early and late infancy

[e]Guatemalan infants at 8 months. Range represents the mean physical contact for boy and girls

[f]Represents infants between 3–4 months old

[g]The Ye'Kwana physical contact figure is an "omnibus" category of engagement (holding, general caregiving and nursing), which may potentially overestimate the percentage of physical contact, but represent behaviors where the infant was likely in physical contact with a caregiver. Note that samples sizes for the Ye'Kwana data are very small (early infancy n=5; late infancy n=2)

[h]The Ngandu time alone data were separated into time alone while awake and time alone while asleep in the original publication. We present a mean percentage of these times

[i]Dutch infants cried or fretted 7.2 min/waking hour at 0–3 months and 5.0 min/waking hour at 4–6 months (12 % and 8.3 % respectively). We calculated the mean of those percentages and report a mean fuss/cry of 10 % in early infancy for Dutch infants. Older Dutch infants cried or fret just under 3.2 min/waking hour (5.3 %)

new phenomenan in this Aka community or something that has abruptly come about in the last two decades (see Bahuchet and Guillaume 1982; Moise 2014). Additionally, due to sample size or lack of information in one time period or another, we cannot control for variables that affect infant care and their environments (e.g., maternal work patterns, camp composition, the presence/absence of particular caregivers, etc.) (Meehan et al. 2013).

12.6 Results

12.6.1 Caregiver Behavior

In early infancy (2 weeks to < 6 months), for which two time periods are generally represented (TP I and TP III), there is no significant difference in the percent of maternal nursing from TP I to TP III. Physical affection also showed no significant change, with the mean declining < 1 % from 4.2 % in TP I to 3.6 % in TP III. Non-physical affection, in contrast, significantly increased from <1 % in TP I to 3.2 % in TP III. However, we found that sex was a significant predictor of non-physical affection in early infancy, with girls receiving more non-physical affection than boys ($P = <0.01$), making it difficult to determine whether the difference is due to cohort or sex. Infant holding significantly declines from 95.7 % to 82.7 % (over an hour difference) across the time periods. Infant physical contact, where only TP III is represented, illustrates that infants are in physical contact 91.4 % during the last time period.

In late infancy (6–12 months), the mean percent of daytime nursing is approximately 13.0 % in TP I, drops to 10.1 % in TP II, then increasing almost 5 % in TP III, although these changes are not statistically significant. Physical and non-physical affection remained similar (a maximum of < 1 and 1.2 % difference, respectively) across all time periods. Holding shows no significant change over time. For the latter two time periods, physical contact also shows no change, with infants being held or touched by caregivers approximately 80 % of the day in late infancy.

12.6.2 Social Environment

The social environment in early infancy appears similar across TP I and TP III. However, there is a trend suggesting a small decline in the amount of time that infants are in proximity to caregivers in early infancy across the two time periods for which we have data on early infancy [TP I (97.3 %) and TP III (94.5 %)]. Nevertheless, the amount of time that infants are alone is <1 % in both time periods, demonstrating that Aka infants are essentially never alone, regardless of the time period (see Fig. 12.1b).

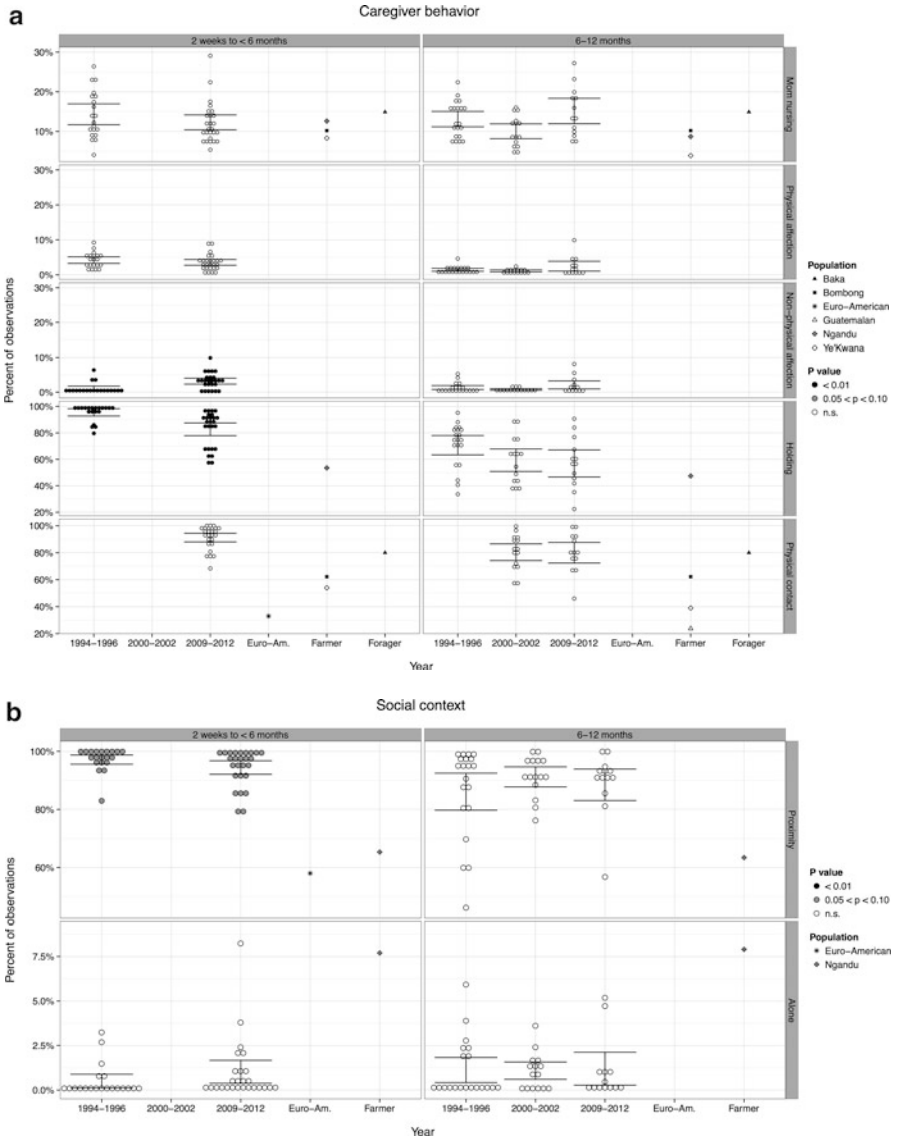

Fig. 12.1 (a) Aka infant care, (**b**) Social environment, and (**c**) Infant behavior in early and late infancy across three time periods (with cross-cultural examples provided). For the Aka, each dot represents one infant. Bars are bootstrapped 95 % confidence intervals for the mean. For other populations, each dot represents the mean value

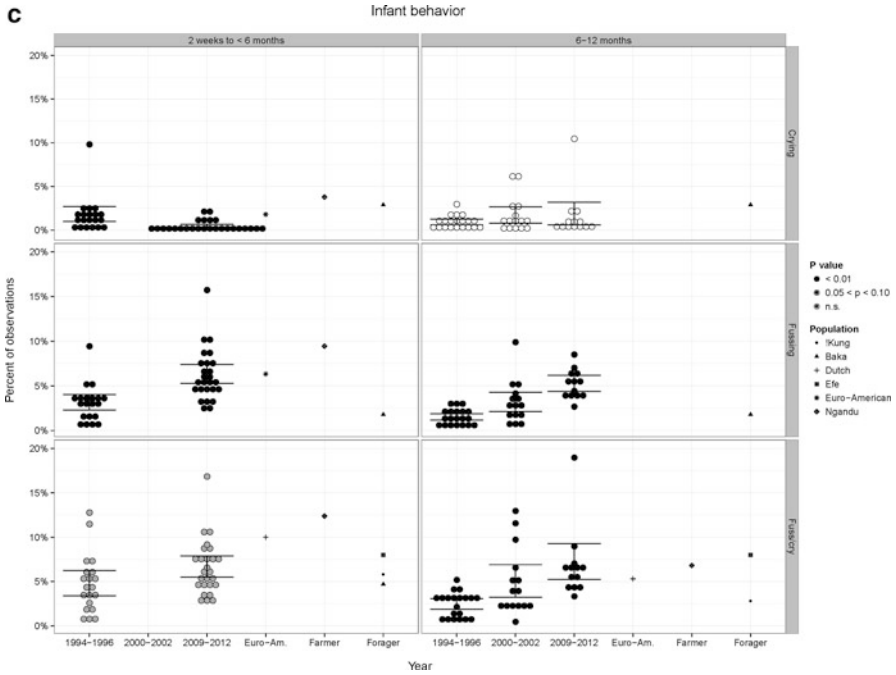

Fig. 12.1 a–c (continued)

Proximity to caregivers for older infants is consistent over the three time periods—the means range from 86.5 % of the day in proximity in TP I to 91.3 % in TP II, to 89.3 % in TP III. Similar to early infancy, Aka older infants are in essence never alone. Someone is available to the infant approximately 99 % of the day in all three time periods (see Fig. 12.1b).

12.6.3 Infant Behavior

In early infancy we see a highly significant decrease in the percent of crying across daylight hours across TP I and TP III. Infants in TP I cried 1.7 % of the day, compared to 0.4 % of the day in TP II. Infant fussing, however, showed a highly significant reverse pattern. Infants fussed half as frequently in TP I (3.1 %) compared to infants in TP III (6.2 %). Here, again, we found a significant sex difference, where young female infants fussed more than young male infants ($P = <0.01$). Again, whether the difference is due to cohort or sex is not known. The composite variable of fuss/cry, driven by the frequency of fussing, showed a trend toward increasing across the two time periods, an increase of 1.9 % (a difference of ~10 min) from TP I to TP III (see Fig. 12.1c).

There was no significant change in the mean percent of crying in late infancy. Infants cried 0.9 % in TP I, 1.7 % in TP II, and 1.6 % in TP III, a less than 1 % change. Infant fussing significantly increased across the time periods, from 1.5 % in TP I to 5.2 % in TP III. Finally, the composite variable fuss/cry showed a 4.4 % statistically significant increase across the time periods. This increase is, again, driven by fussing behavior or low-level agitation. Six to twelve month old infants in TP II fussed and cried, on average, for an additional 13 min, and on average just over 24 more min in TP III, with the caveat that TP III comprised 92 % boys (across all older infants, there were no significant sex differences in infant behavior, however) (see Fig. 12.1c).

There were also some notable differences in the variation of variables. There was notably little inter-individual variation in proportions of time alone, crying, physical and non-physical affection, and fussing. There was considerably more variation in proximity, physical contact and especially holding.

12.7 Discussion

12.7.1 Persistence and/or Change in Infant Care

Despite some variation across time periods, caregiver behaviors towards infants and infants' social environments have remained fairly similar across the almost 20 year time frame of this study. We found a significant increase in non-physical affection over time, but only in early infancy. There was also a reverse pattern, where there was a significant decrease in holding but, again, only in early infancy. Although only representing one TP in early infancy, physical contact (holding and touching) was over 90 % of the day, indicating that while holding may be lower in early infancy, Aka infants are still in almost constant physical contact with caregivers. Additionally, Aka caregivers almost never leave infants alone—a characteristic and care feature that shows virtually no change over the entire time span represented. Given the relatively few changes and that the preponderance of caregiving behaviors showed no difference, we suggest that Aka caregiver behavior and Aka infant's social environments have remained similar across time.

Alternatively, infant crying and fussing behavior suggest several changes, although, again, not all in the same direction, nor across all time periods. Crying decreased across time periods in early infancy and showed a minor increase in late infancy. Infant fussing and fuss/cry, however, showed much larger increases across time periods. For instance, in early infancy while there is only a <2 % increase in infant fuss/cry frequencies from TP I to TP III, Aka fussing and crying in late infancy more than doubled from TP I to TP III.

Although we found some statistically significant changes in Aka infant and caregiver over time, as noted above, our data cannot determine if these changes are due to social and cultural changes over time, or to unrelated changes in unmeasured factors, such as camp composition.

12.7.2 Cross-Cultural Comparison

Cross-cultural data provides additional evidence suggesting the few significant changes observed do not represent a major shift in Aka care patterns. These data do not indicate that Aka caregivers are taking on more "farmer-like" or industrialized care patterns. The mean percent of time that infants are in physical contact in early infancy exceeds or comes close to matching other published hunter-gatherer accounts. Additionally, Aka infants in TP III (the TP with the lowest percent of holding) are still held more than farmer infants and, on average, are in proximity to their caregivers anywhere from 2 to 3 hrs more per day in comparison to their Ngandu peers. In contrast to farmer patterns (Hames 1988; Hewlett et al. 1998), Aka infants, in early or late infancy and across all time periods, are engaged with most of the day. Aka nursing frequencies in early infancy are comparable to other forager and farming populations, suggesting that nursing frequency in early infancy is driven primarily by infant need. In later infancy, the lowest mean percent in TP II almost matches the highest rate for farmer patterns. The other TPs exceed farmer nursing rates by several percentage points. This may indicate a greater continued emphasis on frequent breastfeeding in late infancy among foragers compared to other groups even after complementary feedings become routine.

In terms of infant behaviors, young Aka infants cry approximately 50 % less frequently in early infancy than do Ngandu infants in the same age range, but these same Aka infants show a very similar pattern to the Euro-American population. The composite of fussing and crying shows that even at the high point, in early infancy, Aka infants seem to fuss and cry at similar frequencies than other foragers, but less often than Ngandu and Euro-American infants. In late infancy, when there is the significant increase in infant fussing and crying, Aka infant fussing and crying in the latter TP matches the mean percentage of Ngandu infants. Yet, in comparison to other hunter-gatherers, this level of fussing and crying does not seem decidedly unusual, suggesting it is difficult to determine a unique forager pattern of fussing and crying. Therefore, it is unlikely that the additional average 24 min per day of fussing and crying seen in late infancy in the last time period, compared to the first period, is due to change in care patterns.

12.8 Conclusion

Change in the Congo Basin has occurred for millennia and will continue, albeit perhaps it occurs now at a faster pace than in the past. Aka residence and subsistence patterns, and parental workloads and camp composition will likely be altered in the future. Over time we may begin to see more effects of such change on Aka culture as a whole and on infant care in particular. However, to date, infant care practices seem to be resistant to change. We argue that these patterns persist because, as mentioned earlier, other features of Aka life such as egalitarianism, sharing, and

autonomy remain important. Neighboring farmers may experience greater material comforts, more access to education and Western medical care, but the differences are not so great as to provide reproductive advantages. Thus, we argue that vertical and other forms of transmission (i.e., conformist and concerted) that conserve cultural variants persist because infant care practices remain adaptive in the described contexts of change. As others have argued, infant care is symptomatic of egalitarianism and much broader cultural patterns among hunter-gatherers (Lewis 2014). Aka infant care practices in this region, and hunter-gatherer infant care in general, is indicative of a much larger cultural pattern of trust, intimacy, and sharing that is not immediately affected by outside influences.

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Chapter 13
Globalized Conflicts, Globalized Responses. Changing Manners of Contestation Among Indigenous Communities

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Abstract In a globalized world, environmental conflicts affecting indigenous communities (including hunter-gatherer groups) have intensified and grown in their transnational character. These changes have affected the choice of manners of contestation of these groups, favouring in some cases the emergence of alternative responses based on the use of new technologies and scientifically gathered evidence. In this chapter, we examine these interlinked changes, describing also – through two case studies- an emerging methodology of scientific enquiry that aims to enable indigenous communities to lead scientific activities and confront conflicts through a truly bottom-up approach. The chapter ends discussing how, despite the potential of such new manners of contestation, the power imbalances that currently underpin many indigenous conflicts are first to be addressed.

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13.1 Introduction

Globalisation, understood as a process of intensification and integration of worldwide economic and social relations that transcend national spaces, can be seen as a major driver of increasing economic, political and cultural linkages between once distant communities (Kearney 1995; Parks and Roberts 2006). Researchers have argued that globalization is driving the re-scaling of political, social and cultural relations leading to a diversity of economic, cultural, political and socio-ecological changes in many different contexts (Berkes 2007; Cerny 1995; Cohen 2007; Young et al. 2006). Globalization affects even the most remote societies around the globe, including hunter-gatherer societies, often generating many negative impacts. For example, increased interaction between nation-states and indigenous societies has led to forced acculturation, deskilling, and discrimination against cultural minorities (Baker 2007; Gómez-Baggethun and Reyes-García 2013; Stone 2007). Similarly, international economic integration (characterised by the specialisation of productive systems, including agriculture) has led to the loss of both economic and food sovereignty of the people subject to externally driven productive agendas (Andrée et al. 2014; Quiggin 2001; Sassen 1996). Furthermore, the intensification of natural resources extraction that occurs in some of the areas inhabited by indigenous groups has been said to contribute to an unequal access to resources and severe environmental degradation, often threatening local livelihoods (Escobar 2006; Muradian et al. 2003; Obi 1999; Roberts and Thanos 2003).

The negative impact of globalization over indigenous societies has often led to the rise of different sorts of conflicts. While conflicts between indigenous societies and external agents (namely the state and the corporations) are not new, globalization has changed the scale of conflicts blurring the line between the local and the global, both regarding the drivers of conflicts and the responses to them (Cerny 1995; Edelman 2001). Hence, as traditional hierarchical and state-centred collective action does not seem effective to respond to flexible, dynamic and transnational global conflicts (Cerny 1995), a diversity of alternative manners of contestation has emerged, at times relying on technological inputs brought by the globalization process itself. For instance, information sharing boosted by the use of communication technologies has served to up-scale the responses to certain conflicts and has favoured grassroots movements' organisation (Sandoval-Almazan and Gil-García 2014). This shift in the use of technology (that is progressively being appropriated by lay citizens) is parallel to the shift in the use of scientific evidence (from being used by dominant systems to legitimize their actions, to be adopted by citizens as a manner of contestation; McCormick 2007).

In this chapter, we describe changes in the nature of conflicts and the manners of contestation of indigenous societies linked to globalisation. We first review how conflicts and manners of contestation of indigenous peoples have evolved throughout history, and the role of science in such change. We then present two examples of indigenous communities-led responses to existing environmental conflicts, emphasizing the global nature of both conflicts and responses. Finally, we discuss and

compare these initiatives, reflecting both on the potential and limits of participatory citizen science as a tool for indigenous contestation and advocacy in the global world. Although the two studied societies cannot be classified as hunter-gatherers, we consider that the issues presented in this chapter transcend this category and thus can affect a more inclusive range of local communities with indigenous identity while still directly relating to hunter-gatherer societies.

13.2 The Changing Nature of Global Conflicts and Indigenous Responses

Indigenous communities have typically inhabited their territories for thousands of years, displaying a strong sense of place attachment rooted on a long social-ecological interaction history (Cunningham and Stanley 2003). Since colonial times, most indigenous groups have faced struggles against colonising states and other dominant or competing systems (Alfred and Corntassel 2005). Relations with outsiders have taken many forms and have often lead to environmental, social, political and cultural conflicts whose nature has changed through time. The evolution of such conflicts can be understood in the context of changing economic/productive systems and political institutions (Friedman 1999) as well as in the context of political, cultural and social relations that change in scale and intensity (Cerny 1995). Changes in the nature of conflicts are associated with changes in indigenous responses to such conflicts, including their manners of contestation and their ways of doing advocacy.

Conflicts between indigenous societies and national societies can be traced back to colonial times. Colonial nations commonly looked down upon the original populations of the areas in which they established their economic and political rule, sometimes even ignoring the mere previous existence of people in those territories (Buchan 2006). Not acknowledging the existence or the rights of indigenous communities clearly favoured colonial control over indigenous people's and land's, leading to conflicts related to natural resource extraction, cultural imposition, and political repression (Alfred and Corntassel 2005). The fragmentation of colonial powers brought new forms of governance (namely economic and political "empires" funded in expanding control and appropriation processes; Hardt and Negri 2001; van der Ploeg 2009) which substituted colonialism as the main dominance system but that continued oppressing the people living in the economic, political and social periphery until nowadays (Galtung 1971; Wallerstein 2004).

Parallel to the emergence of new forms of governance, indigenous manners of contestation also evolved. Indigenous contestation to colonial domination was commonly done through physical struggle and sabotage in response to a very identifiable dominating force (Schwarz and Ray 2008). During colonial independence, indigenous peoples started organising themselves differently, changing their strategies somehow mimicking the hierarchical and national structures of the newly

created nation-states (Corntassel 2008). This was generally done in a quest for institutional recognition (legal rights) and self-determination, yet the process was also imposed by the states, which required these forms of organization in order to grant communities with official representation. However, in recent times, sovereignty is no longer necessarily granted by national powers (due to the change in scale of the socio-political relations towards transnationalism and political integration), leaving indigenous peoples often stripped of their basic human rights (Holden et al. 2011).

This recent intensification and integration of political and economic relations (core to globalisation) has not only resulted in new forms of domination, but also has made it more difficult to directly link a conflict to a specific causing institution or agent (Cerny 1995). This has led to the apparition of different, more global and transnational, struggles and manners of contestation (Robinson 2003), a shift that is especially evident in the case of environmental conflicts (Çoban 2004; Martinez-Alier 2001). For example, extraction of raw materials in remote areas raised environmental conflicts in the past, but the relatively recent liberalisation of extractive companies and the organisational engineering of corporations has driven the situation to a point where, increasingly, there are no "doors to be knocked on", so claims need to be addressed to different levels that those of the state or the extractive company (although there is space also for the more "traditional" contestation strategies; e.g., road blocking or litigation; Clark 2002). This situation has led many indigenous peoples' groups and movements in search of other types of recognition, frequently changing their approach to contestation.

New indigenous contestation initiatives vary greatly depending on the region and the conflict (Hall and Fenelon 2015), but have often moved to the supra-national level by means of further transnational organisation and advocacy (Bandy and Smith 2005; Di Chiro 1997; Edelman 2008). For example, indigenous contestation to environmental conflicts try to demonstrate the linkages between local environmental problems and global issues (e.g., deforestation and climate change) to create global awareness and somehow respond to the domination situations leading to conflicts (Doherty and Doyle 2006). Another alternative contestation initiative has been the use of information communication technologies and organisational tools, paradoxically core to the globalization process, to support indigenous claims (Turner 1992). Finally, and increasingly, another new form of contestation has been the gathering of scientific evidence by indigenous people to prove not only the local consequences of environmental, cultural or political problems but also the linkages between global trends and their associated local impacts (Lewis and Nkuintchua 2012). The growing use of scientific evidence to support indigenous claims is parallel to changes in the roles that indigenous peoples play in scientific projects and can be contextualized in a science democratizing or 'decolonizing' trend that is changing the ways in which the scientific community interacts with citizens in general and indigenous peoples in particular.

The changing relation between the scientific and the indigenous communities can also be understood in line with the shifting of mainstream economic, social, political and cultural world visions. As some authors argue (Harding 1992; Jasanoff 2009; Mattli and Büthe 2011), science has been (and continues to be) used by

dominant political systems to legitimise their power and actions. For example, during colonial times, scientific evidence was often used to legitimate the oppression of indigenous communities (Baber 1996; Gascoigne 1998; McClellan and Regourd 2000). Following social-Darwinist ideas of civilization and development, indigenous communities were at first studied as 'primitive socio-cultural and economic systems', thus re-enforcing the paternalistic colonial control over these communities (Howard-Wagner 2007). These ideas were progressively refuted as indigenous groups started to contest the oppressing systems and gained self-determination, and thus a less objectified position in the scientific world (Rigney 2001). However, indigenous peoples and their knowledge systems continued to be an object to scientific studies, either as a source of valuable information (both in the scientific and economic sense) or as an element needed to be integrated into scientific accounts of the world's reality (Nadasdy 1999; Watson and Huntington 2014). Although these approaches are still the norm, some exceptional initiatives are emerging progressively changing the agency of indigenous people in scientific projects.

One of such initiatives relates to 'citizen science', broadly understood as scientific activities in which non-professional scientists participate (Cohn 2008), and more specifically to "community science" and "do it yourself science" (Haklay 2013a; Nascimento et al. 2014) or to "volunteered environmental monitoring" and "community-based monitoring", understood as citizen science projects in which local participants engage in natural resource monitoring activities in collaboration with professional non-indigenous scientists (Conrad and Hilchey 2011; Danielsen et al. 2009; Stepenuck and Green 2015). Differently than in "classic" citizen science, in which resources, research questions and research design stay close to the professional scientists and citizens are basically relegated to being a network of observers, "community science" and "do-it-yourself science" promote a bottom-up approach in which the research questions and the implementation are closer to the citizens' side, so citizens are drivers of scientific projects. Such approach, however, is still considered far from being truly bottom-up since the research questions are still closer to the professional scientists' interests. Moreover, its contributions are argued to be limited by issues such as strict project timing and funding or lack of unbiased local engagement, threatening the long term sustainability and meaningful local impacts of such projects (Haklay 2013a).

In response to these issues, a truly bottom-up "extreme" citizen science approach (that we call "participatory monitoring" in the context of this chapter), has been growing rapidly, especially in the context of environmental conflicts. Differently from the previous citizen science approaches, in extreme citizen science citizens engage actively in all phases of research; from research question to design, implementation and analysis. The implementation of extreme citizen science projects require that tools and technologies which are normally used in scientific contexts and by dominating systems are appropriated by lay users. In most such citizen science projects, information and communication technologies are being used even in very remote areas and by illiterate people to undertake mapping, data sourcing or evaluation activities (Ansell and Koenig 2011; Stevens et al. 2014; Vitos et al. 2013), which can provide valuable evidence to support the communities' claims. These

technologies, as well as all the related data management infrastructures, are progressively being made widely accessible not only by means of changing the intellectual property rights associated to datasets, software and hardware, but also by developing innovative solutions that can solve technology access shortages (http://www.cybertracker.org/; https://publiclab.org/).

The results from these types of monitoring activities have been successfully used not necessarily to respond to academic merit driven objectives, but to support many environmental justice claims, in some cases linked to indigenous struggles (Vitos et al. 2013). However, as the following examples will illustrate, a question still remains regarding the extent to which the new contestation will be able to address the power imbalances and other systemic issues that are at the core of the conflicts.

13.3 Indigenous Scientists and Environmental Participatory Monitoring

13.3.1 Community-led Oil Spill Monitoring in the Peruvian Amazon

Our first example of alternative manners of contestation by means of "participatory monitoring" refers to the monitoring of oil impacts in the Peruvian Amazon. Underlying the Peruvian Amazon are large reserves of oil and gas, the exploration and extraction of which is being stimulated by the expanding global oil demand (Orta-Martínez and Finer 2010). Compared to the 7.1 % in 2003, in 2009, 48.6 % of the Peruvian Amazon was covered by oil and gas concessions, overlapping 17.1 % of the Peruvian Amazon protected area system and over half of all titled indigenous lands (Finer and Orta-Martínez 2010).

The first concessions for hydrocarbon extraction in the northern Peruvian Amazon were the Blocks 192 and 8, in the large sedimentary Marañón Basin. After the first productive well was drilled in 1972, these oil projects became the most productive in the country, with an average of 70,000 barrels/day from 1974 to 2013 and an accumulated production of 1024 million barrels (39.3 % of total national oil production and 97.8% of total production of the Peruvian Amazon) -own calculation based on MINEM 2013-. Their productivity has since then decreased to 8890 MBLS in 2013 (MINEM 2013). Block 192 was formerly called Block 1AB and was operated by Occidental Petroleum Corporation (OXY) until 2000 and by Pluspetrol Norte until 2015, and it includes 11 central production facilities, 360.3 km of main pipeline routes connected with the North-Peruvian Pipeline, and 250 wells, of which only 112 are currently productive (MINEM 2013). Around 10,000 indigenous people inhabit this area, mainly Achuar and Kichwa communities. Although only nine indigenous settlements are located inside Block 192, a number of downstream and nearby communities depend on the territory inside the oil block to hunt, fish and for subsistence agriculture.

Severe socio-environmental and health impacts related to oil activities in Block 192 have been reported. Orta-Martínez et al. (2007) summarized the official reports issued by Peruvian authorities describing evidences of oil pollution in the study area. For instance, the Research Institute of the Peruvian Amazon found in local fishes' tissues concentrations of hexavalent chromium that exceed the safety limits for human consumption (IIAP 1985 in Orta-Martínez et al. 2007), and the previous government agency for natural resources describes the region as "one of the most damaged critical environmental areas in the country" (ONERN 1984). The indigenous communities also denounced "acute cases of poisoning, cancer and other unfamiliar illnesses including allergic skin and eye reactions", attributing them to oil pollutants (la Torre López and Napolitano 1999 in Orta-Martínez et al. 2007). Other impacts included the overexploitation of forest resources by oil company workers or subcontracting companies, particularly in the form of illegal logging, illegal trafficking of protected animal species, hunting and commercialization of bushmeat (Orta-Martínez et al. 2007). In 2006 the Peruvian Environmental Health Agency reported that the acceptable blood level limits established by the World Health Organization (WHO) were exceeded in 66.21 % of the children for lead and in the 98.65 % of the cases for cadmium (DIGESA 2006). Both heavy metals are among the six most toxic metals known for humans (Spadaro and Rabl 2004 in Orta-Martínez 2010). Pushed by such alarming reports, recently an Environmental and Health Emergency has been declared by Ministerial Resolution in the Pastaza, Corrientes and Tigre basins (Mayor et al. 2014).

Indigenous peoples have resisted in different ways the impacts generated by oil extraction. During the 1980s and 1990s, they largely concentrated in asking for land titles, as they were confident that this strategy would provide them with the tools for the effective control of their territories. However, when after three decades they finally got small and unrepresentative land titles, indigenous peoples realized that these would not guarantee their territorial rights and much less prevent impacts from oil activities (Orta-Martínez 2010). This led to the diversification of tactics to demand meaningful solutions to oil impacts, which ranged from court cases to institutional meetings with Peruvian state agencies. The publication of health reports by the Environmental Health Agency in 2006 triggered the use of new resistance methods, such as roadblocks and occupation of oil infrastructures, in search for a government response. Such methods turned out to be very effective in improving the oil company's operational standards as, according to la Torre López and Napolitano (2007), almost none of the numerous recommendations to minimize and mitigate the oil pollution made in the previous official reports were implemented before the indigenous communities paralyzed oil production for 2 weeks in October 2006.

Simultaneously, in 2006, the indigenous communities started a participatory monitoring programme aiming at mapping and monitoring oil spills (Orta-Martínez 2010). The goal of this programme was to provide irrefutable and striking evidence of the real environmental performance of the oil companies to raise national and international awareness and force the Peruvian state and the oil companies to minimize and mitigate oil-related impacts. The program was born out of the coordinated efforts of the Federation of Native Communities of the Corrientes River

Fig. 13.1 Oil spill detected and documented in 2010 by indigenous monitors (FECONACO)

(FECONACO) with the support of two local NGO (Shinai Serjali and Racimos de Ungurahui) and researchers from the Institut de Ciència i Tecnologia Ambientals at the Universitat Autònoma de Barcelona (ICTA-UAB). Together, they created a team of local environmental monitors which included one person per community (selected during communal assemblies) and trained by the NGO and the academic partners. Training addressed a diverse range of topics, including oil industry operational practices, oil pollution and their associated effects on the environment, and public health. The monitoring team also had, for their first time, contact with electronic devices such as Global Positioning Systems (GPS) and digital cameras, which also required a specific training component. The community-based alarm system initially focused on locating and identifying the typology of impacts (oil spills, drilling muds pits, production water outlets, etc.).

Over the years, monitoring has evolved involving more sophisticated high-tech tools, such as smartphones to improve the management of the data gathered, cameras trap to monitor wildlife behaviour in oil spills (Fig. 13.1), lowcost Do it Yourself (DIY) spectrofluorometer (www.publiclab.org) to measure Polycyclic Aromatic Hydrocarbons, and drones to better map the area covered by oil spills. For example, indigenous communities reported to their scientist partners a new and previously unreported animal behaviour: the ingestion of oil- polluted soil by wild animals (Mayor et al. 2014). To explore the magnitude of this troubling phenomenon, the participatory monitoring program has expanded and now includes an extensive camera trap programme and the analysis of soil and animal tissue samples. At this point the monitoring programme aims to get the collaboration of worldwide online volunteers to analyse the huge amount of videos collected through the camera trap programme. To do so, researchers are now building an online digital citizen science platform that will enable people from around the world to visualise and analyse the impressive images of wildlife licking abandoned oil wells and eating oil polluted soil whist getting a glimpse of the real situation of Amazonian communities and ecosystems and of how local indigenous people are fighting to protect their territories.

Moreover, the monitoring programme has also expanded to the other river basins and has enrolled new partners. Thus, other local indigenous federations (Federación

Indígena Quechua del Pastaza – FEDIQUEP; Federación de Comunidades Nativas del Alto Tigre – FECONAT, Organización del Pueblo Indígena Kichwa de la Frontera Perú-Ecuador – OPIKFPE and Asociación Cocama de Desarrollo y Conservación San Pablo de Tipishca – ACODECOSPAT) are now implementing monitoring programs in their lands. Also, different external stakeholders including NGOs, such as Rainforest Foundation, Digital Democracy, alterNativa, Moviment per la Cooperation Internationale, Hivos, and universities (ICTA-UAB and the International Institute of Social Studies, Erasmus University Rotterdam) have supported the programme in many different ways, from the organization of trainings and meetings to economic funding. In 2014, a hackathon was organized in the city of Tarapoto. During a week, indigenous monitors and leaders worked with a group of software and hardware developer volunteers to build up specific tools for the environmental monitoring needs (www.hacktherainforest.org).

As a result of this monitoring programme, a huge database owned and managed by the indigenous organizations has been created. The analysis of the database has helped uncover several impacts that companies have never reported (hundreds of concealed oil spills, unappropriated and illegal operational practices, etc.; Orta-Martinez 2010) The release of this information has empowered local people and strengthened the role of indigenous leaders in negotiations with the oil companies and the Peruvian state agencies to demand for improved operational standards. These reports have also played a key role in spurring administrative procedures to sanction the oil companies. The reports have also contributed enormously to the receiving of economic and social compensations by the indigenous communities.

13.3.2 Grassroots Monitoring in Prey Long, Cambodia

Our second case study refers to a participatory monitoring initiative aiming to contest deforestation of indigenous peoples' forests in Cambodia. Between 2000 and 2012, Cambodia had the world's third highest national deforestation rate due to large-scale acquisitions of land for agro-industrial purposes, such as economic land concessions (ELCs) (Davis et al. 2015; Hansen et al. 2013). These ELCs led to large scale conversion of forest land and to extensive illegal logging operations outside the borders of the officially granted areas, thereby conflicting with the Land Law, Forestry Law, and the Law on Protected Areas. By the end of 2013, 2.6 million hectares of land (14 % of the country) had been allocated to ELCs and other types of land concessions, mainly to establish rubber plantations. Environmental and Social Impact Assessments (ESIA) are rarely conducted for these concessions and their operations are poorly controlled (Forest Trends 2015). Overall, concessions have resulted in the exhaustion of valuable timber resources and have affected community managed and sacred forests. Moreover, these ELCs negatively affect rural households' total income (Jiao et al. 2015) in a country were about 75 % of the population depends on forest resources for their livelihoods (Royal Government of Cambodia 2010).

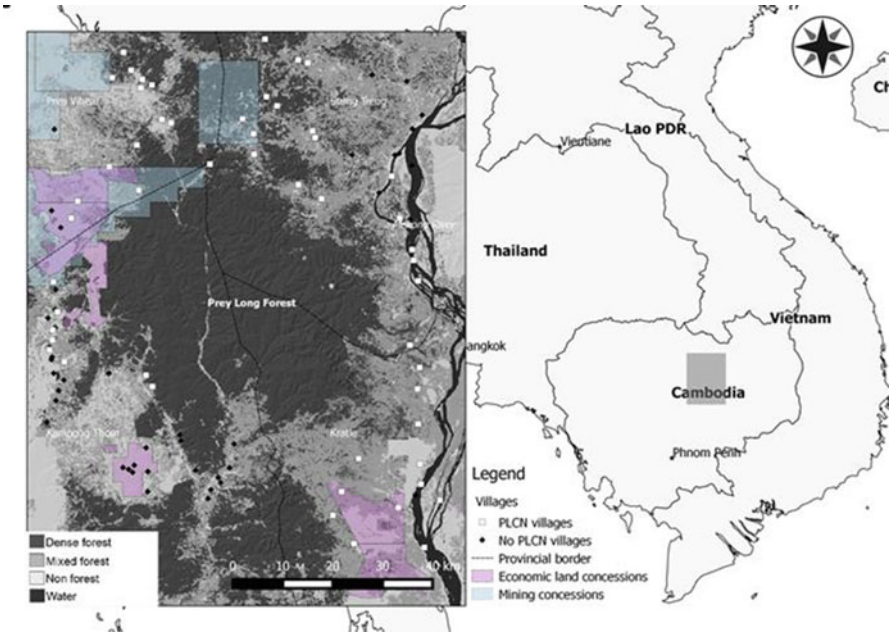

Fig. 13.2 Prey Long forest (*left*) and its location in the Indochinese peninsula (*right*). Created using Forest Cover map (Open Development Cambodia, 2014) and Natural Earth data in QGIS

Prey Long is a forest situated in the central plains of Cambodia (Fig. 13.2) and is the last intact vestige of lowland rainforest in Indochina (McDonald 2004). The Prey Long forest complex covers approximately 360 000 ha and hosts a diverse and unique fauna and flora. Seven vegetation types have been described in Prey Long evergreen, semi-evergreen, and deciduous forests (McDonald 2004; Olsson and Emmett 2007; Theilade et al. 2011). There are around 250 000 people living in 340 villages in the greater Prey Long area. The inhabitants of Prey Long belong to the Kuy and Khmer ethnic groups, who are culturally and spiritually linked to their forests and consider them as sacred. Furthermore, most of the population relies directly on forest natural resources for their livelihoods, resin tapping from Dipterocarp trees being the main source of cash income. Prey Long is also a source of medicines, food, building materials and firewood, essential for the survival of local communities (Olsson and Emmett 2007).

Despite Prey Long's ecological, social, cultural and religious significance, this forest remains under no special protection in Cambodian legislation and is classified as 'state private land', and consequently under state management. Currently, Prey Long is affected by 53 agro-industrial and mining concessions, which threat the natural resources that the local population need for their biocultural survival. Furthermore illegal timber extraction of precious timber trees in nearby areas, often laundered through the concessions, increases such threats, creating a conflictive situation between those who want to safeguard the forest and those driven by the

economic benefits of timber extraction. Furthermore, community chiefs and local authorities often hinder local actions to stop illegal loggers, using verbal and physical threats. As a result of the lack of official protection, and due to the ongoing legal and illegal ELC logging activities, the resin trees and other vital resources for Prey Long's population, as well as the forest biodiversity in general, are under threat (Olsson and Emmett 2007).

As explained by local informants, the villagers living in and around Prey Long have monitored their forests since ancestral times to ensure the protection of their natural resources. In the early 2000s, the increase of ELC-related illegal logging and the lack of protection from the Cambodian State led some of the inhabitants of Prey Long to organise themselves into forest patrolling groups, forming the Prey Long Community Network (PLCN). The aim was to join forces to combat those large scale illegal logging and land grabbing-activities that destroyed the forest and affected peoples' access to natural resources. Over the years, PLCN has become a well-organised group of indigenous environmental advocates, increasingly recognised both at national and international levels. PLCN has organised forest patrols, public debates, capacity building workshops, peaceful demonstrations, and petitioned their right to be officially recognised in the management of Prey Long. However, so far, the PLCN has not been officially recognised by the Government and their forest patrols are claimed to be illegal by local authorities. In 2015, the PLCN involved roughly 500 members.

Through an innovative partnership between the PLCN, the University of Copenhagen, an IT company, an international faith-based organisation (Danmission) and two Cambodian NGOs (Community Peace-building Network and Peace Bridges Organization), a participatory monitoring programme was developed in 2014. The overall aim of the program was to support rights-based and peace building approaches to natural resource management and to build resilience and capacity of the PLCN to continue their autonomous monitoring. Supported by this partnership, the existing PLCN forest monitoring was upgraded with the use of a smartphone App that can geo-reference, document, and upload information that the communities desire to monitor. The App was designed according to the monitoring needs and priorities of the PLCN and mostly covers illegal activities and natural resources over the evergreen forest of Prey Long. Information collected with the App automatically uploads to a specifically designed database, allowing for a more structured and systematised approach to data collection, analysis and therefore grass-root forest monitoring. The PLCN selected men and women of different ages to participate in the project, ensuring the engagement of younger members who were considered more apt to handle new technologies and better placed to continue monitoring in the future. Additionally, the PLCN is active in the social media, where news and updates regarding the organisation's recent activities are shared. As a result of all these initiatives, the PLCN won the prestigious Equator Prize in 2015 for their efforts to conserve biodiversity and build resilient local communities (go to https://vimeo.com/154774156 to see the video).

An advantage of creating a multi-stakeholder partnership has been that different partners could support the PLCN in areas they would otherwise not be able to cover.

Following the PLCN's wishes, representative members of the network were trained in topics such as forest law, indigenous peoples' rights, and peaceful conflict management. They also received training to use the smartphone App. So far, the PLCN members still lack the skills to use computers, analyse the data, and write reports, such work is thus still being conducted by the other project partners. However, the PLCN decides what information should remain confidential (e.g., the exact location of natural resources and names of participants and villages) and revises the content of the monitoring reports before they are published. Local communities have proved to be successful at recording illegal activities using the App. Between February and November 2015, 650 illegal activities were recorded, mainly related to logging (98 %). Most submitted entries referred to stumps (480 cases, 74 %), followed by transport (128 cases, 20 %), and presence of loggers (42 cases, 6 %). The location of some 560 timber and non-timber forest products has been recorded; mainly resin trees and luxury timbers (88 %), with smaller percentages of reported NTFPs (6 %), animals (4 %), and sacred resources (2 %) (Argyriou et al. 2016).

The monitoring reports are a useful tool to provide proofs of illegal logging and build local ownership of the Prey Long forests. They can also be used by the communities to notify authorities and guide legal investigations. Finally, the monitoring reports receive massive media attention within Cambodia. For the first time the public is informed about the state of Prey Long based on almost real-time monitoring. Thus, local communities in Prey Long have proven to be able to effectively monitor their forests. Through conflict resolution approaches, the PLCN has been successful in engaging local authorities in some provinces in a peaceful dialogue concerning rights and resources. Although monitoring only is not enough to halt illegal extractive activities, the PLCN hopes to be recognised by the Cambodian government as an official body for forest monitoring and co-management. This would legally enable them to impose graduated sanctions according to the degree of the offence. Furthermore, the PLCN advocates for Prey Long to be catalogued as a protected area and the legal framework for its protection to be enforced and respected by the higher authorities avoiding the location of ELCs and other concessions in it.

13.4 Conclusions

In this chapter, we have presented two examples of how indigenous communities use ICT to gather data to support their claims and protect their territories and resources and thus also their rights. In the case of Block 192 in the Peruvian amazon, the environmental and health consequences of poorly managed oil concessions have generated the contestation of indigenous communities for over four decades. We have described how, while the sources of conflict have remained unchanged over the years (i.e., private companies' negligence overlooked by the state), the intensity of the oil extraction activity in the area has increased in recent years, making more blatant the inaction of the state regarding oil spill control. In the case of Prey Long forest in Cambodia, the environmental and livelihood threats of abusive

logging activities have also been long term socio-environmental problems. However, conflicts intensified after the 2000s due to large-scale acquisitions of lands for agro-industrial purposes (fostered by state permissiveness). In both cases, the manners of contestation have varied greatly (from the search for land rights recognition, to roadblocks, and to participatory monitoring). The shifting scale and intensity of these conflicts, in line with globalisation processes, can be seen as one of the main drivers of these changes in manners of contestation.

The progressive interconnection of distant communities and the increasing use of ICTs have favoured the organisation of grassroots movements that collaborate in networks who also involve other members of the civil society and scientists but who are driven by local monitoring agents that now have access to new technologies. This recent access is possible largely due to research groups partnering up in activist scientific projects. The result of such processes is the design of projects that provide real involvement of local stakeholders in participatory monitoring, which can result in capacity building, knowledge exchange, and empowerment. Moreover, in the cases of Block 192 and Prey Long forest, the initiatives contributed to developing an existing "bottom-up" monitoring system by including the monitoring needs and priorities of the local stakeholders in the research design, implementation and use of the results.

The two examples presented here show the potential of participatory citizen science as a tool for indigenous contestation and advocacy (in line with results from other "extreme citizen science" projects; Nascimento et al. 2014). These innovative highly participatory initiatives are likely to further change the relations between scientists and the public, and have the potential of empowering lay communities of many kinds, including indigenous communities (Ghose 2001; Stevens et al. 2014). In the case of environmental conflicts attaining indigenous territories, the new approach aims at completely changing the role of indigenous people in scientific projects by listening to their research questions and making science driven by local interests (Haklay 2013a). In truly participatory monitoring schemes, including the interests of the local communities has -in some cases- shifted the monitoring scope from natural resources to the agents who impact those resources and drive environmental conflicts. By changing the direction of scientific studies, legitimisation and power science has the potential to switch sides, from serving dominant systems in their justification of certain actions to serving citizens to confront conflicts. Moreover, this shift in the use of scientific information (and in the ways that locals, not necessarily professional scientists, analyse data trying to answer to their own research questions) can also be considered as a way to claim the validity of alternative and lay knowledge systems (Dunn 2007).

However, considering the existing issues of technology dependence, participation biases, and power imbalances, there is still room for debate about the extent to which these initiatives are really empowering the indigenous peoples and providing effective alternative manners of contestation (Haklay 2013b; Kyem 2004). Moreover, the idea that indigenous legitimization in the context of environmental conflicts can be obtained only by means of scientific evidence can also be seen as a contradiction in itself, since it could be reproducing western ethnocentric ideas of scientific

knowledge supremacy as opposed to lay knowledge systems (Leach and Fairhead 2002). In power imbalanced situations such as the ones depicted in this chapter, in which big extractive corporations own long-term concessions that are safeguarded by the state, scientific evidence can act as a calibrator of the imbalances. Yet, we must not overestimate the power of scientific evidence and pretend that these new forms of contestation can overcome the traditional ways of responding to conflicts in all cases. Moreover, it is possible that this innovative approach remains unfruitful in terms of its contribution to environmental justice if it fails to first resolve the power imbalances affecting indigenous peoples and derived by political and economic inequality.

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Hunter-Gatherers in a Changing World

Victoria Reyes-García and Aili Pyhälä

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